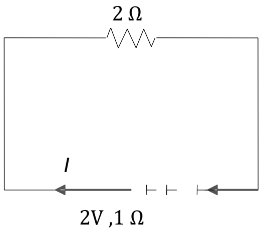
Single Correct Answer Type

1. In the electric circuit shown each cell has an emf of 2V and internal resistance of 1Ω. The external resistance is 2Ω. The value of the current I is(in ampere)

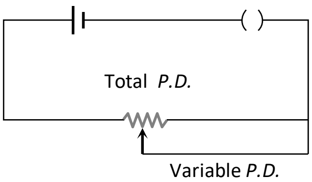


a) 2 b) 1.25 c) 0.4 d) 1.2

2. A, B, C and D are four resistances of 2Ω, 2Ω, 2Ω and 3Ω respectively. They are used to form a Wheatstone bridge. The resistance D is short circuted with a resistances R in order to get the bridge balanced. The value of R will be

a) 4 Ω b) 6 Ω c) 8 Ω d) 3 Ω

3. The arrangement as shown in figure is called as



a) Potential divider b) Potential adder c) Potential substracter d) Potential multiplier

4. If the balance point is obtained at the 35^{th} cm in a meter bridge, the resistances in the left and right gaps are in the ratio of

a) 7 : 13 b) 13 : 7 c) 9 : 11 d) 11 : 9

5. Two electric bulbs rated P_1 watt V volts and P_2 watt V volts are connected in parallel and V volts are applied to it. The total power will be

a) $P_1 + P_2 watt$ b) $\sqrt{P_1 P_2}\ watt$ c) $\frac{P_1 P_2}{P_1 + P_2} watt$ d) $\frac{P_1 + P_2}{P_1 P_2} watt$

6. In a meter bridge a 30Ω resistance is connected in the left gap and a pair of resistances P and Q in the right gap. Measured from the left, the balance point is 37.5 cm, when P and Q are in series and 71.4 cm when they are parallel. The values of P and Q (in ohm) are

a) 40, 10 b) 35, 15 c) 30, 20 d) 25, 25

7. In an experiment to measure the internal resistance of a cell by potentiometer, it is found that the balance point is at a length of $2m$ when the cell is shunted by a 5Ω resistance; and is at a length of $3m$ when the cell is shunted by a 10Ω resistance. The internal resistance of the cell is, then

a) 1.5Ω b) 10Ω c) 15Ω d) 1Ω

8. Two electroplating cells, one of silver and another of aluminium are connected in series. The ratio of the number of silver atoms to that of aluminium atoms deposited during time t will be

a) 1 : 3 b) 3 : 1 c) 1 : 9 d) 9 : 1

9. A coil of wire of resistance 50 Ω is embedded in a block of ice and a potential difference of 210 V is applied across it. The amount of ice which melts in 1 sec is

a) 0.262 g b) 2.62 g c) 26.2 g d) 0.0262 g

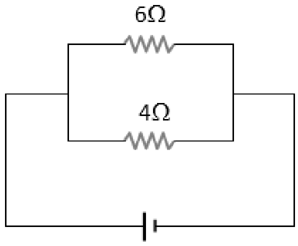
10. The resistance of 1 A ammeter is 0.018Ω. To convert it into 10 A ammeter, the shunt resistance required will be

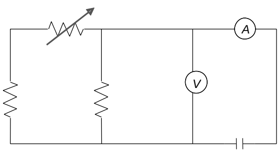
a) 0.18 Ω b) 0.0018 Ω c) 0.002 Ω d) 0.12 Ω

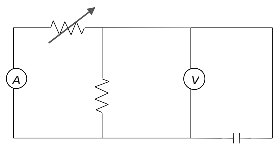
11. When current flows through a conductor, then the order of drift velocity of electrons will be

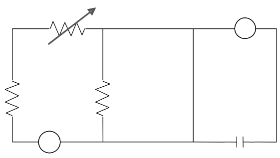
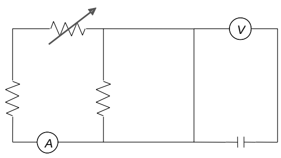
a) $10^{10} m/sec$ b) $10^{-2} cm/sec$ c) $10^{4} cm/sec$ d) $10^{-1} cm/sec$

12. Which of the following statements is wrong
   a) Voltmeter should have high resistance
   b) Ammeter should have low resistance
   c) Ammeter is placed in parallel across the conductor in a circuit
   d) Voltmeter is placed in parallel across the conductor in a circuit
13. A material B has twice the specific resistance of A. A circular wire made of B has twice the diameter of a wire made of A. Then for the two wires to have the same resistance, the ratio l_B/l_A of their respective lengths must be
   a) 1 b) 1/2 c) 1/4 d) 2
14. In the circuit shown below, the power developed in the 6Ω resistor is 6 watt. The power in watts developed in the 4Ω resistor is

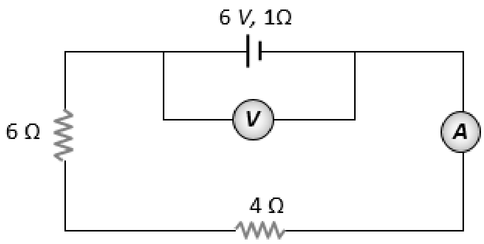


   a) 16 b) 9 c) 6 d) 4
15. The value of internal resistance of an ideal cell is
   a) Zero b) 0.5 Ω c) 1 Ω d) Infinity
16. If the electronic charge is 1.6×10^{-19} C, then the number of electrons passing through a section of wire per second, when the wire carries a current of 2 A is
   a) 1.25×10^{17} b) 1.6×10^{17} c) 1.25×10^{19} d) 1.6×10^{19}
17. Two bulbs are working in parallel order. Bulb A is brighter than bulb B. If R_A and R_B are their resistance respectively then
   a) $R_A > R_B$ b) $R_A < R_B$ c) $R_A = R_B$ d) None of these
18. The amount of chlorine produced per-second through electrolysis in a plate which consumes 100 KW power at 200 V is (Given, electrochemical equivalent of chlorine $= 0.367 \times 10^{-3} \text{gC}^{-1}$)
   a) 18.35 g b) 1.835 g c) 183.5 g d) 0.1835 g
19. Three resistors each of 2 ohm are connected together in a triangular shape. The resistance between any two vertices will be
   a) $4/3 ohm$ b) $3/4$ ohm c) 3 ohm d) 6 ohm
20. Two different conductors have same resistance at 0°C. It is found that the resistance of the first conductor at t_1°C is equal to the resistance of the second conductor at t_2°C. The ratio of the temperature coefficients of resistance of the conductors, $\frac{\alpha_1}{\alpha_2}$ is
   a) $\frac{t_1}{t_2}$ b) $\frac{t_2 - t_1}{t_2}$ c) $\frac{t_2 - t_1}{t_1}$ d) $\frac{t_2}{t_1}$
21. Which of the following set up can be used to verify the Ohm's law?
   a) 

   b) 

   c) 
   d) 

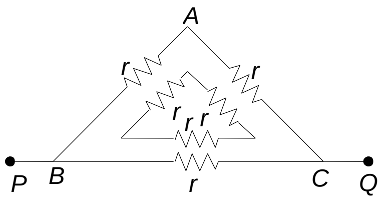
22. The resistance of a galvanometer is 25 ohm and it requires 50 μA for full deflection. The value of the shunt resistance required to convert it into an ammeter of 5 amp is
   a) $2.5 \times 10^{-4} ohm$ b) $1.25 \times 10^{-3} ohm$ c) 0.05 ohm d) 2.5 ohm
23. The resistivity of a potentiometer wire is $40 \times 10^{-8} ohm - m$ and its area of cross-section is $8 \times 10^{-6} m^2$. If 0.2 amp current is flowing through the wire, the potential gradient will be
   a) $10^{-2} volt/m$ b) $10^{-1} volt/m$ c) $3.2 \times 10^{-2} volt/m$ d) 1 $volt/m$
24. In the circuit shown here, the readings of the ammeter and voltmeter are



a) $6\ A, 60\ V$
b) $0.6\ A, 6\ V$
c) $6/11\ A, 60/11\ V$
d) $11/6\ A, 11/60\ V$

25. A thermocouple of negligible resistance produces an e.m.f. of $40\mu V/°C$ in the linear range of temperature. A galvanometer of resistance 10 ohm whose sensitivity is $1\mu A/div$, is employed with the thermocouple. The smallest value of temperature difference that can be detected by the system will be
a) 0.1°C b) 0.25°C c) 0.5°C d) 1°C

26. The resistance across R and Q in the figure.



a) $r/3$ b) $r/2$ c) $2r$ d) $6r$

27. When a current Iflows through a wire, the drift velocity of the electrons is v. When current $2I$ flows through another wire of the same material having double the length and double the area of cross-section, the drift velocity of the electrons will be
a) $\frac{v}{8}$ b) $\frac{v}{4}$ c) $\frac{v}{2}$ d) v

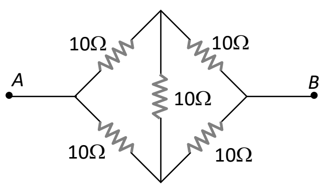
28. A wire is broken in four equal parts. A packet is formed by keeping the four wires together. The resistance of the packet in comparison to the resistance of the wire will be
a) Equal b) One fourth c) One eight d) $\frac{1}{16}th$

29. In an electroplating experiment, m gm of silver is deposited when 4 $ampere$ of current flows for 2 $minute$. The amount (in gm) of silver deposited by 6 $ampere$ of current for 40 $second$ will be
a) $4\ m$ b) $m/2$ c) $m/4$ d) $2\ m$

30. Which of the following relation is wrong?
a) 1 ampere ×1 ohm=1 volt
b) 1 watt ×1 sec=1 joule
c) 1 newton per coulomb =1 volt per metre
d) 1 columb ×1 volt=1 watt

31. To convert a 800 mV range $milli\ voltmeter$ of resistance 40 Ω into a galvanometer of 100 mA range, the resistance to be connected as shunt is
a) 10 Ω b) 20 Ω c) 30 Ω d) 40 Ω

32. The effective resistance between points A and B is

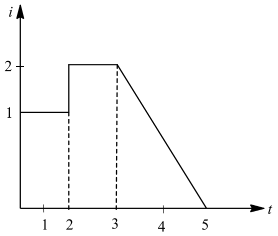


a) 10 Ω
b) 20 Ω
c) 40 Ω
d) None of the above three values

33. If the total emf in a thermocouple is a parabolic function expressed as $E = at + \frac{1}{2}\ bt^2$, which of the following relation does not hold good?

a) Neutral temperature $t_n = -\frac{a}{b}$ b) Temperature of inversion, $t_i = -\frac{-2a}{b}$
c) Thermoelectric power $P = a + bt$ d) $t_n = \frac{a}{b}$

34. The plot represents the flow of current through a wire at three different times.



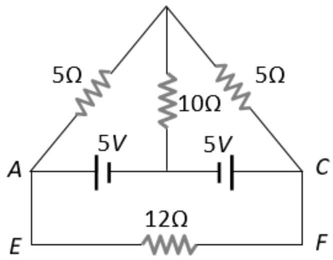
The ratio of charges flowing through the wire at different times is
a) 2 : 1 : 2 b) 1 : 3 : 3 c) 1 : 1 : 1 d) 2 : 3 : 4

35. When the resistance of 9 Ω is connected at the ends of a battery, its potential difference decreases from 40 $volt$ to 30 $volt$. The internal resistance of the battery is
a) 6 Ω b) 3 Ω c) 9 Ω d) 15 Ω

36. A cylindrical metal wire of length l and cross sectional area S, has resistance R, conductance G, conductivity σ and resistivity ρ. Which one of the following expressions for σ is valid
a) $\frac{GR}{\rho}$ b) $\frac{\rho R}{G}$ c) $\frac{GS}{l}$ d) $\frac{Rl}{S}$

37. The heat developed in an electric wire of resistance R by a current I for a time t is
a) $\frac{I^2Rt}{4.2} cal$ b) $\frac{I^2t}{4.2R} cal$ c) $\frac{I^2R}{4.2\, t} cal$ d) $\frac{Rt}{4.2\, I^2} cal$

38. In the circuit of adjoining figure the current though 12 Ω resistor will be



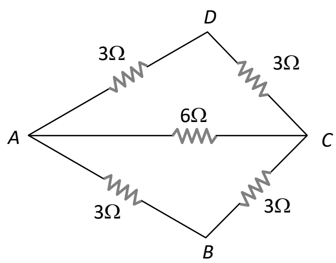
a) 1 A b) $\frac{1}{5} A$ c) $\frac{2}{5} A$ d) 0 A

39. An electric bulb is designed to draw power P_0 at voltage V_0. If the voltage is V it draws a power P. Then
a) $P = \left(\frac{V_0}{V}\right)^2 P_0$ b) $P = \left(\frac{V}{V_0}\right)^2 P_0$ c) $P = \left(\frac{V}{V_0}\right) P_0$ d) $P = \left(\frac{V_0}{V}\right) P_0$

40. When two resistances R_1 and R_2 are connected in series and parallel with 120 V line power consumed will be 25 W and 100 W respectively. Then the ratio of power consumed by R_1 to that consumed by R_2 will be
a) 1 :1 b) 1 :2 c) 2 :1 d) 1 :4

41. For which of the following the resistance decreases on increasing the temperature
a) Copper b) Tungsten c) Germanium d) Aluminium

42. The effective resistance between the points A and B in the figure is

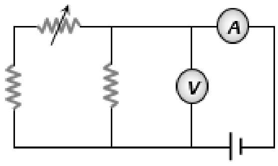


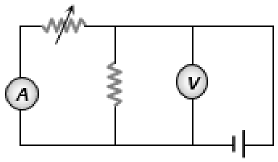
a) 5Ω b) 2Ω c) 3Ω d) 4Ω

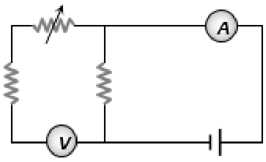
43. How much energy in kilowatt hour is consumed in operating ten 50 watt bulbs for 10 hours per day in a month (30 days)

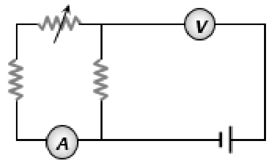
a) 1500 b) 5,000 c) 15 d) 150

44. Express which of the following setups can be used to verify Ohm's law

a) 

b) 

c) 

d) 

45. If in a voltaic cell, 5 g of zinc is consumed, we will get how many ampere hour (given that ECE of zinc is $3.38 \times 10^{-7} \text{kgC}^{-1}$)

a) 2.05 b) 8.2 c) 4.1 d) $5 \times 3.338 \times 10^{-7}$

46. The resistance of a conductor is 5 *ohm* at 50°C and 6 *ohm* at 100°C. Its resistance at 0°C is

a) 1 *ohm* b) 2 *ohm* c) 3 *ohm* d) 4 *ohm*

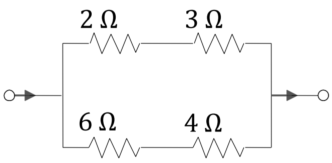
47. A metallic wire of resistance 12 Ω is bent to from a square. The resistance between two diagonal points would be

a) 12 Ω b) 24 Ω c) 6 Ω d) 3 Ω

48. A piece of metal weighing 200 g is to be electroplated with 5% of its weight in gold. How long it would take to deposits the required amount of gold, if the strength of the available current is 2 A?
(Given, electrochemical equivalent of $H = 0.0104 \times 10^{-4}$ gC^{-1} atomic weight of gold = 197.1, atomic weight of hydrogen = 1.008)

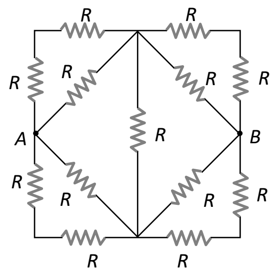
a) 7347.9 s b) 7400.5 s c) 7151.7 s d) 70 s

49. In the circuit shown in figure, the heat produced by the 6 Ω resistance is 60Ω cal s^{-1}. What heat per second is produced across 3Ω resistance?



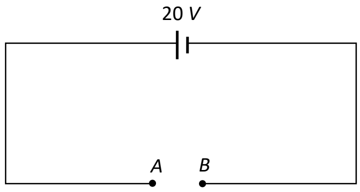
a) 30 cal b) 60 cal c) 100 cal d) 120 cal

50. Thirteen resistance each of resistance *R ohm* are connected in the circuit as shown in the figure below. The effective resistance between *A* and *B* is



a) $2R\ \Omega$ b) $\frac{4R}{3}\ \Omega$ c) $\frac{2\ R}{3}\ \Omega$ d) $R\ \Omega$

51. In the shown circuit, what is the potential difference across A and B



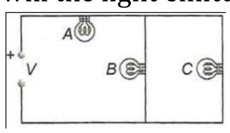
a) 50 V b) 45 V c) 30 V d) 20 V

52. The internal resistance of a cell is the resistance of
a) Electrodes of the cell b) Vessel of the cell
c) Electrolyte used in the cell d) Material used in the cell

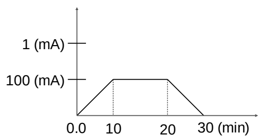
53. In potentiometer a balance point is obtained, when
a) The e.m.f. of the battery becomes equal to the e.m.f. of the experimental cell
b) The p.d. of the wire between the $+ve$ end to jockey becomes equal to the e.m.f. of the experimental cell
c) The p.d. of the wire between $+ve$ point and jockey becomes equal to the e.m.f. of the battery
d) The p.d. across the potentiometer wire becomes equal to the e.m.f. of the battery

54. A conductor wire having 10^{29} free electrons/m^3 carries a current of 20A. If the cross-section of the wire is 1mm^2, then the drift velocity of electrons will be
a) $6.25 \times 10^{-3}\text{ms}^{-1}$ b) $1.25 \times 10^{-5}\text{ms}^{-1}$ c) $1.25 \times 10^{-3}\text{ms}^{-1}$ d) $1.25 \times 10^{-4}\text{ms}^{-1}$

55. Figure shown three similar lamps A, B and C connected across a power supply. If the lamp C fuses, how will the light emitted by A and B change?

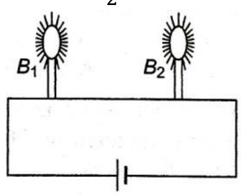


a) No change Brilliance of A decreases and that of B increases

b) 

c) Brilliance of both A and B increases d) Brilliance of both A and B decreases

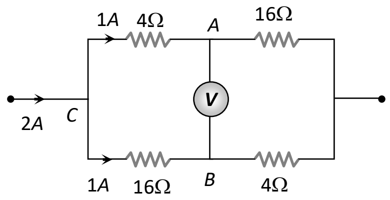
56. Bulb B_1 (100 W-250 V) and bulb B_2 (100 W-200 V) are connected across 250 V. What is potential drop across B_2?



a) 200 V b) 250 V c) 98 V d) 48 V

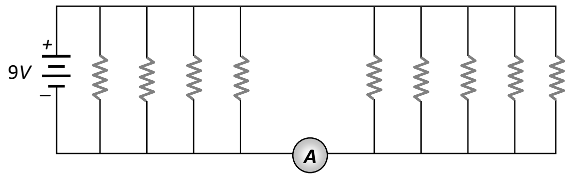
57. The amount of charge required to liberate 9 gm of aluminium (atomic weight =27 and valency = 3) in the process of electrolysis is (Faraday's number =96500 $coulombs/gm$ equivalent)
a) 321660 $coulombs$ b) 69500 $coulombs$ c) 289500 $coulomb$ d) 96500 $coulomb$

58. In the circuit shown below, the reading of the voltmeter V is



a) 12 V b) 8 V c) 20 V d) 16 V

59. If each resistance in the figure is of 9 Ω then reading of ammeter is



a) 5 A b) 8 A c) 2 A d) 9 A

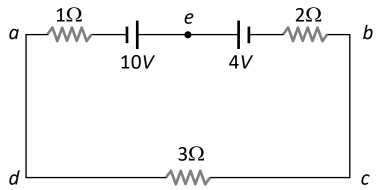
60. 160W-60V lamp is connected at 60 V DC supply. The number of electrons passing through the lamp in 1 min is (the charge of electron $e = 1.6 \times 10^{-19}$C)

a) 10^{19} b) 10^{21} c) 1.6×10^{19} d) 1.4×10^{20}

61. The smallest temperature difference that can be measured with a combination of a thermocouple of thermo e.m.f. 30 μV per degree and a galvanometer of 50 ohm resistance, capable of measuring a minimum current of $3 \times 10^{-7} amp$ is

a) 0.5 degree b) 1.0 degree c) 1.5 degree d) 2.0 degree

62. The magnitude and direction of the current in the circuit shown will be



a) $7/3A$ from a to b through e b) $7/3A$ from b to a through e

c) $1A$ from b to a through e d) $1A$ from a to b through e

63. If the cold junction is held at 0°C, the same thermo-emf V of a thermocouple varies as $V = 10 \times 10^{-6}\, t - \frac{1}{40} \times 10^{-6}\, t^2$, where t is the temperature of the hot junction in °C. The neutral temperature and the maximum value of thermo-emf are respectively

a) 200°C; 2 mV b) 400°C; 2 mV c) 100°C; 1 mV d) 200°C; 1 mV

64. A voltmeter has a range $0 - V$ with a series resistance R. With a series resistance $2R$, the range is $0 - V'$. The correct relation between V and V' is

a) $V' = 2V$ b) $V' > 2V$ c) $V' \gg 2V$ d) $V' < 2V$

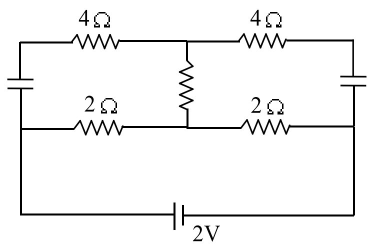
65. A potentiometer wire of length L and resistance 10 Ω is connected in series with a battery of e.m.f. 2.5 V and a resistance in its primary circuit. The null point corresponding to a cell of e.m.f. 1V is obtained at a distance $\frac{L}{2}$. If the resistance in the primary circuit is doubled then the position of new null point will be

a) 0.4 L b) 0.5 L c) 0.6 L d) 0.8 L

66. The ratio of voltage sensitivity (V_S) and current sensitivity (I_S) of a moving coil galvanometer is

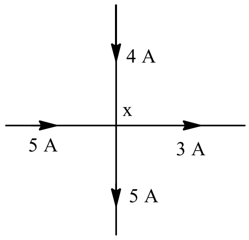
a) $\frac{1}{G}$ b) $\frac{1}{G^2}$ c) G d) G^2

67. Find the power of the circuit



a) 1.5 W b) 2 W c) 1 W d) None of these

68. Five conductors are meeting at a point x as shown in the figure. What is the value of current in fifth conductor?



a) 3 A away from x b) 1 A away from x c) 4 A away from x d) 1 A towards x

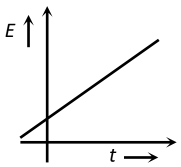
69. A heating coil is labelled 100 W, 220 V. The coil is cut in half and the two pieces are joined in parallel to the same source. The energy now liberated per second is

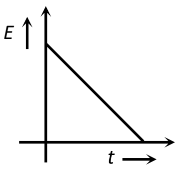
a) 200 J b) 400 J c) 25 J d) 50 J

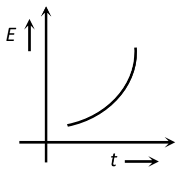
70. For comparing the e.m.f.'s of two cells with a potentiometer, a standard cell is used to develop a potential gradient along the wires. Which of the following possibilities would make the experiment unsuccessful

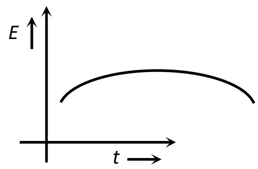
a) The e.m.f. of the standard cell is larger than the E e.m.f.'s the two cells
b) The diameter of the wires is the same and uniform throughout
c) The number of wires is ten
d) The e.m.f. of the standard cell is smaller than the e.m.f.'s of the two cells

71. Two different metals are joined end to end. One end is kept at constant temperature and the other end is heated to a very high temperature. The high depicting the thermo e.m.f. is

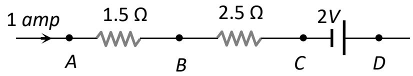
a) 

b) 

c) 

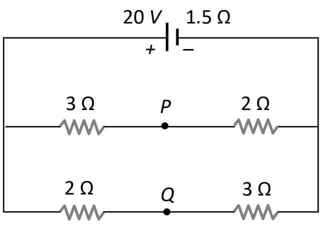
d) 

72. In the circuit element given here, if the potential at point $B, V_B = 0$, then the potentials of A and D are given as



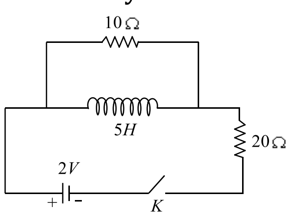
a) $V_A = -1.5V, V_D = +2V$ b) $V_A = +1.5V, V_D = +2V$
c) $V_A = +1.5\ V, V_D = +0.5\ V$ d) $V_A = +1.5V, V_D = -0.5\ V$

73. If in the circuit shown below, the internal resistance of the battery is 1.5 Ω and V_P and V_Q are the potentials at P and Q respectively, what is the potential difference between the points P and Q



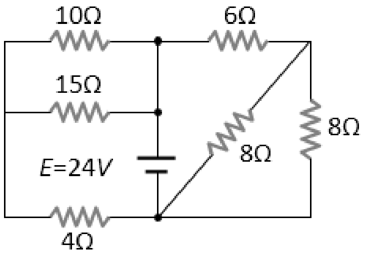
a) Zero b) 4 $volts$ $(V_P > V_Q)$ c) 4 $volts$ $(V_Q > V_P)$ d) 2.5 $volts$ $(V_Q > V_P)$

74. Two resistance of 10 Ω and 20 Ω and an inductor of inductance 5 H are connected to a battery of 2 V through a key k as shown in the figure. At time $t = 0$, when the key k is closed the initial current through the battery is



a) $0.2\ A$ b) $\frac{2}{15} A$ c) $\frac{1}{15} A$ d) 0

75. Find the equivalent resistance across the terminals of source of e.m.f. $24\ V$ for the circuit shown in figure



a) 15 Ω b) 10 Ω c) 5 Ω d) 4 Ω

76. Twelve cells, each having emf E volts are connected in series and kept in a closed box. Some of these cells are wrongly connected with positive and negative terminals reversed. This 12-cell battery is connected with an ammeter, an external resistance R ohm and a two-cell battery (two cells of the same type used earlier, connected perfectly in series). The current in the circuit when the 12-cell battery and 2-cell battery aid each other is 3A and 2A when they oppose each other. Then, the number of cell in 12-cell battery that are connected wrongly is

a) 4 b) 3 c) 2 d) 1

77. In hydrogen atom, the electron makes 6.6×10^{15} revolutions per second around the nucleus in an orbit of radius $0.5 \times 10^{-10} m$. It is equivalent to a current nearly

a) $1\ A$ b) $1\ mA$ c) $1\ \mu A$ d) $1.6 \times 10^{-19} A$

78. Two conductors made of the same material are connected across a common potential difference. Conductor A has twice the diameter and twice the length of conductor B. The power delivered to the two conductors P_A and P_B respectively is such that P_A/P_B equals to

a) 0.5 b) 1.0 c) 1.5 d) 2.0

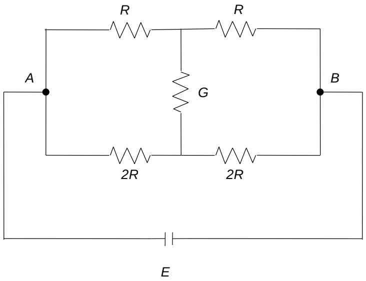
79. Two heater wires of equal length are first connected in series and then in parallel. The ratio of heat produced in the two cases is

a) 1 : 4 b) 4 : 1 c) 1 : 2 d) 2 : 1

80. Consider the following statements regarding the network shown in the figure.

1. The equivalent resistance of the network between point A and B is independent of value of G.
2. The equivalent resistance of the network between points A and B is $\frac{4}{3}R$
3. The current through G is zero.

Which of the above statements is/zero true?



a) 1,2 and 3 b) 2 and 3 c) 2 alone d) 1 alone

81. In a copper voltmeter experiment, current is decreased to one-fourth of the initial value but is passed for four times the earlier duration. Amount of copper deposited will be

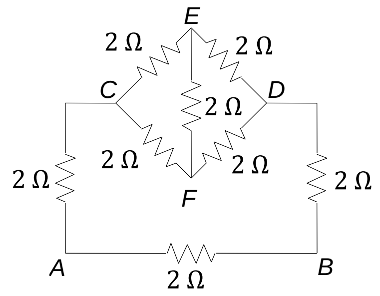
a) Same b) One-fourth the previous value
c) Four times the previous value d) $\frac{1}{16} th$ the previous value

82. A strip of copper and another of germanium are cooled from room temperature to $80\ K$. The resistance of

a) Each of these increases b) Each of these decreases

c) Copper strip increases and that of germanium decreases | d) Copper strip decreases and that of germanium increases

83. The resistance of the following circuit figure between A and B is



a) (3/2) Ω b) 2 Ω c) 4 Ω d) 8 Ω

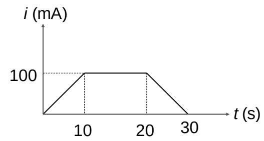
84. The amount of charge Q passed in time t through a cross-section of a wire is $Q = 5t^2 + 3t + 1$.The value of current at time $t = 5\ s$ is

a) 9A b) 49A c) 53A d) None of these

85. Silver and copper voltameter are connected in parallel with a battery of e.m.f. 12 V. In 30 $minutes$, 1g of silver and 1.8g of copper are liberated. The power supplied by the battery is
($Z_{Cu} = 6.6 \times 10^{-4} g/C$ and $Z_{Ag} = 11.2 \times 10^{-4} g/C$)

a) 24.13 J/sec b) 2.413 J/sec c) 0.2413 J/sec d) 2413 J/sec

86. In a copper voltmeter, the mass deposited in 30 s is m gram. If the current-time graph is as shown in figure, the electrochemical equivalent of copper, in gC^{-1} is

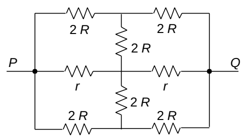


a) 0.1 m b) 0.6 m c) $\frac{m}{2}$ d) m

87. The electron in a hydrogen atom circles around the proton in 1.5941×10^{-18}s. The equivalent current due to motion of the electrons is

a) 127.37 mA b) 122.49 mA c) 100.37 mA d) 94.037 mA

88. The effective resistance between points P and Q of the electrical circuit shown in the figure.

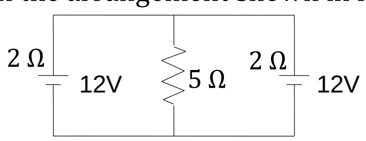


a) $\frac{2Rr}{R+r}$ b) $\frac{8R(R+r)}{(3R+r)}$ c) $2R + 4r$ d) $\frac{5R}{2} + 2R$

89. In a thermo-couple, one junction which is at 0°C and the othe at t°C the emf is given by $E = at^2 - bt^2$. The neutral temperature is given by

a) a/b b) $2\ a/3b$ c) $3a/2b$ d) $b/2a$

90. In the arrangement shown in figure, the current through 5Ω resistor is



a) 2A b) Zero c) $\frac{12}{7}$A d) 1A

91. A straight conductor of uniform cross-section carries a current i, If s is the specific charge of an electron, the momentum of all the free electrons per unit length of the conductor, due to their drift velocity only is

a) is b) $\sqrt{i/s}$ c) i/s d) $(i/s)^2$

92. When a copper voltmeter is connected with a battery of emf 12V, 2 g of copper is deposited in 30 min. If the same voltmeter is connected across 6 V battery, the mass of copper deposited in 45 min would be

a) 1 g b) 1.5 g c) 2 g d) 2.5 g

93. A resistor R and 2μF capacitor in series is connected through a switch to 200 V direct supplies. Across the capacitor is a neon bulb that lights up at 120 V. Calculate the value of R to make the bulk light up 5 s alter the switch has been closed ($\log_{10} 2.5 = 0.4$)

a) $1.7 \times 10^5\ \Omega$ b) $2.7 \times 10^6\ \Omega$ c) $3.3 \times 10^7\ \Omega$ d) $1.3 \times 10^4\ \Omega$

94. In above question, if length is doubled, the drift velocity

a) Is doubled b) Is halved c) Remains same d) Becomes zero

95. Out of five resistances of resistance $R\ \Omega$ each 3 are connected in parallel and are joined to the rest 2 in series. Find the resultant resistance

a) $\left(\frac{3}{7}\right) R\ \Omega$ b) $\left(\frac{7}{3}\right) R\ \Omega$ c) $\left(\frac{7}{8}\right) R\ \Omega$ d) $\left(\frac{8}{7}\right) R\ \Omega$

96. If the resistivity of an alloy is ρ' and that of constituent metal is ρ then

a) $\rho' > \rho$ b) $\rho' < \rho$

c) $\rho' = \rho$ d) There is no simple relation between ρ and ρ'

97. The mass of a substance liberated when a charge $'q'$ flows through an electrolyte is proportional to

a) q b) $1/q$ c) q^2 d) $1/q^2$

98. The resistance of a discharge tube is

a) *Ohmic* b) Non-*ohmic* c) Both (a) and (b) d) Zero

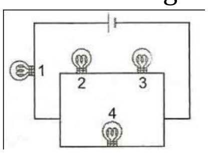
99. If the resistance of a conductor is 5Ω at 50°C and 7Ω at 100°C then the mean temperature coefficient of resistance of the material is

a) 0.008/°C b) 0..006/°C c) 0.004/°C d) 0.001/°C

100. The resistance of a galvanometer coil is R, then the shunt resistance required to convert it into a ammeter of range 4times, will be

a) $4R$ b) $R/3$ c) $R/4$ d) $R/5$

101. All bulbs in figure, are identical. Which bulb lights brightly?



a) 1 b) 2 c) 3 d) 4

102. An ammeter gives full scale deflection when current 1.0 A is passed in it. To convert it into 10 A range ammeter, the ratio of its resistance and the shunt resistance will be

a) 1 : 9 b) 1 : 10 c) 1 : 11 d) 9 : 1

103. Same current is being passed through a copper voltmeter and a silver voltmeter. The rate of increase in weights of the cathode of the two voltmeters will be proportional to

a) Atomic masses b) Atomic number c) Relative densities d) None of the above

104. For measurement of potential difference, potentiometer is preferred in comparison to voltmeter because

a) Potentiometer is more sensitive than voltmeter

b) The resistance of potentiometer is less than voltmeter

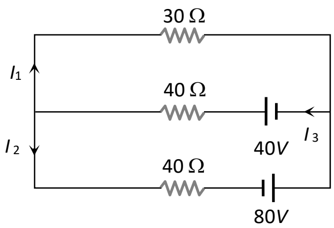
c) Potentiometer is cheaper than voltmeter

d) Potentiometer does not take current from the circuit

105. The resistance of an ideal ammeter is

a) Infinite b) Very high c) Small d) Zero

106. In the given circuit the current I_1 is



a) 0.4 A b) −0.4 A c) 0.8 A d) −0.8 A

107. The chemical equivalent of copper and zinc are 32 and 108 respectively. When copper and silver voltmeters are connected in series and electric current is passed through for sometime, 1.6 g of copper is deposited. Then, the mass of silver deposited will be

a) 3.5 g b) 2.8 g c) 5.4 g d) None of these

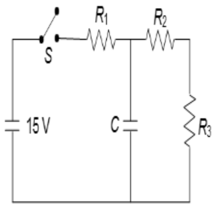
108. When current is passed in antimony-bismuth couple, then

a) The junction becomes hot when the current is from bismuth to antimony
b) The junction becomes hot when current flows from antimony to bismuth
c) Both junctions becomes hot
d) Both junctions becomes cold

109. The current inside a copper voltameter

a) Is half the outside value
b) Is the same as the outside value
c) Is twice the outside value
d) Depends on the concentration of $CuSO_4$

110. $I - V$ characteristic of a copper wire of length L and area of cross-section A is shown in figure. The slope of the curve becomes



a) More if the experiment is performed at higher temperature
b) More if a wire of steel of same dimension is used
c) More if the length of the wire increased
d) Less if the length of the wire increased

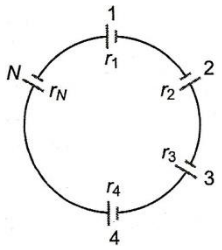
111. A heater of 220 V heats a volume of water in 5 min time. A heater of 110 V heats the same volume of water is

a) 5 min b) 8 min c) 4×10^4 min d) 20 min

112. Two wires having resistance of 2Ω and 4Ω are connected to same voltage. Ratio of heat dissipated at resistance is

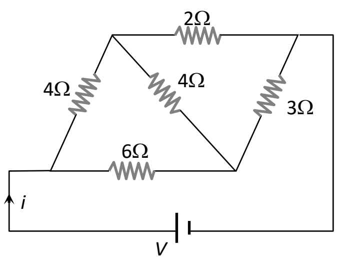
a) 1 :2 b) 4 :3 c) 2 :1 d) 5 :2

113. A group of N cells whose emf varies directly with the internal resistance as per the equation $E_N = 1.5r_N$ are connected as shown in the figure. The current I in the circuit is



a) 5.1A b) 0.51A c) 1.5A d) 0.15A

114. For the network shown in the figure the value of the current i is



a) $\frac{9V}{35}$ b) $\frac{5V}{18}$ c) $\frac{5V}{9}$ d) $\frac{18V}{5}$

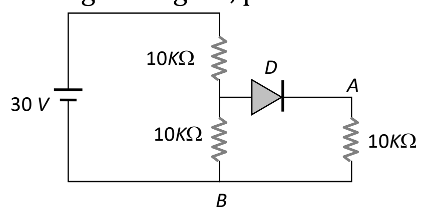
115. Which of the following is not a correct statement

a) Resistivity of electrolytes decreases on increasing temperature
b) Resistance of mercury falls on decreasing its temperature
c) When joined in series a 40 W bulb glows more than a 60 W bulb
d) Resistance of 40 W bulb is less than the resistance of 60 W bulb

116. For a certain thermocouple the emf is $E = aT + bT^2$, where t (in°C) is the temperature of hot junction, the cold junction is at 0°C. The value of contants a and b are 10×10^{-6} and 0.02×10^{-6} respectively, then the temperature of inversion (in°C) will be

a) 150 b) 250 c) 500 d) 750

117. In the given figure, potential difference between A and B is



a) 0 b) 5 $volt$ c) 10 $volt$ d) 15 $volt$

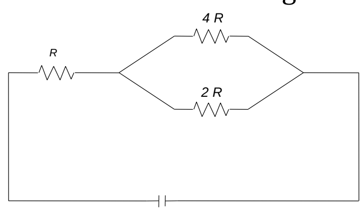
118. A cell of emf E is connected across a resistance R. the potential difference between the terminals of the cell is found to be V volt. Then the internal resistance of the cell must be

a) (E-V) b) $\frac{(E-V)}{V}R$ c) $\frac{2(E-V)R}{E}$ d) $\frac{2(E-V)V}{R}$

119. Electric field (E) and current density (J) have relation

a) $E \propto J^{-1}$ b) $E \propto J$ c) $E \propto \frac{1}{J^2}$ d) $E^2 \propto \frac{1}{J}$

120. In a network as shown in the figure, the potential difference across the resistance $2R$ is (the cell has an emf of E volt and has no ingternal resistance)



a) $2E$ b) $\frac{4E}{7}$ c) $\frac{E}{7}$ d) E

121. Two identical conductors maintained at same temperatures are given potential differences in the ratio 1 : 2. Then the ratio of their drift velocities is

a) 1 : 2 b) 3 : 2 c) 1 : 1 d) $1 : 2^{1/2}$

122. A 100 W bulb produces an electric field of 2.9 V/m at a point 3 m away. If the bulb is replaced by 400 W bulb without disturbing other conditions, then the electric field produced at the same point is

a) 2.9 V/m b) 3.5 V/m c) 5 V/m d) 5.8 V/m

123. The neutral temperature $t_n = 285$°C is constant for a Cu-Fe thermocouple. When the cold junction is at 0°C, the value of inversion temperature is $t_i = 570$°C but if the cold junction is at 10°C, the inversion temperature (t_i) will be

a) 550°C b) 560°C c) 570°C d) 580°C

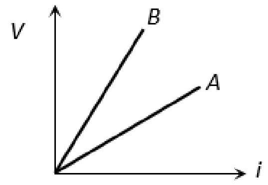
124. When a battery connected across a resistor of 16 Ω, the voltage across the resistor is 12 V. When the same battery is connected across a resistor of 10 Ω, voltage across it is 11V. The internal resistance of the battery (in ohm) is

a) $\frac{10}{7}$ b) $\frac{20}{7}$ c) $\frac{25}{7}$ d) $\frac{30}{7}$

125. For obtaining chlorine by electrolysis a current of 100 kW and 125 V is used. (Electro chemical equivalent of chlorine is 0.367 $\times$ kgC^{-1}). The amount of chlorine obtained in one minute will be

a) 1.7616 g b) 17.616 g c) 0.17161 g d) 1.7616 kg

126. $V - i$ graphs for parallel and series combination of two identical resistors are as shown in figure. Which graph represents parallel combination

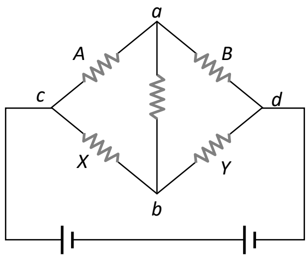


a) A
b) B
c) A and B both
d) Neither A nor B

127. As the temperature rises the resistance offered by metal
a) Increase b) Decrease c) Remains same d) None of these

128. A wire $100 cm$ long and 2.0 mm diameter has a resistance of 0.7 ohm, the electrical resistivity of the material is
a) $4.4 \times 10^{-6}\ ohm \times m$
b) $2.2 \times 10^{-6} ohm \times m$
c) $1.1 \times 10^{-6}\ ohm \times m$
d) $0.22 \times 10^{-6}\ ohm \times m$

129. In the Wheatstone's bridge (shown in figure) $X = Y$ and $A > B$. The direction of the current between ab will be



a) From a to b
b) From b to a
c) From b to a through c
d) From a to b through c

130. The chemical equivalent of silver is 108. If the current in a silver voltmeter is 2 amp, the time required to deposit 27 $grams$ of silver will be
a) 8.57 hrs b) 6.70 hrs c) 3.35 hrs d) 12.50 hrs

131. By increasing the temperature, the specific resistance of a conductor and a semiconductor
a) Increases for both b) Decreases for both c) Increases, decreases d) Decreases, increases

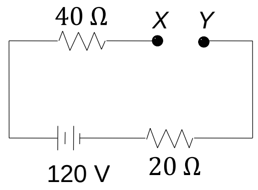
132. Two electric bulbs whose resistances are in the ratio of 1 : 2 are connected in parallel to a constant voltage source. The powers dissipated in them have the ratio
a) 1 :2 b) 1 :1 c) 2 :1 d) 1 :4

133. Two cells of same emf E but of different internal resistances r_1 and r_2 are connected in series with an external resistance R. The potential drop across the first cell is found to be zero. The external resistance R is
a) $r_1 + r_2$ b) $r_1 - r_2$ c) $r_2 - r_1$ d) $r_1 r_2$

134. A thermocouple is made from two metals, Antimony and Bismuth. If one junction of the couple is kept hot and the other is kept cold, then, an electric current will
a) Flow from Antimony to Bismuth at the hot junction
b) Flow from Bismuth to Antimony at the cold junction
c) Not flow through the thermocouple
d) Flow from Antimony to Bismuth at the cold junction

135. The resistivity of a wire
a) Increase with the length of the wire
b) Decreases with the area of cross-section
c) Decreases with the length and increases with the cross-section of wire
d) None of the above statement is correct

136. In the circuit shown figure potential difference between X and Y will be



a) Zero b) 20 V c) 60 V d) 120 V

137. Heat produced (cals) in a resistance R when a current I amperes flows through it for t seconds is given by the expression

a) $\frac{I^2Rt}{4.2}$ b) $\frac{IR^2t}{4.2}$ c) $\frac{4.2IR}{t^2}$ d) $\frac{IRt^2}{4.2}$

138. Kirchoff's second law for the analysis of circuit is based on

a) Conversion of charge
b) Conversion of energy
c) Conversion of both charge and energy
d) Conversion of momentum of electron

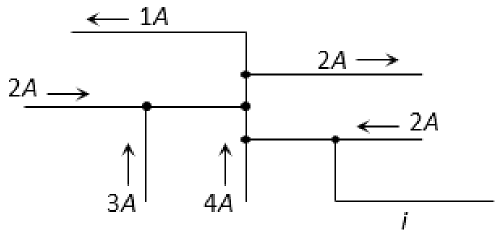
139. A constant voltage is applied between the two ends of a uniform metallic wire. Some heat is developed in it. The heat developed is doubled if

a) Both the length and radius of wire are halved
b) Both the length and radius of wire are doubled
c) The radius of wire is doubled
d) The length of wire is doubled

140. If an increase in length of copper wire is 0.5% due to stretching, the percentage increase in its resistance will be

a) 0.1% b) 0.2% c) 1% d) 2%

141. The figure here shows a portion of a circuit. What are the magnitude and direction of the current i in the lower right-hand wire



a) 7 A b) 8 A c) 6 A d) 2 A

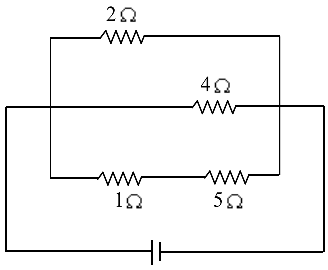
142. The current flowing through a wire depends on time as $I = 3t^2 + 2t + 5$. The charge flowing through the cross-section of the wire in time from $t = 0$ to $t = 2$ sec. is

a) 22 C b) 20 C c) 18 C d) 5 C

143. We have a galvanometer of resistance 25Ω. It is shunted by a 2.5 Ω wire. The part of total current that flows through the galvanometer is given as

a) $\frac{I}{I_0} = \frac{1}{11}$ b) $\frac{I}{I_0} = \frac{1}{10}$ c) $\frac{I}{I_0} = \frac{3}{11}$ d) $\frac{I}{I_0} = \frac{4}{11}$

144. A current of 3 amp. flows through the 2Ω resistor shown in the circuit. The power dissipated in the 5Ω resistor is



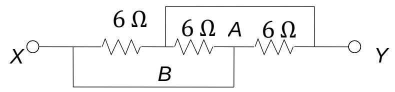
a) 1 $watt$ b) 5 $watt$ c) 4 $watt$ d) 2 $watt$

145. One junction of a certain thermoelectric couple is at a fixed temperature T_r and the other junction is at temperature T. The thermo-electromotive force for this is expressed by $E = k(T - T_r)\left[T_0 - \frac{1}{2}(T + T_r)\right]$.

At temperature $T = \frac{1}{2} T_0$, the thermoelectric power is

a) $\frac{1}{2}kT_0$ b) kT_0 c) $\frac{1}{2}kT_0^2$ d) $\frac{1}{2}k\,(T_0 - T_r)^2$

146. In a given network, each resistance has value of 6Ω. The point X is connected to point A by a copper wire of negligible resistance and point Y is connected to point B by the same wire. The effective resistance between X and Y will be



a) 18Ω b) 6 Ω c) 3 Ω d) 2 Ω

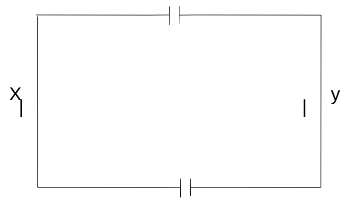
147. Faraday's laws of electrolysis are related to

a) The atomic number of positive ion b) The equivalent weight of electrolyte
c) The atomic number of negative ion d) The velocity of positive ion

148. A cell having emf of 1.5V, when connected across a resistance of 14 Ω, produces a voltage of only 1.4V across this resistance. The internal resistance of the cell must be

a) 1 Ω b) 14 Ω c) 15 Ω d) 21 Ω

149. Two similar accumulators each of emf E and internal resistance r are connected as shown in the following figure. Then, the potential difference between x and y is



a) 2E b) E c) Zero d) None of these

150. In a meter bridge experiment, the ratio of the left gap resistance to right gap resistance is 2:3, the balance point from left is

a) 60 cm b) 50 cm c) 40 cm d) 20 cm

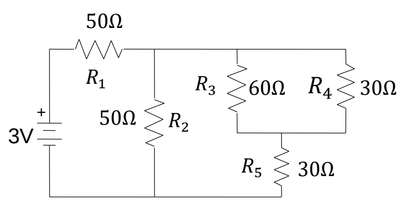
151. A conductor wire having 10^{29} free electrons/m^3 carries a current of 20A. If the cross-section of the wire is $1mm^2$, then the drift velocity of electrons will be

a) $6.25 \times 10^{-3} ms^{-1}$ b) $1.25 \times 10^{-5} ms^{-1}$ c) $1.25 \times 10^{-3} ms^{-1}$ d) $1.25 \times 10^{-4} ms^{-1}$

152. A potentiometer wire of length 10 m and resistance 20 Ω is connected is series with a 15V battery and an external resistance 40 Ω. A secondary cell of emf E in the secondary circuit is balanced by 240 cm long the potentiometer wire. The emf E of the cell is

a) 2.4V b) 1.2V c) 2.0V d) 3V

153. In circuit shown below, the resistances are given in ohm and the battery is assumed ideal with emf equal to 3V. The voltage across the resistance R_4 is



a) 0.4V b) 0.6V c) 1.2V d) 1.5V

154. Constant current is flowing through a linear conductor of non-uniform area of cross-section. The charge flowing per second through the area of conductor at any cross-section is

a) Proportional to the area of cross- section b) Inversely proportional to the area of cross-section
c) Independent of the area of cross-section d) Dependent on the length of conductor

155. Total surface area of a cathode is $0.05m^2$ and 1 A current passes through it for 1 $hour$. Thickness of nickle

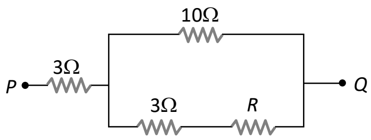
deposited on the cathode is (Given that density of nickle = $9g/cc$ and it's E.C.E. = $3.04 \times 10^{-4} g/C$)

a) 2.4 m b) 0.24 μm c) 2.4 μm d) None of these

156. An AC generator of 220 V have internal resistance $r = 10\ \Omega$ and external resistance $R = 100\ \Omega$. What is the power developed in the external circuit?

a) 227 W b) 325 W c) 400 W d) 500 W

157. In the circuit shown here, what is the value of the unknown resistor R so that the total resistance of the circuit between points P and Q is also equal to R



a) 3 ohm b) $\sqrt{39}\ ohm$ c) $\sqrt{69}\ ohm$ d) 10 ohm

158. The resistance of a wire is R. If the length of the wire is doubled by stretching, then the new resistance will be

a) $2R$ b) $4R$ c) R d) $\frac{R}{4}$

159. By ammeter, which of the following can be measured

a) Electric potential b) Potential difference c) Current d) Resistance

160. The maximum power drawn out of the cell from a source is given by (where r is internal resistance)

a) $E^2/2r$ b) $E^2/4r$ c) E^2/r d) $E^2/3r$

161. The emf is thermocouple changes sign at 600 K. If the neutral temperature is 210°C, the temperature of cold junction is

a) 180 K b) 117 K c) 93°C d) 90°C

162. How many minimum number of 2 Ω resistance can be connected to have an effective resistance of 1.5 Ω?

a) 3 b) 2 c) 4 d) 6

163. Equal potentials are applied on an iron and copper wire of same length. In order to have the same current flow in the two wires, the ration r (iron)/r (copper) of their radii must be (Given that specific resistance of iron = $1.0 \times 10^{-7}\ ohm - m$ and specific resistance of copper = $1.7 \times 10^{-8} ohm - m$)

a) About 1.2 b) About 2.4 c) About 3.6 d) About 4.8

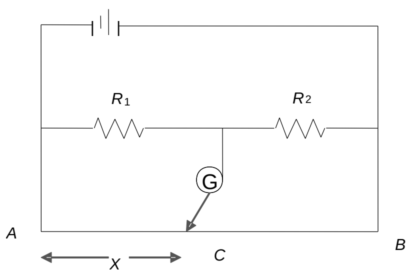
164. A fuse wire of circuit cross-section and having diameter of 0.4 mm, allows 3 A of current to pass through it. But if another fuse wire of same material and circular cross-section and having diameter of 0.6 mm is taken, then the amount of current passed through the fuse is

a) 3 A b) $3 \times \sqrt{\frac{3}{2}}$ A c) $3 \times \left(\frac{3}{2}\right)^{3/2}$ A d) $3 \times \left(\frac{3}{2}\right)$ A

165. Two identical cells weather connected in parallel or in series gives the same current when connected to an external resistance 1.5 Ω. Find the value of internal resistance of each cell.

a) 1 Ω b) 0.5 Ω c) Zero d) 1.5 Ω

166. In the shown arrangement of the experiment of the meter bridge if AC corresponding to null deflection of galvanometer is x, what would be its value if the radius of the wire AB is doubled?



a) x b) $x/4$ c) $4x$ d) $2x$

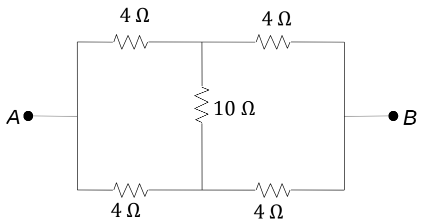
167. A current of two ampere is flowing through a cell of e. m. f. 5 $volt$ and internal resistance 0.5 ohm from negative to positive electrode. If the potential of negative electrode is $10V$, the potential of positive electrode will be

a) 5 V b) 14 V c) 15 V d) 16 V

168. Two bulbs 25 W, 220 V and 100 W, 220 V are given. Which has higher resistance?
a) 25 W bulb b) 100 W bulb
c) Both bulbs will have equal resistance d) Resistance of bulbs cannot be compared

169. The temperature of cold, hot junction of a thermocouple is 0°C and T°C respectively. The thermo-emf produced is $E = AT - \frac{1}{2} BT^2$. If $A = 16, B = 0.080$, the temperature of inversion will be
a) 100°C b) 300°C c) 400°C d) 500°C

170. The equivalent resistance across A and B is

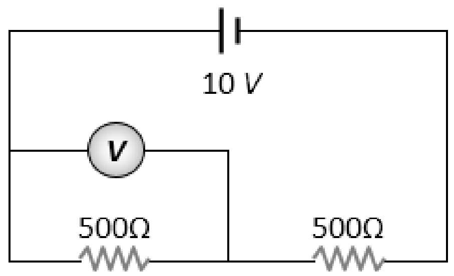


a) 2Ω b) 3Ω c) 4Ω d) 5Ω

171. The length of a potentiometer wire is 5m. An electron in this wire experiences a force of 4.8×10^{-19}N, emf of the main cell used in potentiometer is
a) 3 V b) 15 V c) 1.5 V d) 5 V

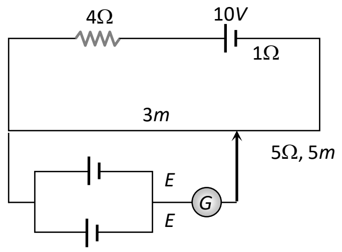
172. When a piece of aluminium wire of finite length is drawn through a series of dies to reduce its diameter to half its original value, its resistance will become
a) Two times b) Four times c) Eight times d) Sixteen times

173. A voltmeter of resistance 1000 Ω is connected across a resistance of 500 Ω in the given circuit. What will be the reading of voltmeter



a) 1 V b) 2 V c) 6 V d) 4V

174. A resistance of 4Ω and a wire of length 5 $metres$ and resistance 5Ω are joined in series and connected to a cell of e.m.f. 10 V and internal resistance 1Ω. A parallel combination of two identical cells is balanced across 300 cm of the wire. The e.m.f. E of each cell is



a) 1.5 V b) 3.0 V c) 0.67 V d) 1.33 V

175. Current flows through a metabolic conductor whose area of cross-section increases in the direction of the current. If we move in this direction,
a) The carrier density will change b) The current will change
c) The drift velocity will decrease d) The drift velocity will increase

176. The resistance will be least in a wire with dimension
a) $L/2, 2A$ b) $2L, A$ c) L, A d) None of these

177. At room temperature, copper has free electron density of 8.4×10^{28} per m^3. The copper conductor has a

cross-section of $10^{-6} m^2$ and carries a current of 5.4 A. The electron drift velocity in copper is

a) 400 m/s b) 0.4 m/s c) 0.4 mm/s d) 72 m/s

178. A battery is charged at a potential of 15 V in 8 hours when the current flowing is 10 A. The battery on discharge supplies a current of 5 A for 15 hours. The mean terminal voltage during discharge is 14 V. The "$Watt - hour$" efficiency of battery is

a) 80% b) 90% c) 87.5% d) 82.5%

179. A combination of two resistance of 2 W and 2/3 W connected in parallel is joined across a battery of emf of 3 V and of negligible internal resistance. The energy given out per sec will be

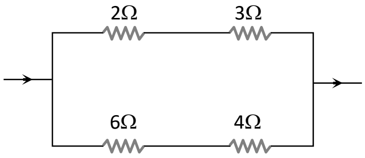
a) $\frac{1}{2} \times 3 \times 3$ J b) $\frac{1}{2} \times \frac{1}{3} \times 3 \times 3$ J c) 2×3 J d) $3 \times 3 \times 2$ J

180. The length of the wire is doubled. Its conductance will be

a) Unchanged b) Halved

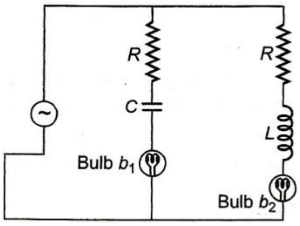
c) Quadrupled d) 1/4 of the original value

181. In the circuit as shown in the figure, the heat produced by 6 ohm resistance due to current flowing in it is 60 $calorie$ per $second$. The heat generated across 3 ohm resistance per second will be



a) 30 $calorie$ b) 60 $calorie$ c) 100 $calorie$ d) 120 $calorie$

182. Two identical incandescent light bulbs are connected as shown in the figure. When the circuit is an AC voltage source of frequency f, which of the following observations will be correct?



a) Both bulbs will glow alternatively

b) Both bulbs will glow with same brightness provided frequency $f = \frac{1}{2\pi}\sqrt{(1/LC)}$

c) Bulb b_1 will light up initially and goes off, bulb b_2 will be ON constantly

d) Bulb b_1 will blink and bulb b_2 will be ON constantly

183. A wire of length 5m and radius 1 mm has a resistance of 1 ohm. What length of the wire of the same material at the same temperature and of radius 2 mm will also have a resistance of 1 ohm

a) 1.25 m b) 2.5 m c) 10 m d) 20 m

184. It is possible that any some constant value of emf, but the potential difference between the plates is zero?

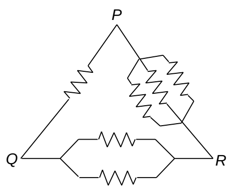
a) Not, possible

b) Yes, if another identical battery is joined in series

c) Yes, if another identical battery is joined in opposition

d) Yes, possible, if another similar battery is joined in parallel

185. Six equal resistances are connected between point s P, Q and R as shown in the figure. Then the net resistance will be maximum between



a) P and Q b) Q and R c) P and R d) Any two points

186. When a 12Ω resistor is connected with a moving coil galvanometer then its deflection reduces from 50 divisions to 10 divisions. The resistance of the galvanometer is

a) 24 Ω b) 36 Ω c) 48 Ω d) 60 Ω

187. A galvanometer having a resistance of 8 ohm is shunted by a wire of resistance 2 ohm. If the total current is 1 amp, the part of it passing through the shunt will be

a) 0.25 amp b) 0.8 amp c) 0.2 amp d) 0.5 amp

188. Resistors of 1, 2, 3 ohm are connected in the form of a triangle. If a 1.5 volt cell of negligible internal resistance is connected across 3 ohm resistor, the current flowing through this resistance will be

a) 0.25 amp b) 0.5 amp c) 1.0 amp d) 1.5 amp

189. A galvanometer of resistance 50 Ω is connected to a battery of 3V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be

a) 5050 Ω b) 5550 Ω c) 6050 Ω d) 4450 Ω

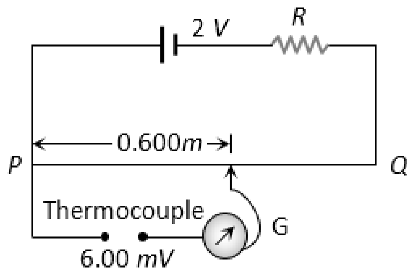
190. If a 30 V, 90 W bulb is to be worked on a 120 V line, a resistance of how many ohms should be connected in series with the bulb

a) 10 ohm b) 20 ohm c) 30 ohm d) 40 ohm

191. n equal resistors are first connected in series and then connected in parallel. What is the ratio of the maximum to the minimum resistance

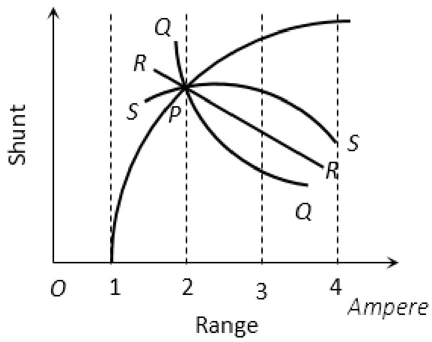
a) n b) $\frac{1}{n^2}$ c) n^2 d) $\frac{1}{n}$

192. Figure shows a simple potentiometer circuit for measuring a small e.m.f. produced by a thermocouple. The meter wire PQ has a resistance 5 Ω and the driver cell has an e.m.f. of 2 V. If a balance point is obtained 0.600m along PQ when measuring an e.m.f. of 6.00 mV, what is the value of resistance R



a) 995 Ω b) 1995 Ω c) 2995 Ω d) None of these

193. The ammeter has range 1 $ampere$ without shunt. The range can be varied by using different shunt resistances. The graph between shunt resistance and range will have the nature

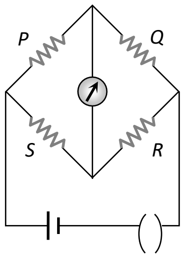


a) P b) Q c) R d) S

194. In a Wheatstone's network $P = 2\Omega, Q = 2\Omega$, R = 2Ω and S = 3Ω. The resistance with which S is to be shunted in order that the bridge may be balanced is

a) 1 Ω b) 2 Ω c) 4 Ω d) 6 Ω

195. In the Wheatstone's bridge shown, $P = 2\Omega, Q = 3\Omega, R = 6\Omega$ and $S = 8\ \Omega$. In order to obtain balance, shunt resistance across $'S'$ must be



a) 2 Ω b) 3 Ω c) 6 Ω d) 8 Ω

196. If an observer is moving with respect to a stationary electron, then he observes

a) Only magnetic field b) Only electric field c) Both (a) and (b) d) None of the above

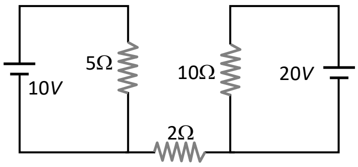
197. If $2.2kW$ power is transmitted through a 100Ω line at $22,000V$, the power loss in the form of heat will be

a) $0.1\ W$ b) $1\ W$ c) $10\ W$ d) $100\ W$

198. The resistance of a bulb filament is 100 Ω at a temperature of 100°C. If its temperature coefficient of resistance be 0.005 per°C, its resistance will become 200 Ω at a temperature of

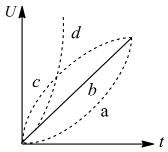
a) 300°C b) 400°C c) 500°C d) 200°C

199. Find out the value of current through 2Ω resistance for the given circuit



a) $5\ A$ b) $2\ A$ c) Zero d) $4\ A$

200. Which of the plots shown in figure may represent the thermal energy produced in a resistor in a given time as a function of the electric current?



a) a b) b c) c d) d

201. Two resistors of resistances $200\ k\Omega$ and $1M\Omega$ respectively form a potential divider with outer junctions maintained at potentials of $+3V$ and $-15V$. Then, the potential at the junction between the resistors is

a) $+1\ V$ b) $-0.6\ V$ c) $0\ V$ d) $-12\ V$

202. In a Wheatstone bridge, $P = 90\Omega, Q = 110\Omega, R = 40\Omega$ and $S = 60\Omega$ and a cell of 4 V emf. Then the potential difference between the diagonal along which a galvanometer is connected is

a) −0.2 V b) +0.2 V c) −1 V d) +1 V

203. A thermo couple develops $200\mu\ V$ between 0°C and 100°C. If it develops 64 $\mu\ V$ and 76 $\mu\ V$ respectively between (0°C − 32°C) and (32°C − 70°C) then what will be the thermo emf it develops between 70°C and 100°C

a) 65 $\mu\ V$ b) 60 $\mu\ V$ c) 55 $\mu\ V$ d) 50 $\mu\ V$

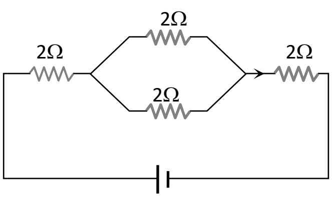
204. In a potentiometer arrangement, a cell of emf 1.5V gives a balance point at 27cm length of wire. If the cell is replaced by another cell and balance point shifts to 54cm, the emf of the second cell is

a) 3V b) 1.5V c) 0.75V d) 2.25V

205. Which of the following is not reversible

a) Joule effect b) Peltier effect c) Seebeck effect d) Thomson effect

206. The equivalent resistance of the circuit shown in the figure is



a) 8 Ω b) 6 Ω c) 5 Ω d) 4 Ω

207. A battery having e.m.f. $5V$ and internal resistance 0.5 Ω is connected with a resistance of 4.5 Ω then the

voltage at the terminals of battery is

a) 4.5 V b) 4 V c) 0 V d) 2 V

208. If the electric current through an electric bulb is 3.2 A, the number of electrons flow through it in one second is

a) 2×10^9 b) 2×10^{19} c) 3.2×10^{19} d) 1.6×10^{18}

209. Two tangent galvanometer A and B are identical except in their number of turns. They are connected in series. On passing a current through them, deflections of 60° and 30° are produced. The ratio of the number of units A and B is

a) 1:3 b) 3:1 c) 1:2 d) 2:1

210. A solenoid is at potential difference of 60 V and current flowing through it is 15 $ampere$, then the resistance of coil will be

a) 4Ω b) 8Ω c) 0.25Ω d) 2Ω

211. A 50 ohm galvanometer gets full scale deflection when a current of 0.01 A passes through the coil. When it is converted to a 10 A ammeter, the shunt resistance is

a) 0.01 Ω b) 0.05 Ω c) 2000 Ω d) 5000 Ω

212. Sensitivity of potentiometer can be increased by

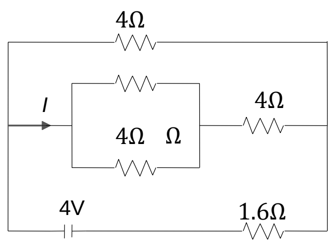
a) Increasing the e.m.f. of the cell

b) Increasing the length of the potentiometer wire

c) Decreasing the length of the potentiometer wire

d) None of the above

213. In the circuit shown the value of I in ampere is



a) 1 b) 060 c) 0.4 d) 1.5

214. A moving coil galvanometer of resistance 100Ωis used as an ammeter using a resistance 0.1Ω. The maximum deflection current in the galvanometer is 100μA. Find the minimum current in the circuit so that the ammeter shows maximum deflection

a) 100.1mA b) 1000.1mA c) 10.01mA d) 1.01mA

215. When two identical batteries of internal resistance 1 Ω each are connected in series across a resistor R, the rate of heat produced in R is J_1. When the same batteries are connected I parallel across R, the rate is J_2. If $J_1 = 2.25\, J_2$ then the value of R in Ω is

a) 4 b) 6 c) 4.8 d) 5.16

216. A metal wire is subjected to a constant potential difference. When the temperature of the metal wire increases, the drift velocity of the electron in it

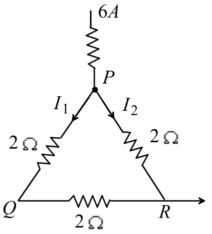
a) increases, thermal velocity of the electron decreases

b) Decreases, thermal velocity of the electron decreases

c) increases, thermal velocity of the electron increases

d) Decreases, thermal velocity of the electron increases

217. A current of 6A enters one corner P of an equilateral triangle PQR having 3 wires of resistances 2Ω each and leaves by the corner R. Then the current I_1 and I_2 are

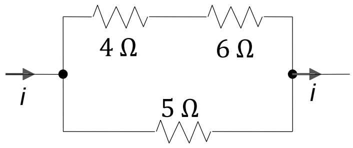


a) $2A, 4A$ b) $4A, 2A$ c) $1A, 2A$ d) $2A, 3A$

218. There is a current of 0.21 A in a copper wire whose area of cross-section is 10^{-6}m^2. If the number of free electrons per m^3 is 8.4×10^{28}, then find the drift velocity,
($e = 1.6 \times 10^{-19}$C)
a) $2 \times 10^{-5}\ \text{ms}^{-1}$ b) $1.56 \times 10^{-5}\ \text{ms}^{-1}$ c) $1 \times 10^{-5}\ \text{ms}^{-1}$ d) $0.64 \times 10^{-5}\ \text{ms}^{-1}$

219. If 2.2 *kilowatt* power is transmitted through a 10 *ohm* line at 22000 *volt*, the power loss in the form of heat will be
a) 0.1 *watt* b) 1 *watt* c) 10 *watt* d) 100 *watt*

220. In the circuit shown in figure the heat produced in the 5Ω resistor due to the current flowing through it is 100Js^{-1}.The heat generated in the 4Ω resistor is



a) $10\ \text{Js}^{-1}$ b) $20\ \text{Js}^{-1}$ c) $30\ \text{Js}^{-1}$ d) $40\ \text{Js}^{-1}$

221. Two copper wires have their masses in the ratio 2 : 3 and the lengths in the ratio 3 : 4 the ratio of their resistance is
a) 4 : 9 b) 27 : 32 c) 16 : 9 d) 27 :128

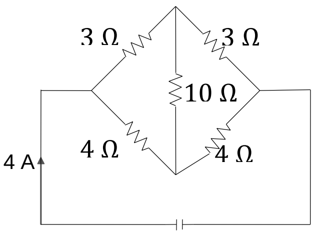
222. A battery of emf E and internal resistance r is connected to an external resistance R the condition for maximum power transfer is
a) r<R b) r>R c) r=1/R d) R=R

223. The cold junction of a thermocouple is maintained at 10°C. No thermo *e*.m.f. is developed when the hot junction is maintained at 530°C. The neutral temperature is
a) 260°C b) 270°C c) 265°C d) 520°C

224. An electric heater boils 1 kg of water in a time t_1. Another heater boils the same amount of water in a time t_2. When the two heaters are connected in parallel, the time required by them together to boil the same amount of water is
a) $t_1 + t_2$ b) $t_1 t_2$ c) $\frac{t_1 + t_2}{2}$ d) $\frac{t_1 t_2}{t_1 + t_2}$

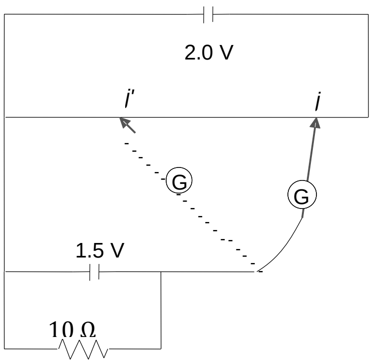
225. A voltmeter having a resistance of 998 *ohm* is connected to a cell of e.m.f. 2 *volt* and internal resistance 2 *ohm*. The error in the measurement of e.m.f. will be
a) 4×10^{-1}*volt* b) 2×10^{-3}*volt* c) 4×10^{-3} *volt* d) 2×10^{-1} *volt*

226. In the circuit shown, if the 10 Ω resistance is replaced by 20 Ω then what is the amount of current drawn from the battery?



a) 2.5A b) 3A c) 3.5A d) 4A

227. The figure below shows a 2.0 V potentiometer used for the determination of internal resistance of a 2.5 V cell. The balance point of the cell in the open circuit is 75cm. When a resistor of 10 Ωis used in the external circuit of the cell, the balance point shifts to 65 cm length of potentiometer wire. Then the internal resistance of the cell is



a) 2.5 Ω b) 2.0 Ω c) 1.54 Ω d) 1.0 Ω

228. A battery of 24 cells, each of emf 1.5 V and internal resistance 2Ω is to be connected in order to send the maximum current through a 12Ω resistor. The correct arrangement of cells will be

a) 2 rows of 12 cells connected in parallel b) 3 rows of 8 cells connected in parallel
c) 4 rows of 6 cells connected in parallel d) All of these

229. A cell of emf E and internal resistance r supplies currents for the same time t through external resistance R_1 =100 Ω and R_2 = 40 Ω separately. If the heat developed in both the cases in the same, then the internal resistance of the cell is given by

a) 28.6 Ω b) 70 Ω c) 63.3 Ω d) 140 Ω

230. Incandescent bulbs are designed by keeping in mind that the resistance of their filament increases with the increase in temperature. If at room temperature, 100 W, 60 W and 40 W bulbs have filament resistances R_{100}, R_{60} and R_{40}, respectively, the relation between these resistances is

a) $\frac{1}{R_{100}}=\frac{1}{R_{40}}+\frac{1}{R_{60}}$ b) $R_{100} = R_{40} + R_{60}$ c) $R_{100} > R_{60} > R_{40}$ d) $\frac{1}{R_{100}}>\frac{1}{R_{60}}>\frac{1}{R_{40}}$

231. In a potentiometer circuit there is a cell of e.m.f. 2 $volt$, a resistance of 5 ohm and a wire of uniform thickness of length 1000 cm and resistance 15 ohm. The potential gradient in the wire is

a) $\frac{1}{500}V/cm$ b) $\frac{3}{2000}V/cm$ c) $\frac{3}{5000}V/cm$ d) $\frac{1}{1000}V/cm$

232. Equal amounts of a metal are converted into cylindrical wire of different lengths L and cross-sectional area A.The wire with the maximum resistance is the one, which has

a) Length=L and area = A
b) lengths = $\frac{L}{2}$ and area = $2A$
c) lengths = $2L$ and area = $\frac{A}{2}$
d) All have the same resistance, as the amount of the metal is the same

233. Amount of electricity required to pass through the H_2O voltmeter so as to liberate 11.2 $litre$ of hydrogen will be

a) 1 $faraday$ b) $\frac{1}{2}faraday$ c) 2 $faraday$ d) 3 $faraday$

234. Five cells each of internal resistances 0.2Ω and emf 2 V are connected in series with a resistance of 4Ω. The current through the external resistance is

a) 4 A b) 2 A c) 1 A d) 0.5 A

235. 3 identical bulbs are connected in series and these together dissipate a power P. If now the bulbs are connected in parallel, then the power dissipated will be

a) $\frac{P}{3}$ b) $3P$ c) $9P$ d) $\frac{P}{9}$

236. How many coulombs of electric charge must pass through acidulated water in order to release 22.4 L Of hydrogen at NTP?

a) 96500 Faraday b) 193000 coulomb c) 196500 Faraday d) 96500 coulomb

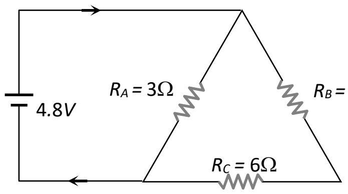
237. Two identical cells connected in series send 1.0 A current through a 5Ω resistor. When they are connected in parallel, they send 0.8 A current through the same resistor. What is the internal resistance of the cell?

a) 0.5 Ω b) 1.0 Ω c) 1.5 Ω d) 2.5 Ω

238. Which of the following is not equal to *watt*

a) $(Amp)^2 \times ohm$ b) $Amp/Volt$ c) $Amp \times Volt$ d) $Joule/sec$

239. The current in the given circuit is



a) 8.31 A b) 6.82 A c) 4.92 A d) 2 A

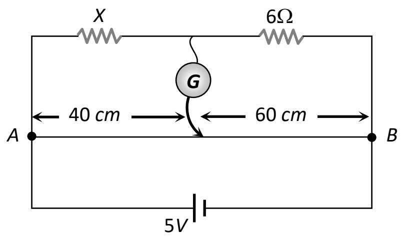
240. A lamp having tungsten filament consumes 50 W. Assume the temperature coefficient of resistance for tungsten is $4.5 \times 10^{-3}°C^{-1}$ and temperature of the surrounding is 20°C. When the lamp burns, the temperature of its filament becomes 2500°C , then the power consumed at the moment switch is on, is

a) 608 W b) 710 W c) 215 W d) 580 W

241. A wire of resistance R is divided in 10 equal parts. These parts are connected in parallel, the equivalent resistance of such connection will be

a) 0.01 R b) 0.1 R c) 10 R d) 100 R

242. In the circuit shown, a *meter* bridge is in its balanced state. The *meter* bridge wire has a resistance 0.1 ohm/cm. The value of unknown resistance X and the current drawn from the battery of negligible resistance is



a) 6 Ω, 5 amp b) 10 Ω, 0.1 amp c) 4 Ω, 1.0 amp d) 12 Ω, 0.5 amp

243. Emf is most closely related to

a) Mechanical force b) Potential difference c) Electric field d) Magnetic field

244. An electron (charge $= 1.6 \times 10^{-19} coulomb$) is moving in a circle of radius $5.1 \times 10^{-11} m$ at a frequency of 6.8×10^{15} $revolutions/sec$. The equivalent current is approximately

a) $5.1 \times 10^{-3} amp$ b) $6.8 \times 10^{-3} amp$ c) $1.1 \times 10^{-3} amp$ d) $2.2 \times 10^{-3} amp$

245. The drift velocity of free electrons in a conductor is $'v'$ when a current $'i'$ is flowing in it. If both the radius and current are doubled, then drift velocity will be

a) v b) $\frac{v}{2}$ c) $\frac{v}{4}$ d) $\frac{v}{8}$

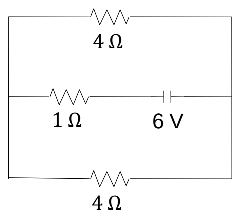
246. If a steady current of 100 A is passed then how much time is taken to deposit 0.254 kg of copper on the cathode of copper voltmeter. Use the known value of Faraday constant and relative atomic mass of copper is 63.5.

a) 15440 s b) 7720 s c) 3760 s d) 5480 s

247. Two similar cells, whether joined in series or in parallel, have the same current through an external resistance of 2 Ω. The internal resistance of each cell is

a) 1 Ω b) 2 Ω c) 0.5 Ω d) 1.5 Ω

248. The current in the 1Ω resistor shown in the circuit is



a) $\frac{2}{3}A$ b) 3A c) 6A d) 2A

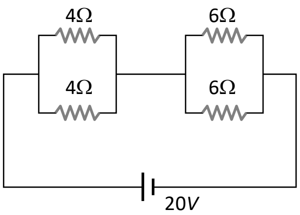
249. An electric heater of 1.08 Kw is immersed in water. After the water has reached a temperature of 100°C, how much time will be required to produce 100 g of steam?

a) 420 s b) 210 s c) 105 s d) 50 s

250. How many calories of heat will be produced approximately in a 210 W electric bulb in 5 min?

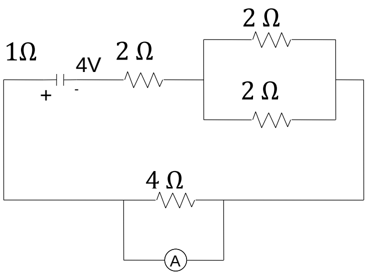
a) 80000 cal b) 63000 cal c) 1050 cal d) 15000 cal

251. Four resistances are connected in a circuit in the given figure. The electric current flowing through 4 *ohm* and 6 *ohm* resistance is respectively



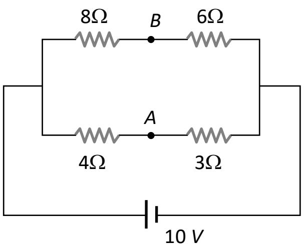
a) 2 *amp* and 4 *amp* b) 1 *amp* and 2 *amp* c) 1 *amp* and 1 *amp* d) 2 *amp* and 2 *amp*

252. The current passing through the ideal ammeter in the circuit given below is



a) 1.25A b) 1A c) 0.75A d) 0.5A

253. The potential difference between point A & B is

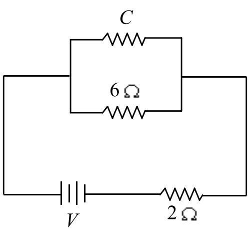


a) $\frac{20}{7}V$ b) $\frac{40}{7}V$ c) $\frac{10}{7}V$ d) 0

254. According to Joule's law, if the potential difference across a conductor having a material of specific resistance remains constant, then the heat produced in the conductor is directly proportional to

a) ρ b) ρ^2 c) $\frac{1}{\sqrt{\rho}}$ d) $\frac{1}{\rho}$

255. If power dissipated in the 9 Ω resistor in the circuit shown is 36 Watt, the potential difference across the 2 Ω resistor is

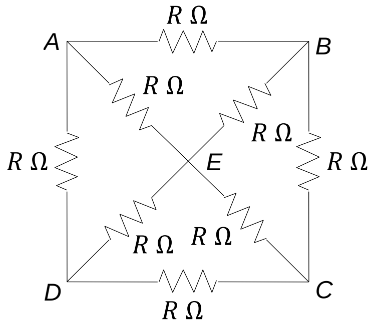


a) 2 *volt* b) 4 *volt* c) 8 *volt* d) 10 *volt*

256. The resistor of resistance R is connected to 25 V supply and heat produced in it is 25 Js^{-1}. The value of R is

a) 225 Ω b) 1 Ω c) 25 Ω d) 50 Ω

257. The resistance between the points A and C in the figure below is



a) $R\ \Omega$ b) $\frac{4}{3}\ \Omega$ c) $\frac{2}{3}\ R\Omega$ d) $\frac{8R}{3}$

258. The deflection in a moving coil galvanometer is reduced to half when it is shunted with a 40 Ω coil. The resistance of the galvanometer is

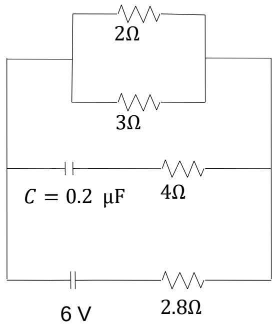
a) 15 Ω b) 20 Ω c) 40 Ω d) 80 Ω

259. The resistance of a cell does not depend on

a) Current drawn from the cell b) Temperature of electrolyte

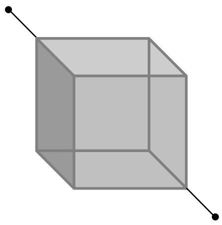
c) Concentration of electrolyte d) The e.m.f. of the cell

260. In the given figure the steady state current in the circuit is



a) Zero b) 0.6A c) 0.9A d) 1.5A

261. Twelve wires of equal length and same cross-section are connected in the form of a cube. If the resistance of each of the wires is R, then the effective resistance between the two diagonal ends would be

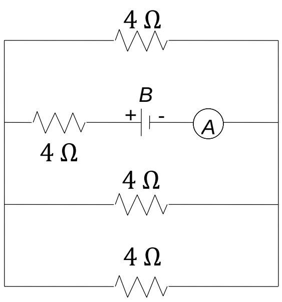


a) 2 R b) 12 R c) $\frac{5}{6}R$ d) 8 R

262. The length of a conductor is doubled and its radius is halved, its specific resistance is

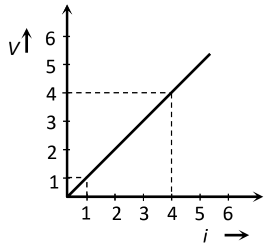
a) Unchanged b) Halved c) Doubled d) Quadrupled

263. Four identical resistors of 4 Ω each are joined in circuit as shown in figure. The cell B has emf 2V and its internal resistance is negligible. The ammeter reading is



a) $\frac{3}{8}$A b) 2A c) $\frac{1}{2}$A d) $\frac{1}{8}$A

264. Variation of current and voltage in a conductor has been shown in the diagram below. The resistance of the conductor is



a) 4 ohm b) 2 ohm c) 3 ohm d) 1 ohm

265. Resistance of rod is 1 Ω.It is bent in form of square. What is resistance across adjoint corners?

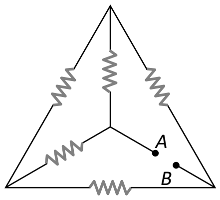
a) 1 Ω b) 3 Ω c) $\frac{3}{16}$Ω d) $\frac{3}{4}$Ω

266. The Avogadro's number is 6×10^{23} per gm mole and electronic charge is $1.6 \times 10^{-19} C$. The Faraday's number is

a) $6 \times 10^{23} \times 1.6 \times 10^{-19}$ b) $\frac{6 \times 10^{23}}{1.6 \times 10^{-19}}$

c) $\frac{2}{6 \times 10^{23} \times 1.6 \times 10^{-19}}$ d) $\frac{1.6 \times 10^{-19}}{6 \times 10^{23}}$

267. In the network shown in the figure, each of the resistance is equal to 2 Ω. The resistance between the points A and B is



a) 1 Ω b) 4 Ω c) 3 Ω d) 2 Ω

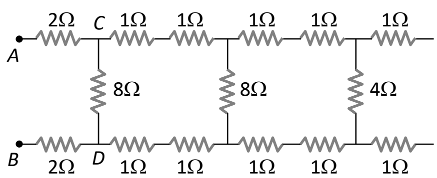
268. The temperature of cold junction of thermo-couple is 0°C. If the neutral temperature is 270°C, then the inversion temperature is

a) 540°C b) 520°C c) 640°C d) 580°C

269. The mobility of free electrons (charge e, mass m and relaxation time τ) in a metal is proportional to

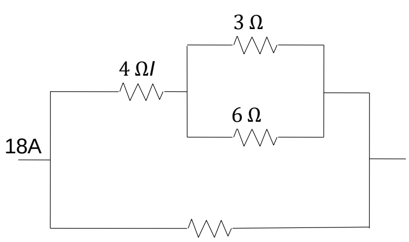
a) $\frac{e}{m}\tau$ b) $\frac{m}{e}\tau$ c) $\frac{e}{m\tau}$ d) $\frac{m}{e\tau}$

270. In the figure shown, the total resistance between A and B is



a) 12 Ω b) 4 Ω c) 6 Ω d) 8 Ω

271. In the electrical network shown in the figure, the potential difference across 3Ω resistance will be

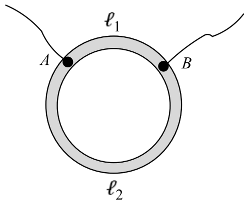


a) 12V b) 2.4V c) 24 V d) 36 V

272. If n, e, τ and m respectively represent the density, charge relaxation time and mass of the electron, then the resistance of a wire of length l and area of cross-section A will be

a) $\dfrac{ml}{ne^2\tau A}$ b) $\dfrac{m\tau^2 A}{ne^2 l}$ c) $\dfrac{ne^2\tau A}{2ml}$ d) $\dfrac{ne^2 A}{2m\tau l}$

273. A ring is made of a wire having a resistance $R_0 = 12\Omega$. Find the points A and B as shown in the figure, at which a current carrying conductor should be connected so that the resistance R of the sub circuit between these points is equal to $\frac{8}{3}\Omega$

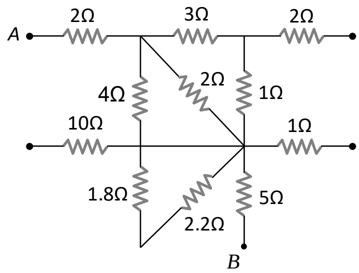


a) $\dfrac{\ell_1}{\ell_2} = \dfrac{5}{8}$ b) $\dfrac{\ell_1}{\ell_2} = \dfrac{1}{3}$ c) $\dfrac{\ell_1}{\ell_2} = \dfrac{3}{8}$ d) $\dfrac{\ell_1}{\ell_2} = \dfrac{1}{2}$

274. When a Daniel cell is connected in the secondary circuit of a potentiometer, the balancing length is found to be 540 cm. If the balancing length becomes 500 cm when the cell is short circuited with 1 Ω, the internal of the cell is

a) 0.08 Ω b) 0.04 Ω c) 1.0 Ω d) 1.08 Ω

275. What is the equivalent resistance between the points A and B of the network



a) $\dfrac{57}{7}\Omega$ b) 8 Ω c) 6 Ω d) $\dfrac{57}{5}\Omega$

276. An electric water kettle rated 2.1 kW is filled with 1.5 kg of water at 20°C. How many seconds does it take to reach the boiling point of water? Assume that there are no heat losses from the kettle. Specific heat capacity of water is 4200 $\text{Jkg}^{-1}\ \text{K}^{-1}$

a) 60 b) 120 c) 240 d) 480

277. A cell can be balanced against 110cm and 100cm of potentiometer wire, respectively with and without being short circuited through a resistance of 10 Ω. Its internal resistance is

a) 1.0 Ω b) 0.5 Ω c) 2.0 Ω d) Zero

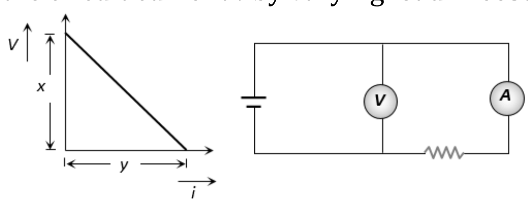
278. Kirchhoff's I law and II law of current, prove the

a) Conservation of charge and energy b) Conservation of current and energy
c) Conservation of mass and charge d) None of these

279. The resistivity of iron is $1 \times 10^{-7} ohm - m$. The resistance of a iron wire of particular length and thickness is 1 ohm. If the length and the diameter of wire both are doubled, then the resistivity in $ohm - m$ will be

a) 1×10^{-7} b) 2×10^{-7} c) 4×10^{-7} d) 8×10^{-7}

280. In an experiment, a graph was plotted of the potential difference V between the terminals of a cell against the circuit current i by varying load rheostat. Internal conductance of the cell is given by



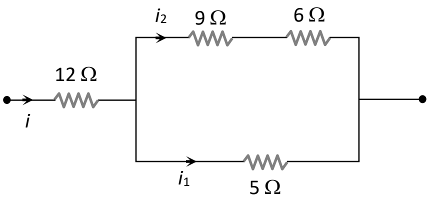
a) xy b) $\dfrac{y}{x}$ c) $\dfrac{x}{y}$ d) $(x - y)$

281. For a thermocouple the neutral temperature is 270°C when its cold junction is at 20°C. What will be the neutral temperature and the temperature of inversion when the temperature of cold junction is increased

to 40°C

a) 290°C, 580°C b) 270°C, 580°C c) 270°C, 500°C d) 290°C, 540°C

282. In the following circuit, 5Ω resistor develops 45 J/s due to current flowing through it. The power developed per second across 12 Ω resistor is



a) 16 W b) 192 W c) 36 W d) 64 W

283. A current of $\left(\frac{2}{3}\right) A$ produces a deflection of 60° in a tangent galvanometer. The reduction factor is

a) $\left(\frac{2}{3}\right) A$ b) 2A c) $\left(\frac{2}{3}\right) A$ d) $\left(\frac{2}{\sqrt{3}}\right) A$

284. Two sources of equal emf are connected to an external resistance R. The internal resistances of the two sources are R_1 and $R_2 (R_2 > R_1)$. If the potential difference across the source having internal resistance R_2 is zero, then

a) $R = R_1R_2/(R_1 + R_2)$ b) $R = R_1R_2/(R_2 - R_1)$

c) $R = R_2 \times (R_1 + R_2)/(R_2 - R_1)$ d) $R = R_2 - R_1$

285. Which of the following has a negative temperature coefficient

a) C b) Fe c) Mn d) Ag

286. A cell supplies a current $i_1$through a resistance R_1 and a current I_2 through a resistance R_2. The internal resistance of a cell is

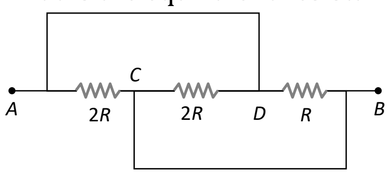
a) $R_2 - R_1$ b) $\frac{(i_1 + i_2)}{i_1 - i_2} R_1R_2$ c) $\frac{i_1R_2 - i_2R_1}{i_1 - i_2}$ d) $\frac{i_2R_2 - i_1R_1}{i_1 - i_2}$

287. Two ends of a conductor are at different temperatures the electromotive force generated between two ends is

a) Seebeck electro motive force (e.m.f.) b) Peltier electro motive force (e.m.f.)

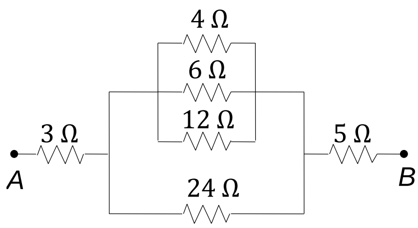
c) Thomson electro motive force (e.m.f.) d) None of these

288. What is the equivalent resistance between A and B



a) $\frac{2}{3}R$ b) $\frac{3}{2}R$ c) $\frac{R}{2}$ d) $2R$

289. The effective resistance between points A and B in figure

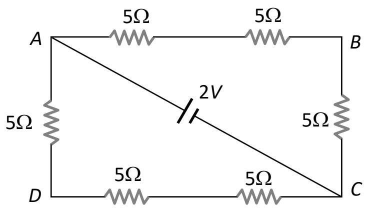


a) 10 Ω b) 12 Ω c) 9.85 Ω d) 10.85 Ω

290. The current density (number of free electrons per m^3) in metallic conductor is of the order of

a) 10^{22} b) 10^{24} c) 10^{26} d) 10^{28}

291. The potential difference between points A and B of adjoining figure is

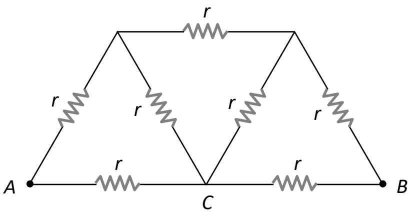


a) $\frac{2}{3}V$ b) $\frac{8}{9}V$ c) $\frac{4}{3}V$ d) $2V$

292. The potential gradient along the length of a uniform wire is 10Vm^{-1}.The length of the potentiometer wire is 4 m. What is the potential difference across two points on the wire separated by 50cm?

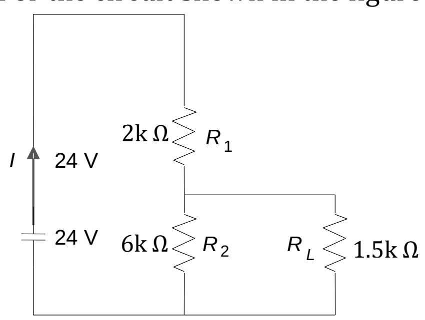
a) 2.5 V b) 5.0 V c) 1.25 V d) 4.0 V

293. In the circuit shown, the value of each resistance is r, then equivalent resistance of circuit between points A and B will be



a) $(4/3)r$ b) $3r/2$ c) $r/3$ d) $8r/7$

294. For the circuit shown in the figure



a) The current I through the battery is 7.5mA

b) The potential difference across R_L is 18 V

c) Ratio of powers dissipated in R_1 and R_2 is 3

d) If R_1 and R_2 are interchanged, magnitude of the power dissipated in R_L will decrease by a factor of 9

295. A brass rectangular plate 12cm × 3cm is to be electroplated with copper. If we wish to coat it with a layer of 0.02 mm thick both sides, how much time will it take with a constant current of 5A? Given ECE of copper is $33 \times 10^{-5}\text{g C}^{-1}$ and density of copper is 8.9 g cm^{-3}.

a) 388 s b) 776 s c) 400 s d) 800 s

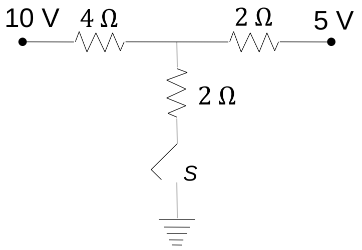
296. You are given several identical resistances each of value $R = 10\Omega$ and each capable of carrying maximum current of 1 ampere. It is required to make a suitable combination of these resistances to produce a resistance of 5Ω which can carry a current of 4 ampere. The minimum number of resistances of the type R that will be required for this job

a) 4 b) 10 c) 8 d) 20

297. A 12 V lead accumulator is being charged using 24 V supply with an external resistance 2Ω. The internal resistance of the accumulator is 1Ω. Find the time in which it will store 360 W-hour energy

a) 1 hr b) 7.5 hr c) 10 hr d) None of these

298. As the switch S is closed in the circuit shown in figure, current passed through it is



a) Zero b) 1 A c) 2 A d) 1.6 A

299. If nearly 10^5C liberate 1 g equivalent of aluminium, then the amount of aluminium (equivalent weight 9) deposited through electrolysis in 20 min by a current of 50 A will be

a) 0.09 g b) 0.6 g c) 5.4 g d) 10.8 g

300. Potential gradient is defined as

a) Fall of potential per unit length of the wire
b) Fall of potential per unit area of the wire
c) Fall of potential between two ends of the wire
d) Potential at any one end of the wire

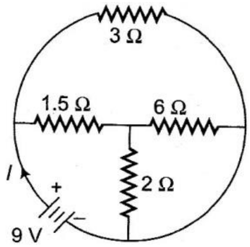
301. The current flowing in a copper voltmeter is 3.2 A. The number of copper ions (Cu^{2+}) deposited at the cathode per minute is

a) 0.5×10^{20} b) 1.5×10^{20} c) 3×10^{20} d) 6×10^{20}

302. The specific resistance of manganin is 50×10^{-8} $ohm \times m$. The resistance of a cube of length 50cm will be

a) 10^{-6} ohm b) 2.5×10^{-5} ohm c) 10^{-8} ohm d) 5×10^{-4} ohm

303. The total current supplied to the given circuit by the battery is



a) 9 A b) 6 A c) 2 A d) 4 A

304. Combination of two identical capacitors, a resistor R and a DC voltage source of voltage 6 V is used in an experiment on$C - R$ circuit. It is found that for a parallel combination of the capacitor the time in which the voltage of the fully charged combination reduces to half its original voltage is 10s. For series combination the time needed for reducing the voltage of the fully charged series combination by half is

a) 200s b) 10s c) 5s d) 2.5s

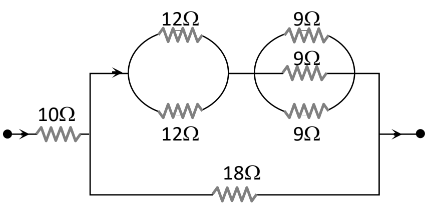
305. If 400Ω of resistance is made by adding four 100Ω resistance of tolerance 5%, then the tolerance of the combination is

a) 20 % b) 5 % c) 10 % d) 15 %

306. A 5°C rise in temperature is observed in a conductor by passing a current. When the current is doubled the rise in temperature will be approximately

a) 16°C b) 10°C c) 20°C d) 12°C

307. In the following circuit, 18Ω resistor develops $2J/sec$ due to current flowing through it. The power developed across 10Ω resistance is



a) 125 W b) 10 W c) $\frac{4}{5}W$ d) 25 W

308. $e = \alpha\, t - \frac{1}{2}\beta\, t^2$, if temperature of cold junction is 0°C then temperature of inversion is

(if $\alpha = 500.0\mu V/°C, \beta = 5.0\mu V/\text{square}°C$)

a) 100　　b) 200　　c) 300　　d) 400

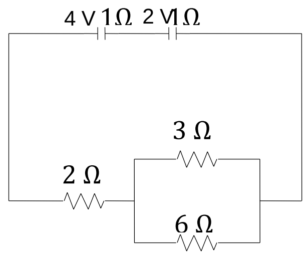
309. In $Cu - Fe$ couple, the flow of current at the temperature of inversion is
a) From Fe to Cu through the hot junction
b) From Cu to Fe through the hot junction
c) Maximum
d) None of the above

310. Two wires A and B of same material and same mass have radii $2r$ and r respectively. If resistance of wire A is 34Ω, then resistance of B will be
a) 544Ω　　b) 272Ω　　c) 68Ω　　d) 17Ω

311. Three electric bulbs with same voltage ratings of 110 volts but wattage ratings of 40, 60 and 100 watts respectively are connected in series across a 220 volt supply line. If their brightness are B_1, B_2, B_3 respectively, then
a) $B_1 > B_2 > B_3$
b) $B_1 > B_2 < B_3$
c) $B_1 = B_2 = B_3$
d) Bulbs will burn out due to the high voltage supply

312. Consider a rectangular slab of length L and area of cross section A. A current I is passed through it. If the length is doubled, the potential drop across the end faces
a) Becomes half of the initial value　　b) Becomes one-fourth of the initial value
c) Becomes double the initial value　　d) Remains same

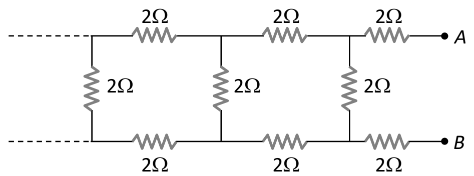
313. Two cells having emf 4V, 2V and internal resistances 1 Ω, 1 Ω are connected as shown in figure below. Current through 6 Ω resistance is



a) $\frac{1}{3}A$　　b) $\frac{2}{3}A$　　c) 1A　　d) $\frac{2}{9}A$

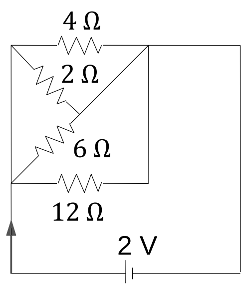
314. Kirchhoff's first law $i.e. \sum i = 0$ at a junction is based on the law of conservation of
a) Charge　　b) Energy　　c) Momentum　　d) Angular momentum

315. The equivalent resistance of the following infinite network of resistance is



a) Less than 4Ω　　b) 4Ω
c) More than 4Ω but less than 12Ω　　d) 12Ω

316. The resistance in which the maximum heat is produced is given by



a) 2Ω b) 6Ω c) 4Ω d) 12Ω

317. We are able to obtain fairly large currents in a conductor because
a) The electron drift speed is usually very large
b) The number density of free electrons is very high and this can compensate for the low values of the electron drift speed and the very small magnitude of the electron charge
c) The number density of free electrons as well as the electron drift speeds are very large and these compensate for the very small magnitude of the electron charge
d) The very small magnitude of the electron charge has to be divided by the still smaller product of the number density and drift speed to get the electric current

318. A battery of emf E has an internal resistance r. A variable resistance R is connected to the terminals of the battery. A current i is drawn from the battery. V is the terminal potential difference. If R alone is gradually reduced to zero, which of the following best describes i and V?
a) i approaches zero, V approaches E
b) i approaches $\frac{E}{r}$, V approaches zero
c) i approaches $\frac{E}{r}$, V approaches E
d) i approaches infinity, V approaches E

319. Kirchhoff's second law is based on the law of conservation of
a) Charge
b) Energy
c) Momentum
d) Sum of mass and energy

320. The temperature at which thermal electric power of a thermo couple becomes zero is called
a) Inversion temperature
b) Neutral temperature
c) Junction temperature
d) Null temperature

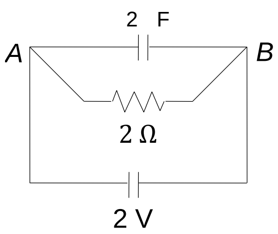
321. Resistances R_1 and R_2 are joined in parallel and a current is passed so that the amount of heat liberated is H_1 and H_2 respectively. The ratio $\frac{H_1}{H_2}$ has the value
a) $\frac{R_2}{R_1}$ b) $\frac{R_1}{R_2}$ c) $\frac{R_1^2}{R_2^2}$ d) $\frac{R_2^2}{R_1^2}$

322. Two wires A and B of same material and mass have their lengths in the ratio 1:2. On connecting them to the same source, the rate of heat dissipation in B is found to be $5W$. The rate of heat dissipation in A is
a) $10W$ b) $5W$ c) $20W$ d) None of these

323. Two electrolytic cells containing $CuSO_4$ and $AgNO_3$ respectively are connected in series and a current is passed through them until 2 mg of copper is deposited in the first cell. The amount of silver deposited in the second cell during this time in approximately (atomic weight of copper and silver are 63.6 and 108.0)
a) 1.7 mg b) 3.4 mg c) 5.1 mg d) 6.8 mg

324. At neutral temperature, the thermoelectric power $\left(\frac{dE}{dT}\right)$ has the value
a) Zero
b) Maximum but negative
c) Maximum but positive
d) Minimum but positive

325. At steady state, energy stored in capacitor is



a) 4×10^{-6} J b) 2 J c) 4 J d) Zero

326. A fuse wire with a radius of 1 mm blows at 1.5 A. If the fuse wire of the same material should blow at 3.0 A, the radius of the fuse wire must be
a) $4^{1/3}$ mm b) $\sqrt{2}$ mm c) 0.5 mm d) 8.0 mm

327. 5 *ampere* of current is passed through a metallic conductor. The charge flowing in one minute in coulomb will be

a) 5 b) 12 c) 1/12 d) 300

328. The $V - i$ graph for a good conductor makes angle 40° with V −axis. Here V denotes voltage and i denotes current. The resistance of the conductor will be

a) sin 40° b) cos 40° c) tan 40° d) cot 40°

329. A galvanometer of resistance, G, is shunted by a resistance S ohm. To keep the main current in the circuit unchanged, the resistance to be put in series with the galvanometer is

a) $\frac{G^2}{(S+G)}$ b) $\frac{G}{(S+G)}$ c) $\frac{S^2}{(S+G)}$ d) $\frac{SG}{(S+G)}$

330. A 50V battery is connected across a 10 Ω resistor and a current of 4.5 A flows. The internal resistance of the battery is

a) 10 Ω b) 0.5 Ω c) 1.1 Ω d) 5 Ω

331. There are two electric bulbs of 40 W and 100 W. Which one will be brighter when first connected in series and then in parallel

a) 40 W in series and 100 W in parallel
b) 100 W in series and 40 W in parallel
c) 40 W both in series and parallel will be uniform
d) 100 W both in series and parallel will be uniform

332. The conductivity of a superconductor is

a) Infinite b) Very large c) Very small d) Zero

333. Two identical cell send the same current in 2Ω resistance, whether connected in series or in parallel. The internal resistance of the cell should be

a) 1 Ω b) 2 Ω c) $\frac{1}{2}$Ω d) 2.5 Ω

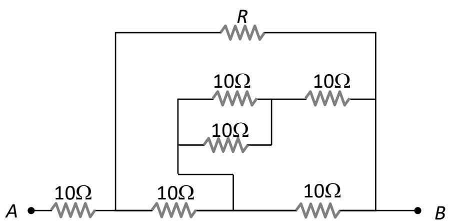
334. According to Faraday's law of electrolysis, the amount of decomposition is proportional to

a) 1/time for which current passes b) Electrochemical equivalent of the substance
c) 1/current d) 1/electrochemical equivalent

335. Three similar cells, each of emf 2V and internal resistance r send the same current through an external resistance of 2Ω,when connected in series or in parallel. The strength of current flowing through the external resistance is

a) 0.75 A b) 1 A c) 1.5 A d) zero

336. For what value of R the net resistance of the circuit will be 18 $ohms$



a) 8 Ω b) 10 Ω c) 16 Ω d) 24 Ω

337. The resistance of a wire is R Ω.The wire is stretched to double its length keeping volume constant. Now the resistance of the wire will become

a) 4 R Ω b) 2 R Ω c) $R/2$ Ω d) $R/4$ Ω

338. A uniform copper wire of length 1 m and cross-section area 5×10^{-7}m^2 carries a current of 1 A. Assuming that there are 8×10^{28} free electron m^{-3}in copper, how long will an electron take to drift from one end of the wire to the other?

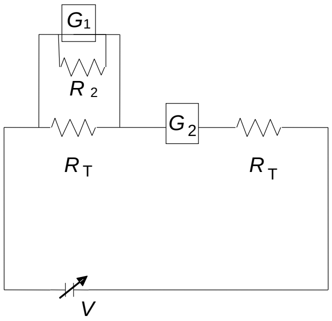
a) 0.8×10^3s b) 1.6×10^3s c) 3.2×10^3s d) 6.4×10^3s

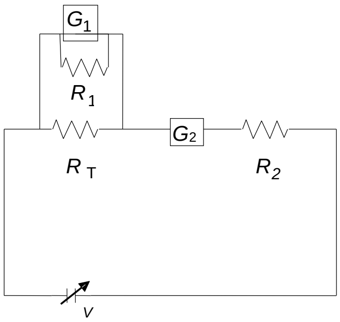
339. A voltmeter has a resistance of G ohm and range Vvolt. The value of resistance used in series to convert it into a voltmeter of range $_nV$ volt is

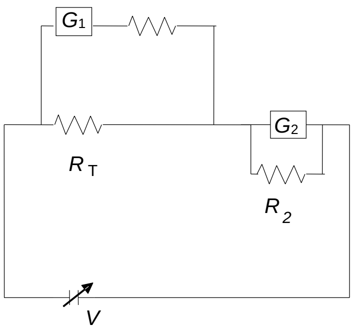
a) nG b) $\frac{G}{n}$ c) $(n-1)G$ d) $\frac{G}{n-1}$

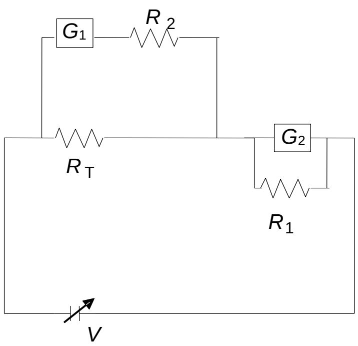
340. To verify Ohm's law, a student is provided with a test resistor R_T, a high resistance R_1, a small resistance R_2, two identical galvanometers $G_1$and $G_2$and a variable voltage source V. the correct circuit to carry out

the experiment is

a) 

b) 

c) 

d) 

341. To decrease the range of an ammeter, its resistance need to be increased. An ammeter has resistance R_0 and range I. Which of the following resistance can be connected in series with it to decreases its range to I/n?

a) $\frac{R_0}{n}$ b) $\frac{R_0}{(n-1)}$ c) $\frac{R_0}{(n+1)}$ d) None of these

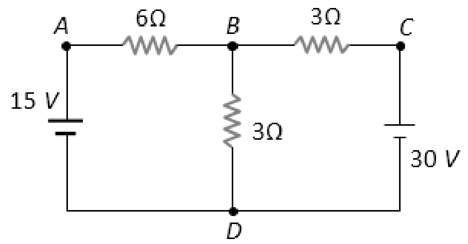
342. If a current is allowed to pass through a circuit consisting of two dissimilar metals, there is either evolution or absorption of heat at the junction, depending upon the direction of the current. The effect is known as

a) Seebeck effect b) Joule effect c) Peltier effect d) Thomson effect

343. Two bulbs when connected in parallel to a source take 60 W each. The total power consumed when they are connected in series with the same source is

a) 15 W b) 30 W c) 60 W d) 120 W

344. In the circuit shown in figure, find the current through the branch BD



a) 5 A b) 0 A c) 3 A d) 4 A

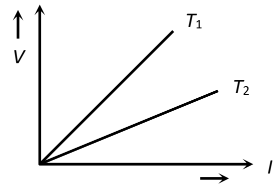
345. If $E = at + bt^2$, what is the neutral temperature

a) $-\frac{a}{2b}$ b) $+\frac{a}{2b}$ c) $-\frac{a}{b}$ d) $+\frac{a}{b}$

346. The resistance of an incandescent lamp is

a) Greater when switched off
b) Smaller when switched on
c) Greater when switched on
d) The same whether it is switched off or switched on

347. The voltage V and current I graph for a conductor at two different temperatures T_1 and T_2 are shown in the figure. The relation between T_1 and T_2 is



a) $T_1 > T_2$ b) $T_1 \approx T_2$ c) $T_1 = T_2$ d) $T_1 < T_2$

348. The current in a conductor varies with time t as $I = 2t + 3t^2$ where I is in *ampere* and t in *seconds*. Electric charge flowing through a section of the conductor during $t = 2$ *sec* to $t = 3$ *sec* is

a) 10 C b) 24 C c) 33 C d) 44 C

349. The maximum power dissipated in an external resistance R, when connected to a cell of emf E and internal resistance r, will be

a) $\frac{E^2}{r}$ b) $\frac{E^2}{2r}$ c) $\frac{E^2}{3r}$ d) $\frac{E^2}{4r}$

350. When a resistance of 100 Ω is connected in series with a gal vinometer of resistance R, its range is V. to double its range, a resistance of 1000 Ω is connected in series. Find R

a) 700 Ω b) 800 Ω c) 900 Ω d) 100 Ω

351. A 10 Ω electric heater operates on a 110V line. The rate at which heat is developed in watts is

a) 1310 W b) 670 W c) 810 W d) 1210 W

352. In a galvanometer 5% of the total current in the circuit passes through it. If the resistance of the galvanometer is G, the shunt resistance S connected to the galvanometer is

a) 19G b) G/19 c) 20G d) G/20

353. A resistance of 2Ω is to be made from a copper wire (specific resistance=1.7×10^{-8}Ω m) using a wire of length 50cm. The radius of the wire is

a) 0.0116 mm b) 0.367 mm c) 0.116 mm d) 0.267 mm

354. When a charged particle of charge e revolves in circular orbit of radius r with frequency n, then orbital current will be

a) $\frac{ev}{\pi r^2}$ b) $\frac{ev}{4\pi r}$ c) $\frac{ev}{2\pi r}$ d) $\frac{ev}{4\pi r^2}$

355. A battery of $e.m.f.$ 10 V and internal resistance 0.5 *ohm* is connected across a variable resistance R. The value of R for which the power delivered in it is maximum is given by

a) 2.0 *ohm* b) 0.25 *ohm* c) 1.0 *ohm* d) 0.5 *ohm*

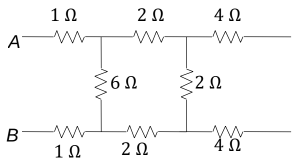
356. In an electrical cable there is a single wire of radius 9 *mm* of copper. Its resistance is 5Ω. The cable is replaced by 6 different insulated copper wires, the radius of each wire is 3*mm*. Now the total resistance of the cable will be

a) 7.5 Ω b) 45 Ω c) 90 Ω d) 270 Ω

357. Two identical cells send the same current in 3 Ω resistance, whether connected in series or in parallel. The internal resistance on the cell should be

a) 1 Ω b) 3 Ω c) $\frac{1}{2}$ Ω d) 3.5 Ω

358. In the adjoining figure the equivalent resistance between A and B is



a) 5 Ω b) 8 Ω c) 2.5 Ω d) 6.8 Ω

359. If the ratio of the concentration of electron to that of holes in a semiconductor is $\frac{7}{5}$ and the ratio of current is $\frac{7}{4}$, then what is the ratio of their drift velocities

a) $\frac{4}{5}$ b) $\frac{5}{4}$ c) $\frac{4}{7}$ d) $\frac{5}{8}$

360. Electroplating does not help in

a) Fine finish to the surface b) Shining appearance

c) Metals to become hard d) Protecting metal against conosion

361. Corresponding to the resistance $4.7 \times 10^6 \Omega \pm 5\%$, which is order of colour coding on carbon resistors?

a) Yellow, violet, blue, gold b) Yellow, violet, green, gold

c) Orange, blue, green, gold d) Orange, blue, violet, gold

362. For a thermocouple, the neutral temperature is 270°C and the temperature of its cold junction is 20°C. If there is no deflection in the galvanometer, the temperature of the hot junction should be

a) 210°C b) 540°C c) 520°C d) 209°C

363. Two cells A and B are connected in the secondary circuit of a potentiometer one at a time and the balancing length are respectively 400 cm and 440 cm. The emf of the cell A is 1.08V. The emf of the second cell B is volt is

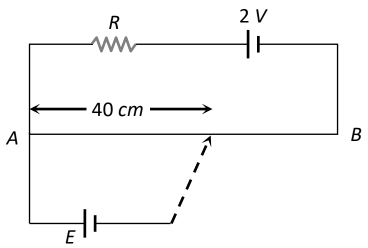
a) 1.08 b) 1.188 c) 11.88 d) 12.8

364. What determines the emf between the two metals placed in an electrolyte?

a) Relative position of metals in the electro chemical series b) Distance between them

c) Strength of electrolyte d) Nature of electrolyte

365. AB is a potentiometer wire of length 100 cm and its resistance is 10 ohm. It is connected in series with a resistance $R = 40$ ohm and a battery of e.m.f. 2 V and negligible internal resistance. If a source of unknown e.m.f. E is balanced by 40 cm length of the potentiometer wire, the value of E is



a) 0.8 V b) 1.6 V c) 0.08 V d) 0.16 V

366. In a closed circuit, the current I (in ampere) at an instant of time t (in second) is given by $I = 4 - 0.08t$. The number of electrons flowing in 50s through the cross-section of the conductor is

a) 1.25×10^{19} b) 6.25×10^{20} c) 5.25×10^{19} d) 2.55×10^{20}

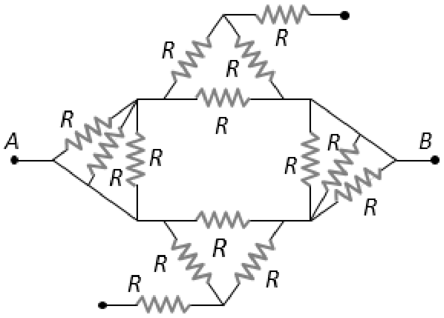
367. The internal resistance of a cell of emf 2 V is 0.1Ω. It is connected to a resistance of 3.9Ω . The potential difference across is

a) 0.5 V b) 1.9 V c) 1.95 V d) 2 V

368. The accurate measurement of emf can be obtained using
a) Multimeter b) Voltmeter c) Voltameter d) Potentiometer

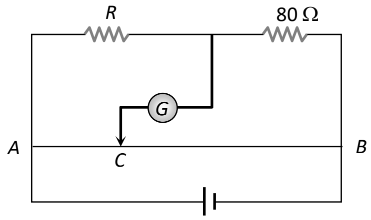
369. A potential difference of V is applied at the ends of a copper wire of length l and diameter d. On doubling only d, the drift velocity,
a) Becomes two times b) Becomes half c) Does not change d) Becomes one-fourth

370. Find equivalent resistance between A and B



a) R b) $\frac{3R}{4}$ c) $\frac{R}{2}$ d) $2R$

371. AB is a wire of uniform resistance. The galvanometer G shows no current when the length $AC = 20cm$ and $CB = 80cm$. The resistance R is equal to

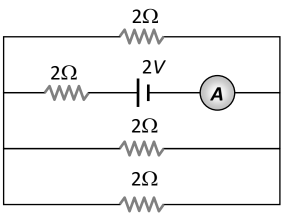


a) 2 Ω b) 8 Ω c) 20 Ω d) 40 Ω

372. A heater coil is cut into two parts of equal length and one of them is used in the heater. The ratio of the heat produced by this half coil to that by the original coil is
a) 2 :1 b) 1 :2 c) 1 :4 d) 4 :1

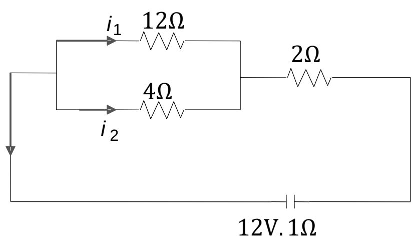
373. If the cold junction of a thermocouple is kept at 0°C and the hot junction is kept at T°C, then the relation between neutral temperature (T_n) and temperature of inversion (T_i) is
a) $T_n = \frac{T_i}{2}$ b) $T_n = 2T_i$ c) $T_n = T_i - T$ d) $T_n = T_i + T$

374. The reading of the ammeter as per figure shown is



a) $\frac{1}{8}A$ b) $\frac{3}{4}A$ c) $\frac{1}{2}A$ d) $2\ A$

375. In the circuit shown, the currents i_1 and $i_2$are



a) $i_1 = 3A, i_2 = 1A$ b) $i_1 = 1A, i_2 = 3A$ c) $i_1 = 0.5A, i_2 = 1.5\ A$ d) $i_1 = 1.5\ A, i_2 = 0.5\ A$

376. When a potential difference is applied across the ends of a linear metallic conductor
a) The free electrons are accelerated continuously from the lower potential end to the higher potential end

of the conductor

b) The free electrons are accelerated continuously from the higher potential end to the lower potential end of the conductor

c) The free electrons acquire a constant drift velocity from the lower potential end to the higher potential end of the conductor

d) The free electrons are set in motion from their position of rest

377. A thermocouple of resistance 1.6Ω is connected in series with a galvanometer of 8Ω resistance. The thermocouple develops an e.m.f. of $10\mu V$ per degree temperature difference between two junctions. When one junction is kept at 0°C and the other in a molten metal, the galvanometer reads 8 $millivolt$. The temperature of molten metal, when e.m.f. varies linearly with temperature difference, will be

a) 960°C b) 1050°C c) 1275°C d) 1545°C

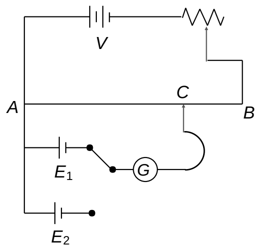
378. The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of 100 W and 200 lamps, when not in use?

a) 40 Ω b) 20 Ω c) 400 Ω d) 200 Ω

379. The potential difference between the terminals of a cell in open circuit is 2.2V with resistance of 5 Ω across the terminals of a cell, the terminal potential difference is 1.8V. the resistance of the cell is

a) $\frac{9}{10}\Omega$ b) $\frac{10}{9}\Omega$ c) $\frac{7}{12}\Omega$ d) $\frac{12}{7}\Omega$

380. The circuit shown here is used to compare the emf of two cells E_1 and$E_2 (E_1 > E_2)$.
The null point is at C when the galvanometer is connected to E_2. when the galvanometer is connected to E_2, the null point will be

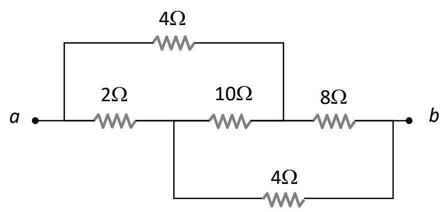


a) To the left of C b) To the right of C c) At C itself d) None where on AB

381. A cell of constant emf first connected to a resistance $R_1$and then connected to a resistanceR_2.

a) $\sqrt{R_1 R_2}$ b) $\sqrt{\frac{R_1}{R_2}}$ c) $\frac{R_1 - R_2}{2}$ d) $\frac{R_1 + R_2}{2}$

382. Find the equivalent resistance between the points a and b

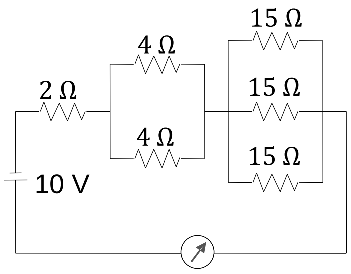


a) 2 Ω b) 4 Ω c) 8 Ω d) 16 Ω

383. An ammeter with internal resistance 90Ω reads 1.85 A when connected in a circuit containing a battery and two resistors 700Ω and 410Ω in series. Actual current will be

a) 1.85 A b) Greater than 1.85 A c) Less than 1.85 A d) None of these

384. The current through the circuit shown in figure 1A. If each of 4Ω the resistors is replaced by 2Ω resistor, the current in circuit will become nearly

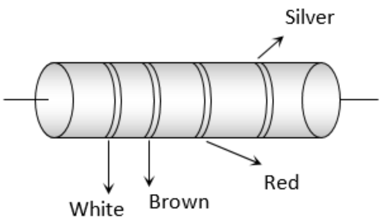


a) 1.11 A b) 1.25 A c) 1.34 A d) 1.67 A

385. A 36Ω galvanometer is shunted by resistance of 4Ω. The percentage of the total current, which passes through the galvanometer is

a) 8% b) 9% c) 10% d) 91%

386. In the figure a carbon resistor has bands of different colours on its body as mentioned in the figure. The value of the resistance is

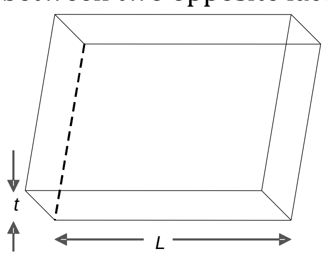


a) 2.2 k Ω b) 3.3 k Ω c) 5.6 k Ω d) 9.1 k Ω

387. In a potentiometer experiment, the galvanometer shows no deflection when a cell is connected across 60 cm of the potentiometer wire. If the cell is shunted by a resistance of 6Ω, the balance is obtained across 50 cm of the wire. The internal resistance of the cell is

a) 0.5 Ω b) 0.6 Ω c) 1.2 Ω d) 1.5 Ω

388. Consider a thin square sheet of side L and thickness t, made of a material of resistivity ρ. The resistance between two opposite faces, shown by the shaded areas in the figure is



a) Directly proportional to L b) Directly proportional to t

c) Independent of L d) Independent of t

389. When 1 kg of hydrogen forms water, 34×10^6 cal of heat is liberated. If ECE of hydrogen is (1/96500,000)kg C^{-1}, then the minimum voltage requird for decomposition of water is

a) 0.75 V b) 3.0 V c) 1.5 V d) 6.0 V

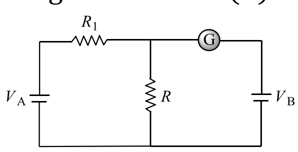
390. The reciprocal of resistance is

a) Conductance b) Resistivity c) Voltage d) None of the above

391. The resistance of a wire is 20 ohm. It is so stretched that the length becomes three times, then the new resistance of the wire will be

a) 6.67 ohm b) 60.0 ohm c) 120 ohm d) 180.0 ohm

392. In the circuit shown the cells A and B have negligible resistance. For $V_A = 12V, R_1 = 500\Omega$ and $R = 100\Omega$ the galvanometer (G) shows no deflection. The value of V_B is



a) $4V$ b) $2V$ c) $12V$ d) $6V$

393. Under what condition will the strength of current in a wire of resistance R be the same for connection is n

series or in parallel of n identical cells each of the internal resistance r, when

a) $R = nr$ b) $R = r/n$ c) $R = r$ d) $R \to \infty, r \to 0$

394. Two bulbs 40 W and 60 W and rated voltage 240 V are connected in series across a potential difference of 420 V. Which bulb will work at above its rated voltages?

a) 40 W bulb b) 60 W bulb c) Both will work d) None of these

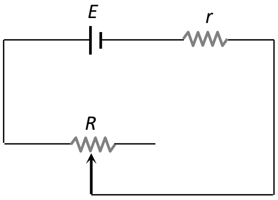
395. A thermocouple uses Bismuth and Tellurium as the dissimilar metals. The sensitivity of bismuth is $-72\mu\ V/°C$ and that of the tellurium is $500\mu\ V/°C$. If the difference between hot and cold junction is 100°C, then the maximum output will be

a) 50 mV b) 7.2 mV c) 42.8 mV d) 57.2 mV

396. The resistance of an ideal voltmeter is

a) Zero b) Very low c) Very large d) Infinite

397. A battery of e. m. f. E and internal resistance r is connected to a variable resistor R as shown here. Which one of the following is true



a) Potential difference across the terminals of the battery is maximum when $R = r$

b) Power delivered to the resistor is maximum when $R = r$

c) Current in the circuit is maximum when $R = r$

d) Current in the circuit is maximum when $R \gg r$

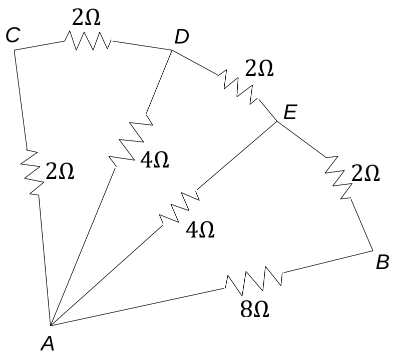
398. A potential difference V is applied to a copper wire of length l and thickness d. If V is doubled, the drift velocity

a) Is doubled b) Is halved c) Remains same d) Becomes zero

399. Two copper wires of lengths l and $2l$ have radii r and $2r$ respectively. What is ratio of their specific resistances?

a) 1 : 2 b) 2 : 1 c) 1 : 1 d) 1 : 3

400. What is the equivalent resistance between A and B in the given circuit?



a) 4Ω b) 2Ω c) $\frac{8}{3}\Omega$ d) $\frac{3}{8}\Omega$

401. A metal wire of specific resistance $64 \times 10^{-6} ohm - cm$ and length 198 cm has a resistance of 7 ohm, the radius of the wire will be

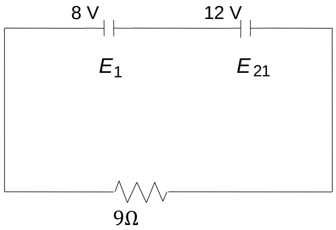
a) 2.4 cm b) 0.24 cm c) 0.024 cm d) 24 cm

402. A potential difference is applied across the ends of a metallic wire. If the potential difference is doubled, the drift velocity will

a) Be doubled b) Be halved c) Be quadrupled d) Remain unchanged

403. In the figure shown below, the terminal voltage across E_2 is

1Ω 2Ω



a) 12 V b) 12.66 V c) 11.34 V d) 11.66 V

404. A silver voltameter of resistance 2 ohm and a 3 ohm resistor are connected in series across a cell. If a resistance of 2 ohm is connected in parallel with the voltameter, then the rate of deposition of silver

a) Decreases by 25% b) Increases by 25% c) Increases by 37.5% d) Decreases by 37.5%

405. A tap supplies water at 22°C. A man takes 1 L of water per min at 37°C from the geyser. The power of the geyser is

a) 525 W b) 1050 W c) 1575 W d) 2100 W

406. When a current flows through a conductor its temperature

a) May increase or decrease b) Remains same
c) Decrease d) Increase

407. An electric bulb is marked 100 W, 230 V. If the supply voltage drops to 115 V, what is the total energy produced by the bulb in 10 min?

a) 30 kJ b) 20 kJ c) 15 kJ d) 10 kJ

408. The potentiometer is superior to a voltmeter for measuring a potential difference because

a) The resistance of the voltmeter
b) The potentiometer does not draw any current from the source of the potential
c) The sensitivity of potentiometer is better than that of the voltmeter
d) The voltmeter has a dial and of small size

409. Constantan wire is used in making standard resistances because its

a) Specific resistance is low
b) Density is high
c) Temperature coefficient of resistance is negligible
d) Melting point is high

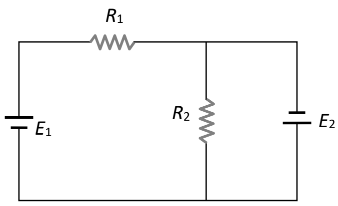
410. For a given thermocouple neutral temperature

a) Is a constant b) Depends on cold junction temperature
c) Depends on inversion temperature d) Double that of cold junction temperature

411. An electric cable of copper has just one wire of radius 9 mm. Its resistance is 5Ω. This single copper wire of cable is replaced by 6 different well insulated copper wires each of radius 3 mm. The total resistance of the cable will now be equal to

a) 7.5 Ω b) 45 Ω c) 90 Ω d) 270 Ω

412. Two resistance R_1 and R_2 are joined as shown in the figure to two batteries of e.m.f. E_1 and E_2. If E_2 is short-circuited, the current through R_1 is



a) E_1/R_1 b) E_2/R_1 c) E_2/R_2 d) $E_1/(R_2+R_1)$

413. When two resistances R_1 and R_2 are connected in series, they consume 12 W powers. When they are connected in parallel, they consume 50 W powers. What the ratio of the powers of R_1 and R_2?

a) 1/4 b) 4 c) 3/2 d) 3

414. The lowest resistance which can be obtained by connecting 10 resistors each of 1/10 ohm is

a) 1/250 Ω b) 1/200 Ω c) 1/100 Ω d) 1/10 Ω

415. The electron of hydrogen atom is considered to be revolving round in circular orbit of radius h^2/me^2 with

velocity e^2/h, where $h = h/2\pi$. The current i is

a) $\frac{4\pi^2 me^5}{h^2}$ b) $\frac{4\pi^2 me^2}{h^3}$ c) $\frac{4\pi^2 m^2 e^5}{h^3}$ d) $\frac{4\pi^2 me^5}{h^3}$

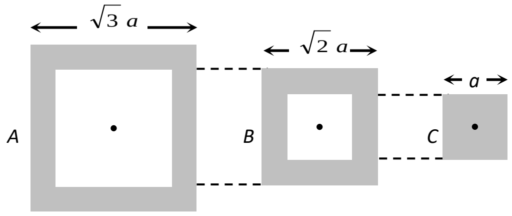
416. Two wires of same metal have the same length but their cross sections are in the retio 3:1. They are joined in series. The resistance of the thicker wire is 10Ω. The total resistance of the combination is

a) 5/2 Ω b) 40/3 Ω c) 40 Ω d) 100 Ω

417. A copper wire of length L and radius r is nickel plated till its final radius become R but length remains L. If the resistivity of nickel and copper be ρ_n and ρ_c respectively, the conductance of the nickelled wire is

a) $\frac{\pi r^2}{L.\rho_c}$ b) $\frac{\pi(R^2 - r^2)}{L.\rho_n}$ c) $\frac{\pi}{L}\left[\frac{r^2}{\rho_c} + \frac{(R^2 - r^2)}{\rho_n}\right]$ d) $\frac{L\rho_c}{\pi r^2} + \frac{L.\rho_n}{\pi(R^2 - r^2)}$

418. Following figure shows cross-sections through three long conductors of the same length and material, with square cross-section of edge lengths as shown. Conductor B will fit snugly within conductor A, and conductor C will fit snugly within conductor B. Relationship between their end to end resistance is



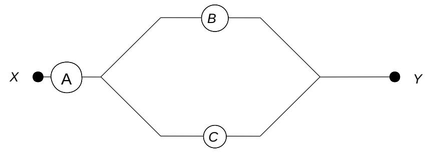
a) $R_A = R_B = R_C$ b) $R_A > R_B > R_C$

c) $R_A < R_B < R_C$ d) Information is not sufficient

419. A 100 V voltmeter of internal resistance 20 $k\Omega$ in series with a high resistance R is connected to a 110 V line. The voltmeter reads 5 V, the value of R is

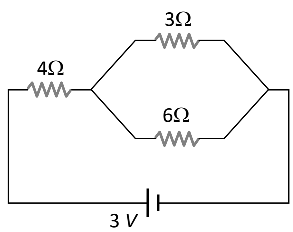
a) 210 $k\Omega$ b) 315 $k\Omega$ c) 420 $k\Omega$ d) 440 $k\Omega$

420. Three voltmeters A, B and C having resistances R, 1.5R and 3R respectively are used in a circuit as shown. When a potential difference is applied between X and Y, the readings of the voltmeters are $V_1, V_2 and V_3$ respectively. Then



a) $V_1 = V_2 = V_3$ b) $V_1 < V_2 = V_2$ c) $V_1 > V_2 > V_3$ d) $V_1 > V_2 > V_3$

421. The potential drop across the 3Ω resistor is



a) 1 V b) 1.5 V c) 2 V d) 3 V

422. A conductor wire having 10^{29} free electrons/m^3 carries a current of 20A. If the cross-section of the wire is 1mm^2, then the drift velocity of electrons will be

a) $6.25 \times 10^{-3} ms^{-1}$ b) $1.25 \times 10^{-5} ms^{-1}$ c) $1.25 \times 10^{-3} ms^{-1}$ d) $1.25 \times 10^{-4} ms^{-1}$

423. Two wires have resistances R and $2R$. When both are joining in series and in parallel, then ratio of heats generated in these situations on applying the same voltage, is

a) 2 : 1 b) 1 : 2 c) 2 : 9 d) 9 : 2

424. The potential difference in open circuit for a cell is 2.2 $volt$. When a 4 ohm resistor is connected between its two electrodes the potential difference becomes 2 $volt$. The internal resistance of the cell will be

a) 1 ohm b) 0.2 ohm c) 2.5 ohm d) 0.4 ohm

425. The temperature of hot junction of a thermocouple changes from 80°C to 100°C, the percentage change in thermo electric power is

a) 25% b) 20% c) 10% d) 8%

426. Two bulbs, one of 50 *watt* and another of 25 *watt* are connected in series to the mains. The ratio of the currents through them is
a) 2 :1
b) 1 :2
c) 1 :1
d) Without voltage, cannot be calculated

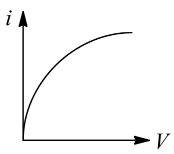
427. When a resistor of 11 Ω is connected in series with an electric cell, the current flowing in it is 0.5 *A*. Instead, when a resistor of 5 Ω is connected to the same electric cell in series, the current increases by 0.4 *A*. The internal resistance of the cell is
a) 1.5 Ω b) 2 Ω c) 2.5 Ω d) 3.5 Ω

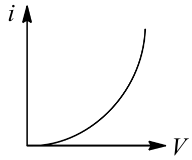
428. A battery of emf 10V and internal resistance 3 Ωis connected to an external resistor. The current in the circuit is 0.5A. the terminal voltage of the battery when the circuit is close is
a) 10V b) Zero c) 1.5 V d) 8.5 V

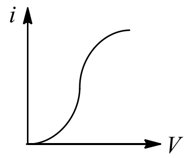
429. The relation between voltage sensitivity (σ_V) and current sensitivity (σ_i) of a moving coil galvanometer is (resistance of galvanometer is G).
a) $\frac{\sigma_i}{G} = \sigma_{\text{v}}$ b) $\frac{\sigma_{\text{v}}}{\text{G}} = \sigma_{\text{i}}$ c) $\frac{G}{\sigma_{\text{v}}} = \sigma_{\text{i}}$ d) $\frac{G}{\sigma_{\text{i}}} = \sigma_{\text{V}}$

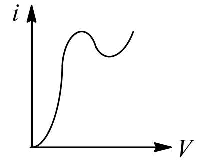
430. An electric heater of resistances 6 Ω is run for 10 min on 120 V line. The energy librated in this period of time is?
a) 7.2×10^5 J b) 14.4×10^5 J c) 43.2×10^5 J d) 28.8×10^5 J

431. A certain piece of silver of given mass is to be made like a wire. Which of the following combinations of length (L) and the area of cross-section (A) will lead to the smallest resistance
a) L and A
b) $2L$ and $A/2$
c) $L/2$ and $2\,A$
d) Any of the above, because volume of silver remains same

432. The variation between $V - i$ has been shown by $V - i$ graph for heater filament.
a) 

b) 

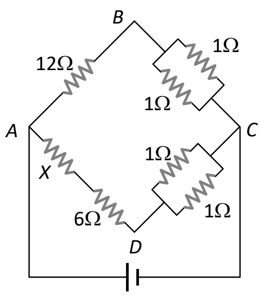
c) 

d) 

433. Thomson coefficient of a conductor is $10\mu V/K$. The two ends of it are kept at 50°C and 60°C respectively. Amount of heat absorbed by the conductor when a charge of $10C$ flows through it is
a) 1000 J b) 100 J c) 100 mJ d) 1 mJ

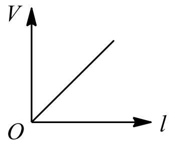
434. The junction of Ni-Cu thermo couple are maintained at 0°C and 100°C. The seeback emf developed in the temperature is
$a_{\text{Ni-Cu}} = 16.3 \times 10^{-6}\text{V°C}^{-1}$
$b_{\text{Ni-Cu}} = -0.021 \times 10^{-6}\text{V°C}^{-1}$
a) 2.73×10^3V b) 1.42×10^{-3}V c) 3.68×10^{-3}V d) 2.23×10^3V

435. A source of a primary cell is 2V. what is the short circuited it provides 4A current, then the internal resistance of cell will be
a) 8 Ω b) 2.0 Ω c) 4 Ω d) 0.5 Ω

436. For what value of unknown resistance X, the potential difference between B and D will be zero in the circuit shown in the figure


a) 4 Ω b) 6 Ω c) 2 Ω d) 5 Ω

437. The $V-I$ graph for a wire of copper of length L and cross-section ares A is shown in adjoining figure. The slope of the graph will be

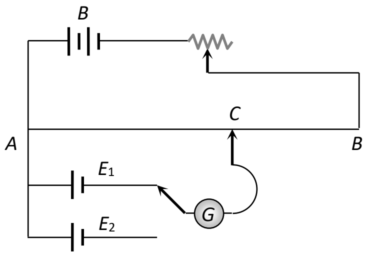


a) Less if the experiment is repeated at a higher temperature
b) More if a wire of silver having the same dimension is used
c) Doubled if the length of the wire is doubled
d) Halved if length of the wire is halved

438. The heat generated through 2 ohm and 8 ohm resistances separately, when a condenser of 200 μF capacity charged to 200 V is discharged one by one, will be

a) 4 J and 16 J respectively
b) 16 J and 4 J respectively
c) 4 J and 8 J respectively
d) 4 J and 4 J respectively

439. The circuit shown here is used to compare the e.m.f.'s of two cells E_1 and $E_2 (E_1 > E_2)$. The null point is at C when the galvanometer is connected to E_1. When the galvanometer is connected to E_2, the null point will be



a) To the left of C b) To the right of C c) At C itself d) No where on AB

440. The colour code for a resistor of resistance 3.5$k\Omega$ with 5% tolerance is

a) Orange, green, red and gold
b) Red, yellow, black and gold
c) Orange, green, orange and silver
d) Orange, green, red and silver

441. The tangent galvanometer, when connected in series with a standard resistance can be used as

a) An ammeter
b) A voltmeter
c) A wattmeter
d) Both ammeter and voltmeter

442. Which of the following statement is correct

a) Both Peltier and Joule effects are reversible
b) Both Peltier and Joule effects are irreversible
c) Joule effect is reversible, whereas Peltier effect is irreversible
d) Joule effect is reversible, whereas Peltier effect is reversible

443. Four wires AB, BC, CD, DA of resistance 4 ohm each and a fifth wire BD of resistance 8 ohm are joined to form a rectangle $ABCD$ of which BD is a diagonal. The effective resistance between the points A and B is

a) 24 ohm b) 16 ohm c) $\frac{4}{3}$ ohm d) $\frac{8}{3}$ ohm

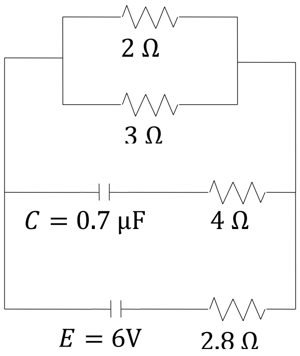
444. Two resistors are connected (a) in series (b) in parallel. The equivalent resistance in the two cases are 9 ohm and 2 ohm respectively. Then the resistance of the component resistors are

a) 2 ohm and 7 ohm b) 3 ohm and 6 ohm c) 3 ohm and 9 ohm d) 5 ohm and 4 ohm

445. Two wires of the same material and equal length are joined in parallel combination. If one of them has half the thickness of the other and the thinner wire has a resistance of 8 $ohms$, the resistance of the combination is equal to

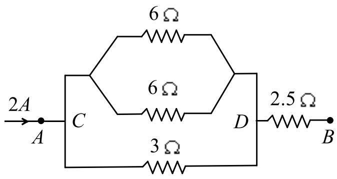
a) $\frac{5}{8}$ ohm b) $\frac{8}{5}$ ohm c) $\frac{3}{8}$ ohm d) $\frac{8}{3}$ ohm

446. In the circuit shown, the internal resistance of the cell is negligible. The steady state current in the 2 Ω resistance is



a) 0.6A b) 1.2A c) 0.9A d) 1.5A

447. The equivalent resistance and potential difference between A and B for the circuit is respectively



a) $4\ \Omega, 8\ V$ b) $8\ \Omega, 4\ V$ c) $2\ \Omega, 2\ V$ d) $16\ \Omega, 8\ V$

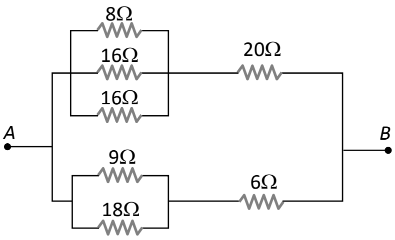
448. A wire of resistance 18Ω is divided into three equal parts. These parts are connected in side of triangle, the equivalent resistance of any two corners of triangle will be

a) 18Ω b) 9Ω c) 6Ω d) 4Ω

449. The power of heater is 500 W at 800°C. What will be its power at 200°C ? (Given : temperature coefficient of resistance, $\alpha = 4 \times 10^{-4}$°C^{-1})

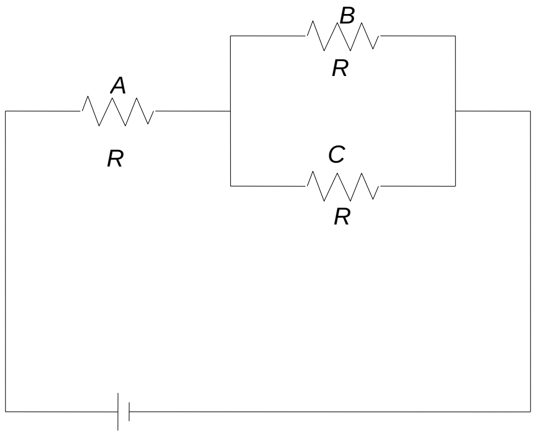
a) 484 W b) 672 W c) 526 W d) 620 W

450. The equivalent resistance of the arrangement of resistances shown in adjoining figure between the points A and B is



a) 6 ohm b) 8 ohm c) 16 ohm d) 24 ohm

451. Three identical resistances A, B and C are connected as shown in figure.



The heat produced will be maximum

a) In B b) In B and C c) In A d) Same for A, B and C

452. In a conductor 4 $coulomb$ of charge flows for 2 $seconds$. The value of electric current will be

a) 4 $volt$ b) 4 $ampere$ c) 2 $ampere$ d) 2 $volt$

453. The main supply voltage to a room is 120 V. The resistance of the lead wires is 6Ω. A 60 W bulb is already giving light. What is the decrease in voltage across the bulb when a 240 W heater is switched on?

a) No change b) 10 V c) 20 V d) More than 10 V

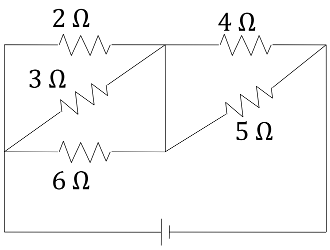
454. Two bulbs consume same power when operated at 200 V and 300 V respectively. When these bulbs are connected in series across a DC source of 400 V, then the ratio of power consumed across them is

a) 2/3 b) 3/2 c) 4/9 d) 9/4

455. A wire is stretched so as to change its diameter by 0.25%. The percentage change in resistance is

a) 4.0% b) 2.0% c) 1.0% d) 0.5%

456. The resistor in which maximum heat will be produced is

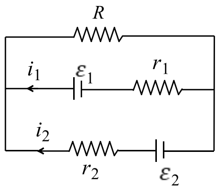


a) 2 Ω b) 3 Ω c) 4 Ω d) 6 Ω

457. If an ammeter is connected in parallel to a circuit, it is likely to be damaged due to excess

a) Current b) Voltage c) Resistance d) All of these

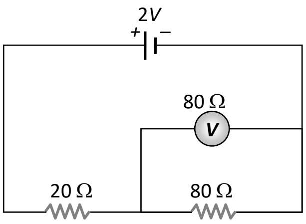
458. See the electrical circuit shown in this figure. Which of the following equations is a *correct* equation for it



a) $\varepsilon_1 - (i_1 + i_2)R - i_1 r_1 = 0$ b) $\varepsilon_2 - i_2 r_2 - \varepsilon_1 - i_1 r_1 = 0$

c) $-\varepsilon_2 - (i_1 + i_2)R + i_2 r_2 = 0$ d) $\varepsilon_1 - (i_1 + i_2)R + i_1 r_1 = 0$

459. In the adjoining circuit, the e.m.f. of the cell is 2 *volt* and the internal resistance is negligible. The resistance of the voltmeter is 80 *ohm*. The reading of the voltmeter will be



a) 0.80 *volt* b) 1.60 *volt* c) 1.33 *volt* d) 2.00 *volt*

460. 5 cells, each of emf $0.2V$ and internal resistance 1Ω are connected to an external circuit of resistance of 10Ω. Find the current through external circuit

a) $\frac{1}{2.5}A$ b) $\frac{1}{10}A$ c) $\frac{1}{15}A$ d) $\frac{1}{2}A$

461. A 2V battery, a 990 Ω resistor and a potentiometer of 2m length, all are connected in series of the residence of potentiometer wire is 10 Ω, then the potential gradient of the potentiometer wire is

a) $0.05Vm^{-1}$ b) $0.5Vm^{-1}$ c) $0.01Vm^{-1}$ d) $0.1\ Vm^{-1}$

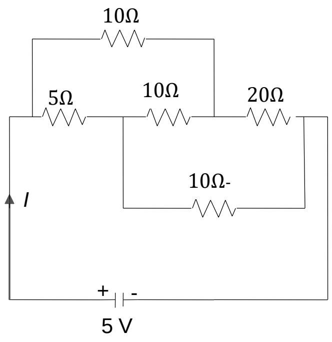
462. A galvanometer of resistance 36 Ω is changed into an ammeter by using a shunt of 4 Ω. The fraction f_0 of total current passing through the galvanometer is

a) $\frac{1}{40}$ b) $\frac{1}{4}$ c) $\frac{1}{140}$ d) $\frac{1}{10}$

463. Two cells of equal $e.m.f.$ and of internal resistance r_1 and $r_2 (r_1 > r_2)$ are connected in series. On connecting this combination to an external resistance R, it is observed that the potential difference across the first cell becomes zero. The value of R will be

a) $r_1 + r_2$ b) $r_1 - r_2$ c) $\frac{r_1 + r_2}{2}$ d) $\frac{r_1 - r_2}{2}$

464. The current I drawn from the 5 V source will be



a) 0.33A b) 0.5A c) 0.67A d) 0.17A

465. If 2 A of current is passed through $CuSO_4$ solution for 32 s, then the number of copper ions deposited at the cathode will be

a) 4×10^{20} b) 2×10^{20} c) 4×10^{19} d) 2×10^{19}

466. A steady current is set up in a metallic wire of non-uniform cross-section. How is the rate of flow of electrons (R) related to the area of cross-section (A)?

a) $R \propto A^{-1}$ b) $R \propto A$ c) $R \propto A^2$ d) R is independent of A

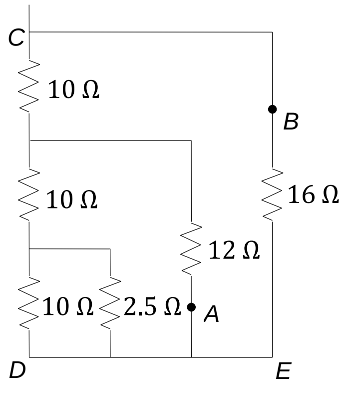
467. If 96500 *coulombs* of electricity liberates one gram equivalent of any substance, the time taken for a current of 0.15 *amperes* to deposit 20mg of copper from a solution of copper sulphate is (Chemical equivalent of copper = 32)

a) 5 *min* 20 *sec* b) 6 *min* 42 *sec* c) 4 *min* 40 *sec* d) 5 *min* 50 *sec*

468. The electron drift speed is small and the charge of the electron is also small but still, we obtain large current in a conductor. This is due to

a) The conducting property of the conductor
b) The resistance of the conductor is small
c) The electron number density of the conductor is small
d) The electron number density of the conductor is enormous

469. What is the equivalent resistance across the points A and B in the circuit given below?



a) 8 Ω b) 12 Ω c) 16 Ω d) 32 Ω

470. The resistance of the filament of an electric bulb changes with temperature. If an electric bulb rated 220 volt and 100 watt is connected to $(220 \times .8)$ *volt* sources, then the actual power would be

a) 100×0.8 *watt* b) $100 \times (0.8)^2$ *watt*
c) Between 100×0.8 *watt* and 100 *watt* d) Between $100 \times (0.8)^2$*watt* and 100×0.8 *watt*

471. Every atom makes one free electron in copper. If 1.1 A Current is flowing in the wire of copper having 1 mm diameter, then the drift velocity(approx.) will be (density of copper$=9 \times 10^3$ kg m^{-3}and atomic weight of copper=63)

a) 0.1 mms^{-1} b) 0.2 mms^{-1} c) 0.3 mms^{-1} d) 0.2 mms^{-1}

472. In a copper voltmeter , if the current (I) and time (t) variations of the type as shown in figure, the mass deposited in 30 min is [Atomic weight of copper is 63.5 and Faraday constant is 96500 C per g equivalent]

a) 0.078 g b) 0.054 g c) 0.039 g d) 0.0195 g

473. A wire when connected to $220V$ mains supply has power dissipation P_1. Now the wire is cut into two equal pieces which are connected in parallel to the same supply. Power dissipation in this case is P_2. Then $P_2 : P_1$ is

a) 1 b) 4 c) 2 d) 3

474. A source of e. m. f. $E = 15\ V$ and having negligible internal resistance is connected to a variable resistance so that the current in the circuit increases with time as $i = 1.2\ t + 3$. Then, the total charge that will flow in first five seconds will be

a) $10\ C$ b) $20\ C$ c) $30\ C$ d) $40\ C$

475. Electric bulb $50\ W$-$100\ V$ glowing at full power are to be used in parallel with battery $120\ V$, $10\ \Omega$. Maximum number of bulbs that can be connected so that they glow in full power is

a) 2 b) 8 c) 4 d) 6

476. 10 wires (same length, same area, same material) are connected in parallel and each has 1Ω resistance, then the equivalent resistance will be

a) $10\ \Omega$ b) $1\ \Omega$ c) $0.1\ \Omega$ d) $0.001\ \Omega$

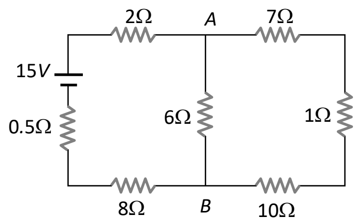
477. In order to pass 10% of main current through a moving coil galvanometer of 99 ohm, the resistance of the required shunt is

a) $9.9\ \Omega$ b) $10\ \Omega$ c) $11\ \Omega$ d) $9\ \Omega$

478. If the resistivity of a potentiometer wire be ρ and area of cross-section be A, then what will be potential gradient along the wire

a) $\frac{I\rho}{A}$ b) $\frac{I}{A\rho}$ c) $\frac{IA}{\rho}$ d) $IA\rho$

479. The current from the battery in circuit diagram shown is



a) $1\ A$ b) $2\ A$ c) $1.5\ A$ d) $3\ A$

480. Two bulbs when connected in parallel to a source take 100 W each. The total power consumed when they are connected in series with the same source is

a) 25 W b) 50 W c) 100 W d) 200 W

481. A uniform resistance R and length L is cut into for equal parts, each of length $L/4$, which are then connected in parallel combination. The effective resistance of the combination will be

a) R b) $4R$ c) $\frac{R}{4}$ d) $\frac{R}{16}$

482. In a circuit 5 percent of total current passes through a galvanometer. If resistance of the galvanometer is G then value of the shunt is

a) $19\ G$ b) $20\ G$ c) $\frac{G}{20}$ d) $\frac{G}{19}$

483. An electric lamp is marked $60\ W$, $230\ V$. The cost of a 1 kWh of energy is $Rs.$ 1.25. The cost of using this lamp 8 hrs a day for 30 days is

a) $Rs.$ 10 b) $Rs.$ 16 c) $Rs.$ 18 d) $Rs.$ 20

484. Two wires $'A'$ and $'B'$ of the same material have their lengths in the ratio $1 : 2$ and radii in the ratio $2 : 1$. The two wires are connected in parallel across a battery. The ratio of the heat produced in $'A'$ to the heat produced in $'B'$ for the same time is

a) 1 :2 b) 2 :1 c) 1 :8 d) 8 :1

485. (1)The product of a volt and a coulomb is a joule

(2)The product of a volt and an ampere is a joule/second

(3)The product of volt and watt is horse power

(4)Watt-hour can be measured in terms of electron volt

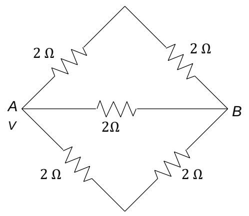
State if

a) All four are correct
b) (1), (2) and (4) are correct
c) (1) and (3) are correct
d) (3) and (4) are correct

486. A copper and a chromium voltmeter are connected in series with a battery. It found that in half an hour 0.475 g of copper and 0.130 g of chromium have been deposited. The ECE ratio of copper and chromium is

a) 0.274
b) 0.523
c) 3.65
d) 1.85

487. Each resistance shown in figure is 2 Ω. The equivalent resistance between A and B is



a) 2 Ω
b) 4 Ω
c) 8 Ω
d) 1 Ω

488. If σ_1, σ_2 and σ_3 are the conductances of three conductors, then their equivalent conductance, when they are joined in series, will be

a) $\sigma_1 + \sigma_2 + \sigma_3$
b) $\frac{1}{\sigma_1} + \frac{1}{\sigma_2} + \frac{1}{\sigma_3}$
c) $\frac{\sigma_1\sigma_2\sigma_3}{\sigma_1 + \sigma_2 + \sigma_3}$
d) None of these

489. The resistance of a metal increases with increasing temperature because

a) The collisions of the conducting electrons with the electrons increase
b) The collisions of the conducting electrons with the lattice consisting of the ions of the metal increases
c) The number of conduction electrons decrease
d) The number of conduction electrons increase

490. Two electric bulbs A and B are rated as 60 W and 100 W. They are connected in parallel to the same source. Then

a) B draws more current than A
b) Currents drawn are in the ratio of their resistances
c) Both draw the same current
d) A draws more current than B

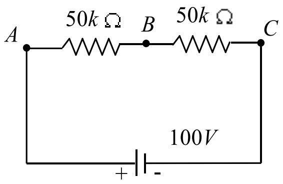
491. If an electric current is passed through a nerve of a man, then man

a) Begins to laugh
b) Begins to weep
c) Is excited
d) Becomes insensitive to pain

492. An electric bulb is rated 220 V-100 W. The power consumed by it when operated on 110 V will be

a) 75 W
b) 40 W
c) 25 W
d) 50 W

493. In the adjacent shown circuit, a voltmeter of internal resistance R, when connected across B and C reads $\frac{100}{3}V$. Neglecting the internal resistance of the battery, the value of R is



a) 100 $k\Omega$
b) 75 $k\Omega$
c) 50 $k\Omega$
d) 25 $k\Omega$

494. A resistor R_1 dissipates power P when connected to a certain generator. If the resistor R_2 is put in series with R_1, the power dissipated by R_1

a) Decreases
b) Increases
c) Remains the same
d) Any of the above depending upon the relative values of R_1 and R_2

495. If two wires having resistances R and $2R$ both are joined in series and in parallel, then ratio of heat generated in this situation, applying the same voltage is

a) 2 :1
b) 1 :2
c) 2 :9
d) 9 :2

496. For driving a current of 2 A for 6 $minutes$ in a circuit, 1000 J of work is to be done. The e.m.f. of the source in the circuit is

a) 1.38 V b) 1.68 V c) 2.04 V d) 3.10 V

497. A heater of 220 V heats a volume of water in 5 min. The same heater when connected to 110 V heats the same volume of water in (minute)

a) 5 b) 20 c) 10 d) 2.5

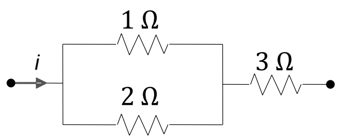
498. 50 Ω and 100 Ω resistors are connected in series. This connection is connected with a battery of 2.4 $volt$. When a voltmeter of 100 Ω resistance is connected across 100 Ω resistor, then the reading of the voltmeter will be

a) 1.6 V b) 1.0 V c) 1.2 V d) 2.0 V

499. A series combination of two resistors 1 Ω each is connected to a 12 V battery of internal resistance 0.4 Ω. The current flowing through it will be

a) 3.5 A b) 5 A c) 6 A d) 10 A

500. In the circuit shown in figure, power developed across 1Ω , 2Ω , 3 Ω resistance are in ratio of



a) 1 : 2 : 3 b) 4 : 2 : 27 c) 6 : 4 : 9 d) 2 : 1 : 27

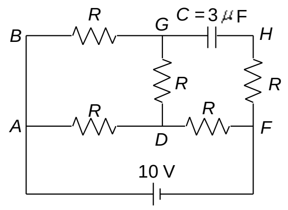
501. Four resistances 10 Ω, 5 Ω, 7 Ω and 3 Ω are connected so that they form the sides of a rectangle AB, BC, CD and DA respectively. Another resistance of 10 Ω is connected across the diagonal AC. The equivalent resistance between A and B is

a) 2 Ω b) 5 Ω c) 7 Ω d) 10 Ω

502. A copper voltmeter and a silver voltmeter are connected in series in a circuit. The rate of the increase in the weight of the cathode in the two voltmeters will be in the ratio of

a) Atomic weights of Cu and Ag b) Densities of Cu and Ag c) Half of the atomic weight of Cu to the atomic weight of Ag d) Half of the atomic weight of Ag to half the atomic weight of Cu

503. In the circuit shown, the cell is ideal, with emf=10V. Each resistance is of 2Ω. The potential difference across the capacitor is



a) 12 V b) 10 V c) 8 V d) zero

504. A current of 16 $ampere$ flows through molten $NaCl$ for 10 $minute$. The amount of metallic sodium that appears at the negative electrode would be

a) 0.23 gm b) 1.15 gm c) 2.3 gm d) 11.5 gm

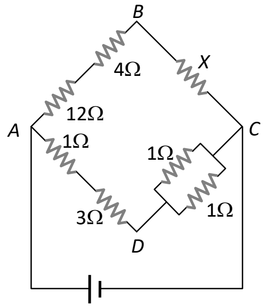
505. A storage battery has e.m.f. 15 $volt$ and internal resistance 0.05 ohm. Its terminal voltage when it is delivering 10 $ampere$ is

a) 30 $volt$ b) 1.00 $volt$ c) 14.5 $volt$ d) 15.5 $volt$

506. There are three voltmeters of the same range but of resistances 10000Ω, 8000Ω and 4000Ω respectively. The best voltmeter among these is the one whose resistance is

a) 10000 Ω b) 8000 Ω c) 4000 Ω d) All are equally good

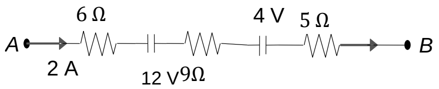
507. In the circuit shown in the adjoining figure, the current between B and D is zero, the unknown resistance is of



a) 4 Ω
b) 2 Ω
c) 3 Ω
d) $e.m.f$. of a cell is required to find the value of X

508. In meter bridge or wheatstone bridge for measurement of resistance, the known and the unknown resistance are interchanged. The error so removed is
a) End correction
b) Index error
c) Due to temperature effect
d) Random error

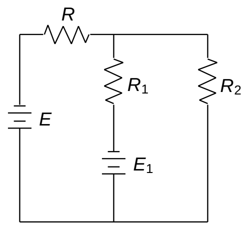
509. The potential difference between A and B in the following figure is



a) 32 V
b) 48 V
c) 24 V
d) 14 V

510. Two conductors have the same resistance at 0°C but their temperature coefficients of resistance are $\alpha_1 and\ \alpha_2$. The respective temperature coefficients of their series and parallel combinations are nearly
a) $\frac{\alpha_{1+}\alpha_2}{2}, \alpha_1+\alpha_2$
b) $\alpha_{1+}\alpha_2, \frac{\alpha_{1+}\alpha_2}{2}$
c) $\alpha_1+\alpha_2, \frac{\alpha_1\alpha_2}{\alpha_{1+}\alpha_2}$
d) $\frac{\alpha_{1+}\alpha_2}{2}, \frac{\alpha_{1+}\alpha_2}{2}$

511. Figure shows a circuit with known resistances R_1 .Neglect the internal resistance of the sources of current and resistance of the connecting wire. The magnitude of electromotive force E_1 such that the resistances R is zero will be



a) ER_1/R_2
b) ER_2/R_1
c) $E(R_1+R_2)/R_2$
d) $ER_1/(R_1+R_2)$

512. A current I is passed for a time t through a number of voltmeters. If m is the mass of a substance deposited on an electrode and z is its electrochemical equivalent, then
a) $\frac{zIt}{m}=$ constant
b) $\frac{z}{mIt}=$ constant
c) $\frac{I}{zmt}=$ constant
d) $\frac{It}{zm}=$ constant

513. The drift velocity of the electrons in a copper wire of length 2 m under the application of a potential difference of 220 V is $0.5 ms^{-1}$. Their mobility (in $m^2V^{-1}s^{-1}$)
a) 2.5×10^{-3}
b) 2.5×10^{-2}
c) 5×10^{2}
d) 5×10^{-3}

514. The inversion temperature of a copper-iron thermocouple is 540°C when the cold junction temperature is 0°C. If the cold junction temperature is increased by 10°C, then the inversion temperature and neutral temperature of the thermocouple respectively are
a) 270°C and 530°C
b) 270°C and 550°C
c) 280°C and 530°C
d) 280°C and 550°C

515. The heat produced by a 100 W heater in 2 min will be equal to
a) 12×10^3 J
b) 10×10^3 J
c) 6×10^3 J
d) 3×10^3 J

516. There is a current of 1.344 amp in a copper wire whose area of cross-section normal to the length of the wire is 1 mm^2. If the number of free electrons per cm^3 is 8.4×10^{22}, then the drift velocity would be
a) 1.0 mm/sec
b) 1.0 m/sec
c) 0.1 mm/sec
d) 0.01 mm/sec

517. The neutral temperature of a thermocouple is 350°C when the cold junction is at 0°C. When the cold junction is immersed in a bath of 30°C, the inversion temperature is

a) 700°C b) 600°C c) 350°C d) 670°C

518. $Ohm's$ law is true
a) For metallic conductors at low temperature
b) For metallic conductors at high temperature
c) For electrolytes when current passes through them
d) For diode when current flows

519. Which of the following statements is correct
a) Liquids obey fully the $ohm's$ law
b) Liquids obey partially the $ohm's$ law
c) There is no relation between current and p.d. for liquids
d) None of the above

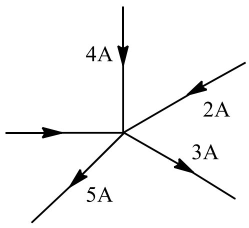
520. The range of a voltmeter of resistance 500 Ω is 10V. the resistance to be connected to convert it into an ammeter of range 10A is
a) 1 Ω in parallel b) 1 Ω in series c) 0.1 Ω in parallel d) 0.1 Ω in series

521. A uniform wire of resistance R is uniformly compressed along its length, until its radius becomes n times the original radius. Now resistance of the wire becomes
a) $\frac{R}{n^4}$ b) $\frac{R}{n^2}$ c) $\frac{R}{n}$ d) nR

522. The rate of increase of thermo e.m.f. with temperature at the neutral temperature of a thermocouple
a) Is negative
b) Is positive
c) Is zero
d) Depends upon the choice of the two materials of the thermocouple

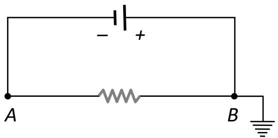
523. What length of the wire of specific resistance $48 \times 10^{-8} \Omega\ m$ is needed to make a resistance of 4.2 Ω (diameter of wire $= 0.4\ mm$)
a) $4.1\ m$ b) $3.1\ m$ c) $2.1\ m$ d) $1.1\ m$

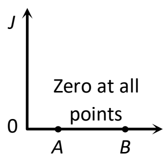
524. In the given current distribution, what is the value of I?

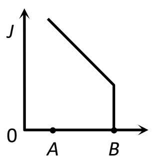


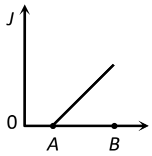
a) 3A b) 8A c) 2A d) 5A

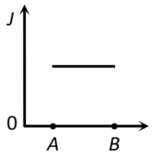
525. A battery is connected to a uniform resistance wire AB and B is earthed. Which one of the graphs below shows how the current density J varies along AB



a) 

b) 

c) 

d) 

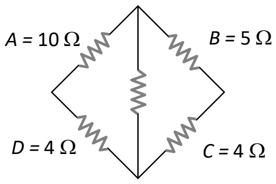
526. An ammeter and a voltmeter of resistance R are connected in series to an electric cell of negligible internal resistance. Their readings are A and V respectively. If another resistance R is connected in parallel with the voltmeter

a) Both A and V will increase
b) Both A and V will decrease
c) A will decrease and V will increase
d) A will increase and V will decrease

527. When the current i is flowing a conductor, the drift velocity is v. If $2i$ current is flowed through the same metal but having double the area of cross-section, then the drift velocity will be

a) $v/4$
b) $v/2$
c) v
d) $4v$

528. In a typical Wheatstone network, the resistances in cycle order are $A = 10\ \Omega, B = 5\ \Omega, C = 4\ \Omega$ and $D = 4\ \Omega$. For the bridge to be balanced



a) 10 Ω should be connected in parallel with A
b) 10 Ω should be connected in series with A
c) 5 Ω should be connected in series with B
d) 5 Ω should be connected in parallel with B

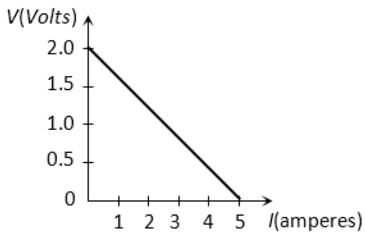
529. When a resistance of $2 ohm$ is connected across the terminals of a cell, the current is 0.5 $ampere$. When the resistance is increased to 5 ohm, the current is 0.25 $ampere$. The internal resistance of the cell is

a) 0.5 ohm
b) 1.0 ohm
c) 1.5 ohm
d) 2.0 ohm

530. A tap supplies water at 22°C, a man takes of 1 L of water per min at 37°C from the geyser. The power of geyser is

a) 525 W
b) 1050 W
c) 1775 W
d) 2100 W

531. For a cell, the graph between the potential difference (V) across the terminals of the cell and the current (I) drawn from the cell is shown in the figure. The e.m.f. and the internal resistance of the cell are



a) $2V, 0.5\Omega$
b) $2V, 0.4\Omega$
c) $> 2V, 05\Omega$
d) $> 2V, 0.4\Omega$

532. The thermistors are usually made of

a) Metals with low temperature coefficient of resistivity
b) Metals with high temperature coefficient of resistivity
c) Metal oxides with high temperature coefficient of resistivity
d) Semiconducting materials having low temperature coefficient of resistivity

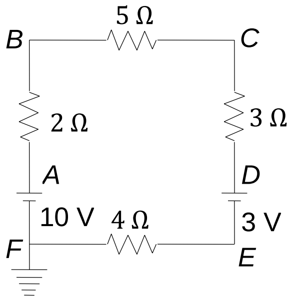
533. A storage cell is charged by 5 amp D.C. for 18 $hours$. Its strength after charging will be

a) 18 AH
b) 5 AH
c) 90 AH
d) 15 AH

534. The internal resistance of a cell of e.m.f. $12V$ is $5 \times 10^{-2}\Omega$. It is connected across an unknown resistance. Voltage across the cell, when a current of 60 A is drawn from it, is

a) 15 V b) 12 V c) 9 V d) 6 V

535. In the circuit shown in figure, the points F is grounded. Which of the following is wrong statement?



a) D is at 5V
b) E is at zero potential
c) The current in the circuit will be 0.5 A
d) The potential at E is same whether or not F is rounded

536. Potentiometer wire of length 1m is connected in series with 490Ωresistance and 2V battery. If 0.2m $Vcm^{-1}$is the potential gradient, then resistance of the potentiometer wire is

a) 4.9Ω b) 7.9Ω c) 5.9Ω d) 6.9Ω

537. The potential difference across the terminals of a battery is 50V when 11A current is drawn and 60V when 1A current is drawn. The $e.m.f$. and the internal resistance of the battery are

a) 62V, 2Ω b) 63V, 1Ω c) 61V, 1Ω d) 64V, 2Ω

538. Two resistance R_1 and R_2 are made of different materials. The temperature coefficient of the material of R_1 is α and of the material of R_2 is $-\beta$. The resistance of the series combination of R_1 and R_2 will not change with temperature, if R_1/R_2 equals

a) $\frac{\alpha}{\beta}$ b) $\frac{\alpha+\beta}{\alpha-\beta}$ c) $\frac{\alpha^2+\beta^2}{\alpha\beta}$ d) $\frac{\beta}{\alpha}$

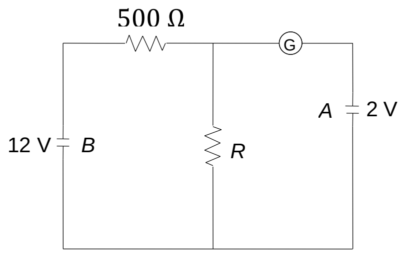
539. To deposit one litre of hydrogen at 22.4 atmosphere from acidulated water, the quantity of electricity that must pass through is

a) 1 *coulomb* b) 22.4 *coulomb* c) 96500 *coulomb* d) 193000 *coulomb*

540. In ballistic galvanometer, the frame in which the coil is wound is non-metallic to

a) Avoid the production of induced emf
b) Avoid the production of eddy currents
c) Increase the production of eddy currents
d) Increase the production of induced emf

541. In the circuit, the galvanometer Gshows zero deflection. If the batteries A and Bhave negligible internal resistance, the value of the resistor Rwill be



a) 200Ω b) 100 Ω c) 500 Ω d) 1000 Ω

542. The resistivity of alloys = R_{alloy}; the resistivity of constituent metals R_{metal}. Then, usually

a) $R_{\text{alloy}} = R_{\text{metal}}$
b) $R_{\text{alloy}} < R_{\text{metal}}$
c) There is no simple relation between R_{alloy} and R_{metal}
d) $R_{\text{alloy}} > R_{\text{metal}}$

543. The production of e.m.f. by maintaining a difference of temperature between the two junctions of two different metals is known as

a) Joule effect b) Seebeck effect c) Peltier effect d) Thomson effect

544. An electric heater is heated respectively by $d.c.$ and $a.c.$ Applied voltage for both the currents is equal. The heat produced per second will be

a) More on heating by $a.c.$ source
b) More on heating by $d.c.$ source

c) Same for both
d) None of the above

545. A coil takes 15 min to boil a certain amount of water; another coil takes 20 min for the same process. Time taken to boil the same amount of water when both coils are connected in series

a) 5 min
b) 8.6 min
c) 35 min
d) 30 min

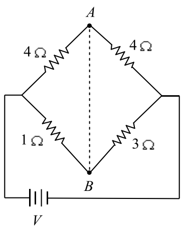
546. The electron dirft speed is small and the charge of the electron is also small but still, we obtain large current in a conductor. This is due to

a) The conducting property of the conductor
b) The resistance of the conductor is small
c) The electron number density of the conductor is small
d) The electron number density of the conductor is enormous

547. A small power station supplies electricity to 5000 lamps connected in parallel. Each lamp has a resistance of 220 and is operated at 220 V. The total current supplied by the station is

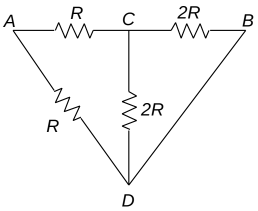
a) 2500 A
b) 3500 A
c) 5000 A
d) 10000 A

548. In the circuit shown, if a conducting wire is connected between points A and B, the current in this wire will



a) Be zero
b) Flow from B to A
c) Flow from A to B
d) Flow in the direction which will be decided by the value of V

549. The effective resistance between points A and B is

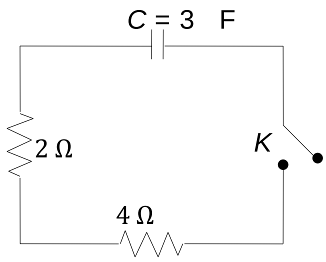


a) R
b) $\frac{R}{3}$
c) $\frac{2R}{3}$
d) $\frac{3R}{5}$

550. A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10 divisions per milliampere and voltage sensitivity is 2 divisions per millivolt. In order that each division reads 1V, the resistance in Ohm's needed to be connected in series with the coil will be

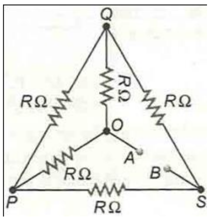
a) 10^3
b) 10^5
c) 99995
d) 9995

551. A capacitor of capacitance 3μF is first charged by connecting across 10 V battery, then it is allowed to get discharged through 2 Ω and 4Ω resistor by closing the key Kas shown in figure. The total energy dissipated in 2Ω resistor is equal to



a) 0.15 m J
b) 0.5 m J
c) 0.05 m J
d) 1.0 m J

552. If each of the resistances in the network in figure. R, the equivalent resistance between terminals A and B is



a) 5 R b) 2 R c) 4 R d) R

553. The tolerance level of a resistor with the colour code red, blue, orange, gold is

a) $\pm 5\%$ b) $\pm 10\%$ c) $\pm 20\%$ d) $\pm 40\%$

554. A given piece of wire of length l and radius r is having a resistance R. This wire is stretched uniformly to a wire of radius$\frac{r}{2}$. What is the new resistance?

a) $3R$ b) $8R$ c) $16R$ d) $2R$

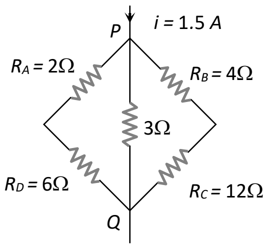
555. The expression for thermo e.m.f. in a thermocouple is given by the relation $E = 40\theta - \frac{\theta^2}{20}$, where θ is the temperature difference of two junctions. For this, the neutral temperature will be

a) 100°C b) 200°C c) 300°C d) 400°C

556. The steady current flows in a metallic conductor of non-uniform cross-section. The quantity/quantities constant along the length of the conductor is/are

a) Current, electric field and drift velocity b) Drift speed only
c) Current and drift speed d) Current only

557. Potential difference between the points P and Q in the electric circuit shown is



a) 4.5 V b) 1.2 V c) 2.4 V d) 2.88 V

558. Who among the following scientists made the statement –"Chemical change can produce electricity"

a) Galvani b) Faraday c) Coulomb d) Thomson

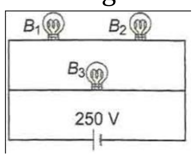
559. A thin wire of resistance 4 Ω is bent to form a circle. The resistance across any diameter is

a) 4 Ω b) 2 Ω c) 1 Ω d) 8 Ω

560. A wire P has a resistance of 20Ω. Another wire Q of same material but length twice that of P has resistance of 8Ω. If r is the radius of cross-section of P, the radius of cross-section of $Q$is

a) r b) $\frac{r}{\sqrt{2}}$ c) $\sqrt{5r}$ d) $2r$

561. A 100 W bulb B_1 and two 60 W bulb B_2 and B_3 are connected to a 250 V source as shown in the figure.



Now W_1, W_2 and W_3 are the out-put powers of the bulbs B_1, B_2 and B_3 respectively. Then

a) $W_1 > W_2 = W_3$ b) $W_1 > W_2 > W_3$ c) $W_1 < W_2 = W_3$ d) $W_1 < W_2 < W_3$

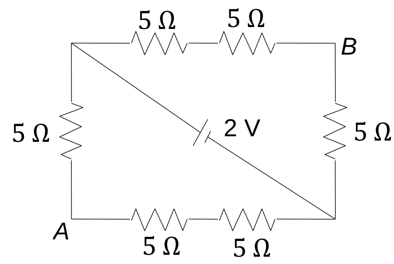
562. The electric intensity E, current density j and specific resistance k are related to each other by the relation

a) $E = j/k$ b) $E = jk$ c) $E = k/j$ d) $k = jE$

563. The kirchoff;s forst law $(\sum i = 0)$and second law $(\sum iR = \sum E)$where the symbols have their usual meanings, are respectively based on

a) Conservation of charge, conversion of momentum
b) Conservation of energy, conservation of charge
c) Conservation of momentum, conservation of charge
d) Conservation of charge, conservation of energy

564. In the circuit shown in figure the potential difference between the points A and B will be



a) $\frac{2}{3}$V　　b) $\frac{8}{9}$V　　c) $\frac{4}{3}$V　　d) 2V

565. For goldplating on a copper chain, the substance required in the form of solution is
a) Copper sulphate　　b) Copper chloride
c) Potassium cyanide　　d) Potassium aurocyanide

566. A milliammeter of range 10 mA has a coil of resistance 1 Ω. To use it as voltmeter of range 10 $volt$, the resistance that must be connected in series with it, will be
a) 999 Ω　　b) 99 Ω　　c) 1000 Ω　　d) None of these

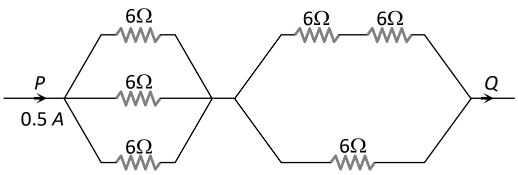
567. Two wires of resistance R_1 and R_2 have temperature coefficient of resistances α_1 and α_1 respectively. These are joined in series. The effective temperature coefficient of resistance is
a) $\frac{\alpha_1 + \alpha_2}{2}$　　b) $\sqrt{\alpha_1 \alpha_2}$　　c) $\frac{\alpha_1 R_1 + \alpha_2 R_2}{R_1 + R_2}$　　d) $\frac{\sqrt{R_1 R_2 \alpha_1 \alpha_2}}{\sqrt{R_1^2 + R_2^2}}$

568. Conductivity increases in the order of
a) Al, Ag, Cu　　b) Al, Cu, Ag　　c) Cu, Al, Ag　　d) Ag, Cu, Al

569. A current of 1.5 A flows through a copper voltmeter. The thickness of copper deposited on the electrode surface of area 50 cm^2 in 20 min is (density of Cu=9000 kgm^{-3}; ECE of Cu $= 3.3 \times 10^{-7} kgC^{-1}$)
a) 1.3×10^{-4} m　　b) 1.3×10^{-5} m　　c) 2.6×10^{-4} m　　d) 2.6×10^{-5} m

570. If resistance of the filament increases with temperature, what will be power dissipated in a 220 V- 100 W lamp when connected to 110 V power supply
a) 25 W　　b) $<$ 25 W　　c) $>$ 25 W　　d) None of these

571. Resistances of 6 ohm each are connected in the manner shown in adjoining figure. With the current 0.5 $ampere$ as shown in figure, the potential difference $V_P - V_Q$ is

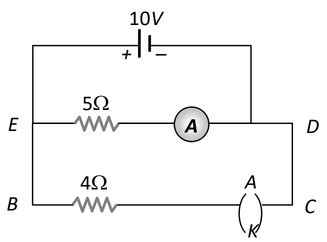


a) 3.6 V　　b) 6.0 V　　c) 3.0 V　　d) 7.2 V

572. What is the volume of hydrogen liberated at NTP by the amount of charge which liberates 0.3175 g of copper?
a) 224 cc　　b) 112 cc　　c) 56 cc　　d) 1120 cc

573. A coil develops heat of 800 cal/sec. When 20 $volts$ is applied across its ends. The resistance of the coil is ($1\ cal = 4.2\ joule$)
a) 1.2 Ω　　b) 1.4 Ω　　c) 0.12 Ω　　d) 0.14 Ω

574. In the given figure, when key K is opened, the reading of the ammeter A will be

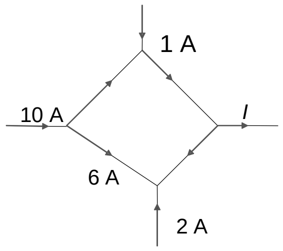


a) 50 A　　b) 2 A　　c) 0.5 A　　d) $\frac{10}{9} A$

575. An electric wire of length $'L'$ and area of cross-section a has resistance $R\ ohm$. Another wire of the same material having same length and area of cross-section $4a$ has a resistance of

a) $4R$　　b) $R/4$　　c) $R/16$　　d) $16R$

576. The figure shows a network of currents. The magnitude of current is shown here. The current I will be



a) 3A　　b) 9A　　c) 13A　　d) 19A

577. An ammeter of 5 ohm resistance can read 5 mA. If it is to be used to read 100 $volt$, how much resistance is to be connected in series

a) 19.9995 Ω　　b) 199.995 Ω　　c) 1999.95 Ω　　d) 19995 Ω

578. The thermo-emf of a thermocouple is 25μ V/°C at room temperature. A galvanometer of 40 Ω resistance, capable of detecting current as low as 10^{-5} A, is connected with the thermocouple. The smallest temperature difference that can be detected by this system is

a) 16°C　　b) 12°C　　c) 8°C　　d) 20°C

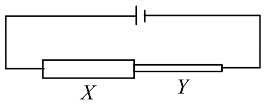
579. An ionization chamber with parallel conducting plates as anode and cathode has 5×10^7 electrons and the same number of singly-charged positive ions per cm^3. The electrons are moving at 0.4 m/s. The current density from anode to cathode is $4\mu A/m^2$. The velocity of positive ions moving towards cathode is

a) 0.4 m/s　　b) 16 m/s　　c) Zero　　d) 0.1 m/s

580. In a potentiometer experiment, when three cells A, B and C care connected in series the balancing length is found to be 740 cm. if A and B are connected in series balancing length is 540 cm. then the emf of $E_A, E_B and\ E_C$ are respectively (in volts)

a) 1,1.2 and 1.5　　b) 1,2 and 3　　c) 1.5,2 and 3　　d) 1.5, 2.5 and 3.5

581. Figure below shows a thick copper rod X and a thin copper wire Y joined in series. They carry a current which is sufficient to make Y much hotter than X



Which one of the following is correct?

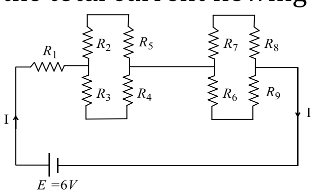
Number density of Conduction electrons	Mean time between collisions of the electrons
a) Same in X and Y	less in X than in Y
b) Same in X and Y	same in X and Y
c) Same in X and Y	more in X than in Y
d) more in X and Y	less in X than in Y

582. A steady current i is flowing through a conductor of uniform cross-section. Any segment of the conductor has

a) Zero charge　　b) Only positive charge

c) Only negative charge　　d) Charge proportional to current i

583. Nine resistors each of 1 $k\Omega$ are conneted to a battery of 6 V as shown in the circuit given below. What is the total current flowing in the circuit



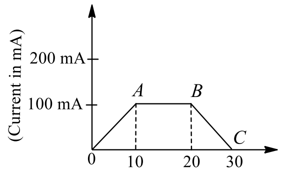
a) $3mA$ b) $\frac{2}{3}mA$ c) $\frac{3}{2}mA$ d) $2mA$

584. In order to increase the sensitivity of galvanometer
a) The suspension wire should be made stiff
b) Area of the coil should be reduced
c) The magnetic field should be increased
d) The number of turns in the coil should be reduced

585. When the number of turns of the coil is doubled, the current sensitivity of a moving coil galvanometer is doubled whereas the voltage sensitivity of the galvanometer
a) Remains the same b) Is halved c) Is doubled d) Is quadrupled

586. The reading of a high resistance voltmeter when a cell is connected across it is 2.2 V. When the terminals of the cell are also connected to a resistance of 5 Ω the voltmeter reading drops to 1.8 V. Find the internal resistance of the cell
a) 1.2 Ω b) 1.3 Ω c) 1.1 Ω d) 1.4 Ω

587. In copper voltameter, mass deposited in 30 s is m gram. If the time current is as shown in figure, ECE of copper is

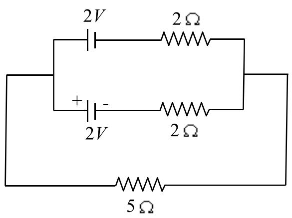


a) m b) $m/2$ c) 0.6 m d) 0.1 m

588. Two cells with the same emf E and different internal resistances r_1 and r_2 are connected in series to an external resistance R. the value of R so that the potential difference across the first cell be zero is
a) $\sqrt{r_1 r_2}$ b) $r_1 + r_2$ c) $r_1 - r_2$ d) $\frac{r_1 + r_2}{2}$

589. The resistivity of a wire depends on its
a) Length b) Area of cross-section c) Shape d) Material

590. In the circuit shown, the current through the 5 Ω resistor is



a) $\frac{8}{3}A$ b) $\frac{9}{13}A$ c) $\frac{4}{13}A$ d) $\frac{1}{3}A$

591. A 5.0 A current is setup in an external circuit by a 6.0 storage battery for 6.0 min. The chemical energy of the battery is reduced by
a) 1.08×10^4 J b) 1.08×10^3 J c) 1.8×10^4 J d) 1.8×10^3 J

592. A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be
a) Doubled b) Four times c) One-fourth d) Halved

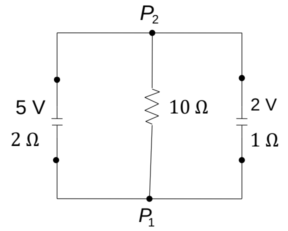
593. The resistance of a galvanometer is 90 ohm. If only 10 percent of the main current may flow through the galvanometer, in which way and of what value, a resistor is to be used
a) 10 ohm in series b) 10 ohm in parallel c) 810 ohm in series d) 810 ohm in parallel

594. One junction of a certain thermo-couple is at a fixed temperature T_r and the other junction is at temperature T. The thermo electric force for this is expressed by
$E = K(T - T_r)[\,T_0 + \frac{1}{2}(T^2 + T_r^2)\,]$.
At temperature $T = T_0/2$ the thermoelectric power is
a) $\frac{1}{2}\,K\,T_0$ b) $\frac{3}{2}K\,T_0$ c) $\frac{1}{2}\,K\,T_0^2$ d) $\frac{1}{2}K\,(T_0 - T_r)^2$

595. An electric lamp is marked 60 W, 230 V. The cost of kilowatt hour of power is Rs 1.25. The cost of using this lamp 8 h a day for 30 days is

a) Rs 10 b) Rs 16 c) Rs 18 d) Rs 20

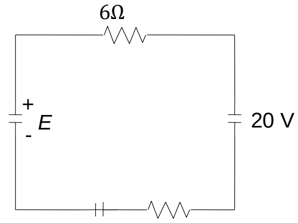
596. A 5V battery with internal resistance 2 Ω and a 2V battery with internal resistance 1 Ω are connected to a 10 Ω resistor as shown in the figure



The current in the 10 Ω resistor is

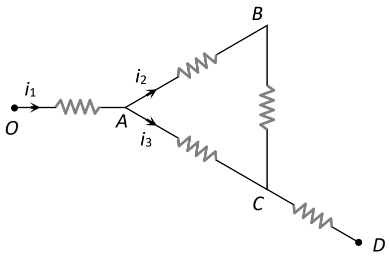
a) 0.27A, $P_2 to\ P_1$ b) 0.03A, P_1 to P_2 c) 0.03A, P_2 tp P_1 d) 0.27A, $P_1 to\ P_2$

597. Calculate the value E, for given circuit, when value of 2A current is either flowing in clockwise or anticlockwise direction



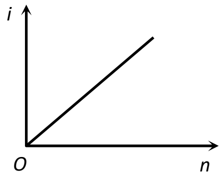
a) 32 V, 8V b) 38V, 2V c) 32V, 2V d) 30V, 8V

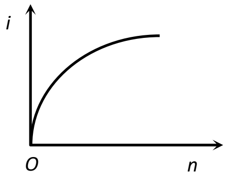
598. The current in the arm CD of the circuit will be

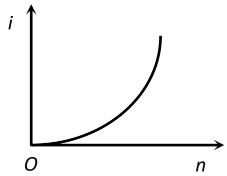


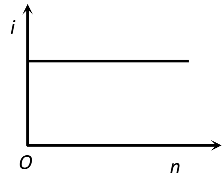
a) $i_1 + i_2$ b) $i_2 + i_3$ c) $i_1 + i_3$ d) $i_1 - i_2 + i_3$

599. A battery consists of a variable number $'n'$ of identical cells having internal resistances connected in series. The terminals of battery are short circuited and the current i is measured. Which of the graph below slows the relationship between i and n

a) 

b) 

c) 

d) 

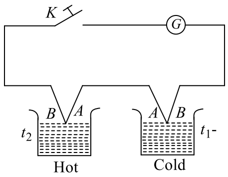
600. Assume that each atom of copper contributes one electron. If the current flowing through a copper wire of 1 mm diameter is 1.1 A, the drift velocity of electrons will be (density of Cu=9 g cm^{-3}, atomic wt. of Cu=63)

a) 0.3 mm s^{-1} b) 0.5 mm s^{-1} c) 0.1 mm s^{-1} d) 0.2 mm s^{-1}

601. The specific resistance of a wire is ρ, its volume is 3 m^3 and its resistance is 3Ω, then its length will be

a) $\sqrt{1/\rho}$ b) $3/\sqrt{\rho}$ c) $\sqrt{3}/\rho$ d) $\rho/\sqrt{3}$

602. Two similar thermocouples, made of dissimilar metals A and B are connected as shown in figure through a key K and a sensitive galvanometer G. One of the thermocouples is dipped in a hot bath maintained at temperature t_2 and the other in a cold bath at temperature t_1. When the key is pressed, a deflection is seen in the galvanometer because



a) An emf of the order of a few microvolt is generated which is proportional to $(t_2 - t_1)$
b) An emf is generated the value of which will depend upon the temperature of the hot bath only
c) An emf of about one volt is generated which will be proportional to $(t_2 - t_1)$
d) An emf of a few microvolt is generated which will be proportional to t_2 only.

603. 100 cells each of e. m. f. 5 V and internal resistance 1 ohm are to be arranged so as to produce maximum current in a 25 ohm resistance. Each row is to contain equal number of cells. The number of rows should be
a) 2 b) 4 c) 5 d) 10

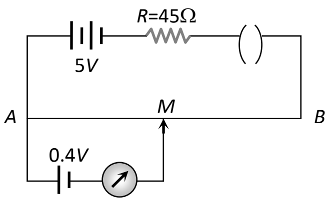
604. A steady current of 1.5 A flows through a copper voltameter for 10 min. If the electrochemical equivalent of copper is 30×10^{-5} g C^{-1}, the mass of copper deposited on the electrode will be
a) 0.40 g b) 0.50 g c) 0.67 g d) 0.27 g

605. 1kg piece of copper is drawn into a wire 1 mm thick, and another piece into a wire 2 mm thick. Compare the resistance of these wires
a) 2: 1 b) 4: 1 c) 8: 1 d) 16: 1

606. A 2 $volt$ battery, a 15 Ω resistor and a potentiometer of 100 cm length, all are connected in series. If the resistance of potentiometer wire is 5Ω, then the potential gradient of the potentiometer wire is
a) 0.005 V/cm b) 0.05 V/cm c) 0.02 V/cm d) 0.2 V/cm

607. In charging a battery of motor-car, the following effect of electric current is used
a) Magnetic b) Heating c) Chemical d) Induction

608. In given figure, the potentiometer wire AB has a resistance of 5 Ω and length 10 m. The balancing length AM for the emf of 0.4 V is



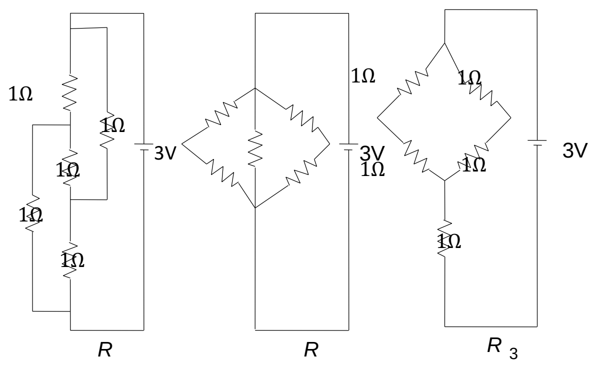
a) 0.4 m b) 4 m c) 0.8 m d) 8 m

609. When 1 A current flows for 1 min through a silver voltmeter, it deposits 0.067 g of silver on the cathode, then how much charge will flow to deposit 108 g of silver?
a) $10.6 \times 10^4 Cg_{eq}^{-1}$ b) $9.67 \times 10^4 Cg_{eq}^{-1}$ c) $8.7 \times 10^4 Cg_{eq}^{-1}$ d) $4.3 \times 10^4 Cg_{eq}^{-1}$`

610. The voltage of clouds is 4×10^6 V with respect to ground. In a light ning strike lasting 100 ms, a charge of 4 C is delivered to the ground. The power of lightning strike is
a) 160 MW b) 80 MW c) 20 MW d) 500 Kw

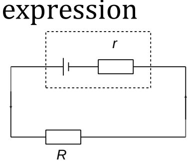
611. A 6V cell with 0.5 Ω internal resistance, a10V cell with 1 Ω internal resistance and a 12 Ω external resistance are connected in parallel. The current (in ampere) through the 10V cell is
a) 0.60 b) 2.27 c) 2.87 d) 5.14

612. Figure shows three resistor configurations R_1, R_2 and R_3 connected to 3 V batteries. If the power dissipated by the configuration R_1, R_2 and R_3 IS P_1, P_2 and P_3, respectively, then



a) $P_1 > P_2 > P_3$ b) $P_1 > P_3 > P_2$ c) $P_2 > P_1 > P_3$ d) $P_3 > P_2 > P_1$

613. A cell of internal resistance r is connected to a load of resistance R. Energy is dissipated in the load, but some thermal energy is also wasted in the cell. The efficiency of such an arrangement is found from the expression



$\frac{\text{energy dissipated in the load}}{\text{energy dissipatd in the compete circuit}}$.

Which of the following gives the efficiency in this case?

a) $\frac{r}{R}$ b) $\frac{R}{r}$ c) $\frac{r}{R+r}$ d) $\frac{R}{R+r}$

614. The resistance of a wire is 5Ω at 50°C and 6Ω at 100°C.The resistance of the wire at 0°C will be

a) 2Ω b) 1Ω c) 4Ω d) 3Ω

615. To convert a moving a coil galvanometer (MCG) into a voltmeter

a) A high resistance R is connected in parallel with MCG
b) A low resistance r is connected in parallel with MCG
c) A low resistance r is connected in series with MCG
d) A high resistance R is connected in series with MCG

616. A dry cell of emf 1.5 V and internal resistance 0.10Ω is connected across a resistor in series with a very low resistance ammeter. When the circuit is switched on, the ammeter reading settles to a steady rate of 2A. Find (i) chemical energy consumption of the cell (ii) energy dissipation inside the cell (iii) energy dissipation inside the resistor (iv) power output of source is

a) (i) 3 W (ii) 0.4 W (iii) 2.6 W (iv) 2.6 W
b) (i) 0.4 W (ii) 3 W (iii) 2.6 W (iv) 2.6 W
c) (i) 2.6 W (ii) 0.4 W (iii) 9 W (iv) 1 W
d) None of the above

617. A wire has a resistance of 12 *ohm*. It is bent in the form of equilateral triangle. The effective resistance between any two corners of the triangle is

a) 9 *ohm* b) 12 *ohm* c) 6 *ohm* d) 8/3 *ohm*

618. One end each of a resistance r capacitor C and resistance 2r are connected together. The other ends are respectively connected to the positive terminals of batteries, P, Q, R having respectively emf's E,E and 2E. the negative terminals of the batteries are then connected together. In this circuit, with steady current the potential drop across the capacitor is

a) $\frac{E}{3}$ b) $\frac{E}{2}$ c) $\frac{2E}{3}$ d) E

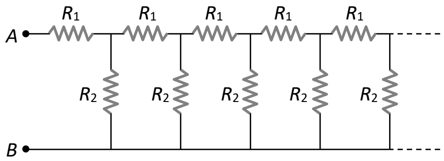
619. Two cells having the internal resistance 0.2 Ω and 0.4 Ω are connected in parallel. The voltage across the battery terminal is 1.5V. the emf of first cell is 1.2V. the emf of second cell is

a) 2.7 V b) 2.1 V c) 3 V d) 4.2V

620. The equivalent resistance of n resistors each of same resistance when connected in series is R. If the same resistances are connected in parallel, the equivalent resistance will be

a) R/n^2 b) R/n c) n^2R d) nR

621. An infinite sequence of resistances is shown in the figure. The resultant resistance between A and B will be, when $R_1 = 1\ ohm$ and $R_2 = 2\ ohm$

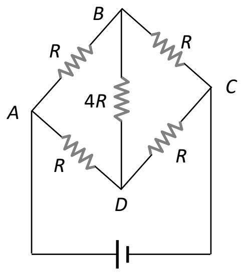


a) Infinity b) 1 Ω c) 2 Ω d) 1.5 Ω

622. A 200 W and a 100 W bulb, both meant for operation at 220 V are connected in series. When connected to a 220 V supply the power consumed by the combination is

a) 33.3 W b) 66.7 W c) 300 W d) 100 W

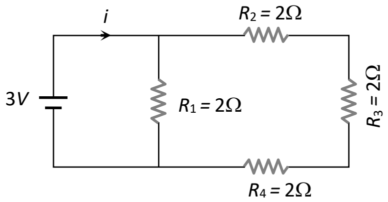
623. Five resistors of given values are connected together as shown in the figure. The current in the arm BD will be



a) Half the current in the arm ABC b) Zero

c) Twice the current in the arm ABC d) Four times the current in the arm ABC

624. What is the current (i) in the circuit as shown in figure



a) 2 A b) 1.2 A c) 1 A d) 0.5 A

625. A galvanometer of resistance 100Ω is converted to a voltmeter of range 10 V by connecting a resistance of 10kΩ. The resistance required to convert the same galvanometer to an ammeter of range 1 A is

a) 0.4Ω b) 0.3Ω c) 1.2Ω d) 0.1Ω

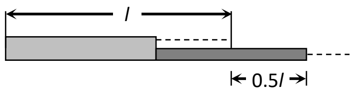
626. The resistance of a 10m long wire is 10Ω. Its length is increased by 25% by stretching the wire uniformly. Then the resistance of the wire will be

a) 12.5 Ω b) 14.5 Ω c) 15.6 Ω d) 16.6 Ω

627. Resistance of 100 cm long potentiometer wire is 10Ω, it is connected to a battery $(2\ volt)$ and a resistance R in series. A source of 10 mV gives null point at 40 cm length, then external resistance R is

a) 490 Ω b) 790 Ω c) 590 Ω d) 990 Ω

628. In order to quadruple the resistance of a uniform wire, a part of its length was uniformly stretched till the final length of the entire wire was 1.5 times the original length, the part of the wire was fraction equal to



a) 1/8 b) 1/6 c) 1/10 d) 1/4

629. A galvanometer has a resistance 50Ω. A resistance of 5Ω is connected parallel to it. Fraction of the total current flowing through galvanometer is

a) $\frac{1}{10}$ b) $\frac{1}{11}$ c) $\frac{1}{50}$ d) $\frac{2}{15}$

630. The thermo emf of copper-constantan couple is 40μV per degree. The smallest temperature difference that can be detected with this couple and a galvanometer of 100Ω resistance capable of measuring the maximum current of 1μA is

a) 10°C b) 7.5°C c) 5.0°C d) 2.5°C

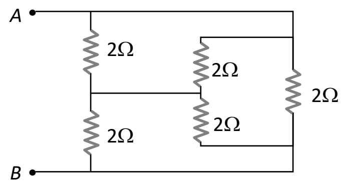
631. A parallel combination of two resistors, of 1Ω each, is connected in series with a 1.5Ω resistor. The total combination is connected across a 10V battery. The current flowing in the circuit is

a) 5A b) 20A c) 0.2A d) 0.4A

632. Dimensions of a block are $1\ cm \times 1\ cm \times 100 cm$. If specific resistance of its material is $3 \times 10^{-7} ohm - m$, then the resistance between the opposite rectangular faces is

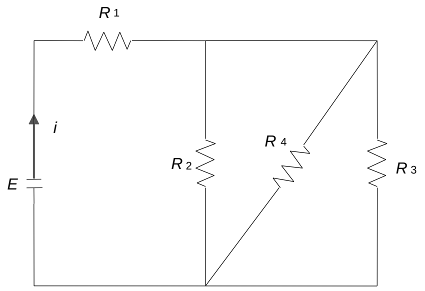
a) $3 \times 10^{-9} ohm$ b) $3 \times 10^{-7} ohm$ c) $3 \times 10^{-5} ohm$ d) $3 \times 10^{-3} ohm$

633. Find the equivalent resistance across AB



a) 1 Ω b) 2 Ω c) 3 Ω d) 4 Ω

634. In the circuit given E=0.6V, R_1=100Ω, $R_2 = R_3 = 50\Omega, R_4 = 75\Omega$. The equivalent resistance of the circuit, in ohm is



a) 11.875 b) 26.31 c) 118.75 d) None of these

635. Three resistances 4 Ω each are connected in the form of an equilateral triangle. The effective resistance between two corners is

a) 8 Ω b) 12 Ω c) $\frac{3}{8}\Omega$ d) $\frac{8}{3}\Omega$

636. The material of wire of potentiometer is

a) Copper b) Steel c) Manganin d) Aluminium

637. A Copper wire of length 1 m and radius 1 mm is joined in series with an iron wire of length 2 m and radius 3 mm and a current is passed through the wires. The ratio of the current density in the wires. The ratio of the current density in the copper and iron wires is

a) 2: 3 b) 6: 1 c) 9: 1 d) 18: 1

638. If the emf of a thermocouple, one junction of which is kept 0°C is given by $e = at + \frac{1}{2} bt^2$, then the neutral temperature will be

a) $\frac{a}{b}$ b) $-\frac{a}{b}$ c) $\frac{a}{2b}$ d) $-\frac{1}{ab}$

639. A given carbon resistor has the following colour code of the various strips: orange, red, yellow and gold. The value of resistance in ohm is

a) $32 \times 10^4 \pm 5\%$ b) $32 \times 10^4 \pm 10\%$ c) $23 \times 10^4 \pm 5\%$ d) $23 \times 10^4 \pm 10\%$

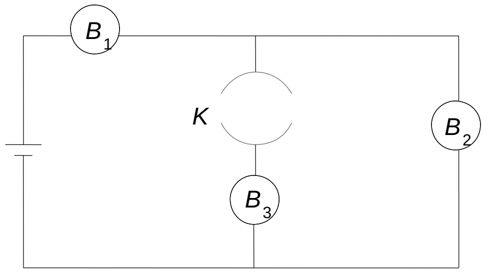
640. The same mass of copper is drawn into two wires 1 mm and 2 mm thick. Two wires are connected in series and current is passed through them. Heat produced in the wire is in the ratio

a) 2 :1 b) 1 :16 c) 4 :1 d) 16 :1

641. The resistances of a wire at temperatures t°C and 0°C are related by

a) $R_t = R_0(1 + \alpha t)$ b) $R_t = R_0(1 - \alpha t)$ c) $R_t = R_0^2(1 + \alpha t)$ d) $R_t = R_0^2(1 - \alpha t)$

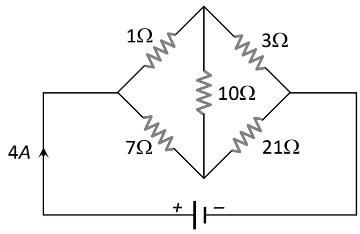
642. B_1, B_2 and B_3 are the three identical bulbs connected to a battery of steady emf with key K closed. What happens to the brightness of the bulbs, B_1 and B_2 when the key is opened?



a) Brightness of the bulb B_1 increases and that of B_2 decreases
b) Brightness of the bulbs B_1 and B_2 increases
c) Brightness of the bulb B_1 decreases and B_2 increases
d) Brightness of the bulbs B_1 and B_2 decreases

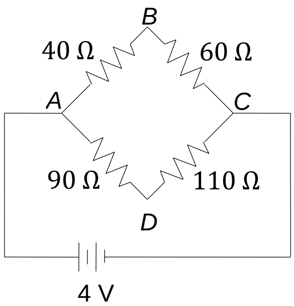
643. A new flashlight cell of e. m. f. 1.5 *volt* gives a current of 15 *amp*, when connected directly to an ammeter of resistance 0.04 Ω. The internal resistance of cell is
a) 0.04 Ω b) 0.06 Ω c) 0.10 Ω d) 10 Ω

644. In the circuit shown in figure, the current drawn from the battery is 4*A*. If 10 Ω resistor is replaced by 20 Ω resistor, then current drawn from the circuit will be



a) 1 *A* b) 2 *A* c) 3 *A* d) 0 *A*

645. Four resistances 40Ω, 60Ω, 90Ω and 110Ω make the arms of a quadrilateral *ABCD*. Across *AC* is the battery circuit, the emf of the battery being 4V and internal resistance negligible. The potential difference across *BD* is

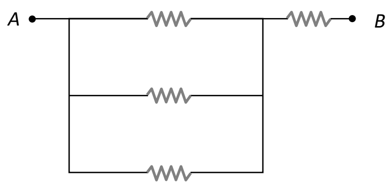


a) 1V b) −1V c) −0.2V d) 0.2V

646. An electric current passes through a circuit containing two wires of the same material connected in parallel. If the lengths of the wires are in the ratio of 4/3 and radius of the wires are in the ratio of 2/3, then the ratio of the current passing through the wires will be
a) 3 b) 1/3 c) 8/9 d) None of these

647. In the above question if potential difference is applied, the drift velocity at temperature T is
a) Inversely proportional to T
b) Proportional to $\sqrt{T}$
c) Zero
d) Finite but independent of T

648. If all the resistors shown have the value 2 *ohm* each, the equivalent resistance over *AB* is



a) 2 *ohm* b) 4 *ohm* c) $1\frac{2}{3}$ *ohm* d) $2\frac{2}{3}$ *ohm*

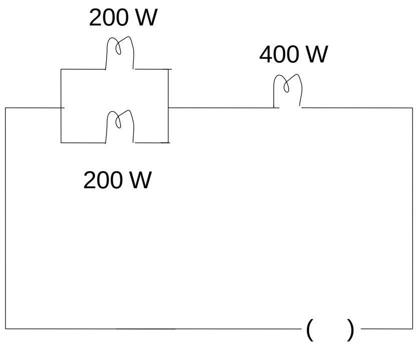
649. A current through a wire depends on time t as $i = 10 + 4t$. The charge crossing through the section of the wire in 10 s is

a) 50 C b) 300 C c) 400 C d) 4C

650. A copper and silver voltmeter are connected in parallel. If 2000 C of charge liberates the same mass of copper and silver, then charge flowing in copper voltmeter is
$[Z(Cu = 3.36 \times 10^{-7}\text{ kg C}^{-1}, Z(Ag) = 1.008 \times 10^{-6}\text{kgC}^{-1}]$

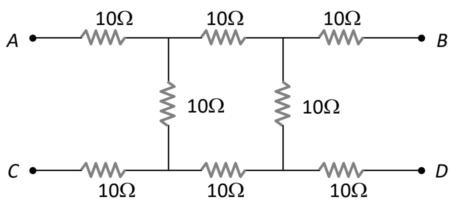
a) 1250 C b) 1500 C c) 1750 C d) 1000 C

651. Three electric bulbs of 200 W, 200 W and 400 W are shown in figure. The resultant power of the combination is



a) 800 W b) 400 W c) 200 W d) 600 W

652. What will be the equivalent resistance between the two points A and D



a) 10 Ω b) 20 Ω c) 30 Ω d) 40 Ω

653. A potentiometer wire, 10 m long, has a resistance of 40Ω. It is connected in series with a resistance box and a 2V storage cell. If the potential gradient along the wire is (0.1 mVcm^{-1}), the resistance unplugged in the box is

a) 260 Ω b) 760 Ω c) 960 Ω d) 1060 Ω

654. The electrolyte used in Lechlanche cell is

a) Copper sulphate solution b) Ammonium chloride solution
c) Dilute sulphuric acid d) Zinc sulphate

655. In a thermocouple, which of the following statements is not true

a) Neutral temperature depends upon the nature of materials in the thermocouple
b) Temperature of inversion depends upon the temperature of cold junction
c) When the temperature of the hot junction is equal to the temperature of inversion, the thermo $e$mf becomes zero
d) When the temperature of cold junction increases, the temperature of inversion also increases

656. If current in an electric bulb changes by 1%, then the power will change by

a) 1% b) 2% c) 4% d) $\frac{1}{2}$%

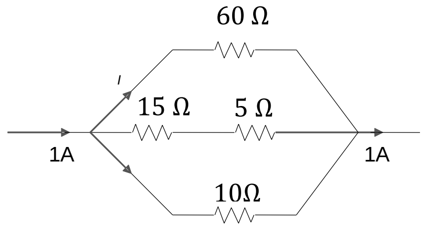
657. Neutral temperature of a thermocouple is defined as the temperature at which

a) The thermo e.m.f. changes sign b) The thermo e.m.f. is maximum
c) The thermo e.m.f. is minimum d) The thermo e.m.f. is zero

658. Electric power is transmitted over long distances through conducting wires at high voltage because

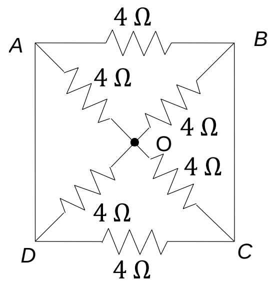
a) High voltage travels faster
b) Power loss is large
c) Power loss is less
d) Generator produce electrical energy at a very high voltage

659. The magnitude of I in ampere is



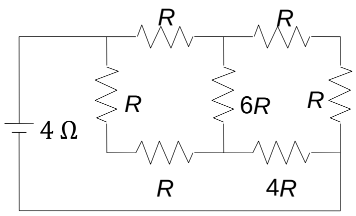
a) 0.1 b) 0.3 c) 0.6 d) None of the above

660. Six equal resistances each of 4Ω are connected to form a figure. The resistance between two corners A and B is



a) 4 Ω b) 4/3 Ω c) 12 Ω d) 2 Ω

661. A battery of internal resistance 4 Ω is connected to the network of resistance as shown. In order to given the maximum power to the network, the value of R (in Ω) should be



a) 4/9 b) 8/9 c) 2 d) 18

662. An electrical cable having a resistance of 0.2 Ω delivers 10 kW at 200 V DC to a factory. What is the efficiency of transmission

a) 65% b) 75% c) 85% d) 95%

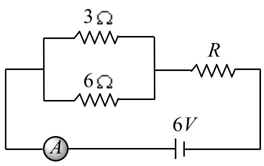
663. A heating coil can heat the water of a vessel from 20°C to 60°C in 30 $minutes$. Two such heating coils are put in series and then used to heat the same amount of water through the same temperature range. The time taken now will be (neglecting thermal capacity of the coils)

a) 60 $minutes$ b) 30 $minutes$ c) 15 $minutes$ d) 7.5 $minutes$

664. What is the resistance of a carbon resistance which has bands of colours brown, black and brown

a) 100 Ω b) 1000 Ω c) 10 Ω d) 1 Ω

665. If the ammeter in the given circuit reads 2 A, the resistance R is

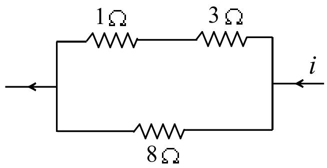


a) 1 ohm b) 2 ohm c) 3 ohm d) 4 ohm

666. Faraday's 2nd law states that mass deposited on the electrode is directly proportional to

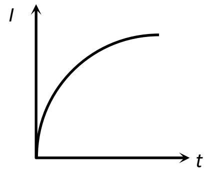
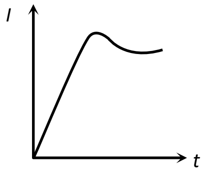
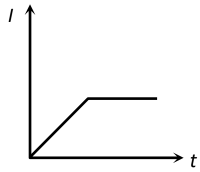
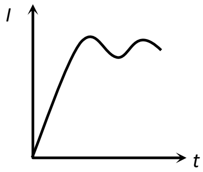
a) Atomic mass b) Atomic mass × Velocity
c) Atomic mass/Valency d) Valency

667. Power dissipated across the 8Ω resistor in the circuit shown here is 2 $watt$. The power dissipated in watt units across the 3Ω resistor is



a) 0.5 b) 3.0 c) 2.0 d) 1.0

668. When an electric heater is switched on, the current flowing through it (i) is plotted against time (t). Taking into account the variation of resistance with temperature, which of the following best represents the resulting curve

a) 
b) 
c) 
d) 

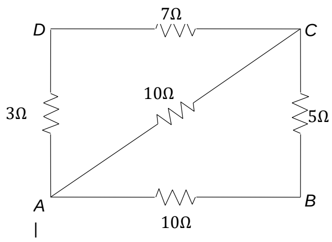
669. Which of the following are true, when the cells are connected in series?

a) Current capacity decreases b) Current capacity increases
c) The emf decreases d) The emf increases

670. Two wires have lengths, diameters and specific resistances all in the ratio of 1 : 2. The resistance of the first wire is 10Ω. Resistance of the second wire in ohm will be

a) 5 b) 10 c) 20 d) Infinite

671. The resistance is connected as shown in the figure below. Find the equivalent resistance between the points A and B.

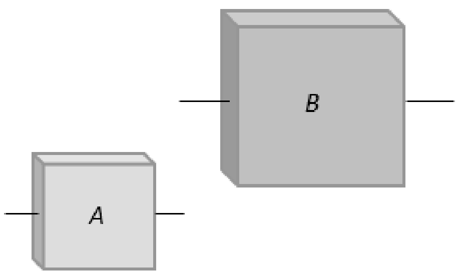


a) 205Ω b) 10 Ω c) 3.5 Ω d) 5 Ω

672. The n rows each containing m cells in series are joined in parallel. Maximum current is taken from this combination across as external resistance of 3 Ω resistance. If the total number of cells used are 24 and internal resistance of each cell is 0.5 Ω, then

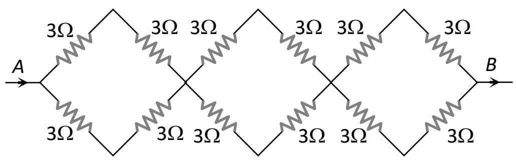
a) $m = 8, n = 3$ b) $m = 6, n = 4$ c) $m = 12, n = 2$ d) $m = 2, n = 12$

673. A and B are two square plates of same metal and same thickness but length of B is twice that of A. Ratio of resistances of A and B is



a) 4 : 1 b) 1 : 4 c) 1 : 1 d) 1 : 2

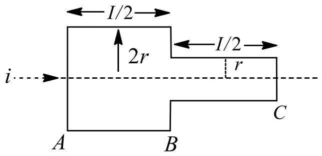
674. In the network of resistors shown in the adjoining figure, the equivalent resistance between A and B is



a) 54 ohm b) 18 ohm c) 36 ohm d) 9 ohm

675. Two bars of radius r and $2r$ are kept in contact as shown. An electric current i is passed through the bars.

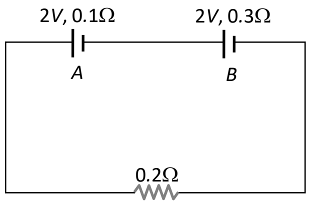
Which one of the following is correct?



a) Heat produced in bar BC is 4 times the heat produced in bar AB
b) Electric field in both halves is equal
c) Current density across AB is doubled that of across BC
d) Potential difference across AB is 4 times that of across BC

676. The alloys constantan and manganin are used to make standard resistance because they have
a) Low resistivity
b) High resistivity
c) Low temperature coefficient of resistance
d) Both (b) and (c)

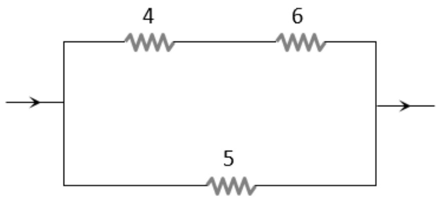
677. The internal resistances of two cells shown are 0.1 Ω and 0.3 Ω. If $R = 0.2\Omega$, the potential difference across the cell



a) B will be zero
b) A will be zero
c) A and B will be $2V$
d) A will be $> 2V$ and B will be $< 2V$

678. In a Wheatstone's bridge, three resistances P, Q and R connected in the three arms and the fourth arm is formed by two resistances S_1 and S_2 connected in parallel. The condition for the bridge to be balanced will be
a) $\frac{P}{Q} = \frac{2R}{S_1 + S_2}$
b) $\frac{P}{Q} = \frac{R(S_1 + S_2)}{S_1 S_2}$
c) $\frac{P}{Q} = \frac{R(S_1 + S_2)}{2S_1 S_2}$
d) $\frac{P}{Q} = \frac{R}{S_1 + S_2}$

679. In the circuit shown in figure, the heat produced in 5 *ohm* resistance is 10 *calories* per *second*. The heat produced in 4 *ohm* resistance is



a) 1 cal/sec
b) 2 cal/sec
c) 3 cal/sec
d) 4 cal/sec

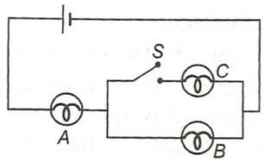
680. In a potentiometer experiment the balancing with a cell is at length 240 cm. on shunting the cell with a resistance of 2 Ω, the balancing length becomes 120cm. the internal resistance of cell is
a) 4 Ω
b) 2 Ω
c) 1 Ω
d) 0.5 Ω

681. A current I is passing through a wire having two sections P and Q of uniform diameters d and $d/2$ respectively. If the mean drift velocity of electrons in sections P and Q is denoted by v_P and v_Q respectively, then
a) $v_P = v_Q$
b) $v_P = \frac{1}{2} v_Q$
c) $v_P = \frac{1}{4} v_Q$
d) $v_P = 2v_Q$

682. The relaxation time in conductors
a) Increases with the increase of temperature
b) Decreases with the increase of temperature
c) It does not depend on temperature
d) All of sudden changes at 400 K

683. Two resistances R and $2R$ are connected in parallel in an electric circuit. The thermal energy developed in R and $2R$ are in the ratio
a) 1 : 2
b) 2 : 1
c) 1 : 4
d) 4 : 1

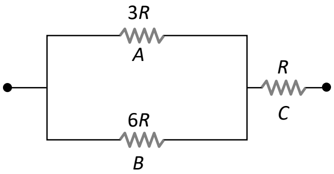
684. In the given figure. A, B and C are three identical bulbs. When the switch S is closed



a) The brightness of bulb A does not change and that of B decreases
b) The brightness of bulb A increases and that of B decreases
c) The brightness of A increases bulb B does not glow
d) The brightness of both bulbs A not B decrease

685. Three resistances each of 4Ω are connected in the form of an equilateral triangle. The effective resistance between any two corners is
a) (3/8) Ω b) (8/3) Ω c) 8 Ω d) 12 Ω

686. Three resistance A, B and C have values $3R, 6R$ and R respectively. When some potential difference is applied across the network, the thermal powers dissipated by A, B and C are in the ratio



a) 2 :3 :4 b) 2 :4 :3 c) 4 :2 :3 d) 3 :2 :4

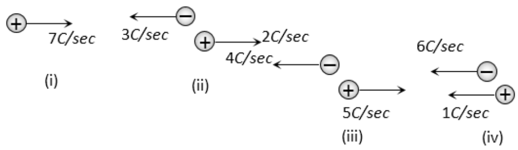
687. 12 cells each having same emf are connected in series with some cells wrongly connected. The arrangement is connected in series with an ammeter and two cells which are in series. Current is 3 A when cells and battery aid each other and is 2 A when cells and battery oppose each other. The number of cells wrongly connected is
a) 4 b) 1 c) 3 d) 2

688. Three resistance P, Q, R each of 2Ω and an unknown resistance S form the four arms of a wheatstone bridge circuit. When a resistance of 6Ω is connected in parallel to S the bridge gets balanced. What is the value of S
a) 2 Ω b) 3 Ω c) 6 Ω d) 1 Ω

689. A galvanometer of 25 Ω resistance can read a maximum current of $6mA$. It can be used as a voltmeter to measure a maximum of 6 V by connecting a resistance to the galvanometer. Identify the correct choice in the given answers
a) 1025 Ω in series b) 1025 Ω in parallel c) 975 Ω in series d) 975 Ω in parallel

690. The dimensions of $\frac{1}{2}\varepsilon_o E^2$ (ε_o:permittivity of free space; E: electric field) is
a) [MLT] b) $[ML^2T^{-2}]$ c) $[ML^{-1}T^{-2}]$ d) $[ML^2T^{-1}]$

691. Following figure shows four situations in which positive and negative charges move horizontally through a region and gives the rate at which each charge moves. Rank the situations according to the effective current through the region greatest first

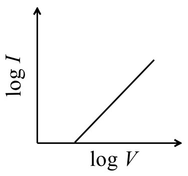


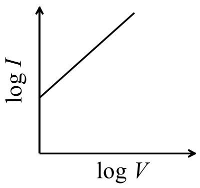
a) $i = ii = iii = iv$ b) $i > ii > iii > iv$ c) $i = ii = iii > iv$ d) $i = ii = iii < iv$

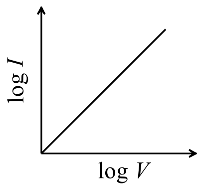
692. An aluminium (resistivity$\rho = 2.2 \times 10^{-8}\Omega - \text{m}$) wire of a diameter 1.4 mm is used to make a 4Ω esistor. The length of the wire is
a) 220 m b) 1000 m c) 280 m d) 1 m

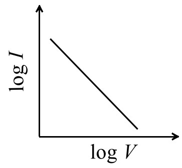
693. Voltmeters $V_1$and V_2 are connected in series across a DC line. V_1reads 80V and has a resistance of $200\Omega V^{-1}$and V_2 has a total resistance of 32k Ω. The line voltage is
a) 240 V b) 220 V c) 160 V d) 120 V

694. When a current I is passed through a wire of constant resistance, it produces a potential difference V across its ends. The graph drawn between log I and log V will be

a) 

b) 

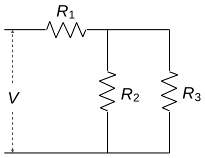
c) 

d) 

695. A galvanometer of resistance 20 Ω shows a deflection of 10 divisions when a current of 1 mA is passed through it. If a shunt of 4 Ωis connected and there are 50 divisions on the scale, the range of the galvanometer is

a) 1A b) 3A c) 10mA d) 30mA

696. For ensuring dissipation of same energy in all three resistors (R_1, R_2, R_3)connected as shown in figure, their values be related as



a) $R_1 = R_2 = R_3$ b) $R_2 = R_3$ and $R_1 = 4\,R_2$

c) $R_2 = R_3$ and $R_1 = R_2/4$ d) $R_1 = R_2 + R_3$

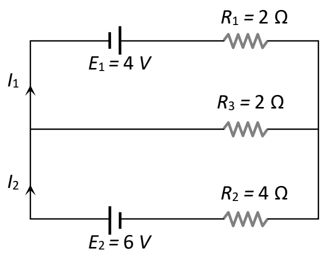
697. x g of Ag is deposited by passing 4 A of current of for 1 h. How many gram of Ag will be deposited by passing 6 A for 40 min?

a) $2x$ g b) $4x$ g c) x g d) $5x$ g

698. Resistance in the two gaps of a $meter$ bridge are 10 ohm and 30 ohm respectively. If the resistances are interchanged the balance point shifts by

a) 33.3 cm b) 66.67 cm c) 25 cm d) 50 cm

699. In the circuit shown below $E_1 = 4.0\,V, R_1 = 2\,\Omega, E_2 = 6.0\,V, R_2 = 4\,\Omega$ and $R_3 = 2\,\Omega$. The current I_1 is



a) 1.6 A b) 1.8 A c) 1.25 A d) 1.0 A

700. The amount of charge Q passed in time t through a cross-section of a wire is $Q = 5t^2 + 3t + 1$. The value of current at time $t = 5$s is

a) 9 A b) 49 A c) 53 A d) None of the above

701. In water voltmeter, the electrolysis of …… takes place

a) H_2O b) H_2SO_4 c) H_2O and H_2SO_4 both d) H_2 and O_2

702. Which statement is true?

(i) Kirchoff's law is equally applicable to both AC and DC.

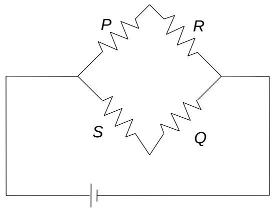
(ii) Semiconductors have a positive temperature coefficient of resistance.

(iii) Meter bridge is greater sensitive when the resistance of all four arms of the bridge is of the same order.

(iv) The emf of a cell depends upon the size and area of electrodes.

a) (i) and (iv) b) (ii) and (iv) c) (iii) and (iv) d) None of these

703. In the circuit given, the current relation to a balanced Wheatstone's bridge is

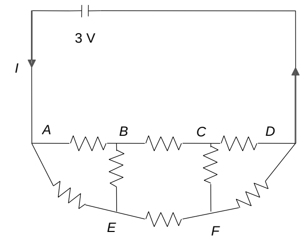


a) $\frac{P}{Q}=\frac{R}{S}$ b) $\frac{P}{Q}=\frac{S}{R}$ c) $\frac{P}{S}=\frac{Q}{R}$ d) $\frac{P}{R}=\frac{S}{Q}$

704. A thick wire is stretched, so that its length become two times. Assuming that there is no change in its density, then what is the ratio of change in resistance of wire to the initial resistance of wire?
a) 2 : 1 b) 4 : 1 c) 3 : 1 d) 1 : 4

705. Two electric bulbs marked 40 W, 220 V and 60 W, 220 V when connected in series, across same voltage supply of 220 V, the effective power is P_1 and when connected in parallel the effective power is P_2. Then $\frac{P_1}{P_2}$ is
a) 0.5 b) 0.48 c) 0.24 d) 0.16

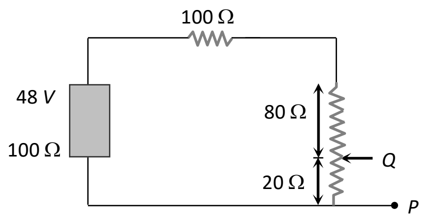
706. Figure shows a network of eight resistors, each equal to 2 Ω, connected to a 3V battery of negligible internal resistance. The current I in the circuit is



a) 0.25A b) 0.50A c) 0.75A d) 1.0A

707. If the length of filament of a heater is reduced by 10%, the power of the heater will
a) Increase by about 9% b) Increase by about 11%
c) Increase by about 19% d) Decrease by about 10%

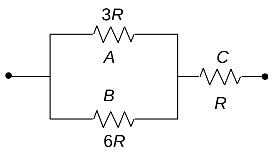
708. In the circuit, the potential difference across PQ will be nearest to



a) 9.6 V b) 6.6 V c) 4.8 V d) 3.2 V

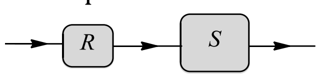
709. A current of 5 A is passing through a metallic wire of cross-sectional area $4 \times 10^{-6}\text{m}^2$. If the density of charge carries of the wire is $5 \times 10^{26}\text{m}^{-3}$, the drift velocity of the electrons will be
a) $1 \times 10^2\text{ms}^{-1}$ b) $1.56 \times 10^{-2}\text{ms}^{-1}$ c) $1.56 \times 10^{-3}\text{ms}^{-1}$ d) $1 \times 10^{-2}\text{ms}^{-1}$

710. Figure shows a network of three resistance. When some potential difference is applied across the network, the thermal powers dissipated by A,B and C in the ratio



a) 2 : 3 : 4 b) 2 : 4 : 3 c) 4 : 2 : 3 d) 3 : 2 : 4

711. Two plates R and S are in the form of a square and have the same thickness. A side of S is twice the side of R Compare their resistances. The direction of current is shown by an arrow head figure.



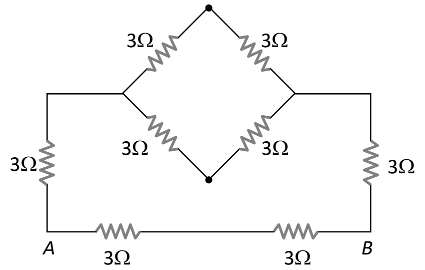
a) The resistance of R is twice that of S b) Both have the same resistance
c) The resistance of S is four times that of R d) The resistance of R is half that of S

712. A resistor has a colour code of green, blue, brown and silver. What is its resistance?
a) $5600\Omega \pm 10\%$ b) $560\Omega \pm 5\%$ c) $560\Omega \pm 10\%$ d) $56\Omega \pm 5\%$

713. The electric resistance of a certain wire of iron is R. If its length and radius are both doubled, then
a) The resistance will be doubled and the specific resistance will be halved
b) The resistance will be halved and the specific resistance will remain unchanged

c) The resistance will be halved and the specific resistance will be doubled
d) The resistance and the specific resistance, will both remain unchanged

714. Equivalent resistance between A and B will be



a) 2 ohm b) 18 ohm c) 6 ohm d) 3.6 ohm

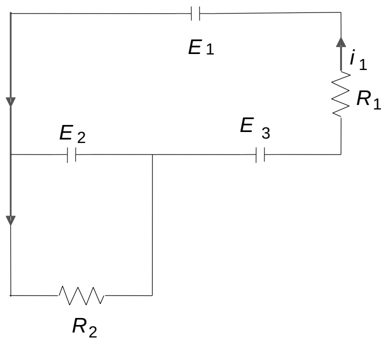
715. With the rise of temperature the resistivity of a semiconductor
a) Remains unchanged
b) Increases
c) Decreases
d) First increases and then decreases

716. Two wires of the same material and having same uniform area of cross-section are connected in series in an electrical circuit. The masses of the wires are m and $2m$. When a current Iflows in the circuit, the heats produced by them in a given time are in ratio
a) 2 : 1 b) 1 : 2 c) 4 : 1 d) 1 : 4

717. When a wire of uniform cross-section a, length l and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be
a) $\frac{R}{4}$ b) $\frac{R}{8}$ c) $4R$ d) $\frac{R}{2}$

718. The resistance of a 5 cm long wire is 10 Ω. It is uniformly stretched so that its length becomes 20 cm. The resistance of the wire is
a) 160 Ω b) 80 Ω c) 40 Ω d) 20 Ω

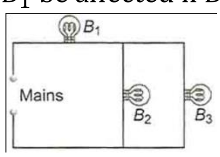
719. The current $i_1$and $i_2$through the resistor $R_1(= 10\Omega)$and $R_2(= 30\Omega)$in the circuit diagram with $E_1 = 3V, E_2 = 3\ and\ E_3 = 2V$are respectively.



a) 02.A, 0.1A b) 0.4A, 0.2A c) 0.1A, 0.2A d) 0.2A, 0.4A

720. A battery has an emf of 15V and internal resistance of 1Ω. Is the terminal to terminal potential difference less than, equal to or greater than 15V if the current in the battery is (1) from negative to positive terminal, (2) from positive to negative terminal (3) zero current?
a) Less, grater, equal
b) Less, less, equal
c) Greater, greater, equal
d) Greater, less, equal

721. Three bulbs B_1 , B_2 and B_3 are connected to the main as shown in figure. How will the brightness of bulb B_1 be affected if B_2 or B_3 are disconnected from the circuit?



a) Bulb B_1 become brighter
b) Bulb B_1 become dimmer
c) No change occurs in the brightness
d) Bulb B_1 becomes brighter if bulb B_2 is disconnected and dimmer if bulb B_3 is

disconnected.

722. Two wires of same material have length L and $2L$ and cross-sectional areas $4A$ and A respectively. The ratio of their specific resistances would be

a) 1 : 2 b) 8 : 1 c) 1 : 8 d) 1 : 1

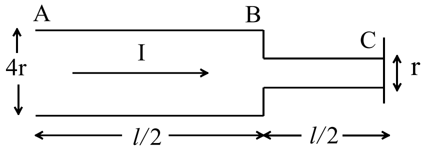
723. A steady current of 5 $amps$ is maintained for 45 $mins$. During this time it deposits 4.572 gm of zinc at the cathode of a voltmeter. E.C.E. of zinc is

a) $3.387 \times 10^{-4} gm/C$ b) $3.387 \times 10^{-4} C/gm$ c) $3.384 \times 10^{-3} gm/C$ d) $3.394 \times 10^{-3} C/gm$

724. The colour sequence in a carbon resistor is red, brown, orange and silver. The resistance of the resistor is

a) $21 \times 10^3 \pm 10\%$ b) $23 \times 10^1 \pm 10\%$ c) $21 \times 10^3 \pm 5\%$ d) $12 \times 10^3 \pm 5\%$

725. Consider a cylindrical element as shown in the figure. Current flowing through element is I and resistivity of material of the cylinder is ρ. Choose the correct option out the following



a) Power loss is second half is four times the power loss in first half

b) Voltage drop in first is twice of voltage drop in second half

c) Current density in both halves are equal

d) Electric field in both halves is equal

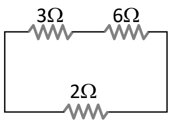
726. In Wheatstone's bridge $P = 9\ ohm, Q = 11\ ohm, R = 4\ ohm$ and $S = 6\ ohm$. How much resistance must be put in parallel to the resistance S to balance the bridge

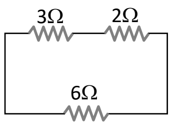
a) 24 ohm b) $\frac{44}{9} ohm$ c) 26.4 ohm d) 18.7 ohm

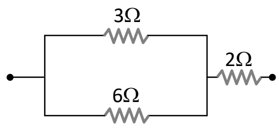
727. A galvanometer, having a resistance of 50 Ω, gives a full scale deflection for a current of 0.05A. The length in meter of a resistance wire of area of cross-section $2.97 \times 10^{-2} \text{cm}^2$ that can be used to convert the galvanometer into a ammeter which can read a maximum of 5A current is
(Specific resistance of the wire = 5×10^{-7} Ωm)

a) 9 b) 6 c) 3 d) 1.5

728. You are provided three resistances 2 Ω, 3 Ω and 6 Ω. How will you connect them so as to obtain the equivalent resistance of 4 Ω

a) 

b) 

c) 

d) None of these

729. A uniform wire has resistance 24 Ω. It is bent in the form of a circle. The effective resistance between the two end points on any diameter of the circle is

a) 6 Ω b) 12 Ω c) 3 Ω d) 24 Ω

730. Above neutral temperature, thermo e.m.f. in a thermocouple

a) Decreases with rise in temperature b) Increases with rise in temperature

c) Remains constant d) Changes sign

731. A galvanometer coil has a resistance of 15 Ω and gives full scale deflection for a current of 4mA. To convert it to an ammeter of range 0 to 6A

a) 10 m Ω resistance is to be connected in parallel to the galvanometer

b) 10 m Ω resistance is to be connected in series with the galvanometer

c) 0.1 Ω resistance is to be connected in parallel to the galvanometer

d) 0.1 Ω resistance is to be connected in series with the galvanometer

732. When 1 g hydrogen (ECE=1.044×106^{-8} kg C^{-1}) forms water, 34 kilo cal heat is liberated. The minimum voltage required to decompose water is

a) 0.75 V b) 1.5 V c) 3.0 V d) 4.5 V

733. A current 2 A flows through a 2Ω resistor when connected across a battery. The same battery supplies a current 0.5 A when connected across a 9Ω resistor. The internal resistance of the battery is

a) 1Ω b) 0.5Ω c) 1/3Ω d) 1/4Ω

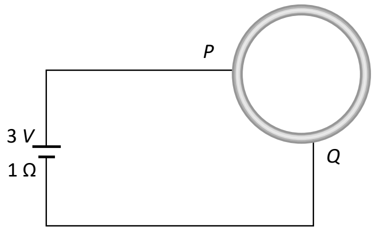
734. A cell in secondary circuit gives null deflection for 2.5m length of potentiometer having 10m length of wire. If the length of the potentiometer wire is increased by 1 m without changing the cell in the primary, the position of the null point now is

a) 3.5 m b) 3 m c) 2.75 m d) 2.0 m

735. Certain wire has resistance of 10Ω. If its is stretched by 1/10th of its length, then its resistance is nearly

a) 9 Ω b) 10 Ω c) 11 Ω d) 12 Ω

736. A wire of resistance 10 Ω is bent to form a circle. P and Q are points on the circumference of the circle dividing it into a quadrant and are connected to a battery of 3 V and internal resistance 1 Ω as shown in the figure. The currents in the two
parts of the circle are



a) $\frac{6}{23}A$ and $\frac{18}{23}A$ b) $\frac{5}{26}A$ and $\frac{15}{26}A$ c) $\frac{4}{25}A$ and $\frac{12}{25}A$ d) $\frac{3}{25}A$ and $\frac{9}{25}A$

737. In an experiment of meter bridge, a null point is obtained at the centre of the bridge wire. When a resistance of 10 ohm is connected in one gap, the value of resistance in other gap is

a) 10Ω b) 5Ω c) $\frac{1}{5}$Ω d) 500Ω

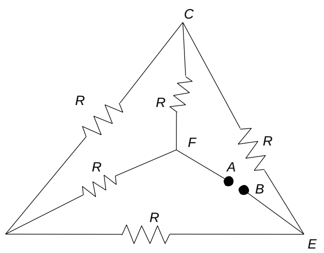
738. A conductor wire having 10^{29} free electrons/m^3 carries a current of 20A. If the cross-section of the wire is 1mm^2, then the drift velocity of electrons will be

a) $6.25 \times 10^{-3} ms^{-1}$ b) $1.25 \times 10^{-5} ms^{-1}$ c) $1.25 \times 10^{-3} ms^{-1}$ d) $1.25 \times 10^{-4} ms^{-1}$

739. Two resistances R and $2R$ are connected in parallel in an electric circuit. The thermal energy developed in in R and $2R$ is in the ratio

a) 1 : 2 b) 1 : 4 c) 4 : 1 d) 2 : 1

740. Five equal resistances, each of resistance R,are connected as shown in figure below. A bettery of V volt is connected between A and B. The current flowing in FC will be

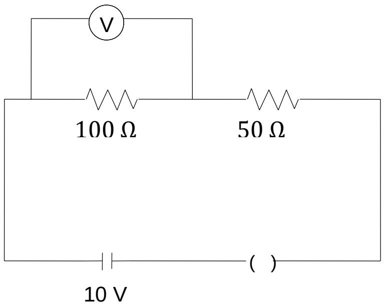


a) $\frac{3V}{R}$ b) $\frac{V}{R}$ c) $\frac{V}{2R}$ d) $\frac{2V}{R}$

741. Three moving coil galvanometers A, B and C are made of coils of three different material having torsional constant 1.8×10^{-8}, 2.8×10^{-8} and 3.8×10^{-8} respectively. If the three galvanometers are identical in all other respect, then in which of the above cases sensitivity is maximum?

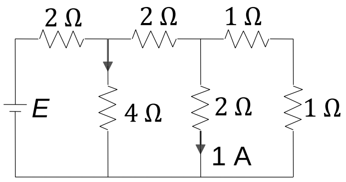
a) A b) C c) B d) Same in each case

742. In the given circuit, the voltmeter records 5V. The resistance of the voltmeter in ohm is



a) 200 b) 100 c) 10 d) 50

743. The emf of the battery shown in figure, is



a) 12 V b) 13 V c) 16 V d) 18 V

744. A charge of 2×10^{-1}C move at 30 revolutions per second in a circle of diameter 80 cm. The current linked with the circuit is

a) 0.02 A b) 20 A c) 0.60 A d) 60 A

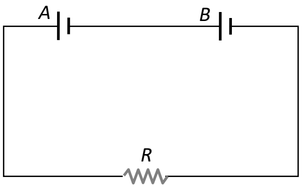
745. A capacitor of 10 μF has a potential difference of 40 V across it. If it is discharged in 0.2 s, the average current during discharge is

a) 2 mA b) 4 mA c) 1 mA d) 0.5 mA

746. An electric bulb is rated 220 V – 100 W. The power consumed by it when operated on 110 V will be

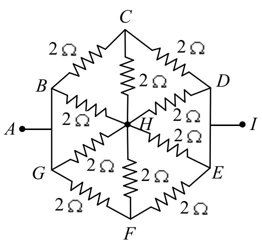
a) 75 W b) 40 W c) 25 W d) 50 W

747. Two batteries A and B each of e.m.f. 2 V are connected in series to an external resistance $R = 1$ ohm. If the internal resistance of battery A is 1.9 ohm and that of B is 0.9 ohm, what is the potential difference between the terminals of battery A



a) 2 V b) 3.8 V c) Zero d) None of the above

748. The effective resistance across the points A and I is



a) 2 Ω b) 1 Ω c) 0.5 Ω d) 5 Ω

749. When the length and area of cross-section both are doubled, then its resistance

a) Will become half b) Will be doubled

c) Will remain the same d) Will become four times

750. The resistance of a conductor increases with

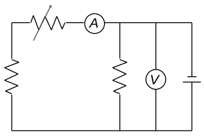
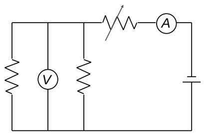
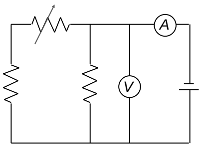
a) Increase in length b) Increase in temperature

c) Decrease in cross-sectional area d) All of these

751. A copper wire of resistance R is cut into ten parts of equal length. Two pieces each are joined in series and then five such combinations are joined in parallel. The new combination will have a resistance

a) R b) $\frac{R}{4}$ c) $\frac{R}{5}$ d) $\frac{R}{25}$

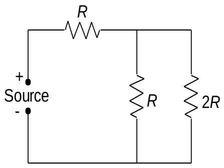
752. Which of the following characteristics of electron determines the current in a conductor?
a) Thermal velocity alone b) Drift velocity alone
c) Both thermal velocity and drift velocity d) None of the above

753. Which of the following circuits is correct for verification of Ohm's law?
a)  b)  c)  d) None of these

754. If the free electron density be n and relaxation time be τ, the electrical conductivity of a conductor may be expressed as
a) $\frac{ne\tau}{m_e}$ b) $\frac{ne^2\tau}{m_e}$ c) $\frac{ne^2}{\tau m_e}$ d) $\frac{m_e e^2\tau}{n}$

755. Two identical electric lamps marked $500\ W, 220\ V$ are connected in series and then joined to a $110\ V$ line. The power consumed by each lamp is
a) $\frac{125}{4}W$ b) $\frac{25}{4}W$ c) $\frac{225}{4}W$ d) $125\ W$

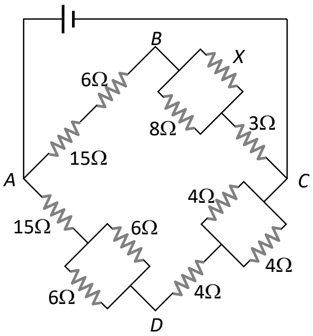
756. The charge supplied by source varies with time t as $Q = at - bt^2$. The total heat produced in resistor $2R$ is



a) $\frac{a^3R}{6b}$ b) $\frac{a^3R}{27b}$ c) $\frac{a^3R}{3b}$ d) None of these

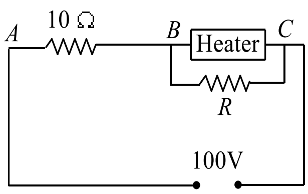
757. A 4_μ F conductor is charged to 400 V and then its plates are joined through a resistance of 1 kΩ. The heat produced in the resistance is
a) 0.18 J b) 0.21 J c) 0.25 J d) 0.32 J

758. In the figure given the value of X resistance will be, when the p.d. between B and D is zero



a) 4 ohm b) 6 ohm c) 8 ohm d) 9 ohm

759. A heater is operated with a power of $1000W$ in a $100V$ line. It is connected in combination with a resistance of 10Ω and a resistance R to a $100V$ line as shown in figure. What should be the value of R so, that the heater operates with a power of $62.5W$

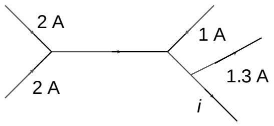


a) 10Ω b) 62.5Ω c) $\frac{1}{5}\Omega$ d) 5Ω

760. The masses of three wires of copper are in the ratio $1:3:5$ and lengths are in the ratio $5:3:1$. Then the ratio of their electrical resistances are

a) 1: 3: 5 b) 5: 3: 1 c) 1: 15: 25 d) 125: 15: 1

761. In the figure a part of electric circuit has been shown. The value of current i is



a) 1.7 A b) 3.7 A c) 1.3 A d) 1A

762. A wire of length L and 3 identical cells of negligible internal resistances are connected in series. Due to the current, the temperature of the wire due to the current, the temperature of the wire is raised by ΔT is a time t. A number N of similar cells is now connected in series with a wire of the same material and cross-section but of length $2L$. The temperature of the wire is raised by the same amount ΔT in the same time t. The value of N is

a) 4 b) 6 c) 8 d) 9

763. A milli voltmeter of 25 milli volt range is to be converted into an ammeter to 25 ampere range. The value (in ohm) of necessary shunt will be

a) 0.001 b) 0.01 c) 1 d) 0.05

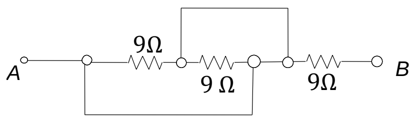
764. Three bulbs of 40 W, 60 W, 100 W are arranged in series with 220 $volt$ supply. Which bulb has minimum resistance

a) 100 W b) 40 W c) 60 W d) Equal in all bulbs

765. A copper voltmeter is connected in series with a heater coil of resistance 0.1Ω. A steady current flows in the circuit for twenty minutes and mass of 0.99 g of copper is deposited at the cathode. If electrochemical equivalent of copper is 0.00033 gm/C, then heat generated in the coil is

a) 750 J b) 650 J c) 350 J d) 250 J

766. In the circuit shown the equivalent resistance between A and B is



a) 27 Ω b) 18 Ω c) 9 Ω d) 3 Ω

767. The relation between Seeback coefficient (or thermo electric power) S and Peltier coefficient π is given by

a) $S = \pi T$ b) $S = \frac{\pi}{T}$ c) $S = \frac{\pi^2}{T}$ d) $S = \frac{\pi}{T^2}$

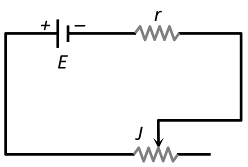
768. A thermocouple develops 40 $\mu V/kelvin$. If hot and cold junctions are at 40°C and 20°C respectively, then then emf developed by a thermopile using such 150 thermocouples in series shall be

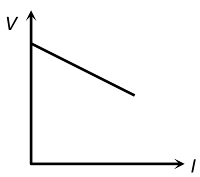
a) $150mV$ b) $80mV$ c) $144mV$ d) $120mV$

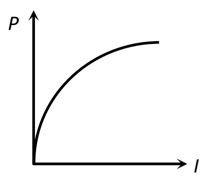
769. The thermo emf produced in a thermo-couple is 3 microvolt per degree centigrade. If the temperature of the cold junction is 20°C and the thermo emf is 0.3 millivolt, the temperature of the hot junction is

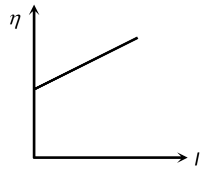
a) 80°C b) 100°C c) 120°C d) 140°C

770. Battery shown in figure has e.m.f. E and internal resistance r. Current in the circuit can be varied by sliding the contact J. If at any instant current flowing through the circuit is I, potential difference between terminals of the cell is V, thermal power generated in the cell is equal to η fraction of total electrical power generated in it.; then which of the following graphs is correct



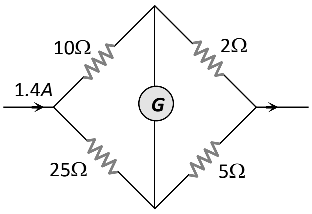
a) 

b) 

c) 

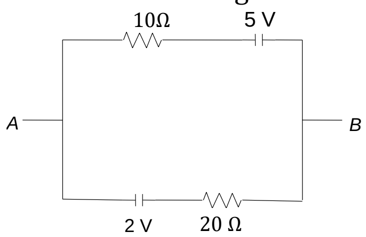
d) Both (a) and (b) are correct

771. In the circuit shown in the figure, the current flowing in 2 Ω resistance



a) 1.4 A b) 1.2 A c) 0.4 A d) 1.0 A

772. The current in the given circuit is

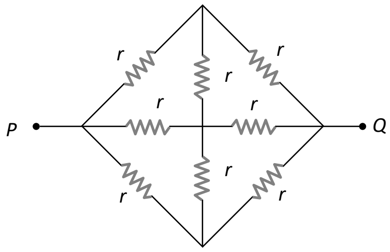


a) 0.3A b) 0.4A c) 0.1A d) 0.2A

773. Given $R_1 = 5.0 \pm 0.2\Omega, R_2 = 10.0 \pm 0.1\Omega$. What is total resistance in parallel with possible percentage error?

a) $15\Omega \pm 2\%$ b) $3.3\ \Omega \pm 7\%$ c) $15\ \Omega \pm 7\%$ d) $3.3\Omega \pm 2\%$

774. The equivalent resistance between the points P and Q in the network given here is equal to (given $r = \frac{3}{2}\Omega$)



a) $\frac{1}{2}\Omega$ b) $1\ \Omega$ c) $\frac{3}{2}\Omega$ d) $2\ \Omega$

775. The resistance of a wire at 300 K is found to be 0.3Ω. If the temperature coefficient of resistance of wire is $1.5 \times 10^{-3}\text{K}^{-1}$, the temperature at which the resistance becomes 0.6Ω is

a) 720 K b) 345 K c) 993 K d) 690 K

776. Resistance of a resistor at temperature $t°\ C$ is $R_t = R_0(1 + \alpha t + \beta t^2)$.

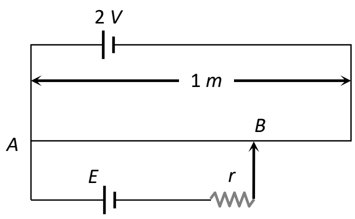
Here R_o is the resistance at 0°C. The temperature coefficient of resistance at temperature t°C is

a) $\frac{(1 + \alpha t + \beta t^2)}{\alpha + 2\beta t}$ b) $(\alpha + 2\beta t)$ c) $\frac{\alpha + 2\beta t}{(1 + \alpha t + \beta t^2)}$ d) $\frac{(\alpha + 2\beta t)}{2(1 + \alpha t + \beta t^2)}$

777. If a rod has resistance 4Ω and if rod is turned as half circle, then the resistance along diameter is

a) 1.56Ω b) 2.44Ω c) 4Ω d) 2Ω

778. In the given figure, battery E is balanced on 55 cm length of potentiometer wire but when a resistance of 10 Ω is connected in parallel with the battery then it balances on 50 cm length of the potentiometer wire then internal resistance r of the battery is



a) 1 Ω b) 3 Ω c) 10 Ω d) 5 Ω

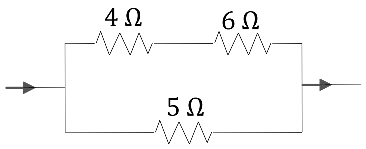
779. Two wires of equal diameters, of resistivities ρ_1 and ρ_2 and lengths l_1 and l_2, respectively, are joined in series. The equivalent resistivity of the combination is

a) $\frac{\rho_1 l_1 + \rho_2 l_2}{l_1 + l_2}$ b) $\frac{\rho_1 l_2 + \rho_2 l_1}{l_1 - l_2}$ c) $\frac{\rho_1 l_2 + \rho_2 l_1}{l_1 + l_2}$ d) $\frac{\rho_1 l_1 - \rho_2 l_2}{l_1 - l_2}$

780. If six identical cells each having an e. m. f. of $6V$ are connected in parallel, the e.m.f. of the combination is

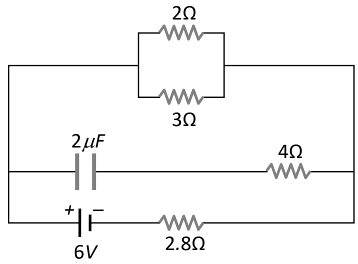
a) $1\ V$ b) $36\ V$ c) $\frac{1}{6}V$ d) $6\ V$

781. In the circuit shown, the heat produced in the 5Ω resistor due to current flowing in it is 10 cal $-$ s^{-1}. The heat generated in Ω resistor is



a) 1 cal $-$ s^{-1} b) 2 cal $-$ s^{-1} c) 3 cal $-$ s^{-1} d) 4 cal $-$ s^{-1}

782. In the figure shown, the capacity of the condenser C is $2\ \mu F$. The current in 2Ω resistor is

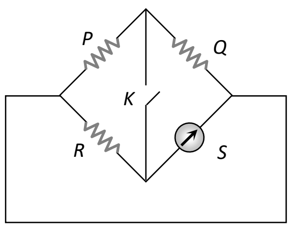


a) $9\ A$ b) $0.9\ A$ c) $\frac{1}{9}A$ d) $\frac{1}{0.9}A$

783. To deposit one gm equivalent of an element at an electrode, the quantity of electricity needed is

a) One *ampere* b) 96000 *amperes* c) 96500 *farads* d) 96500 *coulombs*

784. In the following Wheatstone bridge $P/Q = R/S$. If key K is closed, then the galvanometer will show deflection



a) In left side b) In right side c) No deflection d) In either side

785. We have two wires A and B of same mass and same material. The diameter of the wire A is half of that B. If the resistance of wire A is 24 *ohm* then the resistance of wire B will be

a) 12 *Ohm* b) 3.0 *Ohm* c) 1.5 *Ohm* d) None of the above

786. The Petlier coefficient of a thermo-couple of metls A and B at junction temperature T is given by

a) $T^2 \frac{dE}{dT^2}$ b) $T \frac{dE}{dT}$ c) $T^3 \frac{dE^2}{dT}$ d) $T^4 \frac{d^2E}{dT^2}$

787. A 30, 90 W lamps are to be operated on a 120 V DC line. For proper glow, a resistor of ……. Ω should be connected in series with the lamp.

a) 40 b) 10 c) 20 d) 30

788. The lead wires should have

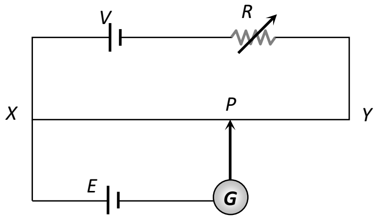
a) Larger diameter and low resistance b) Smaller diameter and high resistance

c) Smaller diameter and low resistance d) Larger diameter and high resistance

789. A battery of emf 2V and internal resistance 0.1 Ω is being charged by a current of 5A. the potential difference between the terminals of the battery is

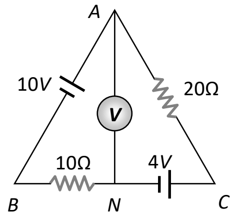
a) 2.5 Ω b) 1.5 Ω c) 0.5 Ω d) 1 Ω

790. A potentiometer circuit shown in the figure is set up to measure e.m.f. of a cell E. As the point P moves from X to Y the galvanometer G shows deflection always in one direction, but the deflection decreases continuously until Y is reached. In order to obtain balance point between X and Y it is necessary to



a) Decreases the resistance R b) Increase the resistance R
c) Reverse the terminals of battery V d) Reverse the terminals of cell E

791. The reading of the ideal voltmeter in the adjoining diagram will be

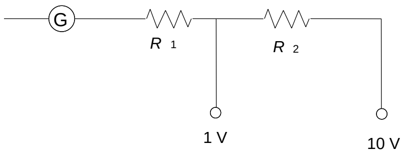


a) 4 V b) 8 V c) 12 V d) 14 V

792. A wire 20 cm long and 1 mm^2in cross-section carries a current of 4A when connected to a 2V battery. The resistivity of the wire is

a) $2 \times 10^{-7} \Omega$ m b) $5 \times 10^{-7} \Omega$ m c) $4 \times 10^{-6} \Omega$ m d) $1 \times 10^{-6} \Omega$ m

793. The resistance of a galvanometer is 50 Ω and it shows full scale deflection for a current of 1mA. To convert it into a voltmeter to measure 1V and as well as 10 V (refer circuit digram) the resistance R_1 and R_2 respectively are

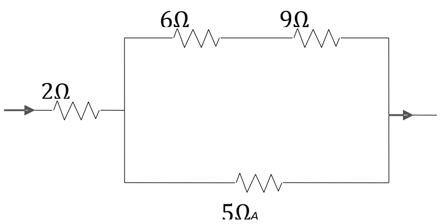


a) 950 Ω and 9150 Ω b) 900 Ω and 9950 Ω c) 900 Ω and 9000Ω d) 950 Ω and 9950 Ω

794. The temperature of cold junction of thermocouple is 0°C. If the neutral temperature is 270°C, then the inversion temperature is

a) 540°C b) 520°C c) 640°C d) 58°C

795. In the circuit shown, if the resistance 5 Ω develops a heat of 42 J per second, heat developed in 2 Ω must be about (in Js^{-1})

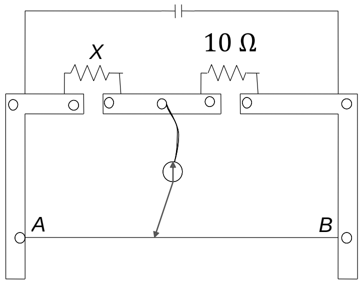


a) 25 b) 20 c) 30 d) 35

796. The following four wires are made of the same material and are at the same temperature. Which one of them has highest electrical resistance?

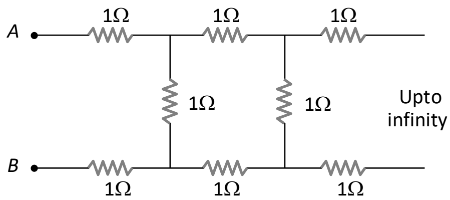
a) Length =50 cm, diameter=0.5 mm b) Length =100 cm, diameter=1 mm
c) Length=200 cm , diameter=2 mm d) Length=300cm, diameter=3 mm

797. A meter bridge is set-up as shown in figure, to determine an unknown resistance X using a standard 10 Ω resistor. The galvanometer shows null point when tapping key is at 52cm mark. The end-corrections are 1cm and 2cm respectively for the ends A and B. the determined value of x is



a) 10.2 Ω b) 10.6 Ω c) 10.8 Ω d) 11.1 Ω

798. The resistance between the terminal points A and B of the given infinitely long circuit will be



a) $(\sqrt{3}-1)$ b) $(1-\sqrt{3})$ c) $(1+\sqrt{3})$ d) $(2+\sqrt{3})$

799. A 60 *watt* bulb carries a current of 0.5 *amp*. The total charge passing through it in 1 *hour* is

a) 3600 *coulomb* b) 3000 *coulomb* c) 2400 *coulomb* d) 1800 *coulomb*

800. A bulb of 220 V and 300 W is connected across 110 V circuit, the percentage reduction in power is

a) 100% b) 25% c) 70% d) 75%

801. If the temperature of cold junction of thermocouple is lowered, then the neutral temperature

a) Increases b) Approaches inversion temperature
c) Decreases d) Remains the same

802. The resistance of the filament of a lamp increases with the increase in temperature. A lamp rated 100 W and 200 V is connected across 220 V power supply. If the voltage drops by 10%, then the power of the lamp will be

a) 90 W b) 81 W
c) Between 90 and 100 W d) Between 81 and 90 W

803. Which factor is immaterial for the wire used in electric fuse?

a) Length b) Radius c) Material d) Current

804. If 1 A current is passed through $CuSO_4$ solution for 10 s, the number of copper atoms deposited at the cathode will be

a) 8×10^{19} b) 3.1×10^{19} c) 6.2×10^{19} d) 1.6×10^{20}

805. All of the following statements are true except

a) Conductance is the reciprocal of resistance and is measured in *Siemen*
b) *Ohm's* law is not applicable at very low and very high temperatures
c) *Ohm's* law is applicable to semiconductors
d) *Ohm's* law is not applicable to electron tubes, discharge tubes and electrolytes

806. A galvanometer of resistance 20 Ω is to be converted into an ammeter of range 1 A. If a current of 1 mA produces full scale deflection, the shunt required for the purpose is

a) 0.01 Ω b) 0.05 Ω c) 0.02 Ω d) 0.04 Ω

807. The net resistance of a voltmeter should be large to ensure that

a) It does not get overheated
b) It does not draw excessive current
c) It can measure large potential difference
d) It does not appreciably change the potential difference to be measured

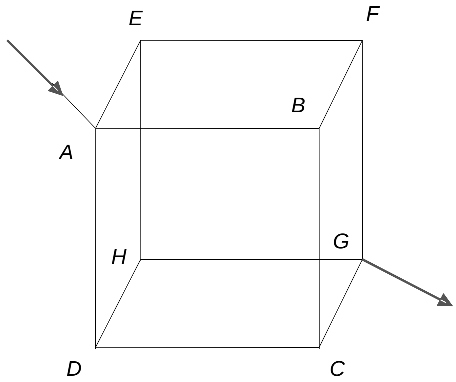
808. A galvanometer of 50 *ohm* resistance has 25 divisions. A current of 4×10^{-4} *ampere* gives a deflection of one division. To convert this galvanometer into a voltmeter having a range of 25 *volts*, it should be connected with a resistance of

a) 2500 Ω as a shunt b) 2450 Ω as a shunt c) 2550 Ω in series d) 2450 Ω in series

809. A 25 $watt$, 220 $volt$ bulb and a 100 $watt$, 220 $volt$ bulb are connected in series across a 220 $volt$ lines. Which electric bulb will glow more brightly

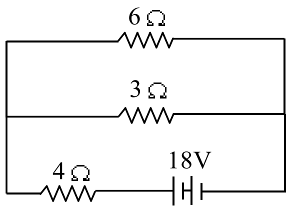
a) 25 $watt$ bulb
b) 100 $watt$ bulb
c) First 25 watt and then 100 $watt$
d) Both with same brightness

810. Twelve wires of resistance 6 Ω are connected to form a cube as shown in the figure. The current centers at a corner A and leaves at the diagonally opposite corner G. the joint resistance across the corner A and G are



a) 12 Ω
b) 6 Ω
c) 3 Ω
d) 5 Ω

811. The total power dissipated in Watts in the circuit shown here is

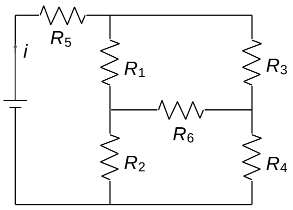


a) 16
b) 40
c) 54
d) 4

812. The equivalent resistance of resistor connected in series is always

a) Equal to the mean of component resistors
b) Less than the lowest of component resistors
c) In between the lowest and the highest of component resistors
d) Equal to sum of component resistors

813. In the given circuit shown in figure it is observed that the current i is independent of the value of resistance R_6. Then the resistance values must satisfy



a) $R_1R_2R_5 = R_3R_4R_6$
b) $\frac{1}{R_5} + \frac{1}{R_6} = \frac{1}{R_1 + R_2} + \frac{1}{R_3 + R_4}$
c) $R_1R_4 = R_2R_3$
d) $R_1R_3 = R_2R_4 = R_5R_6$

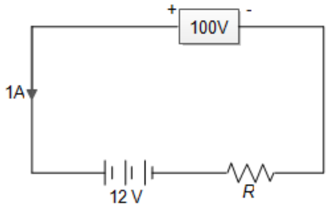
814. By using only two resistances coils-singly, in series or in parallel one should be able to obtain resistance of 3,4,12 and 16 ohm. The separate resistance of the coil are

a) 3 and 4
b) 4 and 12
c) 12 and 16
d) 16 and 13

815. A battery is charged at a potential of 15 V for 8 $hours$ when the current flowing is 10 A. The battery on discharge supplies a current of 5 A for 15 $hours$. The mean terminal voltage during discharge is 14 V. The "$Watt - hour$" efficiency of the battery is

a) 82.5%
b) 80%
c) 90%
d) 87.5%

816. A battery is charged by a supply of 100 V as shown in figure. The charging current is 1.0A. the value of R is

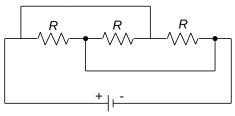


a) 88 Ω b) 68 Ω c) 44 Ω d) None of these

817. Three resistances of values 2Ω, 3Ω and 6Ω are to be connected to produce an effective resistance of 4Ω. This can be done by connecting
a) 6Ω resistance in series with the parallel combination of 2Ω and 3Ω
b) 3Ω resistance in series with the parallel combination of 2Ω and 6Ω
c) 2Ω resistance in series with the parallel combination of 3Ω and 6Ω
d) 2Ω resistance in parallel with the parallel combination of 3Ω and 6Ω

818. Current provided by a battery is maximum when
a) Internal resistance equal to external resistance
b) Internal resistance is greater than external resistance
c) Internal resistance is less than external resistance
d) None of these

819. Three equal resistances, each of R ohm, are connected as shown in figure. A battery of 2 V and internal resistance 0.1 Ω is connected across the circuit. The value of R for which the heat generated in the circuit will by maximum is



a) 0.3Ω b) 0.01Ω c) 0.1Ω d) 0.03Ω

820. For a certain thermocouple, if the temperature of the cold junction is 0°C, the neutral temperature and inversion temperature are 285°C and 570°C respectively. If the cold junction is brought to 10°C, then the new neutral and inversion temperatures are respectively
a) 285°C and 560°C b) 285°C and 570°C c) 295°C and 560°C d) 275°C and 560°C

821. Two resistances when connected in parallel across a cell of negligible internal resistance consume 4 times the power they would consume when connected in series. If one resistance is 5 Ω , the other is
a) 1 Ω b) 2.5 Ω c) 5 Ω d) 10 Ω

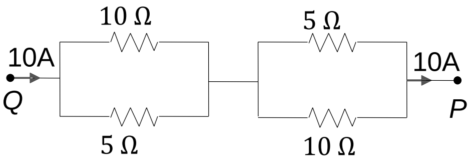
822. The maximum current that flows through a fuse wire before it blows out varies with its radius as
a) $r^{3/2}$ b) r c) $r^{2/3}$ d) $r^{1/2}$

823. At what temperature will the resistance of a copper wire become three times its value at 0°C (Temperature coefficient of resistance for copper = $4 \times 10^{-3} per$ °C)
a) 400°C b) 450°C c) 500°C d) 550°C

824. If N is the Avogadro's number and e is the electronic charge then the Faraday's constant F is equal to
a) Ne b) N^2e c) Ne^2 d) $\frac{1}{Ne}$

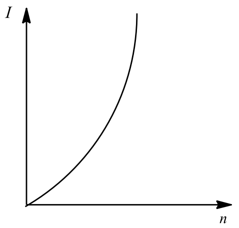
825. A current of 1.5 A flows through a copper voltameter. The thickness of copper deposited on the electrode surface of size 50 cm × 10 cm is 20 min will be (density of copper = 9000 kg − m^{-3} and ECE of copper = 0.00033gC^{-1})
a) 3.3×10^{-6} m b) 6.6×10^{-6} m c) 1.3×10^{-5} m d) 2.6×10^{-5} m

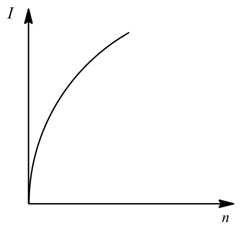
826. Four resistances carrying a current shown in the circuit diagram re immersed in a box containing ice at 0°C. How much ice must be put in the box every 10 min to keep the average quantity of in the box constant?

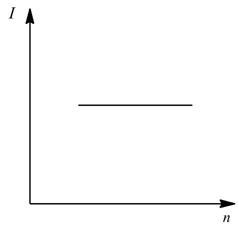


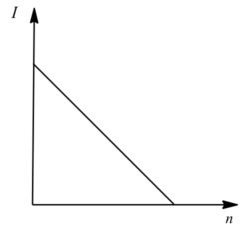
a) 5 kg b) 1.19 kg c) 3 kg d) 2.29 kg

827. A battery consists of a variable number (n) of identical cells, each having an internal resistance r connected in series. The terminal of the battery is short-circuited. A graph of current *versus* the number of cells will be as shown in figure

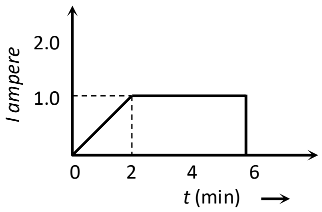
a) 

b) 

c) 

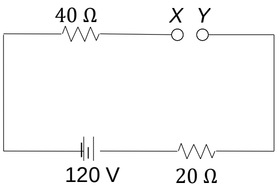
d) 

828. In a copper voltameter, mass deposited in 6 minutes is m gram. If the current-time graph for the voltameter is as shown here, then the E.C.E of the copper is



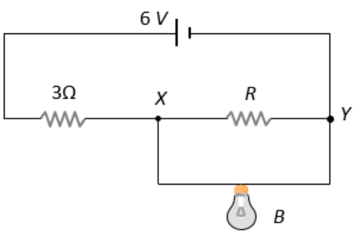
a) $m/5$ b) $m/300$ c) $5\,m$ d) $m/18000$

829. In the circuit shown in the figure the potential difference between X and Y will be



a) Zero b) 20 V c) 60 V d) 120 V

830. In the following circuit, bulb rated as $1.5\ V, 0.45\ W$. If bulbs glows with full intensity then what will be the equivalent resistance between X and Y



a) 0.45 Ω b) 1 Ω c) 3 Ω d) 5 Ω

831. Two wires of same dimensions but resistivities ρ_1 and ρ_2 are connected in series. The equivalent resistivity of the combination is

a) $\sqrt{\rho_1\rho_2}$ b) $(\rho_1 + \rho_2)$ c) $\frac{\rho_1 + \rho_2}{2}$ d) None of these

832. In a balanced Wheatstone's network, the resistance in the arms Q and S are interchanged. As a result of this

a) Network is not balanced
b) Network is still balanced
c) Galvanometer shows zero deflection
d) Galvanometer and the cell must be interchanged to balance

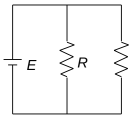
833. On passing the current in water voltmeter, hydrogen

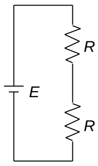
a) Is liberated at anode
b) Is liberated at cathode
c) Is not liberated
d) Remains in the solution

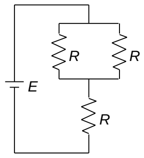
834. Two electric bulbs have ratings respectively of 25 W, 220 V and 100 W, 220 V. If the bulbs are connected in series with a supply of 440, which bulb will fuse?
a) 25 W bulb
b) 100 W bulb
c) Both of these
d) None of these

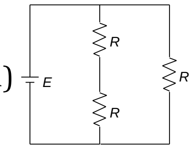
835. A cell of internal resistance 3 ohm and emf 10 $volt$ is connected to a uniform wire of length 500 cm and resistance 3 ohm. The potential gradient in the wire is
a) 30 mV/cm
b) 10 mV/cm
c) 20 mV/m
d) 4 mV/cm

836. Consider four circuits shown in figure. In which circuit power dissipated is greatest. (Neglect the internal resistance of the power supply)

a) 

b) 

c) 

d) 

837. Consider the following two statements A and B and identify the correct choice given in the answer
(A) Duddells thermo-galvanometer is suitable to measure direct current only
(B) Thermopile can measure temperature differences of the order of 10^{-3}°C
a) Both A and B are true
b) Both A and B are false
c) A is true but B is false
d) A is false but B is true

838. Three resistors 1 Ω, 2Ω and 3Ω are connected to form a triangle. Across 3Ω resistor a 3V battery is connected. The current through 3 Ωresistor is
a) 0.75A
b) 1A
c) 2A
d) 1.5A

839. A silver and a zinc voltmeter are connected in series and a current I is passed through them for a time t, liberating w gram of zinc. The weight of silver deposited is nearly
a) 1.7 w g
b) 2.4 w g
c) 3.5 w **g**
d) 1.2 w g

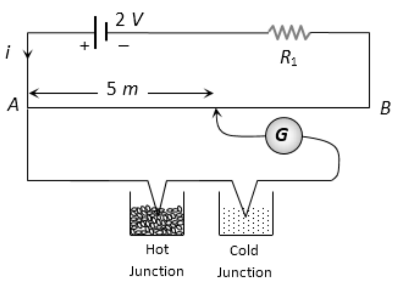
840. In a meter bridge experiment, null point is obtained at 20cm from one end of the wire when resistance $X$is balanced against another resistance Y. If X<Y, then where will be the new position of the null point from the same end, if one decides to, balance a resistance of 4Xagainst Y?
a) 50 cm
b) 80 cm
c) 40 cm
d) 70 cm

841. A galvanometer of resistance 240Ωallows only 4% of the main current after connecting a shunt resistance. The value of the shunt resistance is
a) 10 Ω
b) 20 Ω
c) 8 Ω
d) 5 Ω

842. The two bulbs, one of 60W and other 200W are connected in series to a 200 volt line, then
a) The potential drop across two bulbs in the same
b) The potential drop across the 60 W bulb is greater than the potential drop across the 200 W bulb
c) The potential drop across the 200 W bulb is greater than the 60 W bulb
d) The potential drop across both the bulbs is 200 volt

843. Electromotive force is the force, which is able to maintain a constant
a) Current
b) Resistance
c) Power
d) Potential difference

844. In the following circuit a 10 m long potentiometer wire with resistance 1.2 ohm/m, a resistance R_1 and an accumulator of emf 2 V are connected in series. When the emf of thermocouple is 2.4 mV then the deflection in galvanometer is zero. The current supplied by the accumulator will be



a) $4 \times 10^{-4} A$
b) $8 \times 10^{-4} A$
c) $4 \times 10^{-3} A$
d) $8 \times 10^{-3} A$

845. A house wife uses a 100 W bulb 8 h a day , and an electric heater of 300 W for 4 h a day. The total cost for the month of June at the rate of 0.05 rupee per unit will be

a) Rs 20 b) Rs 25 c) Rs 30 d) Rs 30 paise 50

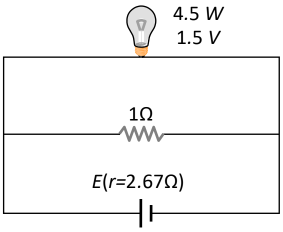
846. In a potentiometer, the null points are received at 7th wire. If now we have to change the null points at 9th wire, what should we do?

a) Attach resistance in series with battery
b) Increase resistance in main circuit
c) Decrease resistant in main circuit
d) Decrease applied emf

847. The effective resistance of two resistors in parallel is $\frac{12}{7}\,\Omega$. If one of the resistors is disconnected the resistance becomes 4 Ω. The resistance of the other resistor is

a) 4 Ω b) 3 Ω c) $\frac{12}{7}\,\Omega$ d) $\frac{7}{12}\,\Omega$

848. A torch bulb rated as $4.5\ W$, $1.5\ V$ is connected as shown in the figure. The $e.m.f.$ of the cell needed to make the bulb glow at full intensity is



a) $4.5\ V$ b) $1.5\ V$ c) $2.67\ V$ d) $13.5\ V$

849. The electric current passing through a metallic wire produces heat because of

a) Collisions of conduction electrons with each other
b) Collisions of the atoms of the metal with each other
c) The energy released in the ionization of the atoms of the metal
d) Collisions of the conduction electrons with the atoms of the metallic wires

850. One junction of a thermo-couple is a particular temperature T_r and another is at T. Its thermo emf is expressed as

$$E = K(T - T_r)\left\{T_0 - \frac{1}{2}(T + T_r)\right\}$$

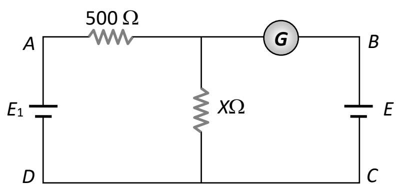
At a temperature $T = \frac{T_0}{2}$, the value of thermo-electric power will be

a) $\frac{1}{2}KT_0$ b) KT_0 c) $\frac{1}{2}KT_0^2$ d) $\frac{1}{2}K(T_0 - T_r)^2$.

851. Two identical heaters rated 220 $volt$, 1000 watt are placed in series with each other across 220 $volt$ lines. If resistance does not change with temperature, then the combined power is

a) 1000 $watt$ b) 2000 $watt$ c) 500 $watt$ d) 4000 $watt$

852. In the adjoining circuit, the battery E_1 has an $e.m.f.$ of 12$volt$ and zero internal resistance while the battery E has an $e.m.f.$ of 2$volt$. If the galvanometer G reads zero, then the value of the resistance X in ohm is



a) 10 b) 100 c) 500 d) 200

853. In a potentiometer of one metre length, an unknown $e.m.f.$ voltage source is balanced at 60 cm length of potentiometer wire, while a 3 volt battery is balanced at 45 cm length. Then the $e.m.f.$ of the unknown voltage source is

a) 3V b) 2.25V c) 4V d) 4.5V

854. A potentiometer has uniform potential gradient across it. Two cells connected in series (i) to support each other and (ii) to oppose each other are balanced over 6m and 2m respectively on the potentiometer wire.

The e.m.f.'s of the cells are in the ratio of

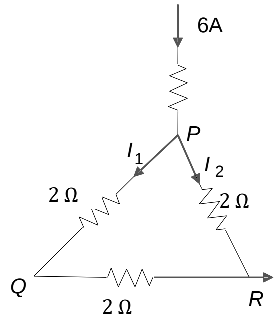
a) 1 : 2 b) 1 : 1 c) 3 : 1 d) 2 : 1

855. In a thermocouple, the temperature that does not depend on the temperature of the cold junction is called

a) Neutral temperature b) Temperature of inversion

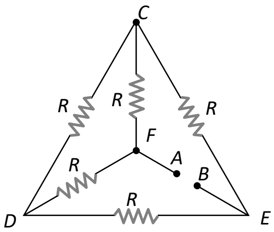
c) Both the above d) None of the above

856. A current of A enters one corner one corner P of an equilateral triangle PQRhaving 3 wires of resistance 2 Ωeach and leaves by the corner R. then the current $I_1$and $I_2$are



a) 2A, 4A b) 4A, 2A c) 1A, 2A d) 2A, 3A

857. Five equal resistances each of resistance R are connected as shown in the figure. A battery of V volts is connected between A and B. The current flowing in $AFCEB$ will be



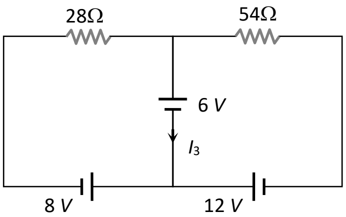
a) $\frac{3V}{R}$ b) $\frac{V}{R}$ c) $\frac{V}{2R}$ d) $\frac{2V}{R}$

858. The resistance of a straight conductor does not depend on its

a) Length b) Temperature

c) Material d) Shape of cross-section

859. Consider the circuit shown in the figure. The current I_3 is equal to



a) 5 amp b) 3 amp c) -3 amp d) $-5/6$ amp

860. An immersion heater with electrical resistance 7 Ω is immersed in 0.1 kg of water at 20°C for 3 min. If the flow of current is 4 A, what is the final temperature of the water in ideal conditions? (Specific heat capacity of water $= 4.2 \times 10^3$ Jkg)$^{-1}$K^{-1}

a) 28°C b) 48°C c) 52°C d) 68°C

861. A cell of internal resistance r is connected to an external resistance R. The current will be maximum in R, if

a) $R = r$ b) $R < r$ c) $R > r$ d) $R = r/2$

862. If an ammeter is to be used in place of a voltmeter, then we must connect with the ammeter a

a) Low resistance in parallel b) High resistance in parallel

c) High resistance in series d) Low resistance in series

863. A nichrome wire 50 cm long and one square $millimetre$ cross-section carries a current of 4A when connected to a 2V battery. The resistivity of nichrome wire in $ohm\ metre$ is

a) 1×10^{-6} b) 4×10^{-7} c) 3×10^{-7} d) 2×10^{-7}

864. The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of

100 W and 200 V lamp, when not in use?
a) 40Ω b) 20Ω c) 400Ω d) 20Ω

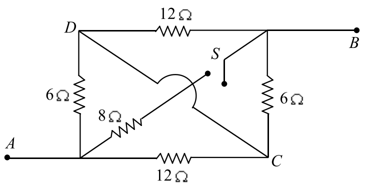
865. In a neon gas discharge tube Ne^+ ions moving through a cross-section of the tube each second to the right is 2.9×10^{18}, while 1.2×10^{18} electron move towards left in the same time; the electronic charge being 1.6×10^{-19}C, the net electric current is
a) 0.27 A to the right b) 0.66 A to the right c) 0.66 A to the left d) Zero

866. A battery of e.m.f. 3 volt and internal resistance 1.0 ohm is connected in series with copper voltmeter. The current flowing in the circuit is 1.5 amperes. The resistance of voltmeter will be
a) Zero b) 1.0 ohm c) 1.5 ohm d) 2.0 ohm

867. If two identical heaters each rated as (1000 W-220 V) are connected in parallel to 220 V, then the total power consumed is
a) 200 W b) 2500 W c) 250 W d) 2000 W

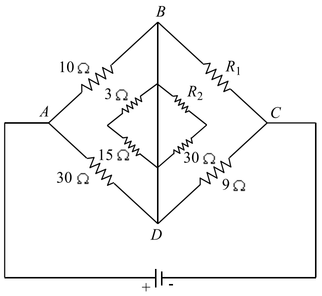
868. A voltmeter essentially consists of
a) A high resistance, in series with a galvanometer b) A low resistance, in series with a galvanometer
c) A high resistance in parallel with a galvanometer d) A low resistance in parallel with a galvanometer

869. The equivalent resistance between points A and B with switch S open and closed are respectively



a) $4\ \Omega, 8\ \Omega$ b) $8\ \Omega, 4\ \Omega$ c) $6\ \Omega, 9\ \Omega$ d) $9\ \Omega, 6\ \Omega$

870. In the Wheatstone bridge shown below, in order to balance the bridge, we must have



a) $R_1 = 3\ \Omega\,; R_2 = 3\ \Omega$ b) $R_1 = 6\ \Omega\,; R_2 = 15\ \Omega$
c) $R_1 = 1.5\ \Omega\,; R_2 =$ any finite value d) $R_1 = 3\Omega\,; R_2 =$ any finite value

871. A wire of resistance R is cut into $'n'$ equal parts. These parts are then connected in parallel. The equivalent resistance of the combination will be
a) nR b) $\frac{R}{n}$ c) $\frac{n}{R}$ d) $\frac{R}{n^2}$

872. The power dissipated across resistance R which is connected across a battery of potential V is P. If resistance is doubled, then the power becomes
a) 1/2 b) 2 c) 1/4 d) 4

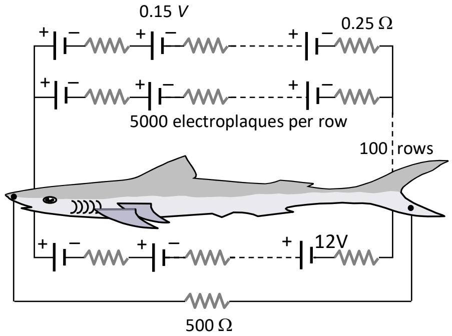
873. What will happen when a 40 $watt$, 220 $volt$ lamp and 100 $watt$, 220 $volt$ lamp are connected in series across 40 $volt$ supply
a) 100 $watt$ lamp will fuse b) 40 $watt$ lamp will fuse
c) Both lamps will fuse d) Neither lamp will fuse

874. If nearly 10^5C liberate 1 g equivalent of aluminium, then the amount of aluminium (equivalent weight g) deposited through electrolysis in 20 min by a current of 50 A will be
a) 0.09 g b) 0.6 g c) 5.4 g d) 10.8 g

875. Two cells, each of e. m. f. E and internal resistance r are connected in parallel between the resistance R. The maximum energy given to the resistor will be, only when
a) $R = r/2$ b) $R = r$ c) $R = 2r$ d) $R = 0$

876. Eels are able to generate current with biological cells called electroplaques. The electroplaques in an eel

are arranged in 100 rows, each row stretching horizontally along the body of the fish containing 5000 electroplaques. The arrangement is suggestively shown below. Each electroplaque has an emf of 0.15 V and internal resistance of 0.25 Ω



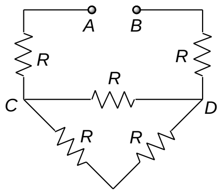
The water surrounding the eel completes a circuit between the head and its tail. If the water surrounding it has a resistance of 500 Ω, the current an eel can produce in water is about

a) 1.5 A b) 3.0 A c) 15 A d) 30 A

877. Time taken by a 836 W heater to heat one litre of water from 10°C to 40°C is

a) 50 s b) 100 s c) 150 s d) 200 s

878. What is the equivalent resistance between points A and B in the circuit if figure, if $R = 3\ \Omega$?



a) 8 Ω b) 9 Ω c) 12 Ω d) 15 Ω

879. What must be the efficiency of an electric kettle marked 500 W, 230 V, if it was found to bring 1 kg of water at 15°C to boiling point in 15 min? (Given specific heat capacity of water = 420 J/kg°C)

a) 79% b) 81% c) 72% d) 69%

880. A metallic resistor is connected across a battery. If the number of collisions of the free electrons with the lattice is some how decreased in the resistor (for example by cooling it), the current will

a) Remains constant b) Increase c) Decrease d) Become zero

881. Tap supplies water at 20°C. A man takes 1 L of water per minute at 35°C from a geyser connected to the tap. The power of geyser is

a) 1050 W b) 2100 W c) 1500 W d) 3000 W

882. The number of free electrons per 100 mm of ordinary copper wire is 2×10^{21}. Average drift speed of electrons is 0.25mms^{-1}. The current flowing is

a) 8 A b) 0.8 A c) 80 A d) 5 A

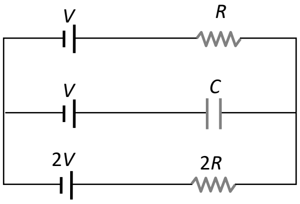
883. On increasing the temperature of a conductor, its resistance increases because the

a) Relaxation time increases b) Mass of electron increases
c) Electron density decreases d) Relaxation time decreases

884. In India electricity is supplied for domestic use at 220 V. It is supplied at 110 V in USA. If the resistance of a 60 W bulb for use in India is R,the resistance of a 60 W bulb for use in USA will be

a) R b) 2 R c) $R/4$ d) $R/2$

885. In the given circuit, with steady current, the potential drop across the capacitor must be



a) V b) $V/2$ c) $V/3$ d) $2V/3$

886. Two resistances R_1 and another R_2 of the same material but twice the length and half the thickness are

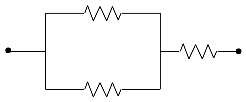
connected in series with a standard battery E of internal resistance r. The balancing point is

a) $\frac{1}{8l}$ b) $\frac{1}{4l}$ c) $8\,l$ d) $16\,l$

887. When a current passes through the junction of two different metals, evolution or absorption of heat at the junction is known as

a) Joule effect b) Seebeck effect c) Peltier effect d) Thomson effect

888. Three equal resistors are connected as shown in figure. The maximum power consumed by each resistor is 18 W. Then maximum power consumed by the combination is



a) 18 W b) 27 W c) 36 W d) 54 W

889. The length of the resistance wire is increased by 10%. What is the corresponding change in the resistance of wire?

a) 10 % b) 25 % c) 21 % d) 9 %

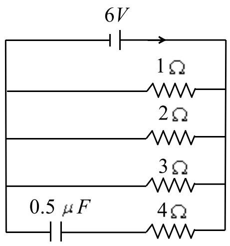
890. The number of dry cells, each of e.m.f. 1.5 *volt* and internal resistance 0.5 *ohm* that must be joined in series with a resistance of 20 *ohm* so as to send a current of 0.6 *ampere* through the circuit is

a) 2 b) 8 c) 10 d) 12

891. A thermister is dipped in a bath whose temperature is to be measured. When the temperature increase the current also increase, because of decreases in

a) Capacitance b) Reactance c) Resistance d) Resistivity

892. In the given circuit diagram the current through the battery and the charge on the capacitor respectively in steady state are



a) $1A$ and $3\ \mu C$ b) $17\ A$ and $0\ \mu C$ c) $\frac{6}{7}A$ and $\frac{12}{7}\mu C$ d) $11A$ and $3\mu C$

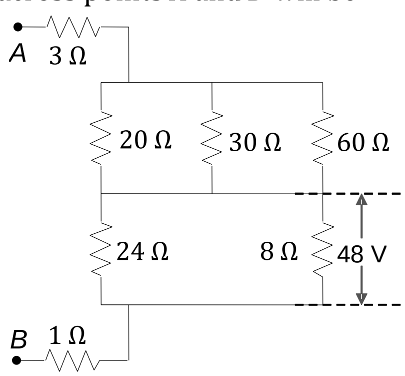
893. To sand 10% of main current through a moving coil galvanometer of resistance 9 Ω shut required

a) 9 Ω b) 11 Ω c) 10 Ω d) 9.9 Ω

894. The resistance of a wire of uniform diameter d and length L is R. The resistance of another wire of the same material but diameter $2d$ and length $4\ L$ will be

a) $2R$ b) R c) $R/2$ d) $R/4$

895. The potential difference across 8Ω resistance is 48V as shown in figure. The value of potential difference across points A and B will be



a) 62 V b) 80 V c) 128 V d) 160 V

896. For obtaining chlorine by electrolysis a current of 100 KW and 125 V is used. (Electro chemical equivalent of chlorine is $0.367 \times 10^{6}\text{kgC}^{-1}$). The amount of chlorine obtained in one min will be

a) 1.7616 g b) 17.616 g c) 0.17161 kg d) 1.7616 kg

897. In a meter bridge, the balancing length from the left end (standard resistance of one ohm is in the right gap) is found to be 20 cm. The value of the unknown resistance is

a) 0.8 Ω b) 0.5 Ω c) 0.4 Ω d) 0.25 Ω

898. A 25 W and 100 W bulbs are joined in series and connected to the mains. Which bulb will glow brighter?

a) 25 W bulb b) 100 W bulb

c) Both bulb will glow brighter d) None will glow brighter

899. Temperature of cold junction in a thermocouple is 270°C, then the temperature of inversion is

a) 540°C b) 530°C c) 280°C d) 260°C

900. A galvanometer having a coil resistance of 60 Ω shows full scale deflection when a current of 1.0 amp passes through it. It can be converted into an ammeter to read currents upto 5.0 amp by

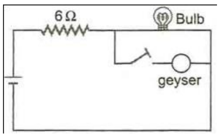
a) Putting in parallel a resistance of 240 Ω b) Putting in series a resistance of 15 Ω

c) Putting in series a resistance of 240 Ω d) Putting in parallel a resistance of 15 Ω

901. A voltmeter having resistance of 50×10^3 ohm is used to measure the voltage in a circuit. To increase the range of measurement 3 times the additional series resistance required is

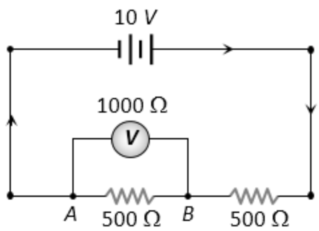
a) 10^5 ohm b) 150 $k.ohm$ c) 900 $k.ohm$ d) $9 \times 10^6 ohm$

902. The wiring of a house has resistance 6 Ω. A 100 W bulb is glowing as shown in figure. If a geyser of 1000 W is switched on, the change in potential drop across the bulb is nearly



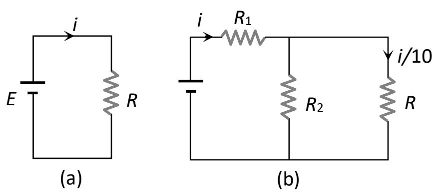
a) Nil b) 12 V c) 24 V d) 32 V

903. What is the reading of voltmeter in the following figure



a) 3 V b) 2 V c) 5 V d) 4 V

904. Consider the circuits shown in the figure. Both the circuits are taking same current from battery but current through R in the second circuit is $\frac{1}{10} th$ of current through R in the first circuit. If R is 11 Ω, the value of R_1

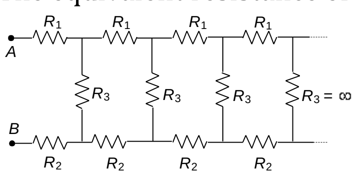


a) 9.9 Ω b) 11 Ω c) 8.8 Ω d) 7.7 Ω

905. A given resistor has the following colour scheme of the various strips on it, brown, black, green and silver. Its value in ohm is

a) $1.0 \times 10^4 \pm 10\%$ b) $1.0 \times 10^5 \pm 10\%$ c) $1.0 \times 10^6 \pm 10\%$ d) $1.0 \times 10^7 \pm 10\%$

906. The equivalent resistance of the figure ie, infinite network of resistors between the terminals A and B is



a) Zero b) Infinite

c) $\frac{R_1 + R_2 + R_3}{3}$ d) $\frac{1}{2}\left[(R_1 + R_2) + \sqrt{(R_1 + R_2)(R_1 + R_2 + 4R_3)}\right]$

907. If R_1 and R_2 are respectively the filament resistances of a 200 *watt* bulb and 100 *watt* bulb designed to operate on the same voltage, then

a) R_1 is two times R_2 b) R_2 is two times R_1 c) R_2 is four times R_1 d) R_1 is four times R_2

908. The atomic weight of silver and copper are 108 and 64. A silver voltmeter and a copper voltmeter are connected in series and when current is passed 10.8 *gm* of silver is deposited. The mass of copper deposited will be

a) 6.4 *gm* b) 12.8 *gm* c) 3.2 *gm* d) 10.8 *gm*

909. An unknown resistance R_1 is connected in series with a resistance of 10Ω. This combination is connected to one gap of meter bridge while a resistance R_2 is connected in the other gap. The balance point is at 50 cm, Now, when the 10Ω resistance is removed the balance point shifts 40cm. The value of R_1 (in ohm) is

a) 20 b) 10 c) 60 d) 40

910. A wire has a resistance of 6Ω. It is cut into two parts and both half values are connected in parallel. The new resistance is

a) 3Ω b) 6Ω c) 12Ω d) 1.5Ω

911. A source of emf E=15V and having negligible internal resistance, is connected to a variable resistance, so that the current in the circuit increases with time as I=1.2t+3. Then, the total charge that will flow in first 5s will be

a) 10C b) 20C c) 30C d) 40C

912. Two resistors of resistance R_1 and R_2 having $R_1 > R_2$ are connected in parallel. For equivalent resistance R, the correct statement is

a) $R > R_1 + R_2$ b) $R_1 < R < R_2$ c) $R_2 < R < (R_1 + R_2)$ d) $R < R_1$

913. Identify the incorrect statement regarding a superconducting wire

a) Transport current flows through its surface

b) Transport current flows through the entire area of cross-section of the wire

c) It exhibits zero electrical resistivity and expels applied magnetic field

d) It is used to produce large magnetic field

914. By a cell a current of 0.9 *A* flows through 2 *ohm* resistor and 0.3 *A* through 7 *ohm* resistor. The internal resistance of the cell is

a) 0.5 Ω b) 1.0 Ω c) 1.2 Ω d) 2.0 Ω

915. The value of current required to deposit 0.972 *gm* of chromium in 3 *hours* if the E.C.E. of chromium is 0.00018 *gm* per coulomb, is

a) 1 *amp* b) 1.5 *amp* c) 0.5 *amp* d) 2 *amp*

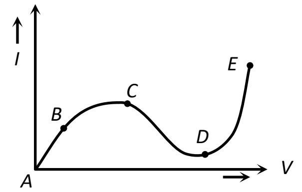
916. If for a thermocouple T_n is the neutral temperature, T_c is the temperature of the cold junction and T_i is the temperature of inversion, then

a) $T_i = 2T_n - T_c$ b) $T_n = T_i - 2T_c$ c) $T_i = T_n - T_c$ d) None of these

917. The temperature of the cold junction of a thermocouple is 0°C and the temperature of the hot junction is T°C. The emf is $E = 16T - 0.04T^2$ μV. The inversion temperature T_i is

a) 200°C b) 400°C c) 100°C d) 300°C

918. From the graph between current I and voltage V shown below, identify the portion corresponding to negative resistance



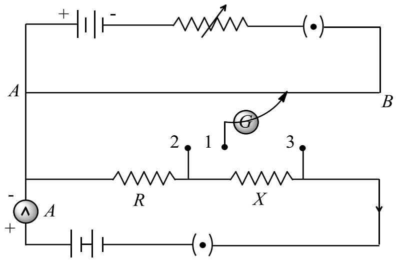
a) AB b) BC c) CD d) DE

919. A thermocouple is formed by two metals X and Y, metal X comes earlier to Y in Seebeck series. If temperature of hot junction increases beyond the temperature of inversion, then direction of current in thermocouple will be from

a) X to Y through cold junction b) X to Y through hot junction

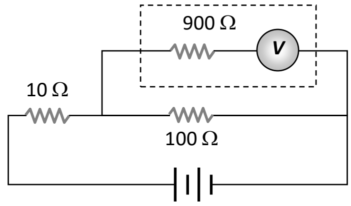
c) Y to X through cold junction d) Both (b) and (c)

920. A potentiometer circuit is set up as shown. The potential gradient, across the potentiometer wire, is k volt/cm and the ammeter, present in the cicuit, reads 1.0 A when two way key is switched off. The balance points, when the key between the terminals (i) 1 and 2 (ii) 1 and 3, is plugged in, are found to be at lengths l_1 cm and $l_2 cm$ respectively. The magnitudes, of the resistors R and X, in ohms, are then, equal, respectively, to



a) kl_1 and kl_2 b) $k(l_2 - l_1)$ and kl_2 c) kl_1 and $k(l_2 - l_1)$ d) $k(l_2 - l_1)$ and kl_1

921. The potential difference across the 100Ω resistance in the following circuit is measured by a voltmeter of 900 Ω resistance. The percentage error made in reading the potential difference is



a) $\frac{10}{9}$ b) 0.1 c) 1.0 d) 10.0

922. A heater coil cut into two equal parts and one part is connected with heater. Now heat generated in heater will be

a) Twice b) Half c) One-fourth d) Four times

923. Some electric bulbs are connected in series across a 220V supply in a room. If one bulb is fused, then remaining bulbs are connected again in series across the same supply. The illumination in the room will be

a) Increase b) Decrease c) Remain the same d) Not continuous

924. A moving coil galvanometer has a resistance of 50Ω and gives full scale deflection for 10 mA. How could it be converted into an ammeter with a full scale deflection for 1A

a) 50/99 Ω in series b) 50/99 Ω in parallel c) 0.01 Ω in series d) 0.01 Ω in parallel

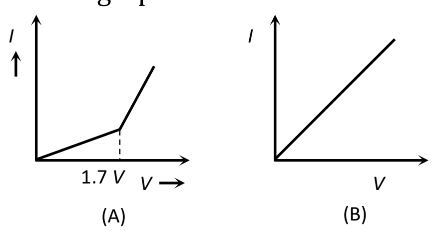
925. An ammeter reads upto 1A. Its internal resistance is 0.81Ω. To increase the range to 10A the value of the required shunt is

a) 0.03Ω b) 0.3Ω c) 0.9Ω d) 0.09Ω

926. There are two concentric spheres of radius a and b respectively. If the space between them is filled with medium of resistivity ρ, then the resistance of the inter gap between the two spheres will be

a) $\frac{\rho}{4\pi(b+a)}$ b) $\frac{\rho}{4\pi}\left(\frac{1}{b}-\frac{1}{a}\right)$ c) $\frac{\rho}{4\pi}\left(\frac{1}{a^2}-\frac{1}{b^2}\right)$ d) $\frac{\rho}{4\pi}\left(\frac{1}{a}-\frac{1}{b}\right)$

927. The V-i graphs A and B are drawn for two voltameters. Identify each graph



a) A for water voltameter and B for Cu voltameter

b) A for Cu voltmeter and B for water voltameter

c) Both A and B represents Cu voltameter

d) None of these

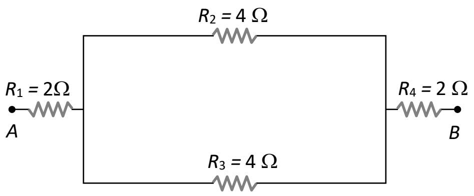
928. A certain electrical conductor has a square cross-section, 2.0 mm on side, and is 12 m long. The resistance between its ends is 0.072Ω. The resistivity of its material is equal to

a) 2.4×10^{-6}Ωm b) 1.2×10^{-6}Ωm c) 1.2×10^{-8}Ωm d) 2.4×10^{-8}Ωm

929. A galvanometer has a resistance of 3663Ω. A shunt S is connected across it such that (1/34) of the total current passes through the galvanometer. Then the value of shunt is

a) 3663Ω b) 111Ω c) 107.7Ω d) 3555.3Ω

930. In the given figure, the equivalent resistance between the points A and B is

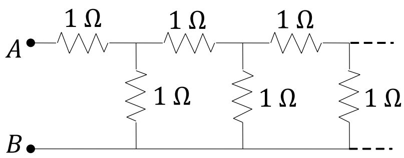


a) 8 Ω b) 6 Ω c) 4 Ω d) 2 Ω

931. Three resistances of 4Ω, 6Ω and 12Ω are connected in parallel and the combination is connected in series with 4 V battery with internal resistance of 2 Ω. The battery current is

a) 1 A b) 10 A c) 2 A d) 0.5 A

932. The equivalent resistance between points A and B of an infinite network of resistances each of 1Ω connected as shown in figure, is

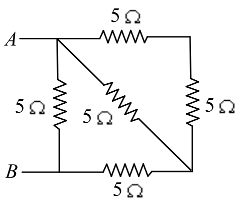


a) Infinite b) Zero c) 2Ω d) $(1+\sqrt{5})/2\Omega$

933. An electric iron draws 5 *amp*, a TV set draws 3 *amp* and refrigerator graws 2 *amp* from a 220 *volt* main line. The three appliances are connected in parallel. If all the three are operating at the same time, the fuse used may be of

a) 20 *amp* b) 5 *amp* c) 15 *amp* d) 10 *amp*

934. The equivalent resistance between the points A and B in the following circuit is

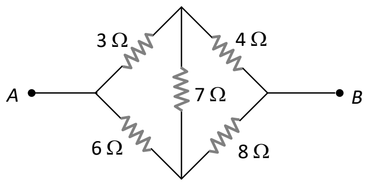


a) 3.12 Ω b) 1.56 Ω c) 6.24 Ω d) 12.48 Ω

935. A 3°C rise in temperature is observed in a conductor by passing certain current. When the current is doubled, the rise in temperature will be

a) 15°C b) 12°C c) 9°C d) 3°C

936. In the given figure, equivalent resistance between A and B will be



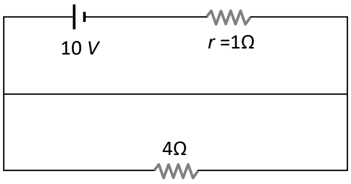
a) $\frac{14}{3}\Omega$ b) $\frac{3}{14}\Omega$ c) $\frac{9}{14}\Omega$ d) $\frac{14}{9}\Omega$

937. If θ_i is the inversion temperature, θ_n is the natural temperature, θ_c is the temperature of the cold junction then

a) $\theta_i + \theta_c = \theta_n$ b) $\theta_i - \theta_c = 2\theta_n$ c) $\frac{\theta_i + \theta_c}{2} = \theta_n$ d) $\theta_c - \theta_i = 2\theta_n$

938. Potential difference across the terminals of the battery shown in figure is (r = internal resistance of

battery)

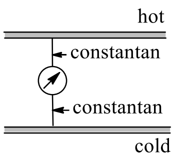


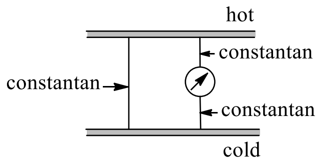
a) 8 V b) 10 V c) 6 V d) Zero

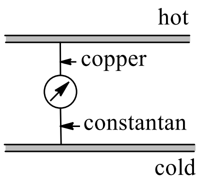
939. Potentiometer measures the potential difference more accurately than a voltmeter because
a) It has a wire of high resistance
b) It has a wire of low resistance
c) It does not draw current from external circuit
d) It draws a heavy current from external circuit

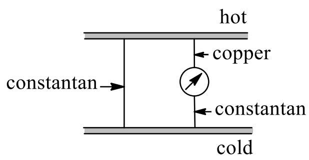
940. To get maximum current through a resistance of 2.5 Ω, one can use m rows of cells, each row having n cells. The internal resistance of each cell is 0.5 Ω. What are the values of n and m, if the total number of cell is 45?
a) $m = 3, n = 15$ b) $m = 5, n = 9$ c) $m = 9, n = 5$ d) $m = 15, n = 3$

941. A cold-water pipe and a hot-water pipe are both made of copper and are initially electrically isolated. In which one of the following arrangements will the galvanometer indicate a thermo-electric current?

a) 

b) 

c) 

d) 

942. The emf of a thermocouple, cold junction of which is kept at −300°C is given by $E = 40t + \frac{1}{10}t^2$. The temperature of inversion of thermocouple will be
a) 200°C b) 400°C c) −200°C d) −100°C

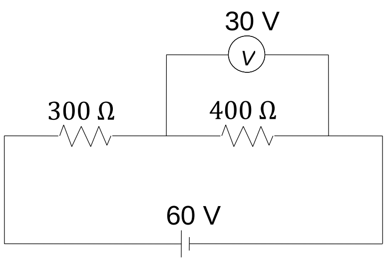
943. How much current should be passed through acidified water for 100s to liberate 0.224 L of hydrogen?
a) 22.4 A b) 19.3 A c) 9.65 A d) 1 A

944. The speed at which the current travels, in a conductor, is nearly
a) 3×10^{-4} ms^{-1} b) 3×10^{-5} ms^{-1} c) 4×10^{6} ms^{-1} d) 3×10^{8} ms^{-1}

945. A uniform wire of resistance 9 Ω is cut into 3 equal parts. They are connected in the form of equilateral triangle ABC. A cell of e. m. f. 2 V and negligible internal resistance is connected across B and C. Potential difference across AB is
a) 1 V b) 2 V c) 3 V d) 0.5 V

946. A bulb rated at $(100W - 200V)$ is used on a $100V$ line. The current in the bulb is
a) $\frac{1}{4}$ amp b) 4 amp c) $\frac{1}{2}$ amp d) 2 amp

947. In the circuit figure, the voltmeter reads 30 V. what is the resistance of the voltmeter?

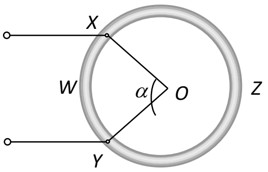


a) 1200 Ω b) 700 Ω c) 400 Ω d) 300 Ω

948. Forty electric bulbs are connected in series across a 220 V supply. After one bulb is fused, the remaining 39 are connected again in series across the same supply. The illumination will be
a) More with 40 bulbs than with 39
b) More with 39 bulbs than with 40

c) Equal in both the cases d) In the ratio of $49^2 : 39^2$

949. A wire of resistor R is bent into a circular ring of radius r. Equivalent resistance between two points X and Y on its circumference, when angle XOY is α, can be given by

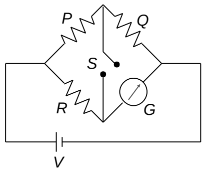


a) $\frac{R\alpha}{4\pi^2}(2\pi-\alpha)$ b) $\frac{R}{2\pi}(2\pi-\alpha)$ c) $R(2\pi-\alpha)$ d) $\frac{4\pi}{R\alpha}(2\pi-\alpha)$

950. Ampere hour is the unit of

a) Quantity of charges b) Potential c) Energy d) Current

951. In the circuit shown as $P \neq R$ and the reading of the galvanometer G is same with switch open or closed. Then



a) $I_R = R_G$ b) $I_P = I_G$ c) $I_Q = I_G$ d) $I_Q = I_R$

952. A bulb of 220 V and 300 W is connected across 110 V circuit. The percentage reduction in power is

a) 100% b) 25% c) 70% d) 75%

953. Peltier coefficient for the junction of a pair of metals is proportional to

a) Absolute temperature of junction T b) Square of absolute temperature of junction

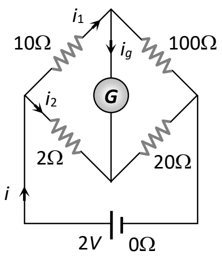
c) $1/T$ d) $1/T^2$

954. The following four wires are made of the same material and are at the same temperature. Which one of them has the highest electrical resistance?

a) Length=50 cm, diameter=0.5 mm b) Length=100 cm, diameter=1 mm

c) Length=200 cm, diameter=2 mm d) Length=300 cm, diameter=3 mm

955. In the circuit shown below the resistance of the galvanometer is 20 Ω. In which of the following alternative are the currents arranged strictly in the decreasing order

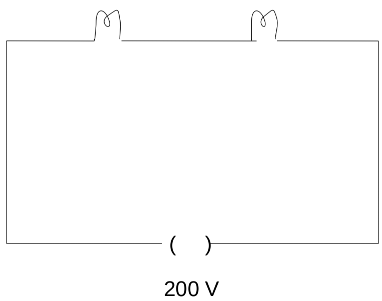


a) i, i_1, i_2, i_g b) i, i_2, i_1, i_g c) i, i_2, i_g, i_1 d) i, i_1, i_g, i_2

956. A potentiometer having the potential gradient of 2 mV/cm is used to measure the difference of potential across a resistance of 10 ohm. If a length of 50 cm of the potentiometer wire is required to get the null point, the current passing through the 10 ohm resistor is (in mA)

a) 1 b) 2 c) 5 d) 10

957. Two bulbs marked 200 V -100 W and 200 V-200 W are joined in series and connected to a power supply of



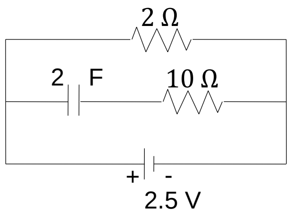
200 V. The total power consumed by the two will be near to

a) 35 W b) 66 W c) 100 W d) 300 W

958. A colour coded carbon resistor has the colours orange, blue, green and silver. Its resistance value and tolerance percentage respectively are

a) $36 \times 10^5 \Omega$ and 10% b) $36 \times 10^4 \Omega$ and 5% c) $63 \times 10^5 \Omega$ and 10% d) $35 \times 10^6 \Omega$ and 5%

959. A capacitor of capacitance 2μF is connected as shown in figure. The internal resistance of the cell is 0.5Ω. The amount of charge on the capacitor plates is



a) Zero b) 2μ C c) 4μC d) 6μC

960. A wire of a certain material is stretched slowly by ten percent. Its new resistance and specific resistance become respectively

a) Both remain the same b) 1.1 times, 1.1 times c) 1.2 times , 1.1 times d) 1.21 times, same

961. Two conductors are made of the same material and have the same length. Conductor A is a solid wire of diameter 1.0 mm. Conductor B is a hollow tube of outside diameter 2.0 mm and inside diameter 1.0 mm. The resistance ratio R_A/R_B will be

a) 1 b) 2 c) 3 d) 4

962. A certain current passing through a galvanometer produces a deflection of 100 divisions. When a shunt of one ohm is connected, the deflection reduces to 1 division. The galvanometer resistance is

a) 100 Ω b) 99 Ω c) 10 Ω d) 9.9 Ω

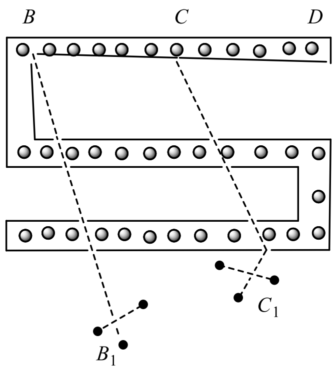
963. An expression for rate of heat generated, if a current of I ampere flows through a resistance of R Ω, is

a) I^2Rt b) I^2R c) V^2R d) $I\ R$

964. If a 2 kW boiler is used everyday for 1 hour, then electrical energy consumed by boiler in thirty days is

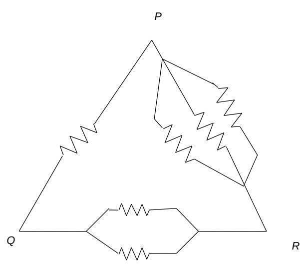
a) 15 unit b) 60 unit c) 120 unit d) 240 unit

965. For the post office box arrangement to determine the value of unknown resistance, the unknown resistance should be connected between



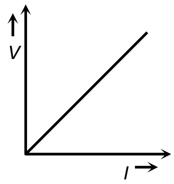
a) B and C b) C and D c) A and D d) B_1 and C_1

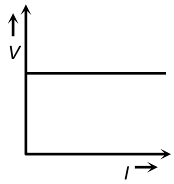
966. Six equal resistances are connected between points P, Q and R as shown in the figure. Then the net resistance will be maximum between

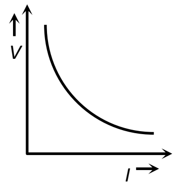


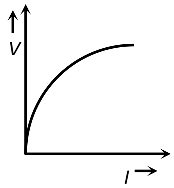
a) P and Q b) Q and R c) P and R d) Only two points

967. Which of the adjoining graphs represents *ohmic* resistance

a) 

b) 

c) 

d) 

968. A lead acid accumulatory (storage battery) is connected to a battery charge for over night charging. Which of the following observations will indicate that the battery was partly charged during the next morning

a) The density of acid has decreased
b) The density of acid has increased
c) The acid has changed colour
d) The acid level has dropped

969. How much current should be passed through a silver voltmeter to deposit 200 gm of silver per hour on the cathode? (Faraday constant =96500 C/mol and relative atomic mass of silver is 108)

a) 50 mA
b) 50 A
c) 15 mA
d) 15 A

970. All the edges of a block with parallel faces are unequal. Its tangent edge is twice its shortest edge. The ratio of the maximum to minimum resistance between parallel faces is

a) 8
b) 4
c) 2
d) None of these

971. A battery has e.m.f. 4 V and internal resistance r. When this battery is connected to an external resistance of 2 ohm, a current of 1 amp. flows in the circuit. How much current will flow if the terminals of the battery are connected directly

a) 1 amp
b) 2 amp
c) 4 amp
d) Infinite

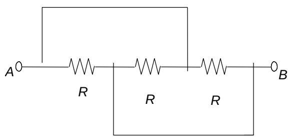
972. A cell of emf 6 V and resistance 0.5 ohm is short circuited. The current in the cell is

a) 3 amp
b) 12 amp
c) 24 amp
d) 6 amp

973. It is easier to start a car engine on a hot day than on a cold day. This is because the internal resistance of the car battery

a) Decreases with rise in temperature
b) Increases with rise in temperature
c) Decreases with a fall in temperature
d) Does not change with a change in temperature

974. The resistance across A and Bin the figure below will be

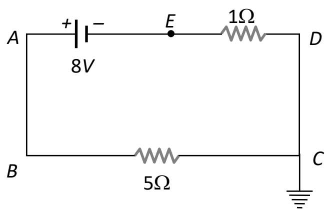


a) $3R$
b) R
c) $\frac{R}{3}$
d) None of these

975. With a potentiometer null point were obtained at 140 cm and 180 cm with cells of emf 1.1 V and one unknown X volt. Unknown emf is

a) 1.1 V
b) 1.8 V
c) 2.4 V
d) 1.41 V

976. In the given circuit, the potential of the point E is

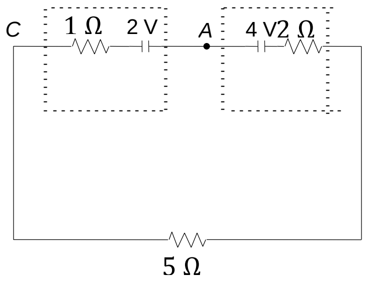


a) Zero
b) $-8\ V$
c) $-4/3\ V$
d) $4/3\ V$

977. Two resistors 400 Ω and 800 Ω are connected in series with 6 V battery. The potential difference measured by voltmeter of 10k Ω across 400 Ω resistor is

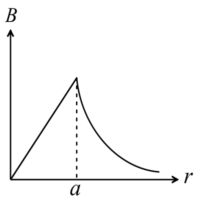
a) 2 V
b) 1.95 V
c) 3.8 V
d) 4 V

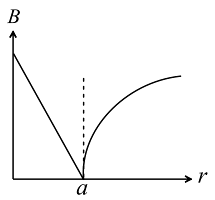
978. What is the potential drop between points A and C in the following circuit? Resistances 1 Ω and 2 Ω represent the internal resistance of the respective cells

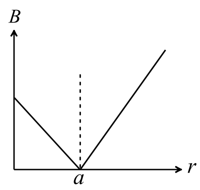


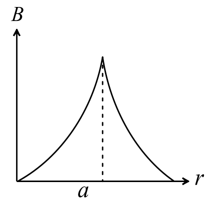
a) 1.75V b) 2.25V c) $\frac{5}{4}V$ d) $\frac{4}{5}V$

979. A long straight wire of a circular cross section (radius a) carries a steady current I and the current I is uniformly distributed across this cross-section. Which of the following plots represents the variation of magnitude of magnetic field B with distance r from the centre of the wire

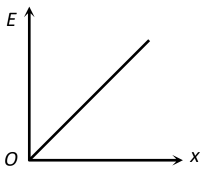
a) 

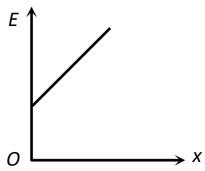
b) 

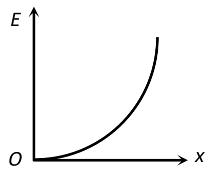
c) 

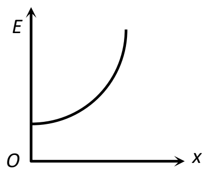
d) 

980. A cylindrical conductor has uniform cross-section. Resistivity of its material increases linearly from left end to right end. If a constant current is flowing through it and at a section distance x from left end, magnitude of electric field intensity is E, which of the following graphs is correct

a) 

b) 

c) 

d) 

981. The emf of a battery is 2 V and its internal resistance is 0.5 Ω. The maximum power which it can deliver to any external circuit will be

a) 8 $Watt$ b) 4 $Watt$ c) 2 $Watt$ d) None of the above

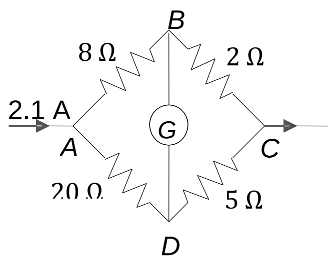
982. An electric bulb of 100 $watt$ is connected to a supply of electricity of 220 V. Resistance of the filament is

a) 484 Ω b) 100 Ω c) 22000 Ω d) 242 Ω

983. n identical bulbs, each designed to draw a power p from a certain voltage supply, are joined in series across that supply. The total power which they will draw is

a) p/n^2 b) p/n c) p d) np

984. In the given figure when galvanometer shows no deflection current flowing through 5Ω resistance will be

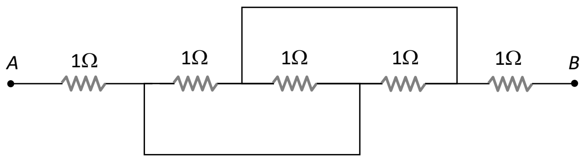


a) 0.5 A b) 0.6 A c) 1.5 A d) 2.0 A

985. If voltage across a bulb rated 220 Volt-100 Watt drops by 2.5% of its rated value, the percentage of the rated value by which the power would decrease is

a) 20% b) 2.5% c) 5% d) 10%

986. Equivalent resistance between the points A and B is (in Ω)



a) $\frac{1}{5}$　　b) $1\frac{1}{4}$　　c) $2\frac{1}{3}$　　d) $3\frac{1}{2}$

987. A fuse wire with radius 1 mm blows at 1.5 A. The radius of the fuse wire of the same material to blow at 3 A will be

a) $3^{1/4}$ mm　　b) $4^{1/3}$ mm　　c) $3^{1/2}$ mm　　d) $2^{1/3}$ mm

988. A galvanometer of resistance G can measure 1 A current. If a shunt S is used to convert it into an ammeter to measure $10A$ current. The ratio of $\frac{G}{S}$ is

a) $\frac{1}{9}$　　b) $\frac{9}{1}$　　c) 10　　d) $\frac{1}{10}$

989. Calculate the amount of charge flowing in 2 *minutes* in a wire of resistance 10Ω when a potential difference of 20 V is applied between its ends

a) 120 C　　b) 240 C　　c) 20 C　　d) 4 C

990. An electric wire is connected across a cell of e.m.f. E. The current I is measured by an ammeter of resistance R. According to *ohm's* law

a) $E = I^2R$　　b) $E = IR$　　c) $E = R/I$　　d) $E = I/R$

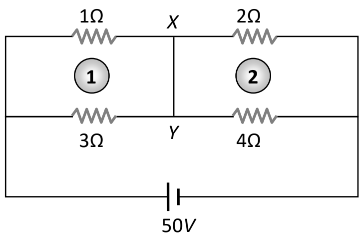
991. Drift velocity v_d varies with the intensity of electric field as per the relation

a) $v_d \propto E$　　b) $v_d \propto \frac{1}{E}$　　c) $v_d =$ constant　　d) $v_d \propto E^2$

992. An immersion heater is rated 418 W. It should heat a litre of water from 10°C to 30°C in nearly

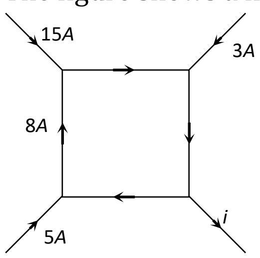
a) 44 s　　b) 100 s　　c) 200 s　　d) 400 s

993. Current through wire XY of circuit shown is



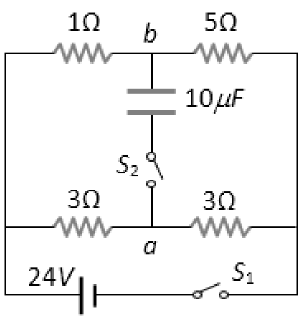
a) 1 A　　b) 4 A　　c) 2 A　　d) 3 A

994. The figure shows a network of currents. The magnitude of currents is shown here. The current i will be



a) 3 A　　b) 13 A　　c) 23 A　　d) −3 A

995. In the circuit shown in the figure, switch S_1 is initially closed and S_2 is open. Find $V_a - V_b$



a) 4 V b) 8 V c) 12 V d) 16 V

996. 62.5×10^{18} electrons per second are flowing through a wire of area of cross-section 0.1 m^2, the value of current flowing will be

a) 1 A b) 0.1 A c) 10 A d) 0.11 A

997. If three bulbs $60W$, $100W$ and 200 W are connected in parallel, then

a) 200 W bulb will glow more
b) 60 W bulb will glow more
c) 100 W bulb will glow more
d) All the bulbs will glow equally

998. Four resistances of 100 Ω each are connected in the form of square. Then, the effective resistance along the diagonal points is

a) 200 Ω b) 400 Ω c) 100 Ω d) 150 Ω

999. Water of volume 2 $litre$ in a container is heated with a coil of 1 kW at 27°C. The lid of the container is open and energy dissipates at rate of 160 J/s. In how much time temperature will rise from 27°C to 77°C [Given specific heat of water is 4.2 kJ/kg]

a) 8 min 20 s b) 6 min 2 s c) 7 min d) 14 min

1000. Flash light equipped with a new set of batteries, produces bright white light. As the batteries wear out

a) The light intensity gets reduced with no change in its colour
b) Light colour changes first to yellow and then red with no change in intensity
c) It stops working suddenly while giving white light
d) Colour changes to red and also intensity gets reduced

1001. A potentiometer has uniform potential gradient. The specific resistance of the material of the potentiometer wire is 10^{-7} $ohm - meter$ and the current passing through it is 0.1 $ampere$; cross-section of the wire is $10^{-6} m^2$. The potential gradient along the potentiometer wire is

a) 10^{-4} V/m b) 10^{-6} V/m c) 10^{-2} V/m d) 10^{-8} V/m

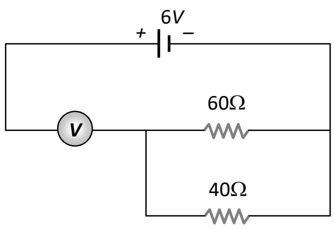
1002. A hot electric iron has a resistance of 80 Ω and is used on a 200 V source. The electrical energy spent, if it is used for two hours, will be

a) 8000 Wh b) 2000 Wh c) 1000 Wh d) 800 Wh

1003. The thermocouple is based on the principle of

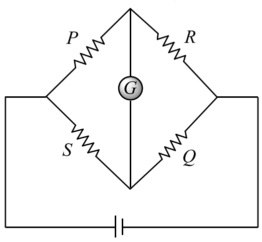
a) Seebeck effect b) Thomson effect c) Peltier effect d) Joule effect

1004. The measurement of voltmeter in the following circuit is



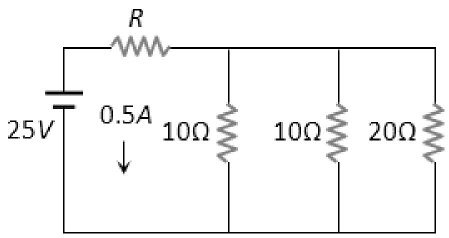
a) 2.4 V b) 3.4 V c) 4.0 V d) 6.0 V

1005. In the circuit given, the correct relation to a balanced Wheatstone bridge is



a) $\frac{P}{Q} = \frac{R}{S}$ b) $\frac{P}{Q} = \frac{S}{R}$ c) $\frac{P}{R} = \frac{S}{Q}$ d) None of these

1006. In the circuit as shown in figure the



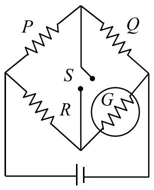
a) Resistance $R = 46\ \Omega$
b) Current through $20\ \Omega$ resistance is $0.1\ A$
c) Potential difference across the middle resistance is $2\ V$
d) All option are correct

1007. Two electric bulbs, each designed to operate with a power of 500 W in 220 V line are connected in series in a 110 V line. The power generated by each bulb will be
a) 31.25 W
b) 40 W
c) 60 W
d) 3.125 W

1008. A heater draws a current of $2A$ when connected to a $250\ V$ source. The rate of energy dissipation is
a) $500\ W$
b) $1000\ W$
c) $250\ W$
d) $125\ W$

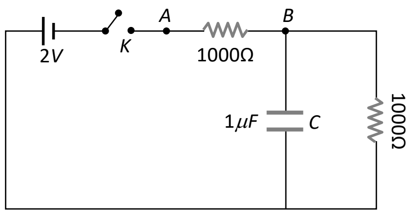
1009. A 100 ohm galvanometer gives full scale deflection at $10\ mA$. How much shunt is required to read $100\ mA$
a) $11.11\ ohm$
b) $9.9\ ohm$
c) $1.1\ ohm$
d) $4.4\ ohm$

1010. The figure shows a circuit diagram of a 'Wheatstone Bridge' to measure the resistance G of the galvanometer. The relation $\frac{P}{Q} = \frac{R}{G}$ will be satisfied only when



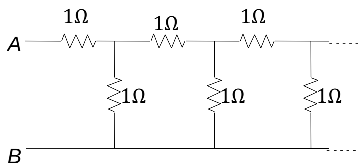
a) The galvanometer shows a deflection when switch S is closed
b) The galvanometer shows a deflection when switch S is open
c) The galvanometer shows no change in deflection whether S is open or closed
d) The galvanometer shows no deflection

1011. When the key K is pressed at time $t = 0$, which of the following statements about the current I in the resistor AB of the given circuit is true



a) $I = 2\ mA$ at all t
b) I oscillates between $1\ mA$ and $2mA$
c) $I = 1\ mA$ at all t
d) At $t = 0, I = 2\ mA$ and with time it goes to $1\ mA$

1012. The equivalent resistance between points A and B of an infinite network of resistances, each of $1\ \Omega$, connected as shown is

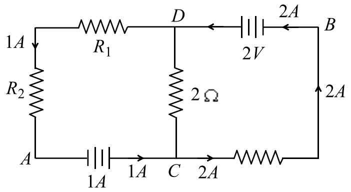


a) Infinite b) $2\ \Omega$ c) $\frac{1+\sqrt{5}}{2}\Omega$ d) zero

1013. If 100 kWh of energy is consumed at 66 V in a copper voltmeter, then the mass of copper liberated will be (Given ,ECE of Cu $= 0.33 \times 10^{-6}$kg C^{-1})

a) 1.65 kg b) 1.8 kg c) 3.3 kg d) 3.6 kg

1014. In the circuit shown in the figure, if the potential at point A is taken to be zero, the potential at point B is



a) $-2V$ b) $+1V$ c) $-1V$ d) $+2V$

1015. When a current is passed through water, acidified with a dilute sulphuric acid, the gases formed at the platinum electrodes are

a) 1 vol. hydrogen (cathode) and 2 vol. oxygen (anode)
b) 2 vol. hydrogen (cathode) and 1 vol. oxygen (anode)
c) 1 vol. hydrogen (cathode) and 1 vol. oxygen (anode)
d) 1 vol. oxygen (cathode) and 2 vol. hydrogen (anode)

1016. The temperature at which thermo emf is zero, is

a) Temperature of inversion b) Temperature of cold junction
c) Neutral temperature d) None of the above

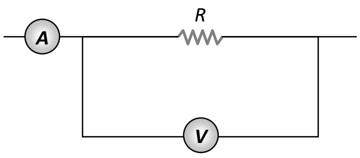
1017. An emf of 0.9 V is generated when the temperature difference hot and cold junction of thermocouple is 75 K. Assuming that the thermo emf is directly proportional to the temperature difference, the extent to which the thermo emf will change when the cold junction is heated up by 15 K is

a) 10% b) 20% c) 40% d) 60%

1018. n identical cells, each of emf E and internal resistance r, are connected in series a cell A is joined with reverse polarity. The potential difference across each cell, except A is

a) $\frac{2nE}{n-2}$ b) $\frac{(n-2)E}{n}$ c) $\frac{(n-1)E}{n}$ d) $\frac{2E}{n}$

1019. The ammeter A reads 2 A and the voltmeter V reads 20 V. The value of resistance R is (Assuming finite resistance's of ammeter and voltmeter)



a) Exactly 10 ohm b) Less than 10 ohm
c) More than 10 ohm d) We cannot definitely say

1020. An electric heater kept in vacuum is heated continuously by passing electric current. Its temperature

a) Will go on rising with time
b) Will stop after sometime as it will loose heat to the surroundings by conduction
c) Will rise for sometime and there after will start falling
d) Will become constant after sometime because of loss of heat due to radiation

1021. Two identical batteries each emf E =2V and internal resistance $r = 1\Omega$ are available to produce heat in an external resistance by passing a current through it. The maximum Joulean power that can be developed across R using these batteries is

a) 1.28 W b) 2.0 W c) $\frac{8}{9}$ W d) 3.2 W

1022. One junction of thermocouple is at 0°C and the other is at T°C. The thermo emf (in volts) is given by $E = 20 \times 10^{-6}T - 0.02 \times 10^{-6}T^2$

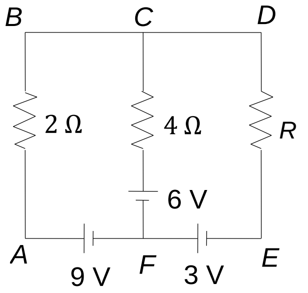
The maximum value of E is

a) 5 mV b) 1 m V c) 10 m V d) Zero

1023. If t_1 and t_2 are the times taken by two different coils for producing same heat with same supply, then the time taken by them to produce the same heat when connected in parallel will be

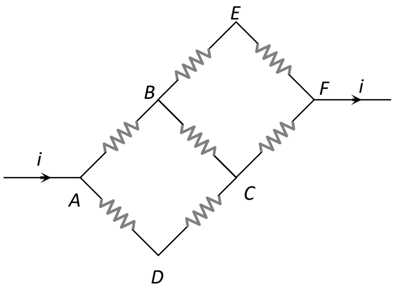
a) $t_1 + t_2$ b) $\frac{t_1 t_2}{t_1 + t_2}$ c) $\frac{2t_1 t_2}{t_1 + t_2}$ d) $t_1 t_2$

1024. For what value of R in the circuit as shown in figure, current passing through 4Ω resistance will be zero.



a) 1 Ω b) 2 Ω c) 3 Ω d) 4 Ω

1025. In the adjoining circuit diagram each resistance is of 10 Ω. The current in the arm AD will be



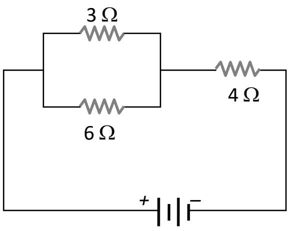
a) $\frac{2i}{5}$ b) $\frac{3i}{5}$ c) $\frac{4i}{5}$ d) $\frac{i}{5}$

1026. An electric fan and a heater are marked as 100 $watt$, 220 $volt$ and 1000 $watt$, 220 volt respectively. The resistance of the heater is

a) Zero b) Greater than that of the fan

c) Less than that of the fan d) Equal to that of the fan

1027. In the figure, current through the 3Ω resistor is 0.8 $ampere$, then potential drop through 4 Ω resistor is



a) 9.6 V b) 2.6 V c) 4.8 V d) 1.2 V

1028. In a potentiometer experiment two cells of e.m.f.' s E_1 and E_2 are used in series and in conjunction and the balancing length is found to be 58 cm of the wire. If the polarity of E_2 is reversed, then the balancing length becomes 29 cm. The ratio $\frac{E_1}{E_2}$ of the e.m.f. of the two cells is

a) 1 : 1 b) 2 : 1 c) 3 : 1 d) 4 : 1

1029. An energy source will supply a constant current into, the load, if its internal resistance is

a) Equal to the resistance of the load

b) Very large as compared to the load resistance

c) Zero

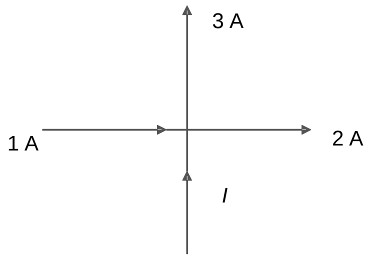
d) Non-zero but less than the resistance of the load

1030. The electric bulbs have tungsten filaments of same length. If one of then gives 60 $watt$ and other 100 $watt$,

0. then

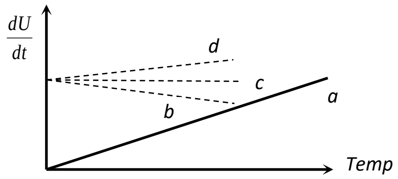
a) 100 *watt* bulb has thicker filament
b) 60 *watt* bulb has thicker filament
c) Both filaments are of same thickness
d) It is possible to get different wattage unless the lengths are different

1031. The value of current I in figure is



a) 4A | b) 6A | c) 3A | d) 5A

1032. A constant current i is passed through a resistor. Taking the temperature coefficient of resistance into account, indicate which of the plots shown in figure best represents the rate of production of thermal energy in the resistor



a) a | b) b | c) c | d) d

1033. A torch battery consists of two cells of 1.45 *volt* and an internal resistance 0.15 Ω. If each cell sends current through the filament of the lamps having resistance 1.5 *ohm*, the value of current will be

a) 16.11 *amp* | b) 1.611 *amp* | c) 0.1611 *amp* | d) 2.6 *amp*

1034. Thermoelectric constant of a thermocouple are α and β. Thermoelectric power at inversion temperature is

a) α | b) $-\alpha$ | c) $\frac{\alpha}{\beta}$ | d) $-\frac{\alpha}{\beta}$

1035. A galvanometer whose resistance is 120Ω gives full scale deflection with a current of 0.005 A so that it can read a maximum current of 10 A. A shunt resistance is added in parallel with it. The resistance of the ammeter so formed is

a) 0.06 Ω | b) 0.006 Ω | c) 0.6 Ω | d) 6 Ω

1036. An electron revolves 6×10^{15} *times/sec* in circular loop. The current in the loop is

a) 0.96 mA | b) 0.96 μA | c) 28.8 A | d) None of these

1037. A galvanometer of resistance 25 Ω measures 10^{-3}A. shunt required to increase range upto 2A is

a) 12.5 Ω | b) 0.125 Ω | c) 0.125 Ω | d) 1.25 Ω

1038. The maximum current that can be measured by a galvanometer of resistance 40Ω is 10mA. It is converted into a voltmeter that can read upto 50V. The resistance to be connected is series with the galvanometer (in ohm) is

a) 2010 | b) 4050 | c) 5040 | d) 4960

1039. A student has 10 resistors of resistance $'r'$. The minimum resistance made by him from given resistors is

a) 10 r | b) $\frac{r}{10}$ | c) $\frac{r}{100}$ | d) $\frac{r}{5}$

1040. n identical cells each of e. m. f. E and internal resistance r are connected in series. An external resistance R is connected in series to this combination. The current through R is

a) $\frac{nE}{R+nr}$ | b) $\frac{nE}{nR+r}$ | c) $\frac{E}{R+nr}$ | d) $\frac{nE}{R+r}$

1041. A thermoelectric refrigerator works on

a) Joule effect b) Seeback effect c) Peltier effect d) Thermonic emission

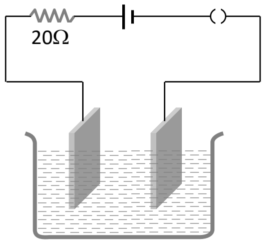
1042. A wire of length 100 cm is connected to a cell of emf 2 V and negligible internal resistance. The resistance of the wire is 3 Ω. The additional resistance required to produce a potential drop of 1 $milli\ volt$ per cm is

a) 60 Ω b) 47 Ω c) 57 Ω d) 35 Ω

1043. An electric bulb is rated $60W, 220V$. The resistance of its filament is

a) 708 Ω b) 870 Ω c) 807 Ω d) 780 Ω

1044. In a Ag voltameter 2.68 g of silver is deposited in 10 min. The heat developed in 20Ω resistor during the same period will be



a) 192 kJ b) 192 J c) 200 J d) 132 kJ

1045. A railway compartment is lit up by thirteen lamps each taking 2.1 A at 15 V. The heat generated per second in each lamp will be

a) 4.35 cal b) 5.73 cal c) 7.5 cal d) 2.5 cal

1046. If R_1 and R_2 be the resistances of the filaments of 200 W and 100 W electric bulbs operation at 220 V, then $\left(\frac{R_1}{R_2}\right)$ is

a) 1 b) 2 c) 0.5 d) 4

1047. In voltaic air cell if 5g zinc is consumed, how many ampere hours shall we get?

a) 2.05 b) 8.2 c) 4.1 d) $5 \times 5.38 \times 10^{-3}$

1048. A house, served by 220 V supply line, is protected by a 9 A fuse. The maximum number of 60 W bulbs in parallel that can be turned on is

a) 11 b) 22 c) 33 d) 44

1049. The temperature coefficient of resistance for a wire is $0.00125°\ C^{-1}$.At 300 K its resistance is 1 Ω.The temperature at which the resistance becomes 1.5 Ω is?

a) 450 K b) 727 K c) 454 K d) 900 K

1050. A 10 μF capacitor is charged to 500 V and then its plates are joined together through a resistance of 10 Ω. The heat produced in the resistance is

a) 500 J b) 250 J c) 125 J d) 1.25 J

1051. The ratio of the amounts of heat developed in the four arms of a balanced Wheatstone bridge, when the arms have resistance $P = 100\ \Omega;\ Q = 10\ \Omega; R = 300\ \Omega$ and $S = 30\ \Omega$ respectively is

a) 3 : 30 : 1 : 10 b) 30 : 3 : 10 :1 c) 30 : 10 : 1 : 3 d) 30 : 1 : 3 : 10

1052. If the resistivity of an alloy of ρ' and that of constituent metals is ρ, then

a) $\rho' > \rho$ b) $\rho' < \rho$
c) $\rho' = \rho$ d) There is no simple relation between ρ and ρ'

1053. The electrochemical equivalent of a material in an electrolyte depends on

a) The nature of the material
b) The current though the electrolyte
c) The amount of charge passed through electrolyte
d) The amount of material present in electrolyte

1054. A current passing through a copper voltmeter deposits 0.002 kg of copper on cathode plate in 100 min. If

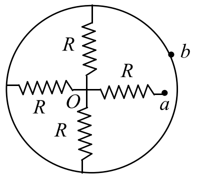
4. there are 10^{25} copper atoms in one kg of copper, the electric charge delivered to cathode by Cu^{++} ions per second will be

a) 0.53 C b) 0.71 C c) 1.06 C d) 10.06 C

1055. Resistance of a wire at 20°C is 20Ω and at 500°C is 60Ω. At what temperature its resistance is 25Ω?

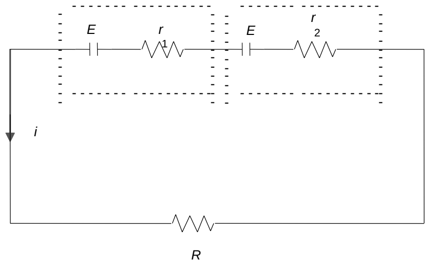
a) 160°C b) 250°C c) 100°C d) 80°C

1056. The equivalent resistance between points a and b of a network shown in the figure is given by



a) $\frac{3}{4}R$ b) $\frac{4}{3}R$ c) $\frac{5}{4}R$ d) $\frac{4}{5}R$

1057. If the potential difference across the internal resistance r_1 is equal to the emf E of the battery, then

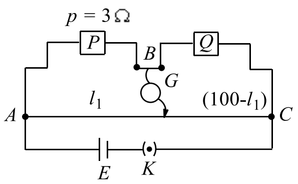


a) $R = r_1 + r_2$ b) $R = \frac{r_1}{r_2}$ c) $R = r_1 - r_2$ d) $R = \frac{r_2}{r_1}$

1058. In an electric heater 4 *amp* current passes for 1 *minute* at potential difference of 250 *volt*, the power of heater and energy consumed will be respectively

a) 1 kW, 60 kJ b) 0.5 kW, 30 kJ c) 10 kW, 600 kJ d) None of these

1059. In a metre bridge experiment, resistances are connected as shown in figure. The balancing length l_1 is 55 cm. Now an unknown resistance x is connected in series with P and the new balancing length is found to be 75 cm. The value of x is



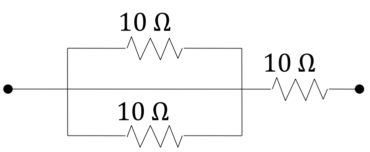
a) $\frac{54}{12}\Omega$ b) $\frac{20}{11}\Omega$ c) $\frac{48}{11}\Omega$ d) $\frac{11}{48}\Omega$

1060. The plates of a charged condenser is connected to a voltmeter. If the plates are moved apart, the reading of voltmeter will

a) Increase b) Decrease

c) Remain unchanged d) Information is insufficient

1061. Three equal resistances, each of 10 Ω are connected as shown in figure. The maximum power consumed by each resistance is 20 W. What is maximum power that can be consumed by the combination?

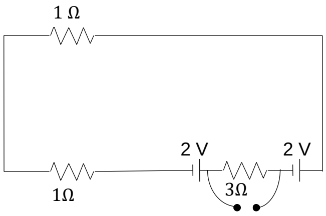


a) 5 W b) 15 W c) 30 W d) 60 W

1062. Two resistance wires on joining in parallel the resultant resistance is $\frac{6}{5}$ *ohms*. One of the wire breaks, the effective resistance is 2 *ohms*. The resistance of the broken wire is

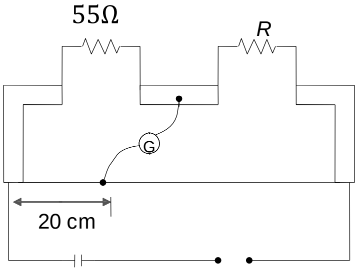
a) $\frac{3}{5}$ *ohm* b) 2 *ohm* c) $\frac{6}{5}$ *ohm* d) 3 *ohm*

1063. For the circuit shown in the figure the potential difference between A and B will be (in volt)



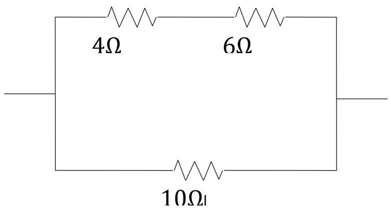
a) 2 b) 1.5 c) 1.0 d) Zero

1064. Shown in the figure adjacent is a meter-bridge set up with null deflection in the galvanometer. The value of the unknown resistor R is



a) 13.75 Ω b) 220 Ω c) 110 Ω d) 55 Ω

1065. The heat produced in 4 Ω resistance is 10 cal. The heat produced in 10 Ω resistance will be

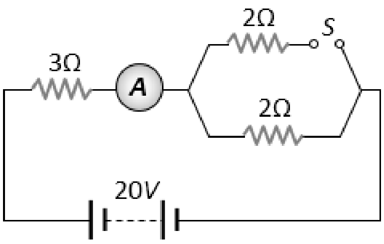


a) 25 cal b) 14 cal c) 10 cal d) 20 cal

1066. To liberate two litres of hydrogen at 222.4 atmosphere from acidulated water the quantity of electricity that must pass through is

a) 44.8 C b) 96500 C c) 193000 C d) 386000 C

1067. In the circuit shown, the reading of ammeter when switch S is open and when switch S is closed respectively are



a) 3 A and 4 A b) 4 A and 5 A c) 5 A and 6 A d) 6 A and 7 A

1068. In the process of electrolysis, the current is carried out inside the electrolyte by

a) Electrons b) Atoms
c) Positive and negative ions d) All the above

1069. The resistance of an ammeter is 3 Ω and its scale is graduated for a current upto 100A. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750A by this meter. The value of shunt resistance is

a) 20Ω b) 2 Ω c) 0.2 Ω d) 2K Ω

1070. The relation between Faraday's constant F, electron charge e and avogadro number N is

a) $F = N/e$ b) $F = Ne$ c) $N = F^2$ d) $F = N^2e$

1071. The resistance of a wire is 10Ω. Its length is increased by 10% by stretching. The new resistance will now be

a) 12Ω b) 1.2Ω c) 13Ω d) 11Ω

1072. The length of a given cylindrical wire is increased by 100%. Due to the consequent decrease in diameter the change in the resistance of the wire will be

a) 200 % b) 100 % c) 50 % d) 300 %

1073. The power of heater is 750 W at 1000°C. What will be its power at 200°C if $a = 4 \times 10^{-4}$ per°C ?

a) 400 W b) 990 W c) 250 W d) 1500 W

1074. Masses of the three wires of same material are in the ratio of 1: 2: 3 and their lengths in the ratio of 3: 2: 1. Electrical resistance of these wires will be in the ratio of

a) 1: 1: 1 b) 1: 2: 3 c) 9: 4: 1 d) 27: 6: 1

1075. A wire of diameter 0.02 *metre* contains 10^{28} free electrons per cubic metre. For an electrical current of 100 A, the drift velocity of the free electrons in the wire is nearly

a) $1 \times 10^{-19} m/s$ b) $5 \times 10^{-10} m/s$ c) $2 \times 10^{-4} m/s$ d) $8 \times 10^{3} m/s$

1076. Two uniform wires A and B are of the same metal and have equal masses. The radius of wire A is twice that of wire B. The total resistance of A and B when connected in parallel is

a) 4 Ω when the resistance of wire A is 4.25 Ω

b) 5 Ω when the resistance of wire A is 4.25 Ω

c) 4 Ω when the resistance of wire B is 4.25 Ω

d) 5 Ω when the resistance of wire B is 4.25 Ω

1077. A piece of fuse wire melts when a current of 15 *ampere* flows through it. With this current, if it dissipates 22.5 W, the resistance of fuse wire will be

a) Zero b) 10 Ω c) 1 Ω d) 0.10 Ω

1078. A current of 2.0 *ampere* passes through a cell of e.m.f. 1.5 *volt* having internal resistance of 0.15 *ohm*. The potential difference measured, in *volt*, across both the ends of the cell will be

a) 1.35 b) 1.50 c) 1.00 d) 1.20

1079. To draw maximum current from a combination of cells, how should the cells be grouped?

a) Parallel b) Series

c) Mixed grouped d) Depends upon the relative values of internal and external resistances

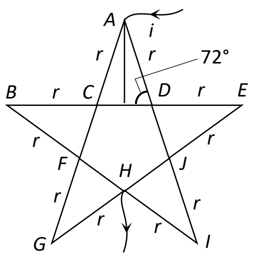
1080. *Watt-hour* meter measures

a) Electric energy b) Current c) Voltage d) Power

1081. A 12 HP motor has to be operated 8 h/day. How much will it cost at the rate of 50 $paise/kWh$ in 10 $days$?

a) Rs 347 b) Rs 358 c) Rs 375 d) Rs 397

1082. In the following star circuit diagram (figure), the equivalent resistance between the points A and H will be



a) 1.944 r b) 0.973 r c) 0.486 r d) 0.243 r

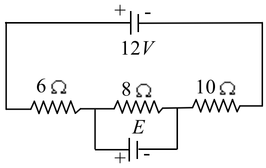
1083. A voltmeter has resistance of 2000 ohm and it can measure upto $2V$. If we want to increase its range to $10\ V$, then the required resistance in series will be

a) 2000 Ω b) 4000 Ω c) 6000 Ω d) 8000 Ω

1084. The thermocouple among the following that can produce maximum thermo-emf for the same temperature difference between the junction is

a) Fe-Cu b) Ag-Au c) Sb-Bi d) Cu-Pb

1085. In the circuit shown, the current though 8 ohm is same before and after connecting E. The value of E is

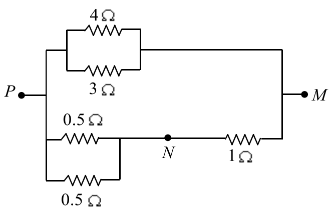


a) $12\ V$ b) $6\ V$ c) $4\ V$ d) $2\ V$

1086. Heat produced in a wire of resistance R due to current flowing at constant potential difference is proportional to

a) $\frac{1}{R^2}$ b) $\frac{1}{R}$ c) R d) R^2

1087. In the circuit shown, the current through the 4 Ω resistor is 1 amp when the points P and M are connected to a d.c. voltage source. The potential difference between the points M and N is



a) $0.5\ V$ b) $3.2\ V$ c) $1.5\ V$ d) $1.0\ V$

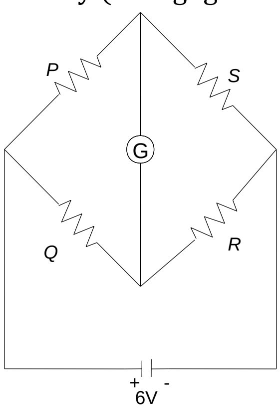
1088. The thermo emf of a thermo-couple is found to depend on temperature T(in degree Celsius) as $E = 4T - \frac{T^2}{200}$, where T°C is the temperature of the hot junction. The neutral and inversion temperature of the thermocouple are (in degree celsius)

a) 100, 200 b) 200, 400 c) 300, 600 d) 400, 800

1089. In the above question, the resistance between the square faces is

a) $3 \times 10^{-9} ohm$ b) $3 \times 10^{-7} ohm$ c) $3 \times 10^{-5} ohm$ d) $3 \times 10^{-3} ohm$

1090. In the Wheatstone's network given, P=10 Ω, $Q = 20\Omega$, R=15 Ω, S=30 Ω, the current passing through the battery (of negligible internal resistance) is



a) 0.36A b) Zero c) 0.18A d) 0.72A

1091. When a current is passed in a conductor, 3°C rise in temperature is observed. If the strength of current is increased by two times, then rise in temperature will approximately be

a) 36°C b) 27°C c) 18°C d) 9°C

1092. To get a maximum current through a resistance of 2.5Ω, one can use m rows of cells each row having n

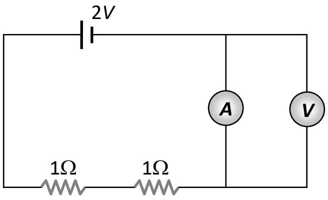
2. cells. The internal resistance of each cell is 0.5Ω. What are the values of m and n if the total number of cells are 20?

a) $m = 2, n = 10$ b) $m = 4, n = 5$ c) $m = 5, n = 4$ d) $n = 2, m = 10$

1093. If an ammeter is joined in parallel through a circuit, it can be damaged due to excess

a) Resistance b) Current c) Voltage d) None of these

1094. In the circuit shown, A and V are ideal ammeter and voltmeter respectively. Reading of the voltmeter will be



a) $2\,V$ b) $1\,V$ c) $0.5\,V$ d) Zero

1095. Two identical batteries each of emf 2 V and internal resistance 1 Ω are available to produce heat in an external resistance by passing current through it. The maximum Joulean power that can be developed across the resistance using these batteries it.

a) 2W b) 3.2 W c) 1.28 W d) 8/9 W

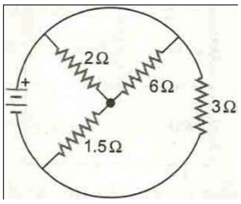
1096. When the temperature difference between hot and cold junctions of a thermo-couple is 100 K an emf of 1 V is generated. Assume the cold junction is heated by 20 K, the percentage change in thermo emf is

a) 20% b) 30% c) 40% d) 25%

1097. There are n similar conductors each of resistance R. The resultant resistance comes out to be x when connected in parallel. If they are connected in series, the resistance comes out to be

a) x/n^2 b) n^2x c) x/n d) nx

1098. The total current supplied to the circuit by the battery as shown figure is



a) 1A b) 6A c) 4A d) 2A

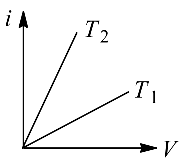
1099. A galvanometer has a resistance of 25 ohm and a maximum of 0.01 A current can be passed through it. In order to change it into an ammeter of range 10 A, the shunt resistance required is

a) $5/999\ ohm$ b) $10/999\ ohm$ c) $20/999\ ohm$ d) $25/999\ ohm$

1100. In cosmic rays 0.15 protons $cm^{-2}\ sec^{-1}$ are entering the earth's atmosphere. If the radius of the earth is 6400 km, the current received by the earth in the form of cosmic rays is nearly.

a) 0.12 A b) 1.2 A c) 12 A d) 120 A

1101. The current i and voltage V graphs for a given metallic wire at two different temperatures T_1 and T_2 are shown in the figure. It is concluded that



a) $T_1 > T_2$ b) $T_1 < T_2$ c) $T_1 = T_2$ d) $T_1 = 2T_1$

1102. In a region 10^{19} α −particales and 10^{19} protons move to the left, while 10^{19} electrons move to the right per second. The current is

a) 3.2 A towards left b) 3.2 A towards right c) 6.4 A towards left d) 6.4 A towards right

1103. An electric heater rated 220 V and 550 W is connected to AC mains. The current drawn by it is

a) 0.8 A b) 2.5 A c) 0.4 A d) 1.25 A

1104. A galvanometer has 30 divisions and a sensitivity 16 μA/div. It can be converted into a voltmeter to read 3 V by connecting

a) Resistance nearly 6 k Ω in series
b) $6k$ Ω in parallel
c) 500 Ω in series
d) It cannot be converted

1105. Three resistors are connected to form the sides of a triangle ABC, the resistance of the sides AB, BC and CA are 40 ohm, 60 ohm and 100 ohm respectively. The effective resistance between the points A and B in ohm will be

a) 32
b) 64
c) 50
d) 200

1106. A potentiometer wire of length $1m$ and resistance 10 Ω is connected in series with a cell of emf $2V$ with internal resistance 1 Ω and a resistance box including a resistance R. If potential difference between the ends of the wire is 1 mV, the value of R is

a) 20000 Ω
b) 19989 Ω
c) 10000 Ω
d) 9989 Ω

1107. An external resistance R is connected to a battery of $e.$m.f. V and internal resistance r. The joule heat produced in resistor R is maximum when R is equal to

a) r
b) $\frac{r}{2}$
c) $2r$
d) Infinitely large

1108. Two bulbs of 500 W and 200 W are manufactured to operate on 220 V line. The ratio of heat produced in 500 W and 200 W, in two cases, when firstly they are connected in parallel and secondly in series will be

a) $\frac{5}{2}:\frac{2}{5}$
b) $\frac{5}{2}:\frac{5}{2}$
c) $\frac{2}{5}:\frac{5}{2}$
d) $\frac{2}{5}:\frac{2}{5}$

1109. The current in a simple series circuit is 5.0.A. when an additional resistance of 2.0 Ω is inserted, the current drops to 4.0 A. the original resistance of the circuit in ohm was

a) 1.25
b) 8
c) 10
d) 20

1110. When connected across the terminals of a cell, a voltmeter measures $5V$ and a connected ammeter measures 10 A of current. A resistance of 2 ohm is connected across the terminals of the cell. The current flowing through this resistance will be

a) 2.5 A
b) 2.0 A
c) 5.0 A
d) 7.5 A

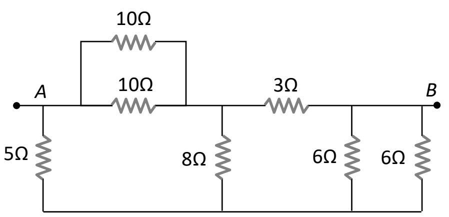
1111. In a potentiometer experiment for measuring the emf of a cell, the null point is at 480 cm when we have a 400 Ω resistor in series with the cell and galvanometer. If the series resistances is reduced to half, the null point will be at

a) 120 cm
b) 240 cm
c) 480 cm
d) 600 cm

1112. An aluminium (Al) rod with area of cross-section $4 \times 10^{-6} m^2$ has a current of 5 A flowing through it. Find the drift velocity of electron in the rod. Density of Al= 2.7×10^3 kgm^{-3} and atomic wt.=27u. Assume that each Al atom provides one electron.

a) $8.6 \times 10^{-4} ms^{-1}$
b) $1.3 \times 10^{-4} ms^{-1}$
c) $2.8 \times 10^{-2} ms^{-1}$
d) $3.8 \times 10^{-3} ms^{-1}$

1113. Seven resistance are connected as shown in the figure. The equivalent resistance between A and B is



a) 3 Ω
b) 4 Ω
c) 4.5 Ω
d) 5 Ω

1114. In a conductor if 3000 coulomb of charge enters and 3000 coulomb of charge exits in time 10 minutes, then the current is

a) 5 ampere
b) 10 ampere
c) 2.5 ampere
d) Zero

1115. There are 8 equal resistance R. Two are connected in parallel, such four groups are connected in series, the total resistance of the system will be

a) $R/2$
b) 2 R
c) 4 R
d) 8 R

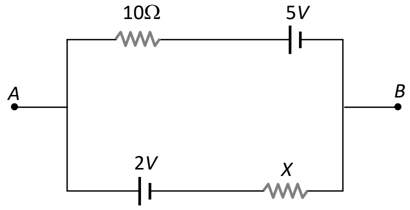
1116. Fifty electric bulbs, all identical, are connected in series across the mains of a 220 V supply. After one bulb is fused, the remaining 49 bulbs connected in series across the same mains. The illumination will be

a) More with 50 bulbs than with 48 bulbs
b) More with 49 bulbs than with 50 bulbs

c) Equal in both cases

d) In the ratio $(50)^2 : (49)^2$ in the first and second case respectively

1117. If $V_{AB} = 4V$ in the given figure, then resistance X will be



a) 5 Ω b) 10 Ω c) 15 Ω d) 20 Ω

1118. A current i passes through a wire of length l, radius of cross-section r and resistivity ρ. The rate of heat generation is

a) $\frac{i^2 l\rho}{\pi r^2}$ b) $i^2\left(\frac{l\rho}{\pi r^2}\right)^2$ c) $i^2 l\,\rho/r$ d) $il\,\rho/r$

1119. Two wires that are made up of two different materials whose specific resistance are in the ratio 2 : 3, length 3 : 4 and area 4 : 5. The ratio of their resistances is

a) 6 : 5 b) 6 : 8 c) 5 : 8 d) 1 : 2

1120. Two electric bulbs ($60W$ and $100W$ respectively) are connected in series. The current passing through them is

a) More in $100W$ bulb b) More in $60W$ bulb c) Same in both d) None of these

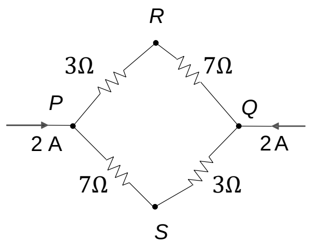
1121. Twelve wires of equal resistance R are connected to form a cube. The effective resistance between two opposite diagonal ends will be

a) $(5/6)R$ b) $(6/5)R$ c) $3R$ d) $12R$

1122. E.C.E. of Cu and Ag are 7×10^{-6} and 1.2×10^{-6}. A certain current deposits 14 gm of Cu. Amount of Ag deposited is

a) 1.2 gm b) 1.6 gm c) 2.4 gm d) 1.8 gm

1123. A current of 2A flows in an electric circuit as shown in figure. The potential difference$(V_R - V_S)$, in volts($V_R - V_S$ are potentials at R and S respectively) is

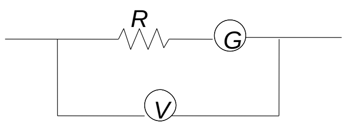


a) -4 b) +2 c) +4 d) -2

1124. Two wires of the same dimensions but resistivities ρ_1 and $\rho_2$are connected in series. The equivalent resistivity of the combination is

a) $\frac{\rho_1 + \rho_2}{2}$ b) $\rho_1 + \rho_2$ c) $2(\rho_1 + \rho_2)$ d) $\sqrt{\rho_1 \rho_2}$

1125. If resistance of voltmeter is 10000Ω and resistance of galvanometer is 2Ω, then find $R$when voltmeter reads 12V and galvanometer reads 0.1A.



a) 118Ω b) 120Ω c) 124Ω d) 114Ω

1126. A 25 W, 220 V bulb and a 100 W, 220 V bulb are connected in parallel across a 440 V line

a) Only 100 $watt$ bulb will fuse

b) Only 25 $watt$ bulb will fuse

c) Both bulbs will fuse

d) None of the bulbs will fuse

1127. A battery is made by connecting 6 cells each having capacity 5 Ah at 1.5V. The battery will have capacity equal to

a) 20 Ah at 9 V b) 30 Ah at 1.5 V c) 5 Ah at 9 V d) 5 Ah at 1.5 V

1128. If a wire of resistance 20Ω is covered with ice and a voltage of 210 V is applied across the wire, then the rate of melting of ice is

a) $0.85 g/s$ b) $1.92 g/s$ c) $6.56 g/s$ d) All of these

1129. A voltmeter of resistance 1000Ω gives full scale deflection when a current of 100 mA flows through it. The shunt resistance required across it to enable it to be used as an ammeter reading 1 A at full scale deflection is

a) 10000Ω b) 9000Ω c) 222Ω d) 111Ω

1130. A certain wire has a resistance R. The resistance of another wire identical with the first except having twice its diameter is

a) 2 R b) 0.25 R c) 4 R d) 0.5 R

1131. As the temperature of hot junction increases, the thermo e.m.f

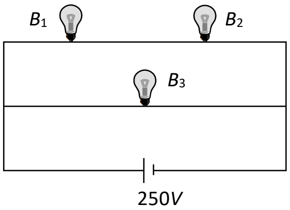
a) Always increases b) Always decreases

c) May increases or de decreases d) Always remains constant

1132. A uniform wire of 16 Ω is made into the form of square. Two opposite corners of the square are connected by a wire of resistance 16Ω. The effective resistance between the other two opposite corners is

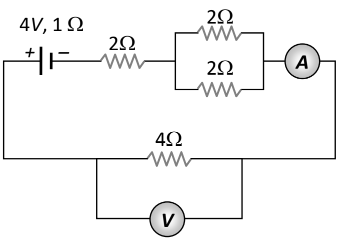
a) 32Ω b) 20Ω c) 8Ω d) 4Ω

1133. A 100 W bulb B_1, and two 60-W bulbs B_2 and B_3, are connected to a 250 V source, as shown in the figure. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3, respectively. Then



a) $W_1 > W_2 = W_3$ b) $W_1 > W_2 > W_3$ c) $W_1 < W_2 = W_3$ d) $W_1 < W_2 < W_3$

1134. What is the equivalent resistance of the circuit



a) 6 Ω b) 7 Ω c) 8 Ω d) 9 Ω

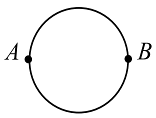
1135. An immersion heater is rated 836 $watt$. It should heat 1 $litre$ of water from 10°C to 40°C in about

a) 200 sec b) 150 sec c) 836 sec d) 418 sec

1136. A resistance of 2 Ω is connected across one gap of a meter-bridge(the length of the wire is 100cm) and an unknown resistance, greater than 2 Ω is connected across the other gap. When these resistances are interchanged, the unknown resistance is

a) 3 Ω b) 2 Ω c) 4 Ω d) 6 Ω

1137. A wire of resistance 12 ohms per meter is bent to form a complete circle of radius 10 cm. The resistance between its two diametrically opposite points A and B as shown in the figure, is



a) 0.6π Ω b) 3 Ω c) 6π Ω d) 6 Ω

1138. Metals have

8.

a) Zero resistivity b) High resistivity c) Low resistivity d) Infinite resistivity

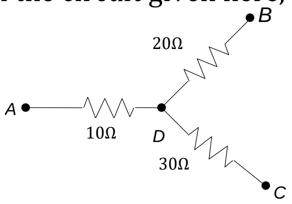
1139. A galvanometer acting as a voltmeter should have

a) Low resistance in series with its coil b) Low resistance in parallel with its coil
c) High resistance in series in series with its coil d) High resistance in parallel with its coil

1140. The electromotive force of a primary cell is 2 $volt$. When it is short-circuited it gives a current of 4 $ampere$. Its internal resistance in ohm is

a) 0.5 b) 5.0 c) 2.0 d) 8.0

1141. In the circuit given here, the points A, B and C are 70V, zero, 10 V respectively. Then



a) The point D will be at a potential of 60V
b) The point D will be at a potential of 20V
c) Currents in the path AD, DB and DC are in the ratio of 1:2:3
d) Currents in the path AD, DB and DC are in the ratio of 3 : 2 : 1

1142. A 500 W heating unit is designed to operate from a 115 $volt$ line. If the line voltage drops to 110 volt, the percentage drop in heat output will be

a) 10.20% b) 8.1% c) 8.6% d) 7.6%

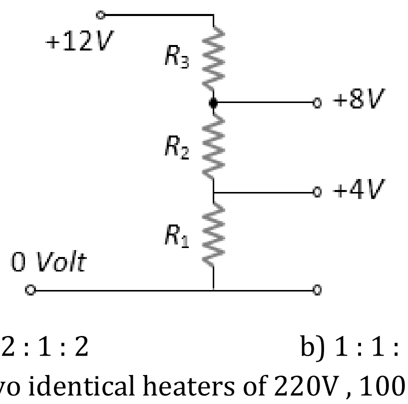
1143. Resistors P and Q are connected in the gaps of the meter bridge. The balancing point is obtained $\frac{1}{3}$ m from the zero end. If a 6 Ω resistance is connected in series with P the balance point shifts to $\frac{2}{3}$ m from the same end. P and Q are

a) 4,2 b) 2,4
c) Both (a) and (b) d) Neither (a) nor (b)

1144. 4 cells each of emf 2 V and internal resistance of 1Ω are connected in parallel to a load resistor of 2Ω. Then the current through the load resistor is

a) 2 A b) 1.5 A c) 1 A d) 0.888 A

1145. A potential divider is used to give outputs of 4 V and 8 V from a 12 V source. Which combination of resistances, $(R_1 : R_2 : R_3)$ gives the correct voltages?



a) 2 : 1 : 2 b) 1 : 1 : 1 c) 2 : 2 : 1 d) 1 : 1 : 2

1146. Two identical heaters of 220V , 1000 W are placed in parallel with each other across 220V line, then the combined power is

a) 1000 W b) 2000 W c) 500 W d) 4000 W

1147. Length of a hollow tube is 5m, it's outer diameter is 10 cm and thickness of it's wall is 5 mm. If resistivity of the material of the tube is $1.7 \times 10^{-8} \Omega \times m$ then resistance of tube will be

a) $5.6 \times 10^{-5} \Omega$ b) $2 \times 10^{-5} \Omega$ c) $4 \times 10^{-5} \Omega$ d) None of these

114 The mass of ions deposited during a given interval of time in the process of electrolysis depends on

8.

a) The current b) The resistance c) The temperature d) The electric power

1149. A current of 0.01mA passes through the potentiometer wire of a resistivity of 10^9 Ω-cm and area of cross-section 10^{-2}cm^2. The potential gradient is

a) 10^9Vm^{-1} b) 10^{11}Vm^{-1} c) 10^{10}Vm^{-1} d) 10^8Vm^{-1}

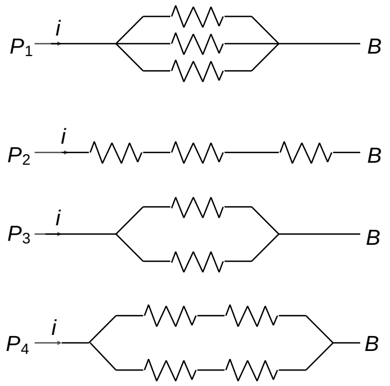
1150. A galvanometer of resistance 25Ω giving full scale deflection for a current of 10 *milliampere*, is to be changed into a voltmeter of range 100 V by connecting a resistance of $'R'$ in series with galvanometer. The value of resistance R in Ω is

a) 10000 b) 10025 c) 975 d) 9975

1151. n conducting wires of same dimensions but having resistivites 1,2,3.....n are connected in series. The equivalent resistivity of the combinations is

a) $\frac{n(n+1)}{2}$ b) $\frac{n+1}{2}$ c) $\frac{n+2}{2n}$ d) $\frac{2n}{n+1}$

1152. Arrange the order of power dissipated in the given circuits, if the same current is passing through all the circuits. The resistance of each resistor is r.



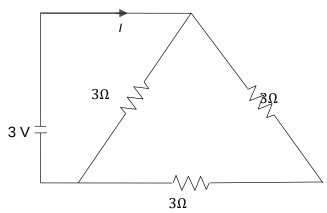
a) $P_1 > P_2 > P_3 > P_4$ b) $P_2 > P_3 > P_4 > P_1$

c) $P_4 > P_3 > P_2 > P_1$ d) $P_1 = P_2 = P_3 = P_4$

1153. Three electric bulbs of rating 60W each are joined in series and then connected to electric mains. The power consumed by these three bulbs will be

a) 180 W b) 60 W c) 20 W d) $\frac{20}{3}W$

1154. A 3 V battery with negligible internal resistance is connected in a circuit as shown in the figure. The current I, in the circuit will be



a) 1A b) 1.5A c) 2A d) $\frac{1}{3}A$

1155. Two conductors of the same material have their diameters in the ratio 1 : 2 and their lengths in the ratio 2 : 1. If the temperature difference between their ends is the same, then the ratio of amounts of heat conducted per second through them will be

a) 4 : 1 b) 1 : 4 c) 8 : 1 d) 1 : 8

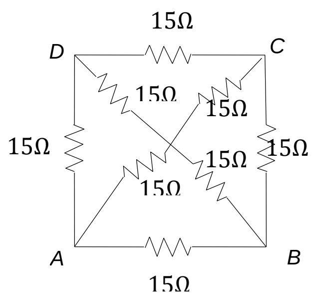
1156. An electric kettle boils some water in 16 min. Due to some defect, it becomes necessary to remove 10% turns of heating coil of the kettle. Now, how much time will it take to boil the same of water?

a) 17.7 min b) 14.4 min c) 20.9 min d) 13.7 min

1157. A rod of a certain metal is 1.0 m long and 0.6 cm in diameter. Its resistance is 3.0×10^{-3}Ω. Another disc made of the same metal is 2.0 cm in diameter and 1.0 mm thick. What is the resistance between the round faces of the disc?

a) 1.35×10^{-8}Ω b) 2.70×10^{-7}Ω c) 4.05×10^{-6}Ω d) 8.10×10^{-5}Ω

1158. The equivalent resistance between the points A and B will be (each resistance is 15 Ω)



a) 30 Ω b) 8 Ω c) 10 Ω d) 40 Ω

1159. An ammeter, suspected to give inaccurate reading, is connected in series with a *silver* voltameter. The ammeter indicates 0.54 A. A steady current passed for one hour deposits 2.0124 g of *silver*. If the E.C.E. of *silver* is $1.118 \times 10^{-3} g/C^{-1}$, then the error in ammeter reading is

a) $+0.04\ A$ b) $+0.02\ A$ c) $-0.03\ A$ d) $-0.01\ A$

1160. The cell has an emf of 2V and the internal resistance of 3.9 Ω, the voltage across the cell will be

a) 1.95 V b) 1.5V c) 2V d) 1.8V

1161. Two bulbs of 100 W and 200 W working at 220 V are joined in series with 220 V supply. Total power consumed will be

a) 65 W b) 33 W c) 300 W d) 100 W

1162. A current of 1 mA is flowing through a copper wire. How many electrons will pass a given point in one *second*

$[e = 1.6 \times 10^{-19} Coulomb]$

a) 6.25×10^{19} b) 6.25×10^{15} c) 6.25×10^{31} d) 6.25×10^{8}

1163. A wire of resistance R is elongated $n -$ fold to make a new uniform wire. The resistance of new wire

a) nR b) n^2R c) $2nR$ d) $2n^2R$

1164. Three unequal resistors in parallel are equivalent to a resistance 1 Ω. If two of them are in the ratio 1:2 and if no resistance value is fractional, the largest of the three resistance in ohm is

a) 4 b) 6 c) 8 d) 12

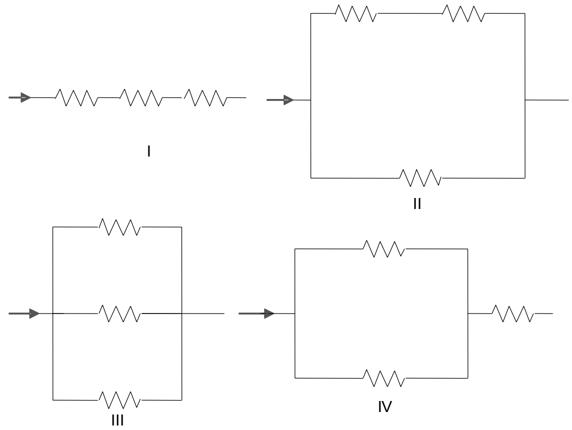
1165. An electric kettle has two heating coils. When one coil is used, water in the kettle boils in 5 minutes, while when second coil is used, same water boils in 10 minutes. If the two coils, connected in parallel are used simultaneously, the same water will boil in time

a) 3 *min* 20 *sec* b) 5 *min* c) 7 *min* 30 *sec* d) 2 *min* 30 *sec*

1166. An electric kettle takes 4 A current at 220 V. How much time will it take to boil 1 kg of water from room temperature 20°C? The temperature of boiling water is 100°C

a) 0.63 *minutes* b) 6.3 *minutes* c) 12.6 *minutes* d) 12.8 *minutes*

1167. The three resistances of equal value are arranged in the different combinations shown below. Arrange them in increasing order of power dissipation



a) III < II < IV <I b) II < III < IV < I c) I < IV < III < II d) I < III < II < IV

1168. When a metal conductor connected to the left gap of a meter bridge is heated, the balancing point

a) Shifts towards right b) Shifts towards left
c) Remains unchanged d) Remains at zero

1169. The electro chemical equivalent of metal is $3.3 \times 10^{-7} \text{kgC}^{-1}$. The mass of the metal liberated at the cathode when a 3 A current is passed for 2 s, will be

a) 19.8×10^{-7} kg b) 9.9×10^{-7} kg c) 6.6×10^{-7} kg d) 1.1×10^{-7} kg

1170. The resistance of a wire of iron is 10 ohm and temp. coefficient of resistance is 5×10^{-3}/°C. At 20°C it carries 30 $milliampere$ of current. Keeping constant potential difference between its ends, the temperature of the wire is raised to 120°C. The current in $milliampere$ that flows in the wire is

a) 20 b) 15 c) 10 d) 40

1171. One $kilowatt$ hour is equal to

a) 36×10^5 $joules$ b) 36×10^3 $joules$ c) 10^3 $joules$ d) 10^5 $joules$

1172. A battery of 6 volts is connected to the terminals of a three metre long wire of uniform thickness and resistance of the order of 100Ω. The difference of potential between two points separated by 50 cm on the wire will be

a) 1 V b) 1.5 V c) 2 V d) 3 V

1173. Two resistances of 400 Ω and 800 Ω are connected in series with 6 $volt$ battery of negligible internal resistance. A voltmeter of resistance 10,000 Ω is used to measure the potential difference across 400 Ω. The error in the measurement of potential difference in $volt$ approximately is

a) 0.01 b) 0.02 c) 0.03 d) 0.05

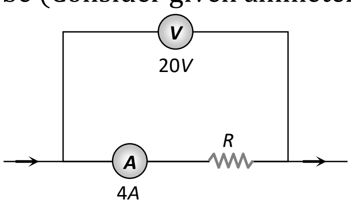
1174. If potential $V = 100 \pm 0.5$ $Volt$ and current $I = 10 \pm 0.2$ amp are given to us, then what will be the value of resistance

a) 10 ± 0.7 ohm b) 5 ± 2 ohm c) 0.1 ± 0.2 ohm d) None of these

1175. An electric bulb rated for 500 W at 100V is used in a circuit having a 200 V supply. The resistance R that must be put in series with the bulb, so that the bulb drawn 500 W is

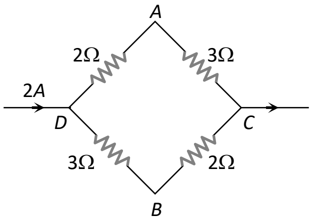
a) 18Ω b) 20Ω c) 40Ω d) 700Ω

1176. In the diagram shown, the reading of voltmeter is 20 V and that of ammeter is 4 A. The value of R should be (Consider given ammeter and voltmeter are not ideal)



a) Equal to 5 Ω b) Greater than 5 Ω
c) Less than 5 Ω d) Greater or less than 5 Ω depending on the material of R

1177. A current of 2 A flows in a system of conductors as shown. The potential difference $(V_A - V_B)$ will be



a) $+2V$ b) $+1V$ c) $-1V$ d) $-2V$

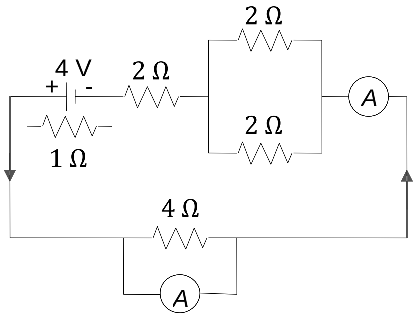
1178. A bulb has specification of one kilowatt and 250 $volts$, the resistance of bulb is

a) 125 Ω b) 62.5 Ω c) 0.25 Ω d) 625 Ω

1179. The direction of current in an iron-copper thermocouple is

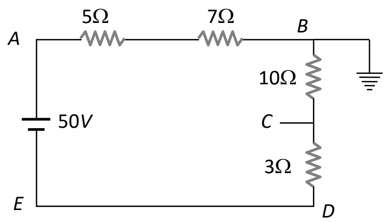
a) From copper to iron at the hot junction b) From iron to copper at the hot junction
c) From copper to iron at cold junction d) No current will flow

1180. What is the total resistance of the circuit?



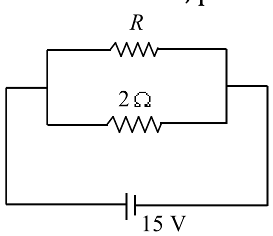
a) 6 Ω b) 7 Ω c) 8 Ω d) 9 Ω

1181. In the circuit shown, the point $'B'$ is earthed. The potential at the point $'A'$ is



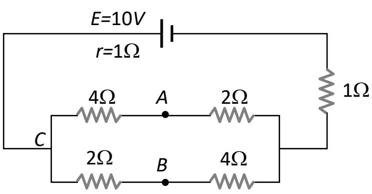
a) 14 V b) 24 V c) 26 V d) 50 V

1182. If in the circuit, power dissipation is 150 W, then R is



a) 2 Ω b) 6 Ω c) 5 Ω d) 4 Ω

1183. In the circuit shown below, the cell has an e.m.f. of 10 V and internal resistance of 1 ohm. The other resistances are shown in the figure. The potential difference $V_A - V_B$ is



a) 6 V b) 4 V c) 2 V d) -2 V

1184. A Daniel cell is balanced on 125cm length of a potentiometer wire. Now the cell is short-circuited by a

4. resistance 2 ohm and the balance is obtained at 100 cm. The internal resistance of the Daniel cell is

a) 0.5 ohm b) 1.5 ohm c) 1.25 ohm d) 4/5 ohm

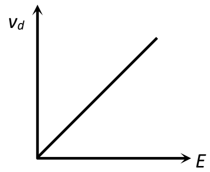
118 Charge Q is divided into two parts which are then kept some distance apart. The force between them will
5. be maximum if the two parts are having the charge

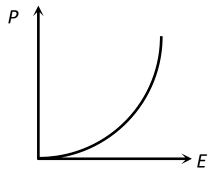
a) $Q/2$ each
b) $Q/4$ and $3Q/4$
c) $Q/3$ and $2Q/3$
d) e and $(Q-e)$,where e =electronic charge

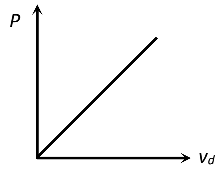
118 When 1 g hydrogen (ECE $= 1.044\times 10^{-8}$ kg C^{-1}) forms water, 34 kcal heat is liberated. The minimum
6. voltage required to decompose water is

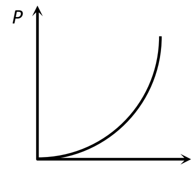
a) 0.75 V b) 3 V c) 1.5 V d) 4.5 V

118 E denotes electric field in a uniform conductor, I corresponding current through it, v_d drift velocity of
7. electrons and P denotes thermal power produced in the conductor, then which of the following graph is incorrect

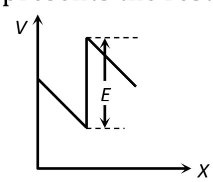
a) 

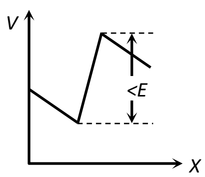
b) 

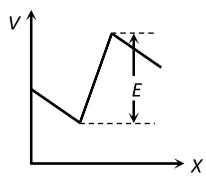
c) 

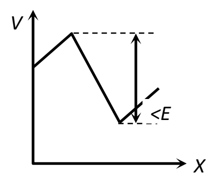
d) 

118 The two ends of a uniform conductor are joined to a cell of e.m.f. E and some internal resistance. Starting
8. from the midpoint P of the conductor, we move in the direction of current and return to P. The potential V at every point on the path is plotted against the distance covered (x). Which of the following graphs best represents the resulting curve

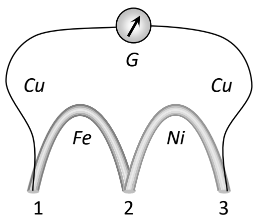
a) 

b) 

c) 

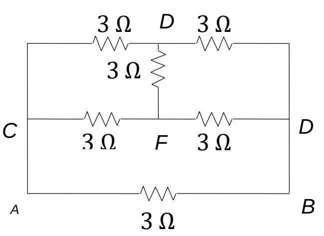
d) 

118 Three wires of copper, iron and nickel are joined to form three junctions as shown in Fig. When the
9. temperature of junction 1 is kept 50°C with the other two junctions at 0°C, the sensitive galvanometer gives a deflection of 14 divisions. When the temperature of junction 3 is kept 50°C, with the other two junctions at 0°C, the galvanometer gives a deflection of 11 divisions. Then the deflection given by the galvanometer, when temperature of the junction 2 is kept at 50°C, with the other two junctions at 0°C, will be



a) 3 div b) 11 div c) 14 div d) 25 div

119 Six resistors, each of value 3 Ω are connected as shown in the figure. A cell of emf 3V is connected across
0. AB. The effective resistance across AB and the current through the arm AB will be

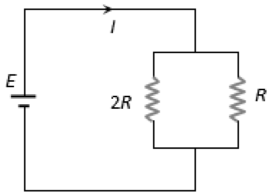


a) 0.6 Ω, 1 A b) 1.5 Ω , 2 A c) 0.6Ω,2 A d) 1.5 Ω, 1 A

119 In Seebeck series Sb appears before Bi. In a $Sb - Bi$ thermocouple current flows from
1.

a) Sb to Bi at the hot junction
b) Sb to Bi at the cold junction
c) Bi to Sb at the cold junction
d) None of the above

1192. What is the ratio of heat generated in R and $2R$

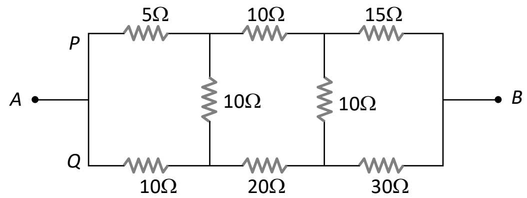


a) 2 :1 b) 1 :2 c) 4 :1 d) 1 :4

1193. Which of the following statement is correct

a) Electric field is zero on the surface of current carrying wire
b) Electric field is non-zero on the axis of hollow current carrying wire
c) Surface integral of magnetic field for any closed surface is equal to μ_0 times of total algebraic sum of current which are crossing through the closed surface
d) None

1194. In the arrangement of resistance shown below, the effective resistance between points A and B is



a) 20 Ω b) 30 Ω c) 90 Ω d) 110 Ω

1195. If 10 A deposits 10.8 g of silver in 25 min, how much copper would deposit when 9 A current flows for 20 min.?

a) 3.81 g b) 6.35 g c) 10.1 g d) 12.7 g

1196. The relation between Faraday constant (F), chemical equivalent (E) and electrochemical equivalent (Z) is

a) $F = EZ$ b) $F = \frac{Z}{E}$ c) $F = \frac{E}{Z}$ d) $F = \frac{E}{Z^2}$

1197. Two resistances are joined in parallel whose resistance is 3/5Ω. One of the resistance wire is broken and the effective resistance become 3Ω.The resistance in ohm of the wire that got broken was

a) 4/3 b) 2 c) 6/5 d) 3/4

1198. A moving coil galvanometer has a resistance of 10Ω and full scale deflection of 0.01A. It can be converted into voltmeter of 10V full scale by connecting into resistance of

a) 9.90Ω is series b) 10Ω in series c) 990Ω in series d) 0.10Ω in series

1199. If a high power heater is connected to electric mains, then the bulbs in the house become dim, because there is a

a) Current drop b) Potential drop c) No current drop d) No potential drop

1200. A 10 m long wire of 20Ω resistance is connected with a battery of 3 $volt$ e.m.f. (negligible internal resistance) and a 10 Ω resistance is joined to it is series. Potential gradient along wire in volt per meter is

a) 0.02 b) 0.3 c) 0.2 d) 1.3

1201. A certain charge liberates 0.8 gm of O_2. The same charge will liberate how many gm of silver

a) 108 gm b) 10.8 gm c) 0.8 gm d) $\frac{108}{0.8}gm$

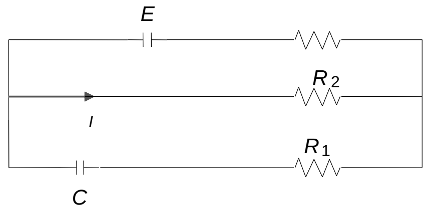
1202. A student measures the terminal potential difference (V) of a cell (of emf E and internal resistance r) as a function of the current (I) flowing through it. The slope, and intercept, of the graph between V and I, then, respectively, equal

a) E and $-r$ b) $-r$ and E c) r and $-E$ d) $-E$ and r

1203. The charge on the capacitor of capacitance C shown in the figure below will be

2Ω

3.

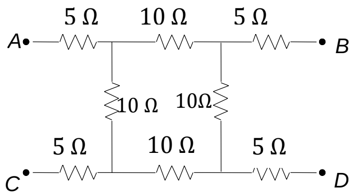


a) CE b) $\frac{CER_1}{R_1 + r}$ c) $\frac{CER_2}{R_2 + r}$ d) $\frac{CER_2}{R_1 + r}$

1204. A meter bridge is used to determine the resistance of an unknown wire by measuring the balance point length l. If the wire is replaced by another wire of same material but with double the length and half the thickness, the balancing point is expected to be

a) $\frac{1}{8l}$ b) $\frac{1}{4l}$ c) $8l$ d) $16l$

1205. The equivalent resistance between the terminals A and B in the following circuit is



a) $10\ \Omega$ b) $20\ \Omega$ c) $5\ \Omega$ d) $30\ \Omega$

1206. A block has dimensions $1\ cm$, $2\ cm$, $3\ cm$. Ratio of the maximum resistance to minimum resistance between any point of opposite faces of this block is

a) 9 : 1 b) 1 : 9 c) 18 : 1 d) 1 : 6

1207. Two rods of same material and length have their electric resistances in ratio 1 : 2. When both rods are dipped in water, the correct statement will be

a) A has more loss of weight
b) B has more loss of weight
c) Both have same loss of weight
d) Loss of weight will be in the ratio 1 : 2

1208. Three resistances each of 1 ohm, are joined in parallel. Three such combinations are put in series, then the resultant resistance will be

a) 9 ohm b) 3 ohm c) 1 ohm d) $\frac{1}{3}\ ohm$

1209. As the temperature of hot junction of a thermo-couple is increased (while cold junction is at constant temperature), the thermo e.m.f

a) Increases uniformly at constant rate
b) Increases slowly in the beginning and more rapidly at higher temperatures
c) Increases more rapidly in the beginning but less rapidly at higher temperatures
d) Is minimum at neutral temperature

1210. Pick out the wrong statement

a) In a simple battery circuit, the point of lowest potential is the negative terminal of the battery
b) The resistance of an incandescent lamp is greater when the lamp is switched off
c) An ordinary 100 W lamp has less resistance than a 60 W lamp
d) At constant voltage, the heat developed in a uniform wire varies inversely as the length of the wire used

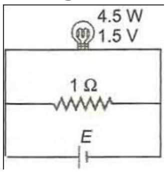
1211. A moving coil galvanometer is converted into an ammeter reading upto 0.03 A by connecting a shunt of resistance $4r$ across it and into an ammeter reading upto 0.06 A when a shunt of resistance r is connected across it. What is the maximum current which can be sent through this galvanometer if no shunt is used

a) 0.01 A b) 0.02 A c) 0.03 A d) 0.04 A

1212. In a Wheatstone's bridge all the four arms have equal resistance R. If the resistance of the galvanometer arm is also R, the equivalent resistance of the combination as seen by the battery is

a) $R/2$ b) R c) $2R$ d) $R/4$

1213. A torch bulb rated at 4.5 W, 1.5 V is connected as shown in figure. The emf of the cell needed to make the bulb glow at full intensity if



a) 4.5 V b) 1.5 V c) 2.67 V d) 13.5 V

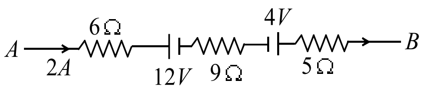
1214. A 60 *watt* bulb operates on $220V$ supply. The current flowing through the bulb is

a) 11/3 *amp* b) 3/11 *amp* c) 3 *amp* d) 6 *amp*

1215. A battery of *emf* E produces currents I_1 and I_2 when connected to external resistances R_1 and R_2 respectively. The internal resistance of the battery is

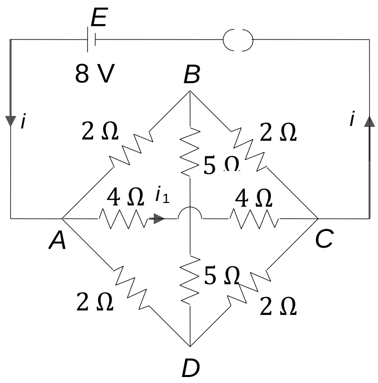
a) $\frac{I_1R_2 - I_2R_1}{I_2 - I_1}$ b) $\frac{I_1R_2 + I_2R_1}{I_1 - I_2}$ c) $\frac{I_1R_1 + I_2R_2}{I_1 - I_2}$ d) $\frac{I_1R_1 - I_2R_2}{I_2 - I_1}$

1216. The potential difference between A and B in the following figure is



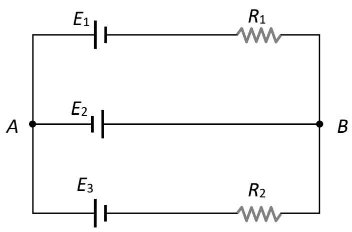
a) 24 V b) 14 V c) 32 V d) 48 V

1217. The value of i_1 in the circuit diagram will be



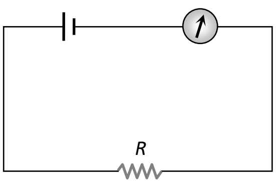
a) 1A b) $\frac{1}{2}$A c) $\frac{3}{4}$A d) $\frac{3}{2}$A

1218. In the circuit shown here, $E_1 = E_2 = E_3 = 2V$ and $R_1 = R_2 = 4$ *ohm*. The current flowing between points A and B through battery E_2 is



a) Zero b) 2 *amp* from A to B c) 2 *amp* from B to A d) None of the above

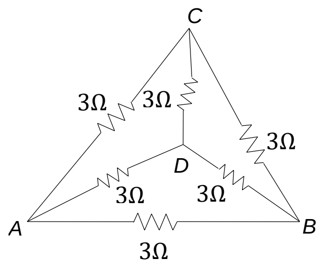
1219. A battery of *emf* 10 V and internal resistance 3Ω is connected to a resistor as shown in the figure. If the current in the circuit is 0.5 A, then the resistance of the resistor will be



a) 19 Ω b) 17 Ω c) 10 Ω d) 12 Ω

1220. The equivalent resistance between A and B in the given circuit is

0.



a) 3Ω　　b) 6Ω　　c) 12Ω　　d) 1.5Ω

1221. The material of fuse wire should have

a) A high specific resistance and high melting point
b) A low specific resistance and low melting point
c) A high specific resistance and low melting point
d) A low specific resistance and a high melting point

1222. Resistance of a voltameter is 2Ω, it is connected in series to a battery of 10 V through a resistance of 3Ω. In a certain time mass deposited on cathode is $1g$. Now the voltameter and the 3Ω resistance are connected in parallel with the battery. Increase in the deposited mass on cathode in the same time will be

a) 0　　b) 1.5 g　　c) 2.5 g　　d) 2 g

1223. The length of a wire of a potentiometer is 100cm, and the emf of its stand and cell is E volt. It is employed to measure the emf of a battery whose internal resistance is 0.5Ω. If the balance point is obtained at $l =$ 30cm from the positive end, the emf of the battery is

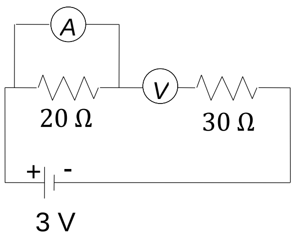
a) $\frac{30E}{100.5}$　　b) $\frac{30E}{100-0.5}$

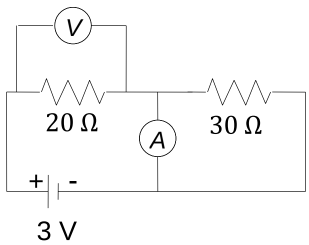
c) $\frac{30(E-0.5i)}{100}$, Where i is the current in the potentiometer wire.　　d) $\frac{30E}{100}$

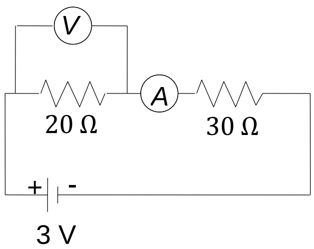
1224. Resistance of tungsten wire at 150°C is 133Ω. Its resistance temperature coefficient is 0.0045/°C. The resistance of this wire at 500°C will be

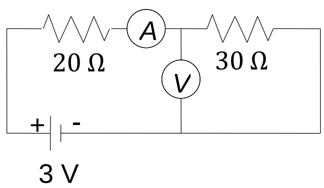
a) 180Ω　　b) 225Ω　　c) 258Ω　　d) 317Ω

1225. Resistors of resistance 20Ω and 30Ω are joined in series with a battery of emf 3V. It is desired to measure current and voltage across the 20Ω resistor with the help of an ammeter and voltmeter. Identify the correct arrangement of ammeter (A) and voltmeter (V) out of four possible arrangements shown in figure. Given below

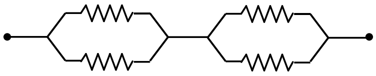
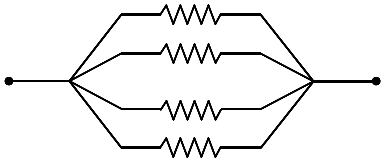
a)


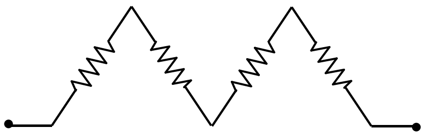
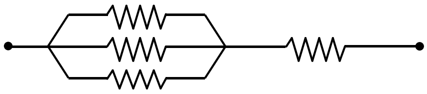
b)


c)


d)


1226. Which arrangement of four identical resistance should be used to draw maximum energy from a cell of voltage V

a) 
b) 

c) 
d) 

1227. A capacitor is connected to a cell of emf E having some internal resistane r. The potential difference across the

a) Cell is $< E$ b) Cell is E c) Capacitor is $> E$ d) Capacitor is $< E$

1228. A wire of resistance 5.5 ohm is drawn out uniformly so that its length is increased twice. Then its new resistance is

a) 44Ω b) 42Ω c) 40Ω d) 22Ω

1229. Silver and copper voltameters are connected in parallel with a battery of emf 12 V. In 30 min 1 g of silver and 1.8 g of copper are liberated. The energy supplied by the battery is

a) 720 J b) 2.41 J c) 24.12 J d) 4.34×10^4 J

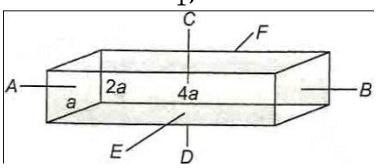
1230. Two bulbs of 250 V and 100 W are first connected in series and then in parallel with a supply of 250 V. Total power in each of the case will be respectively

a) 100 W, 50 W b) 50 W, 100 W c) 200 W, 150 W d) 50 W, 200 W

1231. An ammeter gives full scale deflection when a current of 2A flows through it. The resistance of ammeter is 12 Ω. If the same ammeter is to be used for measuring a maximum current of 5A, then ammeter must be connected with a resistance of

a) 18 Ωin parallel b) 8 Ωin parallel c) 18 Ω in series d) 8 Ω in series

1232. A conductor with rectangular cross-section has dimensions $(a \times 2a \times 4a)$ as shown in figure. Resistance across AB is R_1, across CD is R_2 and across EF is R_3.Then



a) $R_1 = R_2 = R_3$ b) $R_1 > R_2 > R_3$ c) $R_2 > R_3 > R_1$ d) $R_1 > R_3 > R_2$

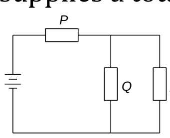
1233. The current flowing in a coil of resistance 90 Ω is to be reduced by 90%. What value of resistance should be connected in parallel with it

a) 9 Ω b) 90 Ω c) 1000 Ω d) 10 Ω

1234. In the absence of applied potential, the electric current flowing through a metallic wire is zero because

a) The electrons remain stationary
b) The electrons are drifted in random direction with a speed of the order of 10^{-2} cm s^{-1}
c) The electrons move in random direction with a speed of the order close to that of velocity of light
d) Electrons and ions move in opposite direction

1235. The resistors P, Q and R in the circuit have equal resistance. The battery, of negligible internal resistance, supplies a total power of 12 W. What is the power dissipated by heating in resistor R?



a) 2 W b) 4 W c) 3 W d) 6 W

1236. The temperature coefficient of resistance of a wire is 0.00125 K^{-1}. At 300K, its resistance is 1Ω. The resistance of the wire will be 2Ω at

a) 1154 K b) 1100 K c) 1400 K d) 1127 K

1237. The resistance of a heater coil is 110 *ohm*. A resistance R is connected in parallel with it and the

7. combination is joined in series with a resistance of 11 ohm to a 220 $volt$ main line. The heater operates with a power of 110 $watt$. The value of R in ohm is

a) 12.22 b) 24.42
c) Negative d) That the given values are not correct

1238. The resistance of a wire at room temperature 36°C is found to be 10Ω. Now to increase the resistance by 10%, the temperature of the wire must be [The temperature coefficient of resistance of the material of the wire is 0.002 per °C]

a) 36°C b) 83°C c) 63°C d) 33°C

1239. A current of 2 A passing through conductor produces 80 J of heat in 10 $seconds$. The resistance of the conductor is

a) 0.5 Ω b) 2 Ω c) 4 Ω d) 20 Ω

1240. What is immaterial for an electric fuse?

a) Its specific resistance b) Its length
c) Its radius d) Current flowing through it

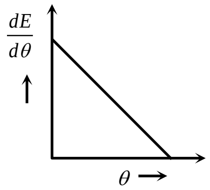
1241. A primary cell has an e. m. f. of 1.5 volt, when short-circuited it gives a current of 3 ampere. The internal resistance of the cell is

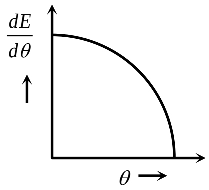
a) 4.5 ohm b) 2 ohm c) 0.5 ohm d) 1/4.5 ohm

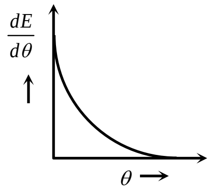
1242. The heating coils rated at 220 $volt$ and producing 50 cal/sec heat are available with the resistance 55 Ω, 110 Ω, 220 Ω and 440 Ω. The heater of maximum power will be of

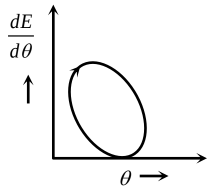
a) 440 Ω b) 220 Ω c) 110 Ω d) 55 Ω

1243. Which of the following graphs shows the variation of thermoelectric power with temperature difference between hot and cold junction in thermocouples

a) 

b) 

c) 

d) 

1244. Five equal resistors when connected in series dissipated 5 W power. If they are connected in parallel, the power dissipated will be

a) 25 W b) 50 W c) 100 W d) 125 W

1245. On passing 96500 $coulomb$ of charge through a solution $CuSO_4$ the amount of copper liberated is

a) 64 gm b) 32 gm c) 32 kg d) 64 kg

1246. In a neon discharge tube $2.9 \times 10^{18} Ne^+$ ions move to the right each $second$ while 1.2×10^{18} electrons move to the left per $second$. Electron charge is $1.6 \times 10^{-19} C$. The current in the discharge tube

a) 1 A towards right b) 0.66 A towards right c) 0.66 A towards left d) Zero

1247. For a metallic wire, the ratio $\frac{V}{i}$ (V =applied potential difference and i=current flowing) is

a) Independent of temperature
b) Increases as the temperature rises
c) Decreases as the temperature rises
d) Increases or decreases as temperature rises depending upon the metal

1248. The resistance of the series combination of two resistance is S. When they are joined in parallel, the total resistance is P. If $S = nP$, then the minimum possible value of n is

a) 4 b) 3 c) 2 d) 1

1249. In a wire of circular cross-section with radius r, free electrons travel with a drift velocity V when a current I flows through the wire. What is the current in another wire of half the radius and of the same material when the drift velocity is $2V$

a) $2I$ b) I c) $I/2$ d) $I/4$

125 Two electric bulbs, one of 200 $volt$ 40 $watt$ and the other 200 $volt$ 100 $watt$ are connected in a house

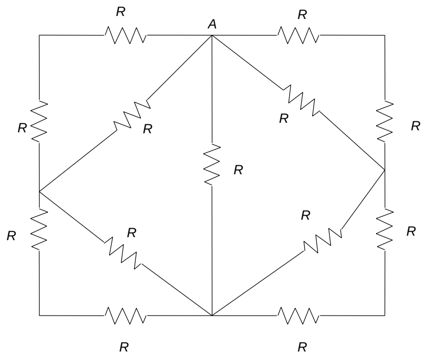
0. wiring circuit

a) They have equal currents through them
b) The resistance of the filaments in both the bulbs is same
c) The resistance of the filament in 40 $watt$ bulb is more than the resistance in 100 $watt$ bulb
d) The resistance of the filament in 100 $watt$ bulb is more than the resistance in 40 $watt$ bulb

1251. In which of the following substances does resistance decrease with increase in temperature?

a) Copper b) Carbon c) Constantan d) Silver

1252. Thirteen resistances each of resistance RΩ are connected in the circuit as shown in the figure. The effective resistance between points A and B is



a) $\frac{4R}{3}\Omega$ b) 2RΩ c) RΩ d) $\frac{2}{3}R\Omega$

1253. The resistance of a 10 m long wire is 10 Ω. Its length is increased by 25% by stretching the wire uniformly. The resistance of wire will change to (approximately)

a) 12.5 Ω b) 14.5 Ω c) 15.6 Ω d) 16.6 Ω

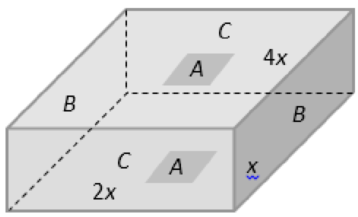
1254. The masses of the three wires of copper are in the ratio 5 : 3 : 1 and their lengths are in the ratio 1 : 3 : 5 the ratio of their electrical resistance is

a) 5 : 3 : 1 b) $\sqrt{125}$: 15 : 1 c) 1 : 15 : 125 d) 1 : 3 : 5

1255. A milliammeter of range 0-30mA has internal resistance of 20 Ω. The resistance to be connected in series to convert it into a voltmeter of maximum reading 3V is

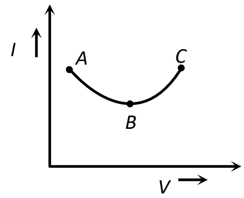
a) 49 Ω b) 80 Ω c) 40 Ω d) 30 Ω

1256. Given figure shows a rectangular block with dimensions x, $2x$ and $4x$. Electrical contacts can be made to the block between opposite pairs of faces (for example, between the faces labelled $A-A$, $B-B$ and $C-C$). Between which two faces would the maximum electrical resistance be obtained ($A-A$: Top and bottom faces, $B-B$: Left and right faces, $C-C$: Front and rear faces)



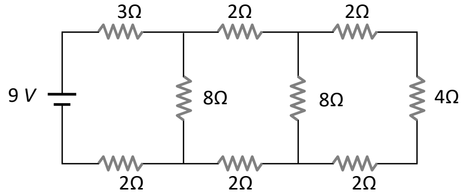
a) $A-A$
b) $B-B$
c) $C-C$
d) Same for all three pairs

1257. Resistance as shown in figure is negative at



a) A b) B c) C d) None of these

1258. In the circuit shown in the figure, the current through



a) The 3Ω resistor is 0.50 A
b) The 3Ω resistor is 0.25 A
c) The 4Ω resistor is 0.50 A
d) The 4Ω resistor is 0.25 A

1259. The potential gradient along the length of a uniform wire is 10 $volt/metre$. B and C are the two points at 30 cm and 60 cm point on a meter scale fitted along the wire. The potential difference between B and C will be

a) 3 $volt$ b) 0.4 $volt$ c) 7 $volt$ d) 4 $volt$

1260. Current is flowing with a current density $J = 480\text{Acm}^{-2}$ in a copper wire. Assuming that each copper atom contributes one free electron and given that

Avogadro number=6.0×10^{23}atoms mol^{-1}

Density of copper=9.0g cm^{-3}

Atomic weight of copper =64 g mol^{-1}

The drift velocity of electrons is

a) 1 mm s^{-1} b) 2 mm s^{-1} c) 0.5 mm s^{-1} d) 0.36 mm s^{-1}

1261. Two wires of the same material but of different diameters carry the same current i. If ratio of their diameters is 1:2, then the corresponding ratio of their mean drift velocities will be

a) 4: 1 b) 1: 1 c) 1: 2 d) 1: 4

1262. How much work is required to carry a 6 μC charge from the negative terminal to the positive terminal of a 9 V battery

a) $54 \times 10^{-3} J$ b) $54 \times 10^{-6} J$ c) $54 \times 10^{-9} J$ d) $54 \times 10^{-12} J$

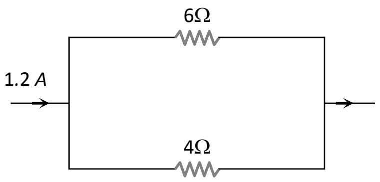
1263. An electric bulb rated 220 V, 100 W is connected in series with another bulb rated 220 V, 60 W. If the voltage across the combination is 220 V, the power consumed by the 100 W bulb will be about

a) 25 W b) 14 W c) 60 W d) 100 W

1264. When a current of 1 ampere is passed through a conductor whose ends are maintained at temperature difference of 1°C, the amount of heat evolved or absorbed is called

a) Peltier coefficient
b) Thomson coefficient
c) Thermoelectric power
d) Thermo e.m.f.

1265. In the figure given below, the current passing through 6Ω resistor is



a) 0.40 $ampere$ b) 0.48 $ampere$ c) 0.72 $ampere$ d) 0.80 $ampere$

1266. For a given temperature difference which of the following pairs will generate maximum thermo-emf?

a) Lead-nickel b) Copper-iron c) Gold-silver d) Antimony-bismuth

1267. The resistance of ideal voltmeter is

a) Zero
b) Greater than zero but finite value
c) Infinite
d) 5000 Ω

1268. A 100 *watt* bulb working on 200 *volt* and a 200 *watt* bulb working on 100 *volt* have
a) Resistances in the ratio of 4 :1
b) Maximum current ratings in the ratio of 1 :4
c) Resistances in the ratio of 2 :1
d) Maximum current ratings in the ratio of 1 :2

1269. The graph between resistivity and temperature, for a limited range of temperatures, is a straight line for a material like
a) Copper
b) Nichrome
c) Silicon
d) Mercury

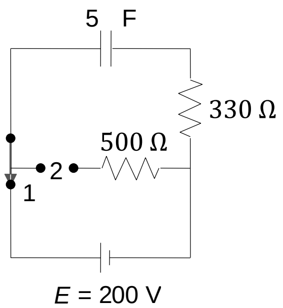
1270. The emf of a generator is 6 V and internal resistance is 0.5 kΩ. The reading of a voltmeter having an internal resistance of 2.5 kΩ is
a) 10^{-3}V
b) 10 V
c) 5 V
d) 0.5 V

1271. A metallic block has no potential difference applied across it, then the mean velocity of free electrons at absolute temperature T is
a) Proportional to T
b) Proportional to $\sqrt{T}$
c) Zero
d) Finite but independent of T

1272. An ammeter reads 0.90 A when connected in series with a silver voltmeter that deposits 2.60 g of silver in 40 min. By what percentage is the ammeter reading is correct? Atomic weight of silver = 108 and 1 F=96500 C?
a) 5%
b) 7%
c) -5%
d) -7%

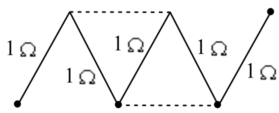
1273. A thermo-$e$mf V appears across a conductor maintained at a temperature difference T. The thomson coefficient is then given by
a) $-T^2\dfrac{d^2V}{dT^2}$
b) $T^2\dfrac{dV}{dT}$
c) $-T\dfrac{d^2V}{dT^2}$
d) $-\dfrac{1}{T^2}\dfrac{dV}{dT}$

1274. The amount of heat generated in 500Ω resistance, when the key is thrown over from contact 1 to 2, as shown in figure is



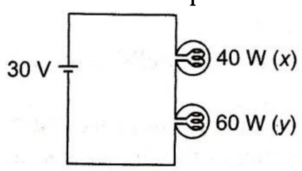
a) 10°C
b) 7.5°C
c) 5.0°C
d) 2.5°C

1275. A circuit consists of five identical conductors as shown in figure. The two similar conductors are added as indicated by the dotted lines. The ratio of resistances before and after addition will be



a) 7/5
b) 3/5
c) 5/3
d) 6/5

1276. Two bulbs X and Y having same voltage rating and of power 40 W and 60 W respectively are connected in series across a potential difference of 300 V, then



a) X will glow brighter
b) Resistance of Y will be greater than X

c) Heat produced in Y will be greater than X

d) Voltage drop in X will be greater than Y

1277. Two voltameters, one of copper and another of silver, are joined in paralleled. When a total charge q flows through the voltameters, equal amount of metals are deposited. If the electrochemical equivalents of copper and silver are z_1 and z_2 respectively, the charge which flows through the silver voltameter is

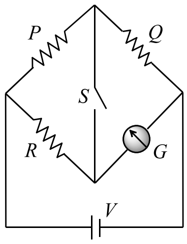
a) $\frac{q}{1+\frac{z_1}{z_2}}$

b) $\frac{q}{1+\frac{z_2}{z_1}}$

c) $q\frac{z_1}{z_2}$

d) $q\, z_2/z_1$

1278. In the circuit shown $P \neq R$, the reading of the galvanometer is same with switch S open or closed. Then



a) $I_R = I_G$

b) $I_P = I_G$

c) $I_Q = I_G$

d) $I_Q = I_R$

1279. The density of copper is 9×10^3 kg/m^{3}and its atomic mass is 63.5 u. Each copper atom provides one free electron. Estimate the number of free electrons per cubic metre in copper.

a) 10^{19}

b) 10^{23}

c) 10^{25}

d) 10^{29}

1280. Find the true statements

a) Ohm's law is applicable to all conductors of electricity

b) In an electrolyte solution, the electric current is mainly due to the movement of electrons

c) The resistance of an incandescent lamp is lesser when the lamp is switched on

d) Specific resistance of a wire depends upon its dimension

1281. A galvanometer can be converted into a voltmeter by connecting

a) Low residence in parallel

b) Low residence in series

c) High residence in parallel

d) High residence in series

1282. By mistake a voltmeter is connected in series and an ammeter is connected in parallel with a resistance in an electrical circuit. What will happen to the instrument?

a) Voltmeter is damaged

b) Ammeter is damaged

c) Both are damaged

d) None is damaged

1283. In a thermocouple, the neutral temperature is 270°C and the temperature of inversion is *525*°C. The temperature of cold junction would be

a) 30°C

b) 255°C

c) 15°C

d) 25°C

1284. Two electric lamps of 40 watt each are connected in parallel. The power consumed by the combination will be

a) 20 *watt*

b) 60 *watt*

c) 80 *watt*

d) 100 *watt*

1285. Consider the following two statements A and B, and identify the correct choice out of given answers

A. Thermo *e*.m.f. is minimum at neutral temperature of a thermocouple

B. When two junctions made of two different metallic wires are maintained at different temperatures, an electric current is generated in the circuit

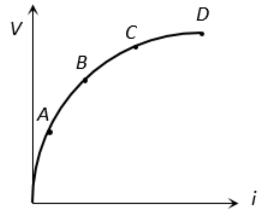
a) A is false and B is true

b) A is true and B is false

c) Both A and B are false

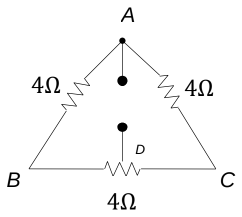
d) Both A and B are true

1286. Variation of current passing through a conductor as the voltage applied across its ends is varied as shown in the adjoining diagram. If the resistance (R) is determined at the points A, B, C and D, we will find that



a) $R_C = R_D$ b) $R_B > R_A$ c) $R_C > R_B$ d) None of these

1287. There resistances of 4 Ω each are connected as shown in figure. If the point D divides the resistance into two equal halves, the resistance between points A and D will be



a) 12 Ω b) 6 Ω c) 3 Ω d) $\frac{1}{3}$ Ω

1288. A copper wire of cross-sectional area 2.0 mm^2, resistivity $=1.7\times 10^{-8}$Ωm, carries a current of 1A. The electric field in the copper wire is

a) 8.5×10^{-5}Vm^{-1} b) 8.5×10^{-4}Vm^{-1} c) 8.5×10^{-3}Vm^{-1} d) 8.5×10^{-2}Vm^{-1}

1289. The thermo-emf of a thermocouple varies with the temperature θ of the hot junction as $E = a\theta + b\theta^2$ in volts where the ratio a/b is 700°C. If the cold junction is kept at 0°C, then the neutral temperature is

a) 700°C. b) 350°C.
c) 1400°C. d) No neutral temperature is possible for this thermocouple

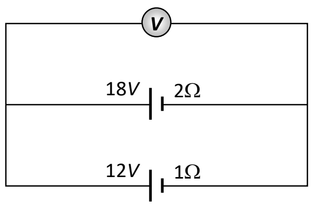
1290. 2, 4 and 6 S are the conductance of three conductors. When they are joined in parallel, their equivalent conductance will be

a) 12 S b) $(1/12)S$ c) $(12/11)S$ d) $(11/12)S$

1291. Two resistances are connected in two gaps of a meter bridge. The balance point is 20cm from the zero end. A resistance of 15Ω is connected is series with the smaller of the two. The null point shifts to 40cm. The value of the smaller resistance in ohm is

a) 3 b) 6 c) 9 d) 12

1292. Two batteries, one of emf 18 $volt$ and internal resistance 2Ω and the other of emf 12 $volt$ and internal resistance 1Ω, are connected as shown. The voltmeter V will record a reading of



a) 15 $volt$ b) 30 $volt$ c) 14 $volt$ d) 18 $volt$

1293. The drift velocity does not depend upon

a) Cross-section of the wire b) Length of the wire
c) Number of free electrons d) Magnitude of the current

1294. The emf of a thermocouple, one junction of which is kept at 0°C, is given by $e = at + bt^2$. The Peltier co-efficient will be

a) $(t + 273)(a + 2bt)$ b) $(t + 273)(a - 2bt)$ c) $(t - 273)(a - 2bt)$ d) $(t - 273)(a + 2bt)$

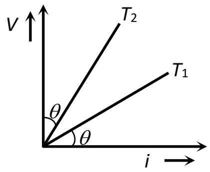
1295. For electroplating a spoon, it is placed in the voltmeter at

a) The position of anode
b) The position of cathode

c) Exactly in the middle of anode and the cathode
d) Anywhere in the electrolyte

1296. Two resistors of 6 Ω and 9Ω are connected in series to a 120 $volt$ source. The power consumed by the 6 Ω resistor is
a) 384 W b) 576 W c) 1500 W d) 1200 W

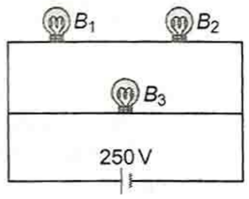
1297. The $V - i$ graph for a conductor at temperatures T_1 and T_2 are as shown in the figure. $(T_2 - T_1)$ is proportional to



a) $\cos 2\theta$ b) $\sin\theta$ c) $\cot 2\theta$ d) $\tan\theta$

1298. For a thermocouple, the inversion temperature is 600°C and the neutral temperature is 320°C. Find the temperature of the cold junction?
a) 40°C b) 20°C c) 80°C d) 60°C

1299. A 100 W bulb B_1 and two 60 W bulbs B_2 and B_3 are connected to a 250 V source as shown in figure. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3 respectively, then



a) $W_1 > W_2 = W_3$ b) $W_1 > W_2 > W_3$ c) $W_1 < W_2 = W_3$ d) $W_1 < W_2 < W_3$

1300. A resistor is constructed as hollow cylinder of dimensions $r_a = 0.5$ cm and $r_b = 1.0$cm and $\rho = 3.5 \times 10^{-5}\Omega$m. The resistance of the configuration for the length of 5 cm cylinder is ….$\times 10^{-3}\Omega$.
a) 7.42 b) 10.56 c) 14.38 d) 16.48

1301. The $V - i$ graph for a conductor makes an angle θ with V-axis. Here V denotes the voltage and i denotes current. The resistance of conductor is given by
a) $\sin\theta$ b) $\cos\theta$ c) $\tan\theta$ d) $\cot\theta$

1302. If a wire is stretched to make it 0.1% longer, its resistance will
a) Increase by 0.2% b) Decrease by 0.2% c) Decrease 0.05% d) Increase by 0.05%

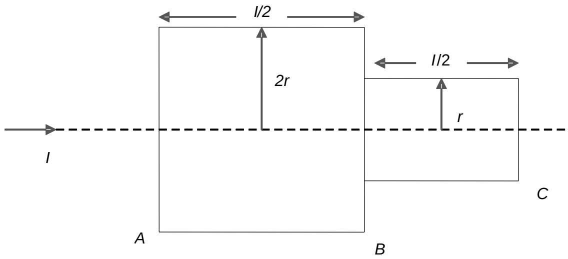
1303. Two filaments of same length are connected first in series and then in parallel. For the same amount of main current flowing the ratio of the heat produced is
a) 2 : 1 b) 1 : 2 c) 4 : 1 d) 1 : 4

1304. Water boils in an electric kettle in 15 $minutes$ after switching on. If the length of the heating wire is decreased to 2/3 of its initial value, then the same amount of water will boil with the same supply voltage in
a) 15 $minutes$ b) 12 $minutes$ c) 10 $minutes$ d) 8 $minutes$

1305. Antimony and bismuth are usually used in a thermocouple, because
a) Negative thermal e.m.f. is produced b) Constant thermal e.m.f. is produced
c) Lower thermal e.m.f. is produced d) Higher thermal e.m.f. is produced

1306. Specific resistance of copper, constantan and silver are $1.78 \times 10^{-8}, 39.1 \times 10^{-8}$ and 10^{-8} Ω-m respectively. Which of these is the best conductor of heat and electricity?
a) Copper b) Constantan c) Silver d) All of them

1307. Two bars of radius r and $2r$ are kept in contact as shown. An electric current I is passed through the bars. Which one of following is correct?



a) Heat produced in bar BC is 4 times the heat produced in bar AB
b) Electric field in both halves is equal
c) Current density across AB is double that of across BC
d) Potential difference across AB is 4 times that of across BC

1308. In producing chlorine through electrolysis 100 $watt$ power at 125 V is being consumed. How much chlorine per minute is liberated? E.C.E. chlorine is $0.367 \times 10^{-6} kg/coulomb$
a) 24.3 mg b) 16.6 mg c) 17.6 mg d) 21.3 mg

1309. The amount of heat produced in a resistor when a current is passed through it can be found using
a) Faraday's Law b) Kirchhoff's Law c) Laplace's Law d) Joule's Law

1310. A beam contains 2×10^8 doubly charged positive ions per cubic centimeter, all of which are moving with a speed of $10^5\ m/s$. The current density is
a) 6.4 A/m^2 b) 3.2 A/m^2 c) 1.6 A/m^2 d) None of these

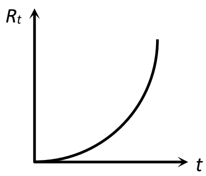
1311. Three equal resistors connected in series across a source of e.m.f. together dissipate 10 watt. If the same resistors are connected in parallel across the same e.m.f., then the power dissipated will be
a) 10 $watt$ b) 30 $watt$ c) 10/3 $watt$ d) 90 $watt$

1312. When a current passes through a wire whose different parts are maintained at different temperatures, evolution or absorption of heat all along the length of wire is known as
a) Joule effect b) Seebeck effect c) Peltier effect d) Thomson effect

1313. To get the maximum current from a parallel combination of n identical cells each of internal resistance r and external resistance R, when
a) $R \gg r$ b) $R \ll r$ c) $R = r$ d) None of these

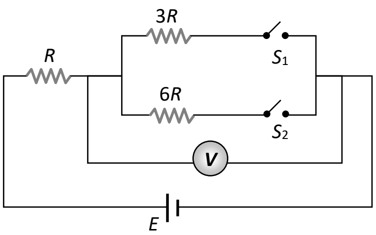
1314. Which of the following is vector quantity
a) Current density b) Current c) Wattless current d) Power

1315. The resistance R_t of a conductor varies with temperature t as shown in the figure. If the variation is represented by $R_t = R_0[1 + \alpha t + \beta t^2]$, then



a) α and β are both negative
b) α and β are both positive
c) α is positive and β is negative
d) α is negative and β are positive

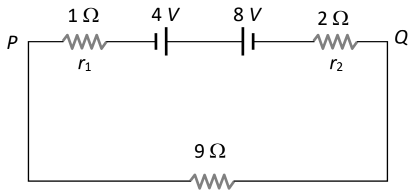
1316. In the circuit shown in the figure reading of voltmeter is V_1 when only S_1 is closed, reading of voltmeter is V_2 when only S_2 is closed and reading of voltmeter is V_3 when both S_1 and S_2 are closed. Then



a) $V_3 > V_2 > V_1$ b) $V_2 > V_1 > V_3$ c) $V_3 > V_1 > V_2$ d) $V_1 > V_2 > V_3$

131 Two batteries of e.m.f. 4 V and 8 V with internal resistances 1 Ω and 2 Ω are connected in a circuit with a

7. resistance of 9 Ω as shown in figure. The current and potential difference between the points P and Q are



a) $\frac{1}{3}$ A and $3V$ b) $\frac{1}{6}$ A and $4V$ c) $\frac{1}{9}$ A and $9V$ d) $\frac{1}{2}$ A and $12V$

1318. Assume that each atom of copper contributes one free electron. What is the average drift velocity of conduction electrons in a copper wire of cross-sectional area 10^{-7} m^2, carrying a current of 1.5 A? (Given density of copper $=9 \times 10^{-3}$kgm^{-3}; atomic mass of copper =63.5; Avogadro's number= 6.023×10^{23} per gram atom)

a) 1.1×10^{-2}ms^{-1} b) 1.1×10^{-3}ms^{-1} c) 2.2×10^{-2}ms^{-1} d) 2.2×10^{-3}ms^{-1}

1319. The internal resistance of a primary cell is 4 Ω . It generates a current of 0.2 A in an external resistance of 21 Ω. The rate at which chemical energy is consumed in providing the current is

a) 0.42 J s^{-1} b) 0.84 J s^{-1} c) 1 J s^{-1} d) 5 J s^{-1}

1320. The current in the primary circuit of a potentiometer is 0.2A. the specific resistance and cross-section of the potentiometer wire are 4×10^{-7}Ωm and $8 \times 10^{-7} m^2$ respectively. Potential gradient will be equal to

a) 0.2 V/m b) 1V/m c) 0.3V/m d) 0.1V/m

1321. A cell of e. m. f. E connected with an external resistance R, then p.d. across cell is V. The internal resistance of cell will be

a) $\frac{(E-V)R}{E}$ b) $\frac{(E-V)R}{V}$ c) $\frac{(V-E)R}{V}$ d) $\frac{(V-E)R}{E}$

1322. The current flowing in a copper voltmeter is 1.6 A. The number of Cu^{++} ions deposited at the cathode per minute are

a) 1.5×10^{20} b) 3×10^{20} c) 6×10^{20} d) 1×10^{19}

1323. There are three resistance coils of equal resistance. The maximum number of resistances you can obtain by connecting them in any manner you choose, being free to use any number of the coils in any way is

a) 3 b) 4 c) 6 d) 5

1324. A galvanometer of resistance 22.8 Ω measures 1A. How much shunt should be used, so that it can be used to measure 20A?

a) 1Ω b) 2Ω c) 1.2Ω d) 2.2Ω

1325. If two electric bulbs have 40 W and 60 W rating at 220 V, then the ratio of their resistances will be

a) 9 :4 b) 4 :3 c) 3 :8 d) 3 :2

1326. The negative Zn pole of Daniell cell, sending a constant current through a circuit, decreases in mass by 0.13 g in 30 min. If the electrochemical equivalent of Zn and Cu are 32.5 and 31.5 respectively, the increase in the mass of the positive Cu pole in this time is

a) 0.180 g b) 0.141 g c) 0.126 g d) 0.242 g

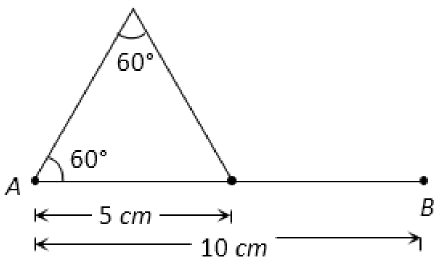
1327. A lead-acid battery of a car has an emf of 12 V. If the internal resistance of the battery is 0.5 Ω, the maximum current that can be drawn from the battery will be

a) 30 A b) 20 A c) 6 A d) 24 A

1328. When an electrical appliance is switched on, it responds almost immediately, because

a) The electrons in the connecting wires move with the speed of light
b) The electrical signal is carried by electromagnetic waves moving with the speed of light
c) The electrons move with speed which is close to but less than speed of light
d) The electron are stagnant

1329. A wire has resistance of 24 Ω is bent in the following shape. The effective resistance between A and B is



a) 24 Ω

b) 10 Ω

c) $\frac{16}{3}\,\Omega$

d) None of these

: ANSWER KEY :

1)	d	2)	b	3)	a	4)	a	189)	d	190)	c	191)	c	192)	a
5)	a	6)	c	7)	b	8)	b	193)	b	194)	d	195)	d	196)	c
9)	b	10)	c	11)	b	12)	c	197)	b	198)	b	199)	c	200)	d
13)	d	14)	b	15)	a	16)	c	201)	c	202)	a	203)	b	204)	a
17)	b	18)	d	19)	a	20)	d	205)	a	206)	c	207)	a	208)	b
21)	a	22)	a	23)	a	24)	c	209)	b	210)	a	211)	b	212)	b
25)	b	26)	a	27)	d	28)	d	213)	c	214)	a	215)	d	216)	a
29)	b	30)	d	31)	a	32)	a	217)	a	218)	b	219)	a	220)	b
33)	a	34)	c	35)	b	36)	a	221)	b	222)	d	223)	b	224)	d
37)	a	38)	d	39)	b	40)	a	225)	c	226)	d	227)	c	228)	a
41)	c	42)	b	43)	d	44)	a	229)	c	230)	b	231)	b	232)	c
45)	c	46)	d	47)	d	48)	a	233)	a	234)	b	235)	c	236)	b
49)	d	50)	c	51)	d	52)	c	237)	d	238)	b	239)	d	240)	a
53)	b	54)	c	55)	b	56)	c	241)	a	242)	c	243)	b	244)	c
57)	d	58)	a	59)	a	60)	b	245)	b	246)	b	247)	b	248)	d
61)	a	62)	d	63)	d	64)	d	249)	b	250)	d	251)	d	252)	d
65)	c	66)	a	67)	c	68)	b	253)	d	254)	d	255)	d	256)	c
69)	b	70)	d	71)	d	72)	d	257)	c	258)	c	259)	d	260)	d
73)	d	74)	c	75)	c	76)	d	261)	c	262)	a	263)	a	264)	d
77)	b	78)	d	79)	a	80)	a	265)	c	266)	a	267)	d	268)	a
81)	a	82)	d	83)	a	84)	c	269)	a	270)	d	271)	c	272)	a
85)	a	86)	c	87)	c	88)	a	273)	d	274)	a	275)	b	276)	c
89)	b	90)	a	91)	c	92)	b	277)	a	278)	a	279)	a	280)	b
93)	a	94)	b	95)	b	96)	a	281)	c	282)	b	283)	c	284)	d
97)	a	98)	b	99)	a	100)	b	285)	a	286)	d	287)	c	288)	c
101)	a	102)	d	103)	a	104)	d	289)	c	290)	d	291)	c	292)	b
105)	d	106)	b	107)	c	108)	b	293)	d	294)	d	295)	b	296)	c
109)	b	110)	a	111)	d	112)	c	297)	b	298)	c	299)	c	300)	a
113)	c	114)	b	115)	d	116)	c	301)	d	302)	a	303)	b	304)	d
117)	c	118)	b	119)	b	120)	b	305)	b	306)	c	307)	b	308)	b
121)	a	122)	d	123)	b	124)	b	309)	a	310)	a	311)	a	312)	c
125)	b	126)	a	127)	a	128)	b	313)	a	314)	a	315)	c	316)	a
129)	b	130)	c	131)	c	132)	c	317)	b	318)	b	319)	b	320)	b
133)	b	134)	d	135)	d	136)	d	321)	a	322)	c	323)	d	324)	a
137)	a	138)	b	139)	b	140)	c	325)	a	326)	a	327)	d	328)	d
141)	b	142)	a	143)	a	144)	b	329)	a	330)	c	331)	a	332)	a
145)	a	146)	d	147)	b	148)	a	333)	b	334)	b	335)	a	336)	c
149)	c	150)	c	151)	c	152)	b	337)	a	338)	d	339)	c	340)	c
153)	a	154)	c	155)	c	156)	c	341)	d	342)	c	343)	b	344)	a
157)	c	158)	b	159)	c	160)	b	345)	a	346)	c	347)	a	348)	b
161)	c	162)	c	163)	b	164)	c	349)	d	350)	c	351)	d	352)	b
165)	d	166)	a	167)	b	168)	a	353)	b	354)	c	355)	d	356)	a
169)	c	170)	c	171)	b	172)	d	357)	b	358)	a	359)	b	360)	c
173)	d	174)	b	175)	c	176)	a	361)	b	362)	c	363)	b	364)	a
177)	c	178)	c	179)	d	180)	b	365)	d	366)	b	367)	c	368)	d
181)	d	182)	b	183)	d	184)	c	369)	c	370)	c	371)	c	372)	a
185)	a	186)	c	187)	b	188)	b	373)	a	374)	b	375)	c	376)	c

377)	a	378)	a	379)	b	380)	a	581)	c	582)	a	583)	d	584)	c
381)	a	382)	b	383)	b	384)	a	585)	a	586)	c	587)	b	588)	c
385)	c	386)	d	387)	c	388)	c	589)	d	590)	d	591)	a	592)	a
389)	c	390)	a	391)	d	392)	b	593)	b	594)	b	595)	c	596)	c
393)	c	394)	b	395)	d	396)	d	597)	a	598)	b	599)	d	600)	c
397)	b	398)	a	399)	c	400)	c	601)	b	602)	a	603)	a	604)	d
401)	c	402)	a	403)	c	404)	d	605)	d	606)	a	607)	c	608)	d
405)	b	406)	d	407)	c	408)	b	609)	b	610)	a	611)	c	612)	c
409)	c	410)	a	411)	a	412)	a	613)	d	614)	c	615)	d	616)	a
413)	c	414)	c	415)	d	416)	c	617)	d	618)	a	619)	a	620)	a
417)	c	418)	a	419)	c	420)	a	621)	c	622)	b	623)	b	624)	a
421)	a	422)	c	423)	c	424)	d	625)	d	626)	c	627)	b	628)	a
425)	a	426)	c	427)	c	428)	d	629)	b	630)	d	631)	a	632)	b
429)	a	430)	b	431)	c	432)	a	633)	a	634)	c	635)	d	636)	c
433)	d	434)	b	435)	d	436)	b	637)	c	638)	b	639)	a	640)	d
437)	c	438)	d	439)	a	440)	a	641)	a	642)	c	643)	b	644)	d
441)	b	442)	d	443)	d	444)	b	645)	d	646)	b	647)	a	648)	d
445)	b	446)	c	447)	a	448)	d	649)	b	650)	b	651)	c	652)	c
449)	d	450)	b	451)	c	452)	c	653)	b	654)	b	655)	d	656)	b
453)	d	454)	c	455)	c	456)	c	657)	b	658)	c	659)	a	660)	b
457)	a	458)	a	459)	c	460)	c	661)	c	662)	d	663)	a	664)	a
461)	c	462)	d	463)	b	464)	b	665)	a	666)	c	667)	b	668)	b
465)	b	466)	a	467)	b	468)	d	669)	d	670)	b	671)	d	672)	c
469)	a	470)	d	471)	a	472)	c	673)	c	674)	d	675)	a	676)	d
473)	b	474)	c	475)	c	476)	c	677)	a	678)	b	679)	b	680)	b
477)	c	478)	a	479)	a	480)	b	681)	c	682)	b	683)	b	684)	b
481)	d	482)	d	483)	c	484)	d	685)	b	686)	c	687)	b	688)	b
485)	b	486)	c	487)	a	488)	d	689)	c	690)	c	691)	c	692)	c
489)	b	490)	a	491)	c	492)	c	693)	a	694)	a	695)	d	696)	c
493)	c	494)	a	495)	c	496)	a	697)	c	698)	d	699)	b	700)	c
497)	b	498)	c	499)	b	500)	b	701)	a	702)	c	703)	d	704)	c
501)	b	502)	c	503)	c	504)	c	705)	c	706)	d	707)	b	708)	d
505)	c	506)	a	507)	b	508)	a	709)	b	710)	c	711)	c	712)	c
509)	b	510)	d	511)	c	512)	a	713)	b	714)	d	715)	c	716)	b
513)	d	514)	a	515)	a	516)	c	717)	a	718)	a	719)	a	720)	a
517)	d	518)	a	519)	b	520)	c	721)	b	722)	d	723)	a	724)	a
521)	a	522)	c	523)	d	524)	c	725)	a	726)	c	727)	c	728)	c
525)	d	526)	d	527)	c	528)	a	729)	a	730)	a	731)	a	732)	b
529)	b	530)	b	531)	b	532)	c	733)	c	734)	c	735)	d	736)	a
533)	c	534)	c	535)	b	536)	a	737)	a	738)	c	739)	d	740)	c
537)	c	538)	d	539)	d	540)	b	741)	a	742)	b	743)	b	744)	c
541)	b	542)	d	543)	b	544)	c	745)	a	746)	c	747)	c	748)	b
545)	c	546)	d	547)	c	548)	b	749)	c	750)	d	751)	d	752)	b
549)	c	550)	d	551)	c	552)	d	753)	b	754)	b	755)	a	756)	b
553)	a	554)	c	555)	d	556)	d	757)	d	758)	c	759)	d	760)	d
557)	d	558)	a	559)	c	560)	c	761)	b	762)	b	763)	a	764)	a
561)	d	562)	b	563)	d	564)	a	765)	a	766)	d	767)	b	768)	d
565)	d	566)	a	567)	c	568)	b	769)	c	770)	d	771)	d	772)	c
569)	b	570)	c	571)	c	572)	b	773)	b	774)	b	775)	c	776)	c
573)	c	574)	b	575)	b	576)	c	777)	c	778)	a	779)	a	780)	d
577)	d	578)	a	579)	d	580)	a	781)	b	782)	b	783)	d	784)	d

785)	c	786)	b	787)	d	788)	a
789)	a	790)	a	791)	b	792)	d
793)	d	794)	a	795)	c	796)	a
797)	b	798)	c	799)	d	800)	d
801)	d	802)	d	803)	a	804)	b
805)	c	806)	c	807)	d	808)	d
809)	a	810)	d	811)	c	812)	d
813)	c	814)	b	815)	d	816)	a
817)	c	818)	a	819)	a	820)	a
821)	c	822)	a	823)	c	824)	a
825)	b	826)	b	827)	c	828)	b
829)	d	830)	b	831)	c	832)	a
833)	b	834)	a	835)	b	836)	a
837)	d	838)	b	839)	c	840)	a
841)	a	842)	b	843)	d	844)	a
845)	c	846)	b	847)	b	848)	d
849)	d	850)	a	851)	c	852)	b
853)	c	854)	d	855)	a	856)	a
857)	b	858)	d	859)	d	860)	d
861)	a	862)	c	863)	a	864)	a
865)	b	866)	b	867)	d	868)	a
869)	b	870)	d	871)	d	872)	a
873)	d	874)	c	875)	a	876)	a
877)	c	878)	a	879)	a	880)	b
881)	a	882)	b	883)	d	884)	c
885)	c	886)	c	887)	c	888)	b
889)	c	890)	c	891)	d	892)	d
893)	b	894)	b	895)	d	896)	b
897)	d	898)	a	899)	b	900)	d
901)	a	902)	c	903)	d	904)	a
905)	c	906)	d	907)	b	908)	d
909)	a	910)	d	911)	c	912)	d
913)	b	914)	a	915)	c	916)	a
917)	b	918)	c	919)	d	920)	c
921)	c	922)	b	923)	a	924)	b
925)	d	926)	d	927)	a	928)	d
929)	b	930)	b	931)	a	932)	d
933)	c	934)	a	935)	b	936)	a
937)	c	938)	d	939)	c	940)	a
941)	d	942)	c	943)	b	944)	d
945)	a	946)	a	947)	a	948)	b
949)	a	950)	a	951)	a	952)	d
953)	a	954)	a	955)	b	956)	d
957)	b	958)	a	959)	c	960)	d
961)	c	962)	b	963)	b	964)	b
965)	c	966)	a	967)	a	968)	b
969)	a	970)	b	971)	b	972)	b
973)	a	974)	c	975)	d	976)	c
977)	b	978)	b	979)	a	980)	b
981)	c	982)	a	983)	b	984)	b
985)	c	986)	c	987)	b	988)	b

989)	b	990)	b	991)	a	992)	c
993)	c	994)	c	995)	b	996)	c
997)	a	998)	c	999)	a	1000)	d
1001)	c	1002)	c	1003)	a	1004)	d
1005)	c	1006)	d	1007)	a	1008)	a
1009)	a	1010)	c	1011)	d	1012)	c
1013)	b	1014)	b	1015)	b	1016)	a
1017)	b	1018)	d	1019)	c	1020)	d
1021)	b	1022)	a	1023)	b	1024)	b
1025)	a	1026)	c	1027)	c	1028)	c
1029)	c	1030)	a	1031)	a	1032)	d
1033)	b	1034)	b	1035)	c	1036)	a
1037)	a	1038)	d	1039)	b	1040)	a
1041)	c	1042)	c	1043)	c	1044)	a
1045)	c	1046)	c	1047)	c	1048)	c
1049)	b	1050)	d	1051)	b	1052)	a
1053)	a	1054)	c	1055)	d	1056)	b
1057)	c	1058)	a	1059)	c	1060)	a
1061)	c	1062)	d	1063)	d	1064)	b
1065)	a	1066)	d	1067)	b	1068)	c
1069)	b	1070)	b	1071)	a	1072)	d
1073)	b	1074)	d	1075)	c	1076)	a
1077)	d	1078)	d	1079)	d	1080)	a
1081)	a	1082)	b	1083)	d	1084)	c
1085)	c	1086)	b	1087)	b	1088)	d
1089)	d	1090)	a	1091)	b	1092)	a
1093)	b	1094)	d	1095)	a	1096)	a
1097)	b	1098)	c	1099)	d	1100)	a
1101)	a	1102)	c	1103)	b	1104)	a
1105)	a	1106)	b	1107)	a	1108)	a
1109)	b	1110)	b	1111)	c	1112)	b
1113)	b	1114)	a	1115)	b	1116)	d
1117)	d	1118)	a	1119)	c	1120)	c
1121)	a	1122)	c	1123)	c	1124)	a
1125)	a	1126)	c	1127)	c	1128)	c
1129)	d	1130)	b	1131)	c	1132)	d
1133)	d	1134)	c	1135)	b	1136)	a
1137)	a	1138)	c	1139)	c	1140)	a
1141)	d	1142)	c	1143)	b	1144)	d
1145)	b	1146)	b	1147)	a	1148)	a
1149)	d	1150)	d	1151)	a	1152)	b
1153)	c	1154)	b	1155)	d	1156)	b
1157)	b	1158)	b	1159)	a	1160)	a
1161)	a	1162)	b	1163)	b	1164)	b
1165)	a	1166)	b	1167)	a	1168)	a
1169)	a	1170)	a	1171)	a	1172)	a
1173)	d	1174)	d	1175)	b	1176)	c
1177)	b	1178)	b	1179)	a	1180)	c
1181)	b	1182)	b	1183)	d	1184)	a
1185)	a	1186)	c	1187)	c	1188)	b
1189)	d	1190)	d	1191)	b	1192)	a

1193) c	**1194) a**	**1195) a**	**1196) c**
1197) d	**1198) c**	**1199) b**	**1200) c**
1201) b	**1202) b**	**1203) c**	**1204) c**
1205) b	**1206) a**	**1207) a**	**1208) c**
1209) c	**1210) b**	**1211) b**	**1212) b**
1213) d	**1214) b**	**1215) d**	**1216) d**
1217) a	**1218) b**	**1219) b**	**1220) d**
1221) c	**1222) b**	**1223) d**	**1224) c**
1225) c	**1226) b**	**1227) b**	**1228) d**
1229) d	**1230) d**	**1231) b**	**1232) d**
1233) d	**1234) c**	**1235) a**	**1236) c**
1237) a	**1238) b**	**1239) b**	**1240) b**
1241) c	**1242) d**	**1243) a**	**1244) d**
1245) b	**1246) b**	**1247) b**	**1248) a**
1249) c	**1250) c**	**1251) b**	**1252) d**
1253) c	**1254) c**	**1255) b**	**1256) c**
1257) a	**1258) d**	**1259) a**	**1260) d**
1261) d	**1262) b**	**1263) b**	**1264) b**

1265) b	**1266) d**	**1267) c**	**1268) b**
1269) b	**1270) c**	**1271) c**	**1272) d**
1273) c	**1274) c**	**1275) c**	**1276) a**
1277) b	**1278) a**	**1279) d**	**1280) c**
1281) d	**1282) d**	**1283) c**	**1284) c**
1285) a	**1286) d**	**1287) c**	**1288) c**
1289) d	**1290) a**	**1291) c**	**1292) c**
1293) b	**1294) a**	**1295) b**	**1296) a**
1297) c	**1298) a**	**1299) d**	**1300) a**
1301) d	**1302) a**	**1303) c**	**1304) c**
1305) d	**1306) c**	**1307) a**	**1308) c**
1309) d	**1310) a**	**1311) d**	**1312) d**
1313) b	**1314) a**	**1315) b**	**1316) b**
1317) a	**1318) b**	**1319) c**	**1320) d**
1321) b	**1322) b**	**1323) b**	**1324) b**
1325) d	**1326) c**	**1327) d**	**1328) b**
1329) b			

: HINTS AND SOLUTIONS :

1 **(d)**

Current $= \dfrac{\text{net emf}}{\text{net resistance}}$

or $I = \frac{2+2+2}{1+1+1+2} = \frac{6}{5} = 1.2A$

2 **(b)**

The bridge will be balanced when the shunted resistance of value 2Ω *ie*, $2 = \frac{3\times S}{3+S}$. On solving $S = 6\,\Omega$

4 **(a)**

Using Wheatstone principle $\frac{P}{Q} = \frac{R}{S} = \frac{R}{100-l}$

$= \dfrac{35}{100-35} = \dfrac{35}{65} = \dfrac{7}{13}$

5 **(a)**

If resistances of bulbs are R_1 and R_2 respectively then in parallel

$\dfrac{1}{R_P} = \dfrac{1}{R_1} + \dfrac{1}{R_2} \Rightarrow \dfrac{1}{\left(\frac{V^2}{P_p}\right)} = \dfrac{1}{\left(\frac{V^2}{P_1}\right)} + \dfrac{1}{\left(\frac{V^2}{P_2}\right)}$

$\Rightarrow P_P = P_1 + P_2$

6 **(c)**

Ist case

$\dfrac{30}{P+Q} = \dfrac{l}{(100-l)}$

$\dfrac{30}{P+Q} = \dfrac{37.5}{(100-37.5)}$

$\dfrac{30}{P+Q} = \dfrac{37.5}{62.5}$

$P + Q = \dfrac{30 \times 62.5}{37.5}$

$P + Q = 50$ ...(i)

IInd case

$\dfrac{30}{\frac{PQ}{P+Q}} = \dfrac{l}{(100-l)}$

$\dfrac{30(P+Q)}{PQ} = \dfrac{71.4}{(100-71.4)}$

$\dfrac{30 \times 50}{PQ} = \dfrac{71.4}{28.6}$

$PQ = \dfrac{30 \times 50 \times 28.6}{71.4}$

$P \approx 600$ ....(ii)

So, from Eqs. (i) and (ii)

$P = 30\Omega$ and $Q = 20\Omega$

7 **(b)**

$r = \left(\frac{l_1 - l_2}{l_2}\right) \times R' = \left(\frac{l_1 - 2}{2}\right) \times 5$ ...(i)

and $r = \left(\frac{l_1 - 3}{3}\right) \times 10$ ...(ii)

on solving (i) and (ii), $r = 10\,\Omega$

8 **(b)**

No. of ions liberated $(n) = \frac{I\times t}{e\times \text{Valency}(p)}$

ie, $n \propto \dfrac{1}{P}$

$\therefore \dfrac{n_{\text{Ag}}}{n_{\text{Al}}} = \dfrac{P_{\text{Al}}}{P_{\text{Ag}}} = \dfrac{3}{1}$

9 **(b)**

Heat produced $= \frac{V^2 t}{4.2\,R} = mL$

or $m = \frac{V^2}{4.2\,R\,L} = \frac{(210)^2\times 1}{4.2\times 50\times 80} = 2.62$ g

10 **(c)**

$S = \dfrac{i_g G}{(i - i_g)} = \dfrac{1 \times 0.018}{10-1} = \dfrac{0.018}{9} = 0.002\Omega$

11 **(b)**

Order of drift velocity $= 10^{-4} m/sec = 10^{-2} cm/sec$

12 **(c)**

Ammeter is always connected in series with circuit

13 **(d)**

Let (ρ_A, l_A, r_A, A_A) and (ρ_B, l_B, r_B, A_B) are specific resistances, lengths, radii and areas of wires A and B respectively.

Resistance of

$A = R_A = \dfrac{\rho_A l_A}{A_A} = \dfrac{\rho_A l_A}{\pi R_A^2}$

Resistance of

$B = R_B = \dfrac{\rho_B l_B}{A_B} = \dfrac{\rho_B l_B}{\pi r_B^2}$

For given information

$\rho_B = 2\rho_A$

$r_B = 2r_A$

And $R_A = R_B$

$\therefore \dfrac{\rho_A l_A}{\pi r_A^2} = \dfrac{\rho_B l_B}{\pi r_B^2}$

$\Longrightarrow \dfrac{\rho_A l_A}{\pi r_A^2} = \dfrac{2\rho_A \times l_B}{\pi (2r_A)^2}$

$\Longrightarrow \dfrac{l_B}{l_A} = \dfrac{2}{1} = 2:1$

14 **(b)**

$P = \dfrac{V^2}{R} \Rightarrow \dfrac{P_1}{P_2} = \dfrac{R_2}{R_1} \Rightarrow \dfrac{6}{P_2} = \dfrac{4}{6} = \dfrac{2}{3} \Rightarrow P_2 = 9\,W$

15 **(a)**

An ideal cell has zero resistance

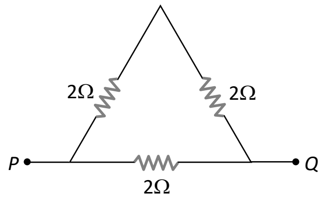
16 **(c)**
$i = q/t = ne/t$

or $n = it/e = \frac{2\times1}{1.6\times10^{-19}} = 1.25 \times 10^{19}$

17 **(b)**
In parallel $P_{consumed} \propto$ Brightness $\propto \frac{1}{R}$
$P_A > P_B$ [Given] $\therefore R_A < R_B$

18 **(d)**
$I = \frac{P}{V} = \frac{10^5}{200} = 500$ A
and $W = zlt = 0.367 \times 10^{-3} \times 500 \times 1 = 0.1835$ g

19 **(a)**
Equivalent resistance of the combination
$$= \frac{(2+2)\times 2}{2+2+2} = \frac{8}{6} = \frac{4}{3}\Omega$$



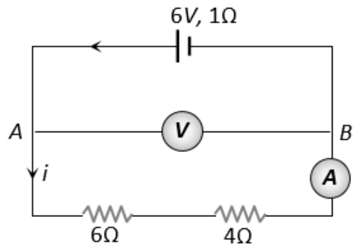
20 **(d)**
Resistance of a conductor varies linearly with temperature as
$R_t = R_0(1+\alpha t)$
For the first conductor
$T_{t_1} = R_0(1+\alpha_1 t_1)$
$$or \quad \alpha_1 = \frac{Rt_1 - R_0}{t} \quad ....(i)$$
Similarly, for second conductor
$$\alpha_2 = \frac{Rt_2 - R_0}{t_2} \quad ....(ii)$$
From Eq. (i) and Eq. (ii), we get
$$\frac{\alpha_1}{\alpha_2} = \frac{t_2}{t_1}$$

21 **(a)**
Ammeter is always connected in series and voltmeter in parallel.

22 **(a)**
$$S = \frac{G}{\frac{i}{i_g} - 1} = \frac{25}{\frac{5}{50\times10^{-6}} - 1} = \frac{25}{10^5 - 1} = \frac{25}{10^5}$$
$$= 2.5 \times 10^{-4}\Omega$$

23 **(a)**
Potential gradient $= \frac{V}{L} = \frac{iR}{L} = \frac{i\rho L}{AL} = \frac{i\rho}{A}$
$$= \frac{0.2 \times 40 \times 10^{-8}}{8 \times 10^{-6}} = 10^{-2} V/m$$

24 **(c)**
The given circuit can be redrawn as follows



Current $i = \frac{6}{6+4+1} = \frac{6}{11} A$
P.D. between A and $B, V = \frac{6}{11} \times 10 = \frac{60}{11} V$

25 **(b)**
1 division $= 1\mu A$
Current for 1°C $= \frac{40\mu V}{10} = 4\mu A$
$$1\mu A = \frac{1}{4}\text{ °C} = 0.25\text{°C}$$

26 **(a)**
Two resistances of each side of triangle are connected in parallel. Therefore, the effective resistance of each arm of the triangle would be $= \frac{r\times r}{r+r} = \frac{r}{2}$. The two arms AB

and AC are in series and they together are in parallel with third one.

$\therefore \quad R'(r/2) + (r/2) = r$

Total resistance

$$\frac{1}{R} = \frac{1}{r} + \frac{2}{r} = \frac{3}{r}$$

$R = r/3$

27 **(d)**
$I = neAv_d$
$$\text{or } v_d = \frac{1}{neA}$$
$$\text{or } v_d \propto \frac{I}{A}$$
$$\therefore \frac{v'd}{vd} = \frac{I'/A'}{I/A} = \frac{2I/2A}{I/A} = 1$$
or $\quad v'd = v_d = v$

28 **(d)**
Let the resistance of the wire be R, then we know that resistance is proportional to the length of the wire. So each of the four wires will have $R/4$ resistance and they are connected in parallel. So the effective resistance will be
$$\frac{1}{R_1} = \left(\frac{4}{R}\right)4 \Rightarrow R_1 = \frac{R}{16}$$

29 **(b)**
By Faraday's law, $m \propto it$
$$\therefore \frac{m_1}{m_2} = \frac{i_1 t_1}{i_2 t_2} \Rightarrow \frac{m}{m_2} = \frac{4 \times 120}{6 \times 40} \Rightarrow m_2 = \frac{m}{2}$$

30 **(d)**

1 coulomb $\times$ 1volt = 1 joule

Hence, option (d) is incorrect.

31 **(a)**

$$\frac{i}{i_g} = 1 + \frac{G}{S} \Rightarrow \frac{i.G}{V_g} = 1 + \frac{G}{S} \Rightarrow \frac{100 \times 10^{-3} \times 40}{800 \times 10^{-3}}$$
$$= 1 + \frac{40}{S}$$
$\Rightarrow S = 10\Omega$

32 **(a)**

This is a balanced Wheatstone bridge. Therefore no current will flow from the diagonal resistance 10Ω

$\therefore$ Equivalent resistance $= \frac{(10+10)\times(10+10)}{(10+10)+(10+10)} = 10\Omega$

33 **(a)**

$E = at + \frac{1}{2}bt^2$ ... (i)

Differentiating Eq. (i), w.r.t., t

We have

$\frac{dE}{dt} = a + bt$

When $t = t_n, ie,$ neural temperature, then

$\frac{dE}{dt} = 0$

$\therefore 0 = a + bt_n$ or $t_n = -\frac{a}{b}$

The temperature of inversion

$t_i = 2t_n = t_0$

$= 2t_n - 0 = -\frac{2a}{b}$

Thermoelectric power

$P = \frac{dE}{dt} = a + bt$

34 **(c)**

Since, charge (q)=current (i) $\times$ times (t)

Therefore, charge is equal to area under the curve.

$\therefore$ Ist rectangle $=q=lb=2$

IInd rectangle $=q=lb=2$

IIIrd triangle = q $= \frac{1}{2}$lb = 2

Hence, ratio is 1:1:1.

35 **(b)**

The internal resistance of battery is given by

$$r = \left(\frac{E}{V} - 1\right)R = \left(\frac{40}{30} - 1\right) \times 9 = \frac{9 \times 10}{30} = 3\Omega$$

36 **(a)**

Conductivity $\sigma = \frac{1}{\rho}$ ...(i)

and conductance $G = \frac{1}{R}$

$\Rightarrow GR = 1$ ....(ii)

From equation (i) and (ii) $\sigma = \frac{GR}{\rho}$

38 **(d)**

Let the current in 12Ω resistance is i

Applying loop theorem in closed mesh $AEFCA$

$12i = -E + E = 0$

$\therefore i = 0$

39 **(b)**

$$P \propto V^2 \Rightarrow \frac{P}{P_0} = \left(\frac{V}{V_0}\right)^2 \Rightarrow P = \left(\frac{V}{V_0}\right)^2 P_0$$

40 **(a)**

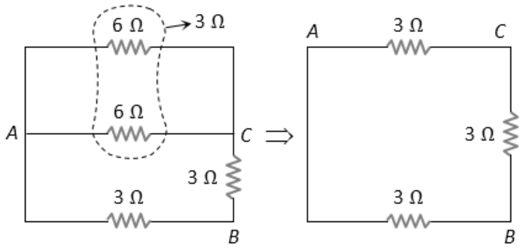
$$P = \frac{V^2}{R} \Rightarrow \frac{P_P}{P_S} = \frac{R_S}{R_P} = \frac{(R_1 + R_2)}{R_1R_2/(R_1 + R_2)}$$
$$= \frac{(R_1 + R_2)^2}{R_1R_2}$$
$$\Rightarrow \frac{100}{25} = \frac{(R_1 + R_2)^2}{R_1R_2} \Rightarrow \frac{R_1}{R_2} = \frac{1}{1}$$

41 **(c)**

For semiconductors, resistance decreases on increasing the temperature

42 **(b)**

Given circuit is equivalent to



So the equivalent resistance between points A and B is equal to

$R = \frac{6 \times 3}{6 + 3} = 2\Omega$

43 **(d)**

Energy consumed in $kWh = \frac{watt \times hour}{1000}$

$\Rightarrow$ For 30 days, $P = \frac{10\times50\times10}{1000} \times 30 = 150kWh$

44 **(a)**

Ammeter is always connected in series and Voltmeter is always connected in parallel

45 **(c)**

$$It = \frac{m}{z} = \frac{5 \times 10^{-3}}{3.387 \times 10^{-7}}$$
$= \frac{5\times10^4}{3.387\times60\times60}$ Ah = 4.1 Ah

46 **(d)**

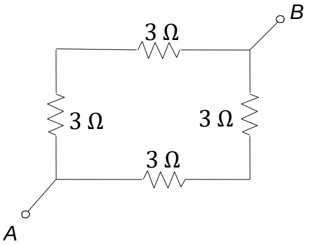
$$\frac{R_1}{R_2} = \frac{(1 + \alpha t_1)}{(1 + \alpha t_2)} \Rightarrow \frac{5}{6} = \frac{(1 + \alpha \times 50)}{(1 + \alpha \times 100)} \Rightarrow \alpha$$
$= \frac{1}{200}$ per °C

Again by $R_t = R_0(1 + \alpha t)$

$$\Rightarrow 5 = R_0\left(1+\frac{1}{200}\times 50\right) \Rightarrow R_0 = 4\Omega$$

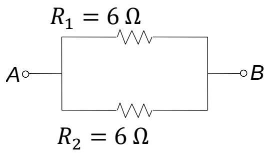
47 **(d)**

Given, the resistance of wire R=12Ω. The wire is bent in square form



$R_1 = 3+3 = 6\Omega$

$R_2 = 3+3 = 6\Omega$



$$\frac{1}{R'} = \frac{1}{6}+\frac{1}{6}$$

or $\frac{1}{R'} = \frac{2}{6}$

or $R' = 3\Omega$

48 **(a)**

Chemical equivalent of gold $= \frac{197.1}{3} = 65.7$

Gold to be deposited $= \frac{200\times5}{100}$ =10g

Electrochemical equivalent of gold

$$z_2 = \frac{W_2}{W_1}z_1\; z_2 = \frac{65.7}{1.008}\times 0.1044\times10^{-4}\text{gC}^{-1}$$

Also $m = zIt, t = \frac{m}{zI}$

$$\Rightarrow = \frac{10}{\left(\frac{65.7}{1.008}\times 0.1044\times10^{-4}\times 2\right)}$$

= 7347.9s

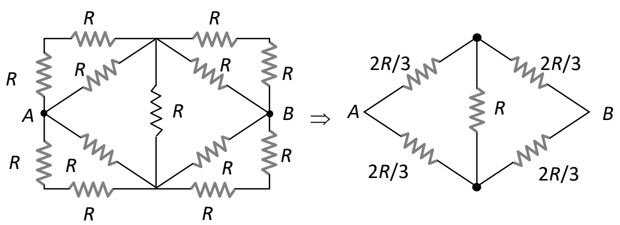
49 **(d)**

$I^2\times 6 = 60$ or $I = \sqrt{10}$ A

Current through upper branch $= 2\sqrt{10}$A. Heat produced per second 3Ω =

$(2\sqrt{10})^2 \times 3$ cal = 120 cal.

50 **(c)**



Hence $R_{eq} = \frac{2R}{3}$ [Since it's a balanced Wheatstone bridge]

51 **(d)**

Because cell is in open circuit

54 **(c)**

$$v_d = \frac{I}{nAe} = \frac{20}{10^{29}\times10^{-6}\times1.6\times10^{-19}}$$
$$= 1.25\times10^{-3}\text{m/s}$$

55 **(b)**

Let R be the resistance of each lamp and V be the voltage supplied to the circuit. Current in the circuit is

$$I_1 = \frac{V}{R+\frac{R\times R}{R+R}} = \frac{2V}{3R}$$

Current flowing through B or C,

$$I_2 = \frac{I_1}{2} = \frac{1}{2}\left(\frac{2V}{3R}\right) = \frac{V}{3R}$$

When C is fused, the whole current flows through A and B.

Then , $I_2' = V/2R$

So current through A decreases and current through B increases. Therefore brilliance of A decreases and that of B increase.

56 **(c)**

As for an electric appliance $R = \frac{V^2}{P}$.

For first bulb, its resistance

$$R_2 = \frac{V^2}{P_1} = \frac{250\times250}{100} = 625\ \Omega$$

For second bulb, its resistance

$$R_2 = \frac{V_2^2}{P_2} = \frac{200\times200}{100}$$
$$= 400\ \Omega$$

Now, in series potential divides in proportion to resistance.

So, $V_2 = \frac{R_2}{(R_1+R_2)}\ V$

Where V is supply voltage.

∴ Potential drop across bulb B_2.

$$V_2 = \frac{400}{(625+400)}\times 250$$
$$= 97.56\text{ V}$$
$$= 98\text{ V}$$

57 **(d)**

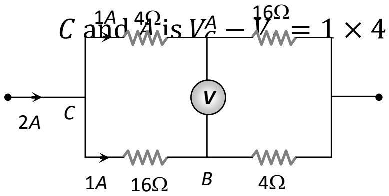
Equivalent weight of aluminium $= \frac{27}{3} = 9$

So 1 $faraday = 96500\ C$ are required to liberate 9 gm of Al

58 **(a)**

In the following circuit potential difference between

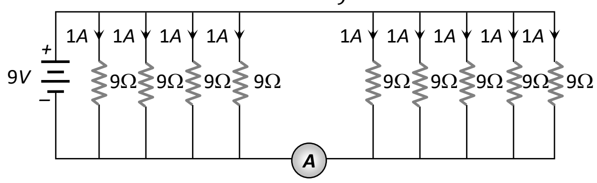
C and A is $V_A - V_C = 1\times4 = 4$ ...(i)



C and B is $V_C - V_B = 1 \times 16 = 16$ ...(ii)
On solving equations (i) and (ii) we get
$V_A - V_B = 12V$

59 **(a)**

Equivalent resistance $R = \frac{9}{9} = 1\Omega$



Current $i = \frac{9}{1} = 9A$

Current passing through the ammeter $= 5A$

60 **(b)**

Power, $P = \frac{V^2}{R}$

$$R = \frac{V^2}{P} = \frac{(60)^2}{160} = 22.5\Omega$$

Now, according to Ohm's law

V=IR

$$\therefore\ I = \frac{60}{22.5}$$

$\Longrightarrow I = 2.6A$

Here, $t = 60s$

As $I = \frac{ne}{t}$

$$\Longrightarrow\ n = \frac{I \times t}{e}$$

$$= \frac{26 \times 60}{1.6 \times 10^{-19}} \approx 10^{21}$$

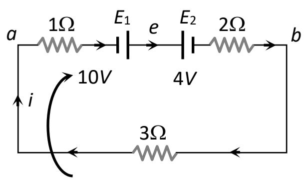
61 **(a)**

$$i = \frac{e}{R} \Rightarrow 3 \times 10^{-7} = \frac{(30 \times 10^{-6}) \times \theta}{50} \Rightarrow \theta = 0.5°$$

62 **(d)**

Since $E_1(10V) > E_2(4V)$

So current in the circuit will be clockwise



Applying Kirchhoff's voltage law

$-1 \times i + 10 - 4 - 2 \times i - 3i = 0 \Rightarrow i$
$= 1A(a \text{ to } b \text{ via } e)$

$\therefore$ Current $= \frac{V}{R} = \frac{10-4}{6} = 1.0$ *ampere*

63 **(d)**

Given, $V = 10 \times 10^{-6}t - \frac{1}{40} \times 10^{-6}t^2$

At neutral temperature

$$\frac{dV}{dt} = 0$$

$$\therefore\ 10 \times 10^{-6} - \frac{1}{20} \times 10^{-6}\ t_n = 0$$

or $t_n = 200°C$

Also at neutral temperature, thermo-emf is maximum.

Thus,

$$V_{max} = 10 \times 10^{-6}(200) - \frac{1}{40} \times 10^{-6}(200)^2$$
$$= 2 \times 10^{-3} - 1 \times 10^{-3} = 1 \text{ mv}$$

64 **(d)**

For conversion of galvanometer (of resistance) into voltmeter, a resistance R is connected in series

$\therefore i_g = \frac{V_1}{R+G}$ and $i_g = \frac{V_2}{2R+G}$

$$\Rightarrow \frac{V_1}{R+G} = \frac{V_2}{2R+G} \Rightarrow \frac{V_2}{V_1} = \frac{2R+G}{R+G}$$
$$= \frac{2(R+G) - G}{(R+G)}$$
$$= 2 - \frac{G}{(R+G)} \Rightarrow V_2 = 2V_1 - \frac{V_1 G}{(R+G)} \Rightarrow V_2 < 2V_1$$

65 **(c)**

$I = \frac{E}{R_T} = \frac{2.5}{10+R}$ and $V = I.R = \frac{2.5 \times 10}{10+R} = \frac{25}{10+R}$

$$x = \frac{V}{L} = \frac{25}{(10+R)L}$$

$E = x.l_1$

$$\Rightarrow 1 = \frac{25}{(10+R)L} \times \frac{L}{2} \Rightarrow 25 = 20 + 2R$$

$$\Rightarrow 2R = 5 \Rightarrow R = \frac{5}{2}$$

$\therefore$ Now the resistance is doubled

$$R^1 = \frac{5}{2} \times 2 = 5\Omega$$

$$\therefore x = \frac{25}{(10+5)L} = \frac{25}{15.L} = \frac{5}{3L}$$

$E = x.l_2$

$$\Rightarrow 1 = \frac{5}{3L}.l_2 \Rightarrow l_2 = \frac{3L}{2} = 0.6L$$

66 **(a)**

Voltage sensitivity $= \frac{Q}{V}$

Current sensitivity $= \frac{Q}{I}$

Also, potential difference

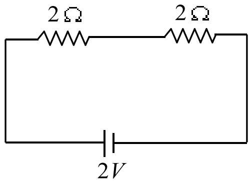
$V = IG$

Hence, $\frac{V_S}{I_S} = \frac{Q/V}{Q/I} = \frac{I}{V} = \frac{I}{IG}$

$$\therefore \frac{V_s}{I_s} = \frac{1}{G}$$

67 **(c)**

In steady state the branch containing capacitors, can be neglected. So reduced circuit is as follows



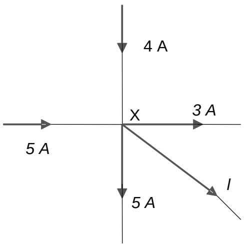
Power $P = \frac{V^2}{R} = \frac{(2)^2}{4} = 1W$

68 **(b)**

According to Kirchhoff's first law

(5A)+(4A)+(-3A)+(-5A)+I=0

Or I=-1A



69 **(b)**

When the heating coil is cut into two equal parts and these parts are joined in parallel, the resistance of coil is reduced to one fourth, so power consumed will become 4 times

$i.e. 400\ Js^{-1}$

70 **(d)**

The emf of the standard cell must be greater than that of experimental cells, otherwise balance point is not obtained

71 **(d)**

$E = \alpha t + \frac{1}{2}\beta t^2$, graph between E and t will be a parabola, such that first emf increases and then decreases

72 **(d)**

Potential difference between A and B

$V_A - V_B = 1 \times 1.5$

$\Rightarrow V_A - 0 = 1.5V \Rightarrow V_A = 1.5V$

Potential difference between B and C

$V_B - V_C = 1 \times 2.5 = 2.5V$

$\Rightarrow 0 - V_C = 2.5V \Rightarrow V_C = -2.5V$

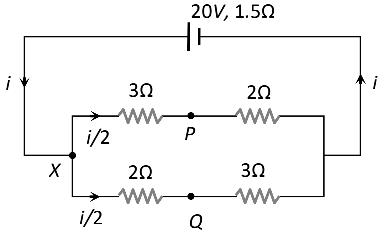
Potential difference between C and D

$V_C - V_D = -2V \Rightarrow -2.5 - V_D = -2 \Rightarrow V_D = -0.5V$

73 **(d)**

$$R_{eq} = \frac{5}{2}\Omega$$

$$i = \frac{20}{\frac{5}{2} + 1.5} = 5A$$



Potential difference between X and P,

$V_X - V_P = \left(\frac{5}{2}\right) \times 3 = 7.5V$ ....(i)

$V_X - V_Q = \frac{5}{2} \times 2 = 5V$ ....(ii)

On solving (i) and (ii) $V_P - V_Q = -2.5\ volt; V_Q > V_P$

Short Trick : $(V_P - V_Q) = \frac{i}{2}(R_2 - R_1) = \frac{5}{2}(2 - 3) = -2.5$

$\Rightarrow V_Q > V_P$

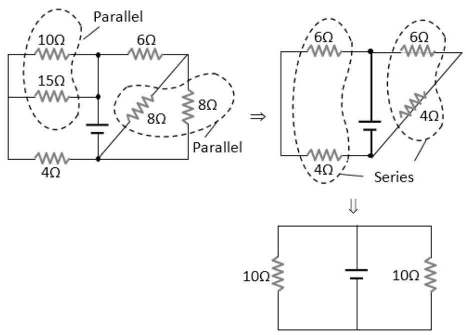
74 **(c)**

Initially the inductance will oppose the current which tries to flow through the inductance. But 10Ω and 20Ω can conduct. The current will be

$$\frac{2V}{30\Omega} = \frac{1}{15}A$$

75 **(c)**

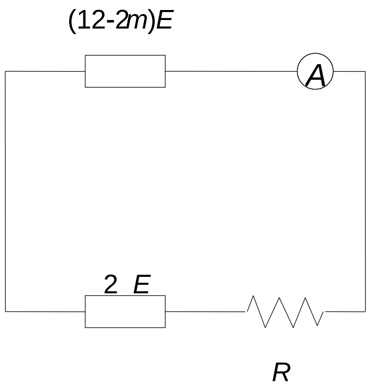
Given circuit can be reduced to a simple circuit as shown in figures below



76 **(d)**

Let polarity of m cells in a 12 cells battery is reversed, then equivalent emf of the battery = $(12 - 2m)E$

Now the circuit can be drawn as



When 12-cell battery and 2-cell battery aid each other, then current through the circuit

$$i_1 = \frac{(12-2m)E + 2E}{R}$$

or $3 = \frac{(14-2m)E}{R}$ ....(i)

When they oppose each other, the current through the circuit.

$$i_2 = \frac{(12-2m)E - 2E}{R}$$

or $2 = \frac{(10-2m)E}{R}$ ...(ii)

Dividing Eq. (i) by Eq. (ii), we have

$$\frac{3}{2} = \frac{14-2m}{10-2m}$$

or $30 - 6m = 28 - 4m$

or $2m = 2$

or $m = 1$

77 **(b)**

$$i = qv = 1.6 \times 10^{-19} \times 6.6 \times 10^{15}$$
$$= 10.56 \times 10^{-4} A = 1 mA$$

78 **(d)**

$R = \rho \frac{l}{A}$ and $P \propto \frac{1}{R} \Rightarrow P \propto \frac{A}{l} \Rightarrow P \propto \frac{d^2}{l} \Rightarrow P_A = 2P_B$

79 **(a)**

Let the resistance of each heater wire is R. When two wires are connected in series, the heat developed is

$$H_1 = \frac{V^2 t}{2R} \quad \text{...(i)}$$

When two heater wires are connected in parallel, the heat developed is

$$H_2 = \frac{V^2 t}{R/2} = \frac{2V^2 t}{R} \quad \text{...(ii)}$$

Dividing Eq. (i) by Eq. (ii), we get

$$\frac{H_1}{H_2} = \frac{1}{4} \text{ or } H_1 : H_2 = 1 : 4$$

80 **(a)**

$$R_{\text{eff}} = \frac{(P+Q)(R+S)}{(P+Q+R+S)} = \frac{4}{3}R$$

81 **(a)**

In the first case, $Zit = m$

In the second case, $Z \times \frac{i}{4} \times 4t = m$

82 **(d)**

For conductors, resistance $\propto$ Temperature and for semiconductor, resistance $\propto \frac{1}{\text{Temperature}}$

83 **(a)**

Since resistance connected in arms CE, ED, CF and FD will form a balanced Wheatstone bridge, therefore, the resistance of arm EF becomes ineffective. Now resistance of arm CED or $CFD = 2 + 2 = 4\Omega$. Effective resistance of these two parallel arm$= \frac{4\times4}{4+4} = 2\Omega$

Now resistance of arm $ACDB = 2 + 2 + 2 = 6\Omega$, is in parallel with resistance arm $AB = 2\Omega$. Thus, effective resistance between A and B

$$= \frac{6\times2}{6+2} = \frac{3}{2}\Omega$$

84 **(c)**

$$i = \frac{dQ}{dt} = \frac{d}{dt}(5t^2 + 3t + 1) = 10t + 3$$

When $t = 5\text{s}, i = 10 \times 5 + 3 = 53\ A$

85 **(a)**

The current taken by the silver voltameter

$$I_1 = \frac{n}{Zt} = \frac{1}{11.2 \times 10^{-4} \times 30 \times 60} = 0.496\ A$$

and by copper voltameter

$$I_2 = \frac{1.8}{6.6 \times 10^{-4} \times 30 \times 60} = 1.515\ A$$

The current $I = (I_1 + I_2) = 2.011\ A$

Power $P = IV = 2.011 \times 12 = 24.132\ J/sec$

86 **(c)**

Average current

$$i = \frac{50+100+50}{3} = \frac{200}{3}\text{mA}$$

$$z = \frac{m}{it} = \frac{3m}{200 \times 10^{-3} \times 30} = \frac{m}{2}$$

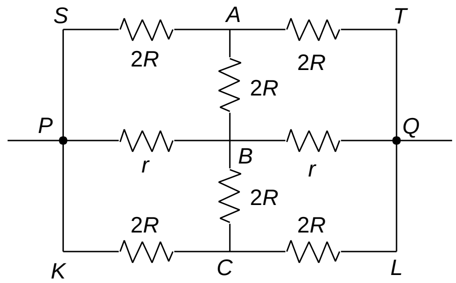
87 **(c)**

The equivalent current due to motion of electrons is given by

$$I = \frac{e}{t} = \frac{1.6 \times 10^{-19}}{1.594 \times 10^{-18}}$$
$$= 1.0037 \times 10^{-1}$$
$$= 100.37 \times 10^{-3} A$$
$$= 100.37 mA$$

88 **(a)**

In the circuit arrangement $PSTQ$ is a balanced Wheatstone bridge, hence resistance $2R$ joined in arm AB be omitted. Similarly, resistance $2R$ joined in arm BC may also be omitted.



$$\therefore \frac{1}{R_{\text{eq}}} = \frac{1}{4R} + \frac{1}{2r} + \frac{1}{4R} = \frac{\mu + 2R + \mu}{4\mu R} = \frac{(R+r)}{2Rr}$$

$$\Rightarrow R_{\text{eq}} = \frac{2Rr}{R+r}$$

89 **(b)**

$$\frac{dT}{dt} = \frac{d}{dt}(at^2 - bt^3) = 2at - 3bt^2$$

When $t = t_n (ie$, neutral temperature), $\frac{dE}{dt} = 0$

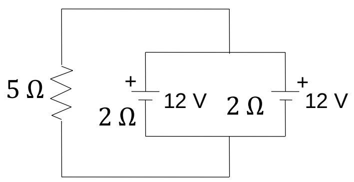
$\therefore 0 = 2at_n - 3bt_n^2$ or $t_n = \frac{2a}{3b}$.

90 **(a)**

The circuit may be redrawn as shown in the adjacent figure

Here $E_{\text{eq}} = 12V, r_{\text{eq}} = \frac{2\times2}{2+2} = 1\Omega$

$$i = \frac{E_{\text{eq}}}{R + r_{\text{eq}}} = \frac{12}{5+1} = \frac{12}{6} = 2\Omega$$



91 **(c)**

$i = nAev_d$

or $v_d = \frac{i}{nAe}$

Total number of free electrons in the unit length of conductor, $N = nA \times 1$.

Total linear momentum of all free electrons per unit length

$$= (Nm)v_d = nAm \times \frac{i}{nAe} = \frac{i}{(e/m)} = \frac{i}{s}$$

92 **(b)**

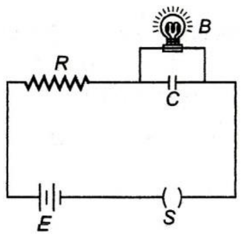
As $m = z\,l\,t = z\left(\frac{V}{R}\right)t$ $ie, m \propto Vt$

$\therefore \frac{m_2}{m_1} = \frac{V_2t_2}{V_1t_1}$

or $m_2 = \frac{V_2t_2}{V_1t_2} \times m_1 = \frac{6\times45\times2}{12\times30}$ =1.5g.

93 **(a)**

Neon bulb is filled with gas, so the resistance is infinite; hence no current flows through it.



Now, $V_c = E(1 - e^{-t/RC})$

$$\Rightarrow 120 = 200(1 - e^{-t/RC})$$

$$\Rightarrow e^{-t/RC} = \frac{2}{5}$$

$$\Rightarrow t = RC \ln 2.5$$

$$\Rightarrow R = \frac{t}{C \ln 2.5} = \frac{5}{2.303 \times 2 \times 10^6 \log 2.5}$$

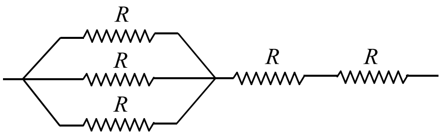
$$= 2.7 \times 10^6\ \Omega$$

94 **(b)**

$v_d \propto 1/l$. Therefore, drift velocity is halued

95 **(b)**

$$\frac{1}{R_P} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$$



$$\Rightarrow R_P = \frac{R}{3}\Omega$$

$$\Rightarrow R_S = R + R = 2\,R\Omega$$

$$\Rightarrow R_{\text{net}} = R_P + R_S = 2R + \frac{R}{3} = \frac{7R}{3}\Omega$$

96 **(a)**

The resistivity of metal increases when it is converted into an alloy

$\therefore \rho' > \rho$

98 **(b)**

This is because of secondary ionisation which is possible in the gas filled in it

99 **(a)**

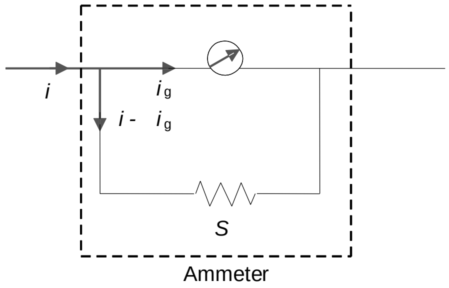
Using $R_{T_2} = R_{T_1}[1 + \alpha(T_2 - T_1)]$

$\Rightarrow R_{100} = R_{50}[1 + \alpha(100 - 50)]$

$\Rightarrow 7 = 5[1 + (\alpha \times 50)] \Rightarrow \alpha = \frac{(7-5)}{250} = 0.008/°\text{C}$

100 **(b)**

Ammeter is made by connecting a low resistance shunt S in parallel with galvanometer G. since G and S are in parallel, the potential difference across them is same.



$i_g \times G = (i - i_g) \times S$

Given, $G = R, i = 4i_g$

$$S = \frac{i_g}{4i_g - i_g} \times R = \frac{i_g}{3i_g} \times R = \frac{R}{3}$$

101 **(a)**

Maximum current flows through bulb (1) Therefore, it will lights brightly.

102 **(d)**

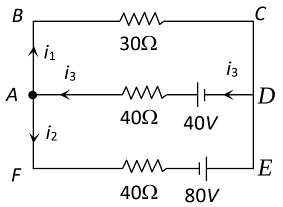
$$S = \frac{i_g G}{(i - i_g)} \Rightarrow \frac{G}{S} = \frac{i = i_g}{i_g} = \frac{10 - 1}{1} = \frac{9}{1}$$

104 **(d)**

Potentiometer works on null deflection method. In balance condition no current flows in secondary circuit.

106 **(b)**

The circuit can be simplified as follows



Applying KCL at junction A

$i_3 = i_1 + i_2$ ...(i)

Applying Kirchhoff's voltage law for the loop $ABCDA$

$-30i_1 - 40i_3 + 40 = 0$

$\Rightarrow -30i_1 - 40(i_1 + i_2) + 40 = 0$

$\Rightarrow 7i_1 + 4i_2 = 4$ ...(ii)

Applying Kirchhoff's voltage law for the loop $ADEFA$

$-40i_2 - 40i_3 + 80 + 40 = 0$

$\Rightarrow -40i_2 - 40(i_1 + i_2) = -120$

$\Rightarrow i_1 + 2i_2 = 3$ ...(iii)

On solving equation (ii) and (iii) $i_1 = -0.4A$

107 **(c)**

From Faraday's law, $m/E =$ constant

where $m =$ mass of substance deposited, $E =$ chemical equivalent

$$\therefore \frac{m_2}{m_1} = \frac{E_2}{E_1} \Rightarrow m_2 = \frac{108}{32} \times 1.6 = 5.4g$$

108 **(b)**

Based on Peltier effect

109 **(b)**

The current through the voltameter is same as drawn from the battery outside it

110 **(a)**

Slope of graph

$$= \frac{I}{V} = \frac{1}{R}$$

If experiment is performed at higher temperature then resistance increase and hence slope decrease, choice (a) is wrong.

Similarly in choice (b) and (c) resistance increase.

But for choice (d) resistance R increases, so slope decreases

111 **(d)**

Heat produced, $H = \frac{V^2 t}{R}$. When voltage is halved, the heat produced becomes one-fourth. Hence time taken to heat the water becomes four time.

112 **(c)**

$$H = \frac{V^2}{R} t \Rightarrow \frac{H_1}{H_2} = \frac{R_2}{R_1} = \frac{4}{2} = \frac{2}{1}$$

113 **(c)**

Given that

emf $E_N = 1.5r_N$

Where r_N is the internal resistance of nth cell.

Total emf $E = E_1 + E_2 + E_3 + \cdots + E_n$

$= 1.5[r_1 + r_2 + r_3 + \cdots + r_n]$

Total internal resistance

$r = r_1 + r_2 + r_3 + \cdots + r_n$

$$\therefore \text{ Current } i = \frac{E_{\text{total}}}{r_{\text{total}}}$$

$$i = \frac{1.5[r_1 + r_2 + r_3 + \cdots + r_n]}{[r_1 + r_2 + r_3 + \cdots + r_n]}$$

Hence, $i = 1.5A$

114 **(b)**

The given network is a balanced Wheatstone bridge. It's equivalent resistance will be $R = \frac{18}{5}\Omega$

So current from the battery $i = \frac{V}{R} = \frac{V}{18/5} = \frac{5V}{18}$

115 **(d)**

The resistance of 40 W bulb will be more and 60 W bulb will be less

116 **(c)**

$E = aT + bT^2$

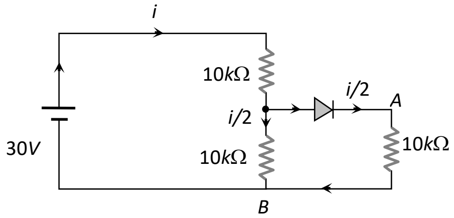
At temperature of inversion, $E = 0$,

$\therefore aT_i + bT_i^2 = 0$

$$\Rightarrow T_i = -\frac{a}{b}$$

$$\Rightarrow T_i = -\frac{10 \times 10^{-6}}{(0.02 \times 10^{-6})} = 500°C$$

117 **(c)**



Equivalent resistance $R = 10 + \frac{10}{2} = 15\ k\Omega$

Current $i = \frac{30}{15} = 2 \times 10^{-3} A$

Hence, potential difference between A and B

$$V = \left(\frac{2 \times 10^{-3}}{2}\right) \times 10 \times 10^3 = 10\ Volt$$

118 **(b)**

Let the potential difference across battery is V and internal resistance of the cell is r, then

$E = V + ir \quad ....(i)$

$V = iR \quad ....(ii)$

Now, from Eqs. (i) and (ii) we have

$E = iR + ir = i(R + r)$ .....(iii)

Now, dividing Eq. (iii) by Eq. (ii), we get

$$\frac{E}{V} = \frac{R + r}{R} = 1 + \frac{r}{R}$$

$$\frac{E}{V} - 1 = \frac{r}{R}$$

or $\left(\frac{E - V}{V}\right) R = r$

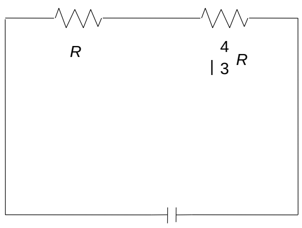
Hence, internal resistance

$$r = \left(\frac{E - V}{V}\right) R$$

120 **(b)**

In the given circuit, resistors $4R$ and $2R$ are connected in parallel while resistance R is connected in series to it.

Hence, equivalent resistance is



$$\frac{1}{R'} = \frac{1}{4R} + \frac{1}{2R}$$

$$= \frac{6R}{8R^2}$$

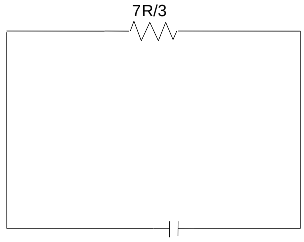
$$R' = \frac{8}{6} R$$

$$= \frac{4}{3} R$$

$$\Rightarrow R'' = R + \frac{4}{3} R = \frac{7R}{3}$$

Given, emf is E volts, therefore

$$i = \frac{E}{R} = \frac{3E}{7R}$$



Potential difference across R is

$$V = ir = \frac{3R}{7R} \times R = \frac{3E}{7}$$

Potential difference across 2R is

$$V' = E - \frac{3E}{7} = \frac{4E}{7}$$

121 **(a)**

Drift velocity, $v_d = \frac{e\tau V}{mL}\ \left[\because E = \frac{V}{L}\right]$

Where the symbols have their usual meaning

If the temperature are not same, τ cannot be same. Then none of the given options is correct

If temperatures are same, then $\frac{v_{d_1}}{v_{d_2}} = \frac{V_1}{V_2} = \frac{1}{2}$

122 **(d)**

The light from bulb spread out uniformly in all directions.

For a 100 W bulb, intensity at a distance of 3 m is

$$I = \frac{\text{Power}}{\text{Area}} = \frac{100}{4\pi(3)^2}$$

As $I = \varepsilon_0 c E_{rms}^2 \Rightarrow E_{rms}^2 = \frac{I}{\varepsilon_0 c}$ ...(i)

For a 400 W bulb, intensity at the same point is

$$I' = \frac{400}{4\pi(3)^2} \Rightarrow E'^2_{rms} = \frac{I'}{\varepsilon_0 c}$$

$$\frac{E'^2_{rms}}{E'^2_{rms}} = \frac{I'}{I} = \frac{400}{4\pi(3)^2} \times \frac{4\pi(3)^2}{100}$$

$E'^2_{rms} = E^2_{rms} \times 4 = (2.9)^2 \times 4\ [\because E_{rms} = 2.9 Vm^{-1}$(Given)]

or $E'_{rms} = 2.9 \times 2 Vm^{-1} = 5.8 Vm^{-1}$

123 **(b)**

Neutral temperature, $t_n = \frac{t_i + t_c}{2}$

$$\Rightarrow \quad 285° = \frac{t_i + 10°}{2}$$

$$570° = t_i + 10°$$

or $\quad t_i = 560°$

124 **(b)**

Here, V<E

$\therefore\ E = V + Ir$

For first case

$$E = 12 + \frac{12}{16}r \qquad \dots.(i)$$

For second case

$$E = 11 + \frac{11}{10}r \qquad \dots\dots(ii)$$

From Eqs. (i) and (ii),

$$12 + \frac{12}{16}r = 11 + \frac{11}{10}r$$

$$\Rightarrow r = \frac{20}{7}\Omega$$

125 **(b)**

The amount of chlorine

$$m = zIt = z\left(\frac{P}{V}\right)t \qquad [\because P = VI]$$

$$= 0.367 \times 10^{-6} \times \left(\frac{100 \times 1000}{125}\right) \times 60$$

$$= 0.017616 \text{ kg} = 17.616 \text{ g}$$

126 **(a)**

$R_{Parallel} < R_{Series}$. From graph it is clear that slope of the line A is lower than the slope of the line B. Also slope = resistance, so line A represents the graph for parallel combination

127 **(a)**

Near room temperature, the electric resistance of a typical metal conductor increases linearly with temperature.

$R = R_0(1 + \alpha T)$

Where α is the thermal resistance coefficient.

128 **(b)**

$$R = \frac{\rho L}{A} \Rightarrow 0.7 = \frac{\rho \times 1}{\frac{22}{7}(1 \times 10^{-3})^2}$$

$\rho = 2.2 \times 10^{-6} ohm - m$

129 **(b)**

In the part $c\ b\ d$,

$$V_c - V_b = V_b - V_d \Rightarrow V_b = \frac{V_c + V_d}{2}$$

In the part $c\ a\ d$

$$V_c - V_a > V_a - V_d \Rightarrow \frac{V_c + V_d}{2} > V_a \Rightarrow V_b > V_a$$

130 **(c)**

$$m = Zi \Rightarrow t = \frac{m}{Zi} = \frac{m \times F}{E \times i} \quad \left[\because Z = \frac{E}{F}\right]$$

$$t = \frac{27 \times 96500}{108 \times 2} = 12062.5 \text{ sec} = \frac{12062.5}{3600} hr$$

$$= 3.35\ hr$$

132 **(c)**

We know that $\frac{P_1}{P_2} = \frac{R_2}{R_1} = \frac{2}{1}$

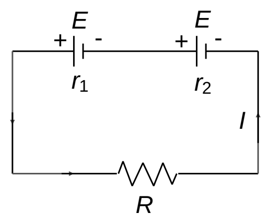
133 **(b)**

As both cells are in series, the circuit current

$$i = \frac{E + E}{r_1 + r_2 + R} = \frac{2E}{r_1 + r_2 = R}$$

As terminal potential drop across 1st cell is zero, hence

$$V_1 = E - ir_1 = E - \frac{2E}{(r_1 + r_2 + R)}r_1 = 0$$



$$\Rightarrow E = \frac{2Er_1}{(r_1 + r_2 + R)} \text{ or } r_1 + r_2 + R = 2r_1 = R$$

$$= (r_1 - r_2)$$

134 **(d)**

When a circuit is made up on any two metals in thermoelectric series, the current flows across the cold junction from the later occurring metal in the series to the one occurring earlier. In thermoelectric series Bismuth comes earlier than Antimony. So, at cold junction current flows from Antimony to Bismuth and at hot junction it flows from bismuth to Antimony.

135 **(d)**

Resistivity is the property of the material. It does not depend upon size and shape

136 **(d)**

As circuit is open, therefore no current flows through circuit. Hence potential difference across X and Y=EMF of battery =120V

137 **(a)**

$$H = \frac{I^2Rt}{J} = \frac{I^2Rt}{4.2} \text{ cal}$$

138 **(b)**

Kirchhoff's second law is $\sum V = 0$

It states that the algebric sum of the potential differences in any loop including those associated emf's and those of resistive elements, must equal zero.

This law represents 'conservation of energy'.

139 **(b)**

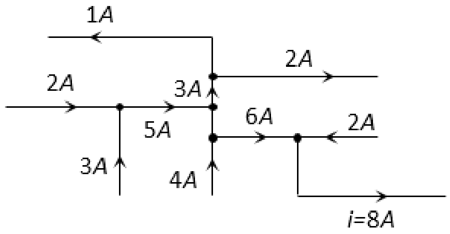
When length and radius both are doubled, in accordance with relation $R = \frac{\rho L}{A}$ the resistance of wire is reduced to 1/2 of its initial value. As at constant voltage the heat produced $H \propto 1/R$, hence heat produced is doubled

140 **(c)**

Approximate change in resistance=2 × % change in length by stretching

141 **(b)**

By using Kirchhoff's junction law as shown below



We get $i = 8A$

142 **(a)**

$I = \frac{dq}{dt} = 3t^2 + 2t + 5$

$\therefore dq = (3t^2 + 2t + 5)dt$

$\therefore q = \int_{t=0}^{t=2} (3t^2 + 2t + 5)dt$

$= \frac{3t^3}{3} + \frac{2t^2}{2} + 5t\Big|_0^2 = t^3 + t^2 + 5t\Big|_0^2 = 22\,C$

143 **(a)**

$\frac{i}{i_g} = \frac{G+S}{S} \Rightarrow \frac{i_g}{i} = \frac{S}{G+S} = \frac{2.5}{27.5} = \frac{1}{11}$

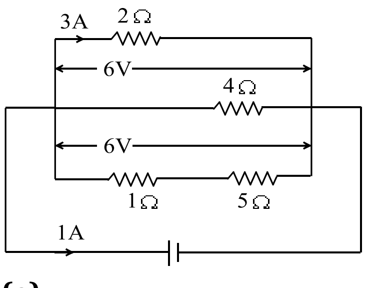
144 **(b)**

Current flowing through 2Ω resistance is $3A$, so P.D. across it is $3 \times 2 = 6V$

Current through the bottom line $= \frac{6}{1+5} = 1A$

$\therefore$ Power dissipated in 5Ω resistance is

$P = i^2R = (1)^2 \times 5 = 5W$



145 **(a)**

We know that thermoelectric power

$S = \frac{dE}{dT}$

Given, $E = K(T - T_r)\left[T_0 - \frac{1}{2}(T + T_r)\right]$

By differentiating the above equation w.r.t. T and putting $T = \frac{1}{2}T_0$, we get $S = \frac{1}{2}kT_0$

146 **(d)**

Three resistances are in parallel,

$\therefore \frac{1}{R'} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$

The equivalent resistance

$R' = \frac{R}{3}\Omega = \frac{6}{3} = 2\Omega$

148 **(a)**

Internal resistance of the cell

$r = \left[\frac{E}{V} - 1\right]R$

$r = \left[\frac{1.5}{1.4} - 1\right]14 = 1\Omega$

149 **(c)**

From Kirchhoff's second law

$V = \sum ir$ (for closed mesh)

Where V is potential difference, i the current and r the resistance.

$\therefore E + E = Ir + Ir = 2Ir$

or $I = \frac{E}{r}$ ….(i)

$V_x - V_y = E - Ir$

Putting the value of I from Eq (i), we get

$V_x - V_y = E - \frac{E}{r} \times V = 0$

150 **(c)**

Here, $\frac{P}{Q} = \frac{2}{3}$

we know

$\frac{P}{Q} = \frac{l}{100 - l}$

$\Longrightarrow \frac{2}{3} = \frac{l}{100 - l}$

$\Longrightarrow l = 40$ cm

151 **(c)**

$v_d = \frac{I}{nAe} = \frac{20}{10^{29} \times 10^{-6} \times 1.6 \times 10^{-19}}$

$= 1.25 \times 10^{-3}\text{m/s}$

152 **(b)**

Total resistance

Or $R = 20 + 40$

$R = 60\Omega$

Given G=15V

Current $I = \frac{V}{R} = \frac{15}{60}$

$I = 0.25A$

Potential gradient $= \frac{V}{l}$

$= \frac{20 \times 0.25}{10} = 0.5\text{Vm}^{-1}$

PD across 240 cm

$E = 0.5 \times 2.4$

$E = 1.2V$

153 **(a)**

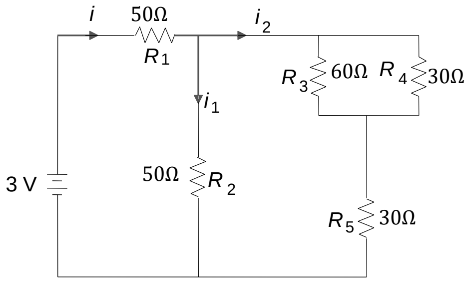
Equivalent resistance of the given network

$R_{eq} = 75\Omega$

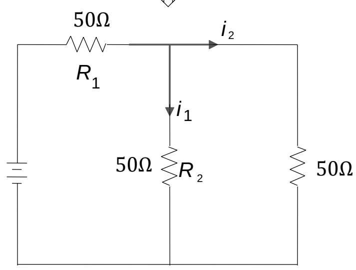
$\therefore$ Total current through battery,

$$i = \frac{3}{75}$$

$$i_1 = i_2 = \frac{3}{75 \times 2} = \frac{3}{150}$$



⇓



Current through resistance

$$R_4 = \frac{3}{150} \times \frac{60}{(30 + 60)}$$

$$= \frac{3}{150} \times \frac{60}{90}$$

$$= \frac{2}{150} A$$

$$V_4 = i_4 \times R_4$$

$$= \frac{2}{150} \times 30$$

$$= \frac{2}{5} = 0.4 \text{ volt}$$

154 **(c)**

Current through a conductor is constant at even cross-section of the conductor

155 **(c)**

Mass deposited = density × volume of the metal

$m = p \times A \times X$ ...(i)

Hence from Faraday's first law $m = Zit$ ...(ii)

So from equation (i) and (ii)

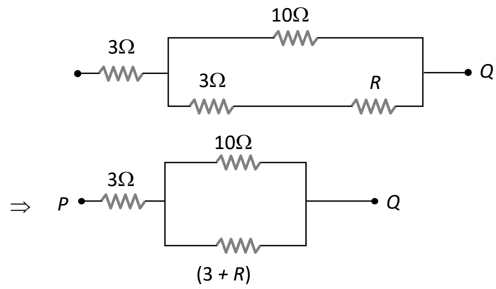
$$Zit = \rho \times Ax \Rightarrow x = \frac{Zit}{\rho A}$$

$$= \frac{3.04 \times 10^{-4} \times 10^{-3} \times 1 \times 3600}{9000 \times 0.05} = 2.4 \times 10^{-6} m$$

$$= 2.4 \mu m$$

157 **(c)**

The given circuit can be simplified as follows



$$R = 3 + \frac{10 \times (3 + R)}{10 + 3 + R} = 3 + \frac{30 + 10R}{13 + R}$$

$$R = \frac{39 + 3R + 30 + 10R}{13 + R} = \frac{69 + 13R}{13 + R}$$

$$13R + R^2 = 69 + 13R \Rightarrow R = \sqrt{69}\Omega$$

158 **(b)**

$R \propto l^2 \Rightarrow$ If l doubled then R becomes 4 times

159 **(c)**

Ammeter is used to measure the current through the circuit

160 **(b)**

$$i = \frac{E}{r + R} \Rightarrow P = i^2 R \Rightarrow P = \frac{E^2 R}{(r + R)^2}$$

Power is maximum when $r = R \Rightarrow P_{\max} = E^2/4r$

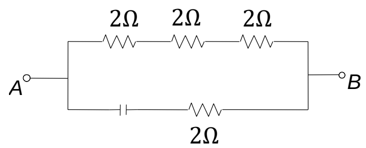
161 **(c)**

$\theta_0 = 2\theta_n - \theta_i = 2 \times 210 - (600 - 273)$

$= 420 - 327 = 93°C$

162 **(c)**

Let the circuit be as shown



Equivalent resistance between A and B is

$$\frac{1}{R} = \frac{1}{2} + \frac{1}{(2 + 2 + 2)} = \frac{2}{3}$$

$$R = \frac{3}{2} = 1.5\Omega$$

Therefore, 4 resistances are required.

163 **(b)**

$$\frac{r_{\text{iron}}}{r_{\text{Copper}}} = \sqrt{\frac{\rho_{\text{iron}}}{\rho_{\text{copper}}}} = \sqrt{\frac{1 \times 10^{-7}}{1.7 \times 10^{-8}}} = 2.4$$

164 **(c)**

For a fuse $I^2 \propto r^3$

$$\therefore \frac{I_1^2}{I_2^2} = \frac{r_1^3}{r_2^2}$$

$$\frac{3^2}{I_2^2} = \left(\frac{0.02}{0.03}\right)^3$$

$$I_2 = 3 \times \left(\frac{3}{2}\right)^{3/2} \text{A}$$

165 **(d)**

Let n cells be in series and m in parallel, then

$$\frac{nE}{R+nr}=\frac{E}{R+\frac{r}{m}}$$

$$\Rightarrow \quad n\left[R+\frac{r}{m}\right]=R+nr$$

$$\Rightarrow nRm+nr=Rm+mnr$$

$$\Rightarrow 6+2r=3+4r$$

$$\Rightarrow 2r=3$$

$$\Rightarrow \quad r=1.5\Omega$$

166 **(a)**

The ratio $\frac{AC}{CB}$ will remain unchanged.

167 **(b)**

$V_2-V_1=E-ir=5-2\times 0.5=4volt$

$\Rightarrow V_2=4+V_1=4+10=14\ volt$

168 **(a)**

Power in electric bulb

$$P=\frac{V^2}{R}$$

So, resistance of electric bulb

$$R=\frac{V^2}{P}$$

Given, $P_1=25$ W, $P_2=100$ W,

$V_1=V_2=220$ volt

Therefore, for same potential difference V

$$R\propto\frac{1}{P}$$

Thus, we observe that for minimum power, resistance will be maximum and $vice-versa$.

Hence, resistance of 25 W bulb is maximum and 100 W bulb is minimum.

169 **(c)**

Let temperature of cold junction be 0°C and that of hot junction be T°C. The relation for thermo-emf is given by

$$E=AT-\frac{1}{2}BT^2$$

Given, $A=16, B=0.08$

$$\therefore E=16T-\frac{1}{2}\times 0.08\times T^2$$

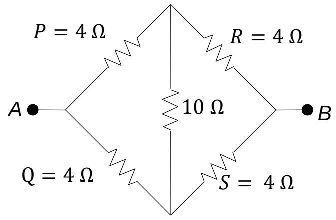
Since, at temperature of inversion emf is zero, we have

$$0=16T-0.04\,T^2$$

$$\Rightarrow T=\frac{16}{0.04}=400°\text{C}$$

170 **(c)**

The equivalent circuit can be redrawn as



we have, $\frac{P}{Q}=\frac{R}{S}$

ie, $\quad \frac{4}{4}=\frac{4}{4}$

So, the given circuit is a balanced Wheatstone's bridge.

Hence, the equivalent resistance

$$R_{AB}=\frac{(4+4)\times(4+4)}{(4+4)+(4+4)}$$

$$=\frac{8\times 8}{8+8}=\frac{64}{16}=4\Omega$$

171 **(b)**

Force =Electric intensity ×charge

$$=\frac{\text{Potential diffsrence}}{\text{distance}}\times\text{charge}$$

$$\therefore\ 4.8\times10^{-19}=\frac{V}{5}\times1.6\times10^{-19}$$

or $V=15$ volt

172 **(d)**

In stretching of wire $R\propto\frac{1}{d^4}$, where $d=$ Diameter of wire

173 **(d)**

Total current through the circuit

$$i=\frac{10}{\frac{1000}{3}+500}=\frac{3}{250}A$$

Now voltmeter reading $=i_v\times R_V=\frac{2}{3}\times\frac{3}{250}\times 500=4V$

174 **(b)**

$$E=xl=\frac{V}{l}=\frac{iR}{L}\times l\Rightarrow E=\frac{r}{(R+R_h+r)}\times\frac{R}{L}\times l$$

$$\Rightarrow E=\frac{10}{(5+4+1)}\times\frac{5}{5}\times3=3V$$

175 **(c)**

$i=nAev_d$

or $v_d=\frac{i}{nAe}ie,\ v_d\propto\frac{1}{A}$

As A increases v_d decreases, because i remains constant

176 **(a)**

$R=\rho l/A$ or $R\propto l/A$. Thus, resistance is least in a wire of length $L/2$ and area of cross-section $2A$

177 **(c)**

$$V_d = \frac{i}{nAe} = \frac{5.4}{8.4 \times 10^{28} \times 10^{-6} \times 1.6 \times 10^{-19}}$$
$$= 0.4 \times 10^{-3}\ m/sec = 0.4\ mm/sec$$

178 **(c)**

The power of the battery, when charged, is given by

$P_1 = V_1 I_1$

The electrical energy dissipated is given by $E_1 = P_1 t_1$

$i.e., E_1 = V_1 I_1 t_1 = 15 \times 10 \times 8 = 1200\ Wh$

Similarly, the electrical energy dissipated during the discharge a battery is given by,

$E_2 = V_2 I_2 t_2 = 14 \times 5 \times 15 = 1050\ Wh$

Hence, watt-hour efficiency of the battery is given by

$$\eta = \frac{E_2}{E_1} \times 100 = 0.875 \times 100 = 87.5\%$$

179 **(d)**

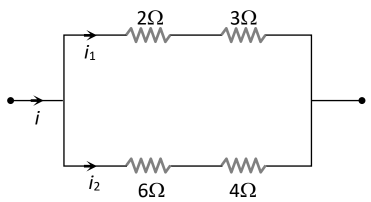
Total power spend across two resistors connected in parallel to battery $= \frac{V^2}{R_1} + \frac{V^2}{R_2}$

$$= \frac{3 \times 3}{2} + \frac{3 \times 3}{2/3} = \frac{36}{2} = 18$$
$$= 3 \times 3 \times 2\ \text{J}$$

180 **(b)**

Conductance $C = \frac{1}{R} = \frac{A}{\rho l} \Rightarrow C \propto \frac{1}{l}$

181 **(d)**



Resistance of upper branch $R_1 = 2 + 3 = 5\Omega$

Resistance of lower branch $R_2 = 4 + 6 = 10\Omega$

Hence $\frac{i_1}{i_2} = \frac{R_2}{R_1} = \frac{10}{5} = 2$

$$\frac{\text{Heat generated across } 3\ \Omega\ (\text{H}_1)}{\text{Heat generated across } 6\ \Omega\ (\text{H}_2)} = \frac{i_1^2 \times 3}{i_2^2 \times 6} = \frac{4}{2} = 2$$

$\therefore$ Heat generated across $3\ \Omega = 120\ cal/sec$

182 **(b)**

At resonance both bulbs will glow with same brightness. At resonance,

$X_L = X_C$

Or $2\pi f L = \frac{1}{2\pi f C}$

Or $f = \frac{1}{2\pi\sqrt{LC}}$

183 **(d)**

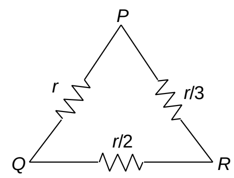
$$R \propto \frac{1}{r^2} \Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2} \times \frac{r_2^2}{r_1^2} \Rightarrow \frac{1}{1} = \frac{5}{l_2} \times \left(\frac{2}{1}\right)^2 \Rightarrow l_2$$
$$= 20m$$

184 **(c)**

If an identical battery is connected in opposition, net emf $= E - E = 0$ and the current through circuit will be zero, although each one of them has constant emf.

185 **(a)**

The circuit given in figure can be redrawn as shown here. Here two resistances are joined in series and the combination is joined in parallel with the third resistance. Since in parallel grouping effective resistance is even less than the smallest individual resistance, hence net resistance will be maximum between the points P and Q



186 **(c)**

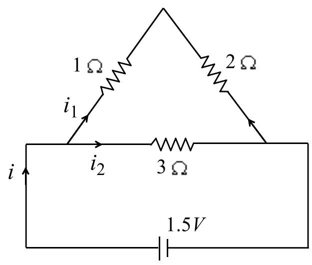
$$i_g = \frac{iS}{S + G} \Rightarrow 10 = \frac{50 \times 12}{12 + G} \Rightarrow 12 + G = 60 \Rightarrow G$$
$$= 48\Omega$$

187 **(b)**

$$i_g S = (i - i_g) G \Rightarrow i_g (S + G) = iG$$
$$\Rightarrow \frac{i_g}{i} = \frac{G}{S + G} = \frac{8}{2 + 8} = 0.8$$

188 **(b)**

$$i_1 + i_2 = \frac{1.5}{3/2} = 1\ amp$$



$$\frac{i_1}{i_2} = \frac{3}{3} \Rightarrow i_1 = i_2\ \therefore i_2 = 0.5A = i_1$$

189 **(d)**

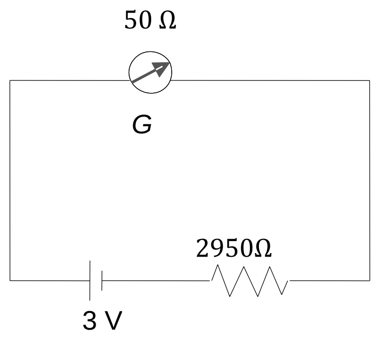
Current through the galvanometer

$$I = \frac{3}{(50 + 2950)} = 10^{-3} A$$

Current for 30 divisions $= 10^{-3} A$

Current for 20 divisions

$$= \frac{10^{-3}}{30} \times 20 = \frac{2}{3} \times 10^{-3} A$$



For the same deflection to obtain for 20 divisions, let resistance added be R

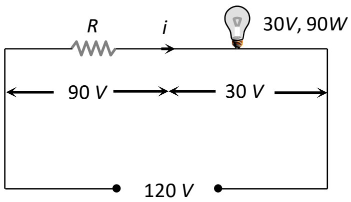
$$\therefore \frac{2}{3} \times 10^{-3} = \frac{3}{(50 + 1R)}$$

or $R = 4450\Omega$

190 **(c)**

Suppose resistance R is corrected in series with bulb

Current through the bulb $i = \frac{90}{30} = 3\ A$



Hence for resistance $V = iR \Rightarrow 90 = 3 \times R \Rightarrow R = 30\Omega$

191 **(c)**

$R_{\text{max}} = nR$ and $R_{\text{min}} = R/n \Rightarrow \frac{R_{\text{max}}}{R_{\text{min}}} = n^2$

192 **(a)**

The voltage per unit light of the metre wire PQ is $\left(\frac{6.00\ mV}{0.600\ m}\right)$ $i.e.\ 10\ mV/m$. Hence potential difference across the metre wire is $10mV/m \times 1m = 10\ mV$. The current drawn from the driver cell is $i = \frac{10\ mV}{5\ \Omega} = 2\ mA$

The resistance $R = \frac{(2V - 10mV)}{2\ mA} = \frac{1990\ mV}{2\ mA} = 995\ \Omega$

193 **(b)**

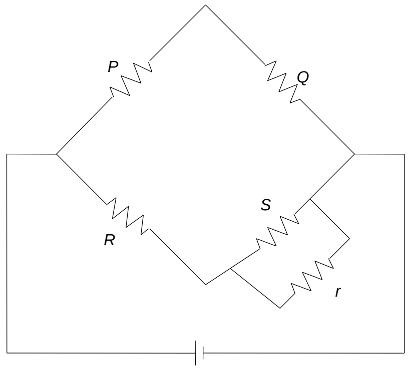
To make range n times, the galvanometer resistance should be G/n, where G is initial resistance

194 **(d)**

Let a resistance r ohm be shunted with resistance S, so that the bridge is balanced.

If S' is the resultant resistance of S and r, then

In balanced position



$$\frac{P}{Q} = \frac{R}{S'}$$

$$\frac{2}{2} = \frac{2}{S'}$$

$\therefore\ S' = 2\Omega$

Now,

$$\frac{1}{S'} = \frac{1}{S} + \frac{1}{r}$$

$$\text{or} \frac{1}{r} = \frac{1}{S'} - \frac{1}{S} = \frac{1}{2} - \frac{1}{3} = \frac{3-2}{6}$$

$$\frac{1}{r} = \frac{1}{6}$$

$r = 6\Omega$

195 **(d)**

Let the value of shunt be r. Hence the equivalent resistance of branch containing S will be $\frac{Sr}{S+r}$

In balance condition, $\frac{P}{Q} = \frac{Sr/(S+r)}{R}$. This gives $r = 8\Omega$

197 **(b)**

$$P = Vi \Rightarrow i = \frac{2.2 \times 10^3}{22000} = \frac{1}{10}A$$

Now loss of power $= i^2R = \left(\frac{1}{10}\right)^2 \times 100 = 1\ W$

198 **(b)**

Let resistance for bulb filament at o°C be R_0 and at a temperature θ°C its value be 200 Ω. Then,

$100 = R_0(1 + \alpha \times 100) = R_0(1 + 0.005 \times 100)$

$= R_0(1.5)$ ...(i)

and $200 = R_0(1 + \alpha \times \theta) = R_0(1 + 0.005 \times \theta)$

$= R_0(1.005\theta)$ ...(ii)

Dividing Eq. (ii) by Eq.(i), we get $2 = \frac{1 + 0.005\theta}{1.5}$

$3 = 1 + 0.005\theta$

$$\Rightarrow\ \theta = \frac{2}{0.005} = 400°\text{C}$$

199 **(c)**

Since the current coming out from the positive terminal is equal to the current entering the negative terminal, therefore, current in the respective loop will remain confined in the loop itself

$\therefore$ Current through 2Ω resistor $= 0$

200 **(d)**

Graph (d) represents the thermal energy produced in a resistor.

201 **(c)**

Potential difference across 1 $M\Omega$ resistor is

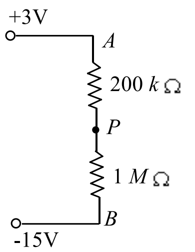
$$V_P - V_B = \frac{18V \times 1 \times 10^6\Omega}{(0.2+1)\times 10^6\Omega} = \frac{18V \times 1 \times 10^6\Omega}{1.2 \times 10^6\Omega}$$

$$= 15V$$

$V_B = -15V$ [Given]

$\therefore V_P - V_B = 15V$ or $V_P = 15V + V_B$

$= 15V - 15V = 0V$



Potential difference across 200 $k\Omega$ resistor is

$$V_A - V_P = \frac{18V \times 0.2 \times 10^6\Omega}{(0.2+1)\times 10^6\Omega}$$

$$= \frac{18V \times 0.2 \times 10^6\Omega}{1.2 \times 10^6\Omega} = 3V$$

$V_A = +3V$ [Given]

$\therefore V_A - V_P = 3V$ or $V_P = V_A - 3V$

$= +3V - 3\,V = 0\,V$

202 **(a)**

Current through resistance P and Q,

$$i_1 = \frac{4}{90+110} = \frac{1}{50}\text{A}$$

$$V_A - V_B = Pi_1 = 90 \times \frac{1}{50} = 1.8\text{ V}$$

Current through resistance R and S,

$$i_2 = \frac{4}{40+60} = \frac{1}{25}\text{A}$$

$$V_A - V_D = Ri_2 = 40 \times \frac{1}{25} = 1.6\text{ V}$$

$$V_B - V_D = (V_A - V_D) - (V_A - V_B)$$

$$= 1.6 - 1.8 = -0.2\text{V}$$

203 **(b)**

By using $e_0^{100} = e_0^{32} + e_{32}^{70} + e_{70}^{100}$

$\Rightarrow 200 = 64 + 76 + e_{70}^{100} \Rightarrow e_{70}^{100} = 60\ \mu V$

204 **(a)**

Given, $E_1 = 1.5V, l_1 = 27\ cm$,

$l_2 = 54\ cm, E_2 = ?$

$$\frac{E_1}{E_2} = \frac{l_1}{l_2}$$

or $E_2 = \dfrac{E_1 l_2}{l_1}$

or $E_2 = \dfrac{1.5 \times 54}{27}$

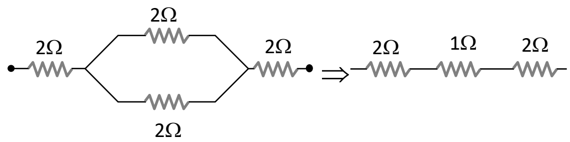
$E_2 = 3V$

205 **(a)**

Joule effect is not reversible

206 **(c)**

The given circuit can be redrawn as follows



$\Rightarrow R_{eq} = 5\Omega$

207 **(a)**

$$i = \frac{E}{R+r} = \frac{5}{4.5+0.5} = 1A$$

$V = E - ir = 5 - 1 \times 0.5 = 4.5$ Volt

208 **(b)**

Current $I = \frac{ne}{t}$

$$3.2 = \frac{n \times 1.6 \times 10^{-19}}{1}$$

$$n = \frac{3.2}{1.6 \times 10^{-19}} = 2 \times 10^{19}$$

209 **(b)**

As the current and the other factors are same for both the galvanometers

$N \propto \tan\theta$

$$\frac{N_1}{N_2} = \frac{\tan 60°}{\tan 30°} = \frac{\sqrt{3}}{1/\sqrt{3}}$$

$$\Rightarrow \frac{\mathrm{N}_1}{\mathrm{N}_2} = 3$$

210 **(a)**

$$\text{Resistance} = \frac{\text{Potential difference}}{\text{Current}}$$

211 **(b)**

$$i_g = i\frac{S}{G+S} \Rightarrow \frac{0.01}{10} = \frac{S}{50+S} \Rightarrow S = \frac{50}{999} = 0.05\Omega$$

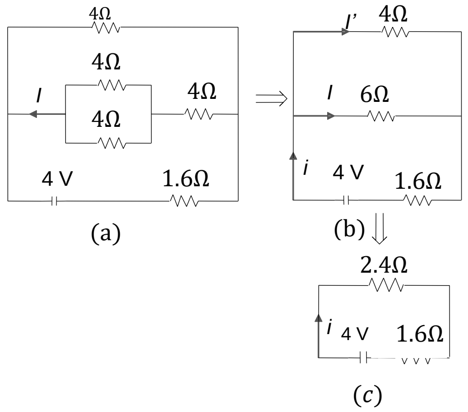
212 **(b)**

The sensitivity of potentiometer can be increased by decreasing the potential gradient *i.e.* by increasing the length of potentiometer wire

[Sensitivity $\propto \frac{1}{P.G.} \propto$ Length]

213 **(c)**

We can simplify the network as shown



So, net resistance,

R=2.4+1.6=4.0Ω

Therefore, current from the battery.

$i = \frac{V}{R} = \frac{4}{4} = 1A$

Now, from the circuit (b),

$4I' = 6I$

$\Rightarrow \quad I' = \frac{3}{2}I$

But $i = I + I'$

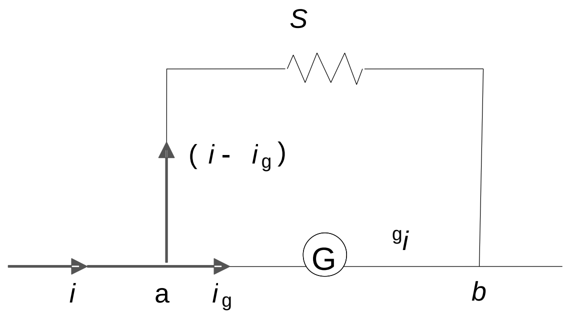
$= I + \frac{3}{2}I = \frac{5}{2}I$

$\therefore \quad 1 = \frac{5}{2}I$

$\Rightarrow \quad I = \frac{2}{5} = 0.4A$

214 **(a)**

$V_{ab} = i_g.G = (i - i_g)S$



$\therefore \quad i = \left(1 + \frac{G}{S}\right) i_g$

Substituting the values we get,

$i = 100.1\text{mA}$

215 **(d)**

In series $\quad i = \frac{2E}{2+R}$

$\therefore \quad J_1 = i^2 R = \left(\frac{2E}{2+R}\right)^2 .R$

In parallel

$i = \frac{E}{0.5+R}$

$J_2 = i^2 R = \left(\frac{E}{0.5+R}\right)^2 .R$

$\frac{J_1}{J_2} = 2.25 = \frac{4(0.5 + R)^2}{(2 + R)^2}$

Solving we get, $R = 4\ \Omega$

216 **(a)**

With rise in temperature the thermal velocity of the electron increases. Relaxation time and hence drift velocity will decrease.

217 **(a)**

$I_1 = \frac{2}{2+4} \times 6 = 2A$

$I_2 = 4\ amp$

218 **(b)**

$v_d = i/nAe$

$= 0.21/(8.4 \times 10^{28} \times 10^{-6} \times 1.6 \times 10^{-19})$

$= 1.56 \times 10^{-5} \text{ms}^{-1}$

219 **(a)**

For power transmission power loss in line $P_L = i^2 R$

If power of electricity is P and it is transmitted at voltage V, then $P = Vi \Rightarrow i = \frac{P}{V}$

$P_L = \left(\frac{P}{V}\right)^2 R = \frac{P^2 R}{V^2} = \frac{2.2 \times 10^3 \times 2.2 \times 10^3 \times 10}{22000 \times 22000}$

$= 0.1W$

220 **(b)**

As 5Ω resister is joined in parallel to series combination of 4Ω and 6Ω (*ie*, total resistance 10Ω), V =constant.

and $\frac{i_1}{i_2} = \frac{R_2}{R_1} = \frac{10}{5} = 2$

or $i_2 = \frac{i_1}{2}$

Now heat produced per second in5Ω resistor

$H_1 = i_1^2 R_1 = i_1^2 \times 5 = 100\text{Js}^{-1}$ ...(i)

and for 4Ω resistor

$H_2 = i_2^2 R_2 = \left(\frac{i_1}{2}\right)^2 \times 4 = i_1^2$ ...(ii)

Simplifying Eqs. (i) and (ii), we get

$\frac{H_2}{100} = \frac{1}{5}$ or $H_2 = \frac{1}{5} \times 100 = 20\text{Js}^{-1}$

221 **(b)**

The resistance of one wire

$R_1 = \rho \frac{l_1}{A_1}$

and the resistance of second wire

$R_2 = \rho \frac{l_2}{A_2}$

Ratio of their resistance

$\frac{R_1}{R_2} = \frac{l_1}{A_1} \times \frac{A_2}{l_2}$

∵Mass=density×volume

∵Mass=density ×area ×length

Or $\frac{R_1}{R_2} = \left(\frac{l_1}{l_2}\right)^2 \times \frac{\rho A_2 l_2}{\rho A_1 l_1}$

Or $\frac{R_1}{R_2} = \left(\frac{l_1}{l_2}\right)^2 \times \frac{m_2}{m_1}$

Or $\frac{R_1}{R_2} = \frac{9}{16} \times \frac{3}{2}$ or $\frac{R_1}{R_2} = \frac{27}{32}$

$R_1 : R_2 = 27 : 32$

222 **(d)**

We know that the current in the circuit

$I = \frac{E}{R + r}$

and power delivered to the resistance R is

$P = I^2 R = \frac{E^2 R}{(R + r)^2}$

It is maximum when $\frac{dP}{dR} = 0$

$\frac{dP}{dR} = E^2 \left[\frac{(r + R)^2 - 2R(r + R)}{(r + R)^4}\right] = 0$

Or $(r + R)^2 = 2R(r + R)$

Or $R = r$

223 **(b)**

$T_n = \frac{T_i + T_c}{2} = \frac{10 + 530}{2} = 270°\text{C}$

224 **(d)**

Let R_1 and R_2 be the resistances of the coils

$H = \frac{V^2 t_1}{R_1}$ and $H = \frac{V^2 t_2}{R_2}$

$\Rightarrow \frac{t_1}{R_1} = \frac{t_2}{R_2}, ie, \frac{R_2}{R_1} = \frac{t_2}{t_1}$ ... (i)

Now in parallel

$R' = \frac{R_1 R_2}{R_1 + R_2} = R_1$

$\therefore H = \frac{V^2 t}{R'}$ ... (ii)

Now, $\frac{V^2 t}{R'} = \frac{V^2 t_1}{R_1}$

$\Rightarrow \frac{t \times (R_1 + R_2)}{R_1 R_2} = \frac{t_1}{R_1}$ ... (iii)

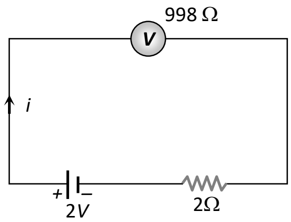
On using Eqs. (i) and (iii), we get

$t = \frac{t_1 t_2}{t_1 + t_2}$

225 **(c)**

Error in measurement = Actual value – Measured value

Actual value = $2V$



$i = \frac{2}{998 + 2}$

$= \frac{1}{500} A$

Since $E = V + ir$

$\Rightarrow V = E - ir = 2 - \frac{1}{500} \times 2 = \frac{998}{500} V$

∴ Measured value $= \frac{998}{500} V$

$\Rightarrow$ Error $= 2 - \frac{998}{500} = 4 \times 10^{-3} volt$

226 **(d)**

The circuit shown is a balanced Wheatstone bridge. So, there is no current flowing through 10Ω resistance. Therefore, by replacing 10Ω resistance by 20Ω resistance, current in the circuit will be as such *ie*., 4A.

227 **(c)**

$r = R\left(\frac{l_1}{l_2} - 1\right) = 10 \left(\frac{75}{65} - 1\right)$

$= 10 \times 0.0154 = 1.54\Omega$

228 **(a)**

Suppose m rows are connected in parallel and each row contains n identical cells (each cell having $E = 15\ V$ and $r = 2\Omega$)

For maximum current in the external resistance R, the necessary condition is $R = \frac{nr}{m}$

$\Rightarrow 12 = \frac{n \times 2}{m} \Rightarrow n = 6m$ ...(i)

Total cells $= 24 = n \times m$ ...(ii)

On solving equations (i) and (ii) $n = 12$ and $m = 2$ $i.e.$ 2 rows of 12 cells are connected in parallel

229 **(c)**

Current drawn from the cell in resistance R_1 will be $I = E/(R_1 + r)$

Therefore, heat produced in R_1 *ie*,

$$H_1 = \frac{E^2R_1t}{(R_1+r)^2}$$

Heat produced in R_2 $ie, H_2 = \frac{E^2R_2t}{(R_2+r)^2}$

As per question $H_1 = H_2$

or $\frac{E^2R_1t}{(R_1+r)^2} = \frac{E^2R_2t}{(R_2+r)^2}$

On solving we get;

$r = \sqrt{R_1R_2}$

$= \sqrt{100 \times 40}$=63.25Ω

230 **(b)**

$$R = \frac{V^2}{P}$$

or $R \propto \frac{1}{P}$

$$\therefore \frac{1}{R_{100}} > \frac{1}{R_{60}} > \frac{1}{R_{70}}$$

Hence, the correct option is (d)

231 **(b)**

Potential gradient $x = \frac{V}{L} = \frac{iR}{L}$

$$\Rightarrow x = \frac{2}{(15+5)} \times \frac{15}{10} = \frac{3}{2000}\ volt/cm$$

232 **(c)**

Resistance, $R = \rho\frac{l}{A}$

$$R \propto l \propto \frac{1}{A}$$

∴R is maximum when

length = 2L and area $= \frac{A}{2}$.

233 **(a)**

22.4 *litre* H_2 = 1 mole of $H_2 = N$ molecules of H_2 $= 2N$ atoms of H

So charge required to liberate 22.4 *litre* of $H_2 = 2Ne = 2F$

Hence charge required to liberate 11.2 *litre* of $H_2 = F$

234 **(b)**

Current through external resistance,

$$i = \frac{nE}{nr+R} = \frac{5\times 2}{5\times 0.2+4} = 2\text{A}$$

235 **(c)**

When bulbs are connected in series, $P = \frac{V^2}{R'} = \frac{V^2}{3R}$

When bulbs are connected in parallel

$$P' = \frac{V^2}{R"} = \frac{V^2\times 3}{R} = 3\times 3P = 9P$$

236 **(b)**

11.2 L of H_2 is liberated by 96500 C 22.4 L of H_2 is liberated by

96500× 2 = 193000 C.

237 **(d)**

Case (i) $E + E = (r + r + 5) \times 1.0$

or $2E = 2r + 5$ ...(i)

Case (ii) $E = \left(\frac{r\times r}{r+r} + 5\right) \times 0.8$

or $E = \left(\frac{r}{2} + 5\right) 0.8$ or $E = 0.4r + 4.0$ ...(ii)

Multiplying Eq.(ii) by 2 and equating with Eq.(i), we get

$2r + 5 = 00.8r + 8$

or $1.2 = 3$ or $r = \frac{3}{1.2} = 2.5\Omega$

239 **(d)**

6Ω and 6Ω are in series, so effective resistance is 12Ω which is in parallel with 3Ω, so

$$\frac{1}{R} = \frac{1}{3} + \frac{1}{12} = \frac{15}{36}$$

$$\Rightarrow R = \frac{36}{15}$$

$$\therefore I = \frac{V}{R} = \frac{4.8\times 15}{36} = 2A$$

240 **(a)**

Let R_0 = resistance of filament at room temperature

R_t = resistance of filament at 2500°C

Similarly powers, P_0 and P_t.

Here, voltage remains the same.

$$P_0 = \frac{V^2}{R_0}$$

or $R_0 = \frac{V^2}{P_0}$, $R^t = \frac{V^2}{P_t}$

also $R_t = R_0[1 + \alpha(2500 - 20)]$

and $P_0 = P_t[1 + \alpha(2500 - 20)]$

$= 50[1 + 4.5 \times 10^{-3}(2500 - 20)]$

= 608W

241 **(a)**

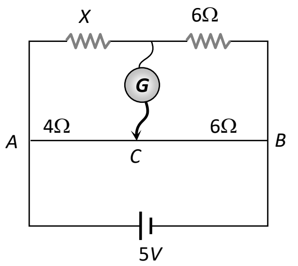
Each part will have a resistance $r = R/10$

Let equivalent resistance be r_R, then

$\frac{1}{r_R} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r}$ ... . 10 times

$$\therefore \frac{1}{r_R} = \frac{10}{r} = \frac{10}{R/10} = \frac{100}{R} \Rightarrow r_R = \frac{R}{100} = 0.01R$$

242 **(c)**



Resistance of the part AC

$R_{AC} = 0.1 \times 40 = 4\Omega$ and $R_{CB} = 0.1 \times 60 = 6\Omega$

In balanced condition $\frac{X}{6} = \frac{4}{6} \Rightarrow X = 4\Omega$

Equivalent resistance $R_{eq} = 5\Omega$ so current drawn from battery

$$i = \frac{5}{5} = 1A$$

244 **(c)**

$$i = ev = 1.6 \times 10^{-19} \times 6.8 \times 10^{15} = 1.1 \times 10^{-3} amp$$

245 **(b)**

$$v_d = \frac{i}{ne\pi r^2} \Rightarrow v_d \propto \frac{i}{r^2} \Rightarrow \frac{v}{v'} = \frac{i_1}{i_2} \times \left(\frac{r_2}{r_1}\right)^2 \Rightarrow v' = \frac{v}{2}$$

246 **(b)**

$$m = z = \frac{E}{F} It = \frac{(M/P)}{F} It$$

or $t = \frac{mF_P}{MI} = \frac{(0.254 \times 10^3) \times 96500 \times 2}{63.5 \times 100}$

$= 7720$ s.

247 **(b)**

In series, current,

$$i_1 = \frac{2E}{2 + 2r}$$

In parallel, current,

$$i_2 = \frac{E}{2 + \frac{r}{2}} = \frac{2E}{4 + r}$$

According to the question

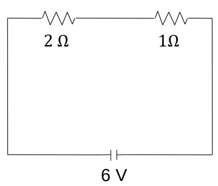
$$i_1 = i_2$$

$$\Rightarrow \frac{2E}{4 + r} = \frac{2E}{2 + 2r}$$

$$\Rightarrow r = 2\Omega$$

248 **(d)**

In the given circuit 4Ω resistors are connected in parallel, this combination is connected in series with 1Ω resistance.



$$\therefore \frac{1}{R'} = \frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$$

$$\Rightarrow R' = 2\Omega$$

Also, R''=2 Ω +1Ω =3Ω

From Ohm's law, $V = iR$

$$\therefore i = \frac{V}{R} = \frac{6}{3} = 2A$$

249 **(b)**

Heat produced by heater per second $= 1.08 \times 10^3$ J

Heat taken by water to form steam mL

$= 100 \times 540$ cal

$= 100 \times 540 \times 4.2$ J

$\therefore 1.08 \times 10^3 \times t = 100 \times 540 \times 4.2$

or $t = \frac{100 \times 540 \times 4.2}{1.08 \times 10^3} = 210$ s

250 **(d)**

Heat developed by 210 W electric bulb in 5 min is given by

$$H = \frac{W}{J} = \frac{210 \times 5 \times 60}{4.2} = 15000 \text{ cal}$$

251 **(d)**

Equivalent resistance $= \frac{4 \times 4}{4+4} + \frac{6 \times 6}{6+6} = 5 ohm$ So the current in the circuit $= \frac{20}{5} = 4\ ampere$ Hence the current flowing through each resistance $= 2\ ampere$

252 **(d)**

Here, 2Ω and 2Ω are in parallel

$$\therefore \frac{1}{R} = \frac{1}{2} + \frac{1}{2}$$

$$R = \frac{2 \times 2}{2 + 2} = 1\Omega$$

Now, internal resistance (1Ω), 2Ω, 4Ω and resistance R in series.

$\therefore R_{\text{net}} = 1\Omega + 2\Omega + 4\Omega + 1\Omega = 8\Omega$

Hence, current

$$I = \frac{V}{R} = \frac{4}{8} = 0.5A$$

253 **(d)**

The given circuit is a balanced wheatstone bridge circuit. Hence potential difference between A and B is zero

254 **(d)**

$P = \frac{V^2}{R}$ but $R = \frac{\rho l}{A} \Rightarrow P = \frac{V^2}{\rho l / A} = \frac{AV^2}{\rho l}$. Since $\frac{AV^2}{l}$ is constant as per given condition so $P \propto \frac{1}{\rho}$

255 **(d)**

Current in 9Ω is $2A$, so that in 6Ω is $3A$. Total current is $2 + 3 = 5A$. Potential drop $5 \times 2 = 10\ V$

256 **(c)**

$$H = \frac{V^2}{R}$$

$$\Rightarrow R = \frac{V^2}{H}$$

$$= \frac{(25)^2}{25} = 25\ \Omega$$

257 **(c)**

If a cell is connected between points A and C, no current will flow in arms BE and ED. Therefore, the resistance of arms BE and ED an be removed. Now resistance between points A and C will be the resistance of three parallel arms, each of resistance= $R + R = 2R$

$\therefore$ Total resistance R_p will be

$$\frac{1}{R_P} = \frac{1}{2R} + \frac{1}{2R} + \frac{1}{2R} = \frac{3}{2R} \text{ or } R_P = \frac{2R}{3}$$

258 **(c)**

$I \propto Q$

$$\frac{I_g}{I} = \frac{1}{2}$$

$$\frac{S}{G+S} = \frac{1}{2}$$

$$\frac{40}{G+40} = \frac{1}{2} \Longrightarrow \text{G} = 40\Omega$$

259 **(d)**

The resistance of the cell is independent of e.m.f

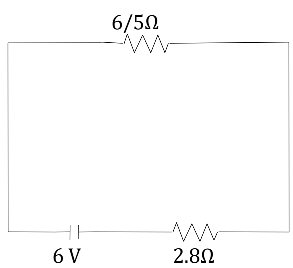
260 **(d)**

In the given circuit the resistors of 2Ω and 3Ω are connected in parallel hence, equivalent resistance is

$$\frac{1}{R'} = \frac{1}{2} + \frac{1}{3} = \frac{5}{6}$$

$$\therefore R' = \frac{6}{5}\Omega$$

Also in steady state, the circuit is shown as. Resistor's of $\frac{6}{5}\Omega$ and 2.8Ω are connected in series.



Hence, $R'' = \frac{6}{5}\Omega + 2.8\Omega$

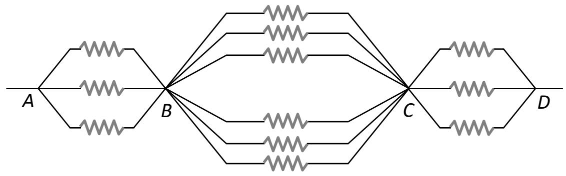
$= 1.2\Omega + 2.8\Omega = 4.0\Omega$

From Ohm's law,

Current $i = \frac{V}{R} = \frac{6}{4.0} = 1.5A$

261 **(c)**

The given circuit can be simplified as follows



$$\therefore R_{AD} = \frac{5R}{6}$$

262 **(a)**

Specific resistance is independent of dimensions of conductor but depends on nature of conductor.

263 **(a)**

Here three resistance of 4Ω each are connected in parallel so that their combined resistance $= \frac{4}{3}\Omega$. It is in series with ammeter, battery and last 4Ω resistance.

$\therefore$ Net resistances $R = \frac{4}{3} + 4 = \frac{16}{3}\Omega$

$\therefore$ Current in main circuit =ammeter reading

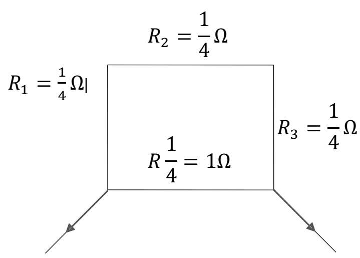
$$i = \frac{E}{R} = \frac{2\text{V}}{\frac{16}{3}\Omega} = \frac{3}{8}\text{A}$$

264 **(d)**

Slope of $V - i$ curve = resistance. Hence $R = \frac{1}{1} = 1\Omega$

265 **(c)**

When rod is bent in the form of square, then each side has resistance of $\frac{1}{4}\Omega$. As shown R_1, R_2 and R_3 are connected in series, so their equivalent resistance



$$R' = R_1 + R_2 + R_3$$

$$= \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}\Omega$$

Now, R' and R_4 are connected in parallel, so equivalent resistance of the circuit is

$$R = \frac{R' \times R_4}{R' + R_4}$$

$$= \frac{\left(\frac{3}{4}\right)\left(\frac{1}{4}\right)}{\left(\frac{3}{4}\right) + \left(\frac{1}{4}\right)}$$

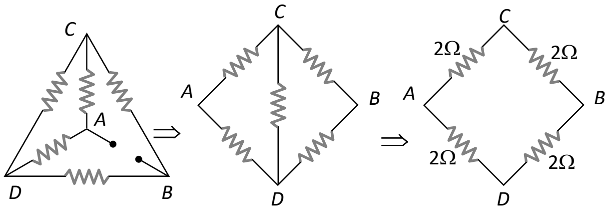
$$= \frac{\left(\frac{3}{16}\right)}{1} = \frac{3}{16}\Omega$$

266 **(a)**

$F = Ne = 6 \times 10^{23} \times 1.6 \times 10^{-19}$

267 **(d)**

The equivalent circuits are as shown below



Clearly, the circuit is a balanced Wheatstone bridge. So effective resistance between A and B is 2Ω

268 **(a)**

$$T_n = \frac{T_i + T_c}{2}$$

$T_i = 2T_n - T_c = 540°\text{C}$

270 **(d)**

The last two resistances are out of circuit. Now 8Ω is in parallel with $(1 + 1 + 4 + 1 + 1)\Omega$

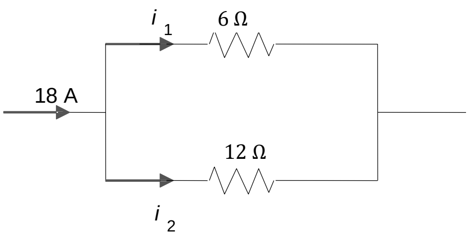
$$\therefore R = 8\Omega || 8\Omega = \frac{8}{2} = 4\Omega \Rightarrow R_{AB} = 4 + 2 + 2 = 8\Omega$$

271 **(c)**

As 3Ω and 6Ω resistances are

In parallel their equivalent resistance will be 2Ω.

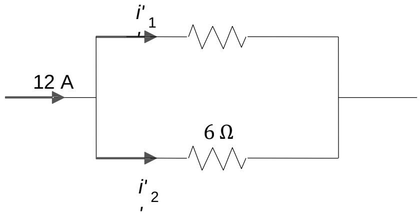
Here 2Ω and 4Ω are in series, their equivalent resistance will be 6Ω. From current distribution law



$$i_1 = \frac{12 \times 18}{18} = 12A$$

$$i_2 = \frac{6 \times 18}{18} = 6A$$

3 Ω



Now, 12A current is entering in parallel combination of 3Ω and 6Ω again from current distribution law

$$i_1' = \frac{6 \times 12}{9} = 8A$$

$$i_2' = \frac{3 \times 12}{9} = 4A.$$

$\therefore$ Potential difference across 3Ω resistance

$=8\times3=24\text{V}$

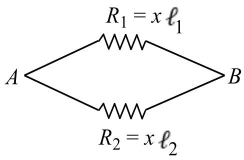
272 **(a)**

$$R = \rho\frac{l}{A} = \frac{m}{ne^2\tau}.\frac{l}{A}$$

273 **(d)**

Let x is the resistance per unit length then

Equivalent resistance



$$R = \frac{R_1R_2}{R_1 + R_2}$$

$$\Rightarrow \frac{8}{3} = \frac{(x\ell_1)(x\ell_2)}{x\ell_1 + x\ell_2} \Rightarrow \frac{8}{3} = x\frac{\ell_1\ell_2}{\ell_1 + \ell_2}$$

$$\Rightarrow \frac{8}{3} = x\frac{\ell_1}{\frac{\ell_1}{\ell_2}+1} \quad ...(i)$$

Also $R_0 = x\ell_1 + x\ell_2 \Rightarrow 12 = x(\ell_1 + \ell_2)$

$$\Rightarrow 12 = x\ell_2\left(\frac{\ell_1}{\ell_2} + 1\right) \quad ...(ii)$$

Dividing eq. (i) by eq. (ii)

$$\frac{\frac{8}{3}}{\frac{12}{1}} = \frac{\frac{x\ell_1}{\left(\frac{\ell_1}{\ell_2}+1\right)}}{x\ell_2\left(\frac{\ell_1}{\ell_2} + 1\right)} = \frac{\ell_1}{\ell_2\left(\frac{\ell_1}{\ell_2} + 1\right)^2}$$

$$\Rightarrow \left(\frac{\ell_1}{\ell_2} + 1\right)^2 \times \frac{8}{36} = \frac{\ell_1}{\ell_2}$$

$$\Rightarrow (y^2 + 1 + 2y) \times \frac{8}{36} = y \qquad [\text{Where } y = \frac{\ell_1}{\ell_2}]$$

$\Rightarrow 8y^2 + 8 + 16y = 36y$

$\Rightarrow 8y^2 - 20y + 8 = 0$

On solving, we get $y = \frac{1}{2}$ or 2

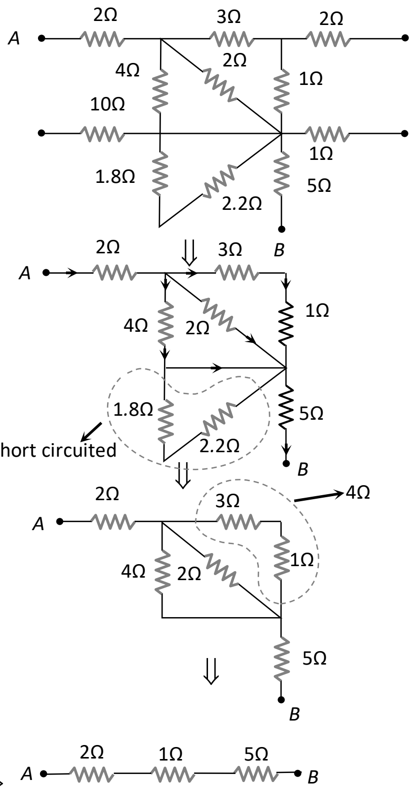
$\therefore y = \frac{\ell_1}{\ell_2} = \frac{1}{2}$ or 2

274 **(a)**

Internal resistance,

$$r = R\left(\frac{l_1 - l_2}{l_2}\right) = 1\left(\frac{540 - 500}{500}\right) = \frac{40}{500} = 0.08\,\Omega$$

275 **(b)**



$R_{AB} = 8\Omega$

276 **(c)**

$$P \times t = ms\,\Delta t$$

$\Rightarrow\ 2.1 \times 10^3 \times t$

$= 1.5 \times 4200 \times [(100 + 273) - (20 + 273)]$

$\Rightarrow\ = \dfrac{1.5 \times 4200 \times 80}{2.1 \times 10^3} = 240\text{s}$

277 **(a)**

In potentiometer experiment in which we find internal resistance of a cell, let E be the emf of the cell and V the terminal potential difference, then

$\dfrac{E}{V} = \dfrac{l_1}{l_2}$

Where l_1 and l_2 are lengths of potentiometer wire with and without short circuited through a resistance.

Since,

$\dfrac{E}{V} = \dfrac{R + r}{R}$ $[\because E = I(R + r) \text{and } V = IR]$

$\therefore\ \dfrac{R + r}{R} - \dfrac{l_1}{l_2}$

or $1 + \dfrac{r}{R} = \dfrac{110}{100}$ or $\dfrac{r}{R} = \dfrac{10}{100}$

or $r = \dfrac{1}{10} \times 10 = 1\Omega$

279 **(a)**

Resistivity of a material is its intrinsic property and is constant at particular temperature. Resistivity does not depend upon shape

280 **(b)**

Here internal resistance is given by the slope of graph

$i.e. \frac{x}{y}$. But conductance $= \frac{1}{\text{Resistance}} = \frac{y}{x}$

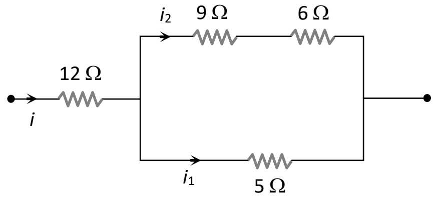
281 **(c)**

No charge in neutral temperature but temperature of inversion is

$t_i = 2t_n - t_c \Rightarrow t_i = 2 \times 270 - 40 = 500°\text{C}$

282 **(b)**

$\dfrac{i_1}{i_2} = \dfrac{15}{5} = \dfrac{3}{1}$ ...(i)



Also $\frac{H}{t} = i^2R \Rightarrow 45 = (i_1)^2 \times 5$

$\Rightarrow i_1 = 3\,A$ and from equation (i) $i_2 = 1\,A$

So $i = i_1 + i_2 = 4\,A$

Hence power developed in 12 Ω resistance

$P = i^2R = (4)^2 \times 12 = 192W$

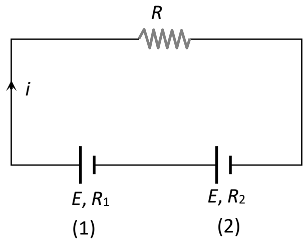
283 **(c)**

$K = \dfrac{I}{\tan\theta} = \dfrac{2/\sqrt{3}}{\tan 60°} = \dfrac{2}{3}A$

284 **(d)**

$i = \dfrac{2E}{R + R_1 + R_2}$

From cell (2) $E = V + iR_2 = 0 + iR_2$



$\Rightarrow E = \dfrac{2E}{R + R_1 + R_2} \times R_2 \Rightarrow R = R_2 - R_1$

285 **(a)**

Temperature coefficient of a semiconductor is negative

286 **(d)**

$E = i_1(R_1 + r) = i_2(R_2 + r)$

On solving, $r = \frac{i_2R_2 - i_1R_1}{(i_1 - i_2)}$

288 **(c)**

The circuit consists of three resistances ($2R, 2R$ and R) connected in parallel

289 **(c)**

Here resistances 4 Ω, 6Ω, 12Ω and 24 Ω are in parallel. Their effective resistances, R_P will be

$$\frac{1}{R_P}=\frac{1}{4}+\frac{1}{6}+\frac{1}{12}+\frac{1}{24}$$

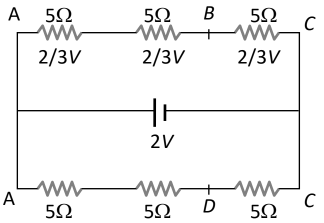
$$=\frac{6+4+2+1}{24}=\frac{13}{24} \text{ or } R_P=\frac{24}{13}$$

Total resistance between A and B

$$=3+\frac{24}{13}+5=\frac{128}{13}=9.85\ \Omega$$

290 **(d)**
The current density of electrons in a metallic conductor $=10^{22}\text{cm}^{-3}=10^{28}\text{m}^{-3}$

291 **(c)**
The given circuit can be redrawn as follows



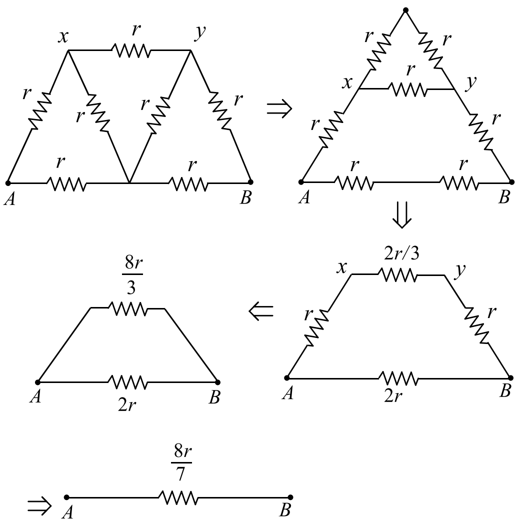
For identical resistance, potential difference distributes equally among all. Hence potential difference across each resistance is $\frac{2}{3}V$, and potential difference between A and B is $\frac{4}{3}V$

292 **(b)**
Here, potential gradient, $K=10\text{Vm}^{-1}$;

Potential difference across length $l=Kl$

$=10\times 0.5=5\text{ V}$

293 **(d)**
The given circuit can be simplified as follows



294 **(d)**

$$R_{\text{total}}=2+\frac{6\times 1.5}{6+1.5}=3.2\text{k}\Omega$$

$$\text{(a)}I=\frac{24\text{V}}{3.2k\Omega}=7.5\text{mA}=I_{R_1}$$

$$I_{R_2}=\left(\frac{R_L}{R_L+R_2}\right)I$$

$$I=\frac{1.5}{7.5}\times 7.5=1.5\text{mA}$$

$$I_{R_L}=6\text{mA}$$

$$(b)V_{R_L}=(I_{R_L})(R_L)=9V$$

$$(c)\ \frac{P_{R_1}}{P_{R_2}}=\frac{(I_{R_1}^2)R_1}{(I_{R_2}^2)R_2}=\frac{(7.5)^2(2)}{(1.5)^2(6)}=\frac{25}{3}$$

(d) When R_1 and R_2 are interchanged, then

$$\frac{R_2R_L}{R_2+R_L}=\frac{2\times 1.5}{3.5}=\frac{6}{7}k\Omega$$

Now potential difference across R_L will be

$$V_L=24\left[\frac{\frac{6}{7}}{6+\frac{6}{7}}\right]3V$$

Earlier it was 9V

Since, $P=\frac{V^2}{R}$ or $P\propto V^2$

In new situation potential difference has been decreased three times. Therefore, power dissipated will decrease by a factor of 9.

295 **(b)**
Mass of copper deposited,
$m=$ volume $\times$ density
$=$ (area $\times$ thickness) $\times$ density
$=[2\times(12\times 3)\times 0.002]\times 8.9$ g

$$t=\frac{m}{zI}=\frac{[2(12\times 3)\times 0.002\times 8.91]}{33\times 10^{-5}\times 5}=776\text{s.}$$

296 **(c)**
Suppose n resistors are used for the required job. Suppose equivalent resistance of the combination is R' and according to energy conservation it's current rating is i'

Energy consumed by the combination $=n\times$ (Energy consumed by each resistance)

$$\Rightarrow i'^2R'=n\times i^2R\Rightarrow n=\left(\frac{i'}{i}\right)^2\times\left(\frac{R'}{R}\right)$$

$$=\left(\frac{4}{1}\right)^2\times\left(\frac{5}{10}\right)=8$$

297 **(b)**
$i=\frac{24-12}{3}=4\ A$, Time of charging $t=\frac{360}{V.i}$

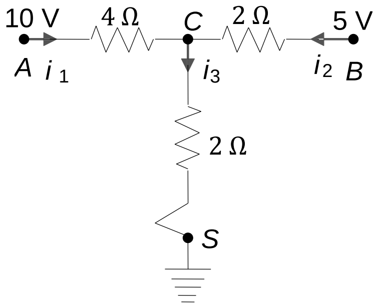
$$\Rightarrow t=\frac{360}{12\times 4}=7.5\ hours$$

298 **(c)**
Let V be the potential at C

Using Kirchhoff's first law $i_1+i_2=i_3$

$$\frac{10-V}{4}+\frac{5-V}{2}=\frac{V-0}{2}$$

On solving, $V = 4$ Volt, $i_3 = \frac{V}{2} = \frac{4}{2} = 2\text{A}$



299 **(c)**

$m = zI\,t$; so $9 = z \times 10^5$ or $z = 9/10^5\ \text{g}\ C^{-1}$

$m = zI\,t = (9 \times 10^5) \times 50 \times (20 \times 60) = 5.4$ g.

300 **(a)**

$$\text{Potential gradient} = \frac{\text{Potential difference}}{\text{Length}}$$

301 **(d)**

Charge supplied per minute $= 3.2 \times 60 = 192\ C$

Charge $2e$ liberates one Cu^{+2} ion

$\therefore$ No of Cu^{+2} ion liberate by 192 C

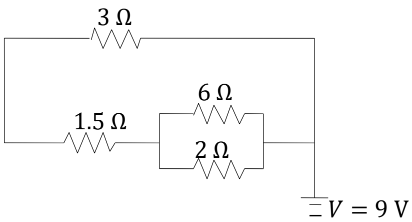
$$=\frac{192}{2e}=\frac{192}{2\times1.6\times10^{-19}}=6\times10^{20}$$

302 **(a)**

$$R=\frac{\rho l}{A}=50\times10^{-8}\times\frac{50\times10^{-2}}{(50\times10^{-2})^2}=10^{-6}\Omega$$

303 **(b)**

The equivalent circuit of the given circuit is as shown



Resistances 6Ω and 2Ω are in parallel

$$\therefore \quad R' = \frac{6\times2}{6+2}=\frac{3}{2}\Omega$$

Resistances $\frac{3}{2}\Omega$ and 1.5Ω are in series

$$\therefore \quad R'' = \frac{3}{2}+1.5=3\Omega$$

Resistances 3Ω and 3Ω are in parallel

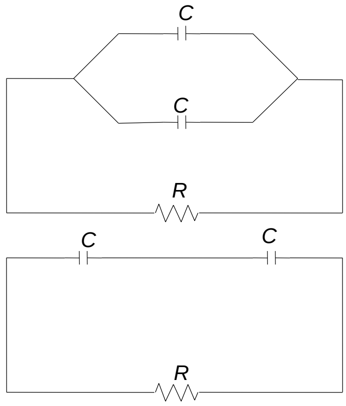
$$\therefore \quad R=\frac{3\times3}{3+3}=\frac{3}{2}$$

The current, $I = \frac{V}{R}$

$$=\frac{9}{3/2}=6A$$

304 **(d)**

If C_e be the effective capacitance, then



$$V_C=\frac{1}{2}V_0$$

$$\frac{q}{C_e}=\frac{q_0}{2C_e}$$

$$\Rightarrow q_0\left(1-e^{-\frac{t}{RC_e}}\right)=\frac{q_0}{2}$$

$$\Rightarrow \quad t = RC_e\ In2$$

For parallel grouping

$$C_e=\frac{2C}{2}$$

$$\therefore\ t_2 = 2RC\ In2$$

For series grouping

$$C_e=\frac{C}{2}$$

$$t_1=\frac{RC}{2}In\ 2$$

$$\frac{t_2}{t_1}=\frac{1}{4}t_2=2.5s$$

305 **(b)**

Resistance of combination $R_e = 4R$

$$\frac{\Delta R_e}{R_e}=\frac{\Delta R}{R}$$

$$=\frac{5\times100}{100}=5\%$$

306 **(c)**

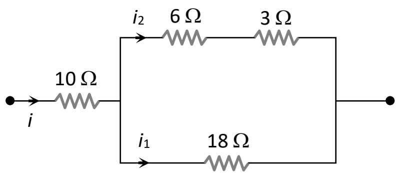
Since $H \propto i^2$, so on doubling the current, the heat produced and hence the rise in temperature becomes four times

307 **(b)**

The given circuit can be redrawn as

$$\frac{i_1}{i_2}=\frac{9}{18}=\frac{1}{2}$$

and $i = i_1 + i_2$



$$\Rightarrow \frac{i}{i_1}=1+\frac{i_2}{i_1}=1+2=3$$

From $P = i^2 R \Rightarrow \frac{P_{10\Omega}}{P_{18\Omega}} = \left(\frac{i}{i_1}\right)^2 \times \frac{10}{18} \Rightarrow P_{10\Omega} = 10W$

308 **(b)**

$t_n = \frac{\alpha}{\beta} = \left(\frac{500}{5}\right) = 100°\text{C}$

Also $t_n = \frac{t_i + t_c}{2} \Rightarrow 100 = \frac{t_i + 0}{2} \Rightarrow t_i = 200°\text{C}$

309 **(a)**

According to Seebeck effect

310 **(a)**

$R = \rho \frac{l}{A}$ and mass $m =$ volume $(V) \times$ density$(d) = (A\ l)d$

Since wires have same material so ρ and d is same for both

Also they have same mass $\Rightarrow Al =$ constant $\Rightarrow l \propto \frac{1}{A}$

$\Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2} \times \frac{A_2}{A_1} = \left(\frac{A_2}{A_1}\right)^2 = \left(\frac{r_2}{r_1}\right)^4$

$\Rightarrow \frac{34}{R_2} = \left(\frac{r}{2r}\right)^4 \Rightarrow R_2 = 544\ \Omega$

311 **(a)**

Resistance of a bulb $= \frac{(Rated\ voltage)^2}{Rated\ power}$

For a given voltage, $R \propto \frac{1}{P}$

$\therefore R_{40} > R_{60} > R_{100}$

Rate of heat produced, $H = I^2 R$

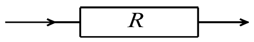
When the bulbs are connected in series, the current flowing through each bulb is same

$\therefore H \propto R$. As $R_{40} > R_{60} > R_{100}$

$\therefore H_{40} > H_{60} > H_{100} \Rightarrow B_1 > B_2 > B_3$

312 **(c)**

Resistance of the slab $= \rho \frac{L}{A}$ where



The potential across R is $I \times R = V$

The length of the slab is doubled. Therefore the resistance is $2R$. Assuming that the same current is passed, the potential across the new resistance is $l \times 2R = 2V$

313 **(a)**

The emf of the circuit is

$E = E_1 + E_2$

$= 4V + 2V = 6V$

In the given circuit, 3Ω and 6Ω are connected in parallel, hence equivalent resistance is

$\frac{1}{R'} = \frac{1}{3} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$

$\Longrightarrow R' = 2\Omega$

Total resistance of circuit is

$R = 1\Omega + 1\Omega + 2\Omega = 6\Omega$

From Ohm's law $V = iR$

$\Longrightarrow i = \frac{V}{R} = \frac{6}{6} = 1A$

The 3Ω and 6Ω resistors are in parallel, hence

$i_1 R_1 = i_2 R_2 = V$

$\therefore i_1 \times 3 = i_2 \times 6$

$\Longrightarrow i_1 = 2i_2\ \ and\ i_1 + i_2 = 1$

$2i_2 + i_2 = 1$

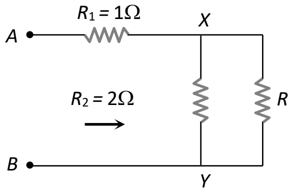
$3i_2 = 1 \Longrightarrow i_2 = \frac{1}{3}A$

314 **(a)**

Kirchhoff's first law is based on the law of conservation of charge

315 **(c)**

Let the resultant resistance be R. If we add one more branch, then the resultant resistance would be the same because this is an infinite sequence



$\therefore \frac{RR_2}{R + R_2} + R_1 = R \Rightarrow 2R + R + 2 = R^2 + 2R$

$\Rightarrow R^2 - R - 2 = 0 \Rightarrow R = -1$ or $R = 2ohm$

$R = 2 + 2 + \frac{2 \times R}{2 + R} \Rightarrow 2R + R^2 = 8 + 4R + 2R$

$\Rightarrow R^2 - 4R - 8 = 0 \Rightarrow R = \frac{4 \pm \sqrt{16 + 32}}{2}$

$= 2 \pm 2\sqrt{3}$

R cannot be negative, hence $R = 2 + 2\sqrt{3} = 5.46\Omega$

316 **(a)**

Here, all resistance are in parallel.

$\therefore \Delta H = \frac{V^2}{R} t$

$\therefore \Delta H \propto \frac{1}{R}$

Hence, (a) is correct.

318 **(b)**

Current, $i = \frac{E}{R + r}$ when R decreases to 0, $i = \frac{E}{r}$.

Similarly, potential difference $V = iR$ when R decreases to 0,

$V = 0.$

319 **(b)**

Kirchhoff's second law is based on the law of conservation of energy

320 **(b)**

Thermo-electric power $P = \frac{dE}{d\theta}$; at $t_n, E \rightarrow$ maximum

So $P \rightarrow$ zero

321 **(a)**

Heat produced $H = \frac{V^2t}{4.2R} = H \propto \frac{1}{R}$ Hence $\frac{H_1}{H_2} = \frac{R_2}{R_1}$

322 **(c)**

$\frac{H}{t} = P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$ also $R \propto \frac{1}{A} \propto \frac{l^2\rho}{A.l\rho}$

$\Rightarrow R \propto \frac{l^2}{m} \Rightarrow R \propto l^2$ [for same mass]

So $\frac{P_A}{P_B} = \frac{l_B^2}{l_A^2} = \frac{4}{1} \Rightarrow P_A = 20W$

323 **(d)**

$m_{\text{Ag}} = m_{\text{Cu}} \times E_{\text{Ag}}/E_{\text{Cu}}$

$= 2 \times 108/(63.6/2) = 6.8\ mg.$

324 **(a)**

At neutral temperature, $\frac{dE}{dT} = 0$

325 **(a)**

$V_A - V_B =$ emf of the cell $= 2$ V

$\therefore U = \frac{1}{2}CV^2 = \frac{1}{2} \times 2 \times 10^{-6} \times (2)^2 = 4 \times 10^{-6}$ J

326 **(a)**

The temperature of the wire increases to such a value at which, the heat produced per second equals heat lost per second due to radiation *ie*,

$I^2\left(\frac{\rho l}{\pi r^2}\right) = H \times 2\pi rl$, where H is heat lost per second per unit area due to radiation.

Hence, $I^2 \propto r^3$

So $\frac{I_1^2}{I_2^2} = \frac{r_1^3}{r_2^3}$ or $r_2 = r_1(I_2/I_1)^{2/3}$

$= 1 \times (3.0/1.5)^{2/3} = 4^{1/3}$ mm.

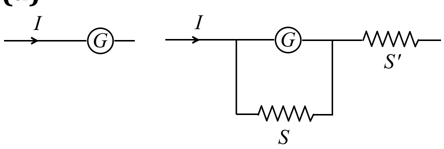
327 **(d)**

Charge = Current × Time $= 5 \times 60 = 300\ C$

328 **(d)**

Resistance, $R = \frac{V}{i} = \cot 40°$

329 **(a)**



$G = \left(\frac{GS}{G+S}\right) + S''$

$G - \frac{GS}{G+S} = S'' \ \therefore S'' = \frac{G^2}{G+S}$

330 **(c)**

$E - V = ir$ or $r = (E-V)i$

and $V = iR = 4.5 \times 10 = 45$V

$\therefore\ r = \frac{(50-45)}{4.5} = \frac{5}{4.5}$

$= 1.10\ \Omega$

331 **(a)**

$\frac{R_1}{R_2} = \frac{P_2}{P_1} = \frac{100}{40} = \frac{5}{2}$. Resistance of 40 W bulb is $\frac{5}{2}$ times than 100 W. In series, $P = i^2R$ and in parallel, $P = \frac{V^2}{R}$. So 40 W in series and 100 W in parallel will glow brighter

332 **(a)**

A particular temperature, the resistance of a superconductor is zero

$\Rightarrow G = \frac{1}{R} = \frac{1}{0} = \infty$

333 **(b)**

In series, $i_1 = \frac{2E}{2+2r}$

In parallel, $i_2 = \frac{E}{2+\frac{r}{2}} = \frac{2E}{4+r}$

Since $i_1 = i_2 \Rightarrow \frac{2E}{4+r} = \frac{2E}{2+2r} \Rightarrow r = 2\Omega$

334 **(b)**

The amount of decomposition (*ie*, mass of the substance liberated during electrolysis) is proportional to ECE of the substance.

335 **(a)**

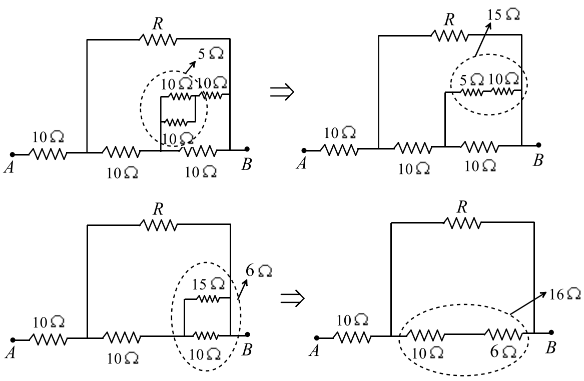
In series, $i = \frac{3\times2}{3r+2}$ ...(i)

In parallel, $i = \frac{2}{r/3+2} = \frac{2\times3}{r+2\times3}$ ...(ii)

From Eqs. (i) and (ii), $3r + 2 = r + 6$ or $r = 2\Omega$

From eqs. (i), $i = \frac{3\times2}{3\times2+2} = 0.75$A

336 **(c)**



$\therefore \frac{R\times16}{R+16} + 10 = 18$, on solving we get, $R = 16\Omega$

337 **(a)**

When wire is stretched to doubled its length, its resistance becomes four times

338 **(d)**

Current in wire $i = Anev_d$

Here, $i = 1A, n = 8 \times 10^{28}$ electron/m^{-3}

$A = 5 \times 10^{-7}\text{m}^2$

$\therefore 1 = 8 \times 10^{28} \times 1.6 \times 10^{-19} \times 5 \times 10^{-7} \times v_d$

or $\ v_d = \frac{1}{8 \times 10^{28} \times 1.6 \times 10^{-19} \times 5 \times 10^{-7}}$

Now,

$t = \frac{1}{v_d} = 8 \times 10^{28} \times 1.6 \times 10^{-19} \times 5 \times 10^{-7}$

$= 64 \times 10^2 = 6.4 \times 10^3$s

339 **(c)**

Voltmeter is an instrument which measure the potential difference between two points. A high resistance is connected in series with coil of the galvanometer to convert it into voltmeter. This resistance is either 2000Ω or more than that.

Resistance connected in series is given by

$R = \frac{V}{I_g} - G \quad ..(i)$

Eq. (i) is the value of the resistance required to convert the galvanometer to voltmeter of range 0 to V.

From the relation

$R = \frac{V}{I_g} - G$

$R = \frac{nV}{\left(\frac{V}{G}\right)} - G$

or $R = nG - G = G(n-1)$

Hence, $R = (n-1)\,G$

340 **(c)**

We will require a voltmeter, an ammeter, a test resistor and a variable battery to verify Ohm's law.

Voltmeter which is made by connecting a high resistance with a galvanometer is connected in parallel with the test resistor.

Further, an ammeter which is formed by connecting a low resistance in parallel with galvanometer is required to measure the current through test resistor.

The correct option is (c).

341 **(d)**

A galvanometer can be converted into an ammeter by using a low resistance wire in parallel with the galvanometer. The range of ammeter can be increased but cannot be decreased. The reason is that a series resistor cannot change the current that will produce full deflection.

A shunt connected in parallel is given by

$S = \frac{I_g G}{I - I_g}$

If $I < I_g$, then the value of S is negative. Hence, a galvanometer cannot be converted into an ammeter of range $I < I_g$.

342 **(c)**

When current is passed through a junction of two different metals, the heat is either evolved or absorbed at the junction. This effect is known as Peltier effect.

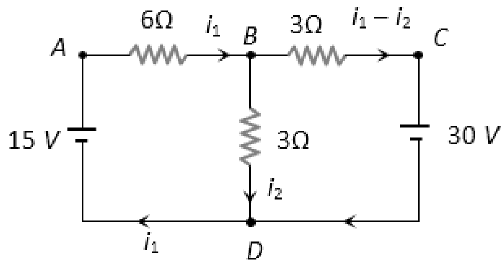
343 **(b)**

$P_1 = P_2 = 60$ W; when bulbs are connected in series then total power

$P_s = \frac{P_1 P_2}{P_1 + P_2} = \frac{60 \times 60}{60+60} = 30$ W

344 **(a)**

The current in the circuit are assumed as shown in the fig.



Applying KVL along the loop $ABDA$, we get

$-6i_1 - 3\,i_2 + 15 = 0$ or $2i_1 + i_2 = 5$ ....(i)

Applying KVL along the loop $BCDB$, we get

$-3(i_1 - i_2) - 30 + 3i_2 = 0$ or $-i_1 + 2i_2 = 10$ ....(ii)

Solving equation (i) and (ii) for i_2, we get $i_2 = 5\,A$

345 **(a)**

$E = \alpha t + bt^2$. At temperature of inversion E is minimum

$i.e., E = 0$

$\therefore \alpha t_i + bt_i^2 = 0, i.e., t_1 = -\frac{a}{b}$

346 **(c)**

$R \propto \frac{1}{\tau}$;where τ = Relaxation time

When lamp is switched on, temperature of filament increases, hence τ decreases so R increases

347 **(a)**

Slope of the $V - i$ curve at any point equals to resistance at that point. From the curve slope for $T_1 >$ slope for $T_2 \Rightarrow R_{T_1} > T_{T_2}$. Also at higher temperature resistance will be higher so $T_1 > T_2$

348 **(b)**

$dQ = Idt \Rightarrow Q = \int_{t=2}^{t=3} Idt = \left[2\int_2^3 tdt + 3\int_2^3 t^2 dt\right]$

$= [t^2]_2^3 + [t^3]_2^3 = (9-4) + (27-8) = 5 + 19$

$= 24C$

349 **(d)**

$i = \frac{R}{r+R}$

$P = i^2 R$

$\Rightarrow \quad P = \frac{E^2 R}{(r+R)^2}$

Power is maximum when r=R

$\therefore \quad P_{\max} = \frac{E^2}{4R}$

or $P_{\max} = \frac{E^2}{4r}$

350 **(c)**

When a resistance of 100Ω is connected in series current,

$i = \frac{V}{100+R} \qquad \ldots\ldots\ldots.(i)$

When a resistance of 1000Ω is connected in series, the its range double

Current, $i = \frac{2V}{1100+R}$ ……(ii)

From Eqs. (i) and (ii)

$\frac{V}{100+R} = \frac{2V}{100+R}$

$R = 900\Omega$

351 **(d)**

The rate at which heat is developed

$H = \frac{V^2}{R} = \frac{(110)^2}{10} = 1210 \text{ W}$

352 **(b)**

Shunt of an ammeter,

$S = \frac{I_g \times G}{I - I_g}$

$= \frac{5 \times G}{100-5} = \frac{G}{19}$

353 **(b)**

$A = \pi r^2 = \rho l/R$ or $r = (\rho l/\pi R)^{1/2}$

$r = \left(\frac{1.7 \times 10^{-8} \times 0.5}{3.14 \times 2}\right)^{1/2} = 0.367 \text{ mm}$

354 **(c)**

If a charged particle of charge q resolves in a circular orbit of radius r with frequency v, then the orbital current is given by

$I = qv$

$or \quad I = q\frac{\omega}{2\pi} \left(\because = 2\pi v \Rightarrow \text{v} = \frac{\omega}{2\pi}\right)$

$\text{I} = \frac{\text{ev}}{2\pi\text{r}} \qquad (\because v = r\omega)$

355 **(d)**

For maximum power $r = R$

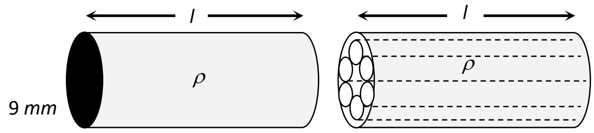
356 **(a)**

Initially : Resistance of given cable

$R = \rho \frac{l}{\pi \times (9 \times 10^{-3})^2}$ …(i)

Finally : Resistance of each insulated copper wire is

$R' = \rho \frac{l}{\pi \times (3 \times 10^{-3})^2}$. Hence equivalent resistance of cable $R_{eq} = \frac{R'}{6} = \frac{1}{6} \times \left(\rho \frac{l}{\pi \times (3 \times 10^{-3})^2}\right)$ …(ii)



on solving equation (i) and (ii), we get $R_{eq} = 7.5\ \Omega$

357 **(b)**

From the Ohm's law

$I = \frac{2E}{2r+R}$

In parallel combination of two cells, the current through the external resistance r will be

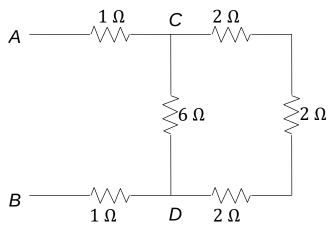
$I' = \frac{E}{\frac{r}{2}+R} = \frac{2E}{r+2R}$

If $I = I'$ then $2r + R = r + 2R$

$\Rightarrow \quad r = R = 3\Omega$

358 **(a)**

Equivalent circuit of the given circuit is



Between points C and D resistors 2Ω, 2Ω and 2Ω are in series, therefore, their equivalent resistance,

$R' = 2 + 2 + 2 = 6\Omega$

Resistors R' and 6Ω are in parallel, therefore their equivalent resistance is given by

$\frac{1}{R''} = \frac{1}{6} + \frac{1}{6}$

$R'' = 3\Omega$

Now between points A and B 1Ω, 3 Ω and 1Ω are in series.

Therefore, resultant resistance is

R=1+3+1=5Ω

359 **(b)**

$i = neAv_d \Rightarrow \frac{(v_d)_e}{(v_d)_h} = \frac{i_e}{i_h} \times \frac{n_h}{n_e} = \frac{7}{4} \times \frac{5}{7} = \frac{5}{4}$

360 **(c)**

Electroplating only provides a thin deposition of a metal on the surface which in no way can give hardness to the metal

361 **(b)**

Yellow, Violet and Gold

362 **(c)**

When there is no deflection, then this temperature is called inversion temperature. It is given by the relation

$$\theta_n = \frac{\theta_i + \theta_c}{2}$$

Where θ_c is temperature of cold junction = 20°C and neutral temperature $\theta_n = 270°C$

$\therefore \theta_i = 2\theta_n - \theta_c = 540 - 20 = 520°C$

363 **(b)**

$$\frac{E_1}{E_2} = \frac{l_1}{l_2} \Rightarrow \frac{1.08}{E_2} = \frac{400}{440}$$

$$\Rightarrow E_2 = \frac{440 \times 1.08}{400} = 1.188V.$$

364 **(a)**

The relative position of metals in the electro chemical series determines the emf between the two metals placed in an electrolyte.

365 **(d)**

$$E = \frac{e}{(R + R_h + r)} \frac{R}{L} \times l$$

$$= \frac{2}{(10 + 40 + 0)} \times \frac{10}{1} \times 0.4$$

$$= 0.16V$$

366 **(b)**

$I = 4 - 0.08t$ A

Or $\frac{dq}{dt} = 4 - 0.08t$ A

or $q = \int_0^{50} (4 - 0.08t) dt\ C$

or $Ne = \left[4t - \frac{0.08t^2}{2}\right]_0^{50} = 100\ C$

Where N is number of electrons.

or $N = \frac{100}{e} = \frac{100}{1.6 \times 10^{-19}}$

$= 6.25 \times 10^{20}$

367 **(c)**

$$i = \frac{E}{R + r} = \frac{2}{3.9 + 0.1} = 0.5;$$

$$V = E - ir = 2 - 0.5 \times 0.1 = 1.95V$$

368 **(d)**

For greater sensitivity of meter bridge the resistance (R) taken in the resistance box should be such that the null point is nearly in the middle of the wire. In this position all resistance P, Q, R and S become nearly equal. The emf of cell depends upon the size and area of electrodes.

369 **(c)**

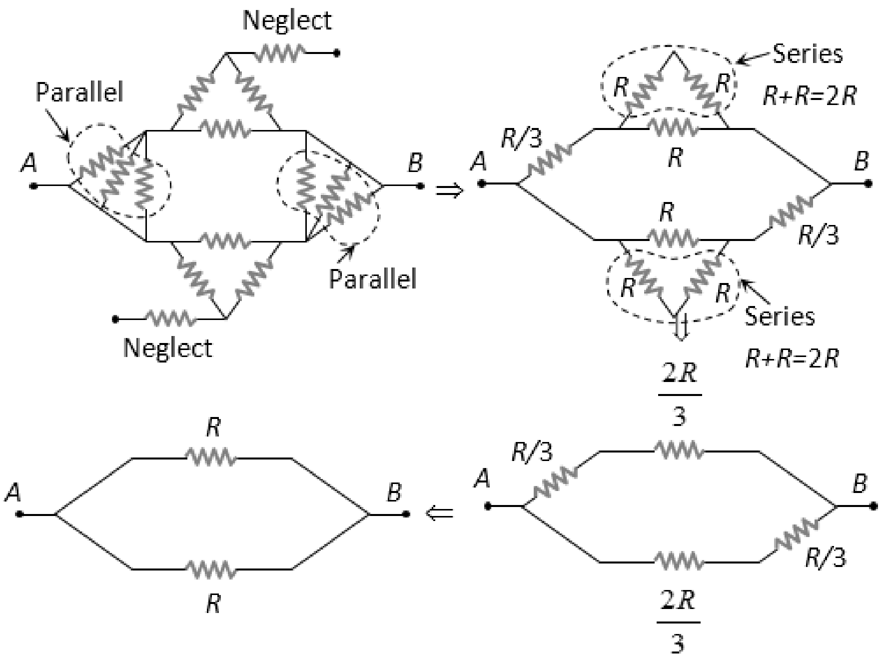
$$v_d = \frac{I}{nAl} = \frac{1}{nAe} \times \frac{V}{R}$$

$$= \frac{1}{nAe} \times \frac{V}{(\rho l/A)} = \frac{V}{ne\rho l}$$

As v_d is independent of area of cross-section hence drift velocity will not change, when diameter is doubled

370 **(c)**

Given circuit can be redrawn as follows



$\Rightarrow R_{eq} = \frac{R}{2}$

371 **(c)**

By Wheatstone bridge, $\frac{R}{80} = \frac{AC}{BC} = \frac{20}{80} \Rightarrow R = 20\ \Omega$

372 **(a)**

$P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$ and $R \propto l$

$\therefore P \propto \frac{1}{l} \Rightarrow \frac{P_1}{P_2} = \frac{l_2}{l_1} = \frac{2}{1}$

373 **(a)**

It is found that temperature of inversion (T_i) is as much above the neutral temperature (T_n) as neutral temperature is above the temperature of the cold junction (T), *ie*,

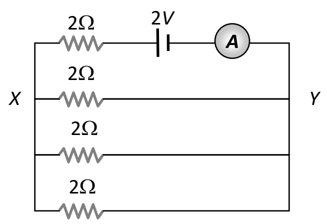
$T_i - T_n = T_n - T$ or $T_i = 2T_n - T$

But, here the cold junction is kept at 0°C, hence $T = 0$.

Thus, $T_i = 2T_n$ or $T_n = \frac{T_i}{2}$

374 **(b)**

Resistance across $XY = \frac{2}{3}\Omega$



Total resistance

$= 2 + \frac{2}{3} = \frac{8}{3}\Omega$

Current through ammeter

$= \frac{2}{8/3} = \frac{6}{8} = \frac{3}{4}A$

375 **(c)**

$R = \frac{12 \times 4}{12 + 4} + 2 = 5\Omega$

$I = \frac{E}{R + r} = \frac{12}{6} = 2A$

$I_1 + I_1 = 2A$

$I \propto \frac{1}{R}$

$\therefore I_1 = 0.5A, I_2 = 1.5A$

377 **(a)**

Let the temperature of molten metal is t°C

The thermo-*emf* $e = 10 \times 10^{-6} t\ volt$

Current in the circuit $\frac{e}{R + R_G} = \frac{10^{-5}t}{8+1.6} = \frac{10^{-5}t}{9.6} amp$

But $i = \frac{V}{R_G} = \frac{8 \times 10^{-3}}{8}$

$\therefore \frac{10^{-5}t}{9.6} = \frac{8 \times 10^{-3}}{8}$ or $t = \frac{9.6 \times 10^{-3}}{10^{-5}} = 960$°C

378 **(a)**

$P = \frac{V^2}{R}$

$\therefore R_{\text{hot}} = \frac{V^2}{P}$

$= \frac{200 \times 200}{1000} = 400\ \Omega$

$R_{\text{cold}} = \frac{400}{10} = 40\ \Omega$

379 **(b)**

Given, $E = 2.2V$, $R = 5\Omega$

$V = 1.8V, r = ?$

Now current in the circuit

$$i = \frac{E}{R+r}$$

or $\frac{V}{R} = \frac{E}{R+r}$

$$\frac{1.8}{5} = \frac{2.2}{5+r}$$

or $r = \frac{10}{9}\Omega$

380 **(a)**

$E_1 E_2 = l_1/l_2$. As, E_1/E_2, therefore $l_1 > l_2$. Therefore the null point for thr cell of emf E_2must be at shorter length than that of cell E_1.Thus null point on potentiometer wire should shift towards left of C.

381 **(a)**

Current given by cell

$$I = \frac{E}{R+r}$$

Power delivered in first case

$$P_1 = I^2 R_1 = \left(\frac{E}{R_1+r}\right)^2 R_1$$

Power delivered in second case

$$P_2 = I^2 R_2 = \left(\frac{E}{R_2+r}\right)^2 R_2$$

Power delivered is same in the both the cases.

$$\left(\frac{E}{R_1+r}\right)^2 R_1 = \left(\frac{E}{R_2+r}\right)^2 R_2$$

$$\frac{R_1}{(R_1+r)^2} = \frac{R_2}{(R_2+r)^2}$$

$$R_1(R_2^2 + r^2 + 2R_2 r) = R_2(R_1^2 + r^2 + 2R_1 r)$$

$$R_1 R_2^2 + R_1 r^2 + 2R_1 R_2 r = R_2 R_1^2 + R_2 r^2 + 2R_1 R_2 r$$

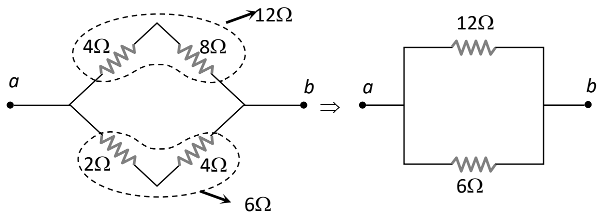
$$R_1 R_2^2 - R_2 R_1^2 = R_2 r^2 - R_1 r^2$$

$$R_1 R_2 (R_2 - R_1) = r^2 (R_2 - R_1)$$

$$r = \sqrt{R_1 R_2}$$

382 **(b)**

Given circuit is a balanced Wheatstone bridge circuit, hence it can be redrawn as follows



$$R_{AB} = \frac{12 \times 6}{(12+6)} = 4\Omega$$

383 **(b)**

In general, ammeter always reads less than the actual value because of its resistance

384 **(a)**

In the circuit shown total external resistance $R =$ 2Ω +parallel combination of two 4 Ω resistors + parallel combination of three 15 Ω resistors

$$= 2 + \frac{4}{2} + \frac{15}{3} = 2 + 2 + 5 = 9\Omega$$

As $E = 10$V and $i = 1$A, hence internal resistance r of the cell should have a value given by

$$E = i(R+r) \text{ or } r = \frac{E}{i} - R = \frac{10}{1} - 9 = 1\Omega$$

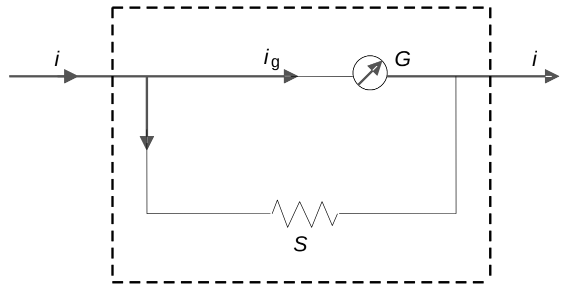
If 4Ω resistors are replaced by 2Ω resistors , then as before

$$R' = 2 + \frac{2}{2} + \frac{15}{3} = 2 + 1 + 5 = 8\Omega$$

$\therefore$ New circuit current $i' = \frac{E}{R'+r} = \frac{10}{8+1} = 1.11$A

385 **(c)**

Let Gbe resistance of galvanometer and i_g the current which on passing through the galvanometer produces full scale deflection. If i is the maximum current, and since, G and S are in parallel.



Ammeter

$$i_g \times G = (i - i_g) \times S$$

$$\Rightarrow \frac{i_g}{i} = \frac{S}{S+G}$$

Given, G=36Ω, S=4Ω

$$\therefore \frac{i_g}{i} = \frac{4}{36+4} = \frac{4}{40}$$

$$\Rightarrow i_g = \frac{i}{10}$$

$$\therefore 100 \times \frac{i_g}{i} = \frac{1}{10} \times 100$$

$$\Rightarrow \frac{i_e}{i}\% = 10\%$$

386 **(d)**

$R = 91 \times 10^2 \approx 9.1 k\Omega$

387 **(c)**

$$r = \frac{(l_1 - l_2)}{l_2} \times R' = \left(\frac{60-50}{50}\right) \times 6 = 1.2\,\Omega$$

388 **(c)**

$R = \frac{\rho(L)}{A} = \frac{\rho L}{tL} = \frac{\rho}{t}$

ie, R is independent of L.

Hence the correct option is (c).

389 **(c)**

$q = \frac{m}{z} = \frac{1}{(1/96500,00)} = 96500,000$ C

$V = \frac{H}{q} = \frac{34\times10^5\times4.2}{96500,000} = 1.48 = 1.5$V.

390 **(a)**

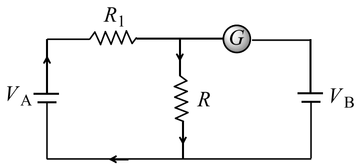
The reciprocal of resistance is called conductance

391 **(d)**

In case of stretching of wire $R \propto l^2$

⇒ If length becomes 3 times so Resistance becomes 9 times $i.e. R' = 9 \times 20 = 180\Omega$

392 **(b)**



Since deflection in galvanometer is zero so current will flow as shown in the above diagram

Current $I = \frac{V_A}{R_1+R} = \frac{12}{500+100} = \frac{12}{600}$

So $V_B = IR$

$= \frac{12}{600} \times 100 = 2V$

393 **(c)**

In series combination of cells current, $i = \frac{nE}{nr+R}$

In parallel combination of cell, $i' = \frac{E}{(r/n)+R}$

If $i = i'$ then $\frac{nE}{nr+R} = \frac{E}{(r/n)+R} = \frac{nE}{r+nR}$

It will be so if $r = R$

394 **(b)**

Resistance of 40 W bulb $= \frac{240\times240}{40}$

$= 1440\ \Omega$

It's safe current $= \frac{240}{1440} = 0.167$ A

Resistance of 60 W bulb $= \frac{240\times240}{60}$

$= 960\ \Omega$

It's safe current $= \frac{240}{960} = 0.25$ A

When connected in series to 420 V supply, then the current

$$I = \frac{420}{1440+960} = \frac{420}{2400}$$

$= 0.175$ A

Thus, current is greater for 40 W bulb, so it will fuse.

395 **(d)**

The sensitivity of the thermocouple will be

$= 500\mu V/°C - (-72\mu V/°C) = 572\mu V/°C$

Therefore for a 100°C temperature difference, the thermo e.m.f. will be

$E = 572 \times 10^{-6} \times 100(volt) = 57.2 \times 10^{-3}$

$= 57.2\ mV$

396 **(d)**

The resistance of an ideal voltmeter is considered as infinite

397 **(b)**

For power to be maximum

External resistance = Equivalent internal resistance of the circuit

398 **(a)**

$v_d = \frac{eE}{m}\tau = \frac{e}{m}\tau\left(\frac{V}{l}\right)$ or $V_d \infty V$

Therefore, drift velocity is doubled

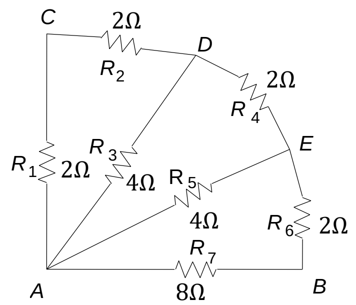
399 **(c)**

The specific resistance (ρ) is the characteristic of the material of conductor. Its value depends only on the material of conductor and its temperature. Its value does not depend on the length and area of cross-section of the conductor.

400 **(c)**

R_1 and R_2 are in series

$\therefore\ R_{12} = R_1 + R_2 = 4\Omega$



R_{12} *and* R_3 are in parallel

$R_{123} = \frac{R_3 \times R_{12}}{R_3 + R_{12}}$

$= \frac{4\times4}{4+4}$

$= 2\Omega$

R_{123} and R_4 are in series

$\therefore\ R_{1234} = R_{123} + R_4$

$= 2\Omega + 2\Omega$

$= 4\Omega$

R_{1234} and R_5 are in parallel

$\therefore R_{12345} = 2\Omega$

R_{12345} and R_6 are in series

$2\Omega + 2\Omega = 4\Omega$

$= R_{123456}$

Now, R_{123456} and R_7 are in parallel

$\therefore R_{comb} = \frac{4 \times 8}{4+8}$

$= \frac{32}{12} = \frac{8}{3}\Omega$

401 **(c)**

$R = \rho\frac{l}{A} \Rightarrow 7 = \frac{64 \times 10^{-6} \times 198}{\frac{22}{7} \times r^2} \Rightarrow r = 0.024cm$

402 **(a)**

Drift velocity is defined as the average velocity with which free electrons get defined towards the positive end of the conductor under the influence of an external electric field.

Drift velocity is given by

$v_d = \frac{eE\tau}{m}$

$But \quad E = \frac{V}{l}$

(if l is length of the conductor and V is constant potential difference applied across the ends of the conductor)

$\therefore v_d = \frac{eV\tau}{ml} \Longrightarrow v_d \propto V$

So, when the potential difference is doubled the drift velocity will be doubled.

403 **(c)**

Net voltage =12-8=4V

Net resistance =9+2+1=12Ω

Current through the circuit

$= \frac{4}{12} = \frac{1}{3}A$

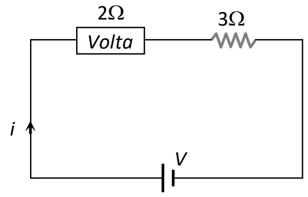
Terminal voltage across E_2 is

$= E_2 - Ir_2 = 12 - \frac{1}{3} \times 2$

$= 12 - \frac{2}{3} = \frac{34}{3} = 11.34\ V$

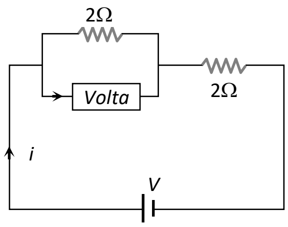
404 **(d)**

Initially current through the voltmeter $i_1 = \frac{V}{(3+2)} = \frac{V}{5}$



Finally main current $i = \frac{V}{3+1} = \frac{V}{4}$

Hence current through voltameter $i_2 = \frac{V}{8}$



$\because$ Rate of deposition $(R) = \frac{m}{t} = Zi \Rightarrow R \propto i$

$\therefore$ % drop in rate $= \frac{R_2 - R_1}{R_1} \times 100 = \frac{i_2 - i_1}{i_1} \times 100$

$= \frac{\left(\frac{V}{8} - \frac{V}{5}\right)}{\frac{V}{5}} \times 100 = -37.5\%$

405 **(b)**

$Pt = mS\theta$

$P = \frac{1 \times 4200 \times 15}{60}$W= 1050 W

406 **(d)**

Heating effect of current

407 **(c)**

$R = \frac{230 \times 230}{100} = 529\ \Omega$

$\therefore H = \frac{V^2}{R} \times t = \frac{115 \times 115}{529} \times 10 \times 60 = 15$ kJ

408 **(b)**

Potentiometer is based on null deflection

409 **(c)**

Due to the negligible temperature co-efficient of resistance of constantan wire, there is no change in it's resistance value with change in temperature

410 **(a)**

Neutral temperature is defined as temperature of a hot junction of a thermocouple at which the electromotive force of the thermocouple attains its maximum value when cold junction is maintained at a constant temperature of 0°C. Hence, for a given thermocouple neutral temperature is a constant.

411 **(a)**

For one wire cable,

Resistance, $R' = \rho l/\pi(9 \times 10^{-3})^2 = 5\Omega$

For other wire of cable,

Resistance, $R' = \rho l/\pi(3 \times 10^{-3})^2$

$= 9^2 \times 5/3^2 = 45\Omega$

When six wires each of resistance R' are connected in parallel, their effective resistance will be

$$R_p = \frac{R'}{6} = \frac{45}{6} = 7.5\Omega$$

412 **(a)**

After short circuiting, R_2 becomes meaningless

413 **(c)**

In series,

$$P_s = \frac{P_1 \times P_2}{P_1 + P_2} = 12 \text{ W}$$

In parallel, $P_p = P_1 + PP_2 = 50 \text{ W}$

$\therefore \quad P_1 P_2 = 12 \times 50 = 600$

Now, $(P_1 - P_2)^2 = (P_1 + P_2)^2 - 4P_1P_2$

$= (50)^2 - 4 \times 600$

$= 2500 - 2400 = 100$

$\therefore \quad P_1 - P_2 = 10$

Or $\quad P_1 = 30 \text{ W}, P_2 = 20 \text{ W}$

$\therefore \quad \frac{P_1}{P_2} = \frac{3}{2}$

414 **(c)**

Lowest resistance will be in the case when all the resistors are connected in parallel

$\frac{1}{R} = \frac{1}{0.1} + \frac{1}{0.1}$ .... 10 times

$\frac{1}{R} = 10 + 10 \ldots \ldots$ 10 times

$\frac{1}{R} = 100 \; i.e. R = \frac{1}{100}\Omega$

415 **(d)**

$$i = \frac{e}{t} = \frac{e}{2\pi r/v} = \frac{ev}{2\pi r}$$

Here, $v = \frac{e^2}{h}$ and $r = h^2/me^2$

$$\therefore i = \frac{e(e^2/h)}{2\pi(h^2/me^2)} = \frac{e^3 \times me^2}{2\pi h^3} = \frac{me^5}{2\pi h^3}$$

$$i = \frac{4\pi^2 me^5}{h^3}$$

416 **(c)**

For the same length and same material,

$$\frac{R_2}{R_1} = \frac{A_1}{A_2} = \frac{3}{1} \text{ or } R_2 = 3R_1$$

The resistance of thick wire, $R_1 = 10\ \Omega$

The resistance of thin wire

$= 3R_1 = 3 \times 10 = 30\ \Omega$

Total resistance $= 10 + 30 = 40\ \Omega$

417 **(c)**

Resistance of copper part of wire $R_c = \frac{\rho_c . L}{A_c} = \frac{\rho_c . L}{\pi r^2}$

and

Resistance of nickel portion of wire $R_n = \frac{\rho_c . L}{A_n} = \frac{\rho_c . L}{\pi(R^2 - r^2)}$

As these two resistances are in parallel, hence conductance

of the nickelled wire $C = \frac{1}{R} = \frac{1}{R_c} + \frac{1}{R_n} = \frac{\pi r^2}{\rho_c . L} + \frac{\pi(R^2 - r^2)}{\rho_n . L}$

$$= \frac{\pi}{L}\left[\frac{r^2}{\rho_c} + \frac{R^2 - r^2}{\rho_n}\right]$$

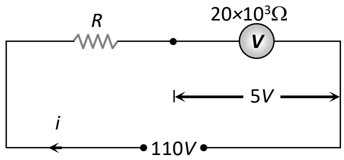
418 **(a)**

All the conductors have equal lengths. Area of cross-section of A is $\left\{\left(\sqrt{3}a\right)^2 - \left(\sqrt{2}a\right)^2\right\} = a^2$

Similarly area of cross-section of $B =$ Area of cross-section of $C = a^2$

Hence according to formula $R = \rho\frac{l}{A}$; resistances of all the conductors are equal $i.e. R_A = R_B = R_C$

419 **(c)**



Here $i = \frac{110}{20 \times 10^3 + R}$

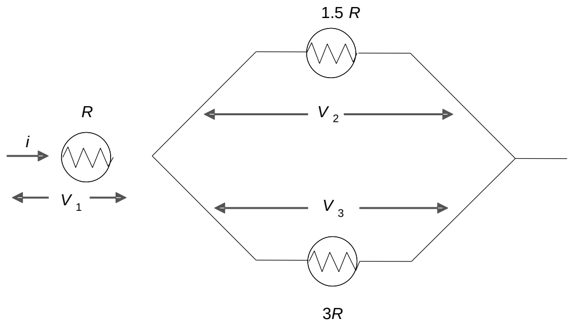
$$\because V = iR \Rightarrow 5 = \left(\frac{110}{20 \times 10^3 + R}\right) \times 20 \times 10^3$$

$$\Rightarrow 10^5 + 5R = 22 \times 10^5 \Rightarrow R = 21 \times \frac{10^5}{5}$$

$$= 420\ K\Omega$$

420 **(a)**

Here, $V_2 = V_3$



$ie., i_2 \times 1.5R = 3R \times i_3$

And $\quad i_2 + i_3 = i$

$\Rightarrow \quad i_2 = \frac{2i}{3}$ *and* $i_3 = \frac{i}{3}$

Now, $V_i = iR$

$V_2 = \frac{2i}{3} \times 1.5R = iR$

$V_3 = \frac{i}{3} \times 3R = iR$

ie, $\quad V_1 = V_2 = V_3$

421 **(a)**

Equivalent resistance $R = 4 + \frac{3\times6}{3+6} = 6\Omega$ and main current $i = \frac{E}{R} = \frac{3}{6} = 0.5A$

Now potential difference across the combination of 3Ω and 6Ω, $V = 0.5 \times \left(\frac{3\times6}{3+6}\right) = 1 Volt$

The same potential difference also develops across 3Ω resistance

422 **(c)**

$v_d = \frac{I}{nAe} = \frac{20}{10^{29} \times 10^{-6} \times 1.6 \times 10^{-19}}$

$= 1.25 \times 10^{-3}$m/s

423 **(c)**

In series combination, the net resistance

$R_s = R + 2R = 3R$

Heat produced in R_s,

$H_s = \frac{V^2}{R_s} = \frac{V^2}{3R} \qquad \ldots$ (i)

I parallel combination, the net resistance

$R_P = \frac{R \times 2R}{R + 2R} = \frac{2R^2}{3R} = \frac{2}{3} R$

Heat produced in R_P,

$H_P = \frac{V^2}{R_P} = \frac{V^2}{2R/3} = \frac{3V^2}{2R} \qquad \ldots$ (ii)

Dividing Eq. (i) by Eq. (ii), we obtain

$\frac{H_s}{H_p} = \frac{V^2/3R}{3V^2/2R} = \frac{2}{9}$

424 **(d)**

$E = 2.2\,V, R = 4\,\Omega, V = 2V$

$r = \left(\frac{E}{V} - 1\right) R = \left(\frac{2.2}{2} - 1\right) \times 4 = 0.1 \times 4 = 0.4\Omega$

425 **(a)**

Thermo electric power, $S \propto \theta$

$\therefore \frac{S_{100}}{S_{80}} = \frac{100}{80}$ or $S_{100} = S_{80} \times \frac{100}{80} = \frac{5}{4} S_{80}$

Therefore % change in thermo electric power

$= \left(\frac{S_{100} - S_{80}}{S_{80}}\right) \times 100$

$= \left(\frac{\frac{5}{4} S_{80} - S_{80}}{S_{80}}\right) \times 100$

$= 25\%$

426 **(c)**

The bulbs are in series, hence they will have the same current through them

427 **(c)**

By using $i = \frac{E}{R+r}$

$\Rightarrow 0.5 = \frac{E}{11+r} \Rightarrow E = 5.5 + 0.5r \quad \ldots$(i)

and $0.9 = \frac{E}{5+r} \Rightarrow E = 4.5 + 0.9r \quad \ldots$(ii)

On solving these equations, we have $r = 2.5\Omega$

428 **(d)**

Terminal voltage of the battery after closing the circuit is

$V = E - ir$

$= 10 - 0.5 \times 3$

$= 10 - 1.5 = 8.5$ V

429 **(a)**

$\sigma_i = \frac{\theta}{i} = \frac{\theta}{iG} . G = \sigma_V G \Longrightarrow \frac{\sigma_i}{G} = \sigma_v$

430 **(b)**

Energy liberated $= \frac{V^2}{R} t$

$= \frac{(120)^2}{6} \times (10 \times 60) = 14.4 \times 10^5$ J

431 **(c)**

$R = \rho \frac{l}{A}$

432 **(a)**

As the current in heater filament increases, it gets more heated, hence its temperature increases and thereby its resistance increases. Due to which the current will decrease. Hence the variation of V and i for heater filament will as shown in Fig.(a)

433 **(d)**

By using $H = \sigma Q \Delta\theta$

$\Rightarrow H = (10 \times 10^{-6}) \times 10 \times (60 - 50) = 10^{-3} J$

$= 1\, mJ$

434 **(b)**

$E_{\text{Ni}-\text{Cu}} = at + bt^2$

$= (16.3 \times 10^{-6})(100) + (-0.021 \times 10^{-6}) \times (100)^2$

$= 1.42 \times 10^{-3}$V

435 **(d)**

From the relation, current $i = \frac{V}{r}$

or $\quad 4 = \frac{2}{r}$

or $r = \frac{1}{2}\Omega$

436 **(b)**

For balanced Wheatstone bridge $\frac{P}{Q} = \frac{R}{S}$

$\Rightarrow \frac{12}{(1/2)} = \frac{x+6}{(1/2)} \Rightarrow x = 6\Omega$

437 **(c)**

On doubling the length of wire its resistance is doubled and slope of $V - I$ graph is doubled

438 **(d)**

Heat generated in both the cases will be same because the capacitor has the same energy initially

$= \frac{1}{2}CV^2 = \frac{1}{2} \times 200 \times 10^{-6} \times (200)^2 = 4J$

439 **(a)**

$E \propto l$ (balancing length)

440 **(a)**

The first two bands indicate the first two significant figures of the resistance in ohm. The third band indicates the decimal multiplier and the last band stands for the tolerance in percent about the indicated value

443 **(d)**

Effective resistance between the points A and B is

$R = \frac{32}{12} = \frac{8}{3}\Omega$

444 **(b)**

$R_1 + R_2 = 9$ and $\frac{R_1R_2}{R_1+R_2} = 2 \Rightarrow R_1R_2 = 18$

$R_1 - R_2 = \sqrt{(R_1+R_2)^2 - 4R_1R_2} = \sqrt{81-72} = 3$

$R_1 = 6\Omega, R_2 = 3\Omega$

445 **(b)**

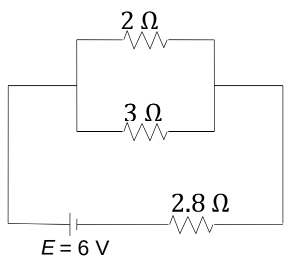
$\rho -$ same, $l -$ same, $A_2 = \frac{1}{4}A_1 \left[\text{as } r_2 = \frac{r_1}{2}\right]$

By using $R = \rho\frac{l}{A} \Rightarrow \frac{R_1}{R_2} = \frac{A_2}{A_1} \Rightarrow \frac{R_1}{8} = \frac{1}{4} \Rightarrow R_1 = 2\Omega$

Hence, $R_{eq} = \frac{R_1R_2}{R_1+R_2} = \frac{2\times8}{(2+8)} = \frac{8}{5}\Omega$

446 **(c)**

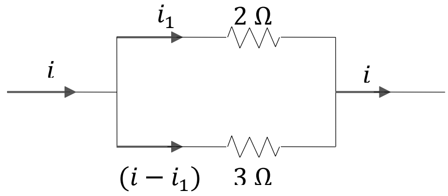
In the steady state, no current flows through the branch containing the capacitor. So, the equivalent circuit will be of the form as shown below:



The effective resistance of the circuit is

$R = \frac{2\times3}{2+3} + 2.8 = 1.2 + 2.8 = 4\Omega$

The current through the circuit is



$i = \frac{E}{R} = \frac{6}{4} = 1.5A$

Let current i_1 flows through 2Ω resistance.

$\therefore \quad 2 \times i_1 = (i - i_1) \times 3$

$\Rightarrow \quad 2i_1 = (1.5 - i_1) \times 3$

$\Rightarrow 2i_1 = 4.5 - 3i_1$

$\Rightarrow 5i_1 = 4.5$

$\Rightarrow i_1 = 0.9A$

447 **(a)**

The equivalent resistance between C and D is

$\frac{1}{R'} = \frac{1}{6} + \frac{1}{6} + \frac{1}{3} = \frac{2}{3}$ or $R' = \frac{3}{2} = 1.5\Omega$

Now the equivalent resistance between A and B as $R' = 1.5\Omega$ and 2.5Ω are connected in series, so

$R" = 1.5 + 2.5 = 4\Omega$

Now by ohm's law, potential difference between A and B is given by $V_A - V_B = iR = 2 \times 4.0 = 8\ volt$

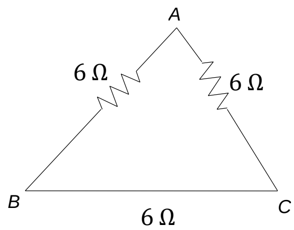
448 **(d)**

To find equivalent resistance across

BC, AB and AC is in series

$R' = 6 + 6 = 12\Omega$

$12\ \Omega$ and 6Ω is in parallel



Total resistance,

$R = \frac{12\times6}{12+6}$

$R = \frac{72}{18} = 4\Omega$

449 **(d)**

$R_{200} = \frac{R_{800}}{1+\alpha t}$

$R_{200} = \frac{R_{800}}{1 + 4\times10^{-4}\times600} = \frac{R_{800}}{1.24}$

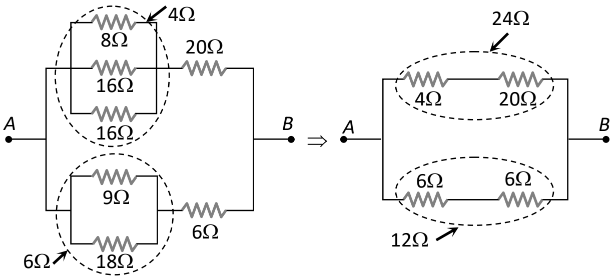
$\frac{V^2}{R_{800}} = P$ ......(i)

and $\frac{V^2}{R_{200}} = P'$ ......(ii)

$$\therefore \frac{P'}{P} = \frac{R_{800}}{R_{200}} = \frac{R_{800}}{\left(\frac{R_{800}}{1.24}\right)}$$

$P' = 1.24P = 1.24 \times 500 = 620$ W

450 **(b)**



$$R_{AB} = \frac{24 \times 12}{(24 + 12)} = 8\Omega$$

451 **(c)**

Let resistors A, B and C have equal resistance R. Let I be the total current then the current in resistor A is I and in resistor B and C are I/2.

So, heat produced in resistor A is

$H_A = I^2 R$ ... (i)

and heat produced in resistor B is

$$H_B = \left(\frac{I}{2}\right)^2 R = \frac{I^2 R}{4} \quad \text{... (ii)}$$

and heat produced in resistor C is

$$H_C = \frac{I^2 R}{4} \quad \text{... (iii)}$$

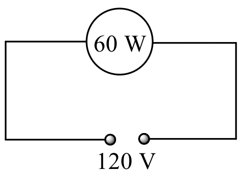
Hence, it is clear that the heat produced will be maximum in A.

452 **(c)**

$$i = \frac{q}{t} = \frac{4}{2} = 2\ ampere$$

453 **(d)**

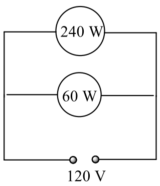
$$R_{60} = \frac{120 \times 120}{60} = 240\Omega$$



Current $= \frac{120}{240+6}$ A $= \frac{120}{246}$ A

Voltage across bulb

$$= \frac{120}{246} \times 240 \text{ volt} = 117.1 \text{ volt}$$



$$R_{240} = \frac{120 \times 120}{240} 60\Omega$$

Resistance of parallel combination

$$= \frac{60 \times 240}{60 + 240} = 48\Omega.$$

Total resistance $= (48 + 6)\Omega = 54\Omega$.

Current $I = \frac{120}{54}$ A

Voltage across parallel combination

$$= \frac{120}{54} \times 48 \text{ volt} = 106.7 \text{ volt}$$

Change in voltage $= (117.1 - 106.7) = 10.4$ V.

454 **(c)**

$R = \frac{V^2}{P}$ or $R \propto V^2$ $\therefore \frac{R_1}{R_2} = \frac{(200)^2}{(300)^2} = \frac{4}{9}$.

When bulbs are connected in series, the current I is same through each. As $P = I^2 R$ or $P \propto R$(as I is same in series),

so $\frac{P_1}{P_2} = \frac{R_1}{R_2} = \frac{4}{9}$.

455 **(c)**

On stretching, volume (V) remains constant. So

$V = Al$ or $l = V/A$.

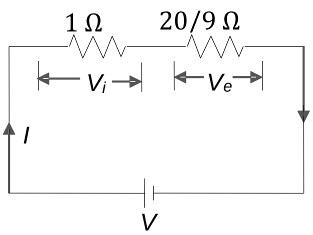
Now, $R = \frac{\rho l}{A} = \frac{\rho V}{A^2} = \frac{\rho V}{\pi^2 D^4/16} = \frac{16\rho V}{\pi^2 D^4}$

Taking logarithm of both the side and differentiating it we get

$$\frac{\Delta R}{R} = -4\frac{\Delta D}{D} \text{or} \frac{\Delta R}{R} = -4 \times 0.25 = 1.0\%$$

456 **(c)**

Here, 2Ω, 3Ω and 6Ω are in parallel. So potential drop across them will be the same. As heat produced, $= \frac{V^2}{R} t\ ie, H \propto \frac{1}{R}$, so maximum heat will be generated across 2Ω resistance. Similarly 4Ω and 5Ω are also in parallel, so more heat will e generated across 4Ω. Now the effective circuit will become



Total resistance, $= 1 + \frac{20}{9} = \frac{29}{9}\Omega$

Current, $I = \frac{V}{29/9} = \frac{9V}{29}$ A

$$V_1 = \frac{9V}{29} \times 1 = \frac{9}{29} V$$

and $V_2 = \frac{9V}{29} \times \frac{20}{9} = \frac{20V}{29}$

Power spent across 2 Ω,

$$P_1 = \frac{V_1^2}{2} = \frac{\left(\frac{9V}{29}\right)^2}{2} = \frac{40.5V^2}{(29)^2}$$

Power spent across 4 Ω,

$$P_2 = \frac{V_2^2}{4} = \frac{\left(\frac{20V}{29}\right)^2}{4} = \frac{50V^2}{(29)^2}$$

$\therefore P_2 > P_1$. Hence maximum heat is produced in 4Ω resistance.

457 **(a)**

When ammeter is connected in parallel to the circuit, net resistance of the circuit decreases. Hence more current is drawn from the battery, which damages the ammeter

458 **(a)**

According to kirchhoff's voltage law only option (a) is correct

459 **(c)**

Total resistance of the circuit $= \frac{80}{2} + 20 = 60\ \Omega$

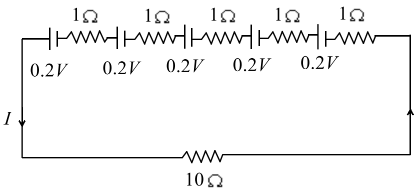
$\Rightarrow$ Main current $i = \frac{2}{60} = \frac{1}{30} A$

Combination of voltmeter and 80Ω resistance is connected in series with 20Ω, so current through 20Ω and this combination will be same $= \frac{1}{30}\ A$

Since the resistance of voltmeter is also 80Ω, so this current is equally distributed in 80Ω resistance and voltmeter [$i.e. \frac{1}{60} A$ through each]

P.D. across 80Ω resistance $= \frac{1}{60} \times 80 = 1.33V$

460 **(c)**



Here, emf of each cell, $\varepsilon = 0.2V$

Internal resistance of each cell, $r = 1\Omega$

External resistance, $R = 10\Omega$

The total emf of 5 cells $= 5\varepsilon = 5(0.2)V = 1V$

Total internal resistance of 5 cells $= 5r = 5(1)\Omega = 5\Omega$

Total resistance of the circuit $= R + 5r = 10 + 5 = 15\Omega$

The current in the external circuit,

$$I = \frac{5\varepsilon}{R + 5r} = \frac{1V}{15\Omega} = \frac{1}{15} A$$

461 **(c)**

Potential gradient

$$x = \frac{e}{(R + R_h + r)} \cdot \frac{R}{L}$$

$$\Longrightarrow \quad x = \frac{2}{(990 + 10)} \times \frac{10}{2}$$

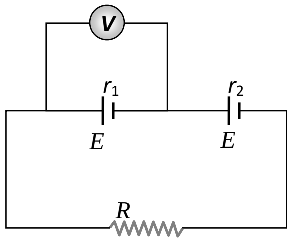
$= 0.01\ \text{Vm}^{-1}$

462 **(d)**

$$\frac{i_g}{i} = \frac{S}{G + S} = \frac{4}{36 + 4} = \frac{4}{40} = \frac{1}{10}$$

463 **(b)**

Let the voltage across any one cell is V, then



$$V = E - ir = E - r_1\left(\frac{2E}{r_1 + r_2 + R}\right)$$

But $V = 0$

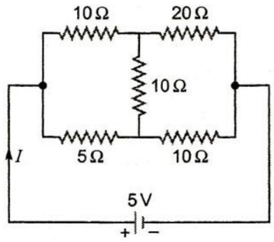
$$\Rightarrow E - \frac{2Er_1}{r_1 + r_2 + R} = 0$$

$\Rightarrow r_1 + r_2 + R = 2r_1$

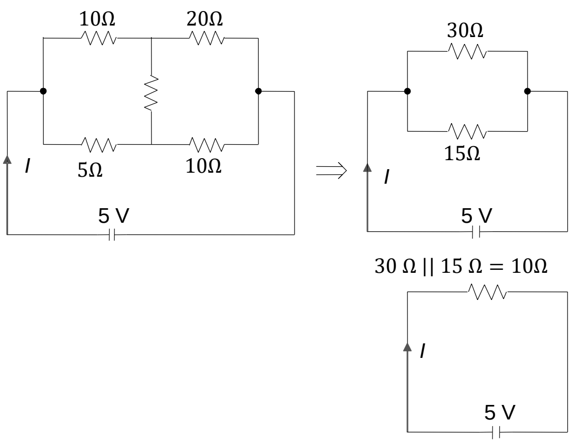
$\Rightarrow R = r_1 - r_2$

464 **(b)**

The given circuit can be redrawn as



Which is a balanced Wheatstone's bridge and hence, no current flows in the centre resistor, so equivalent circuit would be as shown below.



So, $I = \frac{V}{R} = \frac{5}{10} = 0.5A$

465 **(b)**

$q = it = n \times 2e$

$$n = \frac{it}{2e} = \frac{2 \times 32}{2 \times 1.6 \times 10^{-19}} = 2 \times 10^{20}$$

466 **(a)**

Rate of flow of electrons in a conductor is low but number density of free electrons in a conductor is very high. The drifting of electrons over the entire length of the conductor contributes to the current throughout the conductor

467 **(b)**

$m = Z\,i\,t \Rightarrow 20 \times 10^{-3} = \left(\frac{32}{96500}\right) \times 0.15 \times t$

$= 6.7\ min = 6\ min.\,42\ sec$

469 **(a)**

$\frac{1}{R_1} = \frac{1}{10} + \frac{1}{2.5} = \frac{5}{10} = \frac{1}{2} \Rightarrow R_1 = 2\Omega$

Now 2Ω and $10\ \Omega$ are in series

$R_2 = 10 + 2 = 12\Omega$

R_2 and 12Ω are in parallel

$\frac{1}{R_3} = \frac{1}{12} + \frac{1}{12} \Rightarrow R_3 = 6\Omega$

Now R_3 and 6Ω are in series

$R_4 = 10 + 6 = 16\Omega$

Now, R_4 and $16\ \Omega$ are in parallel

$\therefore\ \frac{1}{R} = \frac{1}{16} + \frac{1}{16}$

$\Rightarrow\ R = 3\Omega$

470 **(d)**

$P_1 = \frac{(220)^2}{R_1}$ and $P_2 = \frac{(220 \times 0.8)^2}{R_2}$

$\frac{P_2}{P_1} = \frac{(220 \times 0.8)^2}{(220)^2} \times \frac{R_1}{R_2} \Rightarrow \frac{P_2}{P_1} = (0.8)^2 \times \frac{R_1}{R_2}$

Here, $R_2 < R_1$ (because voltage decreases from $220\ V \to 220 \times 0.8\ V$

It means heat produced $\to$ decreases)

So $\frac{R_1}{R_2} > 1 \Rightarrow P_2 > (0.8)^2 P_1 \Rightarrow P_2 > (0.8)^2 \times 100\ W$

Also $\frac{P_2}{P_1} = \frac{(220 \times 0.8) i_2}{220 i_1}$, Since $i_2 < i_1$ [we expect]

So $\frac{P_2}{P_1} < 0.8 \Rightarrow P_2 (100 \times 0.8)$

Hence the actual power would be between $100 \times (0.8)^2 W$ and $(100 \times 0.8)\ W$

471 **(a)**

$v_d = i/n\,Ae$; where $n = N_\rho/M$

$= 6.023 \times 10^{26} \times 9 \times 10^3/63 = 0.860 \times 10^{29}$

$= 8.6 \times 10^{28}$

and $A = \pi D^2/4 = \frac{22}{7} \times (10^{-3})^2/4\text{m}^2$;

$= \frac{11}{14} \times 10^{-6}\text{m}^2$

$v_d = \frac{1.1}{8.6 \times 10^{28} \times \frac{11}{14} \times 10^{-6} \times 1.6 \times 10^{-19}}$

$= \frac{1}{9.6 \times 10^{+3}} = \frac{100 \times 10^{-4}}{96} = 1.0 \times 10^{-4}\text{m/s}$

$= 0.1\ \text{mms}^{-1}$

472 **(c)**

Charge flowing in 30 min,

q = area under graph

$= \left[\frac{0.1 \times 10}{2} + 0.1 \times 10 + \frac{0.1 \times 10}{2}\right] \times 60$

$= 120\text{C}$

$\therefore m = zq = \frac{M}{F} q = \frac{31.5}{96500} \times 120 = 0.039$ g

473 **(b)**

When wire is cut into two equal parts then power dissipated by each part is $2P_1$

So their parallel combination will dissipate power

$P_2 = 2P_1 + 2P_1 = 4P_1$

Which gives $\frac{P_2}{P_1} = 4$

474 **(c)**

$i = \frac{dQ}{dt} \Rightarrow dQ = idt \Rightarrow Q$

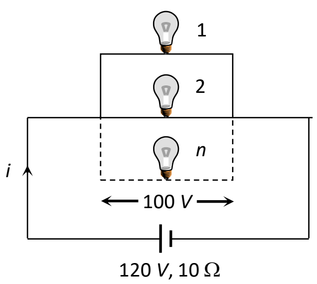
$= \int_{t_1}^{t_2} idt = \int_0^5 (1.2t + 3)dt$

$= \left[\frac{1.2t^2}{2} + 3t\right]_0^5 = 30C$

475 **(c)**

When each bulb is glowing at full power,

Current from each bulb $= i' = \frac{50}{100} = \frac{1}{2} A$



So main current $i = \frac{n}{2} A$

Also $E = V + ir \Rightarrow 120 = 100 + \left(\frac{n}{2}\right) \times 10 \Rightarrow n = 4$

476 **(c)**

$R' = \frac{R}{n} = \frac{1}{10} = 0.1\Omega$

477 **(c)**

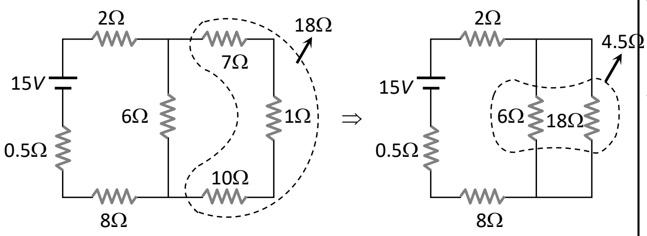
Shunt resistances $S = \frac{i_g G}{(i - i_g)} = \frac{10 \times 99}{(100-10)} = 11\Omega$

478 **(a)**

Potential gradient $x = \frac{V}{L} = \frac{iR}{L} = \frac{i\left(\frac{\rho L}{A}\right)}{L} = \frac{i\rho}{A}$

479 **(a)**

The given circuit can be simplified as follows



On further solving equivalent resistance $R = 15\Omega$

Hence current from the battery $i = \frac{15}{15} = 1A$

480 **(b)**

Let R be the resistance of each bulb.

We have $P = \frac{V^2}{R}$

or $R = \frac{V^2}{P} = \frac{V^2}{100}$

When the bulbs are connected in series, the voltage across each of them is $V/2$. Hence, the total power consumed is

$$P' = \frac{\left(\frac{V}{2}\right)^2}{R} + \frac{\left(\frac{V}{2}\right)^2}{R} = \frac{V^2}{2R}$$

$\therefore P' = \frac{P}{2} = \frac{100}{2}$ =50 W

481 **(d)**

$$R = \frac{\rho l}{A}$$

or $R \propto l$

$$\therefore \frac{R_1}{R_2} = \frac{l_1}{l_2} = \frac{L}{L/4} = 4$$

Or $R_2 = \frac{R}{4}$ $\quad (\because R_1 = R)$

In parallel combination of such four resistances.

$$\frac{1}{R'} = \frac{1}{R_2} + \frac{1}{R_2} + \frac{1}{R_2} + \frac{1}{R_2}$$

or $\frac{1}{R'} = \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4}$

or $\frac{1}{R'} = \frac{4}{R} + \frac{4}{R} + \frac{4}{R} + \frac{4}{R}$

or $\frac{1}{R'} = \frac{16}{R}$

or $R' = \frac{R}{16}$

482 **(d)**

$$\frac{i_g}{i} = \frac{S}{G+S} \Rightarrow \frac{5}{100} = \frac{S}{G+S} \Rightarrow S = \frac{G}{19}$$

483 **(c)**

Total kWh consumed= $\frac{60 \times 8 \times 30}{1000} = 14.4$

Hence cost $= 14.4 \times 1.25 = 18\ Rs$

484 **(d)**

$R_1 = \rho \frac{l_1}{A_1}$ and $R_2 = \rho \frac{l_2}{A_2} \Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2} . \frac{A_2}{A_1} = \frac{l_1}{l_2}\left(\frac{r_2}{r_1}\right)^2$

Given $\frac{l_1}{l_2} = \frac{1}{2}$ and $\frac{r_1}{r_2} = \frac{2}{1}$ or $\frac{r_2}{r_1} = \frac{1}{2} \Rightarrow \frac{R_1}{R_2} = \frac{1}{8}$

$\therefore$ Ratio of heats $\frac{H_1}{H_2} = \frac{V^2/R_1}{V^2/R_2} = \frac{R_2}{R_1} = \frac{8}{1}$

485 **(b)**

$W = qV$ also $P = i \times V = \frac{W}{t}$

486 **(c)**

According to Faraday's first law of electrolysis is

$m = zIt$

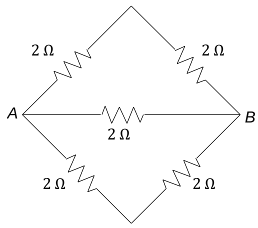
where z is the electrochemical equivalent of the substance

As voltameters are connected in series, same current will pass through them for same time

$$\therefore \frac{m_{Cu}}{m_{Cr}} = \frac{z_{Cu}}{z_{Cr}} \text{ or } \frac{z_{Cu}}{z_{Cr}} = \frac{m_{Cu}}{m_{Cr}} = \frac{0.475}{0.130} = 3.65$$

487 **(a)**

Given circuit is a balanced Wheatstone bridge. So, diagonal resistance of 2Ω will be ineffective.



Equivalent resistance of upper arms

=2+2=4Ω

Equivalent resistance of lower arms

=2+2=4Ω

$$R_{AB} = \frac{4 \times 4}{4+4} = 2\Omega$$

488 **(d)**

In series, effective resistance,

$$R_{eff} = R_1 + R_2 + R_3 \Rightarrow \frac{1}{\sigma_{eff}} = \frac{1}{\sigma_1} + \frac{1}{\sigma_2} + \frac{1}{\sigma_3}$$

$$= \frac{\sigma_2\sigma_3 + \sigma_1\sigma_3 + \sigma_1\sigma_2}{\sigma_1\sigma_2\sigma_3}$$

$$\therefore \sigma_{eff} = \frac{\sigma_1\sigma_2\sigma_3}{\sigma_2\sigma_3 + \sigma_1\sigma_3 + \sigma_1\sigma_2}$$

489 **(b)**

The resistance of a metal increases with increasing temperature this is because, with increase in temperature the ions of the conductor vibrate with greater amplitude and the collision between ions and electrons becomes more frequent.

490 **(a)**

The power drawn by the bulb is

$$P = \frac{V^2}{R}$$

$$\Rightarrow R = \frac{V^2}{P}$$

or $R \propto \frac{1}{P}$

(as V is same in parallel)

It means that greater power will have less resistance and therefore, draws more current. Hence, current flowing in bulb B will be more.

491 **(c)**

Human body, though has a large resistance of the order, of $K\Omega$(say $10k\Omega$), is very sensitive to minute currents even as low as a few mA. Electrons, excites and disorders the nervous system of the body and hence one fails to control the activity of the body

492 **(c)**

Resistance of bulb $R = \frac{V^2}{P} = \frac{220\times220}{100} = 484\Omega$

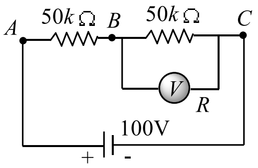
Power when the bulb of operated on a voltage

$V' = 110\text{V}$ will be $P' = \frac{V'^2}{R} = \frac{110\times110}{484} = 25\text{W}$

493 **(c)**

Internal resistance of voltmeter is R

Therefore effective resistance across B and C,



R'' is given by

$$\frac{1}{R''} = \frac{1}{R} + \frac{1}{50} = \frac{50+R}{50R}$$

$$\Rightarrow R'' = \left(\frac{50R}{50+R}\right)$$

According to ohm's law

$V'' = IR''$

$$\Rightarrow \frac{100}{3} = I.\left(\frac{50R}{50+R}\right)$$

$\Rightarrow \frac{100}{3}\left(\frac{50+R}{50R}\right) = I$ ...(ii)

Now, total resistance of circuit

$$R'''' = 50 + \frac{50R}{50+R}$$

$$\Rightarrow R" = \frac{(2500+100R)}{(50+R)}$$

Now, $V" = IR"$

$$\Rightarrow 100 = \frac{100}{3}\left(\frac{50+R}{50R}\right)\frac{2500+100R}{(50+R)}$$

$\Rightarrow 150R = 2500 + 100R$

$\Rightarrow R = 50\ k\Omega$

494 **(a)**

Equivalent resistance in the second case $= R_1 + R_2 = R$

Now, we know that $P \propto \frac{1}{R}$

Since in the second case the resistance $(R_1 + R_2)$ is higher than that in the first case (R_1)

Therefore power dissipation in the second case will be decreased

495 **(c)**

Heat $H = \frac{V^2t}{R} \Rightarrow H \propto \frac{1}{R}$ [If V, t constant]

$$\Rightarrow \frac{H_S}{H_P} = \frac{R_P}{R_S} = \frac{\left(\frac{R\times2R}{3R}\right)}{(R+2R)} = \frac{2}{9}$$

496 **(a)**

$$P = \frac{W}{t} = Vi \Rightarrow V = \frac{W}{it} = \frac{1000}{2\times6\times60} = 1.38\ V$$

497 **(b)**

Heat produced by the heater $H = \frac{V^2}{R} \times t$

For 220V heater heat produced

$$H_1 = \frac{(220)^2}{R} \times 5$$

For 110V heater heat produced

$$H_2 = \frac{(110)^2}{R} \times L$$

Now, $H_1 = H_2$

$$\frac{110\times110}{R}t = \frac{220\times220\times5}{R}$$

$t = 20$ min

498 **(c)**

Equivalent resistance of the circuit $R_{eq} = 100\Omega$

Current through the circuit $i = \frac{2.4}{100}A$

P.D. across combination of voltmeter and 100Ω

Resistance $= \frac{2.4}{100} \times 50 = 1.2V$

Since the voltmeter and 100 Ω resistance are in parallel, so the voltmeter reads the same value $i.e.$ $1.2V$

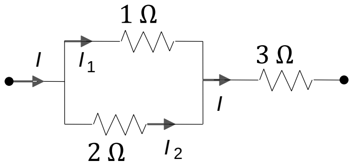
499 **(b)**

$$i = \frac{12}{(1+1)+0.4} = 5A$$

500 **(b)**

Here, $I = I_1 + I_2$ ....(i)

and $\frac{I_1}{I_2} = \frac{1}{2} = 2$



$\therefore I = I_1 + I_2 = 2I_2 + I_2$

$\therefore I_2 = \frac{I}{3}$ and $I_1 \frac{2I}{3}$

$\therefore P = I^2 \times 3 = 3I^2$

$P_1 = I_1^2 \times 1 = \left(\frac{2I}{3}\right)^2 \times 1 = \frac{4I^2}{9}$

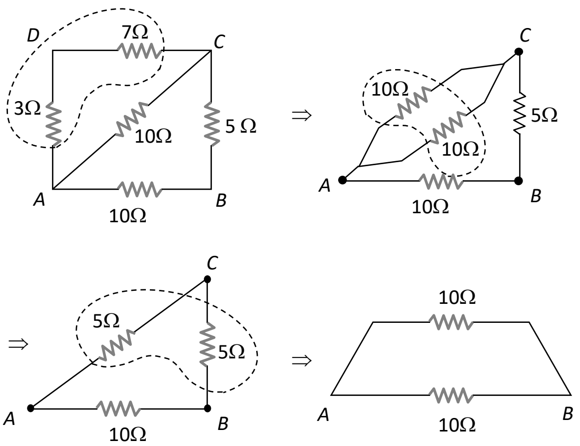
$P_2 = I_2^2 \times 2 = \frac{I^2}{9} \times 2 = \frac{2}{9}I^2$

$P_3 = I^2 \times 3 = 3I^2$

$\therefore P_1 : P_2 : P_3 = \frac{4}{9} : \frac{2}{9} = 4 : 2 : 27$

501 **(b)**

The figure can be drawn as follows



$\Rightarrow R_{AB} = 5\Omega$

502 **(c)**

The ratio of the weights deposited on cathodes will be in the ratio of their chemical equivalents. The chemical equivalent of copper = At. Wt/2 and that of silver = At. Wt/1.

503 **(c)**

A fully charged capacitor draws no current. Therefore, no current flows in arm GHF. So the R of arm HF is ineffective. The total resistance of the resistors in circuit

is $R' = \frac{(R+R)\times R}{(R+R)\times R} + R$

$= \frac{(2+2)\times 2}{(2+2)+2} + 2 = \frac{10}{3}\Omega$

Total current, $i = \frac{E}{R'} = \frac{10}{(10/3)} = 3\text{A}$

In parallel circuit, the current divides in the inverse ratio of resistance, so current in arm $ABGD = 1\text{A}$ and current in arm $AD = 2\text{A}$

Potential difference between G and D

$= V_G - V_D = 1 \times 2 = 2\text{V}$

Potential difference between D and F

$= V_D - V_F = 3 \times 2 = 6\text{V}$

$\therefore \; V_G - V_F = (V_G - V_D) + (V_D - V_F)$

$= 2 + 6 = 8\text{ V}$

Potential difference across capacitor $= V_G - V_F = 8V$

504 **(c)**

Amount of metallic sodium appearing,

$m = Zit = \left(\frac{A}{VF}\right)it$

$= \left(\frac{23}{1 \times 96500}\right) \times 16 \times 10 \times 60$

$= 2.3\; gm$

505 **(c)**

$V = E - IR = 15 - 10 \times 0.05 = 14.5V$

506 **(a)**

Resistance of voltmeter should be high

507 **(b)**

By balanced Wheatstone bridge condition $\frac{16}{X} = \frac{4}{0.5}$

$\Rightarrow X = \frac{8}{4} = 2\Omega$

509 **(b)**

From the given circuit

$V_A - (6 \times 2) - 12 - (9 \times 2) + 4 - (5 \times 2) = V_B$

Or $V_A - 12 - 12 - 18 + 4 - 10 = V_B$

Or $V_A - V_B$ =48 volt

510 **(d)**

Let R_0 be the initial resistance of both conductors.

$\therefore$ At temperature θ their resistances will be,

$R_1 = R_0(1 + \alpha_1\theta)$

and $R_2 = R_0(1 + \alpha_2\theta)$

For series combination, $R_s = R_1 + R_2$

$R_s(1 + \alpha_s\theta) = R_0(1 + \alpha_1\theta) + R_0(1 + \alpha_2\theta)$

Where, $R_{s0} = R_0 + R_0 = 2R_0$

$\therefore 2R_0(1 + \alpha_2\theta) = 2R_0 + R_0\theta(\alpha_1 + \alpha_2)$

or $\alpha_s = \frac{\alpha_1 + \alpha_2}{2}$

For parallel combination,

$R_p = \frac{R_1 R_2}{R_1 + R_2}$

$R_{p0}(1 + \alpha_p\theta) = \frac{R_0(1 + \alpha_1\theta)R_0(1 + \alpha_2\theta)}{R_0(1 + \alpha_1\theta) + R_0(1 + \alpha_2\theta)}$

Where, $R_{p0} = \frac{R_0 R_0}{R_0+R_0} = \frac{R_0}{2}$

$\therefore \quad \frac{R_0}{2}(1+\alpha_p\theta) = \frac{R_0^2(1+\alpha_1\theta+\alpha_2\theta+\alpha_1\alpha_2\theta^2)}{R_0(2+\alpha_1\theta+\alpha_2\theta)}$

as α_1 and α_2 are small quantities.

$\therefore \ \alpha_1\alpha_2$ is negligible.

or $\alpha_p = \frac{\alpha_1+\alpha_2}{2+(\alpha_1+\alpha_2)\theta} = \frac{\alpha_1+\alpha_2}{2}\left[1-\left(\frac{\alpha_1+\alpha_2}{2}\right)\theta\right]$

as $(\alpha_1+\alpha_2)^2$ is negligible

$\therefore \qquad \alpha_p = \frac{\alpha_1+\alpha_2}{2}$

511 **(c)**

Current through resistance R will be zero if

$$\frac{E}{R_2} = \frac{E_1}{R_1+R_2} \text{ or } E_1 = \frac{E(R_1+R_2)}{R_2}$$

512 **(a)**

$m = Zit \Rightarrow \frac{m}{Zit} = 1[\text{constant}]$

513 **(d)**

Drift velocity=mobility× intensity of electric field

or $v_d = \mu E$ or $\mu = \frac{v_d}{E}$

or $\quad \mu = \frac{v_d}{V/l} \qquad \left(\because E = \frac{V}{l}\right)$

$\therefore \mu = \frac{0.5\times 2}{220} = 4.5\times 10^{-3}$

$\approx 5\times 10^{-3}\text{m}^2\text{V}^{-1}\text{s}^{-1}$

515 **(a)**

Heat produced by heater is given by

$H = Pt$

Given, $P = 100$ W, $t = 2$ min $= 2\times 60$s $= 12$s

$\therefore H = 100\times 120 = 12\times 10^3$ J

516 **(c)**

$v_d = \frac{i}{nAe} = \frac{1.344}{10^{-2}\times 1.6\times 10^{-19}\times 8.4\times 10^{22}}$

$= \frac{1.344}{10\times 1.6\times 8.4} = 0.01cm/s = 0.1mm/s$

517 **(d)**

$t_i = 2t_n - t_c \Rightarrow t_i = 2\times 350 - 30 = 670$°C

518 **(a)**

Because with rise in temperature resistance of conductor increases, so graph between V and i becomes non linear

519 **(b)**

In VI graph, we will not get a straight line in case of liquids

520 **(c)**

Here, $V = 10V, G = 500\Omega$

$i_g = \frac{V}{G} = \frac{10}{500} = 2\times 10^{-2}A$

Now,

$S = \frac{i_g G}{i - i_g} = \frac{2\times 10^{-2}\times 500}{10 - 2\times 10^{-2}} \simeq 1\Omega$ in parallel.

521 **(a)**

$\frac{R_1}{R_2} = \left(\frac{r_2}{r_1}\right)^4 \Rightarrow \frac{R}{R_2} = \left(\frac{nr}{r}\right)^4 \Rightarrow R_2 = \frac{R}{n^4}$

522 **(c)**

Slope is zero at neutral temperature

523 **(d)**

$l = \frac{R\pi r^2}{\rho} = \frac{4.2\times 3.14\times (0.2\times 10^{-3})^2}{48\times 10^{-8}} = 1.1m$

524 **(c)**

According to Kirchhoff's first rule

$I + 4 + 2 - 3 - 5 = 0$

$I + 6 - 8 = 0$

$\Rightarrow \qquad I = 2A$

525 **(d)**

Wire AB is uniform so current through wire AB at every across section will be same. Hence current density, $J(= i/A)$ at every point of the wire will be same

526 **(d)**

After connecting a resistance R in parallel with voltmeter its effective resistance decreases. Hence less voltage appears across it $i.e. V$ will decreases. Since overall resistance decreases so more current will flow $i.e. A$ will increase

527 **(c)**

$v_d = \frac{J}{ne} \Rightarrow v_d \propto J$ [current density]

$J_1 = \frac{i}{A}$ and $J_2 = \frac{2i}{2A} = \frac{i}{A} = J_1$; $\therefore (v_d)_1 = (v_d)_2 = v$

528 **(a)**

For a balance Wheatstone bridge

$\frac{A}{B} = \frac{D}{C} \Rightarrow \frac{10}{5} \neq \frac{4}{4}$ [Unbalanced]

$\frac{A'}{B} = \frac{D}{C} \Rightarrow \frac{A'}{5} = \frac{4}{4} \Rightarrow A' = 5\Omega$

$A'(5\Omega)$ is obtained by connecting a 10 Ω resistance in parallel with A

529 **(b)**

Let the e.m.f. of cell be E and internal resistance be r

Then $0.5 = \frac{E}{(r+2)}$ and $0.25 = \frac{E}{(r+5)}$

On dividing, $2 = \frac{5+r}{2+r} \Rightarrow r = 1\Omega$

530 **(b)**

Mass of water = volume × density

= 1000 × 1 = 1000 g.

Heat taken by water = $mc\,\Delta\theta$

= 1000 × 1(37 − 22) cal

= 1000 × 15 × 4.2 J

Power of geyser= $\frac{\text{energy spent}}{\text{time}}$

$= \frac{1000 \times 15 \times 4.2}{60} 1050$ W.

531 **(b)**

E.m.f. is the value of voltage, when no current is drawn from the circuit so $E = 2V$.

Also $r =$ slope $= \frac{2}{5} = 0.4\Omega$

532 **(c)**

They are the resistors made up of semiconductors whose resistance decreases with the increase in temperature. This implies that they have negative and high temperature coefficient of resistivity. They are usually made of metal oxides with high temperature coefficient of resistivity.

533 **(c)**

Strength $= 5 \times 18 = 90AH$

534 **(c)**

$V = E - ir = 12 - 60 \times 5 \times 10^{-2} = 9V$

535 **(b)**

Effective emf of circuit $= 10 - 3 = 7$ V

Total resistance of circuit= $2 + 5 + 3 + 4 = 14\Omega$

Current, $i = 7/14 = 0.5$ A

Potential difference between A and $D = 0.5 \times 10 = 5$V

Potential at $D = 10 - 5 = 5V$

Hence, E cannot be at zero potential, as there is potential drop at E

536 **(a)**

When a constant current is passed through a wire of uniform cross-section, the potential difference across any portion of the wire is directly proportional to the length of that portion.

Potential gradient=0.2 mVcm^{-1}

∴ Potential difference across potentiometer wire =0.02 × 1= 0.02V

Total resistance $= r + R = 490 + R$

$$\therefore \quad \frac{V_1}{V_2} = \frac{R_1}{R_2}$$

$$\Rightarrow \frac{0.02}{2} = \frac{R}{490 + R}$$

$\Rightarrow R = 4.9\Omega$

537 **(c)**

Given $V_1 = 50\ volt, i_1 = 11A; V_2 = 60\ volt, i_2 = 1A$

If $e.m.f.$ and internal resistance of battery are E and r respectively then $P.D.$ across terminals of battery,

$V = E - ir$

We have $50 = E - 11r$ ...(i)

And $60 = E - 1r$ ...(ii)

From (i) and (ii),

$E = 61V$ and $r = 1\Omega$

538 **(d)**

$R_1 + R_2 = R_1(1 + \alpha t) + R_2(1 - \beta t)$

$$\Rightarrow R_1 + R_2 = R_1 + R_2 + R_1 \alpha t - R_2 \beta t \Rightarrow \frac{R_1}{R_2} = \frac{\beta}{\alpha}$$

539 **(d)**

$V_2 = \frac{22.4 \times 1}{1} = 22.4\ litre$ at NTP

∵ 11.2 $litre$ of H_2 is liberated by 96,500 C

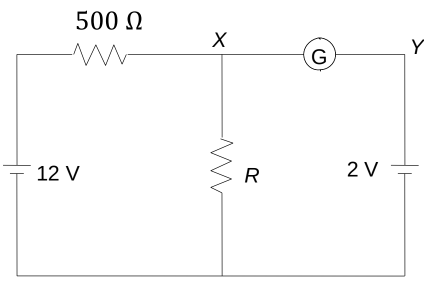
∴ 22.4 $litre$ of H_2 is liberated by $96500 \times 2 =$ 1,93,000 C

540 **(b)**

The moving coil galvanometer have their coil wound on a metallic (copper or aluminium) frame, so as to make the motion dead beat due to the production of eddy currents. In the ballistic galvanometer, on the other hand, the damping is to be reduced to the minimum and hence the frame is of a non-conducting material eg, paper or bamboo.

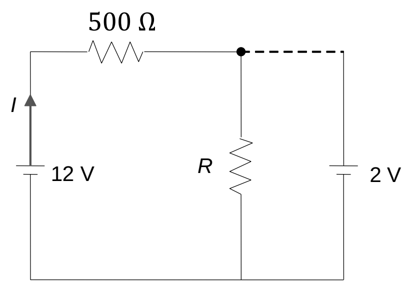
541 **(b)**

The galvanometer shows zero deflection ie, current through XY is zero.



As a result potential drop across R is 2V, circuit can be redrawn as

$$I = \frac{12}{500 + R}$$



Voltage across $R, V = IR$

$$\Rightarrow \quad 2 = \frac{12}{500 + R} \times R$$

$\Rightarrow 1000 + 2R = 12R$

$\Rightarrow R = 100\Omega$

543 **(b)**

Production of e.m.f. by temperature difference is known as Seebeck effect

545 **(c)**

From Joule's law,

$$H = \frac{V^2 t}{RJ} \text{ cal}$$

Where V is potential difference, t the time and R the resistance.

$$R = R_1 + R_2$$

Let $\frac{t}{R} = \frac{HJ}{V^2} =$ constant $= k$

$\Rightarrow R_1 = kt_1$ and $R_2 = kt_2$

$\therefore\ kt = kt_1 + kt_2$

Or $t = 15 + 20$

$t = 35$ min

546 **(d)**

In a conductor, the electron number density *ie*, number of electrons per unit volume of a conductor is very large ($\approx 10^{28} \text{m}^{-3}$), so large current in a conductor is obtained irrespective of their small drift speed.

547 **(c)**

As resistances are in parallel

$\frac{1}{R_{eq}} = \frac{1}{220} + \frac{1}{220} + \ \dots 5000$ times

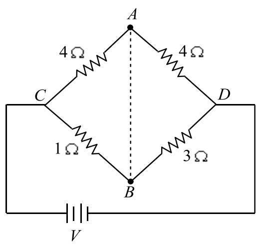
$\frac{1}{R_{eq}} = \frac{5000}{220}$

$R_{eq} = \frac{220}{5000}$

$I = \frac{220}{\frac{220}{5000}}$

$I = 5000$ A

548 **(b)**



Current though arm $CAD, I = \frac{V}{8} amp$

Potential difference between C and $A = V_C - V_A$

$= \frac{V}{8} \times 4 = \frac{V}{2} volt$

Current through $CBD, I'' = \frac{V}{4} amp$

Potential difference between C and $B = V_C - V_B$

$= \frac{V}{4} \times 1 = \frac{V}{4} volt$

Potential between A and $B = V_A - V_B$

$\therefore V_A - V_B = V_C - V_B - (V_C - V_A) = \frac{V}{4} - \frac{V}{2} = -\frac{V}{4}$

$\Rightarrow V_A - V_B < 0$ or, $V_A < V_B$

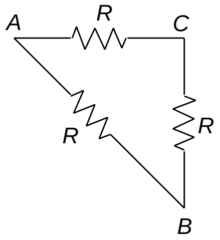
as $V_A < V_B$, so direction of current will be B to A

549 **(c)**

Here points B and D are common. So $2R$ in arm DC and $2\ R$ in arm CB are in parallel between C and B. Their effective resistances

$$= \frac{2R \times 2R}{2R + 2R} = R$$

The modified and simpler circuit will be shown in figure. The effective resistance between A and B is

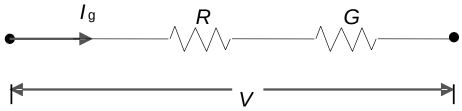


$$R_{\text{eff}} = \frac{R \times (R + R)}{R + (R + R)} = \frac{2}{3} R$$

550 **(d)**

Full scale deflection current

$= \frac{150}{10} \text{mA} = 15\text{mA}$



Full scale deflection voltage

$= \frac{150}{2} \text{mV} = 75\text{mV}$

Galvanometer resistance

$\text{G} = \frac{75\text{mV}}{15\text{mA}} = 5\Omega$

Required full scale deflection voltage.

$V = 1 \times 150 = 150$ volt

Let resistance to be connected in series is R.

$\Longrightarrow\ V = I_g(R + G)$

$\therefore 150 = 15 \times 10^{-3}(R + 5)$

$\Longrightarrow 10^4 = R + 5$

$\Longrightarrow R = 10000 - 5 = 9995$

551 **(c)**

Total energy stored in capacitor, $E_{\text{total}} = \frac{1}{2}CV^2$

$= \frac{1}{2} \times 3 \times 10^{-6} \times 10^2 = 1.5 \times 10^{-4}$ J

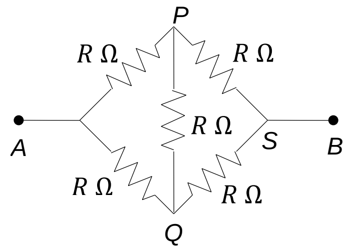
Energy dissipated in $2\Omega = \frac{2}{(2+4)} \times E_{\text{total}}$

$= \frac{2}{6} \times 1.5 \times 10^{-4} = 0.5 \times 10^{-4}$ J $= 0.05$ mJ

552 **(d)**

The equivalent circuit of these network is as shown in figure, which is a balanced Wheatstone bridge. Therefore no current will flow in the resistance of arm PQ. When cell is connected to points A and B

Therefore effective resistance of arm $APS = (R + R = 2R)$ will be in parallel to the total resistance of arm $AQS (= R + R = 2R)$



$\therefore$ Equivalent resistance$= \frac{2R \times 2R}{2R+2R} = R\Omega$

553 **(a)**

The tolerance level of resistance is mostly 1%, 2%, 5% and 10%. In old days 20% was also common, but these are now rare. Now a days 5% tolerance in treands.

554 **(c)**

Resistance of wire given by

$$R = \rho \frac{l}{A}$$

Also, volume (V)=Length(l)×Area (A)

Where, $A = \pi r^2$ (r is radius)

When the wire is stretched its volume (V) remains constant.

Hence,

$$R = \frac{\rho V}{\pi^2 r^4} \quad \ldots.(i)$$

When radius is halved

$$R' = \frac{pV}{\pi r^2 \left(\frac{r}{2}\right)^4} \quad \ldots\ldots\ldots\ldots\ldots(ii)$$

$$\therefore \frac{R'}{R} = \frac{16\rho V}{\pi^2 r^4} \times \frac{\pi^2 r^4}{\rho V} = 16$$

$\Longrightarrow R' = 16R$

Hence, new resistance increases to sixteen times its original value.

555 **(d)**

Comparing the given equation with standard equation

$$E = \alpha t + \frac{1}{2}\beta t^2$$

$$\alpha = 40 \text{ and} \frac{1}{2}\beta = -\frac{1}{20} \Rightarrow \beta = -\frac{1}{10}$$

Hence neutral temperature $t_n = -\frac{\alpha}{\beta} = \frac{-40}{-1/10}$

$\Rightarrow t_n = 400°\text{C}$

Alternate solution : We know at neutral temperature

$$\frac{dE}{d\theta} = 0$$

$$E = 40\theta - \frac{\theta^2}{20} \Rightarrow 40 - \frac{2\theta}{20} = 0 \Rightarrow \theta = 400°\text{C}$$

556 **(d)**

Only current through the conductor of non-uniform area of cross-section is constant. Drift velocity or drift speed vary inversely with the area of cross-section of the conductor

557 **(d)**

Equivalent resistance between P and Q

$$\frac{1}{R_{PQ}} = \frac{1}{(6+2)} + \frac{1}{3} + \frac{1}{(4+12)} \Rightarrow R_{PQ} = \frac{48}{25}\Omega$$

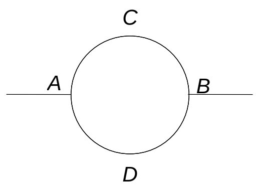
Current between P and Q; $i = 1.5A$

So, potential difference between P and Q

$$V_{PQ} = 1.5 \times \frac{48}{25} = 2.88V$$

559 **(c)**

Given that the resistance of the total wire is 4Ω.



Here, ACB(2Ω) and ADB (2Ω) are in parallel.

So, the resistance across any diameter is

$$\Longrightarrow \frac{1}{R} = \frac{1}{2} + \frac{1}{2} = \frac{2}{2} = 1$$

$\Longrightarrow$ R = 1Ω

560 **(c)**

Resistance, R$= \frac{\rho l}{A}$

For wire P, $20 = \frac{\rho l}{\pi r^2}$ ... (i)

Similarly for wire Q,

$$8 = \frac{\rho(2l)}{\pi(r')^2} \quad \ldots.(ii)$$

Dividing Eq.(i) by Eq. (ii), we have

$$\frac{20}{8} = \frac{\rho l}{\pi r^2} \times \frac{\pi(r')^2}{\rho(2l)}$$

$$\Rightarrow 5 = \left(\frac{r'}{r}\right)^2$$

$$\Rightarrow r' = \sqrt{5}r$$

561 **(d)**

Voltage across B_3 is greatest hence B_3 will show maximum brightness. In series combination of bulbs, the bulb of lesser wattage will glow more bright. Hence $W_2 > W_1$.

So , $W_1 < W_2 < W_3$.

562 **(b)**

Specific resistance $k = \frac{E}{j}$

563 **(d)**

Kirchhoff's Ist law or KCL states that the algebraic sum of current meeting at any junction is equal to zero. In other words we can say that "the sum of all the currents directed towards a junction in a circuit is equal to the sum of all the currents directed away from that junction." Thus, no charge has been accumulated at any junction *i.e.,* charge is conserved, and hence, we can say that KCL ($\sum i = 0$) is based on conservation of charge. Kirchhoff's IInd law or KVL states that algebraic sum of changes in potential around any closed resistor loop must be zero. In other words "around any closed loop, voltage drops are equal to voltage rises". No energy is gained or lost in circulating a charge around a loop, thus, we can say that KVL is based on conservation of energy.

564 **(a)**

The circuit diagram may be redrawn as shown here.

Obviously, $I_{CAD} = I_{CBD} = \frac{2}{12}$A

$$\therefore\ V_C - V_A = \frac{2}{15}\text{A} \times 5\Omega = \frac{2}{3}\text{V}$$

and $V_c - V_B = \frac{2}{15}\text{A} \times 10\Omega = \frac{4}{3}$V

$$\therefore V_A - V_B = (V_C - V_B) - (V_c - V_A) = \frac{4}{3}\text{V} - \frac{2}{3}\text{V}$$

$$= \frac{2}{3}\text{V}$$

566 **(a)**

$$R = \frac{V}{i_g} - G = \frac{10}{10 \times 10^{-3}} - 1 = 999\Omega$$

567 **(c)**

$R_{t_1} = R_1(1 + \alpha_1 t)$ and $R_{t_2} = R_2(1 + \alpha_2 t)$

Also $R_{eq} = R_{t_1} + R_{t_2} \Rightarrow R_{eq} = R_1 + R_2 + (R_1\alpha_1 + R_2\alpha_2)t$

$$\Rightarrow R_{eq} = (R_1 + R_2)\left[1 + \left(\frac{R_1\alpha_1 + R_2\alpha_2}{R_1 + R_2}\right).t\right]$$

So $\alpha_{eff} = \frac{R_1\alpha_1 + R_2\alpha_2}{R_1 + R_2}$

569 **(b)**

$m = zit$

If V is the volume, then V$= \frac{m}{\rho} = \frac{zit}{\rho}$

Thickness $= \frac{zit}{A\rho} = \frac{3.3\times10^{-7}\times1.5\times20\times60}{50\times10^{-4}\times9000}$

Thickness $= 1.3 \times 10^{-5}$m

570 **(c)**

If resistance does not vary with temperature P consumed

$= \left(\frac{V_A}{V_R}\right)^2 \times P_R = \left(\frac{110}{220}\right)^2 \times 100 = 25W$. But in second case resistance decreases so consumed power will be more than 25 W

571 **(c)**

$$V_p - V_q = \left(\frac{6}{3} + \frac{12 \times 6}{12 + 6}\right)(0.5) = (2 + 4)(0.5) = 3V$$

572 **(b)**

$$\frac{m_{H_2}}{M_{Cu}} = \frac{W_{H_2}}{W_{Cu}} = \frac{1}{\left(\frac{63.5}{2}\right)}$$

$\Rightarrow m_{H_2} = \frac{2}{63.5} \times 0.3175 = 0.01$g

2g of H_2 occupies volume at NTP = 22.4 L

$\Rightarrow$ 0.01 g of H_2 occupies volume at NTP given by:

$V = \frac{22.4}{2} \times 0.01$L

$\Rightarrow$ V = 11.2 × 0.01 × 1000 cc = 112 cc

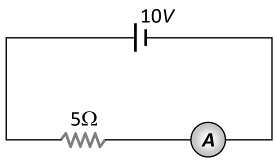
573 **(c)**

$$H = \frac{V^2t}{4.2\ R} \text{ or } \frac{H}{t} = \frac{V^2}{4.2\ R}$$

$$\Rightarrow 800 = \frac{20 \times 20}{4.2 \times R} \Rightarrow R = \frac{5}{42} = 0.119 \approx 0.12\Omega$$

574 **(b)**

The circuit will be as shown



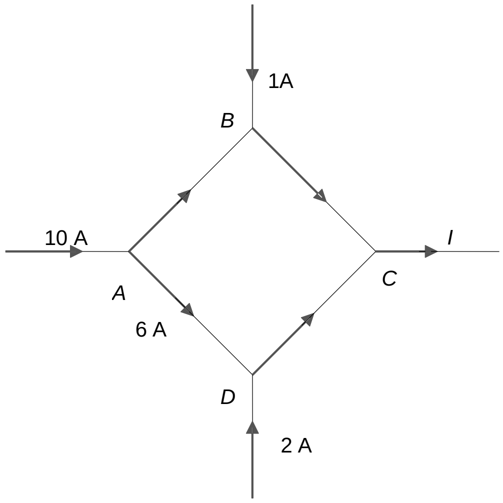
$$i = \frac{10}{5} = 2A$$

575 **(b)**

$R = \frac{\rho l}{a}$ for first wire and $R' = \frac{\rho l}{4a} = \frac{R}{4}$ for second wire

576 **(c)**

Regarding Kirchhoff's junction rule, the circuit can be redrawn as



Current in arm, $AB = 10 - 6 = 4\text{A}$
Current in arm, $DC = 6 + 2 = 8\text{A}$
Current in arm, $BC = 4 + 1 = 5\text{A}$
Hence, $I = 5 + 8 = 13\text{A}$

577 **(d)**
By using $R = \frac{V}{i_g} - G \Rightarrow R = \frac{100}{5\times10^{-3}} - 5 = 19{,}995\Omega$

578 **(a)**
Thermo-emf of thermocouple $= 25\frac{\mu\text{V}}{°\text{C}}$.
Let θ be the smallest temperature difference. Therefore, after connecting the thermocouple with the galvanometer, thermo-emf
$E = \left(25\frac{\mu\text{V}}{°\text{C}}\right) \times \theta(°\text{C})$
$= 25\theta \times 10^{-6}\text{ V}$
Potential drop developed across the galvanometer $= iR = 10^{-5} \times 40 = 4 \times 10^{-4}\text{ V}$
$\therefore 4 \times 10^{-4} = 25\theta \times 10^{-6}$
$\therefore \theta = \frac{4}{25} \times 10^2 = 16°\text{C}$

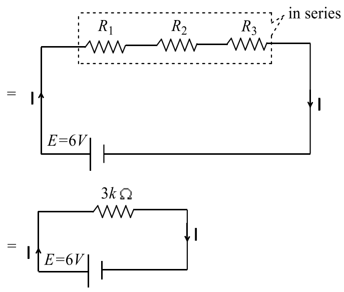
579 **(d)**
Current density of drinking electrons $j = nev$
$n = 5 \times 10^7\ cm^{-3} = 5 \times 10^7 \times 10^6 m^{-3}$
$v = 0.4\ ms^{-1}, e = 1.6 \times 10^{-19} C \Rightarrow j$
$= 3.2 \times 10^{-6}\ Am^{-2}$
Current density of ions $= (4 - 3.2) \times 10^{-6} = 0.8 \times 10^{-6}\frac{A}{m^2}$
This gives v for ions $= 0.1\ ms^{-1}$

580 **(a)**
$V_A + V_B + V_C \propto 740$
$V_A + V_B \propto 440$
$V_B + V_C \propto 540$
Hence $V_A : V_B : V_C = 1 : 1.2 : 3.5$

581 **(c)**
The number density (n) of conduction electrons in the copper is a characteristic of the copper and is about 10^{29} at room temperature for both the copper rod X and the thin copper wire Y.
Both X and Y carry the same current I since they are joined in series
From $I = nAvq$
Where q is the electron charge of 1.6×10^{-19}C,
v is the drift velocity in the conductor and A is the cross-sectional area of the conductor.
We may conclude that rod X has a lower drift velocity of electrons compared to wire Y since rod X has a larger cross-sectional area. This is so because the electrons in X collide more often with one another and with the copper ions when drifting towards the positive end. Thus, the mean time between collisions of the electrons is more in X than Y.

582 **(a)**
As steady current is flowing through the conductor, hence the number of electrons entering from one end and outgoing from the other end of any segment is equal. Hence charge will be zero

583 **(d)**
The given circuit can be simplified as shown below in circuit R_2, R_5 and R_3, R_4 are in series and then their resultant is connected parallel.
Similarly R_7, R_8 and R_6, R_9 are in series and their resultant is connected parallel on simplifying this we get their equivalent circuit



Now current in circuit
$I = \frac{V}{R} = \frac{6}{3 \times 10^3\Omega} \times 10^3 = 2mA$

584 **(c)**
For a galvanometer
$NIAB = C\,\theta$
$\Longrightarrow \frac{\theta}{I} = \frac{NAB}{C}$
Here, $\frac{\theta}{I}$ is called the sensitivity of galvanometer so to increase the sensitivity of galvanometer, C should be decreased and N, A and B should be increased

586 **(c)**
$E = 2.2 volt, V = 1.8\ volt, R = 5R$

$r = \left(\frac{E}{V} - 1\right) R = \left(\frac{2.2}{1.8} - 1\right) \times 5 = 1.1\Omega$

587 **(b)**

$z = m/It$.From graph, $It =$ Area $OABC$

$= \frac{1}{2}(10 + 30) \times \frac{100}{1000} = 2$

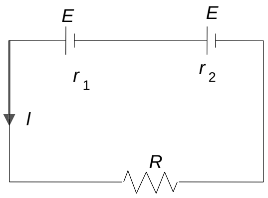
$\therefore\ z = m/2 = -0.5\ m$

588 **(c)**

$I = \frac{2E}{R + r_1 + r_2}$

Potential difference across first cell

$V = E - Ir_1 = 0$



$\text{E} - \frac{2\text{Er}_1}{R + r_1 + r_2} = 0$

$\left[\frac{R + r_1 + r_2 - 2r_1}{R + r_1 + r_2}\right] = 0$

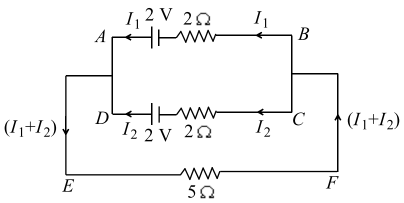
$\Longrightarrow\ \ R + r_2 - r_1 = 0$

$\Longrightarrow\ \ R = r_1 - r_2$

589 **(d)**

Resistivity depends only on the material of the conductor

590 **(d)**



Applying Kirchhoff's second law for closed loop $AEFBA$,

We get

$-(I_1 + I_2) \times 5 - I_1 \times 2 + 2 = 0$ or $7I_1 + 5I_2 = 2$ …(i)

Again, applying Kirchhoff's second law for a closed loop $DEFCD$, we get

$-(I_1 + I_2) \times 5 - I_2 \times 2 + 2 = 0$

or $5I_1 + 7I_2 = 2$ …(ii)

Multiplying (i) by 5 and (ii) by 7, we get

$35I_1 + 25I_2 = 10$ …(iii)

$35I_1 + 49I_2 = 14$ …(iv)

Subtracting (iv) from (iii) we get,

$-24\ I_2 = -4 \Rightarrow I_2 = \frac{1}{6}A$

Substituting the value of I_2 in equation (i), we get

$7I_1 = 2 - 5 \times \frac{1}{6} \Rightarrow 7I_1 = \frac{7}{6} \Rightarrow I_1 = \frac{1}{6}A$

The current through the 5Ω is

$= I_1 + I_2 = \frac{1}{6}A + \frac{1}{6}A = \frac{1}{3}A$

591 **(a)**

Chemical energy reduced

$= VIt$

$= 6 \times 5 \times 6 \times 60 = 10800$

$= 1.08 \times 10^4$ J

592 **(a)**

$H_1 = \frac{V^2}{R}t$

$H_2 = \frac{V^2}{R/2}\ t$

$\therefore\ \frac{H_2}{H_1} = 2$

$\Rightarrow H_2 = 2H_1$

593 **(b)**

$\because i_g = 10\%$ of $i = \frac{i}{10} \Rightarrow S = \frac{G}{(n-1)} = \frac{90}{(10-1)} = 10\Omega$

594 **(b)**

$E = K(T - T_r)T_0 + \frac{1}{2}K(T^2 - T_r^2)$

$\frac{dE}{dT} = KT_0 + \frac{1}{2}K \times 2T = KT_0 + KT$

At temperature $T = T_0/2$,

Thermo-electric power is $\frac{dE}{dT} = KT_0 + K\frac{T_0}{2} = \frac{3}{2}K\ T_0$.

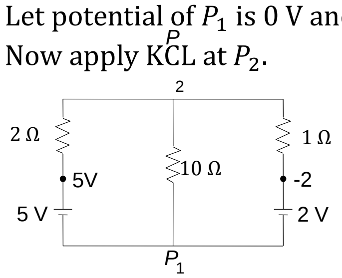
595 **(c)**

Cost $= \left(\frac{60 \times 8 \times 30}{1000}\right) \times 1.25$ =Rs 18.

596 **(c)**

Let potential of P_1 is 0 V and potential of P_2 is V_0.

Now apply KCL at P_2.



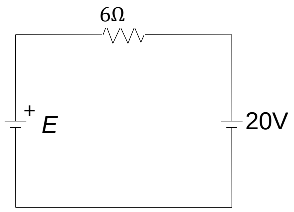
$\frac{V_0 - 5}{2} + \frac{V_0 - 0}{10} + \frac{V_0 - (-2)}{1} = 0$

$\Longrightarrow\ \ V_0 = \frac{5}{16}$

So, current through 10Ω resistor is $\frac{V_0}{10}$ from $P_2 to\ P_1$.

597 **(a)**

Given current $I = 2A$



(i) If current is in clockwise direction then from Kirchhoff's second law

$6 \times 2 + 20 - E = 0$

$\Longrightarrow \quad E = 32V$

(ii) If the current is in anticlockwise direction, then

$6 \times 2 + E - 20 = 0$

$\Longrightarrow \quad E - 8 = 0$

E=8

598 **(b)**

According to Kirchhoff's law $i_{CD} = i_2 + i_3$

599 **(d)**

Short circuited current $i = \frac{nE}{nr} = \frac{E}{r}$ $i.e. i$ doesn't depend upon n

600 **(c)**

When A is area of cross-section of wire, and n be number of free electrons per unit volume, then relation between electric current (i) and drift velocity (v_d) is

$i = ne\, Av_d$

Number of atoms in 63 g of copper is equal to Avogadro's number ie, 6×10^{23}

Volume of 63 g copper

$= \frac{63}{\text{density}} = \frac{63}{9} = 7\text{cm}^3$

$n = \frac{6.02 \times 10^{23}}{7}$ per cm^3

$= \left(\frac{6.02 \times 10^{29}}{7}\right)$ per m^3

Area $A = \pi r^2$

$= \pi(0.5 \times 10^{-3})^2 \text{m}^2$

Hence, drift velocity

v_d

$= \frac{1.1}{\left(\frac{6.02\times10^{29}}{7}\right) \times 1.6 \times 10^{-19} \times \pi \times (0.5 \times 10^{-3})^2}$

$v_d = 0.1 \times 10^{-3} \text{ms}^{-1}$

$v_d = 0.1\ \text{mms}^{-1}$

601 **(b)**

$R = \frac{\rho l}{A} = \frac{\rho l}{V/l} = \frac{\rho l^2}{V}$

or $l = \left(\frac{RV}{\rho}\right)^{1/2} = \left(\frac{3\times3}{\rho}\right)^{1/2} = \frac{3}{\sqrt{\rho}}$

602 **(a)**

An emf of the order of a few microvolt is generated which is proportional to $(t_2 - t_1)$.

603 **(a)**

If m = Number of rows

And n = Number of cells in a row

Then $m \times n = 100$ ...(i)

Also condition of maximum current is $R = \frac{nr}{m}$

$\Rightarrow 25 = \frac{1\times n}{m} \Rightarrow n = 25\, m$ ...(ii)

On solving (i) and (ii), $m = 2$

604 **(d)**

According to Faraday's law of electrolysis

$m = zit$

Here, $i = 1.5$ A, $t = 10$ min $= 10 \times 60$ s

$z = 30 \times 10^{-5}\ \text{gC}^{-1}$

Hence, mass of copper deposited on the electrode

$m = 30 \times 10^{-5} \times 1.5 \times 10 \times 60 = 27 \times 10^{-2}$

$= 0.27$ g

605 **(d)**

Let d be the density of the material of copper wire. Let l_1, l_2 be the lengths of copper wires of diameter 1 mm and 2 mm respectively. As

Mass=volume× density $=(\pi D^2/4)l.d$

So, $1 = \frac{\pi(10^{-3})^2}{4} l_1 \times d = \pi \times \frac{(2\times10^{-3})^2}{4} l_2 \times d$

or $l_1 = 4l_2$

Now, $R = \frac{\rho l}{\pi D^2/4}$ $ie, R \propto \frac{l}{D^2}$

$\therefore \frac{R_1}{R_2} = \frac{l_1}{l_2} \times \frac{D_2^2}{D_1^2} = 4 \times 2^2 = 16$

606 **(a)**

Potential gradient $= \frac{e}{(R+R_h+r)} \cdot \frac{R}{L}$

$= \frac{2}{(15+5+0)} \times \frac{5}{1} = 0.5\frac{V}{m} = 0.005\frac{V}{cm}$

608 **(d)**

$E = \frac{e}{(R+R_h+r)} \cdot \frac{R}{L} \times l \Rightarrow 0.4$

$= \frac{5}{(5+45+0)} \times \frac{5}{10} \times l$

$\Rightarrow l = 8\, m$

609 **(b)**

Charge $\rightarrow q = \frac{m}{z}$

Where, $z =$ electro chemical equivalent

$\therefore\ z = \frac{m}{It} = \frac{0.067}{1 \times 60} = 0.001117$

$q = \frac{108}{0.001117} = \ 9.67 \times 10^4\ \text{C/g}_{\text{eq}}$

610 **(a)**

Work done in delivering q coulomb of charge from clouds to ground.

$W = Vq$

$= 4 \times 10^6 \times 4 = 16 \times 10^6\ \text{J}$

The power of lighting strike is

$P = \frac{W}{t} = \frac{16 \times 10^6}{0.1} = 160 \times 10^6\ \text{W}$

$= 160\ \text{MW}$

611 **(c)**

In closed loop $ABGFEHA$

$10 - i_2 \times 1 + i_1 \times 0.5 - 6 = 0$

$0.5 i_1 - i_2 = -4$

In closed loop $BCDEB$

$(i_1 + i_2) \times 12 + i_2 \times 1 - 10 = 0$

$12 i_i + 13 i_2 = 10$

From Eqs. (i) and (ii)

$i_2 = 2.87A$

612 **(c)**

Applying $\quad P = \frac{V^2}{R}$

$R_1 = 1\ \Omega, R_2 = 0.5\ \Omega$ and $R_3 = 2\ \Omega, V_1 = V_2 = V_3$
$= 3$ volt

$\therefore \quad P_1 = \frac{(3)^2}{1} = 9\ \text{W}$

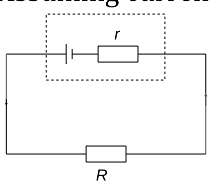
$P_2 = \frac{(3)^2}{0.5} = 18\ \text{W}$ and

$P_3 = \frac{(3)^2}{2} = 4.5\ \text{W}$

$\therefore \quad P_2 > P_1 > P_3$

613 **(d)**

Assuming current I flows through the circuit



Energy dissipated in load $= I^2 R$

Energy dissipated in the compete circuit $= I^2(r + R)$

$\therefore$ The efficiency $= \frac{I^2 R}{I^2 (R+r)} = \frac{R}{R+r}$

Relation between resistance, mass and cross-sectional area

$R = p \frac{l \times \alpha}{\alpha \times \alpha}$ or $R = \rho \frac{V}{\alpha^2}$

$R = \rho \frac{m}{d\alpha^2} = \left[\frac{\rho}{d}\right] \frac{m}{\alpha^2}$

$I \propto \frac{m}{\alpha^2}$

614 **(c)**

From

$R_t = R_0(1 + \alpha t)$

$5 = R_o(1 + 50\alpha) \quad \dots(i)$

and $\quad 6 = R_o(1 + 100\alpha) \ \dots(ii)$

$\therefore \frac{5}{6} = \frac{1 + 50\alpha}{1 + 100\alpha}$

$\Rightarrow \alpha = \frac{1}{200}$

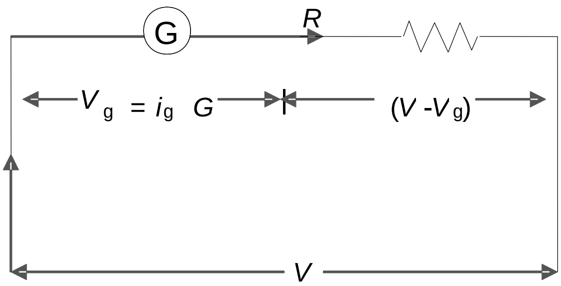
Putting value of αin Eq. (i), we get

$5 = R_0 \left(1 + 50 \times \frac{1}{200}\right)$

$\therefore R_0 = 4\Omega$

615 **(d)**

To convert a moving coil galvanometer (MCG) into a voltmeter a high resistance R is connected in series with (MCG) as shown below.



616 **(a)**

(i) Rate of chemical energy consumption

$= 1.5 \times 2 = 3\ \text{W}$

(ii) Rate of energy dissipation inside the cell

$= 2 \times 2 \times 0.1 = 0.4\ \text{W}$

(iii) Rate of energy dissipation inside the resistor $= (3 - 0.4)\ \text{W} = 2.6\ \text{W}$

(iv) Power output of source $= (3 - 0.4)\ \text{W} = 2.6$ W

* EI represents rate of chemical energy consumption of the cell.

* $I^2 r$ represents the rate of energy dissipation inside the cell.

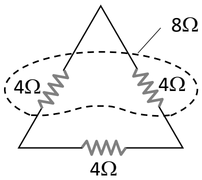
* $(EI - I^2 r)$ represents the power output of the source of emf.

617 **(d)**

As resistance $\propto$ Lengt

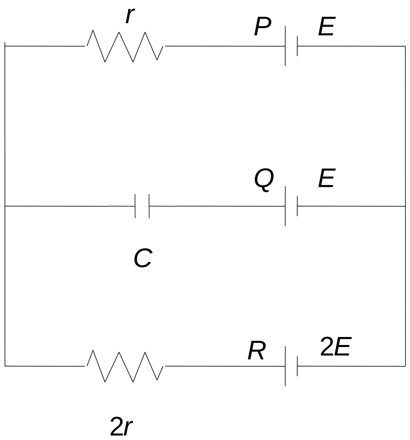
$\therefore$ Resistance of each arm $= \frac{12}{3} = 4\Omega$

$\therefore R_{effective} = \frac{4 \times 8}{4 + 8} = \frac{8}{3}\Omega$



618 **(a)**

In the steady state, no current flows through capacitor branch.



Current in the circuit

$$i = \frac{\text{net emf}}{\text{net resistance}}$$

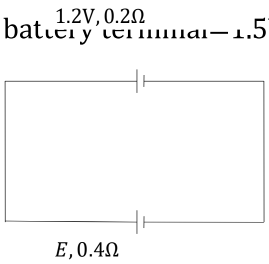
$$= \frac{2E - E}{r + 2r} = \frac{E}{3r}$$

So, potential drop across capacitor

$$V = ir = \frac{E}{3r} \times r = \frac{E}{3}$$

619 **(a)**

Given that, the resultant voltage across the battery terminal=1.5V



Let I be the current in the circuit then total resistance =0.6Ω

Hence, $V = IR$

$\Rightarrow 1.5 = I \times 0.6$

$\Rightarrow I = \frac{1.5}{0.6} \Rightarrow I = \frac{5}{2}A$

Now, applying Kirchhoff's second law in the circuit

$0.4I + 0.2I + 1.2 - E = 0$

$0.6 \times \frac{5}{2} + 1.2 = E$

$\Rightarrow \quad E = 2.7V$

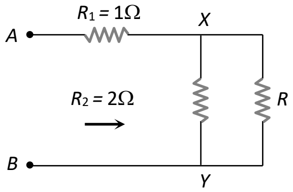
620 **(a)**

Effective resistance of n resistance each of the resistance r in series $R_s = r \times n = R$(as per question); so $r = R/n$. When these resistances are connected in parallel, the effective resistance

$$R_p = r/n = \frac{R/n}{n} = R/n^2$$

621 **(c)**

Let the resultant resistance be R. If we add one more branch, then the resultant resistance would be the same because this is an infinite sequence



$\therefore \frac{RR_2}{R + R_2} + R_1 = R \Rightarrow 2R + R + 2 = R^2 + 2R$

$\Rightarrow R^2 - R - 2 = 0 \Rightarrow R = -1$ or $R = 2ohm$

622 **(b)**

When two similar bulbs of different powers are connected in series, then

$$\frac{1}{P} = \frac{1}{P_1} + \frac{1}{P_2}$$

Given, $P_1 = 200$ W, $P_2 = 100$ W

$$\Rightarrow \frac{1}{P} = \frac{1 + 2}{200}$$

$$\Rightarrow P = \frac{200}{3} = 66.7 \text{ W}$$

623 **(b)**

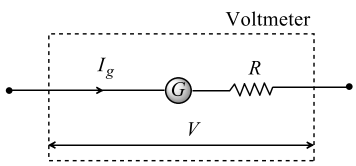
This is a balanced Wheatstone bridge circuit. So potential at B and D will be same and no current flows through $4R$ resistance

624 **(a)**

Equivalent resistance of the circuit $R = \frac{3}{2}\Omega$

$\therefore$ Current through the circuit $i = \frac{V}{R} = \frac{3}{3/2} = 2A$

625 **(d)**

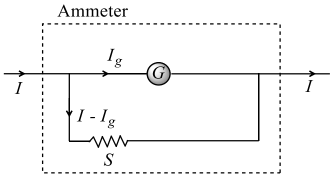


Here, $V = 10\,V, R = 10k\Omega, G = 100\ \Omega = 0.1\ k\Omega$

$V = I_g(G + R)$

$$I_g = \frac{V}{G + R} = \frac{10V}{(10 + 0.1)k\Omega} = \frac{10V}{10.1k\Omega} = 0.99mA$$

$$\approx 1\ mA$$



Here, $I = 1A, (I - I_g)S = I_g G$

$$S = \frac{I_g G}{I - I_g} = \frac{1 \times 10^{-3} \times 100}{1 - 1 \times 10^{-3}}$$

$$\approx \frac{100 \times 10^{-3}}{1} = \frac{100}{1000}\Omega = \frac{1}{10}\Omega = 0.1\Omega$$

626 **(c)**

Resistance, $R = \frac{\rho\lambda}{A}$

For given problem,

$R \propto \lambda^2$

$$\therefore \quad \frac{R_1}{R_2} = \frac{\lambda_1^2}{\lambda_2^2}$$

$$R_2 = \left(\frac{\lambda_2}{\lambda_1}\right)^2 \times R_1 = 15.6\ \Omega$$

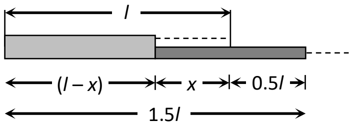
627 **(b)**

$$E = \frac{e}{(R + R_h + r)} \cdot \frac{R}{L} \times l$$

$$\Rightarrow 10 \times 10^{-3} = \frac{2}{(10 + R + 0)} \times \frac{10}{1} \times 0.4 \Rightarrow R = 790\Omega$$

628 **(a)**

Let l be the original length of wire and x be its length stretched uniformly such that final length is 1.5 l



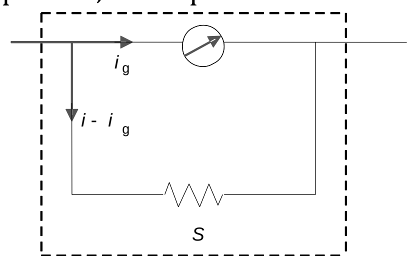
Then $4R = \rho\frac{(l-x)}{A} + \rho\frac{(0.5l+x)}{A'}$ where $A' = \frac{x}{(0.5l+x)}A$

$$\therefore 4\rho\frac{l}{A} = \rho\frac{l-x}{A} + \rho\frac{(0.5l+x)^2}{xA}$$

or $4l = l - x + \frac{1}{4}\frac{l^2}{x} + \frac{x^2}{x} + \frac{lx}{x}$ or $\frac{x}{l} = \frac{1}{8}$

629 **(b)**

The galvanometer G and shunt S is connected in parallel, hence potential difference is the same.



$\therefore i_g \times G = (i - i_g) \times S$

$$\Rightarrow \frac{i_g}{i - i_g} = \frac{S}{G} = \frac{5}{50} = \frac{1}{10}$$

$\Rightarrow 10i_g = i - i_g$

$\Rightarrow 11i_g = i$

$$\Rightarrow \frac{i_g}{i} = \frac{1}{11}$$

630 **(d)**

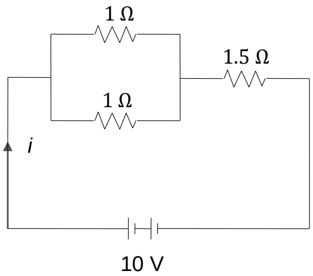
If T is the smallest temperature difference that can be detected, then

$40 \times 10^{-6}T = 100 \times 10^{-6}$

$\Rightarrow T = 2.5°C$

631 **(a)**

The circuit diagram is follows:



For 1Ω resistors in parallel, the resultant resistance is

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

Where, $R_1 = R_2 = 1\Omega$

$$\therefore \quad \frac{1}{R} = \frac{1}{1} + \frac{1}{1} = \frac{2}{1}$$

$\Rightarrow \quad R = 0.5\Omega$

This 0.5Ω resistor is connected in series with1.5Ω resistor.

Hence, equivalent resistance is

R'=0.5+1.5=2Ω

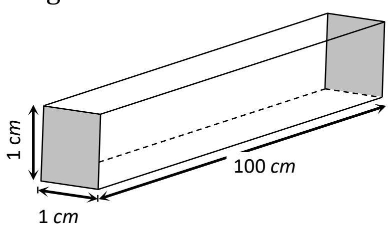
From Ohm's law, current flowing in the circuit is given by

$V = iR$

$$\Rightarrow i = \frac{V}{R} = \frac{10}{2} = 5A$$

632 **(b)**

Length $l = 1\ cm = 10^{-2}m$

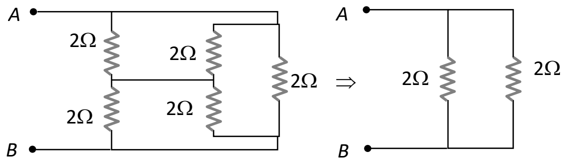


Area of cross-section $A = 1\ cm \times 100\ cm$

$= 100\ cm^2 = 10^{-2}m^2$

Resistance $R = 3 \times 10^{-7} \times \frac{10^{-2}}{10^{-2}} = 3 \times 10^{-7}\ \Omega$

633 **(a)**



$$R_{AB} = \frac{2 \times 2}{2+2} = 1\Omega$$

634 **(c)**

$R_2, R_3 and\ R_4$ are in parallel order, so their equivalent resistance

$$\frac{1}{R'} = \frac{1}{R^2} + \frac{1}{R^3} + \frac{1}{R^4}$$
$$= \frac{1}{50} + \frac{1}{50} + \frac{1}{75}$$
$$= \frac{30+30+20}{1500}$$
$$= \frac{80}{1500} = \frac{4}{75}$$
$$\therefore\ R' = \frac{75}{4}\Omega$$
$$\mathrm{R} = \mathrm{R}_1 + \mathrm{R}' = 100 + \frac{75}{4}$$
$$= \frac{475}{4}\Omega = 118.75\Omega$$

635 **(d)**

Two resistances in series are connected in parallel with the third. Hence $\frac{1}{R_p} = \frac{1}{4} + \frac{1}{8} = \frac{3}{8} \Rightarrow R_p = \frac{8}{3}\Omega$

636 **(c)**

Manganin or constantan are used for making the potentiometer wire

637 **(c)**

$$\frac{\mathrm{J}_1}{\mathrm{J}_2} = \frac{I/\pi r_1^2}{I/\pi r_2^2} = \left(\frac{r_2}{r_1}\right)^2 = \left(\frac{3}{1}\right)^2 = \frac{9}{1}$$

638 **(b)**

When temperature of the hot junction of a thermocouple rises, the thermo-emf increases and becomes maximum at a particular temperature. This temperature is called neutral temperature.

Given, $e = at + \frac{1}{2}\ bt^2$

Differentiating with respect to t, we get

$$\frac{de}{dt} = a + bt$$

For maximum value of e,

$$\frac{de}{dt} = 0$$
$$\therefore a + bt = 0$$
$$\Rightarrow t = -\frac{a}{b}$$

639 **(a)**

$R = 32 \times 10^4 \pm 5\%$

640 **(d)**

$$H = i^2RT = i^2\left(\frac{\rho l}{A}\right)t = \frac{i^2\rho Vt}{A^2} \quad [V = \text{volume} = Al]$$

$$\Rightarrow H \propto \frac{1}{r^4} \Rightarrow \frac{H_1}{H_2} = \left(\frac{r_2}{r_1}\right)^4 = \left(\frac{2}{1}\right)^4 = \frac{16}{1}$$

642 **(c)**

When key K is opened, bulb B_2 will not draw any current from the source, so that terminal voltage of source increases. Hence, power consumed by bulb increases, so light of the bulb becomes more. The brightness of bulb B_1 decreases.

643 **(b)**

Let the internal resistance of cell be r, then

$$i = \frac{E}{R+r} \Rightarrow 15 = \frac{1.5}{0.04+r} \Rightarrow r = 0.06\Omega$$

644 **(d)**

Given circuit is a balanced Wheatstone bridge circuit. So there will be no change in equivalent resistance. Hence no further current will be drawn

645 **(d)**

Current through arm ABC,

$= 4/(40+60) = 0.04$ A

Potential difference across A and B,

$V_A - V_B = 0.04 \times 40 = 1.6$V

Current through arm ADC,

$= 4/(90+110) = 4/200$A

Potential difference between A and D,

$$V_A - V_D = \frac{4}{200} \times 90 = 1.8\text{V}$$

$\therefore V_B - V_D = (V_A - V_D) - (V_A - V_B)$

$1.8 - 1.6 = 0.2$ V

646 **(b)**

Given that,

$$\frac{l_1}{l_2} = \frac{4}{3} \text{and} \frac{r_1}{r_2} = \frac{2}{3}$$

Here, $l_1$and $l_2$are the length of the wires while $r_1$and r_2 are the radii of the wires.

Now, we know that

$V = IR \Longrightarrow IR = \text{constant}$

$\Longrightarrow I_1R_1 = I_2R_2$

or $\quad \frac{I_1}{I_2} = \frac{R_2}{R_1} \quad \dots.(i)$

But we know that the resistance of the wire is

$$R = \frac{\rho l}{A}$$

Hence, from Eq (i)

$$\frac{I_1}{I_2} = \frac{\rho l_2/A_2}{\rho l_1/A_1}$$

Here,

$$R_1 = \frac{\rho l_1}{A_1}, R_2 = \frac{\rho l_2}{A_2} and\ \rho_1 = \rho_2 = \rho$$

Because both wires are of same material.

$$\therefore \frac{I_1}{I_2} = \frac{l_2 A_1}{l_1 A_2}$$

$$\Rightarrow \frac{I_1}{I_2} = \frac{l_2 \pi r_1^2}{l_1 \pi r_2^2}$$

$$\Rightarrow \frac{I_1}{I_2} = \frac{l_2 r_1^2}{l_2 r_2^2}$$

Here, $\frac{l_2}{l_1} = \frac{3}{4}$ $and \frac{r_1}{r_2} = \frac{2}{3}$

$$\Rightarrow \frac{I_1}{I_2} = \frac{3}{4} \times \left(\frac{2}{3}\right)^2$$

Or $\frac{I_1}{I_2} = \frac{1}{3}$

647 **(a)**

When temperature is raised, the ions/atoms of the conductor start vibrating with increased amplitude of vibration and greater frequency. Due to which the electrons moving towards the positive end of conductor will suffermore rapid collisions and hence time of relaxation (τ)decreaseds. As $v_d \propto \tau$, thus drift velocity decrease. Therefore $v_d \propto 1/T$

648 **(d)**

$$R_{AB} = \frac{R}{3} + R = \frac{2}{3} + 2 = \frac{8}{3} = 2\frac{2}{3}\Omega$$

649 **(b)**

$$i = \frac{dQ}{dt} = 10 + 4t \text{ or } dQ = (10 + 4)dt$$

Integrating it, we get $Q = 10t + \frac{4t^2}{2} = 10t + 2t^2$

When $t = 10s$, $Q = 10 \times 10 + 2 \times 10^2 = 300$ C

650 **(b)**

Let q be the charge flowing through copper voltmeter.

The charge flowing through silver voltmeter = $(2000 - q)$

Now, $m = z_{Cu} q = z_{Ag} \times (2000 - q)$;

$$\therefore q = \frac{Z_{Ag}}{Z_{Cu}} \times (2000 - q)$$

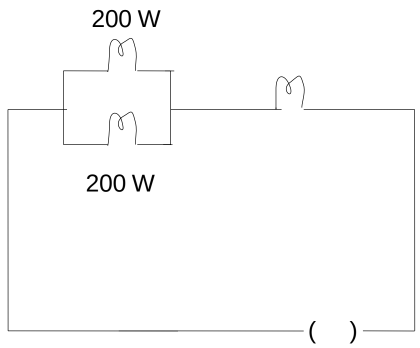
$$= \frac{1.008 \times 10^{-6}}{3.36 \times 10^{-7}} \times (2000 - q)$$

$q = 1500$ C

651 **(c)**

Bulbs A and B are in parallel.

There, effective power is



$$P' = P_A + P_B = 200 + 200$$
$$= 400 \text{ W}$$

Now P' and bulb C are in serried. So, the resultant power of the combination is

$$P'' = \frac{400 \times 400}{400 + 400} = 200 \text{ W}$$

652 **(c)**

Resistances at C and B are not in the circuit. Use laws of resistances in series and parallel excluding the two resistance

653 **(b)**

Potential gradient along wire

$$= \frac{\text{potential difference along wire}}{\text{length of wire}}$$

$$\therefore 0.1 \times 10^{-3} = \frac{I \times 40}{1000} \text{Vcm}^{-1}$$

Current in wire.

$$I = \frac{1}{400} A \quad \text{or } I = \frac{E}{R + R'}$$

$$\therefore \frac{2}{40 + R} = \frac{I}{400}$$

Or $R = 800 - 40 = 760\Omega$

654 **(b)**

Just for your knowledge remember, voltaic cell uses dil. H_2SO_4 ; Dry cell uses $NH_4Cl + ZnCl_2$ paste; Daniel cell uses dil. H_2SO_4 ; Lead Accumulator uses dil. H_2SO_4 and Ni-Fe cell or Alkaline Accumulator uses KOH solution

655 **(d)**

Temperature of cold junction T_c, temperature of inversion T_i and neutral temperature T_n are related as follows

$$T_n = \frac{T_i + T_c}{2} \Rightarrow T_i = 2T_n - T_c$$

As T_n is constant for a given thermocouple T_i decreases with increase in T_c

656 **(b)**

$P = i^2R \Rightarrow \frac{\Delta P}{P} = \frac{2\Delta i}{i}$ [$R \to$ Constant]

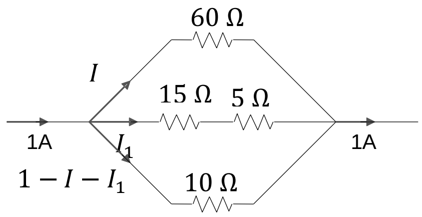
$\Rightarrow$ % change in power $= 2 \times$ % change in current $= 2 \times 1 = 2\%$

658 **(c)**

Power loss in transmission $P_L = \frac{P^2R}{V^2} \Rightarrow P_L \propto \frac{1}{V^2}$

659 **(a)**

All the resistances are in parallel order, so voltage across them will be equal.



$\therefore \quad 60I = (15+5)I_1$

$\Longrightarrow \quad 60I = 20I_1$

$\Longrightarrow \quad I_1 = 3I$

Again $\quad (15+5)I_1 = 10(1 - I - I_1)$

$\Longrightarrow \quad 2I_1 = 1 - I - I_1$

$\Longrightarrow \quad 2(3I) = 1 - I - 3I$

$\Longrightarrow \quad 6I + 4I = 1$

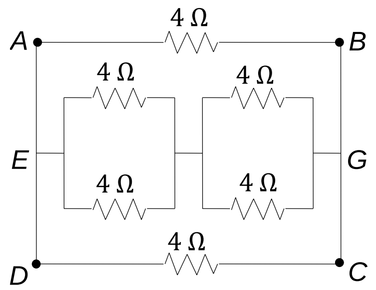
$\Longrightarrow \quad 10I = 1$

$\therefore \quad I = \frac{1}{10} = 0.1A$

660 **(b)**

Equivalent circuit of this combination of resistances is as shown in figure. The effective resistance of arm

$$EG = \frac{4 \times 4}{4 + 4} = 2\Omega$$

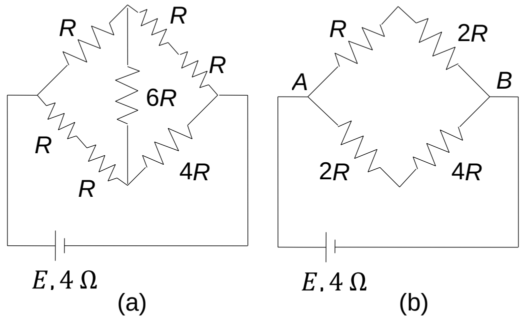


Total resistances between A and B will be

$$\frac{1}{R} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4} \text{ or } R = \frac{4}{3}\Omega$$

661 **(c)**

The equivalent circuit is as shown in figure (a) and (b)



Since, the network of resistances is a balanced Wheat stone bridge, so resistance between points A and B of network figure (b) is given by

$$\frac{1}{R'} = \frac{1}{3R} + \frac{1}{6R} = \frac{2+1}{6R} = \frac{1}{2R} \text{ or } R' = 2R$$

For maximum power to the network, R' should be equal to internal resistance of the battery. So

$R' = 2R = 4$ or $R = 4/2 = 2\Omega$

662 **(d)**

Let x watt be the power loss in transmission line in the form of heat

$\therefore x = \left(\frac{P}{V}\right)^2 R = \left(\frac{10 \times 1000}{200}\right)^2 \times 0.2$

$= 500\text{W} = 0.5 \text{ kW}$

Efficiency of transmission

$= \frac{\text{power delivered by line}}{\text{power supplied to line}} = \frac{10 \text{ kW}}{10 \text{ kW} + x \text{ kW}}$

$= \frac{10}{10 + 0.5} = \frac{10}{10.5} = 0.95 = 95\%$

663 **(a)**

$H_1 = H_2 \Rightarrow \frac{v^2}{R}t_1 = \frac{v^2}{2R}t_2 \Rightarrow t_2 = 2t_1 \Rightarrow t_1$

$= 30$ min

$\therefore t_2 = 60$ min

664 **(a)**

Significant figures		**Multiplier**
Brown	Black	Brown
1	0	10^1

$\therefore R = 10 \times 10^1 = 100\ \Omega$

665 **(a)**

$i = \frac{V}{R} \Rightarrow 2 = \frac{6}{\frac{6 \times 3}{6+3} + R} = \frac{6}{2 + R} \Rightarrow R = 1\ \Omega$

666 **(c)**

$m = zq, z =$ atomic mass / valence

667 **(b)**

Resistance of series combination of 3 Ω and 1 Ω is $R_1 = 3 + 1 = 4\Omega, R_2 = 8\Omega$

Let i be the total current in the circuit

Current through R_1 is $i_1 = \frac{i \times R_2}{R_1+R_2} = \frac{i \times 8}{12} = \frac{2i}{3}$

Current through R_2 is $i_2 = \frac{i \times R_1}{R_1+R_2} = \frac{i \times 4}{12} = \frac{i}{3}$

Power dissipated in 3Ω resistor is $P_1 = i_1^2 \times 3$ ...(i)

Power dissipated in 8Ω resistor is $P_2 = i_2^2 \times 8$ ...(ii)

$\therefore \frac{P_1}{P_2} = \frac{i_1^2 \times 3}{i_2^2 \times 8}$ or, $\frac{P_1}{P_2} = \frac{(2i/3)^2 \times 3}{(i/3)^2 \times 8} = \frac{12}{8} = \frac{3}{2}$

$P_1 = \frac{3}{2} \times P_2 = \frac{3}{2} \times 2 = 3watt$

$\therefore$ Power dissipated across 3Ω resistor is 3 watt

668 **(b)**

The filament of the heater reaches its steady resistance when the heater reaches its steady temperature, which is much higher than the room temperature. The resistance at room temperature is thus much lower than the resistance at its steady state. When the heater is switched on, it draws a larger current than its steady state current. As the filament heats up, its resistance increases and current falls to steady state value

669 **(d)**

When cells are in series, emf of the combination of cells increases

670 **(b)**

Give that,

$\frac{l_1}{l_2} = \frac{d_1}{d_2} = \frac{\rho_1}{\rho_2} = \frac{1}{2}$

and $R_1 = 10\Omega$

We know that, the resistance of the wire

$R = \frac{\rho l}{A} = \frac{\rho l}{\pi \left(\frac{d}{2}\right)^2} = \frac{4\rho l}{\pi d^2} \quad \left[\because A = \pi \left(\frac{d}{2}\right)^2\right]$

So, the resistance of first wire is

$R_1 = \frac{4\rho_1 l_1}{\pi d_1^2} \quad ..(i)$

and the resistance of the second wire is

$R_2 = \frac{4\rho_2 l_2}{\pi d_2^2} \quad ..(ii)$

On dividing Eq. (ii) by Eq (i)

$\frac{R_2}{R_1} = \frac{\rho_2}{\rho_1} \times \frac{l_2}{l_1} \times \frac{d_1^2}{d_2^2}$

$\Rightarrow \frac{R_2}{10} = \frac{2}{1} \times \frac{2}{1} \times \left(\frac{1}{2}\right)^2$

$\Rightarrow \frac{R_2}{10} = 1 \Rightarrow R_2 = 10\Omega$

671 **(d)**

Net resistance of 3Ω and 7Ω resistors (in series)

R'=3+7=10Ω

R' and 10Ω are in parallel, so

$R' = \frac{10 \times 10}{10 + 10} = 5\Omega$

R'and 5Ω are in series, so

R'=5+5=10Ω

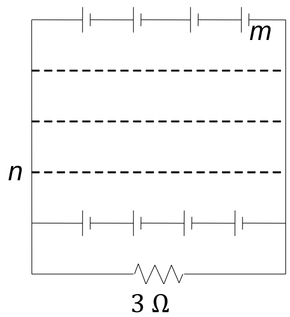
Now, R' and 10Ω are in parallel, so

$R = \frac{10 \times 10}{10 + 10} = 5\Omega$

672 **(c)**

In mixed grouping the current in the external circuit will be maximum when the internal resistance of the battery is equal to the external resistance,

$R = \frac{mr}{n}$



Given, R=3Ω, $r = 0.5\Omega$

$\therefore \quad 3 = \frac{m}{n} \times 0.5$

$\Rightarrow \frac{m}{n} = 6$

$\Rightarrow m = 6n$

Total number of cells= $m \times n = 24$ ...(i)

From Eqs. (i) and (ii), we get ...(ii)

$6n \times n = 24$

$\Rightarrow 6n^2 = 24$

$\Rightarrow n^2 = 4$

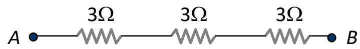
$\Rightarrow n = 2, m = 12$

673 **(c)**

$R_A = \frac{\rho l}{l \times t} = \frac{\rho}{t}$ and $R_B = \frac{\rho \times 2l}{2l \times t} = \frac{\rho}{t}$ $i.e. \frac{R_A}{R_B} = 1 : 1$

674 **(d)**

The network can be redrawn as follows



$\Rightarrow R_{eq} = 9\Omega$

675 **(a)**

Current flowing through both the bars is equal. Now, the heat produced is given by

$H = I^2 Rt$

or $H \propto R$ or $\frac{H_{AB}}{H_{Bc}} = \frac{R_{AB}}{R_{BC}}$

$= \frac{(1/2r)^2}{(1/r)^2}$ $\left(\because R \propto \frac{1}{A} \propto \frac{1}{r^2}\right)$

$= \frac{1}{4}$

or $H_{BC} = 4H_{AB}$

677 **(a)**

Applying Kirchhoff's law

$(2+2) = (0.1+0.3+0.2)i \Rightarrow i = \frac{20}{3}A$

Hence potential difference across A

$= 2 - 0.1 \times \frac{20}{3} = \frac{4}{3}V$ [less than $2V$]

Potential difference across $B = 2 - 0.3 \times \frac{20}{3} = 0$

678 **(b)**

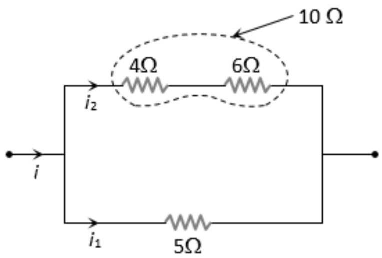
Here S consist of $S_1$and S_2 arranged in parallel, hence

$$S = \frac{S_1 S_2}{S_1 + S_2}$$

So, the balance condition will be $\frac{P}{Q} = \frac{R}{S} = \frac{R(S_1+S_2)}{S_1 S_2}$

679 **(b)**

$\frac{i_1}{i_2} = \frac{R_2}{R_1} = \frac{10}{5} = \frac{2}{1}$



Also heat produced per $sec\ i.e. \frac{H}{t} = P = i^2 R$

$\Rightarrow \frac{P_5}{P_4} = \left(\frac{i_1}{i_2}\right)^2 \times \frac{5}{4} = \left(\frac{2}{1}\right)^2 \times \frac{5}{4} = \frac{5}{1} \Rightarrow P_4 = \frac{10}{5}$

$= 2 cal/s$

680 **(b)**

Here, $r = \frac{l_1 - l_2}{l_2} \times 2\Omega$

Where $l_1 = 240$ cm, $l_2 = 120$ cm

$\therefore \quad r = \frac{240-120}{120} \times 2$

$= \frac{120}{120} \times 2 \times 2\Omega$

681 **(c)**

Drift velocity $v_d = \frac{i}{neA} \Rightarrow v_d \propto \frac{1}{A}$ or $v_d \propto \frac{1}{d^2}$

$\Rightarrow \frac{v_P}{v_Q} = \left(\frac{d_Q}{d_P}\right)^2 = \left(\frac{d/2}{d}\right)^2 = \frac{1}{4} \Rightarrow v_P = \frac{1}{4} v_Q$

682 **(b)**

Because as temperature increases, the resistivity increases and hence the relaxation time decreases for conductors $\left(\tau \propto \frac{1}{\rho}\right)$

683 **(b)**

Given, that, the two resistances R and $2R$ are connected in parallel so the potential drop is equal for both.

The thermal energy developed in a circuit is

$H = \frac{V^2 t}{R} \Rightarrow H \propto \frac{1}{R}$

$\Rightarrow \frac{H_1}{H_2} = \frac{R_2}{R_1} \Rightarrow \frac{H_1}{H_2} = \frac{2R}{R}$

[Here, $R_1 = R, R_2 = 2R$]

Or $\qquad H_1 : H_2 = 2 : 1$

684 **(b)**

When switch $S$is pressed, the resistance of circuit decreases. Hence, the current in bulb A will increase but the current in bulb B will decrease. Hence, the brightness of bulb A will increase and that of bulb B will decrease.

685 **(b)**

The equivalent resistance between two corners of equilateral triangle having resistance R in each arm $= 2R/3 = 2 \times 4/3 = 8/3\Omega$

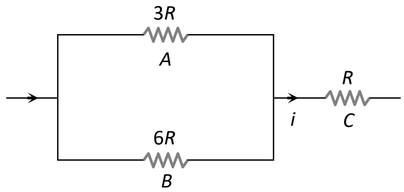
686 **(c)**

Thermal power in $A = P_A = \left(\frac{2i}{3}\right)^2 3R = \frac{4}{3} i^2 R$

Thermal power in $B = P_B = \left(\frac{i}{3}\right)^2 6R = \frac{2}{3} i^2 R$

Thermal power in

$C = P_C = i^2 R$



$\Rightarrow P_A : P_B : P_C$

$= \frac{4}{3} : \frac{2}{3} : 1 = 4 : 2 : 3$

687 **(b)**

Let n be the number of wrongly connected cells

Number of cells helping one another $= (12 - n)$

Total e.m.f. of such cells $= (12 - n)E$

Total e.m.f. of cells opposing $= nE$

Resultant e.m.f. of battery $= (12 - n)E - nE = (12 - 2n)E$

Total resistance of cells $= 12r$

($\because$ resistance remains same irrespective of connections of cells)

With additional cells

(a) Total e.m.f. of cells when additional cells help battery $= (12-2n)E + 2E$

Total resistance $= 12r + 2r = 14r$

$\therefore \frac{(12-2n)E+2E}{14r} = 3$ ...(i)

(b) Similarly when additional cells oppose the battery

$\frac{(12-2n)E-2E}{14r} = 2$ ...(ii)

Solving (i) and (ii), $n = 1$

688 **(b)**

By using $\frac{P}{Q} = \frac{R}{S} \Rightarrow \frac{2}{2} = \frac{2}{\frac{6S}{(6+S)}} \Rightarrow S = 3\Omega$

689 **(c)**

$R = \frac{V}{i_g} - G = \frac{6}{6\times10^{-3}} - 25 = 975\Omega$ [In series]

690 **(c)**

$\therefore\ [\varepsilon_0] = [M^{-1}L^{-3}T^4A^2]$ and $[E] = [MLT^{-3}A^{-1}]$

$\therefore\ \left[\frac{1}{2}\varepsilon_0 E^2\right] = [M^{-1}L^{-3}T^4A^2] \times [MLT^{-3}A^{-1}]^2$

$= [ML^{-1}T^{-2}]$

691 **(c)**

For figure (i) $i_1 = 7A$

For figure (ii) $i_2 = 4+3 = 7A$

For figure (iii) $i_3 = 5+2 = 7A$

For figure (iv) $i_4 = 6-1 = 5A$

692 **(c)**

Length of the wire is

$$l = \frac{RA}{\rho}$$

$$\therefore l = \frac{4\times\pi\times(0.7\times10^{-3})^2}{2.2\times10^{-8}} = 280\text{m}$$

693 **(a)**

Resistance of $V_1 = 80\times200$

$=16000\Omega$

Resistance of V_2=32000Ω

The current flowing in the circuit is given by

$$i = \frac{80}{16000} = \frac{1}{200}A$$

Total resistance of the circuit

=16000+32000=48000Ω

Line voltage= iR

$$= \frac{48000}{200} = 240V$$

694 **(a)**

According to ohm's law $V = iR$

$\Rightarrow \log_e V = \log_e i$

$+ \log_e R$

$\Rightarrow \log_e i = \log_e V - \log_e R$

The graph between $\log_e I$ and $\log_e V$ will be a straight line which cuts $\log_e V$ axis and it's gradient will be positive

695 **(d)**

Current for 50 divisions,

$$I_g = \frac{1\times50}{10} = 2\text{mA}$$

$$\therefore \frac{I_g}{I} = \frac{S}{S+G}$$

$$\Rightarrow I = \left(\frac{S+G}{S}\right)I_g$$

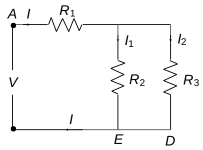
Or

$$I = \left(\frac{4+20}{4}\right)5\text{mA} = 30\text{mA}$$

696 **(c)**

As voltage across the resistors R_2 and R_3 is same and they show same dissipation of energy, so using the relation for energy, $H = \frac{V^2}{R}t$, we have $R_2 = R_3$. Thus, the current in each resistor R_2 and R_3 will be $I/2$

$ie, I_1 = I/2$ and $I_2 = I/2$



Since the energy dissipation is same in all the three resistors, so

$I^2R_1t = I_1^2R_2t$

or $I^2R_1t = (I/2)^2R_2t$

or $R_1 = R_2/4$

697 **(c)**

According to Faraday's first law of electrolysis, mass deposited

$m = ZIt$

Where Z = electrochemical equivalent of substance

$$\therefore \frac{m_1}{m_2} = \frac{I_1}{I_2} \times \frac{t_1}{t_2}$$

Or $\frac{xg}{m_2} = \frac{4\text{A}}{6\text{A}} \times \frac{60\text{ min}}{40\text{ min}}$ or $m^2 = x\text{g}$

698 **(d)**

$$S = \left(\frac{100-l}{l}\right).R$$

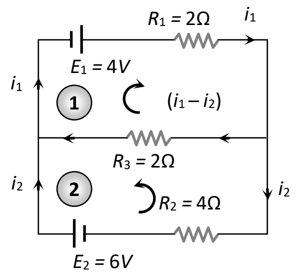
Initially, $30 = \left(\frac{100-l}{l}\right)\times10 \Rightarrow l = 25cm$

Finally, $10 = \left(\frac{100-l}{l}\right)\times30 \Rightarrow l = 75cm$

So, shift $= 50cm$

699 **(b)**

Applying Kirchhoff's law for the loops (1) and (2) as shown in figure



For loop (1)

$-2i_1 - 2(i_1 - i_2) + 4 = 0$

$\Rightarrow 2i_1 - i_2 = 2$ ...(i)

For loop (2)

$-2(i_1 - i_2) + 4i_2 - 6 = 0$

$\Rightarrow -i_1 + 3i_2 = 3$ ...(ii)

On solving equation (i) and (ii), $i_1 = 1.8A$

700 **(c)**

Current, $i = \frac{dQ}{dt} = \frac{d}{dt}(5t^2 + 3t + 1) = 10t + 3$

When t=5s

$i = 10 \times 5 + 3 = 53A$

701 **(a)**

Because H_2O is used as electrolyte

702 **(c)**

In a potentiometer there is no current drawn from the cell whose emf is to be measured whereas a voltmeter always draws some current from the cell. Hence, the emf of a cell can be measured accurately using a potentiometer.

703 **(d)**

For balanced Wheatstone bridge

$\frac{P}{R} = \frac{S}{Q}$

704 **(c)**

Resistance of the wire is given by

$R = \rho\frac{l}{A} = \rho\frac{l^2}{Al} = \frac{\rho l^2}{V}$ $(\because Al = V)$

So,

$R \propto l^2$ (if density remains same)

$or \ \frac{R'}{R} = \frac{(2l)^2}{(l)^2} = 4$

$R' = 4R$

Hence, change in resistance

=4R-R=3R

Therefore, $\frac{\text{change in resistance}}{\text{original resistance}} = \frac{3R}{1R} = 3:1$

705 **(c)**

Resistance of a bulb $= \frac{(\text{Rated voltage})^2}{(\text{Rated power})}$

$R_{B_1} = \frac{(220)^2}{40}\Omega$ and $R_{B_2} = \frac{(220)^2}{60}\Omega$

When the bulbs are connected in series,

$R_S = R_{B_1} + R_{B_2}$

$= \frac{(220)^2}{40} + \frac{(220)^2}{60} = (220)^2\left[\frac{1}{40} + \frac{1}{60}\right]$

$= (220)^2\left[\frac{60 + 40}{60 \times 40}\right] = (220)^2\left(\frac{100}{2400}\right) = \frac{(220)^2}{24}$

$\therefore P_1 = \frac{V_S^2}{R_s} = (220)^2 \times \frac{24}{(220)^2} = 24W$

When the bulbs are connected in parallel

$\frac{1}{R_p} = \frac{1}{R_{B_1}} + \frac{1}{R_{B_2}} \Rightarrow \frac{1}{R_P} = \frac{40}{(220)^2} + \frac{60}{(220)^2}$

$\frac{1}{R_p} = \frac{100}{(200)^2}$ or $R_p = \frac{(220)^2}{100}$

$\therefore P_2 = \frac{V_S^2}{R_p} = (220)^2 \times \frac{100}{(200)^2} = 100\ W$

$\therefore \frac{P_1}{P_2} = \frac{24\ W}{100\ W} = 0.24$

706 **(d)**

The resistance AB, BC and CD in series. The total resistance is

$R_1 = 2 + 2 + 2 = 6\Omega$

The resistance AE, EF and FD in series. The total resistance is

$R_2 = 2 + 2 + 2 = 6\Omega$

The resistance BE and CF are in effective

$\because R_1$ and R_2 are in parallel

$\therefore$ The total resistance

$R = \frac{6 \times 6}{6 + 6} = 3\Omega$

The current in the circuit

$I = \frac{V}{R} = \frac{3}{3} = 1.0A$

707 **(b)**

$P \propto \frac{1}{R}$ and $R \propto l \Rightarrow P \propto \frac{1}{l}$

$\Rightarrow \frac{P_1}{P_2} = \frac{l_2}{l_1} \Rightarrow \frac{P_1}{P_2} = \frac{(100 - 10)}{100} = \frac{90}{100} \Rightarrow P_2$

$= 1.11P_1$

% change in power $= \frac{P_2 - P_1}{P_1} \times 100 = 11\%$

708 **(d)**

Potential difference across PQ $i.e.$ p.d. across the resistance of 20Ω is $V = i \times 20$

and $i = \frac{48}{(100+100+80+20)} = 0.16A$

$\therefore V = 0.16 \times 20 = 3.2V$

709 **(b)**

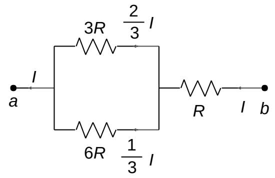
Drift velocity, $v_d = \frac{I}{neA}$

$\Longrightarrow v_d = \frac{5}{(5 \times 10^{26}) \times (1.6 \times 10^{-19}) \times (4 \times 10^{-6})}$

$= \frac{1}{64} = 1.56 \times 10^{-2}\text{ms}^{-1}$

710 **(c)**

Let current flow from b to a as shown



Ratio of thermal power is $\left(\frac{2}{3}I\right)^2 3R : \left(\frac{1}{3}I\right)^2 6R : I^2R$

or $\frac{4}{3} : \frac{2}{3} : 1$ or $4 : 2 : 3$.

711 **(c)**

Both plates have same thickness,

$$R_R = \frac{\rho l}{ld} \text{ and } R_s = \frac{\rho 2l}{2ld}$$

$$\therefore \frac{R_1}{R_2} = 1$$

712 **(c)**

$R = 56 \times 10 \pm 10\% = 560 + 10\%$

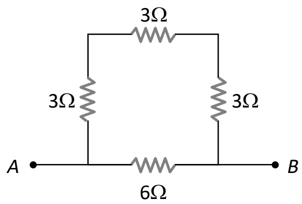
713 **(b)**

$$R \propto \frac{l}{r^2} \Rightarrow \frac{R_2}{R_1} = \frac{l_2}{l_1} \times \frac{r_1^2}{r_2^2} = \left(\frac{2}{1}\right) \times \left(\frac{1}{2}\right)^2 = \frac{1}{2}$$

$\Rightarrow R_2 = \frac{R_1}{2}$, specific resistance doesn't depend upon length, and radius

714 **(d)**

The circuit reduces to



$$R_{AB} = \frac{9 \times 6}{9 + 6} = \frac{9 \times 6}{15} = \frac{18}{5} = 3.6\Omega$$

715 **(c)**

For semiconductor the temperature coefficient of resistance (α) is negative. Hence, resistivity will decrease with the temperature rise.

716 **(b)**

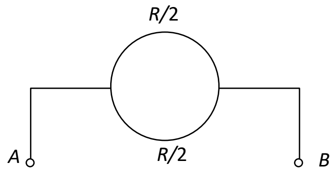
$$\frac{R_1}{R_2} = \frac{m_1}{a_1^2} \times \frac{a_2^2}{m_2}$$

$$= \left(\frac{m1}{m2}\right)\left(\frac{a_2}{a_1}\right)^2 = \left(\frac{1}{2}\right)(1)^2 = \frac{1}{2}$$

$$\frac{Q_1}{Q_2} = \frac{I^2R_1t}{I^2R^2t} = \frac{1}{2}$$

717 **(a)**

$$R_{AB} = \frac{R/2}{2} = \frac{R}{4}$$

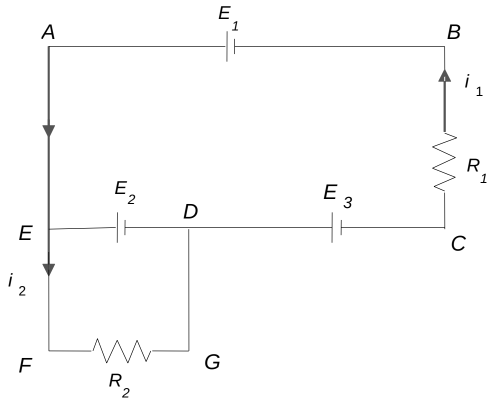


718 **(a)**

$$\frac{R_1}{R_2} = \left(\frac{l_1}{l_2}\right)^2 \Rightarrow \frac{10}{R_2} = \left(\frac{5}{20}\right)^2 = \frac{1}{16} = R_2 = 160\Omega$$

719 **(a)**

In closed loop $EFGDE$



$i_2R_2 = E_2$

$i_2 \times 30 = 3$

$i_2 = 0.1A$

In closed loop $ABCEA$

$-i_1R_1 - E_1 + E_2 + E_3 = 0$

$-i_1 \times 10 - 3 + 3 + 2 = 0$

$i_1 = 0.2A$

720 **(a)**

If E is the emf of the battery, r the internal resistance, i the current drawn and V the PD across the plates of battery, then

$V = E - ir$

Case I When the direction of current in the battery is from –ve to +ve or outside +ve to –ve, then

$i = +$ve (during discharging)

V<E

Case II When the direction of current in the battery is form +ve to –ve or outside –ve to +ve, then

$i = -$ve (during discharging)

$V = E + ir$

⟹V>E

Case III When zero current, then

$i = o$

$V = E$

721 **(b)**

If B_2 or B_3 is disconnected, resistance is increased. Due to which current in the circuit is decreased. Therefore bulb B, will become dimmer.

722 **(d)**

Specific resistance doesn't depend upon length and area

723 **(a)**

$$m = Zit \Rightarrow Z = \frac{m}{it} = \frac{4.572}{5 \times 45 \times 60}$$
$$= 3.387 \times 10^{-4} gm/C$$

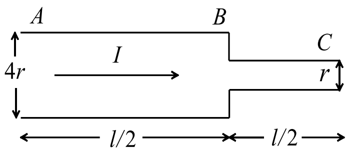
724 **(a)**

Red, brown, orange, silver red and brown represents the first two significant figures

Significant figures		Multiplier	Tolerance
Red	Brown	Orange	Silver
2	1	10^3	$\pm 10\%$

$\therefore R = 21 \times 10^3 \pm 10\%$

725 **(a)**



$$V_{AB} = I.R_{AB} = \frac{I.\rho.L_{AB}}{A_1} = \frac{I.\rho\left(\frac{L}{2}\right)}{\pi(2r)^2} = \frac{I\,\rho.\left(\frac{L}{2}\right)}{\pi 4r^2}$$

$$V_{AB} = \frac{I\,\rho.L}{8\pi r^2}$$

$$V_{BC} = I.R_{BC} = \frac{I.\rho.L}{A_2}$$

$$= \frac{I.\rho.\frac{L}{2}}{\pi(r^2)} = \frac{I.\rho.L}{2\pi r^2} \Rightarrow \frac{V_{AB}}{V_{BC}} = \frac{\frac{I.\rho.L}{8\pi r^2}}{\frac{I.\rho.L}{2\pi r^2}} = \frac{2}{8} = \frac{1}{4}$$

$$V_{AB} = \frac{V_{BC}}{4}$$

Now for power loss

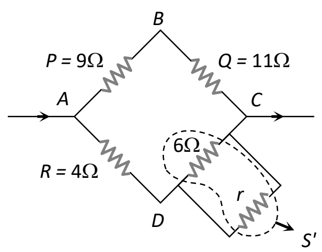
$P_{AB} = V_{A.B}.I$

$P_{BC} = V_{BC}.I$

$$\frac{P_{AB}}{P_{BC}} = \frac{V_{AB}}{V_{BC}} = \frac{1}{4} \Rightarrow V_{AB} = \frac{P_{BC}}{4}$$

726 **(c)**

$\frac{P}{Q} = \frac{R}{S'}$ [For balancing bridge]



$$\Rightarrow S' = \frac{4 \times 11}{9} = \frac{44}{9}$$

$$\Rightarrow \frac{1}{S'} = \frac{1}{r} + \frac{1}{6}$$

$$\Rightarrow \frac{9}{44} - \frac{1}{6} = \frac{1}{r}$$

$$\Rightarrow r = \frac{132}{5} = 26.4\ \Omega$$

727 **(c)**

Resistance of galvanometer

$G = 50\Omega$

Full scale current $i_g = 0.05$

$A = 2.97 \times 10^{-2} \text{cm}^2$

$= 2.97 \times 10^{-2} \times 10^{-4} \text{m}^2$

$= 2.97 \times 10^{-6} \text{m}^2$

$i = 5A$

$\rho = 5 \times 10^{-7} \Omega\text{m}$

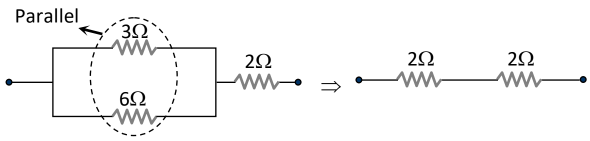
Required resistance to convert the galvanometer into ammeter.

$$R = \frac{i_g G}{i - i_g} = \frac{0.05 \times 50}{5 - 0.05} = \frac{2.5}{4.95}$$

$$\rho \frac{l}{A} = \frac{50}{99}$$

$$l = \frac{50}{99} \times \frac{A}{\rho} = \frac{50}{99} \times \frac{2.97 \times 10^{-6}}{5 \times 10^{-7}} = \frac{50}{99} \times \frac{29.7}{5}$$
$$= 10 \times 0.3 = 3\text{m}$$

728 **(c)**

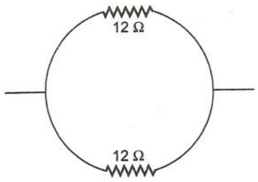


$R_{eq} = 4\Omega$

729 **(a)**

Given, resistance of uniform wire=24Ω.

When the wire is bent in the form of a circle, then resistance will divide the wire in two equal at opposite point in parallel



The effective resistance between the two end points on any diameter of the circle.

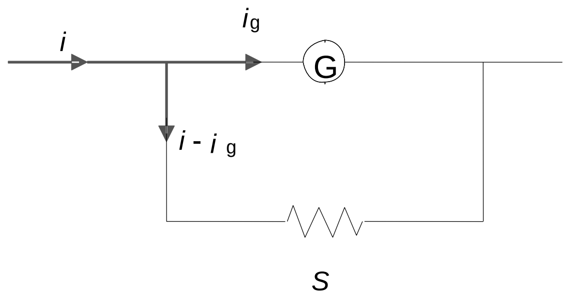
$$R = \frac{12 \times 12}{12 + 12}$$

or $R = \frac{144}{24}$

or $R = 6\Omega$

731 **(a)**

To convert a galvanometer into an ammeter, a shunt resistance in parallel is connected to galvanometer.



Since, galvanometer G and shunt S are in parallel, hence

$i_g G = (i - i_g)$

$\Rightarrow \quad S = \dfrac{i_g G}{i - i_g} = \dfrac{4 \times 10^{-3} \times 15}{6 - 4 \times 10^{-3}}$

$= \dfrac{60 \times 10^{-3}}{5.996} = 10 \times 10^{-3}\Omega = 10\text{m}\Omega$

732 **(b)**

Here , $m = 1\text{ g} = \text{p}^{-3}\text{ kg}$;

$z = 1.044 \times 10^{-8}\text{ kg C}^{-1}$

$H = 34\text{ k cal.} = 34 \times 1000 \times 4.2\text{ J}$

$q = \frac{m}{z} = \frac{10^{-3}}{1.044 \times 10^{-8}} = \frac{10^5}{1.044}\text{ C}$

and $V = \frac{H}{q} = \frac{34 \times 1000 \times 4.2}{(10^5/1.044)} = 1.5\text{ V.}$

733 **(c)**

$2 = \dfrac{\varepsilon}{2 + r}$

$0.5 = \frac{\varepsilon}{9+r}$ or $\frac{2}{0.5} = \frac{9+r}{2+r}$ $\therefore r = \frac{1}{3}\Omega$

734 **(c)**

$L \propto l$

$\dfrac{L_1}{L_2} = \dfrac{l_1}{l_2}$

$\dfrac{10}{11} = \dfrac{2.5}{l_2}$

$10l_2 = 2.5 \times 11$

$l_2 = \dfrac{2.5 \times 11}{10} = 2.75M$

735 **(d)**

$R = \rho l/A = 10$

Now length $l_1 = l + l/10 = 11\ l/10$

$\therefore$ New area $A_1 = Al/l_1$

$\therefore$ New resistance,

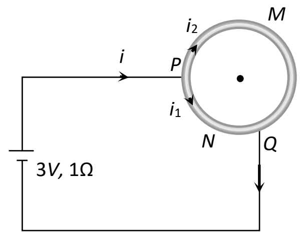
$R_1 = \rho l_1/A_1 = \rho(11/10)/(10/11)A$

$= \dfrac{121}{100}\dfrac{\rho l}{A} = \dfrac{121}{100} \times 10 = 12.1\ \Omega$

736 **(a)**

In the following figure

Resistance of part PNQ;



$R_1 = \frac{10}{4} = 2.5\Omega$ and

Resistance of part PMQ;

$R_2 = \dfrac{3}{4} \times 10 = 7.5\Omega$

$R_{eq} = \dfrac{R_1 R_2}{R_1 + R_2} = \dfrac{2.5 \times 7.5}{(2.5 + 7.5)} = \dfrac{15}{8}\Omega$

Main Current $i = \frac{3}{\frac{15}{8}+1} = \frac{24}{23}A$

So, $i_1 = i \times \left(\frac{R_2}{R_1+R_2}\right) = \frac{24}{23} \times \left(\frac{7.5}{2.5+7.5}\right) = \frac{18}{23}A$

and $i_2 = i - i_1 = \frac{24}{23} - \frac{18}{23} = \frac{6}{23}A$

737 **(a)**

Wheatstone bridge is balanced, therefore

$\frac{P}{Q} = \frac{R}{S}$ or $1 = \frac{10}{S} \Rightarrow S = 10\ ohm$

738 **(c)**

$v_d = \dfrac{I}{nAe} = \dfrac{20}{10^{29} \times 10^{-6} \times 1.6 \times 10^{-19}}$

$= 1.25 \times 10^{-3}\text{m/s}$

739 **(d)**

The resistance are connected in parallel hence, voltage will remain constant

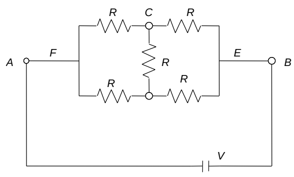
$E = \dfrac{V^2 t}{R}$

$\Rightarrow E \propto \dfrac{1}{R}$

$\dfrac{E_1}{E_2} = \dfrac{R_2}{R_1} = \dfrac{2R}{R} = \dfrac{2}{1}$

740 **(c)**

$I = \dfrac{V}{R}$



$\therefore$ Current in FC $= \dfrac{1}{2} = \dfrac{V}{2R}$

741 **(a)**

Current sensitivity of a galvanometer is defined as the deflection produced in the galvanometer when a unit current flows through it.

If θ is the deflection in the galvanometer when current I is passed through it, then

Current Sensitivity $I_s = \dfrac{\theta}{I} = \dfrac{nBA}{k}$

where k be restoring torque per unit twist, n be number of turns in the coil, B is strength of magnetic field in which coil is suspended, A be area of coil.
Since, restoring per unit twist (torsional constant) is minimum for galvanometer A, hence more sensitive.

742 **(b)**
Let the resistance of voltmeter is $G\Omega$.
$\therefore$ Total resistance of the circuit

$$R = \left(\frac{G \times 100}{G + 100} + 50\right)\Omega$$

Total current

$$i = \frac{V}{G} = \frac{10}{\left(\frac{G\times100}{G+100} + 50\right)}$$

Voltage across 100Ω resistance

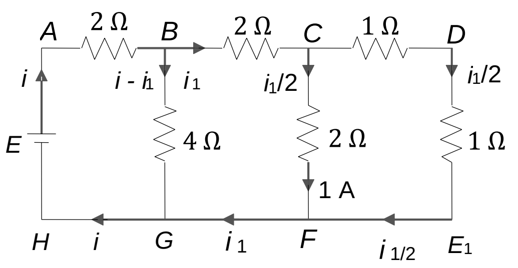
$$= i\left(\frac{G \times 100}{G + 100}\right) = \frac{10}{\left(\frac{G\times100}{G+100} + 50\right)} \times \left(\frac{G \times 100}{G + 100}\right)$$

Reading of voltmeter =5V
$\therefore$ Voltage across 100Ω =5V

$$\therefore 5 = \frac{10}{\left(\frac{G\times100}{G+100} + 50\right)} \times \left(\frac{G \times 100}{G + 100}\right)$$

On solving $G = 100\Omega$

743 **(b)**
The distribution of current is as shown in figure.
As per question,



$$\frac{i_1}{2} = 1 \text{ or } i_1 = 2\text{A}$$

In a closed circuit $ACFG$

$$2i + 2 \times \frac{i_1}{2} - 4(i - i_1) = 0$$

$$7i_1 = 4i$$

or $i = \frac{7}{4}i_1 = \frac{7}{4} \times 2 = \frac{7}{2}$A

Total resistance of the circuit between A and H is

$$= 2 + \frac{4 \times 3}{4 + 3} = \frac{26}{7}$$

EMF of cell is $E = \frac{7}{2} \times \frac{26}{7} = 13\text{V}$

744 **(c)**
$i = q/T = qv$

$= 2 \times 10^{-2} \times 30 = 0.6$ A

745 **(a)**
Current $i = \frac{q}{t} = \frac{CV}{t} = \frac{(10\times10^{-6})\times40}{0.2}$

$= 2 \times 10^{-3}\text{A} = 2$ mA

746 **(c)**
Resistance of electric bulb $R = \frac{V^2}{P}$ where subscripts denote for rated parameters.

$$R = \frac{(220)^2}{100}$$

Power consumed at 110 V, $P_{\text{consumed}} = \frac{V^2}{R}$

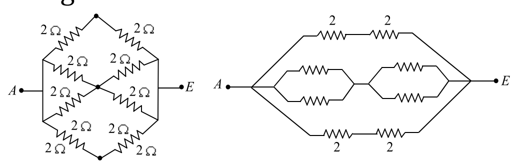
$$\therefore \; P_{\text{consumed}} = \frac{(110)^2}{(220)^2/100} = 25 \text{ W}$$

747 **(c)**

$$i = \frac{2 + 2}{1 + 1.9 + 0.9} = \frac{4}{3.8}A$$

For cell A $E = V + ir \Rightarrow V = 2 - \frac{4}{3.8} \times 1.9 = 0$

748 **(b)**
The given circuit is



$$\frac{1}{\text{Req.}} = \frac{1}{4} + \frac{1}{2} + \frac{1}{4} \Rightarrow \frac{1}{\text{Req.}} = \frac{4}{4} \Rightarrow \text{Req.} = 1\Omega$$

749 **(c)**

$$R_1 \propto \frac{l}{A} \Rightarrow R_2 \propto \frac{2l}{2A} i.e. R_2 \propto \frac{l}{A}$$

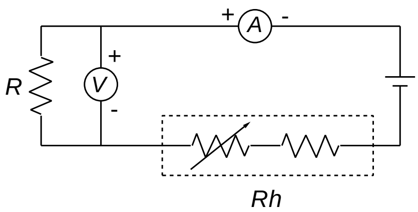
$\therefore R_1 = R_2$

751 **(d)**
$R \propto l$
Hence every new piece will have a resistance $\frac{R}{10}$. If two pieces are connected in series, then their resistance $= \frac{2R}{10} = \frac{R}{5}$
If 5 such combinations are joined in parallel, then net resistance $= \frac{R}{5\times5} = \frac{R}{25}$

752 **(b)**
The current in a conductor depends on the drift velocity of electrons

753 **(b)**
The circuit arrangement shown in figure (b) is the

correct arrangement for verification of Ohm's law. For convenience the same figure has been redrawn here. In the figure, R is the resistance, for which Ohm's law is to be verified. Voltmeter V is connected to its parallel and ammeter, cell and rheostat arrangement in the series.



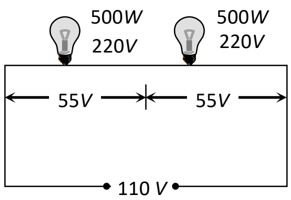
754 **(b)**

Resistivity, $\rho = \frac{m_e}{ne^2t}$

Conductivity, $\sigma = \frac{1}{p} = \frac{ne^2\tau}{m_e}$

755 **(a)**

Voltage across each bulb $V' = \frac{110}{2} = 55W$ so, power consumed by each bulb will be



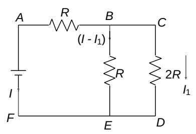
$$P' = \left(\frac{55}{220}\right)^2 \times 500$$

$$= \frac{125}{4}W$$

756 **(b)**

$Q = at - bt^2$

$I = \frac{dQ}{dt} = a - 2bt \quad \dots \text{(i)}$



Where, $t = t_0, I = 0$

In loop $BCDEB$ $I_1(2R) - (I - I_1)R = 0$

or $3I_1 = I$

$\therefore I_1 = \frac{I}{3} = \frac{a - 2bt}{3}$

$$\therefore H = \int_0^{t_0} I_1^2(2R)dt$$

$$= \frac{2R}{9}\int_0^{t_0} (a - 2bt)^2 dt$$

$$= \frac{2R}{9}\left[\int_0^{t_0} (a^2 - 4b^2t^2 - 4dt)dt\right]$$

$$= \frac{2R}{9}\left[\left\{a^2t + \frac{4b^2t^2}{3} - \frac{4bat^2}{2}\right\}_0^{to}\right]$$

$$= \frac{2R}{9}\left[a^2t_0 + \frac{4b^2t_0^3}{3} - 2bat_0^2\right]$$

but $t_0 = \frac{a}{2b}$ [from Eqn.(i)]

$$H = \frac{2R}{9}\left[a^2 \times \frac{a}{2b} + \frac{4b^2}{3}\frac{a^3}{8b^3} - 2ab\frac{a^2}{4b^2}\right]$$

$$= \frac{2R}{9}\left[\frac{a^3}{2b} + \frac{a^3}{6b} - \frac{a^3}{2b}\right] = \frac{a^3R}{27b}$$

757 **(d)**

The energy stored in the capacitor $= \frac{1}{2}CV^2$;

This energy will be converted into heat in the resistor.

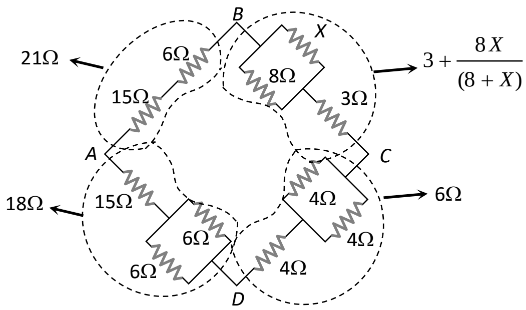
$$H = \frac{1}{2} \times 4 \times 10^{-6} \times 400 \times 400$$

$$= 32 \times 10^{-2}$$

$$= 0.32 \text{ J}$$

758 **(c)**

Potential difference between B and D is zero, it means Wheatstone bridge is in balanced condition



So $\frac{P}{Q} = \frac{R}{S} \Rightarrow \frac{21}{3 + \frac{8X}{(8+X)}} = \frac{18}{6} \Rightarrow X = 8\Omega$

759 **(d)**

Resistance of heater

$$R_H = \frac{V^2}{P} = \frac{(100)^2}{1000} = 10\ \Omega$$

Total resistance of circuit

$$R' = 10 + \frac{10 \times R}{10 + R} = \frac{100 + 20R}{10 + R}$$

Current in heater

$$I_H = I.\frac{R}{10 + R} = \frac{100}{\frac{100 + 20R}{10 + R}} \times \frac{R}{(10 + R)} = \frac{5 \times R}{5 + R}$$

$\therefore$ Power $P = I_H^2R_H \Rightarrow \frac{25R}{(5 + R)^2} \times 10 = 62.5$

$\therefore R = 5\Omega$

760 **(d)**

Let $m_1 = m$, then $m_2 = 3m$ and $m_3 = 5m$. Again let $L_3 = l$, then $L_2 = 3l$ and $L_1 = 5l$. If σ be the density of copper, then

$$A_1 = \frac{m_1}{L_1\sigma} = \frac{m}{5l\sigma}, A_2 = \frac{3m}{3l\sigma} \text{ and } A_3 = \frac{5m}{l\sigma}$$

Hence $A_2 = \frac{5A_1}{3}$ and $A_3 = 25A_1$

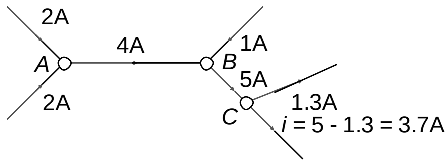
$\therefore\ R_1 = \frac{\rho L_1}{A_1} = \frac{\rho.5l}{A_1}, R_2 = \frac{\rho L_2}{A_2} = \frac{\rho.3l}{5A_1} = \frac{3}{25}R_1,$

and $R_3 = \frac{\rho L_3}{A_3} = \frac{\rho.l}{25A_1} = \frac{R_1}{125}$

$\therefore\ R_1 : R_2 : R_3 = R_1 : \frac{3}{25}R_1 : \frac{R_1}{125} = 125 : 15 : 1$

761 **(b)**

Using Kirchhoffs first law we can find current distribution in the given part of electric circuit as shown in the adjoining figure. From figure $i = 1.7A$



762 **(b)**

$R = \frac{\rho L}{A};\ R_1 = \frac{\rho 2L}{A} = 2R$

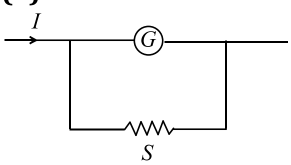
$m = A\ L\ d; m_1 = A\ 2\ L\ d = 2m$

Now, $\frac{(3V)^2 t}{R} = mc\Delta T$ ...(i)

and $\frac{(NV)^2 t}{2R} = 2mc\Delta T$ ...(ii)

Solving (i) and (ii), we get $N = 6$.

763 **(a)**



$\frac{GS}{G+S} = \frac{V_G}{I} = \frac{25 \times 10^{-3}}{25}$

$\frac{GS}{G+S} = 0.001\Omega$

Here $S << G$ So

$S = 0.001\ \Omega$

764 **(a)**

$P_{Rated} = \frac{V_{Rated}^2}{R} \Rightarrow R \propto \frac{1}{P_{Rated}}$ [V – constant]

So bulb of high power will have less resistance

765 **(a)**

$m = Zi\ t\ \Rightarrow i = \frac{m}{Zt} = \frac{0.99}{0.00033 \times 1200} = 2.5A$

Hence heat generated in the coil is

$H = i^2 Rt = (2.5)^2 \times 0.1 \times 1200 = 750\ J$

766 **(d)**

The three resistances between A and B are parallel,

$\frac{1}{R_{\text{comb}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$= \frac{1}{9} + \frac{1}{9} + \frac{1}{9}$

$\frac{1}{R_{\text{comb}}} = \frac{3}{9}$

$\Longrightarrow\ R_{\text{comb}} = 3\Omega$

768 **(d)**

The temperature difference is $20°C = 20\ K$. So that thermo emf developed $E = \alpha\theta = 40\frac{\mu V}{K} \times 20K = 800\ \mu V$

Hence total emf $= 150 \times 800 = 12 \times 10^4\ \mu V = 120\ mV$

769 **(c)**

Given, Thomson's coefficient, $\sigma = 3\mu V/°C$

$\sigma = \frac{dV}{dT}$

or $d\ V = \sigma dT$

so $V = \sigma(T_2 - T_1)$

or $3 \times 10^{-4} = 3 \times 10^{-6}(T_2 - 20)$

or $100 + 20 = T_2$

or $T_2 = 120°\ C$

770 **(d)**

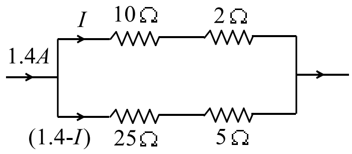
Terminal voltage $V = E - Ir$. Hence the graph between V and i will be a straight line having negative slope and positive intercept.

Thermal power generated in the external circuit $P = EI - I^2 r$. Hence graph between P and I will be a parabola passing through origin.

Also at an instant, thermal power generated in the cell $= i^2 r$ and total electrical power generated in the cell $= Ei$. Hence the fraction $\eta = \frac{I^2 r}{EI} = \left(\frac{r}{E}\right)I;$ so $\eta \propto I$. It means graph between η and I will be a straight line passing through origin

771 **(d)**

Since it's a balanced Wheatstone bridge, the circuit can be redrawn as



$12I = 30(1.4\ I)$

$12I = 42 - 30I$

$\therefore I = 1\ A$

772 **(c)**

We know that when current flow is same then resistors are connected in series, hence resultant resistance is

$R' = R_1 + R_2 = 10\Omega + 20\Omega = 30\Omega$

Also since, cell are connected in opposite directions, the resultant emf is

$E = E_1 - E_2 = 5V - 2V = 3V$

From Ohm's law $E = iR$

$\therefore \quad i = \frac{E}{R} = \frac{3}{30} = 0.1A$

773 **(b)**

In parallel,

$R_p = \frac{R_1 R_2}{R_1 + R_2}$

$= \frac{5.0 \times 10.0}{5.0 + 10.0}$

$= \frac{50}{15} = 3.3\Omega$

Also,

$$\frac{\Delta R_p}{R_p} \times 100 = \frac{\Delta R_1}{R_1} \times 100 + \frac{\Delta R_2}{R_2} \times 100 + \frac{\Delta(R_1 + R_2)}{R_1 + R_2} \times 100$$

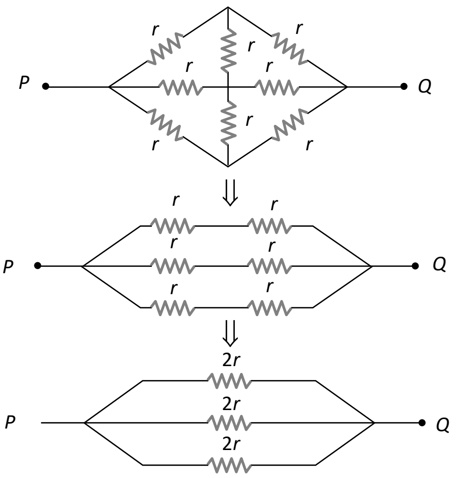
$= \frac{0.2}{5.0} \times 100 + \frac{0.1}{10.0} \times 100 + \frac{0.3}{15} \times 100$

$= 7\%$

$R_p = 3.3\Omega \pm 7\%$

774 **(b)**

The given circuit can be simplifies as follows



$R' = \frac{2r}{3} = \frac{2}{3} \times \frac{3}{2} = 1\Omega$

775 **(c)**

Given, $R_{300} = 0.3\Omega, \mathrm{R_t} = 0.6\Omega$

$\mathrm{T} = 300\mathrm{K} = 27°\mathrm{C}$

Temperature coefficient of resistance,

$\alpha = 1.5 \times 10^{-3}\mathrm{K}^{-1}$

$\therefore R_{300} = R_0(1 + \alpha \times 27)$

$0.3 = R_0(1 + 1.5 \times 10^{-3} \times 27) \quad \ldots$ (i)

Again, $R_t = R_0(1 + \alpha t)$

$0.6 = R_0(1 + \times 10^{-3} \times t) \quad \ldots$ (ii)

Dividing Eq. (ii) by Eq. (i), we get

$\frac{0.6}{0.3} = \frac{1 + 1.5 \times 10^{-3}t}{1 + 1.5 \times 10^{-3} \times 27}$

$\Rightarrow 2(1 + 1.5 \times 10^{-3} \times 27) = 1 + 1.5 \times 10^{-3}t$

$\Rightarrow 2 + 81 \times 10^{-3} = 1 + 1.5 \times 10^{-3}t$

$\Rightarrow 2 + 0.081 = 1 + 1.5 \times 10^{-3}t$

$\Rightarrow t = \frac{1.081}{1.5 \times 10^{-3}} = 720°C = 993K$

776 **(c)**

Temperature coefficient of resistance= $\frac{1}{R_t}\frac{dR}{dt}$

$= \frac{1}{R_o(1 + \alpha t + \beta t^2)}\frac{d}{dt}R_o(1 + \alpha t + \beta t^2)$

$= \frac{\alpha + 2\beta t}{1 + \alpha t + \beta t^2}$

778 **(a)**

$r = \left(\frac{l_1 - l_2}{l_2}\right) \times R' \Rightarrow r = \left(\frac{55 - 50}{50}\right) \times 10 = 1\Omega$

779 **(a)**

$R_1 = \frac{\rho_1 l_1}{A}$ and $R_2 = \frac{\rho_2 l_2}{A}$. In series $R_{eq} = R_1 + R_2$

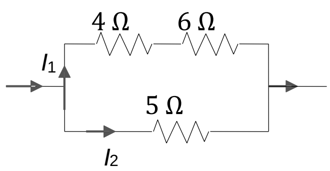
$\frac{\rho_{eq.}(l_1 + l_2)}{A} = \frac{\rho_1 l_1}{A} + \frac{\rho_2 l_2}{A} \Rightarrow \rho_{eq} = \frac{\rho_1 l_1 + \rho_2 l_2}{l_1 + l_2}$

780 **(d)**

In parallel combination $E_{eq} = E = 6V$

781 **(b)**

From the figure



$10I_1 = 5I_2 \quad I_2 = 2I_1 \quad$ ....(i)

Heat produced in resistance

$I_2^2 R = I_2^2 \times 5$

$\therefore \times 5 = 10$ cals^{-1} ....(ii)

From Eqs. (i) and (ii) ,we have

$I_1 = \frac{I_2}{2} = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$ A

Hence, heat produced in resistance of 4Ω

$I_2^2 \times 4 = \frac{1}{2} \times 4 = 2$ cals^{-1}

782 **(b)**

No current flows through the capacitor branch in steady state. Total current supplied by the battery

$i = \frac{6}{2.8 + 1.2} = \frac{3}{2}$

Current through 2 Ω resistor $= \frac{3}{2} \times \frac{3}{5} = 0.9A$

783 **(d)**

96500 *coulombs* of charge is needed to deposit one gram equivalent of an element at an electrode

784 **(d)**

Pressing the key does not disturb current in all resistances as the bridge is balanced. Therefore, deflection in the galvanometer in whatever direction it was, will stay

785 **(c)**

Same mass, same material $i.e.$ volume is same or $Al =$ constant

Also, $R = \rho \frac{l}{A} \Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2} \times \frac{A_2}{A_1} = \left(\frac{A_2}{A_1}\right)^2 = \left(\frac{d_2}{d_1}\right)^4$

$\Rightarrow \frac{24}{R_2} = \left(\frac{d}{d/2}\right)^4 = 16 \Rightarrow R_2 = 1.5\Omega$

786 **(b)**

$\pi = T\, dE/dT$.

787 **(d)**

Resistance of the lamp

$R_0 = \frac{V^2}{P} = \frac{(30)^2}{90} = 10\ \Omega$

Current in the lamp

$i = \frac{30}{10} = 3\ \Omega$

When lamp is operated on a 120 V, then resistance

$R' = \frac{V'}{i} = \frac{120}{30} = 40\ \Omega$

Thus, for proper glow, the resistance required to the put in series will be

$R = R' - R_0 = 40 - 10 = 30\ \Omega$

789 **(a)**

When r is internal resistance of the battery and i the charging current, then

$V = E + ir$

$V = 2 + 5 \times 0.1 = 2.5V$

791 **(b)**

Current flowing in the circuit $i = \frac{E}{R} = \frac{10-4}{20+10} = \frac{1}{5}A$

P.D. across $AC = \frac{1}{5} \times 20 = 4V$

P.D. across $AN = 4 + 4 = 8V$

792 **(d)**

$$\rho = R\frac{A}{l} = \frac{V}{i} \times \frac{A}{l} = \frac{2}{4} \times \frac{10^{-6}}{0.5} = 10^{-6}\Omega\text{m}$$

793 **(d)**

Given, $V = 1\text{V}$

$I_g = 1\text{mA}$

$I_g = 1 \times 10^{-3}A$

Resistance of galvanometer

$R_g = 50\Omega$

$R_g = \frac{V}{I_g} - R_g$

or $R_s = \frac{1}{10^{-3}} - 50$

or $R_1 = 950\Omega$

$R'_2 = \frac{10}{10^{-3}} - 50 = 9950\Omega$

or $R_2 = R'_2 - R_1 = 9950 - 950$

or $R_2 = 9000\Omega$

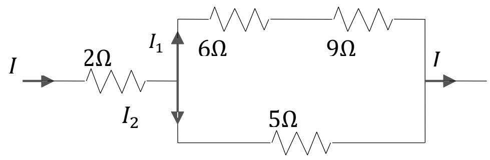
794 **(a)**

Neutral temperature, $T_n = \frac{T_i + T_c}{2}$

or $T_i = 2T_n - T_c = 540°C$.

795 **(c)**

The simplified circuit is shown below



From figure,

$$15\,I_1 = 5I_2 \text{ or } I_2 = \frac{15I_2}{5} = 3I_1$$

$$\therefore \quad I = I_1 + I_2 = \frac{I_2}{3} + I_2 = \frac{4I_2}{3} \quad \text{... (i)}$$

But $I_2^2 \times 5 = 42$

Or $I_2^2 = \frac{42}{5} = 8.4$

Putting value of I_2 in Eq. (i), we get

$$I = \frac{4}{3} \times \sqrt{8.4}$$

Therefore, heat dissipated across 2 Ω

$$= I^2 \times 2 = \frac{16}{9} \times 8.4 \times 2$$

$$\approx 30\ \text{Js}^{-1}$$

796 **(a)**

The resistance of a conductor

$\therefore R = \rho \frac{1}{\pi r^2}$

$\Longrightarrow R \propto \frac{1}{r^2}$

$(a) R_1 = \frac{50}{(0.25 \times 10^{-1})^2} = 800 \times 10^2\Omega$

$(b) R_2 = \frac{100}{(0.5 \times 10^{-1})^2} = 400 \times 10^2\Omega$

$(c) R_3 = \frac{200}{(1 \times 10^{-1})^2} = 200 \times 10^2\Omega$

$(d) R_4 = \frac{300}{(1.5 \times 10^{-1})^2} = 133.3 \times 10^2\Omega$

Hence, electrical resistance of first wire is maximum.

797 **(b)**

Using the concept of balanced wheat stone bridge, we have

$$\frac{P}{Q} = \frac{R}{S}$$

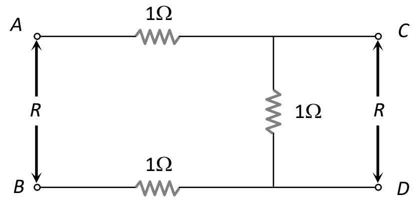
$$\frac{x}{52+1} = \frac{10}{48+2}$$

$$x = \frac{10 \times 53}{50}$$

$$= 10.6\Omega$$

798 **(c)**

Let equivalent resistance between A and B be R, then equivalent resistance between C and D will also be R



$$R' = \frac{R}{R+1} + 2 = R$$
$$\Rightarrow R^2 - 2R - 2 = 0$$
$$\therefore R = \frac{2 \pm \sqrt{4+8}}{2} = \sqrt{3} + 1$$

799 **(d)**

Change $q = it = 0.5\,A \times 3600$ sec $=$ 1800 *coulomb*

800 **(d)**

Power $P = \frac{V^2}{R} \Rightarrow 300 = \frac{220 \times 220}{R}$

$$R = \frac{22 \times 22}{3}$$

Again $P = \frac{110 \times 110 \times 3}{22 \times 22}$

$$P = 75$$
$$P\% = \frac{75 \times 100}{300} = 25\%$$

The percentage reduction in power

$$P = 100 - 25 = 75\%$$

801 **(d)**

Neutral temperature is independent of temperature of cold junction.

802 **(d)**

Let the resistance of the lamp filament be R. Then $100 = (220)^2/R$. When the voltage drops, expected power is

$$P = (220 \times 0.3)^2/R'$$

Here, R' will be less than R, because now the rise in temperature will be less. Therefore, P is more than $(220 \times 0.9)^2\ R = 81$ W. But it will not be 90% of earlier value, because fall in temperature is small. Hence, option (d) is correct.

803 **(a)**

Electric fuse is a type of over current protection device. They are engineered to contribute a negligible amount of extra resistance to the circuits they protect. This is largely accomplished by making the fuse wire as short as possible. Fuses are primarily rated as current amperes. A fuse wire of certain material and gauge will blow at a certain current no matter how long it is. Since, length is not a factor in current rating the shorter it can be made the less resistance it will have end to end.

804 **(b)**

Given, $I = 1$ A, $t = 10$ s, $q = It, q = 10$ C

Charge of $Cu^{2+} = 2e = 2 \times 1.6 \times 10^{-19}$ C

The number of copper atoms deposited at the cathode

$$= \frac{10}{2 \times 1.6 \times 10^{-19}} = 3.1 \times 10^{19}$$

805 **(c)**

Ohm's Law is not obeyed by semiconductors

806 **(c)**

$$\frac{i}{i_g} = 1 + \frac{G}{S} \Rightarrow \frac{1}{10^{-3}} = 1 + \frac{20}{S} \Rightarrow S = \frac{20}{900} \approx 0.02\Omega$$

807 **(d)**

The resistance of voltmeter is too high, so that it draws negligible current from the circuit, hence potential drop in the external circuit is also negligible

808 **(d)**

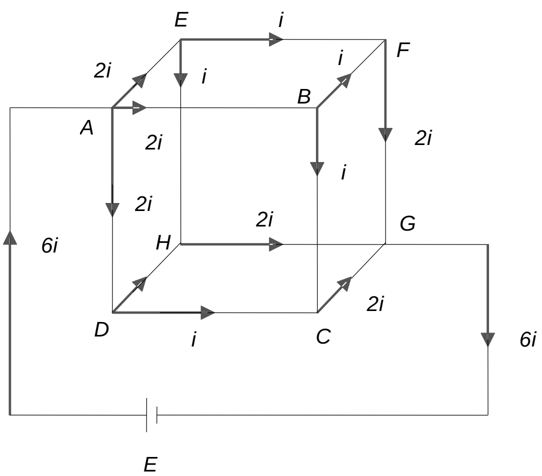
Full deflection current $i_g = 25 \times 4 \times 10^{-4} = 100 \times 10^{-4} A$

Using $R = \frac{V}{I_g} - G = \frac{25}{100 \times 10^{-4}} - 50 = 2450\Omega$ in series

809 **(a)**

The resistance of 25 W bulb is greater than 100 W bulb. So for the same current, heat produced will be more in 25 W bulb. So it will glow more brightly

810 **(d)**



Let *ABCDEFGH* be the skeleton cube formed by joining twelve equal wires each of resistance *r*. Let the current enters the cube at corner A and after passing through all twelve wires, let the current leaves at G, a corner diagonally opposite to corner A.

For the sake of convenience, let us suppose that the total current is $6i$. At A, this current is divided into three equal parts each ($2i$) along AE, AB and AD as the resistance along these paths are equal and their end points are equidistant from exit point G. At the points E, B and D, each part is further divided into two equal parts each part equal to i. The distribution of current in the various arms of skeleton cube is shown according to Kirchhoff's first law. The current leaving the cube at G is again 6i.

Applying Kirchhoff's second law to the closed circuit $ADCGA$, we get

$2ir + ir + 2ir = E$

Or $5ir = E$ ……(i)

Where E is the emf of the cell of neglegible internal resistance. If R is the resistance of the cube between the diagonally opposite corners A and G, then according to Ohm's law, we have

$6i \times R = E$ ……(ii)

From Eqs. (i) and (ii), we have

$6iR = 5ir$

Or $R = \frac{5}{6}r$

Hence, r=6Ω

$\therefore R = \frac{5}{6} \times 6$ or $R = 5\Omega$

811 **(c)**

$P = \frac{V^2}{R} = \frac{(18)^2}{6} = 54W$

812 **(d)**

$R_{\text{series}} = R_1 + R_2 + R_3 + \cdots$

813 **(c)**

Since current i is independent of the value of R_6, it is clear that the circuit is of a balanced Wheatstone bridge. As per condition of balance, we have

$\frac{R_1}{R_3} = \frac{R_2}{R_4} \Rightarrow R_1R_4 = R_2R_3$

814 **(b)**

If we take $R_1 = 4\Omega$, $R_2 = 12\Omega$, then in series resistance

$R = R_1 + R_2 = 4 + 12 = 16\Omega$

In parallel, resistance

$R = \frac{4 \times 12}{4 + 12} = 3\Omega$

So, $\mathrm{R_1} 4\Omega$ and $\mathrm{R_2} = 12\Omega$

815 **(d)**

Watt hour efficiency $= \frac{\text{Discharging energy}}{\text{Charging energy}}$

$= \frac{14 \times 5 \times 15}{15 \times 8 \times 10} = 0.875 = 87.5\%$

816 **(a)**

Effective emf in circuit $= 100 - 12 = 88V$

Current in circuit

$i = \frac{\text{effective emf}}{\text{resistance}} = \frac{88}{R}$

Or $R = \frac{88}{i} = \frac{88}{1} = 88\Omega$

817 **(c)**

These questions are done by hit and trial method only. You check all the options one by one till you get the final desired result

819 **(a)**

Total external resistance

$R' = R/3$

For maximum heat generation

$R_{\text{ext}} = r_{\text{int}}$

$\frac{R}{3} = 0.1$

$R = 0.3\ \Omega$

820 **(a)**

Neutral temperature remains same.

Inversion temperature, $T_i = 2T_n - T_c$

$= 2 \times 285 - 10 = 560°\text{C}$

821 **(c)**

$\frac{V^2}{R} + \frac{V^5}{5} = 4 \times \left(\frac{V^2}{R+5}\right)$ or $\frac{R+5}{5R} = \frac{4}{R+5}$

On solving, we get $R = 5\Omega$.

822 **(a)**

It is called safe current and is proportional to $r^{3/2}$

823 **(c)**

By using $R_t = R_0(1 + \alpha t)$

$3 \times R_0 = R_0(1 + 4 \times 10^{-3}t) \Rightarrow t = 500°\text{C}$

825 **(b)**

Thickness $d = \frac{V}{A} = \frac{m}{\rho A} = \frac{zIt}{\rho A}$

$= \frac{(3.3\times10^7)\times(1.5)\times(20\times60)}{9000\times(50\times10\times2)\times10^{-4}} = 6.6 \times 10^{-6}$ m.

826 **(b)**

Total resistance between points P and Q,

If m gram of the ice mean m given time t, then As per question,

$(10)^2 \times \frac{20}{3}(10 \times 60) = m \times 80 \times 4.2$

or $m = \frac{100\times20\times10\times60}{3\times80\times4.2} = 1.19 \times 10^3$ g

$= 1.19$ kg.

827 **(c)**

For a two cell battery

$I = \frac{2E}{2r} = \frac{E}{r}$

Similarly, for a n cell battery

$I = \frac{nE}{nr} - \frac{E}{r}$

So, current in the circuit does not depend on number of cells in the battery.

Hence, the correct graph will be (c).

828 **(b)**

$m = Zi\,t$ and $i\,t$ =Area of given curve

= Area of triangle + Area of rectangle

$\Rightarrow i\,t = \frac{1}{2} \times (2 \times 60) \times 1 + (6 - 2) \times 60 \times 1$

$= 300$

$\therefore Z = \frac{m}{i\,t} = \frac{m}{300}$

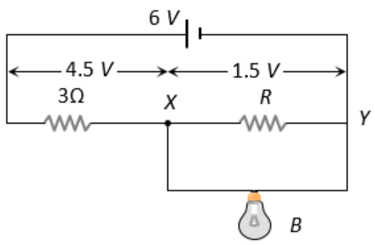
829 **(d)**

As circuit is open, therefore no current flows through circuit.

Hence, potential difference across X and Y =emf of battery =120V.

830 **(b)**

When bulb glows with full intensity, then voltage across it will be 1.5 V and voltage across 3 Ω resistance will be 4.5 V



Current through 3 Ω resistance $i = \frac{4.5}{3} = 1.5A$

Same current will flow between X and Y

So $V_{XY} = iR_{XY} \Rightarrow 1.5 = 1.5R_{XY} \Rightarrow R_{XY} = 1\Omega$

831 **(c)**

$R = R_1 + R_2 = \frac{\rho_1 l}{A} + \frac{\rho_2 l}{A} = (\rho_1 + \rho_2)\frac{l}{A}$ ...(i)

$R = \frac{\rho(2l)}{A}$ ...(ii)

From Eqs.(i) and (ii), $2\rho = \rho_1 + \rho_2$ or $\rho = \frac{\rho_1 + \rho_2}{2}$

833 **(b)**

Because H has positive charge

834 **(a)**

Resistance of 25 W bulb $= \frac{220 \times 220}{25} = 1936\ \Omega$

It's safe current $= \frac{220}{1936} = 0.11$ A

Resistance of 100 W bulb $= \frac{220 \times 220}{100} = 484\ \Omega$

It's safe current $= \frac{220}{484} = 0.48$ A

when connected in series to 440 V supply, then the current

$$i = \frac{440}{(1936 + 484)}$$

$= 0.18$ A

Thus, current is greater for 25 W bulb, so it will fuse.

835 **(b)**

Potential gradient $= \frac{e.R}{(R+r).L} = \frac{10\times3}{(3+3)\times5}$

$= 1V/m = 10\ mV/cm$

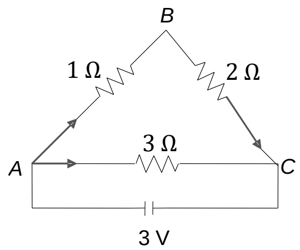
836 **(a)**

Power dissipated $P = \frac{V^2}{R_{\text{eff}}}$;

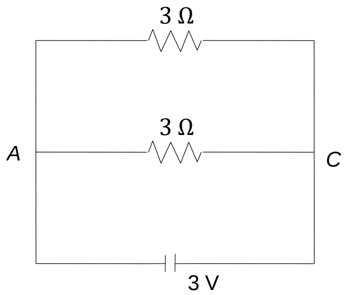
R_{eff} is least in case of figure (a). Hence power dissipated in circuit (a) is maximum

838 **(b)**

Required arrangement is shown in figure.

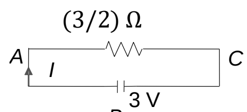


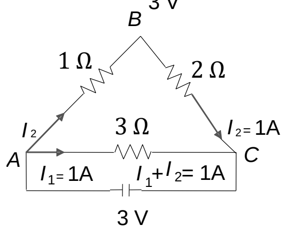
The equivalent circuit will look like (since the two resistances of 1Ω and 2Ω are in series, which from 3Ω which is in parallel with 3Ω resistance).



Therefore, the effective resistance is

$\frac{(1+2) \times 3}{(1+2)+3} = \frac{3}{2}\Omega$





$\therefore$ Current in the circuit,

$I = \frac{3}{\left(\frac{3}{2}\right)} = 2A$

$\therefore$ Current in 3Ω resistor$= \frac{I}{2} = 1A$

839 **(c)**

$m_{\text{Ag}}/m_{\text{Zn}} = E_{\text{Ag}}/E_{\text{Zn}} = 108/31$

or $m_{\text{Ag}} = m_{\text{Zn}} \times 108/31 = w \times 108/31$

3.48 w = 3.5 w

840 **(a)**

Meter bridge is an arrangement which works on Wheatstone's principle, so the balancing condition is

$\frac{R}{S} = \frac{l_1}{l_2}$

Where $l_2 = 100 - l_1$

Ist case $R = X, S = Y, l_1 = 20$ cm, $l_2 = 100 - 20 = 80$cm

$\therefore \quad \frac{X}{Y} = \frac{20}{80} \qquad \ldots$ (i)

IInd Case Let the position null point is obtained at a distance l from same end.

$\therefore R = 4X, S = Y, l_1 = l, l_2 = 100 - l$

So, from Eq. (i)

$\frac{4X}{Y} = \frac{l}{100 - l}$

$\Longrightarrow \frac{X}{Y} = \frac{l}{4(100 - l)} \quad \ldots$ (ii)

Therefore, form Eqs. (i) and (ii)

$\frac{l}{4(100 - l)} = \frac{20}{80}$

$\Longrightarrow \frac{l}{4(100 - l)} = \frac{1}{4}$

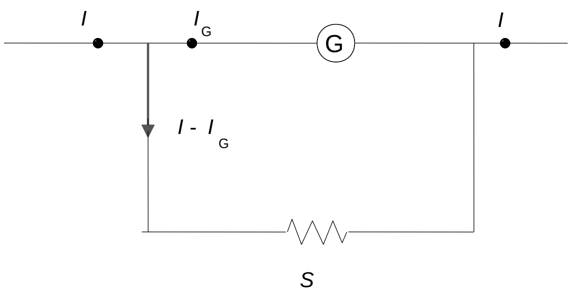
$\Longrightarrow \quad l = 100 - l$

$\Longrightarrow \quad 2l = 100$

Hence, $\quad l$=50cm

841 **(a)**

Given, galvanometer resistance G=240Ω



Shunt resistance $S =$?

$I_G = \frac{4}{100} I$

From figure voltage through the circuit.

$(I - I_G)S = I_G G$

or $\quad \left(I - \frac{4I}{400}\right) S = \frac{4I}{100} \times 240$

or $\quad S = \frac{4 \times 240}{96} = 10\Omega$

842 **(b)**

In series, the current I, is same in two bulbs.

Resistance$R = \frac{V^2}{P}$

And potential drop $(V) = IR$

$\therefore$ Potential difference across 60 W bulb is greater than the potential difference across 200 W bulb.

844 **(a)**

$E = xl = i\rho l \Rightarrow i = \frac{E}{\rho l} = \frac{2.4 \times 10^{-3}}{1.2 \times 5} = 4 \times 10^{-4} A$

845 **(c)**

Since the unit of electrical energy is kilowatt hour (kWh),

So total number of units consumed is

$N = (0.1 \times 8 + 0.3 \times 4) \times 30$

(Because June has 30 days)

$\therefore N = 60$ units

Total cost $= 60 \times 0.5 = 30$ Rs.

846 **(b)**

To shift the balance point on higher length, the potential gradient of the wire is to be decreased. The same can be obtained by decreasing the current of the main circuit, which is possible by increasing the resistance in series of potentiometer wire.

847 **(b)**

$\frac{7}{12} = \frac{1}{4} + \frac{1}{R} \Rightarrow R = 3\Omega$

848 **(d)**

Current in the bulb $= \frac{P}{V} = \frac{4.5}{1.5} = 3A$

Current in 1Ω resistance $= \frac{1.5}{1} = 1.5A$

Hence total current from the cell $i = 3 + 1.5 = 4.5A$

By using $E = V + ir \Rightarrow E = 1.5 + 4.5 \times (2.67) = 13.5V$

849 **(d)**

Colliding electrons lose their kinetic energy as heat

850 **(a)**

Thermo electric power $E = k\left(TT_0 - T_0 T_r - \frac{1}{2}T_0^2 + \frac{1}{2}T_r^2\right)$

$S = \frac{dE}{dT} = k\left[T - 0 - \frac{1}{2} \times 2T + 0\right]$

$= k[T_0 - T]$

At $\; T = T_0/2$

$S = \frac{1}{2}kT_0$

851 **(c)**

Power of the combination $P_s = \frac{P}{n} = \frac{1000}{2} = 500\text{W}$

852 **(b)**

For no current through galvanometer, we have

$\left(\frac{E_1}{500+X}\right)X = E \Rightarrow \left(\frac{12}{500+X}\right)X = 2 \Rightarrow X = 100\Omega$

853 **(c)**

$E_1 = ?, l_1 = 60cm; E_2 = 3V, l_2 = 45cm$

In balance condition

$\frac{E_1}{E_2} = \frac{l_1}{l_2} \Rightarrow \frac{E_1}{3} = \frac{60}{45} \Rightarrow E_1 = 4\ volt$

854 **(d)**

$\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_1 - l_2} = \frac{(6+2)}{(6-2)} = \frac{2}{1}$

855 **(a)**

According to Seebeck effect

856 **(a)**

From Kirchhoff's first law at junction *P*,

$I_1 + I_2 = 6$ ... (i)

From Kirchhoff's second law to the closed circuit *PQRP*,

$-2I_1 - 2I_1 + 2I_2 = 0$

$\Longrightarrow -4I_1 + 2I_2 = 0$

$\Longrightarrow 2I_1 - I_2 = 0$ ...... (ii)

Adding Eqs. (i) and (ii), we get

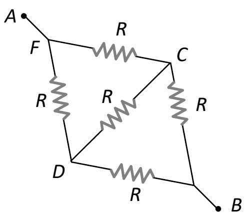
$3I_1 = 6 \Longrightarrow I_1 = 2A$

From Eq. (i),

$I_2 = 6 - 2 = 4A$

857 **(b)**

The given circuit can be redrawn as follows



Equivalent resistance between A and B is R and current $i = \frac{V}{R}$

858 **(d)**

Resistance of a conductor

$R = \frac{\rho l}{A}$ ....(i)

As ρ depends on the material,

so R depends on the material.

According to the given formula in Eq.(i), it depends on length. Moreover resistance $\propto$temperature.

If R_0= resistance of conductor at 0° C,

R_t= resistance of conductor at $t°C$,

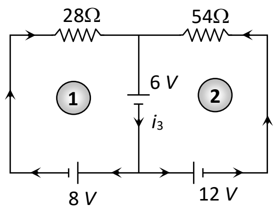
and α, β =temperature coefficient of resistance, then

$R_t = R_0(1 + \alpha t + \beta t^2)$

The resistance of a straight conductor does not depend on shape of cross-section.

859 **(d)**

Suppose current though different paths of the circuit is allows :



After applying KVL for loop (1) and loop (2)

We get $28i_1 = -6 - 8 \Rightarrow i_1 = -\frac{1}{2}A$

and $54i_2 = -6 - 12 \Rightarrow i_2 = -\frac{1}{3}A$

hence $i_3 = i_1 + i_2 = -\frac{5}{6}A$

860 **(d)**

$i^2Rt = ms\,\Delta t$

$\Rightarrow (4)^2 \times 7 \times 3 \times 60$

$= 0.1 \times 4.2 \times 10^3 \times [T - (20 + 273)]$

$\therefore T = 341\text{ K} = 68°\text{C}$

861 **(a)**

Current through R is maximum when total internal resistance of the circuit is equal to external resistance

862 **(c)**

A voltmeter is a high resistance device and is always connected in parallel with the circuit. While an ammeter is a low resistance device and is always connected is series with the circuit. So, to use voltmeter in place of ammeter a high resistance must be connected in series with the circuit.

863 **(a)**

$R = \frac{V}{i} = \rho\frac{l}{A} \Rightarrow \frac{2}{4} = \rho\frac{50 \times 10^{-2}}{(1 \times 10^{-3})^2} \Rightarrow \rho = 1 \times 10^{-6}\Omega m$

864 **(a)**

$P = \frac{V^2}{R}$

$\therefore R_{\text{hot}} = \frac{V^2}{R}$

$= \frac{200 \times 200}{100}$

$= 400\Omega$

$R_{\text{cold}} = \frac{400}{100} = 40\Omega$

865 **(b)**

Current, $i = (2.9 \times 10^{18} + 1.2 \times 10^{18}) \times 1.6 \times 10^{-19}$

$= 0.66$ A towards right

866 **(b)**

$3 = 1.5(1 + r) \Rightarrow r = 1\Omega$

867 **(d)**

When a single heater (resistance $R_1 = R$) is connected to 220 V, then it will consume a power P_1 =1000 W. If two such identical heaters are connected in parallel (total resistance $R_2 = R_1/2 = R/2$) to some source, then it will consume power P_2.

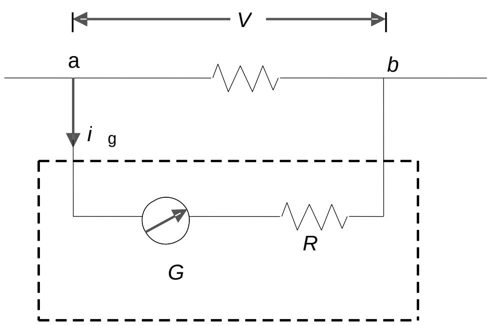
$\frac{P_2}{P_1} = \frac{R_1}{R_2}$

$\Rightarrow P_2 = 2P_1$

$P_2 = 2000$ W

868 **(a)**

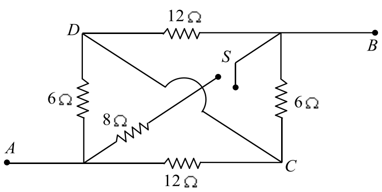
A voltmeter is an instrument used to measure the potential difference between two points in an electrical circuit directly in volts. Voltmeter is essentially a galvanometer which is connected in parallel across two points in the circuit between which the potential difference is to be measured. The potential difference read by the voltmeter is slightly less than the actual value to be measured. Hence, the resistance of the voltmeter should be as high as possible so, that on connecting it in a circuit across two points the potential difference may not fall appreciably.



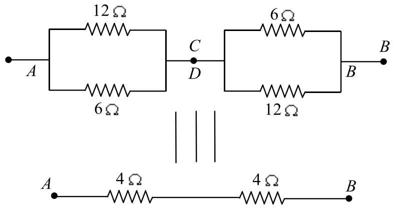
Voltmeter

Hence, a voltmeter is made by connecting a high resistance in series with a pivoted type moving coil galvanometer G. The value of R depends upon the range of the required voltmeter.

869 **(b)**



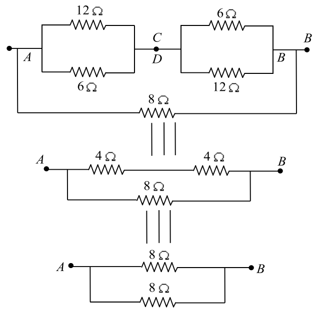
When switch S is open, the corresponding equivalent circuit diagram is as shown in the figure



The equivalent resistance between A and B is

$$R_{eq} = \frac{12 \times 6}{12 + 6} + \frac{6 \times 12}{6 + 12} = 4 + 4 = 8\Omega$$

When switch S is closed, the corresponding equivalent circuit diagram is as shown in the figure below



The equivalent resistance A and B is

$R_{eq}'''''''''''''''''''''''''''''' = \frac{8 \times 8}{8 + 8} = 4\Omega$

870 **(d)**

The bridge $ABCD$ is balanced if

$\frac{10}{R_1} = \frac{30}{9} \Rightarrow R_1 = 3\Omega$

When the bridge is balanced, no current flows in the arm BD. Therefore, R_2 can have any finite value

871 **(d)**

Resistance of each part will be $\frac{R}{n}$; such n parts are joined in parallel so $R_{eq} = \frac{R}{n^2}$

872 **(a)**

The rate of dissipation of electric energy is called electric power

$W = Vit$

The electric power dissipated will be is given by

$$P = \frac{W}{t} = \frac{Vit}{t} = Vi$$

$$= \frac{V^2}{R} \qquad ...(i)$$

When resistance is doubled, then let electric power is P'.

$$\therefore \quad P' = \frac{V^2}{2R} \qquad ...(ii)$$

From Eqs, (i) and (ii), we get

$$P' = \frac{1}{2}P$$

So, power becomes $\frac{1}{2}$ of initial value.

873 **(d)**

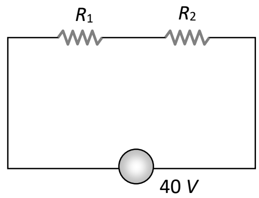
Bulb (I):Rated current $I_1 = \frac{P}{V} = \frac{40}{220} = \frac{2}{11} amp$

Resistance $R_1 = \frac{V^2}{P} = \frac{(220)^2}{40} = 1210\Omega$

Bulb (II):Rated current $I_2 = \frac{100}{220} = \frac{5}{11} amp$

Resistance $R_2 = \frac{(220)^2}{100} = 484\ \Omega$

When both are connected in series across 40 V supply



Total current through supply

$$I = \frac{40}{P_1 + P_2} = \frac{40}{1210 + 484} = \frac{40}{1254} = 0.03A$$

This current is less than the rated current of each bulb. So neither bulb will fuse

Short Trick : Since $V_{Applied} < V_{Rated}$, neither bulb will fuse

874 **(c)**

$m = zit$

$$9 = z \times 10^5 \Rightarrow z = \frac{9}{10^5}\,\mathrm{g\,C^{-1}}$$

$\therefore m = zit = 9 \times 10^{-5} \times 50 \times (20 \times 60)$ =5.4 g.

875 **(a)**

For maximum energy, we have

External resistance of the circuit

= Equivalent internal resistance of the circuit

$i.e. R = \frac{r}{2}$

876 **(a)**

Given problem is the case of mixed grouping of cells

So total current produced $i = \frac{nE}{R + \frac{nr}{m}}$

Here $m = 100, n = 5000, R = 500\Omega$

$E = 0.15\ V$ and $r = 0.25\Omega$

$$\Rightarrow i = \frac{5000 \times 0.15}{500 + \frac{5000 \times 0.25}{100}} = \frac{750}{512.5} \approx 1.5\ A$$

877 **(c)**

Let time taken in boiling the water by the heater is t s. Then

$$Q = ms\Delta T \ \Rightarrow \frac{Pt}{J} = ms\Delta T$$

$$\therefore \frac{836}{4.2}\ t = 1 \times 1000(40 - 10)$$

$$\frac{836}{4.2} t = 1000 \times 30$$

$$t = \frac{1000 \times 30 \times 4.2}{836} = 150\text{s}$$

878 **(a)**

Effective resistance of three resistances between C and

$$D = \frac{R \times 2R}{R + 2R} = \frac{2}{3}R$$

Total resistance between A and B

$$= R + \frac{2}{3}R + R = \frac{8}{3}R = \frac{8}{3} \times 3 = 8\Omega$$

879 **(a)**

Heat produced $H = Vit = Pt$ J

Where, $P = Vi$ watt

$\therefore H = 500 \times 15 \times 60 = 45 \times 10^4$ J

Heat absorbed by water = mass ×

specific heaat capacity

× rise in temperature

$= 1 \times 4200 \times (100 - 15)$

$= 4.2 \times 85 \times 10^{-3}$

Efficiency $= \frac{\text{heat absorbed}}{\text{heat produced}} \times 100$

$$= \frac{85 \times 4.2 \times 10^3}{45 \times 10^4} \times 100 = 79\%$$

880 **(b)**

If number of collisions of the free electrons with the lattice is decreased, the time of relaxation of electrons will increase. Due to which drift velocity of electrons will increase and hence current will increase

881 **(a)**

Power is the amount of work done or energy (Q) transferred per unit of time (t).

$$\therefore \quad P = \frac{H}{t}$$

$$H = mc\,\Delta\theta$$

Where m is mass, c the specific heat and $\Delta\theta$ the temperature difference.

$$\therefore P = \frac{mc\,\Delta\theta}{t}$$

$\Delta\theta = (35 - 20)°\text{C} = 15°\text{C}$

$C = 1000, 4.2\ \text{J} = 1\ \text{cal}$

$t = 1\ \text{min} = 60\text{s}$

$$\therefore P = \frac{1 \times 1000 \times 15 \times 4.2}{60}\ \text{Js}^{-1} = 1050\ \text{W}$$

882 **(b)**

Drift velocity,

$$v_d = \frac{i}{neA}$$

Where I is current, n the number of electrons, e the electron charge and A the area of cross-section of wire.

Number of electrons per unit volume

$$n = \frac{2 \times 10^{21}}{A \times 100}$$

So, current in the wire

$$i = neAv_d$$

$$i = \frac{2 \times 10^{21}}{A \times 100} \times 1.6 \times 10^{-19} \times A \times 0.25$$

=0.8A

883 **(d)**

Resistance of a conductor, $R = \frac{m}{ne^2\tau}\frac{l}{A}$

Where the symbols have their usual meaning

As the temperature increases, the relaxation time τ decreases

884 **(c)**

In India, power, $P_1 = \frac{V^2}{R} = \frac{220^2}{R}$

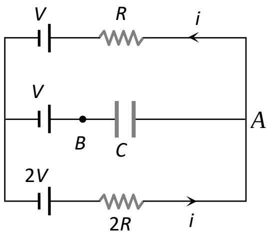
In USA, power, $P_2 = \frac{V'^2}{R'} = \frac{(110)^2}{R'}$

As $P_1 = P_2$, so $\frac{220^2}{R} = \frac{(110)^2}{R'}$

or $R' = \frac{(110)^2}{(220)^2}R = \frac{R}{4}$

885 **(c)**

Moving anticlockwise from A



$$-iR - V + 2V - 2iR = 0$$

or $3iR = V$ or $i = \frac{V}{3R}$

$$V_A - V_B = iR + V - V = iR$$

$\Rightarrow$ Potential drop across $C = \frac{V}{3}$

886 **(c)**

If l is the balancing length for R_1, and l' for R_2,

$\frac{V_0}{L_0}.l = \frac{ER_1}{(r+R_1+R_2)} \Rightarrow \frac{V_0}{L_0}.l = \frac{ER_1}{(r_1+9R_1)}$ as $R_2 = 8R_1$

$$\frac{V_0}{L_0}l' = \frac{E.R_2}{(r_1 + 9R_1)} = \frac{E.8R_1}{(r_1 + 9R_1)}$$

$$\therefore \frac{l'}{l} = \frac{R_2}{R_1} = \frac{8R_1}{R_1} \Rightarrow l' = 8\,l$$

887 **(c)**

Production of heat at junctions due to current is known as Peltier effect

889 **(c)**

If volume and density remains same, then resistance of wire

$R \propto l^2$

Where $l$is the length of the wire

$$\therefore R' = \left(1 + \frac{10}{100}l\right)^2 = \left(\frac{11}{10}\right)^2 R$$

Hence,

$$\frac{R' - R}{R} = \frac{21}{100} = 21\%$$

Therefore, change in resistance of wire =21%

890 **(c)**

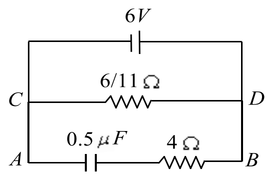
In series $i = \frac{nE}{nr+R} \Rightarrow 0.6 = \frac{n\times1.5}{n\times0.5\times20} \Rightarrow n = 10$

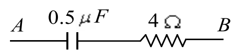
891 **(d)**

The temperature coefficient of resistivity for thermister is negative. Therefore by increase in temperature the resistivity of the thermister decreases.

892 **(d)**

In steady state capacitor is fully charged and no current flows through it





$\therefore$ No current passes through 4Ω

$$\frac{1}{R_{eff}} = \frac{1}{1} + \frac{1}{2} + \frac{1}{3}$$

$$= \frac{6 + 3 + 2}{6} = \frac{11}{6}$$

$$\Rightarrow R_{eff} = \frac{6}{11}\Omega$$

Current $= \frac{6\times11}{6} = 11A$

$$Q = CV = 0.5 \times 10^{-6} \times 6 = 3.0 \times 10^{-6}C = 3\mu C$$

893 **(b)**

Let $R = 100\Omega$

$$\therefore \quad R' = 100 + 100 \times \frac{10}{100}$$

$$= 110\Omega$$

$$\therefore \Delta R = R' - R$$

$$= 110 - 99 = 11\Omega$$

894 **(b)**

$$R \propto \frac{l}{A} \propto \frac{l}{d^2} \Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2} \times \left(\frac{d_2}{d_1}\right)^2 = \frac{L}{4L}\left(\frac{2d}{d}\right)^2 = 1$$

$$\Rightarrow R_2 = R_1 = R$$

895 **(d)**

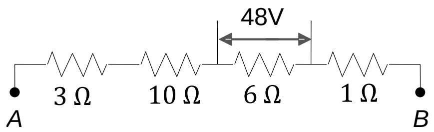
Effective value of resistance of parallel combination of 20Ω, 30 Ω, 60Ω is R_1, where

$$\frac{1}{R_1}=\frac{1}{20}+\frac{1}{30}+\frac{1}{60}=\frac{3+2+1}{60}=\frac{6}{60}=\frac{1}{10}$$

$R_1 = 10\Omega$

Similarly effective value of parallel combination of 24Ω and 8Ω resistance is given by

$$R_2=\frac{24\times 8}{24+8}=6\Omega$$



Hence, the circuit may be redrawn as shown in the adjacent figure, where total resistance across A and B, $R = 3 + 10 + 6 + 1 = 20\Omega$. As potential across $R_2 (= 66\Omega)$ is 48 V, hence

$$V_{AB}=48\times\frac{R}{R_2}=\frac{48\times 20}{6}=160\text{V}$$

896 **(b)**

$m = z\,I\,t = z\left(\frac{P}{V}\right)t$

$= 0.367\times 10^{-6}\left(\frac{100\times1000}{125}\right)\times 60$ kg

$= 0.017616$ kg $= 17.616$ g.

897 **(d)**

$\frac{X}{1}=\frac{20}{80}\Rightarrow X=\frac{1}{4}\Omega=0.25\Omega$

898 **(a)**

As we know that,

$P=\frac{V^2}{R}$

$\Rightarrow R=\frac{V^2}{P}$

$\Rightarrow\ R\propto\frac{1}{P}$

Hence, the resistance of 25 W bulb is greater than the resistance of 100 W bulb.

Now, both the bulbs are joined in series so the current will be same.

So, heat produced by the bulbs

$H = i^2\,Rt\ \Rightarrow\ H\propto R$

So, the heat produced by the 25 W bulb is greater than the bulb of 100 W, because its resistance is more than that of 100 W bulb. Hence, 25 W bulb will glow brighter.

899 **(b)**

Temperature of inversion is

$T_i = 2T_n - T_0$

$\therefore T_i = 2\times 270 - 10 = 530°\text{C}$

900 **(d)**

$\frac{i}{ig}=1+\frac{G}{S}\Rightarrow\frac{5}{1}=1+\frac{60}{S}\Rightarrow S=15\Omega$

901 **(a)**

$R = G(n-1) = 50\times 10^3(3-1) = 10^5\Omega$

902 **(c)**

$R_{\text{bulb}}=\frac{220^2}{100}=484\Omega;$

$R_{\text{geyser}}=\frac{220^2}{1000}=48.4\Omega$

When only bulb is on,

$V_{\text{bulb}}=\frac{220\times484}{484+6}=217.4$ volt

When geyser is also switched on, effective resistance of bulb and geyser

$=\frac{484\times48.4}{484+48.4}=44\ \Omega$

$V_{\text{bulb}}=\frac{220\times44}{(44+)}=193.6$ V

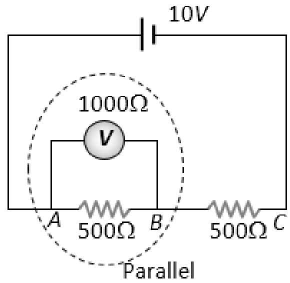
Hence, the potential drop $= 217.4\times 193.6$

$= 23.8$ V≈ 24 V.

903 **(d)**

Resistance between A and $B=\frac{1000\times500}{(1500)}=\frac{1000}{3}$

So, equivalent resistance of the circuit



$R_{eq}=500+\frac{1000}{3}=\frac{2500}{3}$

∴ Current drawn from the cell

$i=\frac{10}{(2500/3)}=\frac{3}{250}A$

Reading of voltmeter $i.e.$

Potential difference across $AB=\frac{3}{250}\times\frac{1000}{3}=4\,V$

904 **(a)**

In figure (b) current through $R_2=i-\frac{i}{10}=\frac{9i}{10}$

Potential difference across R_2 = Potential difference across

$R\Rightarrow R_2\times\frac{9}{10}i=R\times\frac{i}{10}\ i.e.R_2=\frac{R}{9}=\frac{11}{9}\Omega$

$R_{eq}=\frac{R_2\times R}{(R_2+R)}=\frac{\frac{11}{9}\times\frac{11}{1}}{\frac{11}{9}+\frac{11}{1}}=\frac{11}{10}\Omega$

Total circuit resistance $=\frac{11}{10}+R_1=R=11\Rightarrow$

$R_1 = 9.9\Omega$

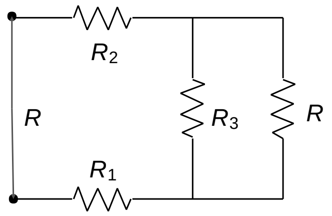
905 **(c)**

Number attached for brown, black, green and silver are 0, 5, ±10% Therefore the resistance of given resistor

$= 10 \times 10^5 \Omega \pm 10\% = 1.0 \times 10^6 \Omega \pm 10\%$

906 **(d)**

Let R be the equivalent resistance. Then addition/ subtraction of one more seat of resistors R_1, R_2 and R_3 will not affect the total resistance. Thus,



$R = R_1$ +(parallel combination of R and R_2)+R_3

$$R = R_1 + \left(\frac{RR_3}{R + R_3}\right) + R_2$$

$$\Rightarrow R^2 + RR_3 = RR_1 + R_1R_3 + RR_3 + RR_2 + R_2R_3$$

$$\Rightarrow R^2 - R(R_1 + R_2) = (R_2 + R_1)R_3 = 0$$

$$\Rightarrow R = \frac{(R_1 + R_2) \pm \sqrt{(R_1 + R_2)^2 + 4(R_1 + R_2)R_3}}{2}$$

As R cannot be negative, hence

$$R = \frac{1}{2}\left[(R_1 + R_2 + \sqrt{(R_1 + R_2)^2 + 4(R_1 + R_2)R_3}\right]$$

$$= \frac{1}{2}\left[(R_1 + R_2) + \sqrt{(R_1 + R_2)(R_1 + R_2 + 4R_3)}\right]$$

907 **(b)**

$$P \propto \frac{1}{R} \Rightarrow \frac{P_1}{P_2} = \frac{R_2}{R_1} \Rightarrow \frac{200}{100} = \frac{R_2}{R_1} \Rightarrow R_2 = 2R_1$$

908 **(d)**

Equivalent weight of copper $= \frac{64}{2} = 32$

$$\frac{\text{Equivalent weight of } Cu}{\text{Equivalent weight of } Ag} = \frac{\text{Weight of } Cu \text{ deposited}}{\text{Weight of } Ag \text{ deposited}}$$

Weight of copper deposited $= \frac{10.8 \times 32}{108} = 3.2gm$

909 **(a)**

The balance condition of a meter bridge experiment

$$\frac{R}{S} = \frac{l_1}{(100 - l_1)}$$

Here, $R = R_1, S = R_2$

$$\therefore \frac{R_1}{R_2} = \frac{l_1}{(100 - l_1)}$$

Ist case

$$\frac{R_1 + 10}{R_2} = \frac{50}{50} \quad \ldots\ldots\ldots(i)$$

$$\Rightarrow R_1 + 10 = R_2$$

IInd case

$$\frac{R_1}{R_2} = \frac{40}{60}$$

$$\Rightarrow R_2 = \frac{60}{40}R_1 \quad \ldots\ldots(ii)$$

So, Eqs. (i) and (ii) give

$$R_1 + 10 = \frac{60}{40}R_1$$

$$\Rightarrow \frac{60}{40}R_1 - R_1 = 10$$

$$\Rightarrow \frac{20}{40}R_1 = 10$$

$$\Rightarrow R_1 = \frac{10 \times 40}{20}$$

$$\therefore R_1 = 20\Omega$$

910 **(d)**

Resistance of original wire is

$$R = \rho\frac{l}{A}$$

ρ ,being the specific resistance of wire. When the wire is cut in two equal halves then resistance becomes

$$R' = \frac{\rho l/2}{A} = \frac{R}{2}$$

Thus, the net resistance of parallel combination of two halves is given by

$$R_{\text{net}} = \frac{R' \times R'}{R' + R'}$$

$$= \frac{R'}{2} = \frac{R}{2 \times 2} = \frac{6}{4} = 1.5\Omega$$

911 **(c)**

Charge (q) is given by

$$q = \int Idt$$

Given, $I = 1.2t + 3$

Integrating the expression using

$$\int x^n\, dx = \frac{x^{n+1}}{n+1}$$

We have

$$q = \int Idt = 1.2 \int t\, dt + 3\int dt$$

$$q = 1.2\left[\frac{t^2}{2}\right]_0^5 + 3[t]_0^5$$

$$q = \frac{1.2}{2} \times 25 + 3 \times 5$$
$$q = 15 + 15 = 30C$$

912 **(d)**

Equivalent resistance of parallel resistors is always less than any of the member of the resistance system

913 **(b)**

Supercurrent always flows on the surface of the superconductor.

914 **(a)**

$$0.9(2 + r) = 0.3(7 + r) \Rightarrow 6 + 3r = 7 + r \Rightarrow r = 0.5\ \Omega$$

915 **(c)**

$$i = \frac{m}{Zt} = \frac{0.972}{0.00018 \times 3 \times 3600} = 0.5\ A$$

916 **(a)**

$$T_n = \frac{T_i + T_C}{2} \Rightarrow T_i = 2T_n - T_C$$

917 **(b)**

$E = 16T - 0.04T^2$

At temperature of inversion, $E = 0$

$\therefore 16T_i - 0.04T_i^2 = 0$

$$\Rightarrow T = \frac{16}{0.04} = 400°\text{C}$$

918 **(c)**

For portion CD slope of the curve is negative $i.e.$ resistance is negative

919 **(d)**

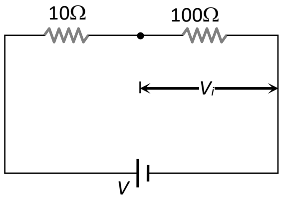
In the normal condition current flows from X to Y through cold junction. After increasing the temperature of hot junction beyond temperature of inversion the current is reversed $i.e. X$ to Y through hot junction or Y to X through cold junction

920 **(c)**

$R = kl_1$ and $R + X = kl_2$

921 **(c)**

Before connecting the voltmeter, potential difference across 100Ω resistance

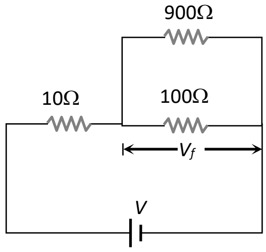


$$V_1 = \frac{100}{(100 + 10)} \times V = \frac{10}{11} V$$

Finally after connecting voltmeter across 100Ω equivalent resistance

$$\frac{100 \times 900}{(100 + 900)} = 90\Omega$$

Final potential difference



$$V_f = \frac{90}{(90 + 10)} \times V = \frac{9}{10} V$$

$$\%\ \text{error} = \frac{V_i - V_f}{V_i} \times 100$$

$$= \frac{\frac{10}{11}V - \frac{9}{10}V}{\frac{10}{11}V} \times 100 = 1.0$$

923 **(a)**

From Joule's law, the heat produced is given by

$$P = \frac{V^2}{R}$$

Where V is potential and R the resistance.

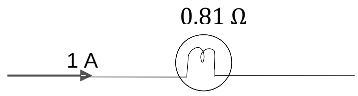
When one bulb is fused, the total resistance of the circuit decreases. Hence, (P) illumination increases.

924 **(b)**

$$S = \frac{i_g \times G}{i - i_g} = \frac{10 \times 10^{-3} \times 50}{1 - 10^{-3} \times 10} = \frac{50}{99}\Omega \text{ in parallel}$$

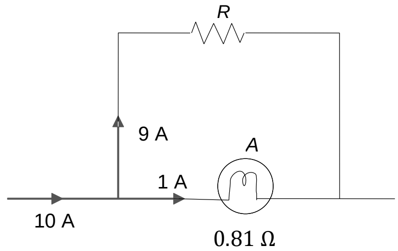
925 **(d)**

To increase the range of ammeter we have to connect a small resistance in parallel



(shunt), let its value be R.

Apply KCL at junction to divide the current.



Voltage across R= Voltage across ammeter

$\Longrightarrow\ 9R = 0.81 \times 1$

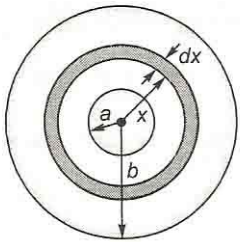
$$\Longrightarrow\quad \text{R} = \frac{0.81}{9} = 0.09\Omega$$

926 **(d)**

Consider a concentric spherical shell of radius x

and thickness dx as showing in figure. Its resistance, dR is

$$dR = \frac{\rho dx}{4\pi x^2}$$



$\therefore$ Total resistance, $R = \frac{\rho}{4\pi}\int_a^b \frac{dx}{x^2} = \frac{\rho}{4\pi}\left[\frac{1}{a} - \frac{1}{b}\right]$

927 **(a)**

Cu voltameter with soluble electrodes obeys ohm's law. In water voltameter, in the beginning when V is small ($< 1.7\ volt$), very little current flows, the voltameter does not obey ohm's law. As soon as V exceeds 1.7 $volt$ (back e.m.f.) the current increases steadily according to ohm's law

928 **(d)**

The resistance R of a particular conductor is related to the resistivity ρ of its material by

$$R = \frac{\rho l}{A}$$

Or

$$\rho = \text{resistivity } = \frac{RA}{l}$$

Given, R=0.072Ω

$A = 2mm \times 2mm = 4 \times 10^{-6}m^2, l$=12

$$\therefore \quad \rho = \frac{0.072 \times 4 \times 10^{-6}}{12}$$

$= 2.4 \times 10^{-8}\Omega$m

929 **(b)**

Shunt

$$S = \frac{I_g G}{I - I_g}$$

Here, $\frac{I_g}{I} = \frac{1}{34}$

$$\therefore \frac{1}{34} = \frac{S}{S+G}$$

$$\therefore \quad S = \frac{G}{33} = \frac{3663}{33} = 111\Omega$$

930 **(b)**

$$R_{AB} = R_1 + \frac{R_2 R_3}{R_2 + R_3} + R_4 = 2 + \frac{4 \times 4}{4+4} + 2 = 6\Omega$$

931 **(a)**

Effective resistance R_P of 4 Ω, 6Ω and 12 Ω in parallel will be

$$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{6} + \frac{1}{12} = \frac{6}{12} = \frac{1}{2} \text{ or } R_p = 2\Omega$$

Total resistance of circuit = 2 + 2 = 4 Ω

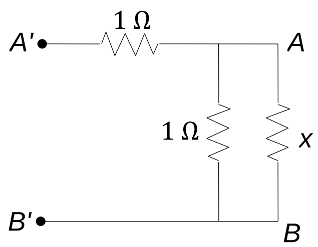
The battery current, $i = 4/4 = 1$A

932 **(d)**

The x be the total resistance of infinite network of resistance connected to points A and B. Therefore the addition of one step of resistances in the infinite network of resistances will not change the total resistance x of the network. Therefore equivalent circuit will be as shown in figure. Then total resistances between A' and B' is x given by

$$x = 1 + \frac{1+x}{1+x} = \frac{1+2x}{1+x}$$

or $x + x^2 = 1 + 2x$



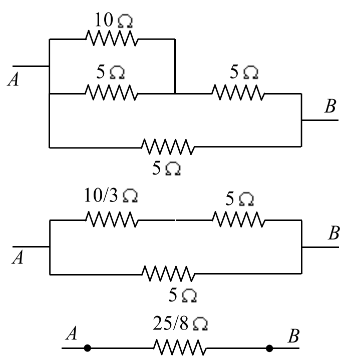
or $x^2 - x - 1 = 0$ or $x = \frac{1 \pm \sqrt{5}}{2} = \frac{1+\sqrt{5}}{2}$

Since negative value of R is not possible

933 **(c)**

Current capacity of a fuse wire should be slightly greater than the total rated load current

934 **(a)**



$R_{AB} = 3.12\Omega$

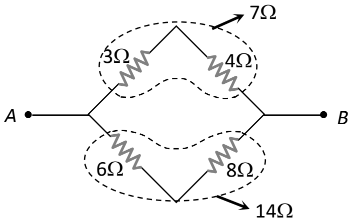
935 **(b)**

$i^2Rt = C\theta = 3C; C =$ Thermal capacity

when $i_1 = 2i \Rightarrow C\theta_1 = 4i^2Rt = 4 \times 3C \Rightarrow \theta_1 =$ 12°C

936 **(a)**

The given circuit is a balanced Wheatstone bridge, hence it can be redrawn as follows



$$\Rightarrow R_{eq} = \frac{7 \times 14}{(7+14)} = \frac{14}{3}\Omega$$

938 **(d)**

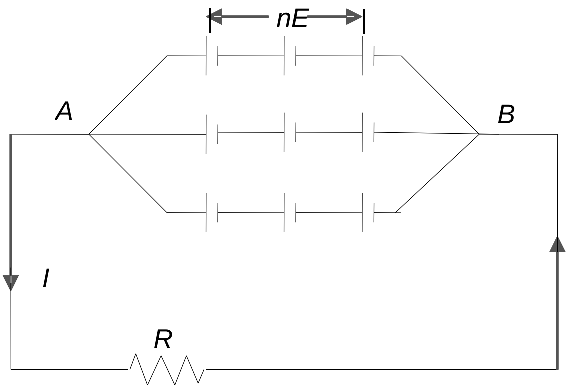
Battery is short circuited so potential difference is zero

939 **(c)**

When we measure the emf of a cell by the potentiometer then no current flows in the circuit in zero-deflection condition *ie*, cell is in open circuit. Thus, in this condition the actual value of a cell is found. In this way, potentiometer is equivalent to an ideal voltmeter of infinite resistance.

940 **(a)**

If the cells are connected as shown in figure, they are said to be connected in mixed grouping. Let there be n cells in series in one row and m rows of cells in parallel. Suppose all the cells are identical. Let each cell be of emf E and internal resistance r.



In each row, there are n cells in series, therefore their total internal resistance$=nr$.

Their total emf $= nE$.

Since, there are m rows of cells in parallel therefore, total internal resistance (r_p) of all the cells is given by

$$\frac{1}{r_p} = \frac{1}{nr} + \frac{1}{nr} + \cdots \text{upto } m \text{ terms}$$

$$= \frac{m}{nr}$$

or $r_p = \frac{nr}{m}$

Total resistance in their circuit $= R + nr/m$

Effective emf of all the cells$=$ nE

The current in the external resistance is given by

$$I = \frac{nE}{R + nr/m} = \frac{mnE}{mR + nr}$$

The current I will be maximum, if $mR + nr$ is minimum.

Mathematically, it can be shown that $mR + nr$ is minimum, if

$mR = nr$

or $R = \frac{nr}{m}$

Here, $mn = 45$ (given)....(i)

and $m \times 2.5 = n \times 0.5$

Or $n = 5m$ ....(ii)

From Eqs. (i) and (ii), we have

$5m^2 = 45$

or $m^2 = 9$

or $m = 3$

∴ n=15

941 **(d)**

The thermo-couple works in a closed circuit. Since the two pipes are isolated, only b *and* a are closed-circuits.

In circuit b, the two constantans wires to the cold copper

pipe produce 2 opposing currents.

In circuit a, the copper-constantan junction is maintained across the cold pipe. A steady current can flow.

942 **(c)**

$E = 40t + \frac{1}{10}t^2$ at

Inversion, E will be minimum

$$\frac{dE}{dt} = 0$$

$$\frac{d}{dt}\left(40t + \frac{1}{10}t^2\right) = 0$$

$$40 + \frac{1}{5}t = 0$$

$$t = -40 \times 5$$

$$t = -200°\text{C}$$

943 **(b)**

Hydrogen liberated per sec $= \frac{0.224}{100}\text{Ls}^{-1}$.

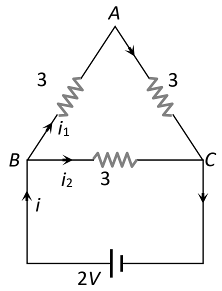
In order to liberate 11.2 L of hydrogen per sec charge passed $= 96500\ \text{Cs}^{-1}$

To liberate $= \frac{0.224}{100}\text{Ls}^{-1}$ of hydrogen

$= \frac{96500}{11.2} \times \frac{0.224}{100}$
$= 19.30\ Cs^{-1} = 19.3A$

944 **(d)**
The speed at which current travels through the conductors means the speed of electric effect travelling through conductor which is at a speed of light

945 **(a)**
The circuit can be drawn as follows



Equivalent resistance $R = \frac{3\times(3+3)}{3+(3+3)} = 2\Omega$
Current $i = \frac{2}{2} = 1A$. So, $i_1 = 1 \times \left(\frac{3}{3+6}\right) = \frac{1}{3}A$
Potential difference between A and $B = \frac{1}{3} \times 3 = 1 volt$

946 **(a)**
$P = \frac{V^2}{R} \Rightarrow 100 = \frac{(200)^2}{R} \Rightarrow R = \frac{4 \times 10^4}{10^2} = 400\ \Omega$
Now, $i = \frac{V}{R} = \frac{100}{400} = \frac{1}{4} amp$

947 **(a)**
The potential difference across $300\ \Omega = 60 - 30 = 30$V Therefore the effective resistance of voltmeter resistance R and $400\ \Omega$ in parallel will be equal to $300\ \Omega$, as 60 V is equally divided between two parts. So $300 = \frac{R\times 400}{R+400}$

or $300R + 120000 = 400R$ or $R = 1200\ \Omega$

948 **(b)**
When 1 bulb fuses, the total resistance of the circuit decreases hence the current increases. Since $P = i^2R$, therefore illumination increases

949 **(a)**
Here $R_{XWY} = \frac{R}{2\pi r} \times (r\alpha) = \frac{R\alpha}{2\pi}$ $\left[\because \alpha = \frac{l}{r}\right]$
and $R_{XZY} = \frac{R}{2\pi r} \times r(2\pi - \alpha) = \frac{R}{2\pi}(2\pi - \alpha)$

$$R_{eq} = \frac{R_{XWY}R_{XZY}}{R_{XWY} + R_{XZY}} = \frac{\frac{R\alpha}{2\pi} \times \frac{R}{2\pi}(2\pi - \alpha)}{\frac{R\alpha}{2\pi} + \frac{R(2\pi-\alpha)}{2\pi}}$$
$$= \frac{R\alpha}{4\pi^2}(2\pi - \alpha)$$

950 **(a)**
$q = it =$ current $\times$ time

951 **(a)**
As galvanometer deflection remains unaffected with switch S open or closed, hence the bridge circuit is balanced. Hence, $I_p = I_Q$ and $I_R = I_G$

However, as $P \neq R$, hence $I_P \neq I_R$

952 **(d)**
Resistance of bulb,
$R = \frac{V^2}{P} = \frac{220 \times 220}{300} = \frac{484}{3}\Omega$
New power, $P' = \frac{(110)^2}{R} = \frac{110\times 110}{484/3} = 75$ watt
reduction
Of power $= \frac{300-75}{300} \times 100 = 75\%$

953 **(a)**
Peltier coefficient is directly proportional to absolute temperature T.

954 **(a)**
Resistance of a wire $R = \frac{\rho L}{A} = \frac{4\rho L}{\pi D^2}$ where D is diameter of wire

As $R \propto L$ and $R \propto \frac{1}{D^2}$, hence it is clear that resistance will be maximum if $\frac{L}{D^2}$ is maximum. On calculation we find

$\frac{L}{D^2}$ maximum when, $L = 50$ cm and $D = 0.5$ mm

955 **(b)**
$i \propto \frac{1}{R}$

956 **(d)**
$V = xl \Rightarrow iR = xl$
$\Rightarrow i \times 10 = \left(\frac{2 \times 10^{-3}}{10^{-2}}\right) \times 50 \times 10^{-2} = 0.1$
$\Rightarrow i = 10 \times 10^{-3}A = 10\ mA$

957 **(b)**
The power of 1st bulb
$$F_1 = \frac{V^2}{R_1} = \frac{(220)^2}{R_1}$$
$$100 = \frac{(220)^2}{R_1}$$
or $R_1 = \frac{200 \times 200}{100} = 400\ \Omega$
The power of IInd bulb
$$P_2 = \frac{(200)^2}{R_2}$$
or $200 = \frac{(200)^2}{R_2}$
or $R_2 = \frac{200 \times 200}{200} = 200\ \Omega$
The bulbs are joined in series.

So, $R = R_1 + R_2$
$= 400 + 200 = 600\ \Omega$

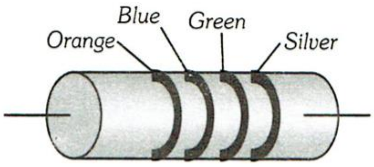
The total power

$$P = \frac{V^2}{R} = \frac{(200)^2}{600}$$

$$P = 66.7\ \text{W}$$

958 **(a)**

First colour gives first digit, second colour gives second digit and third colour gives the multiplier and fourth colour gives the tolerance



$= 36 \times 10^5 \Omega \pm 10\%$

959 **(c)**

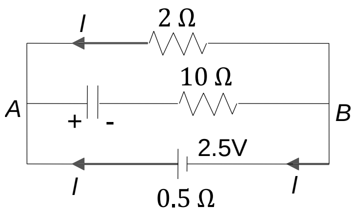
According to loop rule,

$2.5 - 0.5I - 2I = 0$

$\Rightarrow I = 1A$

$V_A - V_B = \frac{q_o}{C} = 2I = 2V$

$q_o = C \times 2 = 2 \times 10^{-6} \times 2 = 4\mu\text{C}$



960 **(d)**

In Stretching of wire $R \propto l^2 \Rightarrow \frac{R_1}{R_2} = \left(\frac{l_1}{l_2}\right)^2$

If $l_1 = 100$, then $l_2 = 110 \Rightarrow \frac{R_1}{R_2} = \left(\frac{100}{110}\right)^2$

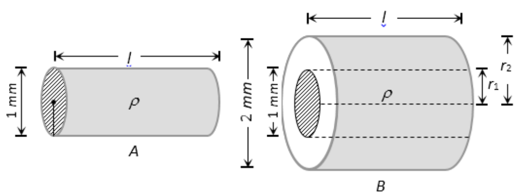
$\Rightarrow R_2 = 1.21\ R_1$

Resistivity doesn't change with stretching

961 **(c)**

For conductor $A, R_A = \frac{\rho l}{\pi r_1^2}$,

For conductor $B, R_B = \frac{\rho l}{\pi(r_2^2 - r_1^2)}$



$$\Rightarrow \frac{R_A}{R_B} = \frac{r_2^2 - r_1^2}{r_1^2} = \left(\frac{r_2}{r_1}\right)^2 - 1 = \left(\frac{d_2}{d_1}\right)^2 - 1$$

$$= \left(\frac{2}{1}\right)^2 - 1 = 3$$

962 **(b)**

Shunt is connected to the galvanometer

$$i_g = \frac{iS}{S + G}$$

$$1 = \frac{100 \times 1}{(1 + G)}$$

$\Longrightarrow G = 99\Omega$

964 **(b)**

Energy $= P \times t = 2 \times 1 \times 30 = 60\ kWh = 60$ unit

965 **(c)**

BC, CD and *BA* are known resistance.

The unknown resistance is connected between *A* and *D*.

Hence, the correct option is (c).

966 **(a)**

$$R_{PQ} = \frac{5}{11}r, R_{QR} = \frac{4}{11}r \ and\ R_{PR} = \frac{3}{11}r$$

$\therefore R_{PQ}$ is maximum.

967 **(a)**

For ohmic resistance $V \propto i \Rightarrow V = Ri$ (here R is constant)

968 **(b)**

During charging of lead-acid accumulator, the specific gravity of H_2SO_4 increases.

969 **(a)**

$m = ZIt$

$$\frac{200}{100} = \frac{108}{96500} \times I \times 60 \times 60$$

$I = 50mA$

970 **(b)**

Let the length of various edges in increase order be $l, x, 2l$ respectively

$$R_{\text{max}} = \frac{\rho 2l}{xl} = \frac{2\rho}{x}; R_{\text{min}} = \frac{\rho l}{2lx} = \frac{\rho}{2x}$$

$$\therefore \frac{R_{\text{max}}}{R_{\text{min}}} = 4$$

971 **(b)**

$$i = \frac{E}{R + r} \Rightarrow 1 = \frac{4}{2 + r} = r = 2\Omega$$

Short circuit, is when terminals of battery are connected directly, then current which flows is

$$i_{SC} = \frac{E}{r} = \frac{4}{2} = 2A$$

972 **(b)**

$$i = \frac{E}{r} = \frac{6}{0.5} = 12\ amp$$

973 **(a)**

Internal resistance $\propto \frac{1}{\text{Temperature}}$

974 **(c)**

Resistance are in parallel

$\therefore \; R_{eq} = \frac{R}{3}$

975 **(d)**

$E = \frac{V}{l}$; E is constant (volt. gradient)

$\Rightarrow \frac{V_1}{l_1} = \frac{V_2}{l_2} \Rightarrow \frac{1.1}{140} = \frac{V}{180} \Rightarrow V = \frac{180 \times 1.1}{140}$

$= 1.41\ V$

976 **(c)**

The current in the circuit $= \frac{8}{5+1} = \frac{4}{3}$

Now $V_C - V_E = \frac{4}{3} \times 1 \Rightarrow V_E = -\frac{4}{3}V$

977 **(b)**

Here, the resistance of 400 Ω and 10000 Ω are in parallel, their effective resistance R_p will be

$$R_P = \frac{400 \times 10,000}{400 + 10,000} = \frac{5000}{13}\Omega$$

Total resistance of circuit

$$= \frac{5000}{13} + 800 = \frac{15400}{13}\Omega$$

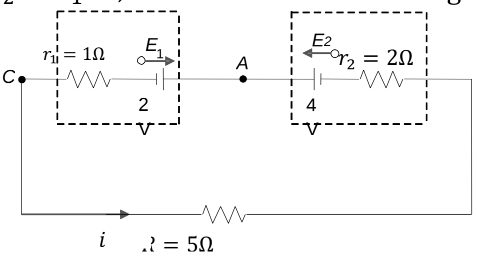
Current in the circuit, $i = \frac{6}{15400/13} = \frac{39}{7700}A$

Potential difference across voltmeter$= iR_P = \frac{39}{7700} \times \frac{5000}{13}$

$= 1.95$ A

978 **(b)**

Emf's E_1 and E_2 are opposing each other. Since $E_2 > E_1$ so, current will move from right to left.



Current in circuit

$i = \frac{E_2 - E_1}{R + r_1 + r_2}$

$= \frac{4-2}{5+1+2} = \frac{2}{8} = 0.25A$

The potential drop between points A and C is

$V_A - V_C = E_1 + ir_1$

$= 2 + (0.25 \times 1)$

$= 2.25V$

979 **(a)**

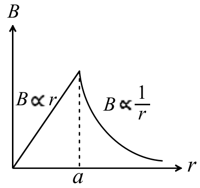
Magnetic field due to a long straight wire of radius a carrying current I at a point distant r from the centre of the wire is given as follows

$B = \frac{\mu_0 Ir}{2\pi a^2}$ for $r < a$

$B = \frac{\mu_0 I}{2\pi r}$ for $r = a$

$B = \frac{\mu_0 I}{2\pi r}$ for $r > a$

The variation of magnetic field B with distance r from the centre of wire is shown in the figure



980 **(b)**

Let resistivity at a distance $'x'$ from left end be $\rho = (\rho_0 + ax)$. Then electric field intensity at a distance $'x'$ from left and will be equal to $E = \frac{i\rho}{A} = \frac{i(\rho_0 + ax)}{A}$

Where i is the current flowing through the conductor. It means $E \propto \rho$ or E varies linearly with distance $'x'$. But at $x = 0, E$ has non-zero value. Hence (b) is correct

981 **(c)**

$P_{\max} = \frac{E^2}{4r} = \frac{(2)^2}{4 \times 0.5} = 2W$

982 **(a)**

$\frac{V^2}{R} = P \Rightarrow R = \frac{V^2}{P} = \frac{220 \times 220}{100} = 484\Omega$

984 **(b)**

Let i be the current through arm ADC. Then current through arm $ABC = (2.1 - i)$. As there is no deflection in the galvanometer, hence

$(20 + 5)i = (8 + 2)(2.1 - i)$

or $25i = 21 - 10i$ or $35i = 21$

or $i = 21/35 = 3/5 = 0.6$ A

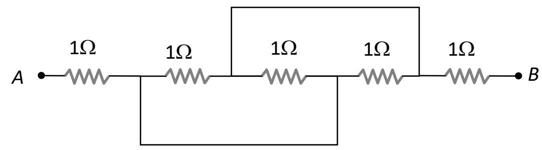
985 **(c)**

Resistance of bulb is constant

$P = \frac{v^2}{R} \Rightarrow \frac{\Delta P}{P} = \frac{2\Delta V}{V} + \frac{\Delta R}{R}$

$\frac{\Delta P}{P} = 2 \times 2.5 + 0 = 5\%$

986 **(c)**



$R_{AB} = 2 + \frac{1}{3} = 2\frac{1}{3}\Omega$

987 **(b)**

The temperature of the wire increase to such a value at which the heat produced per second equals heat lost per second due to radiation.

$$i^2\left(\frac{\rho l}{\pi r^2}\right) = H \times 2\pi r l$$

Where H is heat lost per second per unit area due to radiation.

Hence, $i^2 \propto r^3$

So, $\frac{i_1^2}{i_2^2} = \frac{r_1^3}{r_2^3}$

Or $r_2 = r_1\left(\frac{i_2}{i_1}\right)^{\frac{2}{3}}$

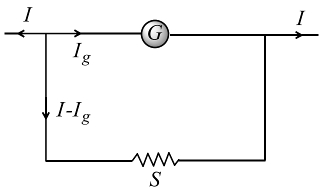
[Here : $r_1 = 1$ mm, $i_1 = 1.5$ A, $i_2 = 3$ A]

$$r_2 = 1 \times \left(\frac{3}{1.5}\right)^{2/3} = 4^{1/3} \text{ mm}$$

988 **(b)**

Here, $I_g = 1A$

$I = 10A$



From figure

$I_g G = (I - I_g)S$

$\frac{G}{S} = \frac{I - I_g}{I_g}$

Substituting the given values, we get

$\frac{G}{S} = \frac{10A - 1A}{1A} = \frac{9}{1}$

989 **(b)**

$$i = \frac{V}{R} = \frac{Q}{t} \Rightarrow Q = \frac{Vt}{R} = \frac{20 \times 2 \times 60}{10} = 240C$$

991 **(a)**

$v_d = \frac{e}{m} \times \frac{V}{l}\tau$ or $v_d = \frac{e}{m}.\frac{El}{l}\tau$ [$\because V = El$]

$\therefore v_d \propto E$

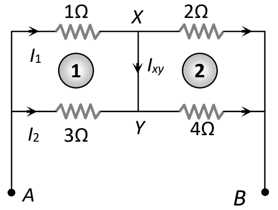
992 **(c)**

$418t = 1 \times 4180 \times 20$ or $t = 200$ s

Note that in this case, $C = 418 \text{ J/kg}^{-1}[°\text{C}^{-1}]$

$J = 4.18 \text{ J cal}^{-1}$

993 **(c)**



$-i_1 + 0 \times i_{xy} + 3i_2 = 0$ $i.e.$ $i_1 = 3i_2$ ...(i)

Also $-2(i_1 - i_{xy}) + 4(i_2 + i_{xy}) = 0$

$i.e.$ $2i_1 - 4i_2 = 6i_{xy}$ ...(ii)

Also $V_{AB} - 1 \times i_1 - 2(i_1 - i_{xy}) = 0 \Rightarrow 50 = i_1 + 2(i_1 - i_{xy})$

$= 3i_1 - 2i_{xy}$ ...(iii)

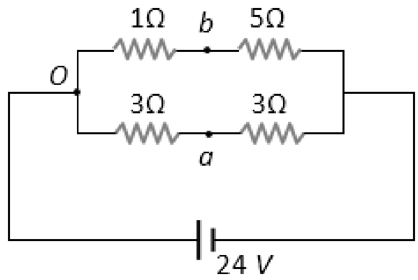
Solving (i), (ii) and (iii), $i_{xy} = 2A$

994 **(c)**

By Kirchhoff's current law

995 **(b)**

Switch S_2 is open so capacitor is not in circuit



Current through 3Ω resistor $= \frac{24}{3+3} = 4A$

Let potential of point $'O'$ shown in fig. is V_O

Then using ohm's law

$V_O - V_a = 3 \times 4 = 12V$ ...(i)

Now current through 5Ω resistor $\frac{24}{5+1} = 4A$

So $V_0 - V_b = 4 \times 1 = 4V$ ...(ii)

From equation (i) and (ii) $V_b - V_a = 12 - 4 = 8V$

996 **(c)**

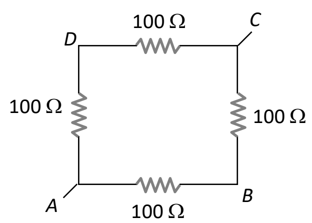
$$i = \frac{ne}{t} = \frac{62.5 \times 10^{18} \times 1.6 \times 10^{-19}}{1} = 10 \ ampere$$

997 **(a)**

In parallel $P_{Consumed} \propto P_{Rated}$

998 **(c)**

The figure can be drawn as follows



$$R_{AC} = \frac{200 \times 200}{200 + 200} = 100\Omega$$

999 **(a)**

Heat gained by water = Heat supplied by container heat lost

$\Rightarrow mS\Delta\theta = 1000t - 160t$

$\Rightarrow t = \dfrac{2 \times 4.2 \times 1000 \times 50}{840} = 8\,min\,20\,sec$

100 **(d)**

0 As batteries wear out, temperature of filament of flash light attains lesser value, therefore intensity of radiation reduces. Also dominating wavelength (λ_m) in spectrum, which is the red colour, increases

100 **(c)**

1 Potential gradient $(x) = \frac{i\rho}{A} = \frac{0.1\times10^{-7}}{10^{-6}} = 10^{-2}V/m$

100 **(c)**

2 Energy $= \dfrac{V^2}{R}t = \dfrac{200 \times 200 \times 2}{80} = 1000\,Wh$

100 **(d)**

4 If the voltmeter is ideal then given circuit is an open circuit, so reading of voltmeter is equal to the e.m.f. of cell $i.e.$, $6V$

100 **(a)**

7 Resistance of each bulb $R = V^2/P$.

When connected in series total resistance of bulbs $= 2R$

Current in each bulb , $I = V'/2R$;

Power generated by each bulb $= I^2\,R$

$= \left(\dfrac{V'}{2R}\right)^2 \times R = \dfrac{V'}{4R} = \dfrac{V'2}{(V^2/P)}$

$= \frac{(110)^2\times500}{4\times(220)^2}$ =31.25 W

100 **(a)**

8 $P = Vi = 250 \times 2 = 500\,W$

100 **(a)**

9 $i_g = i\dfrac{S}{G+S} \Rightarrow 10 \times 10^{-3}$

$= \dfrac{S}{100+S} \times 100 \times 10^{-3}$

$90\,S = 1000 \Rightarrow S = \dfrac{1000}{90} = 11.11\,\Omega$

101 **(c)**

0 In balance condition, no current will flow through the branch containing S

101 **(d)**

1 At time $t = 0$ $i.e.$ when capacitor is charging, current

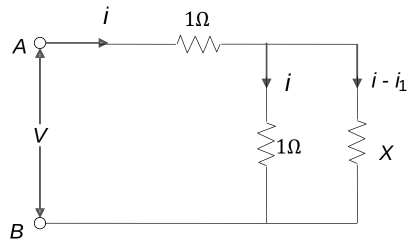
$i = \dfrac{2}{1000} = 2mA$

When capacitor is full charged, no current will pass through it, hence current through the circuit

$i = \dfrac{2}{2000} = 1mA$

101 **(c)**

2 Let x be the equivalent resistance of entire network between A and B. Hence, we have



$R_{AB} = 1 +$ resistance of parallel combination of 1Ω and $x\Omega$

$\therefore \quad R_{AB} = 1 + \dfrac{x}{1+x}$

$\therefore \quad x = 1 + \dfrac{x}{1+x}$

$\Longrightarrow\ x + x^2 = 1 + x + x$

$\Longrightarrow x^2 - x - 1 = 0$

$\Longrightarrow\ x = \dfrac{1+\sqrt{1+4}}{2}$

$= \dfrac{1+\sqrt{5}}{2}\Omega$

101 **(b)**

3 Energy, $E = 1\text{ kWh} = 3.6 \times 10^6\text{ J} = QV$

or $Q = E/V$

$m = zQ = z\dfrac{E}{V}$

$= \frac{(0.33\times10^{-6})(3.6\times10^6)}{66} = 1.8$ kg.

101 **(b)**

4 Current from D to $C = 1A$

$\therefore V_D - V_C = 2 \times 1 = 2V$

$V_A = 0\ \therefore V_C = 1V, \therefore V_D - V_C = 2$

$\Rightarrow V_D - 1 = 2\ \therefore V_D = 3V$

$\therefore V_D - V_B = 2 \therefore 3 - V_B = 2 \therefore V_B = 1V$

101 **(b)**

7 Here, $E_1 = 0.9V, \theta - \theta_0 = 75E; E_2 =?$ when $\theta_0' = \theta_0 + 15$

$\therefore$ temperature difference $\theta - \theta_0' = \theta - (\theta_0 + 15)$

$= (\theta - \theta_0) - 15 = 75 - 15 = 60$ K

As $\frac{E_2}{E_1} = \frac{\theta-\theta_0'}{\theta-\theta_0} = \frac{60}{75} = \frac{4}{5}$

or % decrease in thermo emf

$= \dfrac{E_1 - E_2}{E_1} \times 100 = \left(1 - \dfrac{E_2}{E_1}\right) \times 100$

$= \left(1 - \dfrac{5}{4}\right) \times 100 = 20\%$

101 **(d)**

8 When one call is wrongly connected in series, the emf of cells decrease by 2 E, but internal

resistance of cells remains the same for all the cells.

Current in the circuit is $i = \frac{(n-2)E}{nr} \times r$

Potential difference across each cell is

$$V = E - Ir = E - \frac{(n-2)E}{nr} \times r = \frac{2E}{n}$$

1019 **(c)**

$2R > 20 \Rightarrow R > 10\Omega$

1020 **(d)**

After some time, thermal equilibrium will reach

1021 **(b)**

For maximum power $R_{\text{ext}} = R_{\text{int}}$

When batteries are connected in parallel.

$R_{\text{int}} = \frac{1}{2} = 0.5\Omega$

Current $I = \frac{E}{R_{\text{ext}}+R_{\text{int}}} = \frac{2}{0.5+0.5} = 2\Omega$

Maximum power is given by

$P_{\max} = i^2 R_{\text{ext}}$

$\Rightarrow P_{\max} = (2)^2 \times 0.5 = 2$ W

If we assume batteries to be connected in series, then

$R_{\text{int}} = 1 + 1 = 2\Omega$

Current $I = \frac{2E}{R_{\text{ext}}+R_{\text{int}}} = \frac{2\times 2}{2+2} = 1$ A

So, maximum power is now given by

$P_{\max} = i^2 R_{\text{ext}} = 1 \times 2 = 2$ W

In either case $P_{\max} = 2$ W

1022 **(a)**

For E to be maximum

$\frac{dE}{dT} = 20 \times 10^{-6} - 0.02 \times 10^{-6} \times 2T = 0$

$\Rightarrow T_n = 500°\text{C}$

$\therefore E_{\max} = 20 \times 10^{-6}(500) - 0.02 \times 10^{-6}(500)^2 = 5$ mV

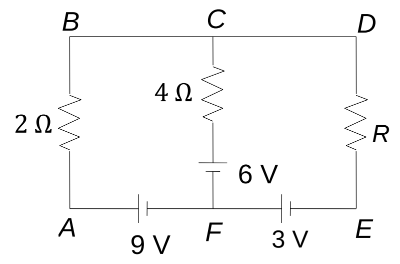
1023 **(b)**

In parallel $\frac{1}{t_p} = \frac{1}{t_1} + \frac{1}{t_2}$

$$t_p = \frac{t_1 t_2}{t_1 + t_2}$$

1024 **(b)**

Since no current is to flow in the 4Ω resistance, hence resistance 4Ω becomes ineffective in current.



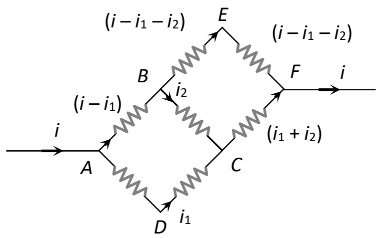
Current through resistances 2 Ω is

$$i = \frac{9-6}{2} = \frac{3}{2}\text{A}$$

In circuit $ABCDEFA, 9 - 3 = (2 + R) \times \frac{3}{2}$

or $12 = 6 + 3R$ or $R = 2\Omega$

1025 **(a)**



Applying Kirchhoff's law in mesh $ABCDA$

$-10(i - i_1) - 10i_2 + 20i_1 = 0 \Rightarrow 3i_1 - i_2 = i$ ...(i)

And in mesh $BEFCB$

$-20(i - i_1 - i_2) + 10(i_1 + i_2) + 10i_2 = 0$

$\Rightarrow 3i_1 + 4i_2 = 2i$ ...(ii)

From equation (i) and (ii)

$i_1 = \frac{2i}{5}, i_2 = \frac{i}{5} \Rightarrow i_{AD} = \frac{2i}{5}$

1026 **(c)**

For constant voltage, we know that $P \propto \frac{1}{R}$

So higher the power, lower will be the resistance

1027 **(c)**

Current through 6Ω resistance in parallel with 3Ω resistance $= 0.4\ A$

So total current $= 0.8 + 0.4 = 1.2\ A$

Potential drop across $4\Omega = 1.2 \times 4 = 4.8V$

1028 **(c)**

$\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_1 - l_2} = \frac{58+29}{58-29} = \frac{3}{1}$

1029 **(c)**

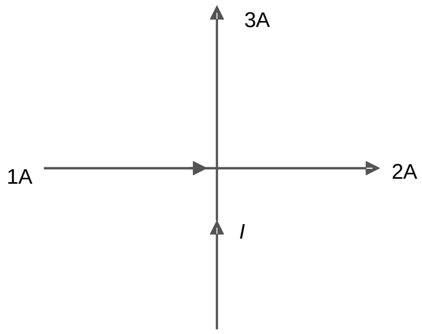
$I = \frac{E}{R+r}$

$I = \frac{E}{R} = \text{constant}$

where, R=external resistance

r= internal resistance =0

103 **(a)**
0 $P_{Rated} \propto \frac{1}{R}$ and $R \propto \frac{1}{[\text{Thickness of filament}]^2}$
So $P_{Rated} \propto (\text{Thickness of filament})^2$
103 **(a)**
1 From Kirchhoff's first law, in an electric circuit the algebraic sum of the currents meeting at any junction is zero,



ie., $\sum i = 0$
∴ Taking inward direction of current as positive and outward as negative, we have
$1\text{A} - 3\text{A} - 2\text{A} + I = 0$
$\Longrightarrow \quad I = 4A$
103 **(d)**
2 Thermal energy is resistor is $U = i^2Rt$
$R = R_0(1 + \alpha\theta) \Rightarrow U = i^2R_0(1 + \alpha\theta)t$ [where θ = temp]
So $\frac{dU}{dt} = i^2R_0(1 + \alpha\theta)$
With time temperature increases, hence dU/dt increases. This is best shown by curve (d)
103 **(b)**
3 Here two cells are in series
Therefore total emf $= 2E$
Total resistance $= R + 2r$
$\therefore i = \frac{2E}{R + 2r} = \frac{2 \times 1.45}{1.5 + 2 \times 0.15} = \frac{2.9}{1.8} = \frac{29}{18}$
$= 1.611\ amp$
103 **(b)**
4 $E = \alpha T + \frac{1}{2}\beta T^2$
For inversion temperature
$E = 0, \qquad T = \frac{-2\alpha}{\beta}$
Thermo electric power
$P = \frac{dE}{dT} = \alpha + \frac{1}{2}\beta.(2T) \Rightarrow \alpha + \beta.T$
$\alpha + \beta\left(\frac{-2\alpha}{\beta}\right) = \alpha - 2\alpha = -\alpha$
103 **(c)**
5 Resistance of shunted ammeter $= \frac{GS}{G+S}$
Also $\frac{i}{i_g} = 1 + \frac{G}{S} \Rightarrow \frac{GS}{G+S} = \frac{i_g.G}{i}$
$\Rightarrow \frac{GS}{G + S} = \frac{0.05 \times 120}{10} = 0.6\ \Omega$
103 **(a)**
6 $i = 6 \times 10^{15} \times 1.6 \times 10^{-19} = 0.96mA$
103 **(d)**
8 To convert galvanometer into voltmeter, the necessary value of resistance to be connected in series with the galvanometer is
$R = \frac{V}{I_g} - G$
$= \frac{50}{10 \times 10^{-3}} - 40$
$= 5000 - 40 = 4960\Omega$
103 **(b)**
9 To obtain minimum resistance, all resistors must be connected in parallel.
Hence equivalent resistance of combination of combination $= \frac{r}{10}$
104 **(a)**
0 Total e.m.f. $= nE$, Total resistance $R + nr \ \Rightarrow i = \frac{nE}{R+nr}$
104 **(c)**
2 Potential gradient $x = \frac{e}{(R+R_h+r)}.\frac{R}{L}$
$\Rightarrow \frac{10^{-3}}{10^{-2}} = \frac{2}{(3 + R_h + 0)} \times \frac{3}{1} \Rightarrow R_h = 57\Omega$
104 **(c)**
3 $R = \frac{V^2}{P} = \frac{(220)^2}{60} = 807\ \Omega$
104 **(a)**
4 $I = \frac{m}{Zt} = \frac{2.68}{\frac{108}{96500} \times 10 \times 60} = \frac{2.68}{108} \times \frac{965}{6} \approx 4\ A$
Energy $= I^2Rt = 4^2 \times 20 \times 600 = 192\ kJ$
104 **(c)**
5 From Joule's law, for a current carrying conductor at a definite temperature the rate of production of heat is given by

$H = Vit$

Where i is current, V the potential difference and t the time.

Given, $V = 1.5$ volt, $i = 2.1$ A, $t = 1$s

$\therefore H = 15 \times 2.1 \times 1 = 31.5$ J

Also, 1 cal $= 4.2$ J

$\therefore H = \frac{31.5}{4.2} = 7.5$ cal

104 **(c)**

6 Power of bulb, $P = \frac{V^2}{R}$

$\therefore \frac{P_2}{P_1} = \frac{R_1}{R_2}$

Or $\frac{R_1}{R_2} = \frac{100}{200} = 0.5$

104 **(c)**
7 $m = zq$

$\Rightarrow q = \frac{m}{z} = \frac{5 \times 10^{-3}}{3.387 \times 10^{-7}}$

$q = 1.476 \times 10^4 \mathrm{C}$

Since a current of 1 A for 1 h gives a charge of 3600 C,

$\therefore$ 1 A h = 3600 C

$\Rightarrow q = \frac{1.476 \times 10^4}{3600}$ Ah = 4.1 Ah

104 **(c)**
8 Resistance of each bulb $= \frac{(220)^2}{60}$

If the number of bulbs is n then effective resistance

$= \frac{(220)^2}{60n}$

$\therefore i = 9 = \frac{V}{R_{\text{eff}}} = \frac{220 \times 60n}{220 \times 220} \Rightarrow n = 33$

104 **(b)**
9 $R_2 = R_o(1 + \alpha t_2)$ and $R_{t_1} = R_o(1 + \alpha t_1)$

$\therefore \frac{R_{t_2}}{R_{t_1}} = \frac{1 + \alpha t_2}{1 + \alpha t_1}$

or $\frac{1.5}{1} = \frac{1 + 0.00125 \times t_2}{1 + 0.00125 \times 27}$

On solving we get; $t_2 = 454°\mathrm{C} = 454 + 273 = 727\mathrm{K}$

105 **(d)**
0 Heat produced = energy stored in capacitor

$= \frac{1}{2} CV^2 = \frac{1}{2} \times (10 \times 10^{-6}) \times (500)^2 = 1.25$ J

105 **(b)**
1 Let I be the total current passing through balanced wheat
stone bridge. Current through arms of resistances P and
Q in series is

$I_1 = \frac{I \times 300}{330 + 110} = \frac{3}{4} I$ and current through arms of

Resistances R and S in series is $I_2 = \frac{I \times 110}{330 + 110} = \frac{1}{4} I$

$\therefore$ Ratio of heat developed per sec

$H_P : H_Q : H_R : H_S$

$= \left(\frac{3}{4} I\right)^2 \times 100 : \left(\frac{3}{4} I\right)^2 \times 10 : \left(\frac{1}{4} I\right)^2 \times 300 : \left(\frac{1}{4} I\right)^2 \times 30$

$= 30 : 3 : 10 : 1.$

105 **(a)**
2 The resistivity of metal increases when it is converted into an alloy

$\rho' > \rho$

105 **(c)**
4 Charge delivered to cathode per second

$= \frac{0.002 \times 10^{25} \times 2 \times 1.6 \times 10^{-19}}{100 \times 60}$

$= 1.06$ C

105 **(d)**
5 Here, $R_{20} = 20, R_{500} = 60\Omega, \mathrm{R_t} = 25\Omega,$

$\because \quad \mathrm{R_t} = \mathrm{R_0}(1 + \alpha \mathrm{t})$

Where α is the temperature coefficient of resistance.

$\therefore \quad R_{20} = R_0(1 + \alpha \times 20)$

$or \quad 20 = R_0(1 + \alpha \times 20) \quad ..\text{(i)}$

$R_{500} = R_0(1 + \alpha \times 500)$

$or \quad 60 = R_0(1 + \alpha \times 500) \quad ...\text{(ii)}$

Dividing Eq. (ii) by Eq. (i), we get

$\frac{60}{20} = \frac{1 + \alpha \times 500}{1 + \alpha \times 20}$

or $\quad 3 + 60\alpha = 1 + 500\alpha$

or $\quad \alpha = \frac{2}{440} = \frac{1}{200}$ °C^{-1}

Again, $R_{20} = R_0(1 + \alpha \times 20)$

or $\quad 20 = R_0\left(1 + \frac{1}{220} \times 20\right) ...\text{(iii)}$

$R_t = R_0(1 + \alpha t)$

$25 = R_0\left(1 + \frac{1}{220} \times t\right) \quad ..(iv)$

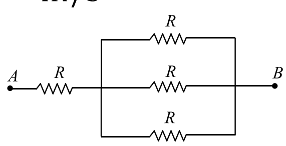
Dividing Eq. (iv) by Eq (iii), we get

$\frac{25}{20} = \frac{\left(1 + \frac{1}{220} \times t\right)}{\left(1 + \frac{1}{220} \times 20\right)} \Longrightarrow 4 + \frac{4t}{220} = 5 + \frac{100}{220}$

or $\quad t = 80°\mathrm{C}$

105 **(b)**
6 $R_N = R + R/3$

$= 4R/3$



105 **(c)**
7 The total emf $= E + E = 2E$

Total resistance $= R + r_1 + r_2$

$\therefore$ Current flowing through the circuit

$i=\dfrac{2E}{R+r_1+r_2}$

According to question $E=ir_1$

$\Rightarrow \quad i=\dfrac{E}{r_1}$

$\therefore \ \dfrac{E}{r_1}=\dfrac{2E}{R+r_1+r_2}$

$R=r_1-r_2$

105 **(a)**

8 Power $P=VI=250\times 4=1000W=1kW$

Energy $=P\times t=1\ kW\times 60\ sec=60\ kJ$

105 **(c)**

9 For the given meter bridge

$\dfrac{P}{Q}=\dfrac{l_1}{100-l_1}$

$l_1=55cm\Rightarrow 100-l_1=45cm$

$\because P=3Q$

$\Rightarrow Q=3\times\dfrac{45}{55}=3\times\dfrac{9}{11}=\dfrac{27}{11}\Omega$

When x is connected in series with $P, l_1=75cm$

$\Rightarrow \dfrac{P+x}{Q}=\dfrac{75\ cm}{25\ cm}\Rightarrow 3+x=3\times\dfrac{27}{11}$

$\Rightarrow x=\dfrac{81}{11}-3\Rightarrow x=\dfrac{48}{11}\Omega$

106 **(a)**

0 The capacitance (C) of a capacity is defined as the ratio of the charge (q) given to the rise in the potential (V) of the conductor. When the plates are moved apart, the charge remains constant, hence

$q=CV=\text{constant}$ ………..(i)

Capacitance (C) of a parallel plate capacitor is given by

$C=\dfrac{\varepsilon_0 A}{d}$ ………..(ii)

Where A is area of plates and d the separation between them.

From Eqs. (i) and (ii), we have

$q=\dfrac{\varepsilon_0 A}{d}.V=\text{constant}$

When plates are moved apart, d increases, hence value of C decreases and in order that charge (q) remains constant V increases.

106 **(c)**

1 Resistance of the combination

$R'=\dfrac{10\times 10}{10+10}+10=15\Omega$

$\because P=I^2R\Rightarrow I\propto R$

$\therefore \dfrac{P}{P'}=\dfrac{R}{R'}\Rightarrow P'=\dfrac{15}{10}\times 20=30\Omega$

106 **(d)**

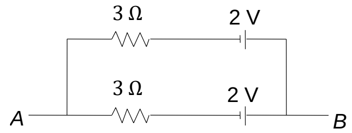
2 Suppose resistance of wires are R_1 and R_2 then

$\frac{6}{5}=\frac{R_1R_2}{R_1+R_2}$. If R_2 breaks then $R_1=2\Omega$

Hence, $\frac{6}{5}=\frac{2\times R_2}{2+R_2}\Rightarrow R_2=3\Omega$

106 **(d)**

3 The equivalent circuit is given by



Since, $V_A=V_B$

Potential difference is zero.

106 **(b)**

4 From balanced Wheatstone bridge concept,

$\dfrac{550\Omega}{R}=\dfrac{20}{80}$

$\Rightarrow \quad R=220\Omega$

106 **(a)**

5 Voltage across parallel combination is same. The equivalent resistance of upper branch

$R=4+6=10\ \Omega$

So, $I_1\times 10=I_2\times 10$

Or $\quad I_1=I_2=I$ (say)

ie, Same current is flowing through both branches.

Now, it is given that

$H_{4\Omega}=10$ cal

Or $I^2t\times 4=10$

Or $\quad I^2t=\frac{10}{4}$

Therefore, heat produced in 10 Ω resistance is

$$H_{10\Omega}=10\times I^2t=\frac{10\times 10}{4}=25\text{ cal}$$

106 **(d)**

6 $V_2=\frac{P_1V_1}{P_2}=\frac{22.4\times 2}{1}=44.8$ L

11.2 L of H_2 is liberated by charge = 96500 C

44.8 L of H_2 is liberated by charge

$=\frac{96500}{11.2}\times 44.8=386000C$

106 **(b)**

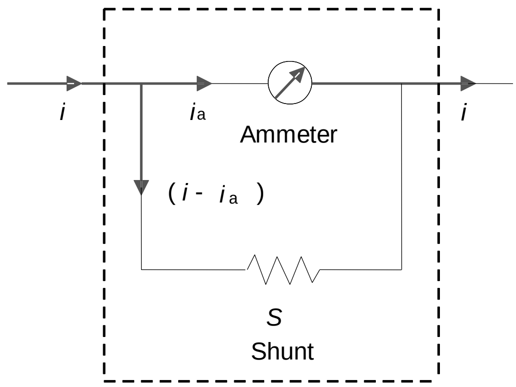
7 When switch S is open total current trough ammeter

$i=\dfrac{20}{(3+2)}=4A$

When switch is closed $i=\frac{20}{3+(2||2)}=5A$

106 **(b)**

9 Let i_a be the current flowing through ammeter and i the total current. So, a current $i-i_a$ will flow through shunt resistance.



High reading ammeter

Potential difference across ammeter and shunt resistance is same,

$ie., i_a \times R = (i - i_a) \times S$

or $S = \dfrac{i_a R}{i - i_a}$ ………… (i)

Given, $i_a = 100A,\ i = 750A, R = 13\Omega$

Hence, $S = \frac{100\times13}{750-100} = 2\Omega$

1070 **(b)**

Faraday constant = 1 mole electron charge $= Ne$
$= 6.02 \times 10^{23} \times 1.6 \times 10^{-19} = 96500$

1071 **(a)**

Since $R \propto l^2 \Rightarrow$ If length is increased by 10%, resistance increases by almost 20%

Hence new resistance $R' = 10 + 20\%$ of 10

$= 10 + \dfrac{20}{100} \times 10 = 12\ \Omega$

1072 **(d)**

Given $l' = l + 100\%\ of\ l = 2l$

Initial volume = final volume

ie, $\pi r^2 l = \pi r'^2 l'$

$\Longrightarrow \quad r'^2 = \dfrac{r^2 l}{l'} = r^2 \times \dfrac{l}{2l}$

$\Longrightarrow \quad r'^2 = \dfrac{r^2}{2}$

$\therefore R' = \rho\dfrac{l'}{A'} = \rho\dfrac{2l}{\pi r'^2} \quad \left(\because R = \dfrac{\rho l}{A}\right)$

$= \dfrac{\rho 4l}{\pi r^2}$

Thus, $\Delta R = R' - R = 4R - R = 3R$

$\therefore \quad \%\Delta R = \dfrac{3R}{R} \times 100\%$

$= 300\%$

1073 **(b)**

$R_{1000} = V^2/750$ and $R_{200} = V^2/P$;

Now, $R_{1000} = R_{200}(1 + \alpha \times 800)$

So, $\frac{V^2}{750} = \frac{V^2}{P}(1 + 4 \times 10^{-4} \times 800)$

or $P = 750(1 + 0.32) = 990$ W

1074 **(d)**

Mass, M = volume × density $= Al \times d$

or $A = M/ld$

Resistance $R = \rho l/A = \rho l/(M/ld)$

$= \dfrac{\rho l^2 d}{M}$

So $R \propto l^2/M$

Thus, $R_1 : R_2 : R_3 = \frac{l_1^2}{M_1} : \frac{l_2^2}{M_2} : \frac{l_3^2}{M_3}$

$= \dfrac{3^2}{1} : \dfrac{2^2}{2} : \dfrac{1^2}{3} = 27 : 6 : 1$

1075 **(c)**

By using $v_d = \frac{i}{neA} = \frac{100}{10^{28}\times1.6\times10^{-19}\times\frac{\pi}{4}\times(0.02)^2}$

$= 2 \times 10^{-4}\ m/sec$

1076 **(a)**

$\dfrac{R_A}{R_B} = \left(\dfrac{r_B}{r_A}\right)^4 \Rightarrow \dfrac{R_A}{R_B} = \left(\dfrac{1}{2}\right)^4 = \dfrac{1}{16} \Rightarrow R_B = 16R_A$

When R_A and R_B are connected in parallel then equivalent resistance

$R_{eq} = \dfrac{R_A R_B}{(R_A + R_B)} = \dfrac{16}{17}R_A$

If $R_A = 4.25\Omega$ then $R_{eq} = 4\Omega\ i.e.$ option (a) is correct

1077 **(d)**

$P = i^2 R \Rightarrow 22.5 = (15)^2 \times R \Rightarrow R = 0.10\ \Omega$

1078 **(d)**

$V = E - ir = 1.5 - 2 \times 0.15 = 1.20\ Volt$

1079 **(d)**

To draw maximum current from a combination of cells, external resistance $R = \frac{nr}{m}$.Therefore, grouping of cells depends upon the relative values of internal and external resistance.

1080 **(a)**

Watt-hour meter measures electric energy

1081 **(a)**

If a motor of 12 HP works for 10 days at the rate of 8 h/day then

Energy consumption = Power × time

$= 12 \times 746\dfrac{J}{s} \times (80 \times 60 \times 60)s$

$= 12 \times 746 \times 80 \times 60 \times 60J = 2.5 \times 10^9 J$

Rate of energy $= 50\,\frac{paise}{kWh}$

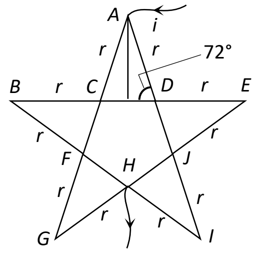
$\therefore 3.6 \times 10^6 J$ energy cost = Rs 0.5

$\therefore 2.5 \times 10^9 J$ energy cost $= \frac{2.5\times10^9}{2\times3.6\times10^6}$ = Rs 347

1082 **(b)**

Resistance of $CD\ arm = 2r\cos 72° = 0.62r$

Resistance of CBFC branch



$$\frac{1}{R}=\frac{1}{2r}+\frac{1}{0.62r}=\frac{1}{r}\left(\frac{2.62}{2\times 0.62}\right)$$

$$\frac{1}{R}=\frac{2.62}{1.24r} \quad \therefore R=\frac{1.24r}{2.62}$$

Equivalent $R'=2R+r=2\times\frac{1.24r}{2.62}+r$

$$=r\left(\frac{2.48}{2.62}+1\right)=1.946r$$

Because the star circuit is symmetrical about the line AH

$\therefore$ Equivalent resistance between A and H

$$\frac{1}{R_{eq}}=\frac{1}{R'}+\frac{1}{R'}$$

$$\Rightarrow R_{eq}=\frac{R'}{2}=\frac{1.946}{2}r=0.973r$$

1083 **(d)**

Here $n=\frac{10}{2}=5$

$\therefore R=(n-1)G=(5-1)2000=8000\ \Omega$

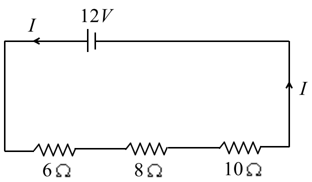
1084 **(c)**

Seebeck arranged the metals in a certain sequence are called the thermoelectric series. The direction of current at the hot junction is from metal occurring earlier in series to one occurring later in series. Some of the substances in series are Bi, Ni, Co, Pd, Pt, Cu, Mn, Hg, Pb, Sn, Au, Ag, Zn, Cd, Fe, Sb, Te.

The more separated the metals are in the series, the greater is the value of thermo-emf generated. Thus, emf developed in Sb-Bi thermocouple is higher than other thermocouples.

1085 **(c)**

Before connecting E, the circuit diagram is as shown in the figure



The equivalent resistance of the given circuit is

$R_{eq}=6\ \Omega+8\ \Omega+10\ \Omega=24\ \Omega$

Current in the circuit, $I=\frac{12V}{24\Omega}=\frac{1}{2}A$

Before connecting E, the current through $8\ \Omega$ is

$$I=\frac{1}{2}A$$

After connecting E, the current through $8\ \Omega$ is also

$$I=\frac{1}{2}A$$

$$\therefore E=\frac{1}{2}A\times 8\Omega=4V$$

1086 **(b)**

At constant p.d., heat produced $=\frac{V^2}{R}$ $i.e.\ H\propto\frac{1}{R}$

1087 **(b)**

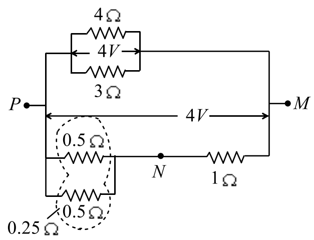
Given current through 4Ω resistance

Is $1A$, so P.D. across upper Branch

$i.e.$ P.D. between P and M is $4V$

Hence P.D. between M & N is

$$\frac{1}{1+0.25}\times 4=3.2V$$



1088 **(d)**

$$\frac{dE}{dT}=4-\frac{2T}{200}4-\frac{T}{100};$$

At neutral point, $T=T_n$.

$\frac{dT}{dT}=0=4-T_n/100$

or $T_n=400°\text{C}, T_i=2T_n-T_0$

$=2\times 400-0=800°\text{C}$

1089 **(d)**

In the above question for calculating equivalent resistance between two opposite square faces $l=100\ cm=1m, A=1\ cm^2=10^{-4}m^2$, so resistance

$$R=3\times 10^{-7}\times\frac{1}{10^{-4}}=3\times 10^{-3}\ \Omega$$

1090 **(a)**

The balanced condition for Wheatstone bridge is

$$\frac{P}{Q}=\frac{R}{S}$$

as is obvious from the given values.

No, current flows through galvanometer is zero.

Now, P and R are in series, so

Resistance $R_1=P+R$

$=10+15=25\Omega$

Similarly, Q and S are in series, so

Resistance $R_2=R+S=20+30=50\Omega$

Net resistance of the network as R_1 and R_2 are in parallel.

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}$$

$$\therefore R=\frac{25\times 50}{25+50}=\frac{50}{3}\ \Omega$$

Hence,
$$I = \frac{V}{R} = \frac{6}{\frac{50}{3}} = 0.36A$$

1091 **(b)**
$H = I^2Rt = mc\Delta\theta$
$\therefore \Delta\theta \propto I^2$
Hence $\frac{\Delta\theta^2}{\Delta\theta_2} = \left(\frac{I_2}{I_1}\right)^2$ or $\frac{\Delta\theta^2}{3} = \left(\frac{2I+I}{I}\right)^2$
or $\Delta\theta_2 = 9 \times 3 = 27°C$.

1092 **(a)**
$m\,n = 20$ ...(i)

For maximum current $R = n\,r/m$

or $2.5 = n \times 0.5/m$ or $n = 5m$

From Eq.(i), $m \times 5m = 20$ or $m^2 = 4$

or $m = 2$. Therefore, $n = 5 \times 2 = 10$

1093 **(b)**
The resistance of ammeter is very low, so when it is used in parallel through a circuit then excess current will flow through it thus, damaging it.

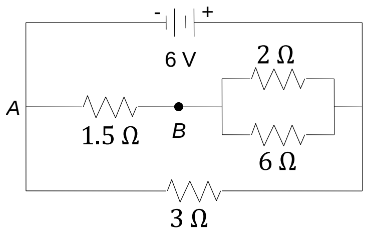
1094 **(d)**
Zero (No potential difference across voltmeter)

1095 **(a)**
When two batteries are in series to the external resistance
R, total resistance of the circuit
$= R + 2r = R + 2 \times 1 = R + 2\Omega$
Total emf of batteries = 2+2 = 4 V
$\therefore$ Joulean power across R
$= \left(\frac{4}{R+2}\right)^2 \times R = \frac{4^2R}{(R-2)^2+8\,R}$.
Joulean power will be maximum if $R - 2 = 0$
or $R = 2\Omega$
$\therefore$ Maximum joulean power $= \frac{4^2\times 2}{(2\ 2)^2+8\times 2} = 2$ watt

1096 **(a)**
Assume thermo emf E is directly proportional to temperature difference T.
$ie, E = aT$
$$a = \frac{1}{100} = 10^{-2}\text{VK}^{-1}$$
When cold junction is heated by 20 K, the temperature
difference T between junction becomes 80K, then thermo
emf
$E = aT = 10^{-2} \times 80 = 0.8$ V
Percentage change of emf
$$= \frac{E - E'}{E} \times 100$$
$$= \frac{1 - 0.8}{1} \times 100 = 20\%$$

1097 **(b)**
In parallel, $x = \frac{R}{n}$ $R = nx$
In series, $R + R + R \ldots n$ times $= nR = n(nx) = n^2x$

1098 **(c)**
The given circuit may be redrawn as shown in adjacent figure. Resistance of parallel combination of 2Ω and 6Ω,



$$R_1 = \frac{2 \times 6}{2 + 6} = 1.5\Omega$$

Now resistance of ABC arm= $1.5 + 1.5 = 3\Omega$

and total network resistance $R = \frac{3\times3}{3+3} = 1.5\Omega$

$\therefore$ Total current supplied by the battery $i = \frac{6V}{1.5\Omega} =$ 4A

1099 **(d)**
$$i_g = i\frac{S}{G+S} \Rightarrow 0.01 = 10\frac{S}{25+S}$$
$$\Rightarrow 1000S = 25 + S \Rightarrow S = \frac{25}{999}\Omega$$

1100 **(a)**
Surface area of earth, $A = 4\pi r^2$

Charge entering the earth per sec per unit area

$J = 0.15 \times 1.6 \times 10^{-19}\text{Cm}^{-2}\text{s}^{-1}$

$= 0.15 \times 1.6 \times 10^{-19} \times 10^4\text{Cm}^{-2}\text{s}^{-1}$

$\therefore$ Current, $i = JA = J4\pi r^2$

$= 0.15 \times 1.6 \times 10^{-19} \times 10^4 \times 4 \times 3.14 \times (6.4 \times 10^6)^2$ on solving

$i = 0.12$ A

1101 **(a)**
Slope of the graph will give us reciprocal of resistance. Here resistance at temperature T_1 is

greater than that at T_2. Since resistance of metallic wire is more at higher temperature then at lower temperature, hence $T_1 > T_2$

1102 **(c)**

An α −particle has a charge equal to 2 protons. Motion of α particle to the left, motion of proton towards left and motion of electrons towards right, all will produce conventional current towards left. The total current will be

$i = 10^{19} \times (2 \times 1.6 \times 10^{-19})$

$+10^{19} \times (1.6 \times 10^{-19}) + 10^{19} \times (1.6 \times 10^{-19})$

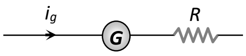
$= 6.4$ A

1103 **(b)**

$$I = \frac{P}{V} = \frac{550}{220} = 2.5 \text{ A}$$

1104 **(a)**

$$(R+G)i_g = V \Rightarrow (R+G) = \frac{V}{i_g}$$

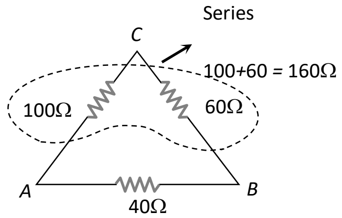


∴ Value of R is nearly equal to $6k\Omega$

This is connected in series in a voltmeter

1105 **(a)**

$$R = \frac{160 \times 40}{160 + 40} = 32\Omega$$



1106 **(b)**

$$V = i.R. = \frac{e}{(R + R_h + r)}.R \Rightarrow 10^{-3}$$

$$= \frac{2}{(10 + R + r)} \times 10$$

$\Rightarrow R = 19{,}989\Omega$

1107 **(a)**

For maximum joule heat produced in resistor external resistance = Internal resistance

1108 **(a)**

In parallel, $\frac{H_1}{H_2} = \frac{P_1 t}{P_2 t} = \frac{P_1}{P_2} = \frac{500}{200} = \frac{5}{2}$

In series, $\frac{H_1}{H_2} = \frac{I^2 R_1 t}{I^2 R_2 t} = \frac{R_1}{R_2} = \frac{V^2/P_1}{V^2/P_2}$

$$= \frac{P_2}{P_1} = \frac{200}{500} = \frac{2}{5}$$

1109 **(b)**

Let the original resistance is R Ω.

∴ $V = IR$

$V = 5 \times R = 5R$ ...(i)

When 2 Ω resistance is inserted, then total resistance

=(R+2) Ω

∴ $V = I'(R+2) = 4(R+2)$ ...(ii)

From Eqs. (i) and (ii), we get

$5R = 4(R+2)$

∴ R=8 Ω

1110 **(b)**

Emf $E = 5V$, Internal resistance $r = \frac{5}{10} = 0.5\Omega$

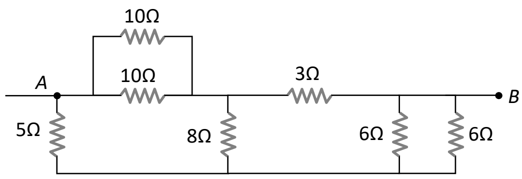
Current through the resistance $i = \frac{5}{(2+0.5)} = 2A$

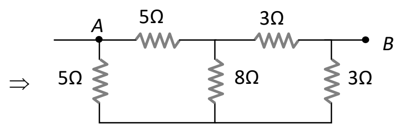
1111 **(c)**

At null point, no current flows through galvanometer. Therefore, the resistance connected in series with galvanometer, at null point position will be in effective. Thus, null point is obtained on potentiometer wire at the original position after the removal wire at the original position after the removal of series resistance from galvanometer

1113 **(b)**

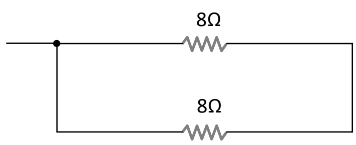
The given circuit can be simplified as follows





Now it is a balanced Wheatstone bridge

So,



$$\Rightarrow R_{AB} = \frac{8 \times 8}{8+8} = \frac{64}{16} = 4\Omega$$

1114 **(a)**

Current, $I = \frac{q}{t} = \frac{3000C}{10 \times 60s} = 5A$

1115 **(b)**

Resistance of parallel group $= \frac{R}{2}$

∴ Total equivalent resistance $= 4 \times \frac{R}{2} = 2R$

1116 **(d)**

If resistance of each bulb be R, then bias voltage V

is same in both cases, hence $P = \frac{v^2}{R_{\text{total}}}$

In the case $R_{\text{total}} = 50R$ and in second case 49 R

$$\therefore \frac{P_1}{P_2} = \left(\frac{49}{50}\right)^2 \Rightarrow P_2 = \left(\frac{50}{49}\right)^2 . P_1$$

or $P_2 > P_1$

1117 **(d)**

$$V_{AB} = 4 = \frac{5X + 2 \times 10}{X + 10} \Rightarrow X$$
$$= 20\Omega, \left[v = \frac{E_2 r_1 + E_1 r_2}{r_1 + r_2}\right]$$

1118 **(a)**

$$H = i^2 Rt \Rightarrow \frac{H}{t} = i^2 R = \frac{i^2 \rho l}{\pi r^2}$$

1119 **(c)**

Resistance $= \rho \frac{l}{A}$

$$\therefore \frac{R_1}{R_2} = \frac{\rho_1}{\rho_2} \times \frac{l_1}{l_2} \times \frac{A_2}{A_1} = \frac{2}{3} \times \frac{3}{4} \times \frac{5}{4} = \frac{5}{8}$$

1120 **(c)**

Because in series current is same

1121 **(a)**

The effective resistance between two diagonally opposite ends= 5 $R/6$

1122 **(c)**

$$\frac{m_1}{m_2} = \frac{Z_1}{Z_2} \Rightarrow m_2 = \frac{m_1 Z_2}{Z_1} = \frac{14 \times 1.2 \times 10^{-6}}{7 \times 10^{-6}} = 2.4g$$

1123 **(c)**

Current through each arm
PRQ and PSQ=1A
$V_p - V_R = 3v$
$V_p - V_s = 7V$
From Eqs. (i) and (ii), we get
$V_R - V_s = +4V$

1124 **(a)**

The effective resistance of combined wire

$$\rho\left(\frac{l + l}{A}\right) = \frac{\rho_1 l}{A} + \frac{\rho_2 l}{A}$$

($\because$total length L=$l + l$)

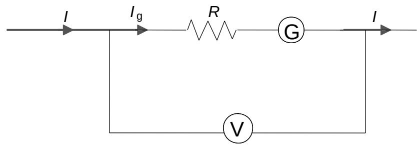
Or

$$\rho = \frac{\rho_1 + \rho_2}{2}$$

1125 **(a)**

The circuit diagram with current variation can be drawn as

Let current I_g flows through R and G.



For a voltmeter with full scale reading, we have

$$V = I_g(G + R)$$

or $R = \frac{V}{I_g} - G$

Given, $G = 2\Omega, V = 12\text{volt}, I_g = 0.1A$

$$\therefore R = \frac{12}{0.1} - 2 = 120 - 2 = 118\Omega$$

1126 **(c)**

Because given voltage is very high

1127 **(c)**

When cells are connected in series: emf increase but current capacity remains unchanged. The emf of 6 cells in series = 6 × 1.5 = 9 V and current capacity = 5A h

1128 **(c)**

$$H = \frac{V^2}{R} \times t = \frac{(210)^2}{20} \times 1 = mL$$

$$\therefore \frac{(210)^2}{20} = m \times 80 \times 4.2 \Rightarrow m = 6.56\ g/s$$

1129 **(d)**

By using $\frac{i}{i_g} = 1 + \frac{G}{S}$

$$\Rightarrow \frac{i}{100 \times 10^{-3}} = 1 + \frac{1000}{S} \Rightarrow S = \frac{1000}{9} = 111\Omega$$

1130 **(b)**

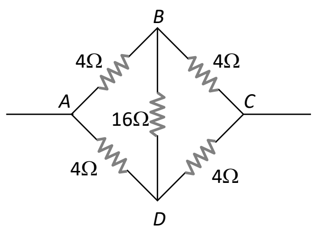
$R \propto \frac{1}{A} \Rightarrow R \propto \frac{1}{r^2} \propto \frac{1}{d^2}$ [d = diameter of wire]

1131 **(c)**

The graph between thermo emf and temperature of hot junction is parabolic in shape

1132 **(d)**

According to the principle of Wheatstone's bridge, the effective resistance between the given points is 4Ω



1133 **(d)**

$P = \frac{V^2}{R}$ so $R = \frac{V^2}{P} \Rightarrow R_1 = \frac{V^2}{100}$ and $R_2 = R_3 = \frac{V^2}{60}$

Now $W_1 = \frac{(250)^2}{(R_1+R_2)^2} . R_1, W_2 = \frac{(250)^2}{(R_1+R_2)^2} . R_2$

and $W_3 = \frac{(250)^2}{R_3}$

$W_1 : W_2 : W_3 = 15 : 25 : 64$ or $W_1 < W_2 < W_3$

113 **(c)**
4 The voltmeter is assumed to have infinite resistance. Hence $(1+2+1)+4=8\Omega$

113 **(b)**
5 $W=JH \Rightarrow P\times t = J\times ms\,\Delta\theta$

$\Rightarrow t=\dfrac{J\times m\times s\Delta\theta}{P}$ [For water 1 $litre = 1\ kg$]

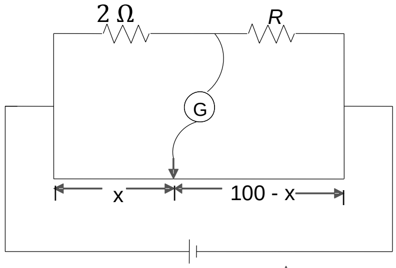
$\Rightarrow t=\dfrac{4.2\times 1\times 1000\times(40-10)}{836}=150\ sec$

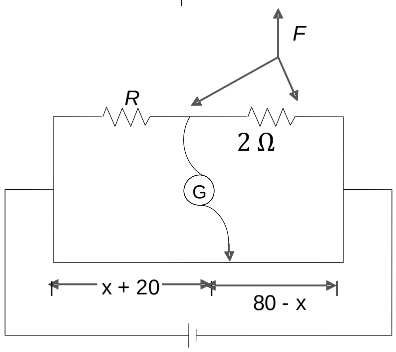
Short Trick : use formula $t=\frac{4200\times m\times\Delta\theta}{P}$

113 **(a)**
6 $R>2\Omega$

$\therefore\ 100-x > x$

Applying, $\frac{P}{Q}=\frac{R}{S}$





We have

$\dfrac{2}{R}=\dfrac{x}{100-x}$ ....(i)

$\dfrac{R}{2}=\dfrac{x+20}{80-x}$ ....(ii)

Solving Eqs. (i) and (ii), we get

$R=3\Omega$

113 **(a)**
7 Length of wire $=2\pi r=2\pi(0.1)=0.2\pi m$

Resistance of complete wire $=12\times 0.2\pi=2.4\pi\Omega$

$\therefore$ Resistance of each semicircle $=1.2\pi\Omega$

Hence equivalent resistance $R_{AB}=\frac{1.2\pi}{2}=0.6\pi\Omega$

113 **(c)**
8 Resistivity $\rho=\frac{RA}{l}$

$\Longrightarrow\quad \rho\propto R$

$\because$ Metals have low resistance, therefore they have low resistivity.

113 **(c)**
9 Voltmeter has high resistance and is always connected in parallel with the circuit. So, to convert a galvanometer into voltmeter, a high resistance must be connected in series with it so that it draws negligible current from the circuit.

114 **(a)**
0 $E=V+ir$

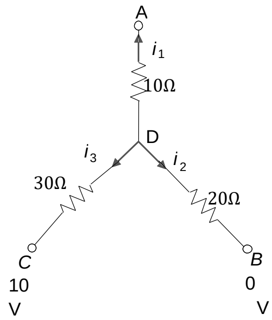
After short-circuiting, $V=0\Rightarrow r=\frac{E}{i}=\frac{2}{4}=0.5\Omega$

114 **(d)**
1 Applying Kirchhoff's law at point D, we get

$I_1=I_2+I_3$

$\dfrac{V_A-V_D}{10}=\dfrac{V_D-0}{20}+\dfrac{V_D-V_C}{30}$

or $70-V_D=\dfrac{V_D}{2}+\dfrac{V_D-10}{3}$



$\Longrightarrow V_D=40V$

$\Longrightarrow i_1=\dfrac{70-40}{10}=3A$

$i_2=\dfrac{40-0}{20}=2A$

and $i_3=\dfrac{40-10}{30}=1A$

114 **(c)**
2 $P_{consumed}=\left(\dfrac{V_A}{V_R}\right)^2\times P_R=\left(\dfrac{110}{115}\right)^2\times 500$

$=457.46\ W$

So, percentage drop in power output

$=\dfrac{(500-457.46)}{500}\times 100=8.6\%$

114 **(b)**
3 $\dfrac{P}{Q}=\dfrac{1/3}{1-1/3}=\dfrac{1/3}{2/3}$

$\Longrightarrow$ P: Q $=1:2$

$P=k,\qquad Q=2k$

$\dfrac{P+6}{Q}=\dfrac{\frac{2}{3}}{1-\frac{2}{3}}$

$\Longrightarrow\dfrac{P+6}{Q}=\dfrac{2}{1}$

$\dfrac{k+6}{2k}=\dfrac{2}{1}$

$\Longrightarrow k+6=4k$

$\Longrightarrow k=2$

$\therefore\ P=2\Omega, Q=4\Omega$

114 **(d)**
4 $I=\frac{E}{R+r/4}=\frac{2}{2+1/4}=\frac{2}{2.25}=0.888A$
114 **(b)**
5 Resistors are connected in series. So current through each resistor will be same

$\Rightarrow i=\frac{12-8}{R_3}=\frac{8-4}{R_2}=\frac{4-0}{R_1}\Rightarrow \frac{4}{R_3}=\frac{4}{R_2}=\frac{4}{R_1}$

So, $R_1 : R_2 : R_3 :: 1:1:1$
114 **(b)**
6 Let the resistance of the two heaters be denoted by R_1 and R_2.

Then, $R_1=\frac{V^2}{P_1}$

$R_2=\frac{V^2}{P_2}$

In parallel combination of resistances,

$$\frac{1}{R_P}=\frac{1}{R_1}+\frac{1}{R_2}$$

$$\frac{P_P}{V^2}=\frac{P_1}{V^2}+\frac{P_2}{V^2}$$

$$P_p=P_1+P_2$$

Given, $P_1=1000$ W

$P_2=1000$ W

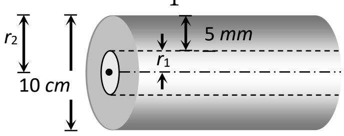
$\therefore \quad P_p=1000+1000$

Hence, $P_p=2000$ W

114 **(a)**
7 By using $R=\rho.\frac{l}{A}$; here $A=\pi(r_2^2-r_1^2)$

Outer radius $r_2=5cm$

Inner radius $r_1=5-0.5=4.5\ cm$



So $R=1.7\times10^{-8}\times\frac{5}{\pi\{(5\times10^{-2})^2-(4.5\times10^{-2})^2\}}$

$=5.6\times10^{-5}\Omega$
114 **(a)**
8 $m\propto q\Rightarrow m\propto it$
114 **(d)**
9 Potential gradient is given by

$k=\frac{V}{l}=\frac{IR}{l} \qquad (\because V=I\,R)$

$=\frac{I\times\rho l/A}{l} \qquad \left(\because R=\frac{\rho l}{A}\right)$

$=\frac{I\rho}{A}$

$\therefore\ k=\frac{0.01\times10^{-3}\times10^{9}\times10^{-2}}{10^{-2}\times10^{-4}}=10^{8}\text{Vm}^{-1}$

115 **(d)**
0 $R=\frac{V}{i_g}-G=\frac{100}{10\times10^{-3}}-25=9975\Omega$
115 **(a)**
1 Resistivity of combination

$=(1+2+3+\cdots+n)$

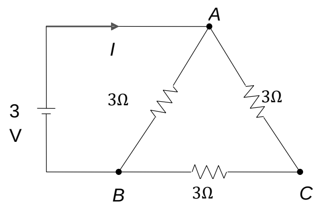
$=\frac{n(n+1)}{2}$
115 **(b)**
2 Here $P_1=i^2\times\frac{r}{3}, P_2=i^2\times3r$,

$P_3=i^2\left(\frac{r}{2}+r\right)=\frac{3}{2}i^2r$

and $P_4=i^2\left[\frac{2r\times2r}{2r+2r}\right]=i^2r$

So it is obvious that $P_2>P_3>P_4>P_1$

115 **(c)**
3 In series $P'=\frac{P}{n}=\frac{60}{3}=20\ watts$
115 **(b)**
4 Resistance in the arms AC and BC are in series,



$\therefore$ R'=3+3=6Ω

Now, R' and 3Ω are in parallel,

$\therefore\ R_{\text{eq}}=\frac{6\times3}{6+3}=2\Omega$

Now, $V=IR$

$\Longrightarrow\ I=\frac{3}{2}=1.5A$
115 **(d)**
5 The residence of conductor

$R=\frac{\rho l}{A}=\frac{1}{\pi r^2}$

$or\ \ R\propto\frac{l}{r^2}$

$\therefore\ \frac{R_1}{R_2}=\frac{l_1}{l_2}\times\frac{r_2^2}{r_1^2}=\frac{2}{1}\times\left(\frac{2}{1}\right)^2=\frac{8}{1}$

Thermal potential between the ends of the roads are same. So, heat conducted per second

$H=\frac{Q}{t}\propto\frac{1}{R}$

$\therefore \frac{H_1}{H_2} = \frac{R_2}{R_1} = \frac{1}{8} = 1:8$

115 **(b)**

6 We know, $\frac{V^2t}{4.2\,R} = Q = ms\,d\theta$

Let, N = initial number of turns

R = resistance of the coil

$\Rightarrow R = \rho\frac{L}{A} = \frac{\rho \times N \times 2\pi r}{A}$

$\frac{V^2t}{4.2 \times \rho \times N \times 2\pi r} = Q = ms\,d\theta$

$\frac{t}{N}$ = Constant

$\therefore \frac{t_1}{N_1} = \frac{t_2}{N_2}$

$\Rightarrow = \frac{N_2}{N_1} \times t_1 = \frac{9}{10} \times 16 =$14.4 min.

115 **(b)**

7 Resistivity of the material of the rod

$\rho = \frac{RA}{l}$

$= \frac{3 \times 10^{-3} \times \pi(0.3 \times 10^{-2})^2}{1}$

$= 27 \times 10^{-9}\pi\ \Omega\text{m}$

Resistance of disc,

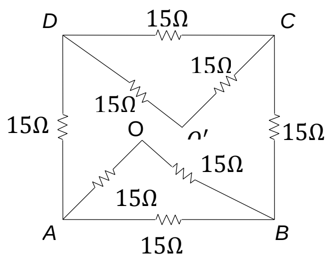
$R = \frac{\text{Resistivity of rod } \times \text{Thickness}}{\text{Area of cross} - \text{section}}$

$= 27 \times 10^{-9}\pi \times \frac{10^{-3}}{\pi \times (1 \times 10^{-2})^2}$

$= 2.7 \times 10^{-7}\ \Omega$

115 **(b)**

8 The circuit can be shown as given below



The equivalent resistance between D and C.

$R_{DC} = \frac{15 \times (15 + 15)}{15 + (15 + 15)}$

$= \frac{15 \times 30}{15 + 30}$

$= \frac{15 \times 30}{45} = 10\Omega$

Now, between A and B, the resistance of upper part $ADCB$,

$R_1 = 15 + 10 + 15 = 40\Omega$

Between A and B, the resistance of middle part AOB

$R_2 = 15 + 15 = 30\Omega$

Therefore, equivalent resistance between A and B

$\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$= \frac{1}{40} + \frac{1}{30} + \frac{1}{15}$

$= \frac{3 + 4 + 8}{120}$

$= \frac{15}{120}$

$\Longrightarrow \quad R' = \frac{120}{15} = 8\Omega$

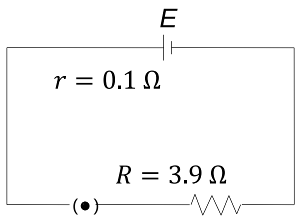
115 **(a)**

9 $i = \frac{m}{Zt} = \frac{2.0124}{1.118 \times 10^{-3} \times 3600} = 0.5\ A$

$\Rightarrow$ Error $= 0.54 - 0.5 = 0.04\ A$

116 **(a)**

0 When a cell of emf E is connected to a resistance of 3.9Ω, then the emf E of the cell remains constant, while voltage V goes on decreasing on taking more and more current from the cell.



$\therefore\ V = E - ir$

Where, r is internal resistance.

Also, current $i = \frac{E}{R+r}$

$\therefore \qquad V = E - \left(\frac{E}{R+r}\right)r$

Putting the numerical values, we have

$E = 2V, r = 0.1\Omega, R = 3.9\Omega$

$V = 2 - \left(\frac{2}{3.9 + 0.1}\right) \times 0.1$

$V = 1.95$ Volt

116 **(a)**

1 $R_1 = \frac{(220)^2}{100} = 484\ \Omega$

And $R_2 = \frac{(220)^2}{200} = 242\ \Omega$

So, $i = \frac{220}{484+242} = 0.3$ A

Hence, total power consumed will be

$P = i^2R = (0.3)^2 \times (484 + 242) = 65.34 \approx 65$ W

116 **(b)**

2 $n = \frac{1 \times 10^{-3}}{1.6 \times 10^{-19}} = 6.25 \times 10^{15}$

116 **(b)**

3

Resistance of the wire, $R = \rho \frac{L}{A}$
When the wire is enlongated to n −fold, its length becomes L′ = nL
As the volume of the wire remains constant
$\therefore A'L' = AL \Rightarrow A' = \frac{AL}{L'} = \frac{A}{n}$
New resistance, $R' = \rho \frac{L'}{A'} = \rho \frac{(nL)}{(A/n)} = n^2 \rho \frac{L}{A} = n^2 R$

116 **(b)**
4 Let the resistances be R_1, R_2 and R_3
$\therefore \frac{R_1}{R_2} = \frac{1}{2} \Longrightarrow R_1 = k, R_2 = 2k$
In parallel $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
$\frac{1}{1} = \frac{1}{k} + \frac{1}{2k} + \frac{1}{R_3}$
$\frac{1}{R_3} = 1 - \frac{1}{k} = \frac{1}{2k}$
$= \frac{2k - 2 - 1}{2k} = \frac{2k - 3}{2k}$
$R_3 = \frac{2k}{2k - 3}$
If k=1, then R_3 is found to be negative, which is impossible.
If k=2, then $R_1 = 2, R_2 = 4\ R_3 = 4$
$R_2 = R_3$, not satisfying the condition of the question that all resistance are unequal.
$If\ k = 3$, then $R_1 = 3, R_2 = 6$
$R_3 = 2\Omega$
∴ Largest resistance =6Ω

116 **(a)**
5 In parallel $\frac{1}{t_p} = \frac{1}{t_1} + \frac{1}{t_2} \Rightarrow t_p - \frac{t_1 t_2}{t_1 + t_2}$
$= \frac{5 \times 10}{5 + 10} = \frac{50}{15} = 3.33 \text{ min} = 3\ min. 20sec$

116 **(b)**
6 Electric power consumed by kettle $P = 220 \times 4W$
Heat required
$H = 1000 \times 1(100 - 20) = 1000 \times 80\ cal$
$= 4200 \times 80\ J$
$P = \frac{H}{t} \Rightarrow H = P \times t$
$\therefore 220 \times 4 \times t = 4200 \times 80 \Rightarrow t = 6.3\ minutes$

116 **(a)**
7 $P = i^2 R$

Current is same, so $P \propto R$

In the first case I is $3r$, in second case it is $\frac{2}{3}\ r$, in third case it is $\frac{r}{3}$ and in fourth case the net resistance is $\frac{3r}{2}$.

$R_{III} < R_{II} < R_{IV} < R_I$

$\therefore P_{III} < P_{II} < P_{IV} < P_I$

116 **(a)**
8 As the resistance of metal increases on increasing the temperature, so resistance of metal conductor in left arm will increase on heating. For meter bridge
$\frac{R_1}{R_2} = \frac{l}{100 - l}$
As R_1 increases l also increases.
Hence, balancing point shifts towards right.

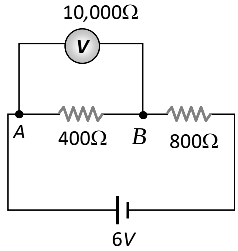
116 **(a)**
9 Mass of substance liberated at cathode $m = zit$
Where, z = electro chemical equivalent
$= 3.3 \times 10^{-7} \text{kg} . \text{C}^{-1}$
i = current flowing = 3 A,
$t = 2\text{s}$
$m = 3.3 \times 10^{-7} \times 3 \times 2$
$= 19.8 \times 10^7$ kg

117 **(a)**
0 $\frac{R_1}{R_2} = \frac{(1 + \alpha t_1)}{(1 + \alpha t_2)} \Rightarrow \frac{10}{R_2} = \frac{(1 + 5 \times 10^{-3} \times 20)}{(1 + 5 \times 10^{-3} \times 120)}$
$\Rightarrow R_2 \approx 15\Omega$
Also $\frac{i_1}{i_2} = \frac{R_2}{R_1} \Rightarrow \frac{30}{i_2} = \frac{15}{10} \Rightarrow i_2 = 20\ mA$

117 **(a)**
1 $1\ kWh = 1000\ W \times 3600\ sec = 36 \times 10^5 W$-$sec$(or J)

117 **(a)**
2 Here same current is passing throughout the length of the wire, hence $V \propto R \propto l$
$\Rightarrow \frac{V_1}{V_2} = \frac{l_1}{l_2} \Rightarrow \frac{6}{V_2} = \frac{300}{50} \Rightarrow V_2 = 1\ V$

117 **(d)**
3 Before connecting voltmeter potential difference across 400Ω resistance is



$V_i = \frac{400}{(400 + 800)} \times 6 = 2V$
After connecting voltmeter equivalent resistance between A and
$B = \frac{400 \times 10,000}{(400 + 10,000)} = 384.6\Omega$
Hence, potential difference measured by

voltmeter

$V_f = \frac{384.6}{(384.6+800)} \times 6 = 1.95V$

Error in measurement $= V_i - V_f = 2 - 1.95 = 0.05V$

117 **(d)**

4 $R = \frac{V}{i} = \frac{100 \pm 0.5}{10 \pm 0.2} = 10 \pm 0.25\Omega$

117 **(b)**

5 $P = VI, I = \frac{P}{V}$

or $I = \frac{500\text{ W}}{100\text{ V}} = 5\text{A}$

Now, $5R = 100$

or $R = 20\Omega$.

117 **(c)**

6 If resistance of ammeter is r then

$20 = (R+r)4 \Rightarrow R + r = 5 \Rightarrow R < 5\Omega$

117 **(b)**

7 Current through each arm DAC and $DBC = 1A$

$V_D - V_A = 2$ and $V_D - V_B - 3 \Rightarrow V_A - V_B = +1V$

117 **(b)**

8 $R = \frac{V^2}{P} = \frac{(250)^2}{10^3} = 62.5\Omega$

118 **(c)**

0 Total resistances $= 1 + 2 + \frac{2\times2}{2+2} + 4 = 8\,\Omega$

118 **(b)**

1 Current in the given circuit $i = \frac{50}{(5+7+10+3)} = 2A$

Potential difference between A and B, $V_A - V_B = 2 \times 12$

$\Rightarrow V_A - 0 = 24V \Rightarrow V_A = 24\,V$

118 **(b)**

2 $P = \frac{V^2}{R_{eq}} \Rightarrow 150 = \frac{(15)^2}{[2R/(R+2)]} = \frac{225 \times (R+2)}{2R}$

$\Rightarrow R = \frac{450}{75} = 6\Omega$

118 **(d)**

3 Total external equivalent resistance $R_{eq} = 4\Omega$

Current supply by cell $i = \frac{E}{R_{eq}+r} = \frac{10}{(4+1)} = 2A$

$\therefore (V_A - V_B) = \frac{i}{2}(R_2 - R_1) = \frac{2}{2}(2-4) = -2V$

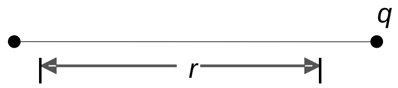
118 **(a)**

4 $r = \left(\frac{l_1 - l_2}{l_2}\right)R = \left(\frac{25}{100}\right)2 = 0.5\,\Omega$

118 **(a)**

5 Let Q is divided into two parts. If one part is q then other will (Q-q).

Let these parts are kept a (Q-q) distance r.



The electrostatic force between them

$F = K.\frac{q(Q-q)}{r^2}$ ……… (i)

(where K=constant –$(1/4\pi\varepsilon_0)$)

On differentiating Eq. (i) w.r.t. q, we get

$\frac{dF}{dq} = \frac{d}{dq}\left[\frac{Kq}{r^2}(Q-q)\right]$

or $\frac{dF}{dq} = \frac{K}{r^2}\frac{d}{dq}[Qq - q^2]$

or $\frac{dF}{dq} = \frac{K}{r^2}[Q - 2q]$ …… (ii)

But we know that, when force is maximum then

$\frac{dF}{dq} = 0$

Then from Eq. (ii), we have

$\frac{K}{r^2}[Q-2q] = 0$ or $Q - 2q = 0$

Or $Q = 2q$ or $q = \frac{Q}{2}$

So, the other part $= Q - \frac{Q}{2} = \frac{Q}{2}$

Hence, the each part have the same charge.

$\frac{Q}{2}$

118 **(c)**

6 $q = \frac{m}{z} = \frac{1\times10^{-3}}{1.044\times10^{-8}} = \frac{10^5}{1.044}$ C;

Given, $H = 43$ k cal.

$= 34 \times 10^3 \times 4.2$ J

$H = VIt = Vq$

$\therefore V = \frac{H}{q} = \frac{34\times4.2\times10^3}{10^5/1.044} = 1.49$ V

118 **(c)**

7 $E = \frac{iR}{L} = \frac{i.\rho}{A} = \frac{neAv_d\rho}{A} \Rightarrow v_d \propto E$ [Straight line]

$P = i^2R = \left(\frac{EA}{\rho}\right)^2 R \Rightarrow P \propto E^2$ [Symmetric parabola]

Also $P \propto i^2$ (parabola)

Hence all graphs a, b, d are correct and c is incorrect

118 **(b)**

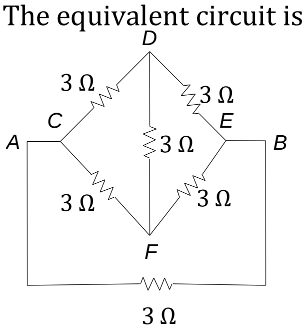
8 When we move in the direction of the current in a uniform conductor, the potential difference decreases linearly. When we pass through the cell, from it's negative to it's positive terminal, the potential increases by an amount equal to it's potential difference. This is less than it's emf, as there is some potential drop across it's internal resistance when the cell is driving current

118 **(d)**

9 At cold junction, current flows from copper to nickel and from iron to copper, and at hot junction from nickel to iron, thus the contributions add

119 **(d)**

0 The equivalent circuit is shown as



We can emit the resistance in the arm DF as balance condition is satisfied.

Therefore, the 3Ω resistances in arm CD and DE are in series.

$\therefore \quad R' = 3 + 3 = 6\Omega$

Similarly, for arms CF and FE, R''=6Ω

R' and R'' are in parallel

$$\therefore \frac{1}{R'''} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$$

R'''=3Ω

Now, R''' and 3Ω resistances are in parallel

$$\therefore \frac{1}{R} = \frac{1}{3} + \frac{1}{3}$$

$\Rightarrow R = 1.5\Omega$

Moreover, V across AB=3V and resistance in the arm=3Ω

∴ Current through the arm will be

$$= \frac{3V}{3\Omega} = 1\text{A}.$$

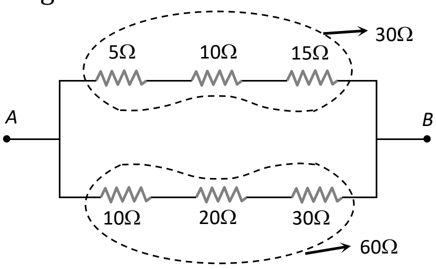
119 **(a)**

2 Both R and $2R$ are in parallel [V − constant]

So using $P = \frac{V^2}{R} \Rightarrow \frac{P_1}{P_2} = \frac{R_2}{R_1} \Rightarrow \frac{H_1}{H_2} = \frac{R_2}{R_1} = \frac{2}{1}$

119 **(a)**

4 By the concept of balanced Wheatstone bridge, the given circuit can be redrawn as follows



$$\Rightarrow R_{AB} = \frac{30 \times 60}{(30 + 60)} = 20\ \Omega$$

119 **(a)**

5 For applying Faraday's second law of electrolysis the same charge should be passed through copper and silver voltmeters.

Charge passed to liberate copper

$= 9 \times 20 \times 60 = 10800$ C

Charge passed to liberate silver

$= 10 \times 15 \times 50 = 9000$ C

As 9000 C charge liberates 10.8 g of Ag.

So 10800 C charge liberates

$= \frac{10.8 \times 10800}{9000} = 10.8 \times 1.2$ g of Ag.

Using Faraday's second law of electrolysis

$$\frac{m_{\text{Cu}}}{m_{\text{Ag}}} = \frac{E_{\text{Cu}}}{E_{\text{Ag}}} = \frac{63.5/2}{108/1}$$

or $m_{\text{Cu}} = \frac{63.5 \times 10.8 \times 1.2}{2 \times 108} = 3.81$ g.

119 **(d)**

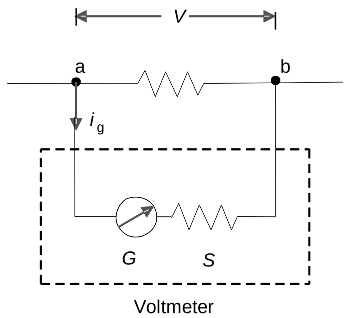
7 $R_p = \frac{R_1 R_2}{R_1 + R^2} = \frac{3}{5}$ and $R_1 = 3\Omega$ then

$$\frac{3 \times R_2}{3 + R_2} = \frac{3}{5} \text{ or } 15R_2 = 9 + 3R_2$$

or $12R_2 = 9$ or $R_2 = \frac{3}{4}\Omega$

119 **(c)**

8 Let G be resistance of galvanometer and i_g the current through it. Let V is maximum potential difference, then from Ohm's law



$$i_g = \frac{V}{G + R}$$

$$\Rightarrow R = \frac{V}{i_g} - G$$

Given $G = 10\Omega,\ i_g = 0.01A$

$V = 10$ volt

$$\therefore \quad R = \frac{10}{0.01} - 10 = 990\Omega$$

Thus, on connecting a resistance R of 990 Ω in series with the galvanometer, the galvanometer will become a voltmeter of range zero to 10V.

120 **(c)**

0 Potential gradient $x = \frac{e}{(R + R_h + r)} \cdot \frac{R}{L}$

$$= \frac{3}{(20 + 10 + 0)} \times \frac{20}{10} = 0.2$$

120 **(b)**

1 $$\frac{\text{Mass of } O_2 \text{ ions}}{\text{Mass of } Ag \text{ ions}} = \frac{\text{Chemical equivalent of } O_2}{\text{Chemical equivalent of } Ag}$$

$\Rightarrow \frac{0.8}{m} = \frac{8}{108} \Rightarrow m = 10.8\, gm$

1202 **(b)**

$E = V + ir \Rightarrow V = -ri + E$

Comparing it with $y = mx + c$; Slope $(m) = -r$ and intercept $= E$

1203 **(c)**

$I = \frac{R}{R_2 + r}$

(since finally no current flows through capacitor)

∴ Potential difference across

$R_2, V = IR_2 = \frac{ER_2}{R_2 + r}$

∴ Charge on the capacitor

$Q = CV = \frac{CER_2}{R_2 + r}$

1204 **(c)**

In a meter bridge the ratio of two resistances is

$\frac{R}{R'} = \frac{l}{l'}$

Where l and l' are balancing lengths.

Resistance $R = \frac{\rho l}{A} = \frac{\rho l}{\pi r^2}$

In material remains same $\rho = \rho'$

Given, $l' = 2l$

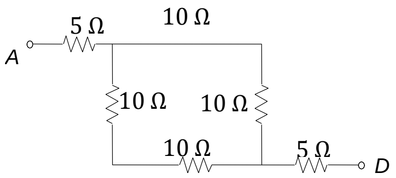
$r' = \frac{r}{2}$

$\therefore \quad R' = \frac{\rho l'}{A'} = \frac{\rho 2l}{\pi \left(\frac{r}{2}\right)^2} = \frac{8\rho l}{\pi r^2}$

$R' = 8R$

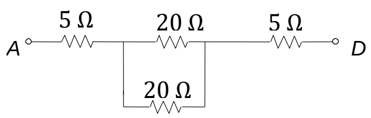
Therefore, the new balancing point is expected to be $8l$.

1205 **(b)**



10Ω in series with 10Ω will gives (10+10)=20Ω

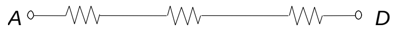
and 10Ω in series with 10Ω will gives (10+10)=20Ω



20Ω in parallel with 20Ω will gives

$\left(\frac{20 \times 20}{20 + 20}\right) = \frac{400}{40} = 10\Omega$

5 Ω 10 Ω 5 Ω



Resistance in series between points A and D

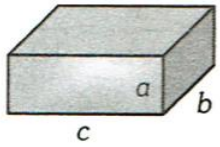
=5+10+5

=20Ω

1206 **(a)**

$a = 1, b = 2, c = 3$

$\Rightarrow R_{\max} = \frac{\rho . L}{A} = \frac{\rho . c}{a . b}$



$R_{\min} = \frac{\rho . L''}{A''} = \frac{\rho . a}{b . c}$

$\Rightarrow \frac{R_{\max}}{R_{\min}} = \frac{\frac{\rho . c}{a . b}}{\frac{\rho . a}{b . c}} = \frac{c}{a} \times \frac{c}{a} \Rightarrow \frac{c^2}{a^2} = \left(\frac{c}{a}\right)^2 = \left(\frac{3}{1}\right)^2 = \frac{9}{1}$

1207 **(a)**

$R = \rho \frac{l}{A} \Rightarrow \frac{R_1}{R_2} = \frac{A_2}{A_1} [\rho, L \text{ constant}] \Rightarrow \frac{A_1}{A_2} = \frac{R_2}{R_1} = 2$

Now, when a body dipped in water, loss of weight $= V\sigma_L g = AL\sigma_L g$

So, $\frac{(\text{Loss of weight})_1}{(\text{Loss of weight})_2} = \frac{A_1}{A_2} = 2$;so A has more loss of weight

1208 **(c)**

$\frac{1}{R} = \frac{1}{1} + \frac{1}{1} + \frac{1}{1} = \frac{3}{1} \Rightarrow R = \frac{1}{3}\ ohm$

Now such three resistance are joined in series, hence total

$R = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1 ohm$

1210 **(b)**

As temperature increases resistance of filament also increase

1211 **(b)**

$\frac{i_g}{i} = \frac{S}{G + S} \Rightarrow i_g G = (i - i_g)S$

$\therefore i_g G = (0.03 - i_g)4r$ ...(i)

and $i_g G = (0.06 - i_g)r$ ...(ii)

from (i) and (ii)

$0.12 - 4i_g = 0.06 - i_g \Rightarrow i_g = 0.02A$

1213 **(d)**

Resistance of the bulb= $\left(1.5 \times \frac{1.5}{4.5}\right) = 0.5 = \frac{1}{2}\Omega$

Resistance of the circuit $R = \frac{1 \times \frac{1}{2}}{1 + \frac{1}{2}} = \frac{1}{3}\ \Omega$

Now , $r = \frac{E - V}{V} R$

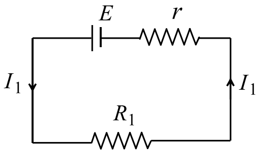
$\frac{8}{3} = \frac{E - 15}{1.5} \times \frac{1}{3}$ or $E = 13.5$ volt

121 **(b)**

4 $P = Vi \Rightarrow i = \frac{P}{V} = \frac{60}{220} = \frac{3}{11} amp$

121 **(d)**

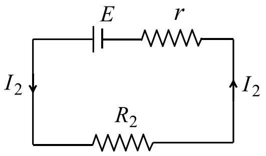
5 Let E and r be the emf and internal resistance of a battery respectively



In the first case current flowing in the circuit

$I_1 = \frac{E}{R_1 r}$

Or $E = I_1(R_1 + r)$



In the second case current flowing in the circuit

$I_2 = \frac{E}{R_2 + r}$

Or $E = I_2(R_2 + r)$

Equating equations (i) and (ii), we get

$I_1(R_1 + r) = I_2(R_2 + r) \Rightarrow I_1R_1 + I_1r = I_2R_2 + I_2r$

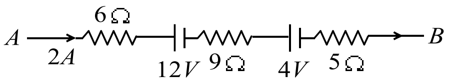
$I_1R_1 - I_2R_2 = (I_2 - I_1)r \Rightarrow (I_2 - I_1)r$

$= I_1R_1 - I_2R_2$

$r = \frac{I_1R_1 - I_2R_2}{I_2 - I_1}$

121 **(d)**

6



This is a series connection. Further, whatever current enters A has to pass . $I = 2\ A$.

The total resistance $= 6 + 9 + 5 = 20\Omega$. The effective potential across the resistances is $20\Omega \times 2\text{A} = 40V$. But $(+12 - 4)V$ is opposing the potential difference caross AB therefore the potential difference applied across AB is $40V + 8V = 48V$

121 **(a)**

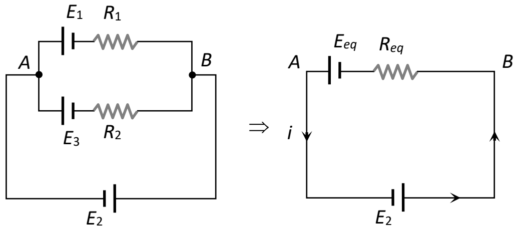
7 $ABCD$ forms a balanced Wheatstone bridge. Hence the resistances of arm BD will be ineffective. Now we have resistance $(2 + 2)\ \Omega$, $(4 + 4)\Omega$ and $(2 + 2)\ \Omega$ in parallel between A and B.

Potential difference across A and C =EMF of battery= 8V

$\therefore$ Current $i_1 = \frac{8}{(4+4)} = 1\text{A}$

121 **(b)**

8 The given circuit can be redrawn



$E_{eq} = \frac{E_1R_2 + E_3R_1}{R_1 + R_2} = \frac{2\times4 + 2\times4}{4+4} = 2V$ and

$R_{eq} = \frac{4}{2} = 2\Omega$. Current $i = \frac{2+2}{2} = 2A$ from A to B through E_2

121 **(b)**

9 $i = \frac{E}{R + r} \Rightarrow 0.5 = \frac{10}{R + 3} \Rightarrow 10 = 0.5R + 1.5 \Rightarrow R = 17\Omega$

122 **(d)**

0 The given circuit having parallel and series combination of resistance 3Ω, we can calculate as

$R_1 = 3 + 3 = 6\Omega$

$\text{R}_2 = 3 + 3 = 6\Omega$

$\frac{1}{\text{R}_3} = \frac{1}{\text{R}_1} + \frac{1}{\text{R}_2}$

$= \frac{1}{6} + \frac{1}{6} = 3\Omega$

$\text{R}_4 = 3\Omega$

$\frac{1}{\text{R}} = \frac{1}{\text{R}_3} + \frac{1}{\text{R}_4}$

$= \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$

$\text{R} = 1.5\Omega$

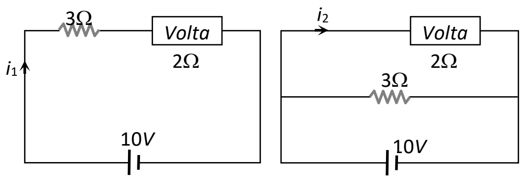
122 **(b)**

2 Remember mass of the metal deposited on cathode depends on the current through the voltameter and not on the current supplied by the battery. Hence by using

$m = Zit$, we can say $\frac{m_{Parallel}}{m_{Series}} = \frac{i_{Parallel}}{i_{Series}}$

$\Rightarrow m_{Parallel} = \frac{5}{2} \times 1 = 2.5\ gm.$

Hence increase in mass $= 2.5 - 1 = 1.5\ g$



122 **(d)**

3 $V \propto l$

$\Longrightarrow \frac{V}{E} = \frac{l}{L}$

Where, l= balance point

L= length of potentiometer wire.

Or $V = \frac{l}{L}E$

or $V = \dfrac{30 \times E}{100} = \dfrac{30}{100}E$

122 **(c)**
4 $\frac{R_{150}}{R_{500}} = \frac{[1+\alpha(150)]}{[1+\alpha(500)]}$. Putting $R_{150} = 133\Omega$ and $\alpha = 0.0045/°\text{C}$, we get $R_{500} = 258\Omega$

122 **(c)**
5 As ammeter must be connected in series of 20Ω resistor, and the voltmeter in parallel to 20Ω resistor, the correct arrangement is as shown in figure(c).

122 **(b)**
6 For maximum energy equivalent resistance of combination should be minimum

122 **(b)**
7 In the given case cell is in open circuit ($i = 0$) so voltage across the cell is equal to its e.m.f

122 **(d)**
8 $R_2 = n^2R = (2)^2 \times 5.5 = 22\Omega$

122 **(d)**
9 Current in silver voltmeter.
$i_1 = \frac{m_1}{z_1t_1} = \frac{1}{(11.2\times10^{-4})\times(30\times60)} = 0.5$ A
Current in copper voltmeter $i_2 = \frac{m_2}{z_2t_2}$
$i_2 = \frac{1.8}{(6.6\times10^{-4})\times(30\times60)} = 1.51$ A
So, total current given by battery $i_1 + i_2 = 2.01$ A
Energy supplied by battery= Eit
$W = (12) \times (2.01) \times (30 \times 60)\text{J} = 4.34 \times 10^4$ A

123 **(d)**
0 Tow bulbs of 100 W are connected in series, the total power
$P' = \dfrac{100 \times 100}{100 + 100} = \dfrac{10000}{200}$
$P' = 50$ W
When two bulbs are connected in parallel the total power
$P'' = 100 + 100 = 200$ W

123 **(b)**
1 From the formula shunt resistance
$$S = \frac{i_g \times g}{i - i_g}$$
$$\Rightarrow\ S = \frac{2 \times 12}{5 - 2} = 8\Omega \quad \text{(in parallel)}$$

123 **(d)**
2 $R = \dfrac{\rho l}{A}.So\ R_1 = \dfrac{\rho(4a)}{(2a)(a)} = \dfrac{2\rho}{a}$

$R_2 = \dfrac{\rho(a)}{(4a)(2a)} = \dfrac{\rho}{8a}$ and $R_3 = \dfrac{\rho(2a)}{(4a)(a)} = \dfrac{\rho}{2a}$

$\therefore R_1 > R_3 > R_2$

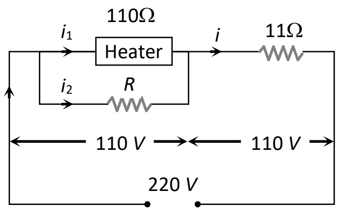
123 **(d)**
3 $i_g = \frac{i}{10} \Rightarrow$ Required shunt $S = \frac{G}{(n-1)} = \frac{90}{(10-1)} =$ 10 Ω

123 **(c)**
4 At room temperature, the free electrons in a conductor move randomly with speed of the order of 10^5ms^{-1}. Since, the motion of the electrons is random there is no net charge flow in any direction.

123 **(a)**
5 Let the resistance of P, Q and R be r.
The total resistance across the battery is
$r_{\text{total}} = r + \dfrac{r}{2} = \dfrac{3}{2}r.$
Current through P,
$I_P = \sqrt{\dfrac{\text{Power}}{r_{\text{total}}}} = \sqrt{\dfrac{12}{\frac{3}{2}r}} = \sqrt{\dfrac{8}{r}}.$
Current through R,
$I = \frac{1}{2}I_P = \sqrt{\frac{2}{r}}.$
Power dissipated in R is thus
$P_R = I^2r = \left(\frac{2}{r}\right)r =$2 W

123 **(c)**
6 The resistance of a metallic wire at temperature t°C is given by
$R_t = R_0(1 + \alpha\, t)$ ... (i)
Given, $\alpha = 0.00125K^{-1}$
$R_{300} = 1\ \Omega$
From Eq. (i), we have
$1 = R_o(1 + 0.00125 \times 300)$ .. (ii)
and $2 = R_0(1 + 0.00125 \times T)$ .. (iii)
$\therefore\ \dfrac{2}{1} = \dfrac{1 + 0.00125 \times T}{1 + 0.00125 \times 300}$
or 2.75=1+0.00125×T
or $T = \frac{1.75}{0.00125} = 1400K$

123 **(a)**
7 Power consumed by heater is 110 W, so by using $P = \frac{V^2}{R}$



$110 = \frac{V^2}{110} \Rightarrow V = 110V$. Also from figure $i_1 = \frac{110}{110} = 1A$
and $i = \frac{110}{11} = 10\ A$. So $i_2 = 10 - 1 = 9\ A$

Applying $Ohms$ law for resistance $R, V = iR$

$\Rightarrow 110 = 9 \times R \Rightarrow R = 12.22\ \Omega$

1238 **(b)**

$R_t = R_0(1 + \alpha t)$

Initially, $R_0(1 + 30\alpha) = 10\Omega$

Finally, $R_0(1 + \alpha t) = 11\Omega$

$\therefore \frac{11}{10} = \frac{1 + \alpha t}{1 + 30\alpha}$

$\Rightarrow 10 + (10 \times 0.002 \times t) = 11 + 330 \times 0.002$

$\Rightarrow 0.02t = 1 + 0.66 = 1.66 \Rightarrow t = \frac{1.66}{0.02} = 83°C$

1239 **(b)**

$H = i^2Rt \Rightarrow R = \frac{H}{i^2t} = \frac{80}{4 \times 10} = 2\ \Omega$

1240 **(b)**

An electric fuse of length l, radius r when used in series of the circuit can withstand only if the rate of heat produced due to current in it is equal to the rate of heat lost due to radiation. If H is the rate of lost per unit area of the fuse wire, then $H \times 2\pi rl = I^2R = I^2\rho l/\pi r^2$

or $H = \frac{I^2\rho}{2\pi^2r^3}$ ie, H is independent of l.

1241 **(c)**

Short circuit current $i_{SC} = \frac{E}{r} \Rightarrow 3 = \frac{1.5}{r} \Rightarrow r = 0.5\Omega$

1242 **(d)**

$\frac{H}{t} = \frac{V^2}{R} \Rightarrow \frac{H}{t} \propto \frac{1}{R}$

1243 **(a)**

Thermo electric power $P = \frac{dE}{d\theta} = \alpha + \beta\theta$

Comparing it with $y = mx + c$, option (a) is correct

1244 **(d)**

In series, total resistance of 5 resistance$= 5R$

Power dissipated $= \frac{V^2}{5R} = 5$

or $= \frac{V^2}{R} = 25$

In parallel, total power $= 5\left(\frac{V^2}{R}\right) = 5 \times 25 = 125$ W

1245 **(b)**

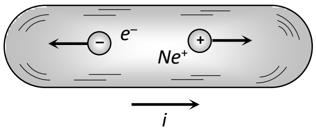
1 faraday $(96500C)$ is the electricity which liberates that amount of substance which is equal to equivalent wt

So liberated amount of Cu is $\frac{63.5}{2}$

$= 31.25\ gm \approx 32\ gm$

1246 **(b)**

Net current $i = i_+ + i_- = \frac{(n_+)(q_+)}{t} + \frac{(n_-)(q_-)}{t}$



$\Rightarrow i = \frac{(n_+)}{t} \times e + \frac{(n_-)}{t} \times e$

$= 2.9 \times 10^{18} \times 1.6 \times 10^{-19} + 1.2 \times 10^{18} \times 1.6 \times 10^{-19}$

$\Rightarrow i = 0.66\ A$

1247 **(b)**

The resistance of a metallic wire at temperature t°C is given by

$R_t = R_0(1 + \alpha t)$

Where α is coefficient of expansion.

Hence, resistance of wire increases on increasing the temperature. Also, from Ohm's law, ratio of $\frac{V}{i}$ is equal to R ie,

$\frac{V}{i} = R$

Hence, on increasing the temperature the ratio $\frac{V}{i}$ increases.

1248 **(a)**

Let resistances are R_1 and R_2,

Then $S = R_1 + R_2$

And $P = \frac{R_1R_2}{R_1+R_2}$

$\therefore (R_1 + R_2) = \frac{n \times R_1R_2}{R_1 + R_2}$ (From $S = nP$)

$\Longrightarrow (R_1 + R_2)^2 = nR_1R_2$

$\Longrightarrow n = \left[\frac{R_1^2 + R_2^2 + 2R_1R_2}{R_1R_2}\right]$

$= \left[\frac{R_1}{R_2} + \frac{R_2}{R_1} + 2\right]$

We know,

Arithmetic Mean ≥ Geometric Mean

$\frac{\frac{R_1}{R_2} + \frac{R_2}{R_1}}{2} \geq \sqrt{\frac{R_1}{R_2} \times \frac{R_2}{R_1}}$

$\Longrightarrow \frac{R_1}{R_2} + \frac{R_2}{R_1} \geq 2$

So, n(minimum value) =2+2=4

1249 **(c)**

From $v_d = \frac{i}{neA} \Rightarrow i \propto v_dA \Rightarrow i \propto v_dr^2$

1250 **(c)**

$P = \frac{V^2}{R} \Rightarrow R_1 = \frac{V_1^2}{P_1} = \frac{(200)^2}{40} = 1000\Omega$

and $R_2 = \frac{V_2^2}{P_2} = \frac{(200)^2}{100} = 400\Omega$

1252 **(d)**

Resistance R bisecting the circuit can be neglected due to the symmetry of the circuit.

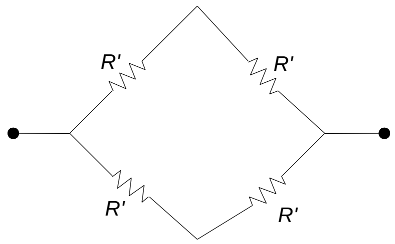
Now, there are four triangles
Effective resistance of each triangle

$$\frac{1}{R'}=\frac{1}{R}+\frac{1}{2R}$$

$$=\frac{2+1}{2R}=\frac{3}{2R}$$

$$\therefore R'=\frac{2}{3}R$$

Now the given circuit reduced to



Therefore, effective resistance between A and B,

$$\frac{1}{R_{AB}}=\frac{1}{2R'}+\frac{1}{2R'}=\frac{1}{R'}$$

$$\Longrightarrow R_{AB}=R'=\frac{2R}{3}\Omega$$

125 **(c)**
3 Given, $l_1=l+\frac{25}{100}l=\frac{5l}{4}$. Since volume or wire remains unchanged on increasing length, hence

$Al-A_1\times 5l/4$ or $A_1=4A/5$

Given, $R=10=\rho l/A$, and

$$R_1=\frac{\rho l_1}{A_1}=\frac{\rho 5l/4}{4A/5}=\frac{25\rho l}{16A}$$

$$\text{or } R_1=\frac{25}{16}\times 10=\frac{250}{16}=15.6\Omega$$

125 **(c)**
4 Given, $l_1=1\text{K}, l_2=3\text{K}, l_3=5\text{K}$
or $m_1=5\text{m}, m_2=3\text{m}, m_3=1\text{m}$
We knows

$$R=\frac{\rho l}{A}$$

So $R_1:R_2:R_3=\frac{l_1}{A_1}:\frac{l_2}{A_2}:\frac{l_3}{A_3}$

$$=\frac{l_1^2}{V_1}:\frac{l_2^2}{V_2}:\frac{l_3^2}{V_3}$$

$$=\frac{l_1^2}{m_1}:\frac{l_2^2}{m_2}:\frac{l_3^2}{m_3}$$

$$=\frac{1}{5}:\frac{9}{3}:\frac{25}{1}=1:15:125$$

125 **(b)**
5 $R=\frac{V}{I_g}-G=\frac{3}{30\times 10^{-3}}-20=10^2-20=80\Omega$

125 **(c)**
6 Let ρ is the resistivity of the material

Resistance for contact $A-A$

$$R_{AA}=\rho\frac{x}{2x\times 4x}=\frac{\rho}{8x}$$

Similar for contacts $B-B$ and $C-C$ are respectively

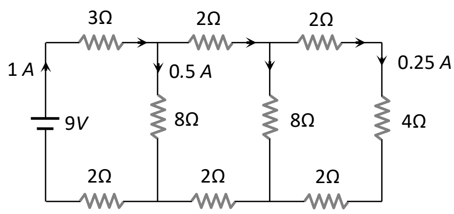
$$R_{BB}=\rho.\frac{2x}{x\times 4x}=\frac{\rho}{2x}=\frac{4\rho}{8x}$$

and $R_{CC}=\rho\frac{4x}{x\times 2x}=\frac{2\rho}{x}=\frac{16\rho}{8x}$

It is clear maximum resistance will be for contact $C-C$

125 **(a)**
7 At point A the slope of the graph will be negative. Hence resistance is negative

125 **(d)**
8 Equivalent resistance of the circuit $R=9\Omega$
$\therefore$ Main current $i=\frac{V}{R}=\frac{9}{9}=1A$



After proper distribution, the current through 4Ω resistance is 0.25 A

125 **(a)**
9 Potential gradient = Change in voltage per unit length

$$\therefore 10=\frac{V_2-V_1}{30/100}\Rightarrow V_2-V_1=3\,volt$$

126 **(d)**
0 Drift velocity is given by

$$v_d=\frac{I}{nqA}$$

Where I is current, n the number of electrons, A the area, q the charge. Given

$$\frac{I}{A}=\frac{480A}{cm^2}, q=1.6\times 10^{-19}C$$

$$n=\frac{6\times 10^{23}\times 9}{64}$$

$$\therefore v_d=480\times\frac{64}{6\times 10^{23}\times 9\times 1.6\times 10^{-19}}$$

$$\Longrightarrow v_d=\frac{480\times 64}{6\times 9\times 1.6\times 10000}cms^{-1}$$

$$\Longrightarrow v_d=\frac{32}{900}cms^{-1}$$

$$=\frac{32\times 10}{900}mms^{-1}$$

$$=0.36mms^{-1}$$

126 **(d)**
1 $v_d=\frac{i}{nAe}=\frac{i\times 4}{n\pi D^2 e}ie, v_d\propto\frac{1}{D^2}$

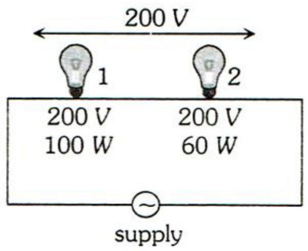
$$\therefore \frac{vd_1}{vd_2} = \frac{D_2^2}{D_1^2} = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

1262 **(b)**

$W = qV = 6 \times 10^{-6} \times 9 = 54 \times 10^{-6} J$

1263 **(b)**

Resistance of bulb 1



$$R_1 = \frac{V^2}{P} = \frac{(220)^2}{100}$$

$R_1 = 484\ \Omega$

Resistance of bulb 2

$$R_2 = \frac{(220\ V)^2}{60\ W} = \frac{4840}{6} = 806.6\ \Omega$$

$$R_{eq} = R_1 + R_2 = (220)^2 \left(\frac{1}{100} + \frac{1}{60}\right)$$

$\Rightarrow$ Current flowing $I = \frac{220\ V}{R_{eq}} = \frac{220}{(220)^2}\left(\frac{100 \times 60}{160}\right)$

$$I = \frac{1}{220}\left(\frac{75}{2}\right), I = \frac{15}{88} A$$

Power consumed by $100W$ bulb $= I^2 R_1$

$$= \left(\frac{15}{88}\right)^2 \times \frac{(220)^2}{100} = \frac{225}{16} = 14W$$

1264 **(b)**

$H = \sigma i t \Delta\theta \Rightarrow$ If $i = 1A, \Delta\theta = 1°\text{C}, t = 1 sec$

then $H = \sigma$

1265 **(b)**

P.d. across the circuit $= 1.2 \times \frac{6 \times 4}{6+4} = 2.88\ volt$

Current through 6 ohm resistance $= \frac{2.88}{6} = 0.48\ A$

1266 **(d)**

Thermocouples are widely used type of temperature sensor and are used as means to convert thermal potential difference into electric potential difference, using different combinations of metals. If metals were arranged according to their heating contrasts a series were formed antimony, iron, zinc, silver, gold, lead, mercury, copper, platinum and bismuth. The greater the heating contrasts between metals, the greater the electromotive force (EMF). Antimony and bismuth formed the best junction for emf.

1267 **(c)**

The resistance of ideal voltmeter is always infinite.

1268 **(b)**

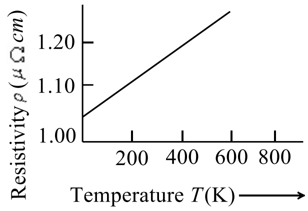
$R = \frac{V^2}{P} \Rightarrow R_1 = \frac{200 \times 200}{100} = 400\ \Omega$ and

$R_2 = \frac{100 \times 100}{200} = 50\ \Omega$. Maximum current rating $i = \frac{P}{V}$

So $i_1 = \frac{100}{200}$ and $i_2 = \frac{200}{100} \Rightarrow \frac{i_1}{i_2} = \frac{1}{4}$

1269 **(b)**

For a limited range of temperatures, the graph between resistivity and temperature is a straight line for a material like nichrome as shown in the figure



1270 **(c)**

Total resistant= $2.5 + 0.5 = 3.0\ \text{k}\Omega = 3000\ \Omega$

$\therefore$ Current, $i = \frac{6}{3000}$ A;

Reading of voltmeter $= i \times (2.5 \times 1000)$

$$= \frac{6}{3000} \times 2500 = 5\text{V}$$

1271 **(c)**

In the absence of electric field (or potential difference applied) across the conductor, the average thermal velocity of electron is zero

1272 **(d)**

$$m = zq = \frac{E}{F} It = \frac{M}{\text{p}F} It \text{ or } I = \frac{mpF}{Mt}$$

$\therefore\ I' = \frac{2.60 \times 1 \times 96500}{108 \times (40 \times 60)} = 0.968$ A

% error in reading of ammeter

$$= \left(\frac{I - I'}{I'}\right) \times 100 = \left(\frac{0.90 - 0.986}{0.968}\right) \times 100$$

$= -7\%$

1274 **(c)**

When the key is in contact with 1, then energy stored in

the condenser $= \frac{1}{2} CE^2$

But when the key is thrown to contact 2, total heat

$$H = I^2(500 + 330) = \frac{1}{2} CE^2$$

$H_1 = I^2(500)$

$$\frac{H_1}{H} = \frac{R_1}{(R_1 + R_2)}$$

$$H_1 = \frac{500}{830} \times \frac{1}{2} \times 5 \times 10^{-6} \times (200)^2$$

$H_1 = 60 \times 10^{-3}$ J

127 **(c)**
5 Before adding, resistance is 5 ohms. After the addition, the central one is a Wheatstone's network.

$\therefore$ Total resistance is $1 + (2 \ \& \ 2$ in parallel$) + 1 = 3\Omega$

$\therefore$ The ratio of resistances $= \frac{5}{3}$

127 **(a)**
6 Resistance of bulb $R = \frac{V^2}{P}$

$$R \propto \frac{1}{P}$$

Here $P_X = 40$ W, and $P_Y = 60$ W

$\therefore \quad R_X > R_Y$

So, potential drop across bulb X ie, of 40 W bulb will be greater and it will glow brighter.

127 **(b)**
7 We know $m = zq$

$\Rightarrow z \propto \frac{1}{q}$

$\therefore \frac{z_2}{z_1} = \frac{q_1}{q_2}$

Total charge $q = q_1 + q_2$

$\frac{q}{q_2} = \frac{q_1}{q_2} + 1$

$\Rightarrow q_2 = \frac{q}{\left(1 + \frac{q_1}{q_2}\right)}$

$\therefore q_2 = \frac{q}{\left(1 + \frac{z_2}{z_1}\right)}$

127 **(a)**
8 Reading of galvanometer remains same whether switch S is open or closed, hence no current will flow through the switch $i.e.$ R and G will be in series and same current will flow through them.

$I_R = I_G$

127 **(d)**
9 Density of copper,

$\rho = 9 \times 10^3$ kg/m^3 $= 9 \times 10^6$g/m^3

Avogadro number, $N_A = 6.023 \times 10^{23}$

Mass of 1 mole of copper atom, M=63.5g

Thus, number of free electrons per volume is

$$n = \frac{N_A}{M}\rho = \frac{6.023 \times 10^{23}}{63.5} \times 9 \times 10^6$$
$$= 8.5 \times 10^{28} \text{m}^{-3}$$

128 **(c)**
0 The temperature coefficient of the carbon is negative so the resistance of carbon decreases with the increase of temperature.

128 **(d)**
1 To convert a moving coil galvanometer into a voltmeter, a high resistance is connected in series with it.

128 **(d)**
2 Due to high resistance of voltmeter, connected in series, the effective resistance of circuit will increase and hence the current in circuit will decrease. Due to which the ammeter and voltmeter will not be damaged.

128 **(c)**
4 $P_p = nP = 2 \times 40 = 80\ W$

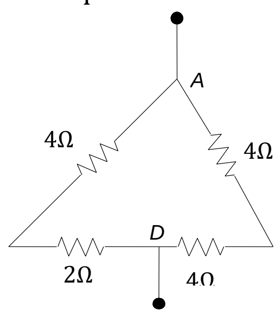
128 **(a)**
5 A is false because at neutral temperature thermo emf is maximum. B is true

128 **(d)**
6 From the curve it is clear that slopes at points A, B, C, D have following order $A > B > C > D$

And also resistance at any point equals to slope of the $V - i$ curve.

So order of resistance at three points will be $R_A > R_B > R_C > R_D$

128 **(c)**
7 The equivalent circuit is given by



4Ω and 2Ω resistances are in series on both sides.

$\therefore 4\Omega + 2\Omega = 6\Omega$

Then 6Ω and6Ω resistances are in parallel on both sides

$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

R=3Ω

128 **(c)**
8 $E = \frac{V}{l} = \frac{iR}{l} = \frac{i\rho l}{Al} = \frac{i\rho}{A} = \frac{1 \times 1.7 \times 10^{-8}}{2 \times 10^{-6}}$

$= 8.5 \times 10^{-3}$Vm^{-1}

128 **(d)**
9 $E = a\theta + b\theta^2$ (given)

For neutral temperature (θ_n), $\frac{dE}{d\theta} = 0$

$\Rightarrow \ a + 2b\ \theta_n = 0$

$\Rightarrow \theta_n = -\frac{a}{2b}$

$\therefore \theta_n = -\frac{700}{2} \quad \left(\because \frac{a}{b} = 700°C\right)$

$= -350°C < 0°C$

But neutral temperature can never be negative (less than zero), *ie*, $\theta_n \nless 0°C$.

Hence, no neutral temperature is possible for this thermocouple.

1290 **(a)**

$R_1 - 1/2\Omega, R_2 = 1/4\Omega; R_3 = 1/6\Omega$

In parallel; $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R3} = 2 + 4 + 6 = 12$

or Equivalent conductance, $G = \frac{1}{R_p} = 12S$

1291 **(c)**

Let S be the large and R be the smaller resistance.

From formula for meter bridge

$S = \left(\frac{100 - l}{l}\right)R = \frac{100 - 20}{20}R = 4R$

Again, $S = \left(\frac{100-l}{100}\right)(R + 15)$

$= \frac{100 - 40}{40}(R + 15) = \frac{3}{2}(R + 15)$

$\therefore \quad 4R = \frac{3}{2}(R + 15)$

$\frac{8R}{3} - R = 15$

$\Rightarrow \frac{5R}{3} = 15$

$R = 9\Omega$

1292 **(c)**

Reading of voltmeter

$= E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} = \frac{18 \times 1 + 12 \times 2}{1 + 2} = 14V$

1294 **(a)**

$\because$ Peltier coefficient $\pi = T\frac{de}{dT}$ and $t°C = T - 273$

$\therefore e = a(T - 273) + b(T - 273)^2$

Differentiating $w.r.t.T\frac{de}{dT} = a + 2b(T - 273)$

$\pi = T\frac{de}{dT} = T[a + 2b(T - 273)] \Rightarrow \pi$

$= (t + 273)(a + 2bt)$

1295 **(b)**

Positive ions get deposited on cathode

1296 **(a)**

Current through the combination $i = \frac{120}{(6 + 9)}$

$= 8\,A$

So, power consumed by $6\,\Omega$ resistance

$P = (8)^2 \times 6 = 384\,W$

1297 **(c)**

As we know, for conductors, resistance $\propto$ temperature.

From figure $R_1 \propto T_1 \Rightarrow \tan\theta \propto T_1 \Rightarrow \tan\theta = kT_1$ ...(i)

and $R_2 \propto T_2 \Rightarrow \tan(90° - \theta) \propto T_2 \Rightarrow \cot\theta = kT_2$ ...(ii)

From equation (i) and (ii), $k(T_2 - T_1) = (\cot\theta - \tan\theta)$

$(T_2 - T_1) = \left(\frac{\cos\theta}{\sin\theta} - \frac{\sin\theta}{\cos\theta}\right) = \frac{(\cos^2\theta - \sin^2\theta)}{\sin\theta\cos\theta}$

$= 2\cot 2\theta$

$\Rightarrow (T_2 - T_1) \propto \cot 2\theta$

1298 **(a)**

Neutral temperature $T_n = \frac{T_c + T_f}{2}$

$320° = \frac{T_c + 600°}{2}$

$640° = T_c + 600°$

$T_c = 40°C$

1299 **(d)**

As resistance of a bulb $R = \frac{V^2}{P}$,

Hence $R_1 : R_2 : R_3 = \frac{1}{100} : \frac{1}{60} : \frac{1}{60}$

Now the combined potential difference across B_1 and B_2 is same as the potential difference across B_3. Hence, W_3 is more than W_1 and W_2, being in series, carry same current and $R_1 < R_2$, therefore $W_1 < W_2$,

$\therefore \; W_1 < W_2 < W_3$

1300 **(a)**

Given,

$l = 5cm = 5 \times 10^{-2}m$,

$\rho = 3.5 \times 10^{-5}\Omega m$

$A = \pi(1 \times 10^{-4} - 0.25 \times 10^{-4})$

$= 0.75\pi \times 10^{-4}m$

$= 7.5\pi \times 10^{-5}m$

$\therefore \quad R = \frac{\rho l}{A} = \frac{3.5 \times 10^{-5} \times 5 \times 10^{-2}}{7.5\pi \times 10^{-5}}$

$= 7.42 \times 10^{-3}\Omega$

1301 **(d)**

At an instant approach the student will choose $\tan\theta$ will be the right answer. But it is to be seen here the curve makes the angle θ with the V-axis. So it makes an angle $(90 - \theta)$ with the i-axis

So resistance = slope = $\tan(90 - \theta) = \cot\theta$

1302 **(a)**

$R = \frac{Sl}{A} = \frac{Sl^2}{V}$

$\therefore \quad \dfrac{\Delta R}{R} = 2\dfrac{\Delta l}{l} = +2.0\%$

130 **(c)**

3 $R_s = R + R = 2R$ and $R_P = \dfrac{R \times R}{R + R} = R/2$

$\frac{H_1}{H_2} = \frac{I^2 R_S}{I^2 R_P} = \frac{R_S}{R_P} = \frac{2R}{R/2} = \frac{4}{1}$.

130 **(c)**

4 $H = \dfrac{V^2}{R} t$

Since supply voltage is same and equal amount of heat is produced, therefore

$\dfrac{R_1}{t_1} = \dfrac{R_2}{t_2}$ or $\dfrac{R_1}{R_2} = \dfrac{t_1}{t_2}$ ... (i)

But $R \propto l \Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2}$ ...(ii)

By (i) and (ii), $\frac{l_1}{l_2} = \frac{t_1}{t_2}$ ...(iii)

Now $l_2 = \frac{2}{3} l_1 \Rightarrow \frac{l_1}{l_2} = \frac{3}{2}$

$\therefore$ By equation (iii), $\frac{3}{2} = \frac{15}{t_2} \Rightarrow t_2 = 10\ minutes$

130 **(c)**

6 The best conductor of electricity is one whose resistance is least. As $R = \rho l/A$. Therefore for the given value of l and $A, R \propto \rho$. Hence, silver is the best conductor of heat and electricity

130 **(a)**

7 Current flowing through both the bars is equal. Now, the heat produced is given by

$H = I^2 Rt$

$H \propto R$ or $\dfrac{H_{AB}}{H_{BC}} = \dfrac{R_{AB}}{R_{BC}}$

$= \dfrac{(1/2r)^2}{(1/r)^2} \qquad \left(\text{as } R \propto \dfrac{1}{A} \propto \dfrac{1}{r^2}\right)$

$= \dfrac{1}{4}$ or $H_{BC} = 4H_{AB}$

130 **(c)**

8 $P = 100$ watt, $V = 125\ V$

Since $P = VI, \therefore I = \frac{P}{V} = \frac{100}{125}\ ampere$

Mass of chlorine liberated $= zIt$

$= 0.367 \times 10^{-6} \times \dfrac{100}{125} \times 60 = 0.0176 \times 10^{-3} kg$

$= 17.6 mg$

131 **(a)**

0 $J = nqv = n(ze)v$

$= \dfrac{2 \times 10^8 \times 2 \times 1.6 \times 10^{-19} \times 10^5}{(10^{-2})^3}$

$= 6.4 A/m^2$

131 **(d)**

1 In series $P_S = \dfrac{P}{n} \Rightarrow 10 = \dfrac{P}{3} \Rightarrow P = 30\ W$

In parallel $P_P = nP = 3 \times 30 = 90\ W$

131 **(b)**

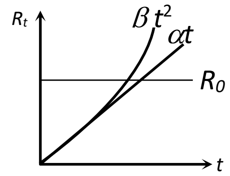
3 Cells are joined in parallel when internal resistance is higher than external resistance. $[R < < r]$

$i = \dfrac{E}{R + \frac{r}{n}}$

131 **(b)**

5 Since the value of R continuously increases, both α and β must be positive.

Actually the components of the given equation are as follows



131 **(b)**

6 In series : Potential difference $\propto R$

When only S_1 is closed $V_1 = \frac{3}{4} E = 0.75E$

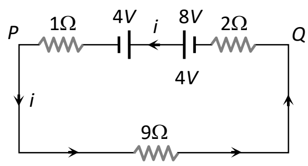
When only S_2 is closed $V_2 = \frac{6}{7} E = 0.86E$

And when both S_1 and S_2 are closed combined resistance of $6R$ and $3R$ is $2R$

$\therefore V_3 = \left(\dfrac{2}{3}\right) E = 0.67E \Rightarrow V_2 > V_1 > V_3$

131 **(a)**

7 Applying Kirchhoff's voltage law in the given loop



$-2i + 8 - 4 - 1 \times i - 9i = 0 \Rightarrow i = \dfrac{1}{3} A$

Potential difference across $PQ = \frac{1}{3} \times 9 = 3V$

131 **(b)**

8 Number of free electrons per unit volume,

$n = \dfrac{N}{M} \rho = \dfrac{6.023 \times 10^{23}}{63.5 \times 10^{-3}} \times 9 \times 10^3$

$\therefore \ v_d = \dfrac{i}{nAe}$

$= \dfrac{1.5 \times 63.5 \times 10^{-3}}{6.023 \times 10^{23} \times 9 \times 10^3 \times 10^{-7} \times 1.6 \times 10^{-19}}$

$= 1.1 \times 10^{-3} \text{ms}^{-1}$

131 **(c)**

9 Chemical energy consumed per sec = heat energy produced per sec.

$I^2(R + r) = (0.2)^2(21 + 4) = 1\ \text{J s}^{-1}$

132 **(d)**

0 Potential gradient of a potentiometer

$K = \frac{I\rho}{A} = \frac{0.2 \times 4 \times 10^{-7}}{8 \times 10^{-7}}$

$= 0.1 \text{V/m}$

132 **(b)**

1 Let the current in the circuit $= i = \frac{V}{R}$

Across the cell, $E = V + ir \Rightarrow r = \frac{E-V}{i} = \frac{E-V}{V/R} = \left(\frac{E-V}{V}\right)R$

132 **(b)**

2 Charge $Q = I\,t = 1.6 \times 60 = 96\ C$

Let n be the number of Cu^{+2} ions, then

$ne = Q \Rightarrow n = \frac{Q}{e} = \frac{96}{2 \times 1.6 \times 10^{-19}} = 3 \times 10^{20}$

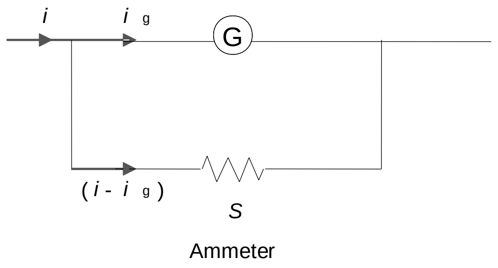
132 **(b)**

3 Maximum number of resistances $= 2^{n-1} = 2^{3-1} = 4$

132 **(b)**

4 Shunt is a low resistance used in parallel with the galvanometer to make it ammeter.

The circuit is shown in figure.



Voltage across galvanometer = voltage across shunt

ie., $i_g G = (i - i_g)S$ or $S = \frac{i_g G}{i - i_g}$

Given, $G = 22.8\Omega$, $i = 20A$, $i_g = 1A$

$\therefore\ S = \frac{1 \times 22.8}{20 - 1} = \frac{22.8}{19} = 1.2\Omega$

132 **(d)**

5 $P_{Rated} \propto \frac{1}{R} \Rightarrow \frac{R_1}{R_2} = \frac{P_2}{P_1} = \frac{60}{40} = \frac{3}{2}$

132 **(c)**

6 According to Faraday's law of electrolysis

$m = zq$

$\frac{m_{zn}}{m_{Cu}} = \frac{z_{Zn}}{z_{Cu}}$

$\therefore \frac{0.13}{m_{Cu}} = \frac{32.5}{31.5}$

$m_{Cu} = 0.126$ g.

132 **(b)**

8 It is the electric field that is set up which moves with the velocity of light in that medium

1 **(b)**

3 Given resistance of each part will be

2

9