2.UNITS AND MEASUREMENTS

Single Correct Answer Type

1. $1\,Wb/m^2$ is equal to

a) $10^4\,gauss$ b) $4\pi\times10^{-3}\,gauss$ c) $10^2\,gauss$ d) $10^{-4}\,gauss$

2. The maximum static friction on a body is $F=\mu N$. Here, $N=¿$ normal reaction force on the body $\mu=¿$ coefficient of static friction. The dimensions of μ are

a) $[MLT^{-2}]$ b) $[M^0L^0T^0\theta^{-1}]$ c) Dimensionless d) None of these

3. The dimensions of gravitational constant G and the moment of inertia are respectively

a) $ML^3T^{-2}; ML^2T^0$ b) $M^{-1}L^3T^{-2}; ML^2T^0$ c) $M^{-1}L^3T^{-2}; M^{-1}L^2T$ d) $ML^3T^{-2}; M^{-1}L^2T$

4. One femtometer is equivalent to

a) $10^{15}\,m$ b) $10^{-15}\,m$ c) $10^{-12}\,m$ d) $10^{12}\,m$

5. In the relation $x=\cos(\omega t+kx)$, the dimensions of ω are

a) $¿$ b) $[M^0L^{-1}T^0]$ c) $[M^0L^0T^{-1}]$ d) $[M^0¿^{-1}]$

6. A physical parameter a can be determined by measuring the parameters b, c, d and e using the relation $a=b^\alpha c^\beta/d^\gamma e^\delta$. If the maximum errors in the measurement of b, c, d and e are $b_1\%, c_1\%, d_1\%$and $e_1\%$, then the maximum error in the value of a determined by the experiment is

a) $(b_1+c_1+d_1+e_1)\%$ b) $(b_1+c_1-d_1-e_1)\%$

c) $(\alpha b_1+\beta c_1-\gamma d_1-\delta e_1)\%$ d) $(\alpha b_1+\beta c_1+\gamma d_1+\delta e_1)\%$

7. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the acceleration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is

a) e_2-e_1 b) e_1+2e_2 c) e_1+e_2 d) e_1-2e_2

8. A body travels uniformly a distance of $(13.8\pm0.2)m$ in a time (4.0 ± 0.3 ¿s. The velocity of the body within error limits is

a) $(3.45\pm0.2)ms^{-1}$ b) $(3.45\pm0.3)ms^{-1}$ c) $(3.45\pm0.4)ms^{-1}$ d) $(3.45\pm0.5)ms^{-1}$

9. In a vernier callipers, one main scale division is $x\,cm$ and n division of the vernier scale coincide with $(n-1)$ divisions of the main scale. The least count ¿incm ¿ of the callipers is

a) $\left(\frac{n-1}{n}\right)x$ b) $\frac{nx}{(n-1)}$ c) $\frac{x}{n}$ d) $\frac{x}{(n-1)}$

10. The dimensions of surface tension are

a) $ML^{-1}T^{-2}$ b) MLT^{-2} c) $ML^{-1}T^{-1}$ d) MT^{-2}

11. The Vander Waal's equation of state for real gases is given as $\left(P+\frac{a}{V^2}\right)(V-b)=nRT$ which of the following terms has dimensions different from that of energy

a) PV b) $\frac{a}{V^2}$ c) $\frac{ab}{V^2}$ d) bP

12. Dimensional formula of magnetic flux is

a) $ML^2T^{-2}A^{-1}$ b) $ML^0T^{-2}A^{-2}$ c) $M^0L^{-2}T^{-2}A^{-3}$ d) $ML^2T^{-2}A^3$

13. If unit of length, mass and time each be doubled, the unit of work done is increased by

a) 4 times b) 6 times c) 8 times d) 2 times

14. Taking frequency f, velocity v and density ρ to be the fundamental quantities, then the dimensional formula for momentum will be

a) $[\rho v^4 f^{-3}]$ b) $[\rho v^3 f^{-1}]$ c) $[\rho v f^2]$ d) $[\rho^2 v^2 f^2]$

15. The length, breadth and thickness of a block is measured to be 50 cm, 2.0 cm and 1.00 cm. The percentage error in the measurement of volume is

a) 0.8 % b) 8% c) 10% d) 12.5%

16. Two quantities A and B are related by the relation $\frac{A}{B}$=m, where m is linear mass den sity and A is force. The dimensions of B will be

a) Mass as that of latent heat b) Same a that of pressure

c) Same as that of work d) Same as that of momentum

17. The number of significant figures in the numbers 4.8000×10^4 and 48000.50 are respectively

a) 5 and 6 b) 5 and 7 c) 2 and 7 d) 2 and 6

18. The specific resistance ρ of a circular wire of radius r. Resistance R and and length l is given by $\rho = \frac{\pi r^2 R}{l}$.

Given, $r = 0 : (24 \pm 0.02)$cm, $R = (30 \pm 1)\,\Omega$ and $l = (4.80 \pm 0.01)$cm. The percentage error in ρ is nearly

a) 7% b) 9% c) 13% d) 20%

19. The dimensional formula of modulus of rigidity is

a) $[ML^{-2}T^{-2}]$ b) $[ML^{-3}T_2]$ c) $[ML^2T^{-2}]$ d) $[ML^{-1}T^{-2}]$

20. Which of the following quantities is dimensionless

a) Gravitational constant b) Planck's constant

c) Power of a convex lens d) None

21. The respective number of significant figures for the numbers $23.023, 0.0003$ and 2.1×10^{-3} are

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

22. One slug is equivalent to 14.6 kg. A force of 10 pound is applied on a body of 1 kg. The acceleration of the body is

a) $44.5\ m s^{-2}$ b) $4.448 m s^{-2}$ c) $44.4 m s^{-2}$ d) None of these

23. The dimensions of magnetic field in M, L, T and C (coulomb) is given as

a) $[MLT^{-1}C^{-1}]$ b) $[MT^2C^{-2}]$ c) $[MT^{-1}C^{-1}]$ d) $[MT^{-2}C^{-1}]$

24. In a system of units if force (F), acceleration (A), and time (T) are taken as fundamental units then the dimensional formula of energy is

a) $F A^2 T$ b) $FA T^2$ c) $F^2 AT$ d) FAT

25. A calorie is a unit of heat and equal 4.2 J. Suppose we employ a system of units in which the unit of mass is αkg, the unit of length is β metre and the unit of time is γ sec. In this new system. 1 calorie =

a) $\alpha^{-1}\beta^{-2}\gamma^2$ b) $4.2\alpha\beta^2\gamma^2$ c) $\alpha\beta^2\gamma^2$ d) $4.2\alpha^{-1}\beta^{-2}\gamma^2$

26. The dimensional formula for young's modulus is

a) $ML^{-1}T^{-2}$ b) M^0LT^{-2} c) MLT^{-2} d) ML^2T^{-2}

27. The dimensional formula for entropy is

a) $[MLT^{-2}K^{-1}]$ b) $[ML^2T^{-2}]$ c) $[ML^2T^{-2}K^{-1}]$ d) $[ML^{-2}T^{-2}K^{-1}]$

28. Dimensions of CR are those of

a) Frequency b) Energy c) Time period d) Current

29. Which one of the following pair of quantities has same dimension?

a) Force and work done b) Momentum and impulse

c) Pressure and force d) Surface tension and stress

30. Given $\pi=3.14$. the value of π^2 with due regard for significant figures is

a) 9.86 b) 9.859 c) 9.8596 d) 9.85960

31. Dimensions of frequency are

a) $M^0L^{-1}T^0$ b) $M^0L^0T^{-1}$ c) M^0L^0T d) MT^{-2}

32. Dimensional formula for angular momentum is

a) ML^2T^{-2} b) ML^2T^{-1} c) MLT^{-1} d) $M^0L^2T^{-2}$

33. Which of the following quantities has the same dimensions as that of energy

a) Power b) Force c) Momentum d) Work

34. If L and R are respectively the inductance and resistance, then the dimensions of $\frac{L}{R}$ will be

a) $M^0L^0T^{-1}$ b) M^0<°

c) M^0L^0T d) Cannot be represented in terms of M, $L$and T

35. The dimension of the ratio of angular to linear momentum is

a) $M^0L^1T^0$ b) $M^1L^1T^{-1}$ c) $M^1L^2T^{-1}$ d) $M^{-1}L^{-1}T^{-1}$

36. The unit of Planck's constant is

a) *Joule* b) *Joule/s* c) *Joule/m* d) *Joule-s*

37. $ML^3T^{-1}Q^{-2}$ is dimensions of

a) Resistivity b) Conductivity c) Resistance d) None of these

38. If force is proportional to square of velocity, then the dimensions of proportionality constant are

a) $[ML^{-1}T]$ b) $[ML^{-1}T^0]$ c) $[MLT^0]$ d) $[M^0$ ¿$^{-1}]$

39. A unit of area, often used in measuring land areas, is the hectare defined as $10^4\ m^2$. An open-pit coal mine consumes 75 hectares of land, down to a depth of 26m, each year. What volume of earth, in cubic kilometre, is removed in this time?

a) 0.01 b) 0.02 c) 0.03 d) 0.04

40. A physical quantity is represented by $X=M^{\alpha}L^{b}T^{-c}$. If percentage errors in the measurements of M, L and T are $\alpha\%$, $\beta\%$and $\gamma\%$ respectively, then total, percentage error is

a) $(\alpha a+\beta b-\gamma c)\%$ b) $(\alpha a+\beta b+\gamma c)\%$ c) $(\alpha a-\beta b-\gamma c)\%$ d) 0%

41. The density of the material of a cube is measured by measuring its mass and length of its side. If the maximum errors in the measurement of mass and the length are 3% and 2% respectively. The maximum error in the measurement of density is

a) 1% b) 5% c) 7% d) 9%

42. The sides of a rectangle are 6.01 m and 12m. taking the significant figures into account, the area of the rectangle is

a) $7.2\ m^2$ b) $72.1\ m^2$ c) $72.00\ m^2$ d) $72.12\ m^2$

43. Density of a liquid in CGS system is $0.625\ g/cm^3$. What is its magnitude in SI system

a) 0.625 b) 0.0625 c) 0.00625 d) 625

44. The equation of state of some gases can be expressed as $\left(P+\frac{a}{V^2}\right)(V-b)=RT$. Here P is the pressure, V is the volume, T is the absolute temperature and a, b, R are constants. The dimensions of 'a' are

a) ML^5T^{-2} b) $ML^{-1}T^{-2}$ c) $M^0L^3T^0$ d) $M^0L^6T^0$

45. A physical quantity u is given by the relation $u=\frac{B^2}{2\mu_0}$

here, $B=¿$magnetic field strength

$\mu_0=¿$magnetic permeability of vacuum.

a) Energy b) Energy density c) Pressure d) None of these

46. A rectangular beam which is supported at its two ends and leaded in the middle with weight w sags by an amount δ such that $\delta=\frac{wl^3}{4Yd^3}$,where l, d and Y represent length, depth and elasticity respectively.

Guess the unknown factor using dimensional considerations

a) Breadth b) $(breadth)^2$ c) $(breadth)^3$ d) Mass

47. The dimension of quantity (L/RCV) is

a) $[A]$ b) $[A^2]$ c) $[A^{-1}]$ d) None of these

48. The pair having the same dimensions is

a) Angular momentum, work b) Work, torque

c) Potential energy, linear momentum d) Kinetic energy, velocity

49. The fundamental unit, which has the same power in the dimensional formulae of surface tension and viscosity is

a) Mass b) Length c) Time d) None of these

50. Which is not a unit of electric field

a) NC^{-1} b) Vm^{-1} c) JC^{-1} d) $JC^{-1}m^{-1}$

51. $newton-second$ is the unit of

a) Velocity b) Angular momentum c) Momentum d) Energy

52. Student I, II and III perform an experiment for measuring the acceleration due to gravity (g) using a simple pendulum. They use different lengths of the pendulum and/or record time for different number of oscillations. The observations are shown in the table..

Least count for length = 0.1 cm.

Least count for time = 0.1 s.

Student	Length of the pendulum (cm)	Number of oscillations (n)	Total time for (n) oscillations (s)	Time period (s)
I	64.0	8	128.0	16.0
II	64.0	4	64.0	16.0
III	20.0	4	36.0	9.0

If $E_1, E_{II} \wedge E_{III}$ are the percentage errors in g, $ie, \left(\frac{\Delta g}{g} \times 100\right)$, for students I, II and III respectively.

a) $E_I = 0$

b) E_I is minimum

c) $E_I = E_{II}$

d) E_{II} is maximum

53. Which of the following is not equal to $watt$

a) $joule/second$ b) $ampere \times volt$ c) $(ampere)^2 \times ohm$ d) $ampere/volt$

54. Which is the correct unit for measuring nuclear radii

a) $Micron$ b) $Millimetre$ c) $Angstrom$ d) $Fermi$

55. The dimensions of electric dipole moment are

a) $[L^2 I]$ b) $[LI]$ c) $[LTI]$ d) $[T^{-2}]$

56. The physical quantities not having same dimensions are

a) Torque and work
b) Momentum and Planck's constant
c) Stress and Young's modules
d) Speed and $(\mu_0 \varepsilon_0)^{-1/2}$

57. In C.G.S. system the magnitude of the force is $100\,dyne$. In another system where fundamental physical quantities are kilogram, $metre$ and minute, the magnitude of the force is

a) 0.036 b) 0.36 c) 3.6 d) 36

58. The mass and volume of a body are found to be $5.00 \pm 0.05\,kg \wedge 1.00 \pm 0.05\,m^3$ respectively. Then the maximum possible percentage error in its density is

a) 6% b) 3% c) 10% d) 5%

59. Given that $2l\sqrt{\frac{m}{T}}$, where l is the length of a string of linear density m, under tension T ha the same dimensional formula as that of

a) Mass b) Time c) Length d) Mole

60. The dimensional formula of relative density is

a) ML^{-3} b) LT^{-1} c) MLT^{-2} d) Dimensionless

61. If $F = 6\pi\eta^a r^b v^c$,
Where $F = ¿$viscous force
$\eta = ¿$coefficient of viscosity

$r=¿$radius of spherical body
$v=¿$terminal velocity of the body.
Find the values of a, b and c.

a) $a=1, b=2, c=1$ b) $a=1, b=1, c=1$
c) $a=2, b=1, c=1$ d) $a=2, b=1, c=2$

62. If L denotes the inductance of an inductor through which a current I is flowing, then the dimensional formula of LI^2 is
a) $[MLT^{-2}]$ b) $[ML^2T^{-2}]$
c) $[M^2L^2T^{-2}]$ d) Not expressible in terms of M, L, T

63. Dimensional formula for torque is
a) L^2MT^{-2} b) $L^{-1}MT^{-2}$ c) L^2MT^{-3} d) LMT^{-2}

64. If force (F), length (L) and time (T) are assumed to be fundamental units, then the dimensional formula of the mass will be
a) $FL^{-1}T^2$ b) $FL^{-1}T^{-2}$ c) $FL^{-1}T^{-1}$ d) FL^2T^2

65. Dimensions of ohm are same as ($h-¿$Planck's constant, $e-¿$charge)
a) h/e b) h^2/e c) h/e^2 d) h^2e^2

66. Dimensions of permeability are
a) $A^{-2}M^1L^1T^{-2}$ b) MLT^{-2} c) ML^0T^{-1} d) $A^{-1}MLT^2$

67. The surface tension of mercury is 32 dyne cm^{-1}. Its value in SI units is
a) 0.032 b) 0.32 c) 3200 d) 32000

68. The internal and external diameters of a hollow cylinder are measured with the help of a vernier calipers. Their values are 4.23 ± 0.01 cm and 3.87 ± 0.01 cm respectively. The thickness of the wall of the cylinder is
a) 0.36 ± 0.02 cm b) 0.18 ± 0.02 cm c) 0.36 ± 0.01 cm d) 0.18 ± 0.01 cm

69. $Henry/ohm$ can be expressed in
a) $Second$ b) $Coulomb$ c) Mho d) $Metre$

70. Coefficient of thermal conductivity has the dimensions
a) $[MLT^{-3}K^{-1}]$ b) $[ML^3T^3K^2]$ c) $[ML^3T^{-3}K^{-2}]$ d) $[M^2L^3T^{-3}K^2]$

71. Tesla is a unit for measuring
a) Magnetic moment b) Magnetic induction
c) Magnetic intensity d) Magnetic pole strength

72. According to $Joule's$ law of heating, heat produced $H=I^2Rt$, where $I$is current, R is resistance and t is time. If the errors in the measurement of I, R and t are 3%, 4% and 6% respectively then error in the measurement of H is
a) $\pm 17\%$ b) $\pm 16\%$ c) $\pm 19\%$ d) $\pm 25\%$

73. In the equation $X=3YZ^2$, X and Z have dimensions of capacitance and magnetic induction respectively. In MKSQ system, the dimensional formula of Y is
a) $[M^{-3}L^{-2}T^{-2}Q^{-4}]$ b) $[ML^{-2}]$ c) $[M^{-3}L^{-2}Q^4T^8]$ d) $[M^{-3}L^{-2}Q^4T^4]$

74. Which of the following system of units is not based on units of mass, length and time alone

a) SI b) MKS c) FPS d) CGS

75. The SI unit of momentum is

a) $\frac{kg}{m}$ b) $\frac{kg.m}{sec}$ c) $\frac{kg.m^2}{sec}$ d) $kg \times newton$

76. The dimensions of resistance are same as those of ……… Where h is the Planck's constant and e is the charge.

a) $\frac{h^2}{e^2}$ b) $\frac{h^2}{e}$ c) $\frac{h}{e^2}$ d) $\frac{h}{e}$

77. Which of the following is a derived unit

a) Unit of mass b) Unit of length c) Unit of time d) Unit of volume

78. In the relation $p=\frac{\alpha}{\beta}e^{\frac{-\alpha z}{k\theta}}$, p is the pressure, z the distance, k is Boltzmann constant and θ is the temperature, the dimensional formula of β will be

a) $[M^0L^2T^0]$ b) $[ML^2T]$ c) $[ML^0T^{-1}]$ d) $[ML^2T^{-1}]$

79. The dimensions of universal gravitational constant are

a) $M^{-2}L^2T^{-2}$ b) $M^{-1}L^3T^{-2}$ c) $ML^{-1}T^{-2}$ d) ML^2T^{-2}

80. If I is the moment of inertia and ω the angular velocity, what is the dimensional formula of rotational kinetic energy $\frac{1}{2}I\omega^2$?

a) $[ML^2T^{-1}]$ b) $[M^2L^{-1}T^{-2}]$ c) $[ML^2T^{-2}]$ d) $[M^2L^{-1}T^{-2}]$

81. A screw gauge gives the following reading when used to measure the diameter of a wire
Main scale reading : $0\,mm$
Circular scale reading : 52 divisions
Given that $1\,mm$ on main scale corresponds to 100 divisions on the circular scale.
The diameter of wire from the above data is

a) $0.52\,cm$ b) $0.052\,cm$ c) $0.026\,cm$ d) $0.005\,cm$

82. The dimensional formula of capacitance in terms of M, L, T and I is

a) $[ML^2T^2I^2]$ b) $[ML^{-2}T^4I^2]$ c) $[M^{-1}L^3T^3I]$ d) $[M^{-1}L^{-2}T^4I^2]$

83. $Volt/metre$ is the unit of

a) Potential b) Work c) Force d) Electric intensity

84. The dimension of magnetic field in M, L, T and C (coulomb) is given as

a) MT^2C^{-2} b) $MT^{-1}C^{-1}$ c) $MT^{-2}C^{-1}$ d) $MLT^{-1}C^{-1}$

85. The dimensional formula of electrical conductivity is

a) $[M^{-1}L^{-3}T^3A^2]$ b) $[ML$¿¿$3T^3A^2]$¿ c) $[M^2L$¿¿$3T^{-3}A^2]$¿ d) $[ML$¿¿$3T^3A^{-2}]$¿

86. The only mechanical quantity which has negative dimension of mass is

a) Angular momentum b) Torque

c) Coefficient of thermal conductivity d) Gravitational constant

87. The dimensional formula for impulse is

a) MLT^{-2} b) MLT^{-1} c) ML^2T^{-1} d) M^2LT^{-1}

88. The physical quantities not having same dimensions are

a) Speed and $(\mu_0 \varepsilon_0)^{-1/2}$
b) Torque and work
c) Momentum and Planck's constant
d) Stress and Young's modulus

89. Which unit is not for length

a) Parsec b) Light year c) Angstrom d) Nano

90. The surface tension is $T = \frac{F}{l}$, then the dimensions of surface tension are

a) $[MLT^{-2}]$ b) $[MT^{-2}]$ c) $[M^0L^0T^0]$ d) None of these

91. The thrust developed by a rocket-motor is given by $F = mv + A(p_1 - p_2)$, where m is the mass of the gas ejected per unit time, v is velocity of the gas, A is area of cross-section of the noszzle, $p_1 \cdot p_2$are the pressures of the exhaust gas and surrounding atmosphere. The formula is dimensionally

a) Correct
b) Wrong
c) Sometimes wrong, sometimes correct
d) Data is not adequate

92. What is the unit of k in the relation $U = \frac{ky}{y^2 + a^2}$ where U represents the potential energy, y represents the displacement and a represents the maximum displacement ie, amplitude?

a) $m s^{-1}$ b) m s c) J m d) J s^{-1}

93. The damping force of an oscillating particle is observed to be proportional to velocity. The constant of proportionality can be measured in

a) Kg s^{-1} b) Kg s c) Kg $m s^{-1}$ d) Kg $m^{-1} s^{-1}$

94. The unit of self-inductance is

a) Weber ampere b) $Weber^{-1}$ ampere c) Ohm second d) Farad

95. If $S = \frac{1}{3} f t^3, f$ has the dimensions of

a) $[M^0L^{-1}T^3]$ b) $[MLT^{-3}]$ c) $[M^0L^1T^{-3}]$ d) $[M^0L^{-1}T^{-3}]$

96. The unit of angular acceleration in the SI system is

a) $N kg^{-1}$ b) $m s^{-2}$ c) $rad\, s^{-2}$ d) $m kg^{-1} K$

97. If $C, R, L \wedge I$ denote capacity, resistance, inductance and electric current respectively, the quantities having the same dimensions of time are

$(1) CR$
$(2) \frac{L}{R}$
$(3) \sqrt{LC}$
$(4) L I^2$

a) (1) and (2) only
b) (1) and (3) only
c) (1) and (4) only
d) (1), (2) and (3) only

98. What will be the unit of time in that system in which the unit of length is metre, unit of mass is kg and unit of force is kg wt?

a) $(9.8)^2$sec b) 9.8 sec c) $\sqrt{9.8}$ sec d) $\frac{1}{\sqrt{9.8}}$ sec

99. An athletic coach told his team that muscle times speed equals power. What dimensions does he view for muscle

a) MLT^{-2} b) ML^2T^{-2} c) MLT^2 d) L

100. The SI unit of universal gas constant (R) is

a) $Watt\,K^{-1}mol^{-1}$ b) $Newton\,K^{-1}mol^{-1}$ c) $Joule\,K^{-1}mol^{-1}$ d) $Erg\,K^{-1}mol^{-1}$

101. Dimensions of luminous flux are

a) ML^2T^{-2} b) ML^2T^{-3} c) ML^2T^{-1} d) MLT^{-2}

102. The dimensional formula of $\frac{1}{\varepsilon_0}\frac{e^2}{hc}$ is

a) $[M^0L^0T^0A^0]$ b) $[M^{-1}L^3T^2A]$ c) $[ML^3T^{-4}A^{-2}]$ d) $[M^{-1}L^{-3}T^4]$

103. *Candela* is the unit of

a) Electric intensity b) Luminous intensity c) Sound intensity d) None of these

104. A highly rigid cubical block A of small mass M and side L is fixed rigidly on to another cubical block of same dimensions and of low modulus of rigidity η such that the lower face of A completely covers the upper face of B. The lower face of B is rigidly held on a horizontal surface. A small force F is applied perpendicular to one of the side faces of A. After the force is withdrawn, block A executes small oscillations, the time period o which is given by

a) $2\pi\sqrt{M\eta L}$ b) $2\pi\sqrt{\frac{M\eta}{L}}$ c) $2\pi\sqrt{\frac{ML}{\eta}}$ d) $2\pi\sqrt{\frac{M}{\eta L}}$

105. The initial temperature of a liquid is $(80.0\pm0.1)^0$C. After it has been cooled, its temperature is $(10.0\pm0.1)^0$C. The fall in temperature in degree centigrade is

a) 70.0 b) 70.0 ± 0.3 c) 70.0 ± 0.2 d) 70.0 ± 0.1

106. The frequency f of vibration of mass m suspended from a spring of spring constant k is given by

$f=c\,m^x k^y$

Where c is dimensionless constant. The values of $x \wedge y$ are respectively

a) 1/2, 1/2 b) -1/2, 1/2 c) 1/2, -1/2 d) -1/2, -1/2

107. If the velocity of light c, gravitational constant G and Planck's constant h are chosen as fundamental units, the dimensions of length L in the new system is

a) hcG^{-1} b) $[h^{1/2}c^{1/2}G^{-1/2}]$ c) $[hc^{-3}G^1]$ d) $[h^{1/2}c^{-3/2}G^{1/2}]$

108. SI unit of pressure is

a) *Pascal* b) $dynes/cm^2$ c) *cm* of *Hg* d) *Atmosphere*

109. Dimensions of strain are

a) MLT^{-1} b) ML^2T^{-1} c) MLT^{-2} d) $M^0L^0T^0$

110. Unit of surface tension is

a) Nm^{-1} b) Nm^{-2} c) N^2m^{-1} d) Nm^{-3}

111. "Pascal-Second" has dimension of

a) Force
b) Energy
c) Pressure
d) Coefficient of viscosity

112. Inductance L can be dimensionally represented as

a) $M L^2 T^{-2} A^{-2}$
b) $M L^2 T^{-4} A^{-3}$
c) $M L^{-2} T^{-2} A^{-2}$
d) $M L^2 T^4 A^3$

113. In the gas equation $\left(p+\frac{a}{V^2}\right)(V-b)=RT$, the dimensions of a are

a) $[ML^3 T^{-2}]$
b) $[M^{-1} L^3 T^{-1}]$
c) $[ML^5 T^{-2}]$
d) $[M^{-1} L^{-5} T^2]$

114. $Erg-m^{-1}$ can be the unit of measure for

a) Force
b) Momentum
c) Power
d) Acceleration

115. If there is a positive error of 50% in the measurement of speed of a body, then the error in the measurement of kinetic energy is

a) 25%
b) 50%
c) 100%
d) 125%

116. The equation of a wave is given by
$Y=A\sin\omega$ ¿
where ω is the angular velocity and υ is the linear velocity.
The dimension of k is

a) ¿
b) T
c) T^{-1}
d) T^2

117. Which of the following pairs has same dimensions?

a) Current density and charge density
b) Angular momentum and momentum
c) Spring constant and surface energy
d) Force and torque

118. The equation of alternating current is $I=I_0 e^{-t/CR}$, where t is time, C is capacitance and R is resistance of coil, then the dimensions of CR is

a) $[MLT^{-1}]$
b) ¿
c) $[M^0 L^0 T]$
d) None of these

119. The dimensions of power are

a) $M^1 L^2 T^{-3}$
b) $M^2 L^1 T^{-2}$
c) $M^1 L^2 T^{-1}$
d) $M^1 L^1 T^{-2}$

120. The concorde is the fastest airlines used for commercial service. It can cruise at 1450 mile per hour (about two times the speed of sound or in other words mach 2). What is it in m/s?

a) 644.4m/s
b) 80 m/s
c) 40 m/s
d) None of these

121. *Faraday* is the unit of

a) Charge
b) Emf
c) Mass
d) Energy

122. The dimensions of shear modulus are

a) MLT^{-1}
b) $ML^2 T^{-2}$
c) $ML^{-1} T^{-2}$
d) MLT^{-2}

123. A force F is given by $F=at+bt^2$, where t is time. What are the dimensions of a and b

a) MLT^{-3} and $ML^2 T^{-4}$
b) MLT^{-3} and MLT^{-4}
c) MLT^{-1} and MLT^0
d) MLT^{-4} and MLT^1

124. Dimensional formula for volume elasticity is

a) $M^1 L^{-2} T^{-2}$
b) $M^1 L^{-3} T^{-2}$
c) $M^1 L^2 T^{-2}$
d) $M^1 L^{-1} T^{-2}$

125. The dimensional formula of coefficient of permittivity for free space (ε_0) in the equation $F=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$, where symbols have their usual meanings, is

a) $[ML^3A^{-2}T^{-4}]$ b) $[M^{-1}L^{-3}T^4A^2]$ c) $[M^{-1}L^{-3}A^{-2}T^{-4}]$ d) $[ML^3A^2T^{-4}]$

126. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is

a) 0.9% b) 2.4% c) 3.1% d) 4.2%

127. The period of a body under SHM is represented by $T=P^aD^bS^c$; where P is pressure, D is density and S is surface tension. The value of a, b and c are

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

128. If C is the capacitance and V is the potential, the dimensional formula for CV^2 is

a) $[ML^2T^{-1}]$ b) $[ML^{-2}T^{-3}]$ c) $[ML^2T^{-2}]$ d) $[ML^{-2}T^{-2}]$

129. Out of the following pairs, which one does not have identical dimensions?

a) Angular momentum and Planck's constant b) Impulse and momentum

c) Moment of inertia and moment of a force d) Work and torque

130. Which one of the following represents the correct dimensions of the coefficient of viscosity?

a) $[ML^{-1}T^{-2}]$ b) $[MLT^{-1}]$ c) $[ML^{-1}T^{-1}]$ d) $[ML^{-2}T^{-2}]$

131. The dimensions of coefficient of self inductance are

a) $[ML^2T^{-2}A^{-2}]$ b) $[ML^2T^{-2}A^{-1}]$ c) $[MLT^{-2}A^{-2}]$ d) $[MLT^{-2}A^{-1}]$

132. The time taken by an electron to go from ground state to excited state is one shake (one shake = 10^{-8}s). this time in nanosecond will be

a) 10 ns b) 4 ns c) 2 ns d) 25 ns

133. The values of two resistors are $R_1=(6\pm0.3)k\,\Omega$ and $R_2=(10\pm0.2)k\,\Omega$. The percentage error in the equivalent resistance when they are connected in parallel is

a) 5.125% b) 2% c) 10.125% d) 7%

134. Which does not have the same unit as others

a) *Watt-sec* b) *Kilowatt-hour* c) *eV* d) *J-sec*

135. In the determination of Young's modulus $\left(Y=\frac{4MLg}{\pi l d^2}\right)$ by using Searle's method, a wire of length $L=2\,m$ and diameter $d=0.5\,mm$ is used. For a load $M=2.5\,kg$, an extension $l=0.25\,mm$ in the length of the wire is observed. Quantities d and l are measured using a screw gauge and a micrometer, respectively. They have the same pitch of $0.5\,mm$. The number of divisions on their circular scale is 100. The contributions to the maximum probable scale is 100. The contributions to the maximum probable error of the Y measurement

a) Due to the errors in the measurements of d and l are the same

b) Due to the error in the measurement of d is twice that due to the error in the measurement of l

c) Due to the error in the measurement of l is twice that due to the error in the measurement of d

d) Due to the error in the measurement of d is four time that due to the error in the measurement of l

136. Out of following four dimensional quantities , which one quantity is to be called a dimensional constant

a) Acceleration due to gravity
b) Surface tension of water
c) Weight of a standard kilogram mass
d) The velocity of light in vacuum

137. A pressure of 10^6 dyne cm^{-2} is equivalent to

a) $10^5 N m^{-2}$
b) $10^4 N m^{-2}$
c) $10^6 N m^{-2}$
d) $10^7 N m^{-2}$

138. The dimensional formula of magnetic permeability is

a) $[M^0 L^{-1} T]$
b) $[M^0 L^2 T^{-1}]$
c) $[M^0 L^2 T^{-1} A^2]$
d) $[MLT^{-2} A^{-2}]$

139. The speed of light (c), gravitational constant (G) and Planck's constant (h) are taken as the fundamental units in a system. The dimension of time in this new system should be

a) $G^{1/2} h^{1/2} c^{-5/2}$
b) $G^{-1/2} h^{1/2} c^{1/2}$
c) $G^{1/2} h^{1/2} c^{-3/2}$
d) $G^{1/2} h^{1/2} c^{1/2}$

140. One yard in SI units is equal

a) 1.9144 *metre*
b) 0.9144 *metre*
c) 0.09144 *kilometre*
d) 1.0936 *kilometre*

141. Let L denote the self-inductance of coil which is in series with a capacitor of capacitance C. Which of the following has the unit second?

a) $\sqrt{LC}$
b) C/L
c) CL
d) $L^2¿C^2$

142. The value of 0.99−¿0.989 is

a) 0.001
b) 0.010×10^{-1}
c) 0.01×10^{-1}
d) 0.1×10^{-3}

143. Universal time is based on

a) Rotation of the earth on its axis
b) Earth's orbital motion around the Sun
c) Vibrations of cesium atom
d) Oscillations of quartz crystal

144. Which of the following is not the unit of energy

a) *Calorie*
b) *Joule*
c) *Electron volt*
d) *Watt*

145. The dimensions of *calorie* are

a) ML^2T^{-2}
b) MLT^{-2}
c) ML^2T^{-1}
d) ML^2T^{-3}

146. If the acceleration due to gravity is $10 m s^{-2}$ and the units of length and time are changed in kilometer and hour respectively, the numerical value of the acceleration is

a) 360000
b) 72,000
c) 36,000
d) 129600

147. The respective number of significant figures for the numbers 23.02310.0003 and 2.1×10^{-3} are

a) 5, 1, 2
b) 5, 1, 5
c) 5, 5, 2
d) 4, 4, 2

148. If p represents radiation pressure, C represents speed of light and q represents radiation energy striking a unit area per second, then non-zero integers a, b and c are such that $p^a q^b C^c$ is dimensionless, then

a) $a=1, b=1, c=-1$
b) $a=1, b=-1, c=1$
c) $a=-1, b=1, c=1$
d) $a=1, b=1, c=1$

149. The refractive index of a material is given by the equation $n=\frac{A+B}{\lambda^2}$, where $A \wedge B$ are constant. The dimensional formula for B is

a) $[M^0 L^2 T^{-1}]$ b) $[M^0 L^{-2} T^0]$ c) $[M^0 L^2 T^{-2}]$ d) $[M^0 L^2 T^0]$

150. Which of the following is not the unit of time

a) Micro *second* b) Leap year c) Lunar month d) Parallactic *second*

151. How many wavelengths of Kr^{86} are there in one *metre*

a) 1553164.13 b) 1650763.73 c) 652189.63 d) 2348123.73

152. The Martians use force (F), acceleration (A) and time (T) as their fundamental physical quantities. The dimensions of length on Martians system are

a) FT^2 b) $F^{-1}T^2$ c) $F^{-1}A^2T^{-1}$ d) AT^2

153. Assuming the mass of Earth as $6.64 \times 10^{24}\, kg$ and the average mass of the atoms that make up earth as $40\,u$ (atomic mass unit), the number of atoms in the Earth are approximately

a) 10^{30} b) 10^{40} c) 10^{50} d) 10^{60}

154. the dimensional formula of latent heat is

a) $[M^0 L^2 T^{-2}]$ b) $[MLT^2]$ c) $[ML^2T^{-2}]$ d) $[MLT^{-1}]$

155. If $v=\frac{A}{t}+Bt^2+Ct^3$ where v is velocity, t is time and A, B and C are constants, then the dimensional formula of B is

a) $[M^0 L T^0]$ b) $[ML^0T^0]$ c) $[M^0L^0T]$ d) $[M^0LT^{-3}]$

156. The square root of the product of inductance and capacitance has the dimension of

a) Length b) Mass c) Time d) No dimension

157. Which of the following is not represented in correct unit

a) $\frac{Stress}{Strain}=N/m^2$

b) Surface tension ¿ N/m

c) Energy ¿ $kg-m/sec$

d) Pressure ¿ N/m^2

158. The expression $[ML^{-1}T^{-1}]$ represents

a) Momentum

b) Force

c) Pressure

d) Coefficient of viscosity

159. The frequency of vibration f of a mass m suspended from a spring of spring constant k is given by relation of the type $f=c\,m^x k^y$, where c is a dimensionless constant. The values of x and y are

a) 1/2, 1/2 b) $-$¿1/2, $-$¿1/2 c) 1/2, $-$¿1/2 d) $-$¿1/2, 1/2

160. $E, m, I \wedge G$ denote energy, mass, angular momentum and gravitational constant respectively, then the dimensions of $\frac{EI^2}{m^5G^2}$ are

a) Angle b) Length c) Mass d) Time

161. If the time period (T) of vibration of a liquid drop depends on surface tension (S), radius (r) of the drop and density (ρ) of the liquid, then the expression of T is

a) $T=k\sqrt{\rho r^3/S}$ b) $T=k\sqrt{\rho^{1/2} r^3/S}$ c) $T=k\sqrt{\rho r^3/S^{1/2}}$ d) None of these

162. The dimensional formula of self-inductance is

a) $[MLT^{-2}]$ b) $[ML^2T^{-1}A^{-2}]$ c) $[ML^2T^{-2}A^{-2}]$ d) $[ML^2T^{-2}A^{-1}]$

163. Two quantities A and B have different dimensions. Which mathematical operation given below is physically meaningful

a) A/B b) $A+B$ c) $A-B$ d) None

164. Size of universe is about

a) Ten million light years b) Million light years

c) Hundred million light years d) 10 million light years

165. The dimension of $\frac{1}{\sqrt{\varepsilon_0 \mu_0}}$ is that of

a) Velocity b) Time c) Capacitance d) Distance

166. If $X=A\times B$ and ΔX and ΔA and ΔB are maximum absolute errors in X, A and B respectively, then the maximum relative error in X is given by

a) $\Delta X=\Delta A+\Delta B$ b) $\Delta X=\Delta A-\Delta B$ c) $\frac{\Delta X}{X}=\frac{\Delta A}{A}-\frac{\Delta B}{B}$ d) $\frac{\Delta X}{X}=\frac{\Delta A}{A}+\frac{\Delta B}{B}$

167. The fundamental physical quantities that have same dimensions in the dimensional formulae of torque and angular momentum are

a) Mass, time b) Time, length c) Mass, length d) Time, mole

168. In an experiment the angles are required to be measured using an instrument. 29 divisions of the main scale exactly coincide with the 30 divisions of the vernier scale. If the smallest division of the main scale is half-a-degree $(¿0.5°)$, then the least count of the instrument is

a) One minute b) Half minute c) One degree d) Half degree

169. What is the SI unit of permeability

a) *Henry* per *metre* b) Tesla *metre* per *ampere*

c) *Weber* per *ampere metre* d) All the above units are correct

170. If L denotes the inductance of an inductor through which a current i is flowing, the dimensions of Li^2 are

a) ML^2T^{-2} b) Not expressible in MLT

c) MLT^{-2} d) $M^2L^2T^{-2}$

171. If V denotes the potential difference across the plates of a capacitor of capacitance C, the dimensions of CV^2 are

a) Not expressible in MLT b) MLT^{-2}

c) M^2LT^{-1} d) ML^2T^{-2}

172. $S=A(1-e^{-Bxt})$, where S is speed and x is displacement. The unit of B is

a) $m^{-1}s^{-1}$ b) $m^{-2}s$ c) s^{-2} d) s^{-1}

173. The quantity $X=\frac{\varepsilon_0 LV}{t}$: ε_0 is the permittivity of free space, L is length, V is potential difference and t is time. The dimensions of X are same as that of

a) Resistance b) Charge c) Voltage d) Current

174. $Newton/metre^2$ is the unit of

a) Energy b) Momentum c) Force d) Pressure

175. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and current I, would be

a) $[ML^2T^{-3}I^{-1}]$ b) $[ML^2T^{-2}]$ c) $[ML^2T^{-1}I^{-1}]$ d) $[ML^2T^{-3}I^{-2}]$

176. The density of a material in CGS system of units is $4\,g/cm^3$, In a system of units which unit of length is $10\,cm$ and unit of mass is $100\,g$, the value of density of material will be

a) 400 b) 0.04 c) 0.4 d) 40

177. The value of Planck's constant is

a) 6.63×10^{-34} J-sec b) 6.63×10^{34} J-sec c) $6.63\times10^{-34}\,kg$-m^2 d) $6.63\times10^{34}\,kg$-sec

178. Which relation is wrong

a) $1\,calorie=4.18\,joule$

b) $1\,Å=10^{-10}\,m$

c) $1\,MeV=1.6\times10^{-13}\,joule$

d) $1\,newton=10^{-5}\,dyne$

179. A plate has a length $(5\pm0.1)\,cm$ and breadth $(2\pm0.01)\,cm$. Then the area of the plate is

a) $(10\pm0.2)\,cm^2$ b) $(10\pm0.01)\,cm^2$ c) $(10\pm0.001)\,cm^2$ d) $(10\pm1)\,cm^2$

180. Given $X=(Gh¿c^3)^{1/2}$, where G, h and c are gravitational constant, Planck's constant and the velocity of light respectively. Dimensions of X are the same as those of

a) Mass b) Time c) Length d) Acceleration

181. The dimensions of farad are

a) $M^{-1}L^{-2}T^2Q^2$ b) $M^{-1}L^{-2}TQ$ c) $M^{-1}L^{-2}T^{-2}Q$ d) $M^{-1}L^{-2}TQ^2$

182. Number of particles is given by $n=-D\frac{n_2-n_1}{x_2-x_1}$crossing a unit area perpendicular to X-axis in unit time, where n_1 and n_2 are number of particles per unit volume for the value of $x$meant to x_2 and x_1. Find dimensions of D called as diffusion constant

a) M^0LT^2 b) $M^0L^2T^{-4}$ c) M^0LT^{-3} d) $M^0L^2T^{-1}$

183. If the unit of force is 1 kN, the length is 1 km and time is 100 s, what will be the unit of mass?

a) 1 kg b) 100 kg c) 1000 kg d) 10000 kg

184. One femtometre is equivalent to

a) $10^{15}\,m$ b) $10^{-15}\,m$ c) $10^{-12}\,m$ d) $10^{12}\,m$

185. Parsec is a unit of

a) Distance b) Velocity c) Time d) Angle

186. Length cannot be measured by

a) *Fermi* b) *Debye* c) *Micron* d) *Light year*

187. A vernier callipers has $1\,mm$ marks on the main scale. It has 20 equal divisions on the Vernier scale which match with 16 main scale divisions. For this Vernier callipers , the least count is

a) $0.02\,mm$ b) $0.05\,mm$ c) $0.1\,mm$ d) $0.2\,mm$

188. If the value of the resistance is $10.845\,\Omega$ and the value of the current is 3.23 A, then the potential difference is 35.02935 V. its value in correct significant figures would be

a) 35 V b) 35.0 V c) 35.03 V d) 35.029 V

189. A student performs an experiment to determine the Young's modulus of a wire, exactly 2 m long, by Searle's method. In a particular reading, the student measures the extension in the length of the wire to be 0.8 mm with an

uncertainty of $\pm 0.05\,mm$ at a load of exactly 1.0 kg. The student also measures the diameter of the wire to be 0.4mm with an uncertainty of $\pm 0.01\,mm$. Take $g=9.8\,ms^{-2}$ (exact). The Young's modulus obtained from the reading is

a) $(2.0\pm0.3)\times10^{11}\,Nm^{-2}$
b) $(2.0\pm0.2)\times10^{11}\,Nm^{-2}$
c) $(2.0\pm0.1)\times10^{11}\,Nm^{-2}$
d) $(2.0\pm0.05)\times10^{11}\,Nm^{-2}$

190. If the speed of light (c), acceleration due to gravity (g) and pressure (p) are taken as the fundamental quantities, then the dimension of gravitational constant is

a) $c^2 g^0 p^{-2}$
b) $c^0 g^2 p^{-1}$
c) $c g^3 p^{-2}$
d) $c^{-1} g^0 p^{-1}$

191. A wire has a mass $0.3\pm0.003\,g$, radius $0.5\pm0.005\,mm$ and length $6\pm0.06\,cm$. The maximum percentage error in the measurement of its density is

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

192. Which of the following sets have different dimensions?

a) Pressure, Young's modulus, Stress
b) Emf, Potential difference, Electric potential
c) Heat, Work done, Energy
d) Dipole moment, Electric flux, Electric field

193. In an experiment, we measure quantities a, b and c. Then x is calculated from the formula $x=\frac{ab^2}{c^3}$. The percentage errors in a, b, c are $\pm1\%, \pm3\%$, and $\pm2\%$ respectively. The percentage error in x can be

a) $\pm1\%$
b) $\pm4\%$
c) 7%
d) $\pm13\%$

194. Which of the following is/are the units of strength of magnetic field at a point?

a) NAm^{-1}
b) NAm
c) $NA^{-1}m^{-1}$
d) $NA^{-2}m^{-2}$

195. Given, potential difference $V=(8\pm0.5)$ volt and current $I=(2\pm0.2)$A. The value of resistance R is

a) $4\pm16.25\%$
b) $4\pm6.25\%$
c) $4\pm10\%$
d) $4\pm8\%$

196. The modulus of elasticity is dimensionally equivalent to

a) Strain
b) Force
c) Stress
d) Coefficient of viscosity

197. The dimensions of $\frac{R}{L}$ are

[here, $R=$¿electric resistance, $L=$¿self inductance]

a) $[T^{-2}]$
b) $[T^{-1}]$
c) $[ML^{-1}]$
d) $[T]$

198. According to Newton, the viscous force acting between liquid layers of area A and velocity gradient $\Delta v/\Delta z$ is given by $F=-\eta A\frac{\Delta v}{\Delta x}$ where η is constant called coefficient of viscosity. The dimensions of η are

a) $[ML^2T^{-2}]$
b) $[ML^{-1}T^{-1}]$
c) $[ML^{-2}T^{-2}]$
d) $[M^0L^0T^0]$

199. Surface tension has the same dimensions as that of

a) Coefficient of viscosity
b) Impulse
c) Momentum
d) Spring constant

200. Density of wood is 0.5 gm/cc in the CGS system of units. The corresponding value in MKS units is

a) 500
b) 5
c) 0.5
d) 5000

201. In an experiment, to measure the height of a bridge by dropping stone into water underneath, if the error in measurement of time is $0.1 s$ at the end of $2 s$, then the error in estimation of height of bridge will be

a) $0.49 m$ b) $0.98 m$ c) $1.96 m$ d) $2.12 m$

202. The dimension of k in the equation $W=\frac{1}{2}kx^2$ is

a) $[ML^0T^{-2}]$ b) $[M^0¿^{-1}]$ c) $[MLT^{-2}]$ d) $[ML^0T^{-1}]$

203. A body of mass $m=3.513 kg$ is moving along the $x-¿$axis with a speed of $5.00 ms^{-1}$. The magnitude of its momentum is recorded as

a) $17.6 kg ms^{-1}$ b) $17.565 kg ms^{-1}$ c) $17.56 kg ms^{-1}$ d) $17.57 kg ms^{-1}$

204. The dimensional formula for the modulus of rigidity is

a) ML^2T^{-2} b) $ML^{-1}T^{-3}$ c) $ML^{-2}T^{-2}$ d) $ML^{-1}T^{-2}$

205. The unit of physical quantity obtained by the line intergral of electric field is

a) NC^{-1} b) Vm^{-1} c) JC^{-1} d) $C^2N^{-1}m^{-2}$

206. The dimensions of gravitational constant G and the moment of inertia are respectively

a) $[ML^3T^{-2}];[ML^2T^0]$ b) $[M^{-1}L^3T^{-2}];[ML^2T^0]$ c) $[M^{-1}L^3T^{-2}];[M^{-1}L^2T]$ d) $[ML^3T^{-2}];[M^{-1}L^2T]$

207. Unit of stress is

a) N/m b) $N-m$ c) N/m^2 d) $N-m^2$

208. Crane is British unit of volume (one crane = 170.4742). convert crane into SI units.

a) 0.170474 m^3 b) 17.0474m^3 c) 0.00170474m^3 d) 1704.74m^3

209. SI unit of intensity of wave is

a) $Jm^{-2}s^{-1}$ b) $Jm^{-1}s^{-2}$ c) W m^{-2} d) Jm^{-2}

210. If F denotes force and t time, then in equation $F=at^{-1}+bt^2$, the dimensions of a and b respectively are

a) $[¿^{-4}]\wedge[¿^{-1}]$ b) $[¿^{-1}]\wedge[¿^{-4}]$ c) $[MLT^{-4}]\wedge[MLT^{-1}]$ d) $[MLT^{-1}]\wedge[MLT^{-4}]$

211. If the constant of gravitation (G), Plank's constant (h) and the velocity of light (c) be chosen as fundamental units. The dimension of the radius of gyration is

a) $h^{1/2}c^{-3/2}G^{1/2}$ b) $h^{1/2}c^{3/2}G^{1/2}$ c) $h^{1/2}c^{-3/2}G^{-1/2}$ d) $h^{-1/2}c^{-3/2}G^{1/2}$

212. The mass and volume of a body are found to be $500\pm0.05 kg$ and $1.00\pm0.05 m^3$ respectively. Then the maximum possible percentage error in its density is

a) 6% b) 3% c) 10% d) 5%

213. The unit of Stefan's constant σ is

a) $Wm^{-2}K^{-1}$ b) Wm^2K^{-4} c) $Wm^{-2}K^{-4}$ d) $Wm^{-2}K^4$

214. In the equation $y=a$ sin $(\omega t+kx,)$ the dimensional formula of ω is

a) $[M^0L^0T^{-1}]$ b) $[M^0LT^{-1}]$ c) $[ML^0T^0]$ d) $[M^0L^{-1}T^0]$

215. The following observations were take for determining surface tension of water by capillary tube method.
Diameter of capillary, $D=1.25\times10^{-2}$ m and rise of water in capillary. $h=1.46\times10^{-2}$m
Taking $g=9.80 m s^{-2}$ and using the relation $T=(rgh/2)\times103 N m^{-1}$, what is the possible error in surface tension$T$?

a) 2.4% b) 15% c) 1.6% d) 0.15%

216. R and L represent respectively resistance and self inductance, which of the following combinations has the dimensions of frequency

a) $\frac{R}{L}$ b) $\frac{L}{R}$ c) $\sqrt{\frac{R}{L}}$ d) $\sqrt{\frac{L}{R}}$

217. The random error in the arithmetic mean of 100 observations is x; then random error in the arithmetic mean of 4000 observations would be

a) $4x$ b) $\frac{1}{4}x$ c) $2x$ d) $\frac{1}{2}x$

218. Which of the following is dimensionally correct

a) Pressure = Energy per unit area

b) Pressure = Energy per unit volume

c) Pressure = Force per unit volume

d) Pressure = Momentum per unit volume per unit time

219. $R, L \wedge C$ represent the physical quantities resistance, inductance and capacitance respectively. Which one of the following combination has dimension of frequency?

a) $\frac{1}{\sqrt{RC}}$ b) $\frac{R}{L}$ c) $\frac{1}{LC}$ d) $\frac{C}{L}$

220. If the length of a rectangle $l=10.5\,cm$, breadth $b=2.1\,cm$ and minimum possible measurement by scale = 0.1 cm, then the area is

a) $22.0\,cm^2$ b) $22.1\,cm^2$ c) $22.05\,cm^2$ d) $22\,cm^2$

221. When a wave traverses a medium, the displacement of a particle located at x at a time t is given by $y=a\sin(bt-cx)$, where a, b and c are constants of the wave. Which of the following is a quantity with dimensions

a) $\frac{y}{a}$ b) bt c) cx d) $\frac{b}{c}$

222. Identify the pair whose dimensions are equal

a) Torque and work b) Stress and energy c) Force and stress d) Force and work

223. The equation $\left(P+\frac{a}{V^2}\right).(V-b)=¿$ constant. The unit of a is

a) $Dyne \times cm^5$ b) $Dyne \times cm^4$ c) $Dyne \times cm^3$ d) $Dyne \times cm^2$

224. If L, C and R represent inductance, capacitance and resistance respectively, then which of the following does not represent dimensions of frequency

a) $\frac{1}{RC}$ b) $\frac{R}{L}$ c) $\frac{1}{\sqrt{LC}}$ d) $\frac{C}{L}$

225. If the units of mass, length and time are doubled, unit of angular momentum will be

a) Doubled b) Tripled

c) Quadrupled d) 8 times the original value

226. The length of a simple pendulum is about 100 cm known to an accuracy of 1 mm. Its period of oscillation is 2s determined by measuring the time for 100 oscillations using a clock of 0.1 s resolution. What is the accuracy in the determined value of g?

a) 0.2% b) 0.5% c) 0.1% d) 2%

227. Temperature can be expressed as a derived quantity in terms of any of the following

a) Length and mass
b) Mass and time
c) Length, mass and time
d) None of these

228. A small steel ball of radius r is allowed to fall under gravity through a column of a viscous liquid of coefficient of viscosity η. After some time the velocity of the ball attains a constant value known as terminal velocity υ_T. The terminal velocity depends on (i) the mass of the ball m, (ii) η , (iii) r and (iv) acceleration due to gravity g. Which of the following relations is dimensionally correct

a) $\upsilon_T \propto \frac{mg}{\eta r}$
b) $\upsilon_T \propto \frac{\eta r}{mg}$
c) $\upsilon_T \propto \eta rmg$
d) $\upsilon_T \propto \frac{mgr}{\eta}$

229. The measured mass and volume of a body are 23.42 g and 4.9 cm^3 respectively with possible error 0.01 g and 0.1 cm^3. The maximum error in density is nearly

a) 0.2%
b) 2%
c) 5%
d) 10%

230. A physical quantity A is related to four observations a, b, c and d as follows, $A=\frac{a^2 b^3}{c\sqrt{d}}$. The percentage error of measurement in a, b, c and d are $1\%, 3\%, 2\%$ and 2% respectively. What is the percentage error in the quantity A

a) 12%
b) 7%
c) 5%
d) 14%

231. The unit of Wien's constant b is

a) $Wm^{-2}K^{-4}$
b) $m^{-1}K^{-1}$
c) Wm^2
d) MK

232. Young's modulus of a material has the same units as

a) Pressure
b) Strain
c) Compressibility
d) Force

233. Which of the following physical quantities has neither dimensions nor unit?

a) Angle
b) Luminous intensity
c) Coefficient of friction
d) Current

234. In the relation $y=a\cos(\omega t-kx)$, the dimensional formula for k is

a) $[M^0L^{-1}T^{-1}]$
b) $[M^0LT^{-1}]$
c) $[M^0L^{-1}T^0]$
d) ¿

235. The dimensional formula for the magnetic field is

a) $[MT^{-2}A^{-1}]$
b) $[ML^2T^{-1}A^{-2}]$
c) $[MT^{-2}A^{-2}]$
d) $[MT^{-1}A^{-2}]$

236. $Dyne/cm^2$ is not a unit of

a) Pressure
b) Stress
c) Strain
d) Young's modulus

237. One side of a cubical block is measured with the help of a vernier callipers of vernier constant 0.01 cm. This side comes out to be 1.23 cm. What is the percentage error in the measurement of area?

a) $\frac{1.23}{0.01}\times 100$
b) $\frac{0.01}{1.23}\times 100$
c) $2\times\frac{0.01}{1.23}\times 100$
d) $3\times\frac{0.01}{1.23}\times 100$

238. $Ampere-hour$ is a unit of

a) Quantity of electricity
b) Strength of electric current
c) Power
d) Energy

239. The velocity v (in cm/sec) of a particle is given in terms of time t (in sec) by the relation $v=at+\frac{b}{t+c}$; the dimensions of a, b and c are

a) $a=L^2, b=T, c=LT^2$

b) $a=LT^2, b=¿, c=L$

c) $a=LT^2, b=L, c=T$

d) $a=L, b=¿, c=T^2$

240. The potential energy of a particle varies with distance x from a fixed origin as $U=\left(\frac{A\sqrt{X}}{x+B}\right)$; where $A \wedge B$ are constants. The dimensions of AB are

a) $[ML^{5/2}T^{-2}]$

b) $[ML^2T^{-2}]$

c) $[M^{3/2}L^{3/2}T^{-2}]$

d) $[ML^{7/2}T^{-2}]$

241. The dimensions of $\frac{a}{b}$ in the equation $p=\frac{a-t^2}{bx}$ where p is pressure, x is distance and t is time, are

a) $[M^2 ¿^{-3}]$

b) $[MT^{-2}]$

c) $[¿^{-3}]$

d) $[ML^3T^{-1}]$

242. The focal length of a mirror is given by $\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$ where u and v represent object and image distances respectively. The maximum relative error in f is

a) $\frac{\Delta f}{f}=\frac{\Delta u}{u}+\frac{\Delta v}{v}$

b) $\frac{\Delta f}{f}=\frac{1}{\Delta u/u}+\frac{1}{\Delta v/v}$

c) $\frac{\Delta f}{f}=\frac{\Delta u}{u}+\frac{\Delta v}{v}-\frac{\Delta(u+v)}{u+v}$

d) $\frac{\Delta f}{f}=\frac{\Delta u}{u}+\frac{\Delta v}{v}+\frac{\Delta u}{u+v}+\frac{\Delta v}{u+v}$

243. Which of the following relation is wrong

a) $1\,ampere \times 1\,ohm = 1\,volt$

b) $1\,watt \times 1\,sec = 1\,joule$

c) $1 \times newton\ per\ coulomb = 1\,volt\ per\ meter$

d) $1\,coulomb \times 1\,volt = 1\,watt$

244. The unit of self inductance of a coil is

a) *Farad*

b) *Henry*

c) *Weber*

d) *Tesla*

245. Out of the following four dimensional quantities, which one qualifies to be called a dimensional constant?

a) Acceleration due to gravity

b) Surface tension of water

c) Weight of a standard kilogram mass

d) The velocity of light in vacuum

246. The radius of the proton is about 10^{-15}m. The radius of the observable universe is 10^{26}m. identify the distance which is half-way between these two extremes on a logarithmic scale.

a) 10^{21}m

b) 10^{6}m

c) 10^{-6}m

d) 10^{0}m

247. The position of a particle at time t is given by the equation $x(t)=\frac{v_0}{A}(1-e^{At}), v_0=¿$ constant and $A>0$. Dimensions of $v_0 \wedge A$ respectively are

a) $[M^0 ¿^0] \wedge [M^0L^0T^{-1}]$

b) $[M^0 ¿^{-1}] \wedge [M^0 ¿^{-2}]$

c) $[M^0 ¿^{-1}] \wedge [M^0L^0T]$

d) $[M^0 ¿^{-1}] \wedge [M^0L^0T^{-1}]$

248. One nanometre is equal to

a) $10^9\,mm$

b) $10^{-6}\,cm$

c) $10^{-7}\,cm$

d) $10^{-9}\,cm$

249. $[ML^2T^{-3}A^{-2}]$ is the dimensional formula of

a) Electric resistance

b) Capacity

c) Electric potential

d) Specific resistance

250. The dimensions of Planck's constant are

a) $[M^2L^2T^{-2}]$

b) $[MLT^{-2}]$

c) $[ML^2T^{-2}]$

d) $[ML^2T^{-1}]$

251. If the length of rod A is $3.25 \pm 0.01 cm$ and that of B is $4.19 \pm 0.01\, cm$ then the rod B is longer than rod A by

a) $0.94 \pm 0.00\, cm$ b) $0.94 \pm 0.01\, cm$ c) $0.94 \pm 0.02\, cm$ d) $0.94 \pm 0.005\, cm$

252. The dimensions of $e^2/4\pi\varepsilon_0 hc$, where $e, \varepsilon_0, h \wedge c$ are electronic charge, electric permittivity, Planck's constant and velocity of light in vacuum respectively, are

a) $[M^0 L^0 T^0]$ b) $[ML^0 T^0]$ c) $[M^0 ¿^0]$ d) $[M^0 L^0 T^1]$

253. The length, breadth and thickness of a block are given by $l=12\, cm, b=6\, cm$ and $t=2.45\, cm$
The volume of block according to the idea of significant figures should be

a) $1 \times 10^2 cm^3$ b) $2 \times 10^2 cm^3$ c) $1.763 \times 10^2 cm^3$ d) None of tehse

254. A physical quantity A is related to four observables $a, b, c \wedge d$ as follows

$$A = \frac{a^2 b^3}{c\sqrt{d}}$$

The percentage errors of measurement in $a, b, c \wedge d$ are 1%, 3%, 2% and 2% respectively. What is the percentage error in the quantity A?

a) 12% b) 7% c) 5% d) 14%

255. Ampere-hour is the unit of

a) Quantity of charge b) Potential c) Energy d) Current

256. The dimensions of $1/2\, \varepsilon E^2$ are same as

a) Energy density (energy per unit volume) b) Energy
c) Power d) None of the above

257. The velocity of a particle (v) at an instant t is given by $v = at + bt^2$ the dimension of b is

a) L b) LT^{-1} c) $LT^{-¿2¿}$ d) LT^{-3}

258. Wavelength of ray of light is $0.00006\, m$. It is equal to

a) $6\, micron$ b) $60\, micron$ c) $600\, micron$ d) $0.6\, micron$

259. The unit of surface tension in SI system is

a) $Dyne/cm^2$ b) $Newton/m$ c) $Dyne/cm$ d) $Newton/m^2$

260. Dimensions of $\frac{1}{\mu_0 \epsilon_0}$, where symbols have their usual meaning, are

a) $[lT^{-1}]$ b) $[L^{-1}T]$ c) $[L^{-2}T^2]$ d) $[L^2 T^{-2}]$

261. Dimensional formula for force is

a) $[ML^2 T^{-2}]$ b) $[MLT^{-2}]$ c) $[ML^{-1} T^{-2}]$ d) $[ML^2 T^{-2}]$

262. $[ML^{-2} T^{-2}]$ represents dimensional formula of which of the following physical quantities?

a) Energy b) pressure c) Torque d) Pressure gradient

263. The velocity of water waves υ may depend upon their wavelength λ, the density of water ρ and the acceleration due to gravity g. The method of dimensions gives the relation between these quantities as

a) $\upsilon^2 \propto \lambda g^{-1} \rho^{-1}$ b) $\upsilon^2 \propto g\lambda\rho$ c) $\upsilon^2 \propto g\lambda$ d) $\upsilon^2 \propto g^{-1} \lambda^{-3}$

264. A gas bubble from an explosion under water oscillates with a time period T, depends upon static pressure p, density of water ρ and the total energy of explosion E. Find the expression for the time period T.(where, k is a dimensionless constant)

a) $T=k\,p^{-5/6}\rho^{1/2}E^{1/3}$ b) $T=k\,p^{-4/7}\rho^{1/2}E^{1/3}$ c) $T=k\,p^{-5/6}\rho^{1/2}E^{1/2}$ d) $T=k\,p^{-4/7}\rho^{1/3}E^{1/2}$

265. The period of oscillation of a simple pendulum in the experiment is recorded as 2.63 s, 2.56 s, 2.42 s, 2.71 s and 2.80 s respectively. The average absolute error is

a) 0.1 s b) 0.11 s c) 0.01 s d) 1.0 s

266. In an experiment, the following observation's were recorded: $L=2.820\,m$, $M=3.00\,kg$,$l=0.087\,cm$,diameter $D=0.041\,cm$. Taking $g=9.81\,m/s^2$ using the formula,

$Y=\frac{4\,MgL}{\pi\,D^2 l}$, the maximum permissible error in Y is

a) 7.96% b) 4.56% c) 6.50% d) 8.42%

267. *Joule-second* is the unit of

a) Work b) Momentum c) Pressure d) Angular momentum

268. If $C$and L denote capacitance and inductance respectively, then the dimensions of LC are

a) $M^0L^0T^0$ b) $M^0L^0T^2$ c) $M^2L^0T^2$ d) MLT^2

269. The dimensional formula of the ratio of angular to linear momentum is

a) $[M^0LT^0]$ b) $[MLT]$ c) $[ML^2T^{-1}]$ d) $[M^{-1}L^{-1}T^{-1}]$

270. The dimensions of $e^2/4\pi\varepsilon_0 hc$, where e , ε_0 , h and c are electronic charge, electric permittivity, Planck's constant and velocity of light in vacuum respectively

a) $[M^0L^0T^0]$ b) $[M^1L^0T^0]$ c) $[M^0L^1T^0]$ d) $[M^0L^0T^1]$

271. Which one of the following is not a unit of young's modulus

a) $N\,m^{-1}$ b) $N\,m^{-2}$ c) $Dyne\,cm^{-2}$ d) *Mega Pascal*

272. The length, breadth and thickness of a metal block is given by $l=90$ cm, $b=8\,cm$, $t=2.45$ cm. The volume of the block is

a) $2\times10^2\,cm^3$ b) $1.8\times10^2\,cm^3$ c) $1.77\times10^2\,cm^3$ d) $1.764\times10^2\,cm^3$

273. The velocity of a freely falling body changes as $g^p h^q$ where g is acceleration due to gravity and h is the height. The values of p and q are

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

274. Which physical quantities have same dimensions

a) Force and power b) Torque and energy c) Torque and power d) Force and torque

275. Electron *volt* is a unit of

a) Charge b) Potential difference c) Momentum d) Energy

276. Position of a body with acceleration a is given by $x=k\,a^m t^n$. Here t is time. Find the dimensions of $m\wedge n$.

a) $m=1,n=1$ b) $m=1,n=2$ c) $m=2,n=1$ d) $m=2,n=2$

277. The dimensions of universal gas constant is

a) $[ML^2T^{-2}\theta^{-1}]$ b) $[M^2LT^{-2}\theta]$ c) $[ML^3T^{-1}\theta^{-1}]$ d) None of these

278. Which of the following is the unit of specific heat?

a) $Jkg\circ C^{-1}$ b) $Jkg^{-1}\circ C^{-1}$ c) $kg\circ CJ^{-1}$ d) $J/kg^{-1}\circ C^{-2}$

279. The dimensions of inter atomic force constant are

a) MT^{-2} b) MLT^{-1} c) MLT^{-2} d) $ML^{-1}T^{-1}$

280. Which physical quantities have the same dimension

a) Couple of force and work b) Force and power

c) Latent heat and specific heat d) Work and power

281. What is the power of a 100 W bulb in CGS units?

a) $10^6\, erg\, s^{-1}$ b) $10^7\, erg\, s^{-1}$ c) $10^9\, erg\, s^{-1}$ d) $10^{11}\, erg\, s^{-1}$

282. The number of particles given by $n=-D\frac{n_2-n_1}{x_2-x_1}$ are crossing a unit area perpendicular to x-axis in unit time, where n_1 and n_2 are the number of particles per unit volume for the values x_1 and x_2 of x respectively. Then the dimensional formula of diffusion constant D is

a) $[M^0LT^0]$ b) $[M^0L^2T^{-4}]$ c) $[M^0LT^{-3}]$ d) $[M^0L^2T^{-1}]$

283. If C the restoring couple per unit radian twist and I is the moment of inertia, then the dimensional representation of $2\pi\sqrt{\frac{I}{C}}$ will be

a) $[M^0L^0T^{-1}]$ b) $[M^0L^0T]$ c) $[M^0LT^{-1}]$ d) $[ML^2T^{-2}]$

284. The dimensions of electric potential are

a) $[ML^2T^{-2}Q^{-1}]$ b) $[MLT^{-2}Q^{-1}]$ c) $[ML^2T^{-1}Q]$ d) $[ML^2T^{-2}Q]$

285. Dimension of R is

a) ML^2T^{-1} b) $ML^2T^{-3}A^{-2}$ c) $ML^{-1}T^{-2}$ d) None of these

286. What is dimensional formula of thermal conductivity?

a) $[MLT^{-1}\theta^{-1}]$ b) $[MLT^{-3}\theta^{-1}]$ c) $[M^2¿^{-3}\theta^{-2}]$ d) $[ML^2T^{-2}\theta]$

287. The temperature of a body on Kelvin scale is found to be X K. When it is measured by a Fahrenheit thermometer, it is found to be X^0F. Then X is

a) 301.25 b) 574.25 c) 313 d) 40

288. Which of the following is the smallest unit

a) *Millimetre* b) *Angstrom* c) *Fermi* d) *Metre*

289. Which one of the following does not have the same dimensions

a) Work and energy b) Angle and strain

c) Relative density and refractive index d) Planck constant and energy

290. The physical quantity which is not a unit of energy is

a) Volt-coulomb b) MeV-sec c) Henry $(ampere)^2$ d) Farad-$(volt)^2$

291. The dimensions of permittivity ε_0 are

a) $A^2T^2M^{-1}L^{-3}$ b) $A^2T^4M^{-1}L^{-3}$ c) $A^{-2}T^{-4}ML^3$ d) $A^2T^{-4}M^{-1}L^{-3}$

292. The values of two resistors are $R_1=(6\pm0.3)\,k\Omega$ and $R_2=(10\pm0.2)\,k\Omega$. The percentage error in the equivalent resistance when they are connected in parallel is

a) 5.125% b) 2% c) 3.125% d) 10.125%

293. The dimensional formula of magnetic induction B is

a) $[M^0 ALT^0]$ b) $[M^0 AL^{-1}T^0]$ c) $[M^0 AL^2 T^0]$ d) $[ML^2 T^{-2} A^{-1}]$

294. The value of universal gas constant is $R=8.3$ J/K-mol. The value of R in atmosphere litre per Kelvin mol

a) 8.12 b) 0.00812 c) 81.2 d) 0.0812

295. A physical quantity is measured and its value is found to be nu where $n=¿$ numerical value and $u=¿$ unit. Then which of the following relations is true

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

296. SI unit of permittivity is

a) $C^2 m^2 N^2$ b) $C^2 m^{-2} N^{-1}$ c) $C^2 m^2 N^{-1}$ d) $C^{-1} m^2 N^{-2}$

297. The work done by a battery is $W=\varepsilon \Delta q$, where Δq change transferred by battery, $\varepsilon=¿$emf of the battery. What are dimensions of emf of battery?

a) $[M^0 L^0 T^{-2} A^{-2}]$ b) $[ML^2 T^{-3} A^{-2}]$ c) $[M^2 L^0 T^{-3} A^0]$ d) $[ML^2 T^{-3} A^{-1}]$

298. If $x=a-b$, then the maximum percentage error in the measurement of x will be

a) $\left(\frac{\Delta a+\Delta b}{a-b}\right)\times 100\%$ b) $\left(\frac{\Delta a}{a}-\frac{\Delta b}{b}\right)\times 100\%$

c) $\left(\frac{\Delta a}{a-a}+\frac{\Delta b}{a-b}\right)\times 100\%$ d) $\left(\frac{\Delta a}{a-a}-\frac{\Delta b}{a-b}\right)\times 100\%$

299. The unit of potential energy is

a) $g¿$ b) $g(cm/sec)^2$ c) $g(cm^2/sec)$ d) $g(cm/sec)$

300. The physical quantity having the dimensions $[M^{-1} L^{-3} A^2]$ is

a) Resistance b) Resistivity

c) Electrical conductivity d) Electromotive force

301. Dimensions of bulk modulus are

a) $[M^{-1} ¿^{-2}]$ b) $[ML^{-1} T^{-2}]$ c) $[ML^{-2} T^{-2}]$ d) $[M^2 L^2 T^{-1}]$

302. Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then error in the value of resistance of the wire is

a) 6% b) Zero c) 1% d) 3%

303. 'Torr' is the unit of

a) Pressure b) Volume c) Density d) Flux

304. The SI unit of length is the metre. Suppose we adopt a new unit of length which equal x metre. The area of 1 m^2 expressed in terms of the new unit has a magnitude

a) x b) x^2 c) x^{-1} d) x^{-2}

305. The velocity of a particle v at an instant t is given by $v=at+bt^2$ the dimension of b is

a) $[L]$ b) $[¿^{-1}]$ c) $[¿^{-2}]$ d) $[¿^{-3}]$

306. The dimensions of electric potential are

a) $[ML^2T^{-2}Q^{-1}]$ b) $[MLT^{-2}Q^{-1}]$ c) $[ML^2T^{-1}Q]$ d) $[ML^2T^{-2}Q]$

307. If the radius of the sphere is $(5.3\pm0.1)cm$. Then percentage error in its volume will be

a) $3+6.01\times\frac{100}{5.3}$ b) $\frac{1}{3}\times0.01\times\frac{100}{5.3}$ c) ¿ d) $\frac{0.1}{5.3}\times100$

308. If the velocity $v(is\,cms^{-1})$ of a particle is given in terms of t (in second) by the relation $v=at+\frac{b}{t+c}$ then, the dimensions of $a,b\wedge c$ are

a b c

a) $[L][¿][T^2]$ b) $[L^2][T][¿^{-2}]$ c) $[¿^2][¿][L]$ d) $[¿^{-2}][L][T]$

309. $\frac{h}{2\pi}$ is the dimension of

a) Velocity b) Momentum c) Energy d) Angular momentum

310. If $E=¿$ energy, $G=¿$ gravitational constant, $I=¿$ impulse and $M=¿$ mass, then dimensions of $\frac{GIM^2}{E^2}$ are same as that of

a) Time b) Mass c) Length d) Force

311. A public park, in the form of a square, has an area of $(100\pm0.2)m^2$. The side of park is

a) (10 ± 0.01)m b) (10 ± 0.1)m c) (10.0 ± 0.1)m d) (10.0 ± 0.2)m

312. Ins is defined as

a) $10^{-9}s\,of\;Kr-clock\;of$ 1650763.73 $oscillations$

b) $10^{-9}s\,of\;Kr-clock\;of$ 6521389.63 $oscillations$

c) $10^{-9}s\,of\;Cs-clock\;of$ 1650763.73 $oscillations$

d) $10^{-9}s\,of\;Cs-clock\;of$ 9192631770 $oscillations$

313. If the dimensions of a physical quantity are given by $M^aL^bT^c$, then the physical quantity will be

a) Pressure if $a=1,b=-1,c=-2$ b) Velocity if $a=1,b=0,c=-1$

c) Acceleration if $a=1,b=1,c=-2$ d) Force if $a=0,b=-1,c=-2$

314. The relative density of material of a body is found by weighing it first in air and then in water. If the weight in air is (5.00 ± 0.05) $newton$ and weight in water is $(4.00\pm0.05)\,newton$. Then the relative density along with the maximum permissible percentage error is

a) $5.0\pm11\%$ b) $5.0\pm1\%$ c) $5.0\pm6\%$ d) $1.25\pm5\%$

315. Identify the pair which has different dimensions

a) Planck's constant and angular momentum b) Impulse and linear momentum

c) Angular momentum and frequency d) Pressure and Young's modulus

316. In which of the following system of units, $weber$ is the unit of magnetic flux

a) CGS b) MKS c) SI d) None of these

317. The equation of state of some gases can be expressed as $\left(P+\frac{a}{V^2}\right)=\frac{R\theta}{V}$. Where P is the pressure, V the volume, θ the absolute temperature and a and b are constants. The dimensional formula of a is

a) $[ML^5T^{-2}]$ b) $[M^{-1}L^5T^{-2}]$ c) $[ML^{-1}T^{-2}]$ d) $[ML^{-5}T^{-2}]$

318. If E, M, L and G denote energy, mass, angular momentum and gravitational constant respectively, then the quantity (EL^2/M^5G^2) has the dimensions of

a) Angle b) Length c) Mass d) Time

319. The physical quantity which has the dimensional formula $[M^1T^{-3}]$ is

a) Surface tension b) Density c) Solar constant d) Compressibility

320. The percentage errors in the measurement of a mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimate of kinetic energy obtained by measuring mass and speed?

a) 11% b) 8% c) 5% d) 1%

321. What is the area of a disc of radius 1.1 cm?

a) $3.8028571\ cm^2$ b) $3.8029\ cm^2$ c) $3.803\ cm^2$ d) $3.8\ cm^2$

322. The physical quantity having the dimensions $[M^{-1}L^{-3}T^3A^2]$ is

a) Resistance b) Resistivity

c) Electrical conductivity d) Electromotive force

323. Dimensions of magnetic field intensity is

a) $[M^0L^{-1}T^0A^1]$ b) $[MLT^{-1}A^{-1}]$ c) $[ML^0T^{-2}A^{-1}]$ d) $[MLT^{-2}A]$

324. A spectrometer gives the following reading when used to measure the angle of a prism
Main scale reading : 58.5 degree
Vernier scale reading : 09 divisions
Given that 1 division on main scale corresponds to 0.5 degree. Total divisions on the vernier scale is 30 and match with 29 divisions of the main scale. The angle of the prism from the above data

a) 58.59 *Degree* b) 58.77 *Degree* c) 58.65 *Degree* d) 59 *Degree*

325. Find the dimensions of electric permittivity

a) $[A^2M^{-1}L^{-3}T^4]$ b) $[A^2M^{-1}L^{-3}T^0]$ c) $[AM^{-1}L^{-3}T^4]$ d) $[A^2M^0L^{-3}T^4]$

326. The radius of the sphere I (4.3 ± 0.1)cm. The percentage error in its volume is

a) $\frac{0.1}{4.3} \times 100$ b) $3 \times \frac{0.1 \times 100}{4.3}$ c) $\frac{1}{3} \times \frac{0.1 \times 100}{4.3}$ d) $3 + \frac{0.1 \times 100}{4.3}$

327. The dimensions of a rectangular block measured with calipers having least count of 0.01 cm are 5 mm × 10 mm × 5 mm. The maximum percentage error in the measurement of the volume of the block is

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

328. In a new system of units, unit f mass is 10 kg, unit of length is 1 km and unit of time is 1 min. The value of 1 joule in this new hypothertical system is

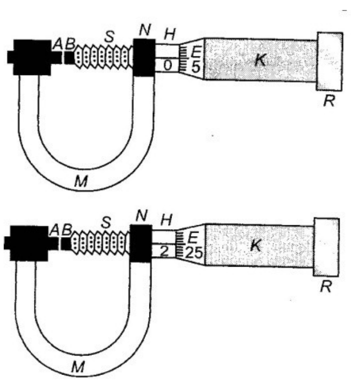
a) 3.6×10^{-4} new units b) 6×10^7 new units c) 10^{11} new units d) 1.67×10^4 new units

329. The wavelength associated with a moving particle depends upon power p of its mass m, qth power of its velocity v and rth power of planck's constant h. Then the correct set of values of p, q and r is

a) $p=1, q=-1, r=1$ b) $p=1, q=1, r=1$

c) $p=-1, q=-1, r=-1$ d) $p=-1, q=-1, r=1$

330. The circular scale of a screw gauge has 50 divisions and pitch of 0.5 mm. Find the diameter of sphere. Main scale reading is 2.



a) 1.2 b) 1.25 c) 2.20 d) 2.25

331. The length of a cylinder is measured with a meter rod having least count 0.1 cm.
Its diameter is measured with vernier callipers having least count $0.01\ cm$. Given that length is $5.0\,cm$. and radius is $2.0\ cm$. The percentage error in the calculated value of the volume will be

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

332. The energy (E), andgular momentum (L) and universal gravitational constant (G) are chosen as fundamental quantities. The dimensions of universal gravitational constant in the dimensional formula of Planck's constant (h) is

a) Zero b) -1 c) $\frac{5}{3}$ d) 1

333. Density of liquid in CGS system is $0.625\ g\,cm^{-3}$. What is its magnitude in SI system?

a) 0.625 b) 0.0625 c) 0.00625 d) 625

334. Which of the following is dimensionless?

a) $\frac{v^2}{r\,g}$ b) $\frac{v^2 g}{r}$ c) $\frac{v\,g}{r}$ d) $v^2 r\,g$

335. The unit of magnetic moment is

a) TJ^{-1} b) JT^{-1} c) Am^{-2} d) Am^{-1}

336. The unit of reduction factor of tangent galvanometer is

a) *Ampere* b) *Gauss* c) *Radian* d) None of these

337. If pressure P, velocity V and time T are taken as fundamental physical quantities, the dimensional formula of force is

a) $P\,V^2T^2$ b) $P^{-1}V^2T^{-2}$ c) $PV\,T^2$ d) $P^{-1}V\,T^2$

338. Which of the following quantity is expressed as force per unit area

a) Work b) Pressure c) Volume d) Area

339. Which of the following cannot be regarded as an essential characteristic of a unit of measurement?

a) Inaccessibility b) Indenstructibility

c) Invariability d) Reproductibility

340. If the unit of length and force be increased four times, then the unit of energy is

a) Increased 4 times b) Increased 8 times c) Increased 16 times d) Decreased 16 times

341. The dimensional formula of magnetic flux is

a) $[MLT^{-2}A^{-1}]$ b) $[ML^2T^{-1}A^{-1}]$ c) $[ML^2T^{-1}A^{-2}]$ d) $[ML^2T^{-2}A^{-1}]$

342. Which one of the following is not a fundamental SI unit?

a) Ampere b) Candela c) Newton d) Kelvin

343. The dimensional formula for areal velocity is

a) $[M^0L^{-2}T]$ b) $[M^0L^{-2}T^{-1}]$ c) $[M^0L^2T^{-1}]$ d) $[M^0L^2T]$

344. What are the units of $K=1/4\pi\varepsilon_0$

a) $C^2N^{-1}m^{-2}$ b) $N\,m^2C^{-2}$ c) $N\,m^2C^2$ d) Unitless

345. The dimensions of potential are the same as that of

a) Work b) Electric field per unit charge

c) Work per unit charge d) Force per unit charge

346. The unit of L/R is (where $L=¿$inductance and $R=¿$ Resistance)

a) Sec b) Sec^{-1} c) $Volt$ d) $Ampere$

347. The unit of specific resistance is

a) Ohm/cm^2 b) Ohm/cm c) $Ohm-cm$ d) $(Ohm-cm)^{-1}$

348. Frequency is the function of density (ρ), length (a) and surface tension (T). Then its value is

a) $k\rho^{1/2}a^{3/2}/\sqrt{T}$ b) $k\rho^{3/2}a^{3/2}/\sqrt{T}$ c) $k\rho^{1/2}a^{3/2}/T^{3/4}$ d) None of these

349. The units of modulus rigidity are

a) $N-m$ b) N/m c) $N-m^2$ d) N/m^2

350. A screw gauge gives the following reading when used to measure the diameter of a wire.
Main scale reading : 0 mm
Circular scale reading : 52 divisions
Given that 1 mm on main scale corresponds to
100 divisions of the circular scale.
The diameter of wire from the above data is

a) 0.052 cm b) 0.026 cm c) 0.005 cm d) 0.52 cm

351. The unit of the coefficient of viscosity in S.I. system is

a) $m/kg-s$ b) $m-s/kg^2$ c) $kg/m-s^2$ d) $kg/m-s$

352. A suitable unit for gravitational constant is

a) $kg\text{-}m\,sec^{-1}$ b) $N\,m^{-1}sec$ c) $N\,m^2kg^{-2}$ d) $kg\,m\,sec^{-1}$

353. The correct value of $0°\,C$ on the Kelvin scale is

a) 273.15 K b) 272.85 K c) 273 K d) 273.2 K

354. The dimensional formula for Boltzmann's constant is

a) $[ML^2T^{-2}\theta^{-1}]$ b) $[ML^2T^{-2}]$ c) $[ML^0T^{-2}\theta^{-1}]$ d) $[ML^{-2}T^{-1}\theta^{-1}]$

355. Energy per unit volume represents

a) Pressure b) Force c) Thrust d) Work

356. Which of the following groups have different dimensions

a) Potential difference, EMF, voltage

b) Pressure, stress, young's modulus

c) Heat , energy, work-done

d) Dipole moment, electric flux, electric field

357. Farad is not equivalent to

a) $\frac{q}{V}$ b) $q v^2$ c) $\frac{q^2}{J}$ d) $\frac{J}{V^2}$

358. The velocity v of water waves may depend on their wavelength (λ), the density of water (ρ) and the acceleration due to gravity (g). The method of dimensions gives the relation between these quantities as

a) $v^2 \propto \lambda^{-1} \rho^{-1}$ b) $v^2 \propto g \lambda$ c) $v^2 \propto g \lambda \rho$ d) $g^{-1} \propto \lambda^3$

359. The dimensional formula for impulse is

a) $[MLT^{-1}]$ b) $[ML^{-1}T]$ c) $[M^{-1}¿^{-1}]$ d) $[ML^{-1}T^{-1}]$

360. A physical quantity is given by $X=[M^a L^b T^c]$. The percentage error in measurement of $M, L \wedge T$ are $\alpha, \beta \wedge \gamma$ respectively. Then, the maximum % error in the quantity X is

a) $a\alpha + b\beta + c\gamma$ b) $a\alpha + b\beta - c\gamma$ c) $\frac{a}{\alpha}+\frac{b}{\beta}+\frac{c}{\gamma}$ d) None of these

361. Dimensional formula for the universal gravitational constant G is

a) $[M^{-1}L^2T^{-2}]$ b) $[M^0L^0T^0]$ c) $[M^{-1}L^3T^{-2}]$ d) $[M^{-1}L^3T^{-1}]$

362. Number of base SI unit is

a) 4 b) 7 c) 3 d) 5

363. Dimensional formula of capacitance (or farad) is

a) $M^{-1}L^{-2}T^4A^2$ b) $ML^2T^4A^{-2}$ c) $MLT^{-4}A^2$ d) $M^{-1}L^{-2}T^{-4}A^{-2}$

364. The dimensional formula of angular velocity is

a) $M^0L^0T^{-1}$ b) MLT^{-1} c) $M^0L^0T^1$ d) ML^0T^{-2}

365. If the length of rod A is $(3.25 \pm 0.01)\,cm$ and that of B is $(4.19 \pm 0.01)\,cm$, then the rod B is longer than rod A by

a) $(0.94 \pm 0.00)\,cm$ b) $(0.94 \pm 0.01)\,cm$ c) $(0.94 \pm 0.02)\,cm$ d) $(0.94 \pm 0.005)\,cm$

366. Electric displacement is given by $D=\varepsilon E$,

Here, $\varepsilon =$¿electric permittivity

$E=$¿electric field strength

The dimensions of electric displacement are

a) $[ML^{-2}TA]$ b) $[L^{-2}T^{-1}A]$ c) $[L^{-2}TA]$ d) None of these

367. Unit of electric flux is

a) Vm b) Nm/C^{-1} c) Vm^{-1} d) CNm^{-1}

368. Two full turns of the circular scale of a screw gauge cover a distance of 1 mm on its main scale. The total number of divisions on the circular scale is 50. Further, it is found that the screw gauge has a zero error of -0.03 mm. While measuring the diameter of a thin wire, a student notes the main scale reading of 3 mm and the number of circular scale divisions in line with the main scale as 35. The diameter of the wire is

a) 3.32 mm b) 3.73 mm c) 3.67 mm d) 3.38 mm

369. Dimensions of coefficient of viscosity are

a) ML^2T^{-2} b) ML^2T^{-1} c) $ML^{-1}T^{-1}$ d) MLT

370. Out of the following which pair of quantities do not have same dimensions

a) Planck's constant and angular momentum
b) Work and energy
c) Pressure and Young's modulus
d) Torque and moment of inertia

371. The force F on the sphere of radius 'a' moving in a medium with velocity $'\upsilon'$ is given by $F=6\pi\eta a\upsilon$. The dimensions of η are

a) $ML^{-1}T^{-1}$
b) MT^{-1}
c) MLT^{-2}
d) ML^{-3}

372. If $f=x^2$, then the relative error in f is

a) $\frac{2\Delta x}{x}$
b) $\frac{(\Delta x)^2}{x}$
c) $\frac{\Delta x}{x}$
d) $(\Delta x)^2$

373. In the context of accuracy of measurement and significant figures in expressing results of experiment, which of the following is/are correct

(1) Out of the two measurements 50.14 cm and 0.00025 $ampere$, the first one has greater accuracy

(2) If one travels 478 km by rail and 397 m by road, the total distance travelled is 478 km

a) Only (1) is correct
b) Only (2) is correct
c) Both are correct
d) None of them is correct

374. Dimensions of kinetic energy are

a) ML^2T^{-2}
b) M^2LT^{-1}
c) ML^2T^{-1}
d) ML^3T^{-1}

375. Given that $r=m^2 \sin pt$, where t represents time. If the unit of m is N, then the unit of r is

a) N
b) N^2
c) N s
d) $N^2 s$

376. In an experiment the angles are required to be measured using an instrument. 29 divisions of the main scale exactly coincide with the 30 divisions of the vertier scale. If the smallest division of the main scale is half-a-degree $(¿0.5°)$ then the least count of the instrument is

a) One minute
b) Half minute
c) One degree
d) Half-degree

377. Dimensions of the following three quantities are the same

a) Work, energy, force
b) Velocity, momentum, impulse
c) Potential energy, kinetic energy, momentum
d) Pressure, stress, coefficient of elasticity

378. Dimension of electric current is

a) $[M^0L^0T^{-1}Q]$
b) $[ML^2T^{-1}Q]$
c) $[M^2LT^{-1}Q]$
d) $[M^2L^2T^{-1}Q]$

379. The period of oscillation of a simple pendulum is given by $T=2\pi\sqrt{\frac{l}{g}}$ where l is about $100\,cm$ and is known to have $1\,mm$ accuracy. The period is about $2\,s$. The time of 100 oscillations is measured by a stop watch of least count $0.1\,s$. The percentage error in $g$is

a) 0.1%
b) 1%
c) 0.2%
d) 0.8%

380. The percentage errors in the measurement of length and time period of a simple pendulum are 1% and 2% respectively. Then the maximum error in the measurement of acceleration due to gravity is

a) 8%
b) 3%
c) 4%
d) 5%

381. A resistor of 4 kΩ with tolerance 10% is connected in parallel with a resistor of 6 kW with tolerance 100%. The tolerance of the parallel combination is nearly

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

382. An important milestone in the evolution of the universe just after the Big Bang is the Planck time t_P, the value of

which depends on three fundamental constants-speed c of light in vacuum, gravitational constant G and Planck's constant h. Then, $t_P \propto$

a) Ghc^5 b) $\frac{c^5}{Gh}$ c) $\frac{Gh}{c^5}$ d) $\left(\frac{Gh}{c^5}\right)^{1/2}$

383. IF L, C and R denote the inductance, capacitance and resistance respectively, the dimensional formula for $C^2 LR$ is

a) $[ML^{-2}T^{-1}I^0]$ b) $[M^0L^0T^3I^0]$ c) $[M^{-1}L^{-2}T^6I^2]$ d) $[M^0L^0T^2I^0]$

384. The unit of $e.m.f.$ is

a) $Joule$ b) $Joule-coulomb$ c) $Volt-coulomb$ d) $Joule/coulomb$

385. Students I, II and III perform an experiment for measuring the acceleration due to gravity (g) using a simple pendulum. They use different lengths of the pendulum and/or record time for different number of oscillations. The observations are shown in the table

Least count for length ¿$0.1\,cm$

Least count for time ¿$0.1\,s$

Student	Length of the pendulum (cm)	Number of oscillation (n)	Total time for (n) oscillations (s)	Time period (s)
I	64.0	8	128.0	16.0
I	64.0	4	64.0	16.0
III	20.0	4	36.0	9.0

If E_I, E_{II} and E_{III} are the percentage errors in $g, i.e., \left(\frac{\Delta g}{g} \times 100\right)$ for students I, II and III, respectively

a) $E_I = 0$ b) E_I is minimum c) $E_I = E_{II}$ d) E_{II} is maximum

386. One million electron $volt\,(1\,MeV)$ is equal to

a) $10^5\,eV$ b) $10^6\,eV$ c) $10^4\,eV$ d) $10^7\,eV$

387. If the units of M and L are increased three times, then the unit of energy will be increased by

a) 3 times b) 6 times c) 27 times d) 81 times

388. The velocity of a body is given by the equation $v = \frac{b}{t} + ct^2 + dt^2$

The dimensional formula of b is

a) $[M^0LT^0]$ b) $[ML^0T^0]$ c) $[M^0L^0T]$ d) $[MLT^{-1}]$

389. Unit of magnetic moment is

a) $Ampere-metre^2$ b) $Ampere-metre$ c) $Weber-metre^2$ d) $Weber/metre$

390. The resistance $R = \frac{V}{i}$ where $V = 100 \pm 5\,volts$ and $i = 10 \pm 0.2\,amperes$. What is the total error in R

a) 5% b) 7% c) 5.2% d) $\frac{5}{2}\%$

391. The least count of a stop watch is 0.2 s. The time of 20 oscillations of a pendulum is measured to be 25 s. The percentage error in the measurement of time will be

a) 8%　　b) 1.8%　　c) 0.8%　　d) 0.1%

392. If C is capacitance and q is charge, then the dimension of q^2/C is same as that of

a) Work　　b) Angular momentum　　c) Force　　d) Torque

393. The dimension of $\frac{1}{2}\epsilon_0 E^2$, where ϵ_0 is permittivity of free space and E is electric field, is

a) MLT^1　　b) ML^2T^{-2}　　c) $ML^{-1}T^{-2}$　　d) ML^2T^{-1}

394. If $L, C \wedge R$ denote inductance, capacitance and resistance respectively, then which of the following combination has the dimension of time?

a) $\frac{C}{L}$　　b) $\frac{1}{RC}$　　c) $\frac{L}{R}$　　d) $\frac{RL}{C}$

395. If E, m, J and G represent energy, mass, angular momentum and gravitational constant respectively, then the dimensional formula of EJ^2/m^5G^2 is

a) $[MLT^{-2}]$　　b) $[M^0L^0T]$　　c) $[M^0L^2T^0]$　　d) Dimensionless

396. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be

a) 8%　　b) 2%　　c) 4%　　d) 6%

397. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is $0.5\,mm$ and there are 50 divisions on the circular scale. The reading on the main scale is $2.5\,mm$ and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is

a) 0.9%　　b) 2.4%　　c) 3.1%　　d) 4.2%

398. If force (F),length (L) and time (T) are assumed to be the fundamental units, then the dimensional formula of the mass will be

a) $[FL^{-1}T^2]$　　b) $[FL^{-1}T^{-2}]$　　c) $[FL^{-1}T^{-1}]$　　d) $[FL^2T^{-2}]$

399. A student performs an experiment for determination of $g=\frac{4\pi^2 l}{T^2}$ and he commits an error of Δl. For that he takes the time of n oscillations with the stop watch of least count ΔT and he commits a human error of $0.1\,sec$. For which of the following data, the measurement of g will be most accurate

	Δl	ΔT	n	Ampli. of oscill.
a)	$5\,mm$	$0.2\,sec$	10	$5\,mm$
b)	$5\,mm$	$0.2\,sec$	20	$5\,mm$
c)	$5\,mm$	$0.1\,sec$	20	$1\,mm$
d)	$1\,mm$	$0.1\,sec$	50	$1\,mm$

400. Write dimensional formula for the intensity of radiation

a) $M^1L^0T^3$　　b) $M^1L^0T^{-3}$　　c) $M^1L^2T^{-2}$　　d) $M^1L^2T^{-3}$

401. If 3.8×10^{-6} is added to 4.2×10^{-5} giving due regard to significant figures, then the result will be

a) 458×10^{-5}　　b) 4.6×10^{-5}　　c) 4.5×10^{-5}　　d) None of the above

402. If the velocity of light (c), gravitational constant (G) and Planck's constant (h) are chosen as fundamental units, then the dimensions of mass in new system is

a) $c^{1/2}G^{1/2}h^{1/2}$　　b) $c^{1/2}G^{1/2}h^{-1/2}$　　c) $c^{1/2}G^{-1/2}h^{1/2}$　　d) $c^{-1/2}G^{1/2}h^{1/2}$

403. An object is moving through the liquid. The viscous damping force acting on it is proportional to the velocity. Then dimension of constant of proportionality is

a) $ML^{-1}T^{-1}$ b) MLT^{-1} c) M^0LT^{-1} d) ML^0T^{-1}

404. Out of the following pairs, which one does not have identical dimensions

a) Moment of inertia and moment of force
b) Work and torque
c) Angular momentum and Planck's constant
d) Impulse and momentum

405. The dimensions of potential are the same as that of

a) Work
b) Electric field per unit charge
c) Work per unit charge
d) Force per unit charge

406. Select the pair whose dimensions are same

a) Pressure and stress b) Stress and strain c) Pressure and force d) Power and force

407. $Kilowatt-hour$ is a unit of

a) Electrical charge b) Energy c) Power d) Force

408. The radius of a wire is 0.24 mm. Then its area of cross section by taking significant figures into consideration is

a) $0.1\ mm^2$ b) $0.2\ mm^2$ c) $0.18\ mm^2$ d) $0.180\ mm^2$

409. Electron – volt is the unit of energy (1 eV = 1.6 $\times 10^{-19}$J). in H-atom, the binding energy of electron in first orbit is 13.6 eV. The same in joule (J) is

a) 10×10^{-19}J b) 21.76×10^{-19}J c) 13.6×10^{-19}J d) None of these

410. A student has measured the length of a wire equal to 0.04580 m. This value of length has the number of significant figures equal to

a) Five b) Four c) Six d) None of these

411. Force constant has the same dimensions as

a) Coefficient of viscosity
b) Surface tension
c) Frequency
d) Impulse

412. The dimensional formula for Planck's constant (h) is

a) $ML^{-2}T^{-3}$ b) ML^2T^{-2} c) ML^2T^{-1} d) $ML^{-2}T^{-2}$

413. The dimensions of physical quantity X in the equation

$Force=\frac{X}{Density}$ is given by

a) $M^1L^4T^{-2}$ b) $M^2L^{-2}T^{-1}$ c) $M^2L^{-2}T^{-2}$ d) $M^1L^{-2}T^{-1}$

414. Dimensional formula for force is

a) $[M^1L^2T^{-2}]$ b) $[M^1L^1T^{-2}]$ c) $[M^1L^{-1}T^{-2}]$ d) $[M^1L^{-2}T^{-2}]$

415. The constant of proportionality $\frac{1}{4\pi\varepsilon_0}$ in Coulomb's law has the following units

a) $C^{-2}Nm^2$ b) $C^2N^{-1}m^{-2}$ c) C^2Nm^2 d) $C^{-2}N^{-1}m^{-2}$

416. Universal time is based on

a) Rotation of earth on its axis

b) Oscillations of quartz crystal

c) Vibrations of cesium atom

d) Earth's orbital motion around the sun

417. Planck's constant has the dimensions (unit) of

a) Energy b) Linear momentum c) Work d) Angular momentum

418. A resistor of 10 kΩ having tolerance 10% is connected in series with another resistor of $20 k\Omega$ having tolerance 20%. The tolerance of the combination will be approximately

a) 10% b) 13% c) 17% d) 20%

419. A cube has a side of length $1.2 \times 10^{-2} m$. Calculate its volume.

a) $1.7 \times 10^{-6} m^3$ b) $1.73 \times 10^{-6} m^3$ c) $1.70 \times 10^{-6} m^3$ d) $1.732 \times 10^{-6} m^3$

420. The speed (v) of ripples on the surface of water depends on surface tension (σ), density (ρ) and wavelength (λ). The square of speed (v) is proportional to

a) $\frac{\sigma}{\rho\lambda}$ b) $\frac{\rho}{\sigma\lambda}$ c) $\frac{\lambda}{\sigma\rho}$ d) $\rho\lambda\sigma$

421. The constant of proportionality $\frac{1}{4\pi\varepsilon_0}$ in Coulomb's law has the following dimensions

a) $C^{-2} N m^2$ b) $C^2 N^{-1} m^{-2}$ c) $C^2 N m^2$ d) $C^{-2} N^{-1} m^{-2}$

422. Unit of power is

a) *Kilowatt* b) *Kilowatt-hour* c) *Dyne* d) *Joule*

423. The dimensions of coefficient of thermal conductivity is

a) $M L^2 T^{-2} K^{-1}$ b) $ML T^{-3} K^{-1}$ c) $ML T^{-2} K^{-1}$ d) $ML T^{-3} K$

424. A physical quantity P is given by $P = \frac{A^3 B^{\frac{1}{2}}}{C^{-4} D^{\frac{3}{2}}}$. The quantity which brings in the maximum percentage error in P is

a) A b) B c) C d) D

425. In the following list, the only pair which have different dimensions, is

a) Linear momentum and moment of a force

b) Planck's constant and angular momentum

c) Pressure and modulus of electricity

d) Torque and potential energy

426. Which one of the following is not a unit of Young's modulus?

a) Nm^{-1} b) Nm^{-2} c) $Dyne\,cm^{-2}$ d) Mega pascal

427. Which of the following is not a unit of energy

a) $W-s$ b) $kg-m/sec$ c) N-m d) *Joule*

428. The speed (v) of ripples on the surface of water depends on surface tension (σ), density (ρ) and wavelength (λ). The square of speed (v) is proportional to

a) $\frac{\sigma}{\rho\lambda}$ b) $\frac{\rho}{\sigma\lambda}$ c) $\frac{\lambda}{\sigma\rho}$ d) $P\lambda\sigma$

429. If error in radius is 3%, what is error in volume of sphere?

a) 3% b) 27% c) 9% d) 6%

430. Oersted is a unit of

a) Dip b) Magnetic intensity c) Magnetic moment d) Pole strength

431. The unit of reactance is

a) Ohm b) $Volt$ c) Mho d) $Newton$

432. What is the dimensional formula of mc^2, where the letters have their usual meanings?

a) $[MLT^{-1}]$ b) $[ML^0T^0]$ c) $[ML^2T^{-2}]$ d) $[M^{-1}L^3T^6]$

433. For the equation $F \propto A^a v^b d^c$, where F is the force, A is the area v is the velocity and d is the density, the value of a, b and c are respectively

a) 1,2,1 b) 2,1,1 c) 1,1,2 d) 0,1,1

434. Dimensions of $\frac{1}{\mu_0 \varepsilon_0}$, where symbols have their usual meaning, are

a) $[L^{-1}T]$ b) $[L^2T^2]$ c) $[L^2T^{-2}]$ d) $[¿^{-1}]$

435. If $L=2.331\,cm, B=2.1\,cm$, then $L+B=¿$

a) $4.431\,cm$ b) $4.43\,cm$ c) $4.4\,cm$ d) $4\,cm$

436. A student performs an experiment for determination of $g\left(¿\frac{4\pi^2 l}{T^2}\right), l \approx 1\,m$, and he commits an error of Δl. For T he takes the time of n oscillations with the stop watch of least count ΔT and he commits a human error of 0.1 s. For which of the following data, the measurement of g will be most accurate?

a) $\Delta L=0.5, \Delta T=0.1, n=20$ b) $\Delta L=0.5, \Delta T=0.1, n=50$

c) $\Delta L=0.5, \Delta T=0.01, n=20$ d) $\Delta L=0.5, \Delta T=0.05, n=50$

437. Which of the following pairs does not have similar dimensions

a) Stress and pressure b) Angle and strain

c) Tension and surface tension d) Planck's constant and angular momentum

438. The mean time period of second's pendulum is 2.00s and mean absolute error in the time period is 0.05s. To express maximum estimate of error, the time period should be written as

a) $(2.00 \pm 0.01)\,s$ b) $(2.00 + 0.025)\,s$ c) $(2.00 \pm 0.05)\,s$ d) $(2.00 \pm 0.10)\,s$

439. Given, Force $¿\frac{\alpha}{density + \beta^3}$

What are the dimensions of α, β ?

a) $[ML^2T^{-2}], [ML^{-1/3}]$ b) $[M^2L^4T^{-2}], [M^{1/3}L^{-1}]$ c) $[M^2L^{-2}T^{-2}], [M^{1/3}L^{-1}]$ d) $[M^2L^{-2}T_2], [ML^{-3}]$

440. One light year is defined as the distance travelled by light in one year. The speed of light is $3 \times 10^8\,m\,s^{-1}$. The same in metre is

a) 3×10^{12}m b) 9.461×10^{15}m c) 3×10^{15}m d) None of these

441. Which of the following sets of quantities have same dimensional formula?

a) Frequency, angular frequency and angular momentum

b) Surface tension, stress and spring constant

c) Acceleration, momentum and retardation

d) Work, energy and torque

442. The frequency of vibration of string is given by $v=\frac{P}{2l}\left[\frac{F}{m}\right]^{1/2}$. Here p is number of segments in the string and l is the length. The dimensional formula for m will be

a) $[M^0LT^{-1}]$ b) $[ML^0T^{-1}]$ c) $[ML^{-1}T^0]$ d) $[M^0L^0T^0]$

443. Length is measured in metre and time in second as usual. But a new unit of mass is so chosen that $G=1$. This new unit of mass is equal to

a) 1.5×10^7kg b) 1.5×10^{10}kg c) 6.67×10^{-11}kg d) 6.67×10^{-8}kg

444. The mass of a box is 2.3 g. Two gold pieces, each of mass 0.035 g, are placed in it. The total mass of the box and gold pieces is

a) 2.3 g b) 2.4 g c) 2.37 g d) 2.370 g

445. Which one of the following units is not that of mutual inductance?

a) Henry

b) $(Weber)^{-1}$

c) Ohm second

d) Volt second $(ampere)^{-1}$

446. Hertz is the unit for

a) Frequency b) Force c) Electric charge d) Magnetic flux

447. Which one has the dimensions different from the remaining three

a) Power b) Work c) Torque d) Energy

448. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate. If the maximum error in the measurement of force and length are respectively 4% and 2%, the maximum error in the measurement of pressure is

a) 1% b) 2% c) 6% d) 8%

449. The physical quantity which has dimensional formula as that of $\frac{Energy}{Mass\times Length}$ is

a) Force b) Power c) Pressure d) Acceleration

450. A thin copper wire of length l *metre* increases in length by 2% when heated through 10^oC. What is the percentage increase in area when a square copper sheet of length l *metre* is heated through 10^oC

a) 4% b) 8% c) 16% d) None of the above

451. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate by using the formula $p=\frac{F}{l^2}$. If the maximum errors in the measurement of force and length are 4% and 2% respectively, then the maximum error in the measurement of pressure is

a) 1% b) 2% c) 8% d) 10%

452. Unit of impulse is

a) $Newton$ b) $kg-m$ c) $kg-m/s$ d) $Joule$

453. The surface tension of a liquid is $70\,dyne/cm$, in MKS system value is

a) $70\, N/m$ b) $7\times10^{-2}\, N/m$ c) $7\times10^{3}\, N/m$ d) $7\times10^{2}\, N/m$

454. Given that : $y=A\sin\left[\left(\frac{2\pi}{\lambda}\right)(ct-x)\right]$ where, $y\wedge x$ are measured in metre. Which of the following statements is true?

a) The unit of λ is same as that of x and A

b) The unit of λ is same as that of x but not of A

c) The unit of c is same as that of $\frac{2\pi}{\lambda}$

d) The unit of $(ct-x)$ is same as that of $\frac{2\pi}{\lambda}$

455. If K denotes coefficient of thermal conductivity, d the density and c the specific heat, the unit of X, where $X=K/dc$ will be

a) $cm\, sec^{-1}$ b) $cm^2\, sec^{-2}$ c) $cm\, sec$ d) $cm^2\, sec^{-1}$

456. Dimensions of impulse are same as that of

a) Force b) Momentum c) Energy d) Acceleration

457. In the relation $y=r\sin(\omega t-kx)$,the dimensions of ω/k are

a) $[M^0L^0T^0]$ b) $[M^0L^1T^{-1}]$ c) $[M^0L^0T^1]$ d) $[M^0L^1T^0]$

458. Which of the following five physical parameters have the same dimensions

(A) Energy density (B) Refractive index (C) Dielectric constant (D) Young's modulus

(E) Magnetic field

a) (A) and (D) b) (A) and (E) c) (B) and (D) d) (C) and (E)

459. The unit of percentage error is

a) Same as that of physical quantity

b) Different from that of physical quantity

c) Percentage error is unit less

d) Errors have got their own units which are different from that of physical quantity measured

460. The physical quantity which has the dimensional formula M^1T^{-3} is

a) Surface tension b) Solar constant c) Density d) Compressibility

461. The SI unit of electrochemical equivalent is

a) Kg C b) C kg^{-1} c) Kg C^{-1} d) kg^2C^{-1}

462. Curie is a unit of

a) Energy of γ-rays b) Half life c) Radioactivity d) Intensity of γ-rays

463. $ML^{-1}T^{-2}$represents

a) Stress

b) Young's Modulus

c) Pressure

d) All of the above three quantities

464. The dimensions of pressure is equal to

a) Force per unit volume

b) Energy per unit volume

c) Force

d) energy

465. Which pair has the same dimensions

a) Work and power
b) Density and relative density
c) Momentum and impulse
d) Stress and strain

466. $[ML^2 L^{-2}]$ are dimensions of

a) Force
b) Moment of force
c) Momentum
d) Power

467. The ratio of 1 kWh to 1 MeV is

a) 2.25×10^{17}
b) 2.25×10^{19}
c) 2.25×10^{23}
d) $2.25\times 4.4\times 10^{9}$

468. In the equation S_{nth} the $=u+\frac{a}{2}(2n-1)$, the letters have their usual meanings. The dimensional formula of S_{nth} is

a) $[ML^0 T]$
b) $[ML^{-1} T^{-1}]$
c) $[M^0 L T^{-1}]$
d) $[M^0 L T^0]$

469. The unit of Stefan's constant is

a) $Wm^{-2} K^{-1}$
b) $Wm K^{-4}$
c) $Wm^{-2} K^{-4}$
d) $Nm^{-2} K^{-4}$

470. Light year is a unit of

a) Time
b) Mass
c) Distance
d) Energy

471. With the usual notations, the following equation
$S_t=u+\frac{1}{2}a(2t-1)$is

a) Only numerically correct
b) Only dimensionally correct
c) Both numerically and dimensionally correct
d) Neither numerically nor dimensionally correct

472. The ratio of the dimension of Planck's constant and that of moment of inertia is the dimension of

a) Frequency
b) Velocity
c) Angular momentum
d) Time

473. Which has not the same unit as other?

a) Watt-sec
b) Kilowatt-hour
c) eV
d) Js

474. The SI unit of gravitational potential is

a) J
b) Jkg^{-1}
c) Jkg
d) Jkg^2

475. Which one of the following pairs of quantities and their units is a proper match

a) Electric field-$coulomb/m$
b) Magnetic flux-$weber$
c) Power-$farad$
d) Capacitance-$henry$

476. Error in the measurement of radius of sphere is 2%. The error in the measurement of volume is

a) 1%
b) 5%
c) 3%
d) 6%

477. The length of a cube is 2.1 $\times 10^{-2}$m. the volume in significant figures will be

a) $9.2\times 10^{-6} m^3$
b) $9.3\times 10^{-6} m^3$
c) $9.26\times 10^{-6} m^3$
d) $9.261\times 10^{-6} m^3$

478. Which one of the following pairs of quantities and their unit is proper match?

a) Electric field-coulomb/m
b) Magnetic flux-weber
c) Power-farad
d) Capacitance-henry

479. $[ML^2T^{-3}]$ is the dimension of

a) Work b) Power c) Force d) Momentum

480. A wire has a mass $0.3 \pm 0.003\, g$, radius $0.5 \pm 0.005\, mm$ and length $6 \pm 0.06\, cm$. The maximum percentage error in the measurement of its density is

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

481. A quantity X is given by $\varepsilon_0 L \frac{\Delta V}{\Delta t}$,where ε_0 is the permittivity of free space, L is a length, ΔV is a potential difference and Δt is a time interval. The dimensional formula for X is the same as that of

a) Electrical resistance b) Electric charge c) Electric voltage d) Electric current

482. The dimensional formula for $r.m.s.$ (root mean square) velocity is

a) $M^0 L T^{-1}$ b) $M^0 L^0 T^{-2}$ c) $M^0 L^0 T^{-1}$ d) $ML T^{-3}$

483. If C be the capacitance and V be the electric potential, then the dimensional formula of CV^2 is

a) $[ML^{-3} TA]$ b) $[K^0 ¿^{-2} A^0]$ c) $[ML^1 T^{-2} A^{-1}]$ d) $[ML^2 T^{-2} A^0]$

484. If 1 g cm s^{-1}= x newton-second, then the number x is equal to

a) 1×10^{-3} b) 3.6×10^{-3} c) 1×10^{-5} d) 6×10^{-4}

485. The dimensions of emf in MKS is

a) $[ML^{-1}T^{-2}Q^{-2}]$ b) $[ML^{-2}T^{-2}Q^{-2}]$ c) $[MLT^{-2}Q^{-1}]$ d) $[ML^2T^{-2}Q^{-1}]$

486. Which of the two have same dimensions

a) Force and strain b) Force and stress

c) Angular velocity and frequency d) Energy and strain

487. Which is different from others by units

a) Phase difference b) Mechanical equivalent

c) Loudness of sound d) Poisson's ratio

488. $1\, kWh = ¿$

a) $1000\, W$ b) $36 \times 10^5\, J$ c) $1000\, J$ d) $3600\, J$

489. There are atomic clocks capable of measuring time with an accuracy of 1 part in 10^{11}. If two such clocks are operated with precision, then after running for 5000 years, these will record

a) A difference of nearly 1 s b) A difference of 1 day

c) A difference of 10^{11} s d) A difference of 1 year

490. If C and R represent capacitance and resistance respectively, then the dimensions of RC are

a) $M^0 L^0 T^2$ b) $M^0 L^0 T$ c) $M L^{-1}$ d) None of these above

491. From the equation $\tan\theta = \frac{rg}{v^2}$, one can obtain the angle of banking $\theta$for a cyclist taking a curve (the symbols have their usual meanings). Then say it is,

a) Both dimensionally and numerically correct b) Neither numerically nor dimensionally correct

c) Dimensionally correct only d) Numerically correct only

492. A physical quantity is given by $X=M^a L^b T^c$. The percentage error in measurement of M, L and T are α, β and γ respectively. The maximum percentage error in the quantity X is

a) $a\alpha+b\beta+c\gamma$ b) $a\alpha+b\beta-c\gamma$ c) $\frac{a}{\alpha}+\frac{b}{\beta}+\frac{c}{\gamma}$ d) None of these

493. The dimensions of couple are

a) ML^2T^{-2} b) MLT^{-2} c) $ML^{-1}T^{-3}$ d) $ML^{-2}T^{-2}$

494. The velocity of transverse wave in a string is $v=\sqrt{\frac{T}{m}}$,where T is the tension in the string and$m$ is mass per unit length. If $T=3.0$ kgf, mass of string is 2.5 g and length of string is 1.00m, then the percentage error in the measurement of velocity is

a) 0.5 b) 0.7 c) 2.3 d) 3.6

495. If voltage $V=(100\pm 5)$ volt and current $I=(10\pm 0.2)A$, the percentage error in resistance R is

a) 5.2% b) 25% c) 7% d) 10%

496. If P represents radiations pressure, c represents speed of light and Q represents radiation energy striking a unit area per $second$, the non-zero integers $x, y$and z such that $P^x Q^y c^z$ is dimensionless, are

a) $x=1, y=1, z=-1$ b) $x=1, y=-1, z=1$ c) $x=-1, y=1, z=1$ d) $x=1, y=1, z=1$

497. Solar constant is defined as energy received by earth per cm^2 per minute. The dimensions of solar constant are

a) $[ML^2T^{-3}]$ b) $[M^2L^0T^{-1}]$ c) $[ML^0T^{-3}]$ d) $[MLT^{-2}]$

498. The dimensions of $\frac{a}{b}$ in the equation $P=\frac{a-t^2}{bx}$, where P is pressure, x is distance and t is time, are

a) MT^{-2} b) M^2LT^{-3} c) ML^3T^{-1} d) LT^{-3}

499. The dimensions of CV^2 matches with the dimensions of

a) L^2I b) L^2I^2 c) LI^2 d) $\frac{1}{LI}$

500. If energy (E), velocity (υ) and force (F) be taken as fundamental quantity, then what are the dimensions of mass

a) $E\upsilon^2$ b) $E\upsilon^{-2}$ c) $F\upsilon^{-1}$ d) $F\upsilon^{-2}$

501. Position of body with acceleration 'a' is given by $x=Ka^m t^n$, here t is time. Find dimensions of m and n

a) $m=1, n=1$ b) $m=1, n=2$ c) $m=2, n=1$ d) $m=2, n=2$

502. If $E=¿$energy, $G=¿$ gravitational constant, $I=¿$ impulse and $M=¿$ mass, the dimensions of $\frac{GIM^2}{E^2}$ are same as that of

a) Time b) Mass c) Length d) Force

503. Two full turns of the circular scale of a screw gauge cover a distance of $1\,mm$ on its main scale. The total number of divisions on the circular scale is 50. Further, it is found that the screw gauge has a zero error of $-0.03\,mm$. While measuring the diameter of a thin wire, a student notes the main scale reading of $3\,mm$ and the number of circular scale divisions in line with the main scale as 35. The diameter of the wire is

a) $3.73\,mm$ b) $3.67\,mm$ c) $3.38\,mm$ d) $3.32\,mm$

504. The air bubble formed by explosion inside water performed oscillation with time period T that is directly proportional to $p^a d^b E^c$, where p is the pressure, d is the density and E is the energy due to explosion. The values of $a, b \wedge c$ will be

a) -5/6, 1/2, 1/3 b) 5/6, 1/3, 1/2 c) 5/6, 1/2, 1/3 d) None of these

505. The expression for centripetal force depends upon mass of body, speed of the body and the radius of circular path. Find the expression for centripetal force

a) $F=\frac{mv^2}{2r^3}$ b) $F=\frac{mv^2}{r}$ c) $F=\frac{mv^2}{r^2}$ d) $F=\frac{m^2v^2}{2r}$

506. How many wavelengths of the Kr^{89} are there in one metre?

a) 658189.63 b) 2348123.73 c) 1650763.73 d) 1553164.12

507. The unit of permittivity of free space ε_0 is

a) $Coulomb/newton-metre$
b) $Newton-metre^2/coulomb^2$
c) $Coulomb^2/(newton-metre)^2$
d) $Coulomb^2/newton-metre^2$

508. The difference in the lengths of a mean solar day and a sidereal day is about

a) $1\,min$ b) $4\,min$ c) $15\,min$ d) $56\,min$

509. To determine the Young's modulus of a wire, the formula is $Y=\frac{F}{A}\times\frac{L}{\Delta L}$; where $L=¿$ length, $A=¿$ area of cross-section of the wire, $\Delta L=¿$ change in length of the wire when stretched with a force F. The conversion factor to change it from CGS to MKS system is

a) 1 b) 10 c) 0.1 d) 0.01

510. The dimensions of Planck's constant is same as that of

a) Angular momentum
b) Linear momentum
c) Work
d) Coefficient of viscosity

511. From the dimensional consideration, which of the following equation is correct

a) $T=2\pi r\sqrt{\frac{R^3}{GM}¿}$ ¿ b) $T=2\pi\sqrt{\frac{GM}{R^3}¿}$ ¿ c) $T=2\pi\sqrt{\frac{GM}{GR^2}¿}$ ¿ d) $T=2\pi\sqrt{\frac{R^2}{GM}¿}$ ¿

512. In $S=a+bt+ct^2$. S is measured in metre and t in $second$. The unit of c is

a) None b) m c) ms^{-1} d) ms^{-2}

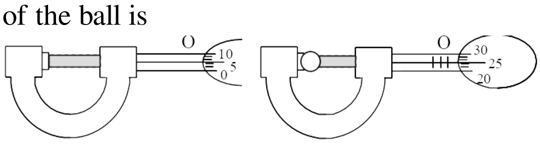
513. A weber is equivalent to

a) $\text{A}\,m^{-2}$ b) $\text{A}\,m^{-1}$ c) $\text{A}\,m^2$ d) $\text{T}\,m^2$

514. The percentage error in the above problem is

a) 7% b) 5.95% c) 8.95% d) 9.85%

515. The circular divisions of shown screw gauge are 50. It moves $0.5\,mm$ on main scale in one rotation. The diameter of the ball is



a) $2.25\,mm$ b) $2.20\,mm$ c) $1.20\,mm$ d) $1.25\,mm$

516. The physical quantity angular momentum has the same dimensions as that of

a) Work b) Force c) Momentum d) Planck's constant

517. If the acceleration due to gravity is $10\,ms^{-2}$ and the units of length and time are changed in kilometer and hour respectively, the numerical value ofacceleration is

a) 360000 b) 72000 c) 36000 d) 129600

518. The physical quantity that has no dimensions is

a) Angular Velocity b) Linear momentum c) Angular momentum d) Strain

519. The time dependence of a physical quantity P is given by $P=P_0 e^{\alpha t^2} - \alpha t^2$ where α is a constant and t is time. Then constant α is

a) Dimensionless b) Dimensionless of T^{-2}

c) Dimensionless of P d) Dimensionless of T^2

520. The unit of momentum is

a) N s b) $N s^{-1}$ c) N m d) $N m^{-1}$

521. A dimensionally consistent relation for the volume V of a liquid of coefficient of viscosity η flowing per second through a tube of radius r and length l and having pressure p across its end, is

a) $V=\frac{\pi p r^4}{8\eta l}$ b) $V=\frac{\pi\eta l}{8 p r^4}$ c) $V=\frac{8 p\eta l}{\pi r^4}$ d) $V=\frac{\pi p\eta}{8 l r^4}$

522. The S.I. unit of gravitational potential is

a) J b) $J-kg^{-1}$ c) $J-kg$ d) $J-kg^{-2}$

523. The dimensions of K in the equation $W=\frac{1}{2}K x^2$ is

a) $M^1 L^0 T^{-2}$ b) $M^0 L^1 T^{-1}$ c) $M^1 L^1 T^{-2}$ d) $M^1 L^0 T^{-1}$

524. Given that υ is speed, r is the radius and g is the acceleration due to gravity. Which of the following is dimensionless

a) υ^2/rg b) $\upsilon^2 r/g$ c) $\upsilon^2 g/r$ d) $\upsilon^2 rg$

525. In the formula, $a=3bc^2$, a and c have dimensions of electric capacitance and magnetic induction respectively. What are dimensions of b in MKS system?

a) $[M^{-3}L^{-2}T^4Q^4]$ b) $[M^{-3}T^4Q^4]$ c) $[M^{-3}T^3Q]$ d) $[M^{-3}L^2T^4Q^{-4}]$

526. The dimensions of stress are equal to

a) Force b) Pressure c) Work d) $\frac{1}{Pressure}$

527. $1\,a.m.u.$ is equivalent to

a) $1.6\times10^{-27}kg$ b) $934\,MeV$ c) $1.6\times10^{-24}gm$ d) All above

528. Dimensional formula of Stefan's constant is

a) $MT^{-3}K^{-4}$ b) $ML^2T^{-2}K^{-4}$ c) ML^2T^{-2} d) $MT^{-2}L^0$

529. Which of the following units denotes the dimensions $[ML^2/Q^2]$, where Q denotes the electric charge?

a) Wbm^{-2} b) Henry (H) c) Hm^{-2} d) Weber (Wb)

530. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are

a) $kgm\,s^{-1}$ b) $kgm\,s^{-2}$ c) $kg\,s^{-1}$ d) kgs

531. The dimensions of resistivity in terms of M, L, T and Q where Q stands for the dimensions of charge, is

a) $ML^3T^{-1}Q^{-2}$ b) $ML^3T^{-2}Q^{-1}$ c) $ML^2T^{-1}Q^{-1}$ d) $MLT^{-1}Q^{-1}$

532. The dimensional formula for impulse is same as the dimensional formula for

a) Momentum
b) Force
c) Rate of change of momentum
d) Torque

533. Dimensions of potential energy are

a) MLT^{-1}
b) ML^2T^{-2}
c) $ML^{-1}T^{-2}$
d) $ML^{-1}T^{-2}$

534. In the relation $P=\frac{\alpha}{\beta}e^{\frac{\alpha Z}{k\theta}}$ P is pressure, Z is the distance, k is Boltzmann's constant and θ is the temperature. The dimensional formula of β will be

a) $[M^0L^2T^0]$
b) $[M^1L^2T^1]$
c) $[M^1L^0T^{-1}]$
d) $[M^0L^2T^{-1}]$

535. If $x=at+bt^2$, where x is the distance travelled by the body in kilometre while t is the time in second, then the units of b are

a) km/s
b) $km-s$
c) km/s^2
d) $km-s^2$

536. Choose the incorrect statement out of the following

a) Every measurement by any measuring instrument has some error
b) Every calculated physical quantity that is based on measured values has some error
c) A measurement can have more accuracy but less precision and vice versa
d) The percentage error is different from relative error

537. Consider a new system of units in which c(speed of light in vacuum), h(Planck's constant) and G(gravitational constant) are taken as fundamental units. Which of the following would correctly represent mass in this new system?

a) $\sqrt{\frac{hc}{G}}$
b) $\sqrt{\frac{Gc}{h}}$
c) $\sqrt{\frac{hG}{c}}$
d) $\sqrt{hGc}$

538. If velocity v, acceleration A and force F are chosen a fundamental quantities, then the dimensional formula of angular momentum in terms of v, A and F would be

a) $FA^{-1}v$
b) Fv^3A^{-2}
c) Fv^2A^{-1}
d) $F^2v^2A^{-1}$

539. The number of significant figures in all the given numbers $25.12, 2009, 4.156$ and 1.217×10^{-4} is

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

540. Linear momentum and angular momentum have the same dimensions in

a) Mass and length
b) Length and time
c) Mass and time
d) Mass, length and time

541. Which of the following units denotes the dimensions ML^2/Q^2, where Q denotes the electric charge

a) Henry (H)
b) H/m^2
c) Weber (Wb)
d) Wb/m^2

542. What is the dimensional formula of $\frac{planck's\ constant}{linear\ momentum}$?

a) $[M^0L^0T^0]$
b) $[M^0L^0T]$
c) $[M^0LT^0]$
d) $[MLT^{-1}]$

543. SI unit of electric intensity is

a) Coulomb
b) Coulomb/m^2
c) Newton
d) Newton/ coulomb

544. The unit of nuclear dose given to a patient is

a) *Fermi* b) Rutherford c) Curie d) Roentgen

545. The dimensional formula of universal gas constant is

a) $[ML^2T^{-2}\theta^{-1}]$ b) $[M^2¿^{-2}\theta]$ c) $[ML^3T^{-1}\theta^{-1}]$ d) None of these

546. Let us choose a new unit of length such that the velocity of light in vacuum is unity. If light takes 8 min and 20 sec to cover the distance between sun and earth, this distance in terms of the new unit is

a) 5 b) 50 c) 500 d) 3×10^8

547. Which of the following represents a *volt*

a) *Joule/second* b) *Watt/ampere* c) *Watt/coulomb* d) *Coulomb/joule*

548. Dimensional formula of Stefan's constant is

a) $[MT^{-3}K^{-4}]$ b) $[ML^2T^{-2}K^{-4}]$ c) $[ML^2T^{-2}]$ d) $[MT^{-2}L^0]$

549. The relative density of the material of a body I the ratio of its weight in air and the loss of its weight in water. By using a spring balance, the weight of the body in air in measured to be 5.00 ± 0.05N. The weight of the body in water is measured to be 4.00 ± 0.05N. Then the maximum possible percentage error in relative density is

a) 11% b) 10% c) 9% d) 7%

550. $X=3YZ^2$ find dimension of Y in $(MKSA)$ system, If X and Z are the dimensions of capacity and magnetic field respectively

a) $M^{-3}L^{-2}T^{-4}A^{-1}$ b) ML^{-2} c) $M^{-3}L^{-2}T^4A^4$ d) $M^{-3}L^{-2}T^8A^4$

551. The percentage errors in the measurement of length and time period of a simple pendulum are 1% and 2% respectively. Then the maximum error in the measurement of acceleration due to gravity is

a) 8% b) 3% c) 4% d) 5%

552. The unit of absolute permittivity is

a) $Fm(farad-metre)$ b) $Fm^{-1}(farad/metre)$

c) $Fm^{-2}(farad/metre^2)$ d) F (farad)

553. Dimensional formula of heat energy is

a) ML^2T^{-2} b) MLT^{-1} c) $M^0L^0T^{-2}$ d) None of these

554. Which of the following quantities has not been expressed in proper unit

a) Torque : Newton metre b) Stress : Newton $metre^{-2}$

c) Modulus of elasticity : Newton $metre^{-2}$ d) Surface tension : Newton $metre^{-2}$

555. If the units of mass, length and time are doubled unit of angular momentum will be

a) Doubled b) Tripled

c) Quadrupled d) Eight times the original value

556. Unit of moment of inertia in MKS system

a) $kg\times cm^2$ b) kg/cm^2 c) $kg\times m^2$ d) $Joule\times m$

557. The dimensions of emf in MKS is

a) $ML^{-1}T^{-2}Q^{-2}$ b) $ML^2T^{-2}Q^{-2}$ c) $MLT^{-2}Q^{-1}$ d) $ML^2T^{-2}Q^{-1}$

558. The length l, breadth b and thickness t of a block are measured with the help of a metre scale. Given $l=15.12\pm0.01$cm, $b=10.15\pm0.01$cm, $t=5.28\pm0.01$cm.
The percentage error in volume is

a) 0.64% b) 0.28% c) 0.37% d) 0.48%

559. A sextant is used to measure

a) Area of hill b) Height of an object
c) Breadth of a tower d) Volume of the building

560. $[ML^3T^{-1}Q^{-2}]$ is the dimensional formula of

a) Resistance b) Resistivity c) Conductance d) Conductivity

561. A current of 2..34 A flows in a resistance of 11.111111Ω. The potential difference across the given resistance with due regard for significant figure is

a) 26.000 V b) 26.00 V c) 26.0 V d) 26 V

562. Dimensions of charge are

a) $M^0L^0T^{-1}A^{-1}$ b) $MLTA^{-1}$ c) $T^{-1}A$ d) TA

563. The dimensions of time constant are

a) $[M^0L^0T^0]$ b) $[M^0L^0T]$ c) $[MLT]$ d) None of these

564. Which physical quantities have same dimensions?

a) Force and power b) Torque and energy c) Torque and power d) Force and torque

565. The number of significant figures in all the given numbers 25.12, 2009, 4.156 and 1.217×10^{-4} is

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

566. The power of lens is $P=\frac{1}{f}$,where f is focal length of the lens . The dimensions of power of lens are

a) $[LT^{-2}]$ b) $[M^0L^{-1}T^0]$ c) $[M^0L^0T^0]$ d) None of these

567. The position of a particle at time t is given by the relation $x(t)=$¿where v_0 is constant and $\alpha>0$. The dimensions of v_0 and α are respectively

a) $M^0L^1T^{-1}$ and T^{-1} b) $M^0L^1T^0$ and T^{-1} c) $M^0L^1T^{-1}$ and LT^{-2} d) $M^0L^1T^{-1}$ and T

568. The dimensions of kinetic energy are

a) $[M^2L^2T]$ b) $[ML^2T]$ c) $[ML^2T^{-2}]$ d) $[ML^2T^{-1}]$

569. If u_1 and u_2 are the units selected in two systems of measurement and n_1 and n_2 their numerical values, then

a) $n_1u_1=n_2u_2$ b) $n_1u_1+n_2u_2=0$
c) $n_1n_2=u_1u_2$ d) $(n_1+u_1)=(n_2+u_2)$

570. Which of the following pairs is wrong

a) Pressure-Barometer b) Relative density-Pyrometer
c) Temperature-Thermometer d) Earthquake-Seismograph

571. The magnetic force on a point moving charge is $\vec{F}=q(\vec{V}\times\vec{B})$.

Here, $q=¿$electric charge

$\vec{V}=¿$ velocity of the point charge

$\vec{B}=¿$magnetic field

The dimensions of $\vec{B}$

a) $[MLT^{-1}A]$ b) $[MLT^{-2}A^{-1}]$ c) $[MT^{-1}A^{-1}]$ d) None of these

572. Pressure gradient has the same dimension as that of

a) Velocity gradient b) Potential gradient c) Energy gradient d) None of these

573. A cube has numerically equal volume and surface area. The volume of such a cube is

a) $216\,units$ b) $1000\,units$ c) $2000\,units$ d) $3000\,units$

574. If $L=2.331\,cm, B=2.1\,cm, then\,L+B$ is equal to

a) 4.431 cm b) 4.43 cm c) 4.4 cm d) 4 cm

575. One is equivalent to 931 MeV energy. The rest mass of electron is 9.1 $\times 10^{-31}$kg. the Mass equivalent energy is

(1 amu $¿\,1.67\times 10^{-17}$kg)

a) 0.5073 MeV b) 0.693 MeV c) 4.0093 MeV d) None of these

: ANSWER KEY :

1)	a	2)	c	3)	b	4)	b
5)	c	6)	d	7)	b	8)	b
9)	c	10)	d	11)	b	12)	a
13)	d	14)	a	15)	b	16)	a
17)	b	18)	d	19)	d	20)	d
21)	b	22)	a	23)	c	24)	b
25)	d	26)	a	27)	c	28)	c
29)	b	30)	a	31)	b	32)	b
33)	d	34)	c	35)	a	36)	d
37)	a	38)	b	39)	b	40)	b
41)	d	42)	a	43)	d	44)	a
45)	b	46)	a	47)	c	48)	b
49)	a	50)	c	51)	c	52)	b
53)	d	54)	d	55)	c	56)	b
57)	c	58)	a	59)	b	60)	d
61)	b	62)	b	63)	a	64)	a
65)	c	66)	a	67)	a	68)	b
69)	a	70)	a	71)	b	72)	b
73)	d	74)	a	75)	b	76)	c
77)	d	78)	a	79)	b	80)	c
81)	b	82)	d	83)	d	84)	b
85)	a	86)	d	87)	b	88)	c
89)	d	90)	b	91)	a	92)	c
93)	a	94)	c	95)	a	96)	c
97)	d	98)	d	99)	a	100)	c
101)	b	102)	a	103)	b	104)	d
105)	c	106)	b	107)	d	108)	a
109)	d	110)	a	111)	d	112)	a
113)	c	114)	a	115)	d	116)	b
117)	c	118)	c	119)	a	120)	a
121)	a	122)	c	123)	b	124)	d
125)	b	126)	c	127)	a	128)	c
129)	c	130)	c	131)	a	132)	a
133)	c	134)	d	135)	a	136)	d
137)	a	138)	d	139)	a	140)	b
141)	a	142)	c	143)	c	144)	d
145)	a	146)	d	147)	a	148)	b
149)	d	150)	d	151)	b	152)	d
153)	c	154)	a	155)	d	156)	c
157)	c	158)	d	159)	d	160)	a
161)	a	162)	c	163)	a	164)	d
165)	a	166)	d	167)	c	168)	a

169)	d	170)	a	171)	d	172)	a
173)	d	174)	d	175)	d	176)	d
177)	a	178)	d	179)	a	180)	c
181)	a	182)	d	183)	b	184)	b
185)	a	186)	b	187)	d	188)	b
189)	b	190)	b	191)	d	192)	d
193)	d	194)	c	195)	a	196)	c
197)	b	198)	b	199)	d	200)	a
201)	c	202)	a	203)	a	204)	d
205)	c	206)	b	207)	c	208)	a
209)	c	210)	d	211)	a	212)	a
213)	c	214)	a	215)	c	216)	a
217)	b	218)	b	219)	b	220)	a
221)	d	222)	a	223)	b	224)	d
225)	c	226)	a	227)	d	228)	a
229)	b	230)	d	231)	d	232)	a
233)	c	234)	c	235)	a	236)	c
237)	c	238)	a	239)	c	240)	d
241)	b	242)	d	243)	d	244)	b
245)	d	246)	b	247)	d	248)	c
249)	c	250)	d	251)	c	252)	a
253)	b	254)	d	255)	a	256)	a
257)	d	258)	b	259)	b	260)	d
261)	b	262)	d	263)	c	264)	a
265)	b	266)	c	267)	d	268)	b
269)	a	270)	a	271)	a	272)	a
273)	b	274)	b	275)	d	276)	b
277)	a	278)	b	279)	a	280)	a
281)	c	282)	d	283)	b	284)	a
285)	b	286)	b	287)	b	288)	c
289)	d	290)	b	291)	b	292)	d
293)	d	294)	d	295)	d	296)	b
297)	d	298)	a	299)	b	300)	c
301)	b	302)	a	303)	a	304)	d
305)	d	306)	a	307)	c	308)	d
309)	d	310)	a	311)	a	312)	d
313)	a	314)	a	315)	c	316)	c
317)	a	318)	a	319)	c	320)	b
321)	d	322)	c	323)	c	324)	c
325)	a	326)	a	327)	a	328)	a
329)	d	330)	a	331)	c	332)	a
333)	d	334)	a	335)	b	336)	a

337)	a	338)	b	339)	a	340)	c
341)	d	342)	c	343)	c	344)	b
345)	c	346)	a	347)	c	348)	a
349)	d	350)	a	351)	d	352)	c
353)	a	354)	a	355)	a	356)	d
357)	b	358)	b	359)	a	360)	a
361)	c	362)	b	363)	a	364)	a
365)	c	366)	c	367)	a	368)	d
369)	c	370)	d	371)	a	372)	a
373)	c	374)	a	375)	b	376)	a
377)	d	378)	a	379)	c	380)	d
381)	c	382)	d	383)	b	384)	d
385)	b	386)	b	387)	c	388)	a
389)	a	390)	b	391)	c	392)	a
393)	c	394)	c	395)	d	396)	d
397)	c	398)	a	399)	d	400)	b
401)	b	402)	c	403)	d	404)	a
405)	c	406)	a	407)	b	408)	c
409)	b	410)	b	411)	b	412)	c
413)	c	414)	b	415)	a	416)	a
417)	d	418)	c	419)	a	420)	a
421)	a	422)	a	423)	b	424)	c
425)	a	426)	a	427)	b	428)	a
429)	c	430)	b	431)	a	432)	c
433)	a	434)	c	435)	c	436)	d
437)	c	438)	c	439)	d	440)	b
441)	d	442)	c	443)	b	444)	b
445)	b	446)	a	447)	a	448)	d
449)	d	450)	a	451)	c	452)	c
453)	b	454)	a	455)	d	456)	b
457)	b	458)	a	459)	c	460)	b
461)	c	462)	c	463)	d	464)	b
465)	c	466)	b	467)	b	468)	c
469)	c	470)	c	471)	c	472)	a
473)	d	474)	b	475)	b	476)	d
477)	b	478)	b	479)	b	480)	d
481)	d	482)	a	483)	d	484)	c
485)	d	486)	c	487)	d	488)	b
489)	a	490)	b	491)	c	492)	a
493)	a	494)	d	495)	c	496)	b
497)	c	498)	a	499)	c	500)	b
501)	b	502)	a	503)	c	504)	a
505)	b	506)	c	507)	d	508)	b
509)	c	510)	a	511)	a	512)	d
513)	d	514)	c	515)	c	516)	d
517)	d	518)	d	519)	b	520)	a
521)	a	522)	b	523)	a	524)	a
525)	a	526)	b	527)	d	528)	a
529)	b	530)	c	531)	a	532)	a
533)	b	534)	a	535)	c	536)	d

537)	a	538)	b	539)	d	540)	c
541)	a	542)	c	543)	d	544)	d
545)	a	546)	c	547)	b	548)	b
549)	a	550)	d	551)	d	552)	b
553)	a	554)	d	555)	c	556)	c
557)	d	558)	c	559)	b	560)	b
561)	c	562)	d	563)	b	564)	b
565)	d	566)	b	567)	a	568)	c
569)	a	570)	b	571)	c	572)	d
573)	a	574)	b	575)	a		

: HINTS AND SOLUTIONS :

1 **(a)**

If a charge of 1 C moving with a velocity of $1\,ms^{-1}$ perpendicular to a uniform magnetic field experiences a force of 1 N, then the magnitude of the field is 1 T. The SI unit of magnetic field is $Wb\,m^{-2}$. Thus,

$1\,T=1\,NA^{-1}m^{-1}=1\,Wbm^{-2}$

In CGS systems

$1\,tesla=10^4\,gauss=1\,Wbm^{-2}$

2 **(c)**

Friction $F=\mu N$

$\mu=\frac{F}{N}$

$\therefore ¿]=\left[\frac{F}{N}\right]=\frac{[MLT^{-2}]}{[MLT^{-2}]}=¿$dimensionsless

5 **(c)**

Given, $x=\cos(\omega t+kx)$

Here, $(\omega t+kx)$ is an angle so the dimension of

$(\omega t+kx)=[M^0L^0T^0]$

Or dimensions of $\omega t=[M^0L^0T^0]$

Or dimensions of $\omega=\frac{[M^0L^0T^0]}{[T]}$

Or $¿[M^0L^0T^{-1}]$

6 **(d)**

$a=b^\alpha c^\beta/d^\gamma e^\delta$

So maximum error in a is given by

$¿¿$

$¿(\alpha b_1+\beta c_1+\gamma d_1+\delta e_1)\%$

7 **(b)**

In $g=\ln h-2\ln t$

$\left(\frac{\Delta g}{g}\times 100\right)_{max}=\frac{\Delta h}{h}\times 100+2\frac{\Delta t}{t}\times 100=e_1+2e_2$

8 **(b)**

Here, $S=(13.8\pm 0.2)\,m$

and $t=(4.0\pm 0.3)\,sec$

Expressing it in percentage error, we have,

$S=13.8\pm\frac{0.2}{13.8}\times 100\%=13.8\pm 1.4\%$

and $t=4.0\pm\frac{0.3}{4}\times 100\%=4\pm 7.5\%$

$\because V=\frac{s}{t}=\frac{13.8\pm 1.4}{4\pm 7.5}=(3.45\pm 0.3)\,m/s$

9 **(c)**

One main scale division, $1\,M.S.D.=x\,cm$

One vernier scale division , $1\,V.S.D.=\frac{(n-1)x}{n}$

Least count $¿1\,M.S.D.-1\,V.S.D.$

$¿\frac{nx-nx+x}{n}=\frac{x}{n}cm$

10 **(d)**

Surface tension $¿\frac{Force}{Length}=\frac{[MLT^{-2}]}{L}=[MT^{-2}]$

11 **(b)**

$PV=¿$[energy]

Vander Waal's equation is $\left(P+\frac{a}{V^2}\right)(V-b)=nRT$

The dimensions of $\frac{a}{V^2}$ should be that of P and b is that of volume

Work done (or energy) should have the dimensions of PV

$\therefore\left[\frac{a}{V^2}\times b\right]=¿$ [Energy]

$[bP]=¿$ [Energy]

$\left[\frac{a}{V^2}\right]=[P]$ is having dimensions different from energy

12 **(a)**

$\phi = BA = \frac{F}{I \times L} A = \frac{[MLT^{-2}][L^2]}{[A][L]} = [ML^2T^{-2}A^{-1}]$

13 **(d)**

$n_2 = n_1 \left[\frac{M_2}{M_1}\right]^1 \left[\frac{L_2}{L_1}\right]^2 \left[\frac{T_2}{T_1}\right]^{-2}$

Given, $M_2 = 2M_1, L_2 = 2L_1, T_2 = 2T_1$

$\therefore n_2 = n_1 [2]^1 [2]^2 [2]^{-2} = 2n_1$

14 **(a)**

Momentum $p \propto f^a v^b \rho^c$

$[MLT^{-1}] = [T^{-1}]^a [LT^{-1}]^b [ML^{-3}]^c$

$[MLT^{-1}] = [M^c L^{b-3c} T^{-a-b}]$

$\Longrightarrow c = 1.$

$b - 3c = 1 \Longrightarrow b = 4$

$-a - b = -1$

$a + b = 1, a = -3$

$\therefore [p] = [f^{-3} v^4 \rho]$

15 **(b)**

Percentage error in length ¿ $\frac{1}{50} \times 100 = 2$

Percentage error in breadth ¿ $\frac{0.1}{2.0} \times 100 = 5$

Percentage error in thickness¿ $\frac{0.1}{1.00} \times 100 = 1$

Percentage error in volume¿ $2 + 5 + 1 = 8$

16 **(a)**

[B]= $\left[\frac{force \times length}{mass}\right] = \left[\frac{energy}{mass}\right]$ =¿[latent heat]

17 **(b)**

Time period of simple pendulum is

$T = 2\pi\sqrt{\frac{l}{g}}$

Or $\frac{\Delta T}{T} = \frac{1}{2}\left(\frac{\Delta l}{l} - \frac{\Delta g}{g}\right)$

Or $\frac{\Delta g}{g} = \frac{\Delta l}{l} - \frac{2\Delta T}{T}$

$\therefore$ Maximum percentage error in equation

$\frac{\Delta g}{g} \times 100 = \frac{\Delta l}{l} \times 100 + \frac{2\Delta T}{T} \times 100$

¿ $1 \times 100 + 2 \times 2 \times 100$

¿ $5 \times 100 = 5\%$

18 **(d)**

Required percentage

¿ $\frac{2 \times 0.02}{0.24} \times 100 + \frac{1}{30} \times 100 + \frac{0.01}{4.80} \times 100$

¿ $16.7 + 3.3 + 0.2$

¿ 20%

19 **(d)**

Modulus of rigidity $\eta = \frac{F/A}{\phi}$

Dimensions of $\eta = \frac{[MLT^{-2}]}{[L^2]}$

¿ $[ML^{-1}T^{-2}]$

20 **(d)**

$[G] = [M^{-1}L^3T^{-2}]; [h] = [ML^2T^{-1}]$

Power ¿ $\frac{1}{focal\ length} = [L^{-1}]$

All quantities have dimensions

21 **(b)**

In 23.023 number of significant figures will be 5 because all the zero's between non zero digits are significant. In 0.0003, number of significant figures will be one because all the zero's before and after decimal point are insignificant if the number is less then one. In 2.1×10^{-3} number of significant figure are to because power of 10 is not considered as significant figure

22 **(a)**

Force, $F = ma$

$\therefore a = \frac{F}{m} = \frac{10\ pound}{kg}$

¿ $10 \frac{pound}{kg} = \frac{10\ slug\ ft}{kg\ s^2} = 146 \frac{ft}{s^2}$

¿ $146 \times 0.30\ m\ s^{-2}$

¿ $44.5\ m\ s^{-2}$

23 **(c)**

Force $F = qvB$

$[MLT^{-2}]=[C][LT^{-1}][B]$

$\Rightarrow[B]=[MC^{-1}T^{-1}]$

24 **(b)**

$E=KF^aA^bT^c$

$[ML^2T^{-2}]=[MLT^{-2}]^a[LT^{-2}]^b[T]^c$

$[ML^2T^{-2}]=[M^aL^{a+b}T^{-2a-2b+c}]$

$\therefore a=1, a+b=2\Rightarrow b=1$

And $-2a-2b+c=-2\Rightarrow c=2$

$\therefore E=KFAT^2$

25 **(d)**

[Calorie]=$[ML^2T^{-2}]$

Comparing with general dimensional formula $[M^aL^bT^c]$, we get

$a=1, b=2, c=-2.$

$n_2=4.2\left[\frac{1\,kg}{\alpha kg}\right]^1\left[\frac{1\,m}{\beta m}\right]^2\left[\frac{1\,s}{\gamma s}\right]^{-2}=4.2\alpha^{-1}\beta^{-2}\gamma^2$

27 **(c)**

[Entropy]=$\frac{Q}{T}=\frac{[ML^2T^{-2}]}{[K]}=[ML^2T^{-2}K^{-1}]$

28 **(c)**

$Capacity\times Resistance=\frac{Charge}{Potential}\times\frac{Volt}{amp}$

$¿\frac{amp\times second\times Volt}{Volt\times amp}=Second$

31 **(b)**

Frequency = $\frac{1}{T}=[M¿¿0L^0T^{-1}]¿$

32 **(b)**

Angular momentum = mvr

= $[MLT^{-1}][L]=[ML^2T^{-1}]$

33 **(d)**

Energy = Work done [Dimensionally]

34 **(c)**

$\frac{L}{R}=Time\,constant$

35 **(a)**

$\frac{Angular\,momentum}{Linear\,momentum}=\frac{mvr}{mv}=r=[M^0L^1T^0]$

37 **(a)**

Resistivity $[\rho]=\frac{[R].[A]}{[I]}$ where $[R]=[ML^2T^{-1}Q^{-2}]$

$\therefore[\rho]=[ML^3T^{-1}Q^{-2}]$

38 **(b)**

Given, $F\propto v^2$

Or $F=kv^2$

$\therefore k=\frac{F}{v^2}$

$[k]=\frac{[F]}{[v^2]}=\frac{[MLT^{-2}]}{[L^2T^{-2}]}$

$¿[ML^{-1}T^0]$

39 **(b)**

Required volume $¿\frac{75\times10^4\times26}{10^3\times10^3\times10^3}(km)^3$

40 **(b)**

$X=M^aL^bT^{-c}$

$\therefore\frac{\Delta X}{X}=\pm\left[\alpha\frac{\Delta M}{M}+b\frac{\Delta L}{L}+c\frac{\Delta T}{T}\right]$

$¿\pm[a\alpha+\beta b+\gamma c]\%$

41 **(d)**

Required error in density $¿3\%+3\times2\%=9\%$.

42 **(a)**

Result should have only two significant numbers (same as in 12 m).

43 **(d)**

1 CGS SI

$N_1U_1=N_2U_2$

$N_1[M_1L_1^{-3}]=N_2[M_2L_2^{-3}]$

$\therefore N_2=N_1\left[\frac{M_1}{M_2}\right]\times\left[\frac{L_1}{L_2}\right]^{-3}=0.625\left[\frac{1\,g}{1\,kg}\right]\times\left[\frac{1\,cm}{1\,m}\right]^{-3}$

$¿0.625\times10^{-3}\times10^6=625$

44 **(a)**

By principle of dimensional homogenity $\left[\frac{a}{V^2}\right]=[P]$

$\therefore[a]=[P][V^2]=[ML^{-1}T^{-2}]\times[L^6]=[ML^5T^{-2}]$

45 **(b)**

Physical quantity $u=\frac{B^2}{2\mu_0}$

Unit of $u = \frac{(N/Am)^2}{N/A^2} = \frac{N^2 A^2}{N A^2 m^2}$

¿ $\frac{N}{m^2} = \frac{Nm}{m^3} = \frac{J}{m^3}$

¿ energy per unit volume = energy density

46 **(a)**

$[?] = \frac{[S l^3]}{[4 y d^3 \delta]} = \frac{[MLT^{-2}][L^3][L^2]}{[MLT^{-2}][L^3][L]} = [L]$

47 **(c)**

$\frac{L}{RCV} = \left[\frac{L}{R}\right]\frac{1}{CV} = \frac{T}{Q} = [A^{-1}]$

48 **(b)**

Dimension of work and torque ¿ $[M L^2 T^{-2}]$

49 **(a)**

[surface tension]=$[M L^0 T^{-2}]$, [viscosity]= $[M L^{-1} T^{-1}]$.

Clearly, mass has the same power in the two physical quantities.

51 **(c)**

Impulse = change in momentum = $F \times t$

So the unit of momentum will be equal to *Newton-sec*

52 **(b)**

Time period $T = 2\pi\sqrt{\frac{l}{g}}$

Or $\frac{t}{n} = 2\pi\sqrt{\frac{l}{g}}$

$\therefore g = \frac{(4\pi^2)(n^2) l}{t^2}$

$\% \, error \in g = \frac{\Delta g}{g} \times 100 = \left(\frac{\Delta l}{l} + \frac{2\Delta t}{t}\right) \times 100$

$E_I = \left(\frac{0.1}{64} + \frac{2 \times 0.1}{128}\right) \times 100 = 0.3125\%$

$E_{II} = \left(\frac{0.1}{64} + \frac{2 \times 0.1}{64}\right) \times 100 = 0.46875\%$

$E_{III} = \left(\frac{0.1}{20} + \frac{2 \times 0.1}{36}\right) \times 100 = 1.055\%$

Hence, E_I is minimum.

53 **(d)**

$Watt = Joule/second = Ampere \times volt = Ampere^2 \times$

55 **(c)**

Electric dipole moment

$p = q(2l) = it(2l)$

The dimensions of electric dipole moment is

$[p] = [i][t][l]$

¿ $[I][T][L]$

¿ $[LTI]$

56 **(b)**

Planck's constant

$(h) = J - s = [M L^2 T^{-2}][T] = [M L^2 T^{-1}]$

Linear momentum $(p) = kg - ms^{-1}$

¿ $[M][L][T]^{-1} = [MLT^{-1}]$

57 **(c)**

$n_2 = n_1\left(\frac{M_1}{M_2}\right)^1\left(\frac{L_1}{L_2}\right)^1\left(\frac{T}{T_2}\right)^{-2}$

¿ $100\left(\frac{gm}{kg}\right)^1\left(\frac{cm}{m}\right)^1\left(\frac{sec}{min}\right)^{-2}$

¿ $100\left(\frac{gm}{10^3 gm}\right)^1\left(\frac{cm}{10^2 cm}\right)^1\left(\frac{sec}{60 \, sec}\right)^{-2}$

$n_2 = \frac{3600}{10^3} = 3.6$

58 **(a)**

$\frac{\Delta p}{p} = \frac{\Delta m}{m} + \frac{\Delta V}{V}$

¿ $\frac{0.05}{5} \times 100 + \frac{0.05}{1} \times 100$

¿ 6

$\frac{\Delta p}{p} = 6\%$

59 **(b)**

$v = \frac{1}{2l}\sqrt{\frac{T}{m}} \Rightarrow \frac{1}{v} = T = 2l\sqrt{\frac{m}{T}}$ has the dimensions of time.

60 **(d)**

Relative density

$¿ \frac{Density\ of\ substance}{Density\ of\ water} = [M^0 L^0 T^0]$

61 **(b)**

According to homogeneity principle

LHS=RHS

Or $F = 6\pi \eta^a r^b v^c$

Or $[MLT^{-2}] = [ML^{-1}T^{-1}]^a [L]^b [LT^{-1}]^c$

Or $[M^1 L^1 T^{-2}] = [M^0 L^{-a+b+c} T^{-a-c}]$

$\therefore a=1, -a+b+c=1$ and $-a-c=-2$

After solving, we get

$a=1, b=1, c=1$

62 **(b)**

Both $\frac{1}{2}LI^2$ and $\frac{1}{2}CV^2$ represent energy.

63 **(a)**

Torque ¿ force × distance $¿ [ML^2T^{-2}]$

64 **(a)**

Let$m = KF^a L^b T^c$

Substituting the dimension of

$[F] = [MLT^{-2}], [C] = [L]$ and $[T] = [T]$

And comparing both sides, we get $m = FL^{-1}T^2$

65 **(c)**

Dimensional formula of

$ohm = [ML^2T^{-3}A^{-2}]$

and that of $\frac{h}{e^2} = \frac{[ML^2T^{-1}]}{A^2T^2} = [ML^2T^{-3}A^{-2}]$

66 **(a)**

$F = \frac{\mu_0}{4\pi} \frac{2I_1I_2I}{r} \Rightarrow \mu_0 = [F][A]^{-2} = [MLT^{-2}A^2]$

67 **(a)**

$T = \frac{32 \times 10^{-5}}{(10)^{-2}}$

$¿ 32 \times 10^{-3}\, N m^{-1} = 0.032\, N m^{-1}$.

68 **(b)**

Subtract 3.87 from 4.23 and then divide by 2.

69 **(a)**

$\frac{L}{R}$ is a time constant of L-Rcircuit so $Henry/ohm$ can be expressed as *second*

70 **(a)**

Heat $Q = \frac{KA(\theta_1 - \theta_2)t}{d}$ or $K = \frac{Qd}{A(\theta_1 - \theta_2)t}$

$[k] = \frac{[ML^2T^{-2}][L]}{[L]^2[K][T]} = [MLK^{-1}T^{-3}]$

72 **(b)**

$H = I^2Rt$

$\therefore \frac{\Delta H}{H} \times 100 = \left(\frac{2\Delta I}{I} + \frac{\Delta R}{R} + \frac{\Delta t}{t}\right) \times 100$

$¿ (2 \times 3 + 4 + 6)\% = 16\%$

73 **(d)**

[capacitance X]=$[M^{-1}L^{-2}T^2Q^2]$

[Magnetic induction Z] = $[MT^{-1}Q^{-1}]$

$[Z^2] = [M^2T^{-2}Q^{-2}]$

Given, $X = 3YZ^2$ or $Y = \frac{X}{3Z^2}$ or $[Y] = \frac{[X]}{[Z]^2}$

$\therefore [Y] = \frac{[M^{-1}L^{-2}T^2Q^2]}{[M^2T^{-2}Q^{-2}]} = [M^{-3}L^{-2}T^4Q^4]$

74 **(a)**

Because in S.I. system there are seven fundamental quantities

75 **(b)**

$mv = kg ¿$

76 **(c)**

Resistance, $R = \frac{V}{i} = \frac{W}{qi}$

$¿ \frac{[ML^2T^{-2}]}{[A^2T]}$

$R = [ML^2T^{-3}A^{-2}]$

$\left[\frac{h}{e^2}\right] = \frac{[ML^2T^{-1}]}{[AT]^2}$

$¿ [ML^2T^{-3}A^{-2}]$

78 **(a)**

In given equation, $\frac{az}{k\theta}$ should be dimensionless

$\alpha = \frac{k\theta}{z}$

$$\Rightarrow [\alpha] = \frac{[ML^2T^{-2}K^{-1} \times K]}{[L]} = [MLT^{-2}]$$

And $p = \frac{\alpha}{\beta}$

$$\Rightarrow [\beta] = \left[\frac{\alpha}{p}\right] = \frac{[MLT^{-2}]}{[ML^{-1}T^{-2}]} = [M^0L^2T^0]$$

79 **(b)**

$$F = \frac{Gm_1m_2}{d^2} \Rightarrow G = \frac{Fd^2}{m_1m_2}$$

$$\therefore [G] = \frac{[MLT^{-2}][L^2]}{[M^2]} = [M¿¿-1L^3T^{-2}]¿$$

80 **(c)**

Do not think in terms of I and ω. Remember; kinetic energy is fundamentally 'work'

$W =$ ¿Force × distance

¿$[MLT^{-2}] \times [L]$

¿$[ML^2T^{-2}]$

81 **(b)**

Least count of screw gauge ¿ $\frac{1}{100} mm = 0.01\,mm$

Diameter ¿ Divisions on circular scale × least count +¿

¿$52 \times \frac{1}{100} + 0 = 0.52\,mm$

Diameter ¿$0.052\,cm$

82 **(d)**

Capacitances $C = \frac{Q}{V} = \frac{QQ}{W} = \frac{Q^2}{W} = \frac{I^2t^2}{W}$,

$$[C] = \frac{[I^2T^2]}{[ML^2T^{-2}]} = [M^{-1}L^{-2}T^4I^2]$$

83 **(d)**

$$E = \frac{-dV}{dx}$$

84 **(b)**

$$[B] = \frac{[F]}{[I][L]} = \frac{[MLT^{-2}]}{[CT^{-1}][L]} = [MT^{-1}C^{-1}]$$

85 **(a)**

Conductivity $\left(\frac{1}{\rho}\right) = \frac{1}{aR} = \frac{[L]}{[L^2][ML^2T^{-3}A^{-2}]}$

¿$[M^{-1}L^{-3}T^3A^2]$

86 **(d)**

Dimensional formula of angular momentum $(L) = [ML^2T^{-1}]$

Torque $(\tau) = [ML^2T^{-2}]$

Coefficient of thermal conductivity

$(K) = [MLT^{-3}K^{-1}]$

Gravitational constant $(G) = [M^{-1}L^3T^{-2}]$

Thus, gravitational constant has negative dimension of mass.

87 **(b)**

Impulse =Force × $Time = [MLT^{-2}][T] = [MLT^{-1}]$

88 **(c)**

Momentum $[MLT^{-1}]$, Plank's constant $[ML^2T^{-1}]$

90 **(b)**

Surface tension, $T = \frac{F}{l}$

$$\therefore [T] = \frac{[F]}{[l]}$$

¿$\frac{[MLT^{-2}]}{[L]} = [ML^0T^{-2}] = [MT^{-2}]$

91 **(a)**

Each of three terms in the given equation has the dimensional formula of force.

92 **(c)**

The right hand side of the given relation is basically $\frac{k}{metre}$. But, since the left hand side is joule, therefore k should be J m.

93 **(a)**

Force, $F = kv$, $[k] = \frac{[F]}{[v]} = \frac{[MlT^{-2}]}{[LT^{-1}]} = [MT^{-1}]$.

So, unit is $kg\,s^{-1}$

94 **(c)**

The magnitude of induced emf is

$|\varepsilon| = L\frac{dI}{dt}$ ¿ $L = \frac{|\varepsilon|\,dt}{dI}$

$$L = \frac{volt \times second}{ampere} = ohm\,second$$

95 **(a)**

Here, $[f]=\frac{[S]}{[t^3]}=[M^0 L T^{-3}]$.

96 **(c)**

$$Angular\ acceleration=\frac{Angular\ velocity}{Time}=\frac{rad}{sec^2}$$

97 **(d)**

$[C]=[M^{-1}L^{-2}T^4A^2],[R]=[ML^2T^{-3}A^{-2}]$

$[L]=[ML^2T^{-2}A^{-2}]\wedge[I]=[M^0L^0T^0A]$

1. $[CR]=[M^{-1}L^{-2}T^4A^2][ML^2T^{-3}A^{-2}]$

   ¿$[M^0L^0TA^0]$

2. $\frac{[L]}{[R]}=\frac{[ML^2T^{-2}A^{-2}]}{[ML^2T^{-3}A^{-2}]}=[M^0L^0TA^0]$

3. $(\sqrt{LC})=([ML^2T^{-2}A^{-2}]\times[M^{-1}L^{-2}A^2])^{1/2}$

   ¿$[M^0L^0TA^0]$

4. $[LI^2]=[ML^2T^{-2}A^{-2}][M^0L^0T^0A^1]^2$

   ¿$[ML^2T^{-2}A^0]$

98 **(d)**

We know $[F]=[MLT^{-2}]$

$T^2=\frac{ML}{F}=\frac{1\,kg\times 1\,m}{1\,kg-wt}=\frac{1kg\times 1\,m}{9.8\,N}$

$T=\frac{1}{\sqrt{9.8}}$ sec

99 **(a)**

According to problem muscle $\times speed=power$

$\therefore muscle=\frac{power}{speed}=\frac{ML^2T^{-3}}{LT^{-1}}=MLT^{-2}$

100 **(c)**

$PV=nRT\Rightarrow R=\frac{PV}{nT}=\frac{joule}{mole\times kelvin}=J\,K^{-1}mol^{-}$

102 **(a)**

The formula for fine structure constant is

¿$\frac{e^2}{4\pi\varepsilon_0\left(\frac{h}{2\pi}\right)c}$

104 **(d)**

$[\eta]=[ML^{-1}T^{-2}]$or $[T]=\left[\frac{M}{L\eta}\right]^{1/2}$

Time period ¿$2\pi\sqrt{\frac{M}{L\eta}}$

105 **(c)**

When quantities are subtracted, their maximum absolute errors are added up.

106 **(b)**

Frequency $f=c\,m^x k^y, k=Force/Length$

$[M^0L^0T^{-1}]=[M]^x[ML^0T^{-2}]^y$

¿$[M]^{x+y}[L]^0[T]^{-2y}$

Comparing the powers on M, L and T

$-2y=-1$

$\Rightarrow y=\frac{1}{2}$

And $x+y=0$

$\therefore x=-y=\frac{-1}{2}$

107 **(d)**

Let $L=[h^a c^b G^c]$

$\therefore[L']=[ML^2T^{-1}]^a[LT^{-1}]^b[M^{-1}L^3T^{-2}]^c$

$\Rightarrow a=\frac{1}{2},b=\frac{-3}{2},c=\frac{1}{2}$

Hence, $L=[h^{1/2}c^{-3/2}G^{1/2}]$

109 **(d)**

Strain is dimensionless

111 **(d)**

$NS\,m^{-2}=N\,m^{-2}\times S=$¿ Pascal-second

112 **(a)**

$E=\frac{1}{2}Li^2 hence\ L=[ML^2T^{-2}A^{-2}]$

113 **(c)**

Given, $\left(p+\frac{a}{V^2}\right)(V-b)=RT$

According to principle of homogeneity

Dimension of $\frac{a}{V^2} = ¿$ dimension of p

Dimension of $a = ¿$ dimension of $p \times$ dimension of V^2

$¿[M L^{-1} T^{-2}][L^3]^2 = [M L^5 T^{-2}]$

114 **(a)**

$Energy(E) = F \times d \Rightarrow F = \frac{E}{d}$

So $Erg/metre$ can be the unit of force

115 **(d)**

Kinetic energy, $E = \frac{1}{2} m v^2$

$\therefore \frac{\Delta E}{E} \times 100 = \frac{v'^2 - v^2}{v^2} \times 100$

$¿[(1.5)^2 - 1] \times 100$

$¿125\%$

116 **(b)**

From the principle of homogenity $\left(\frac{x}{v}\right)$ has dimensions of T

117 **(c)**

Spring constant $¿\frac{F}{l} = [M L^0 T^{-2}]$.

Surface energy $¿\frac{Energy}{Area} = [M L^0 T^{-2}]$

118 **(c)**

CR is known as time constant $CR = [T]$

119 **(a)**

Power = $\frac{Work\ done}{Time} = ¿$

120 **(a)**

$n_1 u_1 = n_2 u_2$

$n_2 = \frac{n_1 u_1}{u_2}$

$¿\frac{1450 mile/h}{m/s} = \frac{1450\ s/mile}{mh}$

$¿\frac{1450 s \times 1.6\ km}{10^{-3} km\, 60 \times 60\, s} = 644.4$

1450 mile/h=644.4m/s

121 **(a)**

$1\ Faraday = 96500\ coulomb$

122 **(c)**

Shear modulus

$¿\frac{Shearing\ stress}{Shearing\ strain} = \frac{F}{A\theta} = [M L^{-1} T^{-2}]$

123 **(b)**

From the principle of dimensional homogeneity

$[a] = \left[\frac{F}{t}\right] = [MLT^{-3}]$ and $[b] = \left[\frac{F}{t^2}\right] = [MLT^{-4}]$

124 **(d)**

Volume elasticity = $\frac{Force/Area}{Volume\ strain}$

Strain is dimensionless, so

$¿\frac{Force}{Area} = \frac{MLT^{-2}}{L^2} = [M L^{-1} T^{-2}]$

125 **(b)**

$[\varepsilon_0] = \frac{[A^2 T^2]}{[M L^3 T^{-2}]} = [M^{-1} L^{-3} T^4 A^2]$

126 **(c)**

Least count of screw gauge $¿\frac{0.5}{50}$

$¿0.01\ mm = \Delta r$

Diameter $r = 2.5\ mm + 20 \times \frac{0.5}{50} = 2.70\ mm$

$\frac{\Delta r}{r} = \frac{0.01}{2.70}$

Or $\frac{\Delta r}{r} \times 100 = \frac{1}{2.7}$

Now density $d = \frac{m}{V} = \frac{m}{\frac{4}{3}\pi\left(\frac{r}{2}\right)^3}$

Here, r is the diameter.

$\therefore \frac{\Delta d}{d} \times 100 = \left\{\frac{\Delta m}{m} + 3\left(\frac{\Delta r}{r}\right)\right\} \times 100$

$¿\frac{\Delta m}{m} \times 100 + 3 \times \left(\frac{\Delta r}{r}\right) \times 100$

$¿2\% + 3 \times \frac{1}{2.7}$

¿3.11%

127 **(a)**

By submitting the dimensions of each quantity we get

$T = [M L^{-1} T^{-2}]^a [L^{-3} M]^b [M T^{-2}]^c$

128 **(c)**

$[C]=[M^{-1}L^{-2}T^{4}A^{2}]$

$[V]=[ML^{2}T^{-3}A^{-1}]$

$\therefore [CV^{2}]=[M^{-1}L^{-2}T^{4}A^{2}][ML^{2}T^{-3}A^{-1}]^{2}$

¿$[ML^{2}T^{-2}]$

129 **(c)**

Moment of inertia $I=mr^{2}$

$\therefore [I]=[ML^{2}]$

And $\tau = moment\ of\ force = r\times F$

$\therefore [\tau]=[L][MLT^{-2}]=[ML^{2}T^{-2}]$

130 **(c)**

By Newton's formula

$\eta=\frac{F}{A(\Delta v_x/\Delta z)}$

$\therefore$ *Dimensions of* η

¿$\frac{dimensions\ of\ force}{dimensions\ of\ area \times dimensions\ of\ velocity\ gradient}$

¿$\frac{[MLT^{-2}]}{[L^{2}][T^{-1}]}=[ML^{-1}T^{-1}]$

131 **(a)**

Energy $U=\frac{1}{2}LI^{2}$

$\Rightarrow L=\frac{2U}{I^{2}}$

$\therefore [L]=\frac{[U]}{[I]^{2}}=\frac{[ML^{2}T^{-2}]}{[A]^{2}}=[ML^{2}T^{-2}A^{-2}]$

132 **(a)**

$n_1u_1=n_2u_2$

$n_2=\frac{1\,shake}{1\,ns}$

¿$\frac{10^{-8}s}{10^{-9}s}$

$\therefore n_2=10$

133 **(c)**

$R_{¿}=\frac{R_1R_2}{(R_1+R_2)}$

$\Rightarrow \frac{\Delta R_p}{R_p}=\frac{\Delta R_1}{R_1}+\frac{\Delta R_2}{R_2}+\frac{\Delta(R_1+R_2)}{R_1+R_2}$

$\Rightarrow \frac{\Delta R_p}{R_p}=\frac{0.3}{6}+\frac{0.2}{10}+\frac{(0.3+0.2)}{10+6}$

¿$0.05+0.02+0.03125=0.10125$

$\therefore \frac{\Delta R_p}{R_p}\times 100=10.125$ or 10.125%

134 **(d)**

Joule-sec is the unit of angular momentum where as other units are of energy

135 **(a)**

Least count of both instrument

$\Delta d=\Delta l=\frac{0.5}{100}mm=5\times10^{-3}mm$

$Y=\frac{4MLg}{\pi l d^{2}}$

$\left(\frac{\Delta Y}{Y}\right)_{max}=\frac{\Delta l}{l}+2\frac{\Delta d}{d}$

Error due to l measurement

$\frac{\Delta l}{l}=\frac{0.5/100\,mm}{0.25\,mm}=2\%$

Error due to d measurement $2\frac{\Delta d}{d}=\frac{2\times\frac{0.5}{100}}{0.5\,mm}$

¿$\frac{0.5/100}{0.25}=2\%$

Hence due to the errors in the measurements of d and l are the same

137 **(a)**

1 Newton = 10^{5} dyne and 1m=100 cm

138 **(d)**

From the expression ¿$\frac{Power}{Area}\left(\because \frac{Energy}{time}=power\right)$

$\frac{W}{m^{2}}=Wm^{-2}$

$\frac{F}{l}=\frac{\mu_0 I_1 I_2}{2\pi r}$

Or $[\mu_0]=\frac{[F]}{[I_1I_2]}=\frac{[MLT^{-2}]}{[A^{2}]}=[MLT^{-2}A^{-2}]$.

139 **(a)**

Time $\propto c^x G^y h^z \Rightarrow T = kc^x G^y h^z$

Putting the dimensions in the above relation

$\Rightarrow [M^0 L^0 T^1] = [LT^{-1}]^x [M^{-1} L^3 T^{-2}]^y [ML^2 T^{-1}]^z$

$\Rightarrow [M$¿¿$0 L^0 T^{-1}] = [M^{-y+z} L^{x+3y+2z} T^{-x-2y-z}]$¿

Comparing the powers of M, L and T

$-y+z=0$ ...(i)

$x+3y+2z=0$ ...(ii)

$-x-2y-z=1$ ...(iii)

On solving equations (i) and (ii) and (iii)

$x = \frac{-5}{2}, y = z = \frac{1}{2}$

Hence dimension of time are ¿]

140 **(b)**

$1\ yard = 36\ inch = 36 \times 2.54\ cm = 0.9144\ m$

141 **(a)**

Time $T = 2\pi\sqrt{LC}$.

142 **(c)**

The result should have two decimal places (same as 0.99)ie, 0. 010$\times 10^{-1}$

143 **(c)**

According to the definition

144 **(d)**

Watt is a unit of power

145 **(a)**

Calorie is the unit of heat $i.e.$, energy

So dimensions of energy = ML^2T^{-2}

146 **(d)**

$n_2 = n_1 \left[\frac{L_1}{L_2}\right]^1 \left[\frac{T_1}{T_2}\right]^{-2} = 10\left[\frac{m}{km}\right]^1 \left[\frac{sec}{hr}\right]^{-2}$

$n_2 = 10\left[\frac{m}{10^3 m}\right]^1 \left[\frac{sec}{3600\ sec}\right]^{-2} = 129600$

147 **(a)**

The number of significant figures in 23.023 = 5.

The number of significant figures in 0.0003 = 1

(Zeros after decimal and before a non-zero number are not significant.)

The number of significant figures in $2.1 \times 10^{-3} = 2$ (zero in powers of are not counted)

(All the zeros between two non-zero numbers are significant).

148 **(b)**

Here, $[M^0 L^0 T^0] = [ML^{-1}T^{-2}]^a [MT^{-3}]^b [LT^{-1}]^c$

Or $[M^0 L^0 T^0] =$¿¿]

Comparing powers of M, L and T, we get

$a+b=0, -a+c=0, -2a-3b=0$

Solving $a=1, b=-1, c=1$

149 **(d)**

The given equation is

$n = \frac{A+B}{\lambda^2}$

Where $A \wedge B$ are constants.

By homogeneity principle the dimensions of all the terms on both sides should be same

$ie, [B] = [A] = [n\lambda^2]$

$\therefore [B] = [M^0 L^0 T^0][L^2]$

¿$[M^0 L^2 T^0]$

151 **(b)**

According to the definition

152 **(d)**

Acceleration = $\frac{Distance}{time^2} \Rightarrow A = LT^{-2} \Rightarrow L = AT^2$

153 **(c)**

$n \times 40\ amu = 6.64 \times 10^{24}$

$n \times 40 \times 1.6 \times 10^{-27} = 6.64 \times 10^{24}$

$n = 10^{50}$

154 **(a)**

$\frac{Heat}{Mass} = \frac{[ML^2T^{-2}]}{[M]} = [M^0 L^2 T^{-2}]$

155 **(d)**

Velocity $v = Bt^2$

$\therefore B = \frac{v}{t^2} = \frac{[LT^{-1}]}{[T^2]} = [LT^{-3}]$

156 **(c)**

We know, $f = \frac{1}{2\pi\sqrt{LC}}$

Or $\sqrt{LC} = \frac{1}{2\pi f} = time$

Thus, $\sqrt{LC}$ has the dimension of time.

157 **(c)**

Unit of energy will be $kg - m^2/sec^2$

158 **(d)**

Coefficient of viscosity ¿ $\frac{F\times r}{A\times v}=\frac{[MLT^{-2}]\times[L]}{[L^2]\times[LT^{-1}]}$

¿ $[ML^{-1}T^{-1}]$

159 **(d)**

$[M^0L^0T^{-1}]=[M^x][M^yT^{2y}]=[M^{x+y}T^{-2y}]$

Equating powers of M and T.

$x+y=0, -2y=-1$

Or $y=\frac{1}{2}, x+\frac{1}{2}=0$ or $x=\frac{-1}{2}$

160 **(a)**

$[E]=[ML^2T^{-2}], [m]=[M], [l]=[ML^2T^{-1}]$ and $[G]=[M^{-1}L^3T^{-2}]$ Substituting the dimensions of above quantities in the given formula:

$\frac{El^2}{m^5G^2}\frac{[ML^2T^{-2}][ML^2T^{-1}]^2}{[M^5][M^{-1}L^3T^{-2}]^2}=\frac{M^3L^6T^{-4}}{M^3L^6T^{-4}}=[M^0L^0$

161 **(a)**

Let $T\propto S^x r^y p^z$

By substituting the dimensions of $[T]=[T]$

$[S]=[MT^{-2}], [r]=[L], [\rho]=[ML^{-3}]$

and by comparing the power of both the sides

$x=-1/2, y=3/2, z=1/2$

so $T\propto\sqrt{\rho r^3/S}\Rightarrow T=k\sqrt{\frac{\rho r^3}{S}}$

162 **(c)**

Energy

$E=\frac{1}{2}LI^2\Rightarrow[L]=\frac{[E]}{[I]^2}=\frac{[ML^2T^{-2}]}{[A^2]}=[ML^2T^{-2}A^{-}$

163 **(a)**

Quantities having different dimensions can only be divided or multiplied but they cannot be added or subtracted

164 **(d)**

Size of universe is about $10^{26}m=10^6\times(9.46\times10^{15})$ m

¿ 10^{10}ly

165 **(a)**

$\frac{1}{\sqrt{\varepsilon_0\mu_0}}=C=$¿velocity of light

166 **(d)**

When two quantities are multiplied, their maximum relative errors are added up.

167 **(c)**

Torque = $[ML^2T^{-2}]$, Angular momentum = $[ML^2T^{-1}]$

So mass and length have the same dimensions

168 **(a)**

$Least\ count=\frac{Value\ of\ main\ scale\ division}{No.\ of\ divisions\ on\ vernier\ scale}$

¿ $\frac{1}{30}MSD=\frac{1}{30}\times\frac{1°}{2}=\frac{1°}{60}=1\,min$

170 **(a)**

$\frac{1}{2}Li^2=$¿ Stored energy in an inductor¿ $[ML^2T^{-2}]$

171 **(d)**

$\frac{1}{2}CV^2$ = Stored energy in a capacitor = $[ML^2T^{-2}]$

172 **(a)**

Bxt is unitless. ∴ Unit of B is $m^{-1}s^{-1}$

173 **(d)**

$[\varepsilon_0 L]=[C] \therefore X=\frac{\varepsilon_0 LV}{t}=\frac{C\times V}{t}=\frac{Q}{t}=current$

175 **(d)**

Resistance, $R=\frac{Potential\ difference}{Current}=\frac{V}{i}=\frac{W}{q^i}$

$(\because Potential\ difference\ is\ equal$ ¿ $work\ doen\ per\ uni$

So, dimensions of R

¿ $\frac{[Dimensions\ of\ work]}{[Dimensions\ of\ charge][Dimensions\ of\ current]}$

¿ $\frac{[ML^2T^{-2}]}{[IT][I]}=[ML^2T^{-3}I^{-2}]$

176 **(d)**

$n_2=n_1\left[\frac{m_1}{m_2}\right]\left[\frac{L_1}{L_2}\right]^{-3}$

¿ $4\left[\frac{1\,gm}{100\,gm}\right]\left[\frac{cm}{10\,cm}\right]^{-3}=4\times\frac{1}{100}\times10^3$

¿ 40 units

178 **(d)**

$1\,newton=10^{-5}\,dyne$

180 (c)

$$[X]=\left[\frac{M^{-1}L^3T^{-2}\times ML^2T^{-1}}{L^3T^{-3}}\right]^{-1/2}=[L]$$

181 (a)

Farad is the unit of capacitance and

$$C=\frac{Q}{V}=\left[\frac{Q}{[ML^2T^{-2}Q^{-1}]}\right]=M^{-1}L^{-2}T^2Q^2$$

182 (d)

$[n]=$¿ Number of particles crossing a unit area in unit time=$[L^{-2}T^{-1}]$

$[n_2]=[n_1]=$¿number of particles per unit volume = $[L^{-3}]$

$[x_2]=[x_1]$ = positions

$$\therefore D=\frac{[n][x_2-x_1]}{[n_2-n_1]}=\frac{[L^{-2}T^{-1}]\times[L]}{[L^{-3}]}=[L^2T^{-1}]$$

184 (b)

One femtometre is equivalent to $10^{-15}m$

$ie, 1\,fm=10^{-15}m$

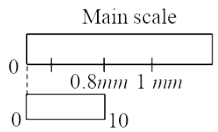
185 (a)

Astronomical unit of distance

187 (d)

$20\,VSD=16\,MSD$

$1\,VSD=0.8\,MSD$



Least count ¿ $MSD-VSD$

¿ $1\,mm-0.8\,mm=0.2\,mm$

188 (b)

We have to retain three significant figures in the result.

189 (b)

Young's modulus $Y=\frac{FL}{Al}=\frac{4FL}{\pi d^2 l}$

¿ $\frac{(4)(1.0\times9.8)(2)}{\pi(0.4\times10^{-3})^2(0.8\times10^{-3})}$

¿ $2.0\times10^{11}\,Nm^{-2}$

Further, $\frac{\Delta Y}{Y}=2\left(\frac{\Delta d}{d}\right)+\left(\frac{\Delta l}{l}\right)$

$$\therefore \Delta Y=\left\{2\left(\frac{\Delta d}{d}\right)+\left(\frac{\Delta l}{l}\right)\right\}Y$$

¿ $\left\{2\times\frac{0.01}{0.4}+\frac{0.05}{0.8}\right\}\times2.0\times10^{11}$

¿ $0.2\times10^{11}\,Nm^{-2}$

Or $(Y+\Delta Y)=(2+0.2)\times10^{11}\,Nm^{-2}$

190 (b)

Let $[G]\propto c^x g^y p^z$

By substituting the following dimensions:

$[G]=[M^{-1}L^3T^{-2}],[c]=[$¿$^{-1}],[g]=[$¿$^{-2}]$

$[p]=[ML^{-1}T^{-2}]$

and by comparing the powers of both sides we can get $x=0, y=2, z=-1$

$\therefore [G]\propto c^0g^2p^{-1}$

191 (d)

Density

$$\rho=\frac{m}{\pi r^2 L}$$

$$\therefore \frac{\Delta\rho}{\rho}\times100=\left(\frac{\Delta m}{m}+2\frac{\Delta r}{r}+\frac{\Delta L}{L}\right)\times100$$

After substituting the values we get the maximum percentage error in density =4%

192 (d)

Dipole momen $=(charge)\times(distance)$

Electric flux $=(electric\,field)\times(area)$

193 (d)

Percentage error in

$x=1\%+2\times3\%+3\times2\%=13\%.$

The sign± has been used because the words `maximum percentage error' have not been used.

Note percentage error is $\pm\frac{\Delta A}{A}\times100$

Maximum percentage error is $\frac{\Delta A}{A}\times100$

194 (c)

Magnetic field $B=\frac{F}{qv\sin\theta}$

Hence, $1\,T=\frac{1\,N}{1\,C\times 1\,ms^{-1}}$

¿ $\frac{1\,N}{1\,As\times 1\,ms^{-1}}\left(\because 1\,C=1\,ampere\times 1\,second\right)$

¿ $1\,NA^{-1}m^{-1}$

195 **(a)**

$V=(8+0.5)$

$I=(2+0.2)$

$R=\frac{8}{2}=4$

$\frac{\Delta R}{R}\%=\left(\frac{\Delta V}{V}+\frac{\Delta I}{I}\right)$

¿ $\left(\frac{0.5}{8}+\frac{0.2}{2}\right)\times 100=16.25\%$

$\therefore R=(4\pm 16.25\%)$

197 **(b)**

Time constant ¿ $\frac{L}{R}$

$\therefore\left[\frac{L}{R}\right]=[T]$

$\therefore\left[\frac{R}{L}\right]=[T^{-1}]$

198 **(b)**

$F=-\eta A\frac{\Delta v}{\Delta z}\Rightarrow[\eta]=[ML^{-1}T^{-1}]$

As $F=[MLT^{-2}], A=[L^2], \frac{\Delta v}{\Delta z}=[T^{-1}]$

$\therefore$ Dimensions of

$\eta=\frac{F}{A}\frac{\Delta z}{\Delta v}=\frac{MLT^{-2}}{L^2}.\frac{1}{T^{-1}}=[ML^{-1}T^{-1}]$

199 **(d)**

Surface Tension = $\frac{Force}{Length}$

¿ $\frac{[MLT^{-2}]}{[L]}=[ML^0T^{-2}]$

Spring constant = $\frac{Force}{Length}$

¿ $\frac{[MLT^{-2}]}{[L]}=[ML^0T^{-2}]$

200 **(a)**

1 C.G.S. unit of density = 1000 M.K.S. unit of density

$\Rightarrow 0.5\,gm/cc=500\,kg/m^3$

201 **(c)**

From $h=ut+\frac{1}{2}gt^2$

$h=0+\frac{1}{2}\times 9.8\times(2)^2=19.6\,m$

$\frac{\Delta h}{h}=\pm 2\frac{\Delta t}{t}[\because a=g=constant]$

¿ $\pm 2\left(\frac{0.1}{2}\right)=\pm\frac{1}{10}$

$\therefore \Delta h=\pm\frac{h}{10}=\pm\frac{19.6}{10}=\pm 1.96\,m$

202 **(a)**

Given, $W=\frac{1}{2}kx^2$

Writing the dimensions on both sides

$[ML^2T^{-2}]=k[M^0L^2T^0]$

$\therefore$ Dimensions of $k=[MT^{-2}]=[ML^0T^{-2}]$

203 **(a)**

Given, $m=3.513\,kg$ and $v=5.00\,ms^{-1}$

So, momentum, $p=mv=17.565$

As the number of significant digits in m is 4 and v is 3, so, p must have 3 significant digits

$p=17.6\,kgms^{-1}$

204 **(d)**

$Modulas\ of\ rigidity=\frac{Shear\ stress}{Shear\ strain}=[ML^{-1}T^{-2}]$

205 **(c)**

The unit of physical quantity obtained by the line intergral of electric field is JC^{-1}.

206 **(b)**

$F=\frac{Gm_1m_2}{d^2}$

$\Rightarrow G=\frac{Fd^2}{m_1m_2}$

$$[G]=\frac{[MLT^{-2}][L^2]}{[M^2]}=[M^{-1}L^3T^2]$$

Moment of inertia $I=mK^2=[ML^2]$

207 **(c)**

$$Stress=\frac{Force}{Area}=\frac{N}{m^2}$$

208 **(a)**

$n_1 u_1 = n_2 u_2$

$n_2 = \frac{n_1 u_1}{u_2}$

¿ $\frac{170.474\, L}{M^3}$

¿ $\frac{170.474 \times 10^{-3} M^3}{M^3}$

¿ 0.170474

209 **(c)**

Intensity $(I) = \frac{Energy}{Area \times time}$

210 **(d)**

By the principle of dimensions homogeneity

$F = a t^{-1}$

$[MLT^{-2}] = a[T^{-1}]$

$a = [MLT^{-1}]$

Similarly for $b = [MLT^{-4}]$

211 **(a)**

Let radius of gyration $[k] \propto [h]^x [c]^y [G]^z$

By substituting the dimension of $[k] = [L]$

$[h] = [M L^2 T^{-1}]$

$[c] = [L T^{-1}]$

$[G] = [M^{-1} L^3 T^{-2}]$

And by comparing the power of both sides

We can get $x = 1/2, y = -3/2, z = 1/2$

Therefore dimension of radius of gyration is

$[h]^{1/2} [c]^{-3/2} [G]^{1/2}$

212 **(a)**

Here,

Mass of a body, $M = 5.00 \pm 0.05\, kg$

Volume of a body, $V = 1.00 \pm 0.05\, m^3$

Density, $\rho = \frac{M}{V}$

Relative error in density is

$\frac{\Delta \rho}{\rho} = \frac{\Delta M}{M} + \frac{\Delta V}{V}$

Percentage error in density is

$\frac{\Delta \rho}{\rho} \times 100 = \frac{\Delta M}{M} \times 100 + \frac{\Delta V}{V} \times 100$

¿ $\left(\frac{0.05}{5} \times 100\right) + \left(\frac{0.05}{1} \times 100\right) = 1\% + 5\% = 6\%$

213 **(c)**

Stefan's law is $E = \sigma (T^4) \Rightarrow \sigma - \frac{E}{T^4}$

$where, E = \frac{Energy}{Area \times Time} = \frac{Watt}{m^2}$

$\sigma = \frac{Watt - m^{-2}}{K^4} = Watt - m^{-2} K^{-4}$

214 **(a)**

$y = a \sin(\omega t + kx)$.

Here, ωt should be dimensionless

$\therefore [\omega] = \left[\frac{1}{t}\right]$

$[\omega] = [M^0 L^0 T^{-1}]$

215 **(c)**

Percentage error in $T = \frac{0.01}{1.26} \times 100 + \frac{0.01}{9.80} \times 100$

$+ \frac{0.01}{1.45} \times 100$

¿ $0.8 + 0.1 + 0.7 = 1.6$

216 **(a)**

$\frac{R}{L} = \frac{V/I}{V \times T/I} = \frac{1}{T} = Frequency$

218 **(b)**

$Pressure = \frac{Force}{Area} = \frac{Energy}{Volume} = M L^{-1} T^{-2}$

219 **(b)**

The dimension of frequency $(f) = [T^{-1}]$

The dimension of $\left(\frac{R}{L}\right) = \frac{[ML^2 T^{-3} A^{-2}]}{[M L^2 T^2 A^{-2}]}$

¿ $\left[\frac{1}{T}\right]$

¿ $[T^{-1}]$

220 **(a)**

Area of rectangle

$A = lb$

¿ 10.5×2.1

$¿ 22.05\, cm^2$

Minimum possible measurement of scale =0.1 cm

So, area measured by scale = $22.0\, cm^2$

221 **(d)**

Given equation , $y=a\sin(bt-cx)$

Comparing the given equation with general wave equation

$y=a\sin\left(\frac{2\pi t}{T}-\frac{2\pi x}{\lambda}\right)$,

We get $b=\frac{2\pi}{T}, c=\frac{2\pi}{\lambda}$

Dimension of $\frac{b}{c}$

$¿ \frac{2\pi/T}{2\pi/\lambda}=[LT^{-1}]$, and other three quantity is dimensionless

223 **(b)**

Units of a and PV^2 are same and equal to $dyne\times cm^4$

224 **(d)**

$f=\frac{1}{2\pi\sqrt{LC}}$

$\therefore ¿$ does not represent the dimensions of frequency

225 **(c)**

$P_1=[ML^2T^{-1}]$

$D_2=[(2M)(2L)^2(2T)^{-1}]$

$P_2=4[ML^2T^{-1}]=4P_1$

226 **(a)**

Time period of a simple pendulum

$T=2\pi\sqrt{\frac{L}{8}}$

$¿ g=\frac{4\pi^2 L}{T^2}\ldots.(i)$

Differentiating Eq. (i), we have

$\frac{\Delta g}{g}=\frac{\Delta L}{L}+\frac{2\Delta T}{T}\ldots\ldots\ldots(ii)$

Given, L=100 cm, T=2s,

$\Delta T=\frac{0.1}{100}=0.001\, s$,

$\Delta L=1\, mm=0.1\, cm$

Substituting the in Eq. (ii), we have

$\therefore \left|\frac{\Delta g}{g}\right|_{max}=\frac{\Delta L}{L}+\frac{2\Delta T}{T}$

$¿ \frac{0.1}{100}+2\times\frac{0.001}{2}$

Thus, maximum percentage eror

$\left|\frac{\Delta g}{g}\right|_{max}\times 100=\left(\frac{0.1}{100}\times 100\right)+\left(\frac{2\times 0.001}{2}\times 100\right)$

$¿ 0.1\%+0.1\%=0.2\%$

227 **(d)**

Because temperature is a fundamental quantity

228 **(a)**

By submitting dimension of each quantity in R.H.S. of option (a) we get

$¿$

This option gives the dimension of velocity

229 **(b)**

Percentage error in mass $¿ \frac{0.01}{23.42}\times 100=0.04$

Percentage error in volume $¿ \frac{0.1}{4.9}\times 100=2.04$

Adding up the percentage errors, we get nearly 2%.

230 **(d)**

Percentage error in A

$¿\left(2\times 1+3\times 3+1\times 2+\frac{1}{2}\times 2\right)\%=14\%$

231 **(d)**

According to Wien's law the product of wavelength corresponding to maximum intensity of radiation and temperature of body (in Kelvin) is constant $ie, \lambda_m T=b=constant$, where b is Wien's constant and has value $2.89\times 10^{-3} m-K$.

232 **(a)**

$Y=\frac{Stress}{Strain}=\frac{Force/Area}{Dimensionless}\Rightarrow Y\equiv Pressure$

233 **(c)**

Coefficient o friction ¿ $\frac{Applied\ force}{Normal\ reaction\ ¿}$
¿

¿ $\frac{[MLT^{-2}]}{[MLT^{-2}]}$ = ¿no dimensions

Unit¿ $\frac{N}{N}$ = ¿no unit

234 **(c)**

$[kx]$ = ¿ Dimension of ωt = ¿(dimensionless)

Hence $K=\frac{1}{X}=\frac{1}{L}=[L^{-1}] \therefore [K]=[L^{-1}]$

235 **(a)**

Magnetic field ¿ $\frac{Force}{Charge \times velocity}$

¿ $\frac{[MLT^{-2}]}{[AT][¿^{-1}]}=[MA^{-1}T^{-2}]$

237 **(c)**

Percentage error in measurement of a side

¿ $\frac{0.01}{1.23} \times 100$

Percentage error in measurement of area

¿ $2 \times \frac{0.01}{1.23} \times 100$

238 **(a)**

Charge ¿ $current \times time$

239 **(c)**

From the principle of dimensional homogenity

$[v]=[at] \Rightarrow [a]=[LT^{-2}]$. Similarly $[b]=[L]$ and $[c]=[T]$

240 **(d)**

Given, $U=\frac{A\sqrt{x}}{x+B} \dots (i)$

Dimensions of U = ¿ dimensions of potential energy

¿ $[ML^2T^{-2}]$

From Eq. (i),

Dimensions of B = ¿dimensions of $x=[M^0LT^0]$

$\therefore$ Dimensions of A

¿ $\frac{dimensions\ of\ U \times dimensions\ of\ (x+B)}{dimension\ of\ \sqrt{x}}$

¿ $\frac{[ML^2T^{-2}][M^0LT^0]}{[M^0L^{1/2}T^0]}$

¿ $[ML^{5/2}T^{-2}]$

Hence, dimensions of AB

¿ $[ML^{5/2}T^{-2}][M^0LT^0]$

¿ $[ML^{7/2}T^{-2}]$

241 **(b)**

Given, $p=\frac{a-t^2}{bx}$ or $pbx=a-t^2$

By the law of homogeneity of dimensional equation.

Dimensions of a = ¿ dimensions of $t^2=[T^2]$

Dimensions of b = ¿dimensions of $\frac{t^2}{px}=[M^{-1}T^4]$

So, dimensions of $\frac{a}{b} is [MT^{-2}]$.

242 **(d)**

$f=\frac{uv}{u+v}, \frac{\Delta f}{f}=\frac{\Delta u}{u}+\frac{\Delta v}{v}+\frac{(u+v)}{u+v}$

244 **(b)**

$L=\frac{\varnothing}{I}=\frac{Wb}{A}=Henry$

246 **(b)**

$r_1=10^{-15}m, r_2=10^{26}$m

Log $r=\frac{1}{2}[\log 10^{-15}+\log 10^{26}]$

$=\frac{1}{2}[-15+26]=5.5 \approx 6 \Rightarrow r=10^6$m

247 **(d)**

The dimensions of x = ¿ dimensions of $\frac{v_0}{A}$

Therefore, out of the given options v_0 has dimensions equal to $[M^0LT^{-1}]$ and A has dimensions equal to $[M^0L^0T^{-1}]$

So, that $\frac{[v_0]}{[A]}=\frac{[M^0 L T^{-1}]}{[M^0 L^0 T^{-1}]}=[L]$

¿ dimension of x

248 **(c)**

$1\,nm=10^{-9}\,m=10^{-7}\,cm$

249 **(c)**

Electric potential $V=IR,[R]=\left[\frac{V}{I}\right]=\left[\frac{Work\ done}{Charge\times I}\right]$

$¿\frac{[ML^2T^{-2}]}{[A^2T]}=[ML^2T^{-3}A^{-2}]$

250 **(d)**

According to Planck's hypothesis

$E=hv$

Or $h=\frac{E}{v}$

Substituting the dimensions of energy E and frequency v, we get

$$[h]=\frac{[ML^2T^{-2}]}{[T^{-1}]}$$

$\therefore[h]=[ML^2T^{-1}]$

252 **(a)**

The dimension of $y=\frac{e^2}{4\pi\varepsilon_0hc}$

Putting the dimensions of

$[e]=[Q]=[AT]$

$[\varepsilon_0]=[M^{-1}L^{-3}T^4A^2], h=[ML^2T^{-1}], c=[LT^{-1}]$

$y=\frac{[A^2T^2]}{[M^{-1}L^{-3}T^4A^2][ML^2T^{-1}][LT^{-1}]}$

$y=[M^0L^0T^0]$

253 **(b)**

Volume $V=l\times b\times t$

$¿12\times6\times2.45=176.4\,cm^3$

$V=1.764\times10^2\,cm^3$

Since, the minimum number of significant figure is one in breadth, hence volume will also contain only one significant figure. Hence, $V=2\times10^2\,cm^3$

254 **(d)**

Percentage error in

$A=\left(2\frac{\Delta a}{a}+3\frac{\Delta b}{b}+\frac{\Delta c}{c}+\frac{1}{2}\frac{\Delta d}{d}\right)\times100\%$

$¿2\times1+3\times3+2+\frac{1}{2}\times2$

$¿2+9+2+1=14\%$

256 **(a)**

The unit of $\frac{1}{2}\varepsilon E^2=\frac{C^2}{Nm^2}\left(\frac{N}{C}\right)^2$

$¿\frac{C^2}{Nm^2}\frac{N^2}{C^2}=\frac{N}{m^2}=\frac{Nm}{m^3}$

$¿\frac{J}{m^3}=¿$energy density

257 **(d)**

$v=at+bt^2$

$[v]=[bt^2]$ or $LT^{-1}=bT^2\Rightarrow[b]=[LT^{-3}]$

258 **(b)**

$6\times10^{-5}=60\times10^{-6}=60\,microns$

259 **(b)**

$Surface\,tension=\frac{Force}{Length}=newton/metre$

260 **(d)**

$C=\frac{1}{\sqrt{\mu_0\varepsilon_0}}\Rightarrow\frac{1}{\mu_0\varepsilon_0}=c^2=[L^2T^{-2}]$

261 **(b)**

$Force=mass\times acceleration$

Or $F=ma$

$\therefore[F]=[m][a]$

$¿[M][LT^2]$

$¿[MLT^{-2}]$

262 **(d)**

$[ML^{-2}T^{-2}]=\frac{[MLT^{-2}]}{[L][L^2]}$

$¿\frac{Force}{distance\times area}=\frac{pressure}{distance}$

$¿\,pressure\,gradient.$

263 **(c)**

Let $v^x=kg^y\lambda^z\rho^\delta$. Now by submitting the dimensions of each quantities and equating the powers of M, L and T

$we\ get\ \delta=0\wedge x=2, y=1, z=1$

264 **(a)**

Time period

$T \propto p^a \rho^b E^c$

Or, $T = k\, p^a \rho^b E^c$

k, is a dimensionless constant.

According to homogeneity of dimensions,

LHS=RHS

$\therefore [T] = [M L^{-1} T^{-2}]^a [M L^{-3}]^b [M L^2 T^{-2}]^c$

$[T] = [M^{a+b+c}][L^{-a-3b+2c}][T^{-2a-2c}]$

Comparing the powers, we obtain

$a+b+c=0$

$-a-3b+2c=0$

$-2a-2c=1$

On solving, we get

$a = \frac{-5}{6}, b = \frac{1}{2}, c = \frac{1}{3}$

265 **(b)**

$Average\ value = \frac{2.63+2.56+2.42+2.71+2.80}{5}$

¿ $2.62\ sec$

Now $|\Delta T_1| = 2.63 - 2.62 = 0.01$

$|\Delta T_2| = 2.62 - 2.56 = 0.06$

$|\Delta T_3| = 2.62 - 2.42 = 0.20$

$|\Delta T_4| = 2.71 - 2.62 = 0.09$

$|\Delta T_5| = 2.80 - 2.62 = 0.18$

Mean absolute error

$\Delta T = \frac{|\Delta T_1| + |\Delta T_2| + |\Delta T_3| + |\Delta T_4| + |\Delta T_5|}{5}$

¿ $\frac{0.54}{5} = 0.108 = 0.11\ sec$

266 **(c)**

$Y = \frac{4 MgL}{\pi D^2 I}$ so maximum permissible error in Y

¿ $\frac{\Delta Y}{Y} \times 100 = \left(\frac{\Delta M}{M} + \frac{\Delta g}{g} + \frac{\Delta L}{L} + \frac{2 \Delta D}{D} + \frac{\Delta l}{l} \right) \times 10($

¿ $\left(\frac{1}{300} + \frac{1}{981} + \frac{1}{2820} + 2 \times \frac{1}{41} + \frac{1}{87} \right) \times 100$

¿ $0.065 \times 100 = 6.5\%$

267 **(d)**

$\tau = \frac{dL}{dt} \Rightarrow dL = \tau \times dt = r \times F \times dt$

$i.e.$, the unit of angular momentum is $joule$-$second$

268 **(b)**

$f = \frac{1}{2\pi\sqrt{LC}} \Rightarrow LC = \frac{1}{f^2} = [M^0 L^0 T^2]$

269 **(a)**

$\frac{angular\ momentum}{linear\ momentum} = \frac{[M L^2 T^{-1}]}{[ML T^{-1}]} = [M^0 L T^0]$

270 **(a)**

$[e] = [AT], \epsilon_0 = [M^{-1} L^{-3} T^4 A^2], [h] = [M L^2 T^{-1}]$

And $[c] = [L T^{-1}]$

$\therefore \left[\frac{e^2}{4\pi \epsilon_0 hc} \right] = \left[\frac{A^2 T^2}{M^{-1} L^{-3} T^4 A^2 \times M L^2 T^{-1} \times L T^{-1}} \right]$

¿ $[M^0 L^0 T^0]$

272 **(a)**

The result has to be in one significant umber only.

273 **(b)**

$v \propto g^p h^q$(given)

By submitting the dimension of each quantity and comparing the powers on both sides we get

$[L T^{-1}] = [L T^{-2}]^p [L]^q$

$\Rightarrow p+q=1, -2p=-1, \therefore p = \frac{1}{2}, q = \frac{1}{2}$

274 **(b)**

$Force = Mass \times acceleration$

¿ $[M][L T^{-2}] = [ML T^{-2}]$

$Torque = Force \times distance = [ML T^{-2}][L] = [M L^2 T$

$Work = Force \times distance = [ML T^{-2}][L] = [M L^2 T^{-2}$

$Energy = [M L^2 T^{-2}]$

$Power = \frac{Work}{Time} = \frac{[M L^2 T^{-2}]}{[T]} = [M L^2 T^{-3}]$

276 **(b)**

Positions $x = k\, a^m t^n$

$[M^0 L T^0] = [L T^{-2}]^m [T]^n$

¿ $[M^0 L^m T^{-2m+n}]$

On comparing both sides

$m=1$

$-2m+n=0$

$n=2m$

$n=2\times 1=2$

277 **(a)**

$$\because R=\frac{PV}{T}=\left[\frac{ML^{-1}T^{-2}\times L^{3}}{\theta}\right]=[ML^{2}T^{-2}\theta^{-1}]$$

278 **(b)**

We know that

Specific heat ¿ $\frac{Q}{m\Delta t}$

$$Unit\ of\ specific\ heat=\frac{unit\ of\ heat}{unit\ of\ mass\times unit\ of\ tempe}$$

$$\therefore Unit\ of\ specific\ heat=\frac{J}{kg\,°C}=Jkg^{-1}\,°C^{-1}$$

279 **(a)**

$K=Y\times r_0=[ML^{-1}T^{-2}]\times[L]=[MT^{-2}]$

Y=Young's modulus and $r_0=$¿ Interatomic distance

280 **(a)**

Couple of force = $|\vec{r}\times\vec{F}|=[ML^2T^{-2}]$

Work ¿ $[\vec{F}.\vec{d}]=[ML^2T^{-2}]$

281 **(c)**

100 W= 100 J $s^{-1}=10^9$ erg s^{-1}

282 **(d)**

From the given relation, $D=\frac{-n(x_2-x_1)}{n_2-n_1}$

Here $[n]=\left[\frac{1}{area\times time}\right]=\frac{1}{[L^2T]}=[L^{-2}T^{-1}]$

$x_2-x_1=[L]$ and $n_2-n_1=\left[\frac{1}{volume}\right]=\left[\frac{1}{L^3}\right]=[L^{-3}]$

So, $[D]=\frac{[L^{-2}T^{-1}L]}{[L^{-3}]}=[L^2T^{-1}]$.

283 **(b)**

Use formula for time period in angular SHM.

284 **(a)**

Electric potential

$$V=\frac{W}{q}=\frac{joule}{coulomb}=\frac{newton\times metre}{coulomb}$$

¿ $\frac{(kg-ms^{-2})\times m}{coulomb}$

¿ $kg-ms^{-2}\times m\times coulomb^{-1}$

$\therefore=[ML^2T^{-2}Q^{-1}]$

285 **(b)**

$$R=\frac{V}{I}=\left[\frac{ML^2T^{-3}A^{-1}}{A}\right]=[ML^2T^{-3}A^{-2}]$$

286 **(b)**

Heat ΔQ transferred through a rod of length L and area A in time Δt is

$$\Delta Q=KA\left(\frac{T_1-T_2}{L}\right)\Delta t$$

$$\therefore K=\frac{\Delta Q\times L}{A(T_1-T_2)\Delta t}\ldots(i)$$

Substituting dimensions for corresponding quantities in Eq. (i), we have

$$[K]=\frac{[ML^2T^{-2}][L]}{[L^2][\theta][T]}$$

$$¿[MLT^{-3}\theta^{-1}]$$

287 **(b)**

$$\frac{F-32}{9}=\frac{K-273}{5}\Rightarrow\frac{x-32}{9}=\frac{x-273}{5}\Rightarrow x=574.25$$

288 **(c)**

1 fermi $¿10^{-15}$ *metre*

289 **(d)**

$[Planck\,constant]=[ML^2T^{-1}]$ and

[Energy] = $[ML^2T^{-2}]$

290 **(b)**

MeV-sec is not a unit of energy. While others are units of energy.

291 **(b)**

$$F=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

$$\Rightarrow\varepsilon_0=|q_1|\vee q_2\vee\frac{¿}{[F][r^2]}=\frac{[A^2T^2]}{[MLT^{-2}][L^2]}=[A^2T^4M$$

292 **(d)**

$$R_1=(6\pm0.3)k\Omega,R_2=(10\pm0.2)k\Omega$$

$$R_¿=\frac{R_1R_2}{(R_1+R_2)}$$

Let $(R_1+R_2)=x$

$$\Rightarrow R_P=\frac{R_1R_2}{x}$$

Taking log of both sides

$\ln R_P = \ln R_1 + \ln R_2 - \ln x$

Differentiating,

$$\frac{\Delta R_P}{R_P} = \frac{\Delta R_1}{R_1} + \frac{\Delta R_2}{R_2} + \left(\frac{-\Delta x}{x}\right)$$

$$\Delta x_{mean} = \frac{0.3+0.2}{2} = 0.25\,\Omega$$

$$R_{mean} = \frac{6+10}{2} = 8\,\Omega$$

$$\therefore x = \frac{6+10}{2} = 8\,\Omega$$

$$\Rightarrow \frac{\Delta x}{x} = \frac{0.25}{8}$$

$$\therefore Total\,error = \frac{0.3}{6} + \frac{0.2}{10} + \frac{0.25}{8}$$

$$¿ 0.05 + 0.02 + 0.03125 = 0.10125$$

$$\therefore \frac{\Delta R_P}{R_P} = 10.125\,\%$$

293 **(d)**

$F_m = Bqv$ or $[B] = \left[\frac{F_m}{qv}\right] = \left[\frac{F_m}{Itv}\right]$

$$¿ \frac{[MLT^{-2}]}{[A][T][LT^{-1}]} = [ML^0T^{-2}A^{-1}]$$

Alternate

$$F = BIl \Rightarrow [B] = \left[\frac{F}{Il}\right] = [ML^0T^{-2}A^{-1}]$$

294 **(d)**

R=8.3 J/K-mol

$n_1u_1 = n_2u_2$

$$\therefore n_2 = \frac{n_1u_1}{u_2}$$

$$¿ \frac{8.3\,J/K-mol}{atm\,L/K-mol}$$

$$¿ \frac{8.3\,J/K-mol}{(1.013\times10^5\,N¿m^2)(10^{-3}m^3)/K-mol}$$

$$¿ \frac{8.12}{10^2} = 0.0812$$

$\therefore$8.3J/K-mol=0.0812 atm L/K-mol

295 **(d)**

$$P = nu \therefore n \propto \frac{1}{u}$$

296 **(b)**

From Coulomb's law

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

Or $\varepsilon_0 = \frac{q_1q_2}{4\pi F r^2}$

$\therefore Units\,of\,\varepsilon_0\,(permittivity)$

$$¿ \frac{C^2}{N-m^2} = C^2N^{-1}m^{-2}$$

297 **(d)**

Work done $W = \varepsilon\Delta q$

$$\therefore \varepsilon = \frac{W}{\Delta q} = \frac{[ML^2T^{-2}]}{[AT]}$$

$$\therefore [\varepsilon] = [ML^2T^{-3}A^{-1}]$$

298 **(a)**

Maximum absolute error is $\Delta a + \Delta b$. Now work out the relative error ad finally the percentage error.

299 **(b)**

$$Potential\,energy = mgh = g\left(\frac{cm}{sec^2}\right)cm = g\left(\frac{cm}{sec}\right)^2$$

300 **(c)**

Resistivity, $\rho = \frac{m}{ne^2\tau}$

$$\therefore [\rho] = \frac{[M]}{[L^{-3}][AT][T^2]}$$

$$¿ [ML^3A^{-2}T^{-3}]$$

So, electrical conductivity

$$\sigma = \frac{1}{\rho}$$

$$\Rightarrow [\sigma] = \frac{1}{[\rho]} = [M^{-1}L^{-3}A^2T^3]$$

301 **(b)**

$$Bulk\,modulus\,K = \frac{normal\,stress}{volumetric\,strain}$$

$¿\frac{F/A}{-\Delta V/V}$

$¿-\frac{FV}{A\Delta V}$

Now, $\frac{F}{A}=p$

$\therefore K=\frac{pV}{\Delta V}$

As volumetric strain is dimensionless.

$\therefore Dimensions\ of\ K = dimensions\ of\ normal\ stress$

$\Rightarrow [K]=[ML^{-1}T^{-2}]$

302 **(a)**

$R=\frac{V}{I}\Rightarrow \pm\frac{\Delta R}{R}=\pm\frac{\Delta V}{V}\pm\frac{\Delta I}{I}$

$¿3+3=6\%$

304 **(d)**

$n(x\,m)^2=1\,m^2$ or $n=\frac{1}{x^2}$

305 **(d)**

Given, $v=at+bt^2$

Applying the law of homogeneity $[v]=[bt^2]$

Or $[LT^{-1}]=[bT^2]$

Or $[b]=[LT^{-3}]$

306 **(a)**

$V=\frac{W}{Q}=[ML^2T^{-2}Q^{-1}]$

307 **(c)**

Volume of sphere $(V)=\frac{4}{3}\pi r^3$

% error in volume $¿3\times\frac{\Delta r}{r}\times 100=\left(3\times\frac{0.1}{5.3}\right)\times 100$

308 **(d)**

Given, $v=at+\frac{b}{t+c}$

Since, LHS is equal to velocity, so at and $\frac{b}{t+c}$ must have the dimensions of velocity.

$\therefore at=v$

Or $a=\frac{v}{t}=\frac{[LT^{-1}]}{[T]}=[LT^{-2}]$

Now, $c=time\ (\because like\ quantities\ are\ added)$

$\therefore c=t=[T]$

Now,

$\frac{b}{t+c}=v$

$\therefore b=v\times time=[¿^{-1}][T]=[L]$

310 **(a)**

Dimensions of $E=[ML^2T^{-2}]$

Dimensions of $G=[M^{-1}L^3T^{-2}]$

Dimensions of $I=[MLT^{-1}]$

And dimension of $M=[M]$

$\therefore Dimensions\ of\ \frac{GIM^2}{E^2}=\frac{[M^{-1}L^3T^{-2}][MLT^{-1}][M}{[ML^2T^{-2}]^2}$

$¿[T]$

$¿\ Dimensions\ of\ time$

311 **(a)**

Percentage error inside $¿\frac{1}{2}\left[\frac{0.2}{100}\times 100\right]=0.1$

Absolute error inside $¿\frac{0.1}{100}\times 10=0.01$

312 **(d)**

The second is the duration of 9192631770 period of the radiation corresponding to the transition between the two hyperfine levels of the ground state of cesium-133 atom. Therefore, 1 ns is 10^{-9}s of Cs-clock of 9192631770 oscillations.

314 **(a)**

Weight in air $=(5.00\pm 0.05)\,N$

Weight in water $=(4.00\pm 0.05)\,N$

Loss of weight in water $=(1.00\pm 0.1)\,N$

Now relative density$=\frac{weight \in air}{weight\ loss \in water}$

$i.e. R.D = \frac{5.00 \pm 0.05}{1.00 \pm 0.1}$

Now relative density with max permissible error

$¿ \frac{5.00}{1.00} \pm ¿$

$¿ 5.0 \pm 11\%$

315 **(c)**

Angular momentum = [

$M L^2 T^{-1} ¿, Frequency = [T ¿¿ -1] ¿$

317 **(a)**

By the principle of dimensional homogenity

$[P] = \left[\frac{a}{V^2}\right] \Rightarrow [a] = [P] \times [V^2] = [M L^{-1} T^{-2}][L^6]$

$¿ [M L^5 T^{-2}]$

318 **(a)**

$[E] = [M L^2 T^{-2}]$

$[M] = [M]$

$[L] = [M L^2 T^{-1}]$

$[G] = [M^{-1} L^3 T^{-2}]$

$\left[\frac{E L^2}{M^5 G^2}\right] = \frac{[M L^2 T^{-2}][M L^2 T^{-1}]^2}{[M]^5 [M^{-1} L^3 T^{-2}]^2}$

$¿ \frac{[M L^2 T^{-2}][M^2 L^4 T^{-2}]}{[M^5][M^{-2} L^6 T^{-4}]} = \frac{[M^3 L^6 T^{-4}]}{[M ¿¿ 3 L^6 T^{-4}] ¿}$

$¿ [m^0 L^0 T^0] = ¿$ Angle

319 **(c)**

$[M T^{-3}] = \frac{[M L^2 T^{-2}]}{[L^2][T]} = ¿$energy /area ×

time=dimensions of solar constant.

320 **(b)**

We know that kinetic energy $¿ \frac{1}{2} m v^2$

Required percentage error is 2%+$2 \times 3\%$ $ie, 8\%$

321 **(d)**

Express the result in two significant figures.

323 **(c)**

$B = \frac{F}{IL} = \frac{[MLT^{-2}]}{[A][L]} = [M T^{-2} A^{-2}]$

324 **(c)**

$30\, VSD = 29\, MSD$

$1\, VSD = \frac{29}{30} MSD$

Least count of vernier $¿ 1\, M.S.D. - 1\, V.S.D.$

$¿ 0.5° - \frac{29}{30} \times 0.5° = \frac{0.5°}{30}$

Reading of vernier ¿ M.S. reading +¿ V.S. reading × $L.C.$

$¿ 58.5° + 9 \times \frac{0.5°}{30} = 58.65$

325 **(a)**

From Coulomb's law, the force of attraction/repulsion between two point charges $q \wedge q$ separated by distance r is

$F = \frac{1}{4\pi\varepsilon_0} \frac{q^2}{r^2}$

$\Rightarrow \varepsilon_0 = \frac{1}{4\pi} \cdot \frac{q^2}{F r^2}$

Where ε_0 is electric permittivity.

Dimensions of $\varepsilon_0 = \frac{[AT]^2}{[MLT^{-2}][L^2]}$

$[\varepsilon_0] = [A^2 M^{-1} L^{-3} T^{-4}]$

326 **(a)**

Percentage error in radius is $\frac{0.1}{4.3} \times 100$. again,

$V \propto R^3$

327 **(a)**

Required percentage error

$¿ 2 \times \frac{0.01}{15.12} \times 0 + \frac{0.001}{10.15} \times 10 = 4 + 1 = 5$

328 **(a)**

We know that the dimensional formula of energy is

$[M L^2 T^{-2}]$

$n_2 = 1 ¿$

$¿ \frac{1}{10} \times \frac{1}{10^6} \times \frac{1}{(60)^{-2}} = \frac{3600}{10^7} = 3.6 \times 10^{-4}$

329 **(d)**

$\lambda = m^p v^q h^r$

$[M^0 L T^0] = [M^p][L T^{-1}]^q [M L^2 T^{-2}]^r$

$[M^0 L T^0] = [M^{p+r} L^{q+2r} T^{-q-r}]$

$\therefore p + r = 0, q + 2r = 1, -q - r = 0$

After solving we get

$p = -1, q = -1, r = 1$

330 **(a)**

Least count LC

$¿\frac{Pitch}{Number\ of\ divisions\ on\ circular\ scale}$

$¿\frac{0.5}{50}=0.01\,mm$

Now, diameter of ball

$¿(2\times0.5\,mm)+(25-5)(0.01)=1.2\,mm$

331 **(c)**

Volume of cylinder $V=\pi r^2 l$

Percentage error in volume

$\frac{\Delta V}{V}\times100=\frac{2\Delta r}{r}\times100+\frac{\Delta l}{l}\times100$

¿¿

332 **(a)**

Let $h\propto G^x L^y E^z$

$[M L^2 T^{-1}]\propto[M^{-1} L^3 T^{-2}]^x [M L^2 T^{-1}]^y [M L^2 T^{-2}]^z$

$[M L^2 T^{-1}]=k[M^{-1} L^3 T^{-2}]^x [M L^2 T^{-1}]^y [M L^2 T^{-2}]^z$

Comparing the powers, we get

$1=-x+y+z\ldots(i)$

$2=3x+2y+2z\ldots(ii)$

$-1=-2x-y-2z\ldots(iii)$

On solving Eqs. (i), (ii) and (iii), we get

$x=0$

∴ Gravitational constant has no dimensions

333 **(d)**

We know that

$density=\frac{mass}{volume}$

In CGS units

$d=0.625\,gcm^{-3}$

In SI units

$d=\frac{0.625\times10^{-3}\,kg}{10^{-6}\,m^3}=625\,kgm^{-3}$

334 **(a)**

The velocity of a body at highest point of vertical circle is,

$v=\sqrt{rg}$

Or $v^2=rg$

Or $\frac{v^2}{rg}=constant$

Hence, $\frac{v^2}{rg}$ is dimensionless.

335 **(b)**

Magnetic moment is the strength of magnet. Its SI unit is $amp\times m^2 \vee N-m/telsa \vee JT^{-1}$.

337 **(a)**

Let $F\propto P^x V^y T^z$

By substituting the following dimensions:

$[P]=[M L^{-1} T^{-2}][V]=[L T^{-1}],[T]=[T]$

and comparing the dimension of both sides

$x=1, y=2, z=2$, so $F=P V^2 T^2$

339 **(a)**

Indestructibility, invariability and reproductibility are essential characteristics of a unit of measurement.

340 **(c)**

$Energy=force\times distance$, so if both are increased by 4 times then energy will increase by 16 times

341 **(d)**

Dimensional formula of magnetic flux

$¿[M L^2 T^{-2} A^{-1}]$

343 **(c)**

Area velocity is area covered per unit time.

344 **(b)**

Unit of $\varepsilon_0=C^2/N-m^2$ ∴ Unit of $K=N m^2 C^{-2}$

345 **(c)**

Potential can be written a potential energy per unit charge,

$$V = \frac{W}{q} = \frac{U}{q}$$

Hence, dimensions of potential are the same as that of work per unit charge.

346 **(a)**

$[L/R]$ is a time constant so its unit is *second*

347 **(c)**

$R=\rho\frac{L}{A}\Rightarrow\rho=\frac{RA}{L}=ohm\times cm$

348 **(a)**

Let $n=k\rho^a a^b T^c$ where $[\rho]=[ML^{-3}],[a]=[L]$ and $[T]=[MT^{-2}]$

Comparing dimensions both sides we get

$a=\frac{-1}{2},b=\frac{-3}{2}$ and $c=\frac{1}{2}\therefore\eta=k\rho^{-1/2}a^{-3/2}T^{-1/2}$

¿ $\frac{K\sqrt{T}}{\rho^{1/2}a^{3/2}}$

350 **(a)**

Diameter of wire,

$d=MSR+CSR\times LC$

¿ $0+52\times\frac{1}{100}$

¿ $0.52\,mm=0.052\,cm.$

351 **(d)**

$[\eta]=ML^{-1}T^{-1}$ so its unit will be $kg/m\text{-}sec$

352 **(c)**

$F=\frac{Gm_1m_2}{d^2};\therefore G=\frac{Fd^2}{m_1m_2}=Nm^2/kg^2$

353 **(a)**

$K=C+273.15$

354 **(a)**

$k=\left[\frac{R}{N}\right]=[ML^2T^{-2}\theta^{-1}]$

355 **(a)**

$\frac{[Energy]}{[Volume]}=\frac{[ML^2T^{-2}]}{[L^3]}=[ML^{-1}T^{-2}]$

[pressure]= $\frac{[MLT^{-2}]}{[L^2]}=[ML^{-1}T^{-2}]$

357 **(b)**

Capacitance $C=\frac{Charge}{potential}=\frac{q}{V}$

Also potential ¿ $\frac{work}{charge}$ $\left(\because V=\frac{W}{q}\right)$

$\therefore C=\frac{q^2}{J}$ as well as $C=\frac{J}{V^2}$.

Thus, (a), (c), (d) are equivalent to farad but (b) is not equivalent to farad.

358 **(b)**

Velocity

$v=k\lambda^a\rho^b g^c\Longrightarrow[M^0LT^{-1}]=[L^a][M^bL^{-3b}][L^cT^{-2c}$

Or $[M^0LT^{-1}]=[M^bL^{a-3b+c}T^{-2c}]$

Equating powers of M, L and T, we get

$-2c=-1$

Again, $a-3b+c=1, b=0, c=\frac{1}{2}$

$\therefore v=k\lambda^{1/2}\rho^0 g^{1/2}$ or $v^2\propto g\lambda$

359 **(a)**

$Impulse=force\times time$

¿ $[MLT^{-2}][T]$

¿ $[MLT^{-1}]$

360 **(a)**

$X=[M^aL^bT^c]$

Maximum % error in $X=a\alpha+b\beta+c\gamma$

361 **(c)**

Gravitational force, $F=\frac{GM_1M_2}{R^2}$

$\Rightarrow G=\frac{FR^2}{M_1M_2}$

$[G]=\frac{[MLT^{-2}][L^2]}{[M^2]}$

¿ $[M^{-1}L^3T^{-2}]$

363 **(a)**

$[C]=\left(\frac{Q}{V}\right)=$ ¿

364 **(a)**

Angular velocity = $\frac{\theta}{t},[\omega]=\frac{[M^0L^0T^0]}{[T]}=[T^{-1}]$

365 **(c)**

Given, length of rod A is

$L_A=3.25\pm0.01$

Of B is $L_B = 4.19 \pm 0.01$

Then, the rod B is longer than rod A by a length

$\Delta l = L_B - L_A$

$\Delta l = (4.19 \pm 0.01) - (3.25 \pm 0.01)$

$\Delta l = (0.94 \pm 0.02)\, cm$

366 **(c)**

Electric displacement, $D = \varepsilon E$

Unit of $D = \frac{C^2}{N m^2} \frac{N}{C}$

$\therefore [D] = \left(\frac{C}{m^2}\right) = \frac{[AT]}{[L^2]} = [L^{-2} TA]$

367 **(a)**

If **E** is the intensity of electric field over a small area element **dS** and θ is angle between **E** and outdrawn normal to area element. Therefore, electric flux through this element is

$d\phi_E = (dS)(E \cos\theta)$

¿ $E\, dS \cos\theta = E . dS$

Hence, $\phi_E = E . S$

¿ $\frac{V}{d} . S$

$\therefore Unit\ of\ \phi_E = \frac{volt \times metre^2}{metre}$

¿ $volt - metre$

368 **(d)**

$Diameter = Main\ scale\ reading$

$+ Circular\ scale\ reading \times LC + Zero\ error$

¿ $3 + 35 \times \frac{1}{2 \times 50} + 0.03 = 3.38\, mm$

369 **(c)**

$F = -\eta . A \frac{dv}{dx} \Rightarrow [\eta] = [M L^{-1} T^{-1}]$

370 **(d)**

Torque = $[M L^2 T^{-2}]$, Moment of inertia $[M L^2]$

371 **(a)**

$\eta = \frac{F}{av} = \frac{[M L T^{-2}]}{[L][L T^{-1}]} = [M L^{-1} T^{-1}]$

372 **(a)**

Required relative error=power$\times$relative error in x.

373 **(c)**

Since for 50.14 cm, significant number = 4 and for 0.00025, significant number = 2

374 **(a)**

Kinetic energy $= \frac{1}{2} m v^2 = M [L T^{-1}]^2 = [M L^2 T^{-2}]$

375 **(b)**

T-ratios are dimensionless. So the unit of r is N^2.

376 **(a)**

$30\, VSD = 29\, MSD$

$1\, VSD = \frac{29}{30} MSD$

$L.C. = 1\, MSD - 1\, VSD$

¿ $\left(1 - \frac{29}{30}\right) MSD = \frac{1}{30} \times 0.5° = 1$ minute

377 **(d)**

[Pressure]=[Stress]=[coefficient of elasticity] = $[M L^{-1} T^{-2}]$

378 **(a)**

$I = \frac{Q}{t} = \frac{[Q]}{[T]} = [M^0 L^0 T^{-1} Q]$

379 **(c)**

$T = 2\pi \sqrt{l/g} \Rightarrow T^2 = 4\pi^2 l/g \Rightarrow g = \frac{4\pi^2 l}{T^2}$

Here, % error in

$l = \frac{1\, mm}{100\, cm} \times 100 = \frac{0.1}{100} \times 100 = 0.1\%$

And % in error in $T = \frac{0.1}{2 \times 100} \times 100 = 0.05\%$

$\therefore$% error in g = % error in l+2(% $error \in T$)

¿ $0.1 + 2 \times 0.05 = 0.2\%$

380 **(d)**

The number of significant figures in 4.8000×10^4 is 5 (zeros on right after decimal are counted while zeros in powers of 10 are not counted).

The number of significant figures in 48000.50 is 7 (all the zeros between two non-zero digits are significant).

381 **(c)**

$R_s=\frac{R_1 R_2}{R_1+R_2}$,

$\frac{\Delta R_s}{R_s}\times 100$

$¿\frac{\Delta R_1}{R_1}\times 100+\frac{\Delta R_2}{R_2}\times 100+\frac{\Delta(R_1+R_2)}{R_1+R_2}=100$

Now, $\Delta R_1=\frac{10}{100}\times 4\text{k}\Omega=0.4\text{k}\Omega$,

$\Delta R_2=\frac{10}{100}\times 6\text{k}\Omega=0.6\,k\Omega$

Again, $\frac{\Delta R_s}{R_s}\times 100=\frac{0.4}{4}\times 100+\frac{0.6}{6}\times 100$

$\frac{+0.4+0.6}{10}\times 100$

$¿10+10+10=30$

382 **(d)**

Note carefully that every alterative has $G\,h$ and c^5.

$[Gh]=[M^{-1}L^3T^{-2}][M L^2T^{-1}]=[M^0L^5T^3]$

$[c]=[L\,T^{-1}]$

$\therefore\left(\frac{Gh}{c^5}\right)^{1/2}=[T]$

383 **(b)**

$C^2LR=[C^2L^2]\times\left[\frac{R}{L}\right]=[T^4]\times\left[\frac{1}{T}\right]=[T^3]$

As $\left[\frac{L}{R}\right]=T$ and $\sqrt{LC}=T$

384 **(d)**

Unit of $e.m.f.=¿\,volt=¿\,joule/coulomb$

385 **(b)**

% error in

$g=\frac{\Delta g}{g}\times 100=\left(\frac{\Delta l}{l}\right)\times 100+2\left(\frac{\Delta T}{T}\right)\times 100$

$E_I=\frac{0.1}{64}\times 100+2\left(\frac{0.1}{128}\right)\times 100=0.3125\,\%$

$E_{II}=\frac{0.1}{64}\times 100+2\left(\frac{0.1}{64}\right)\times 100=0.4687\,\%$

$E_{III}=\frac{0.1}{20}\times 100+2\left(\frac{0.1}{36}\right)\times 100=1.055\,\%$

386 **(b)**

$1\,MeV=10^6eV$

387 **(c)**

[Energy] = $[M\,L^2\,T^{-2}]$. Increasing M and L by a factor of 3 energy is increased 27 times.

388 **(a)**

Dimensionally. $\left[\frac{b}{t}\right]=[v]$ or $[b]=[vt]=[L]$.

389 **(a)**

$M=¿$Pole strength$\times$ length

$¿\,amp-metre\times metre=amp-metre^2$

390 **(b)**

$\therefore\left(\frac{\Delta R}{R}\times 100\right)_{max}=\frac{\Delta V}{V}\times 100+\frac{\Delta I}{I}\times 100$

$¿\frac{5}{100}\times 100+\frac{0.2}{10}\times 100=(5+2)\,\%=7\,\%$

391 **(c)**

$\frac{0.2}{25}\times 100=0.8$

393 **(c)**

$\left[\frac{1}{2}\in_0 E^2\right]=¿$ [Energy density]

$¿\frac{M\,L^2T^{-2}}{L^3}=M\,L^{-1}T^{-2}$

394 **(c)**

Dimensions of $L\wedge R$

$[R]=[ML^2T^{-3}A^{-2}]$

$[L]=[M\,L^2T^{-2}A^{-2}]$

$\left[\frac{L}{R}\right]=\frac{[M\,L^2T^{-2}A^{-2}]}{[M\,L^2T^{-3}A^{-2}]}$

$¿[T]$

395 **(d)**

$\frac{[E][J]^2}{[M]^5[G]^2}\frac{[M\,L^2T^{-2}][M\,L^2T^{-1}]^2}{[M^5][M^{-1}L^3T^{-2}]^2}=[M^0L^0T^0]$

396 **(d)**

As $v=\frac{4}{3}\pi r^3$

$\frac{dv}{v}=3\left(\frac{dr}{r}\right)$

$\therefore$ Percentage error in determination of volume $¿3$ (Percentage error in measurement of radius)

$¿3(2\,\%)=6\,\%$

397 **(c)**

Least count $¿\frac{0.5}{50}=0.01\,mm$

Diameter of ball $D=2.5mm+(20)(0.01)$

$D=2.7\,mm$

$$\rho=\frac{M}{vol}=\frac{M}{\frac{4}{3}\pi\left(\frac{D}{2}\right)^3}\Rightarrow\left(\frac{\Delta\rho}{\rho}\right)_{max}=\frac{\Delta M}{M}+3\frac{\Delta D}{D}$$

$$\left(\frac{\Delta\rho}{\rho}\right)_{max}=2\%+3\left(\frac{0.01}{2.7}\right)\times100\%\Rightarrow\frac{\Delta\rho}{\rho}=3.1\%$$

398 **(a)**

From Newton's second law

$Force\,(F)=Mass\,(M)\times acceleration$

Dimensions of $[F]=[MLT^{-2}]$

$\therefore [M]=[FL^{-1}T^2]$

399 **(d)**

For best results amplitude of oscillation should be as small as possible and more oscillations should be taken

400 **(b)**

Intensity of radiation $¿\frac{Radiation\ Energy}{Area\times time}$

$$\Rightarrow I=\frac{[ML^2T^{-2}]}{[L^2\times T]}=[ML^0T^{-3}]$$

402 **(c)**

Let $m\propto C^xG^yh^z$

By substituting the following dimensions:

$[C]=LT^{-1};[G]=[M^{-1}L^3T^{-2}]$ and $[h]=[ML^2T^{-1}]$

Now comparing both sides we will get

$x=1/2;\,y=-1/2,\,z=+1/2$

So $m\propto c^{1/2}G^{-1/2}h^{1/2}$

403 **(d)**

$$F\propto v\Rightarrow F=kv\Rightarrow[k]=\left[\frac{F}{v}\right]=\left[\frac{MLT^2}{LT^{-1}}\right]=[MT^{-1}]$$

405 **(c)**

According to definition of potential

406 **(a)**

$$Pressure=\frac{Force}{Area}=ML^{-1}T^{-2}$$

$$Stress=\frac{Restoring\ Force}{Area}=ML^{-1}T^{-2}$$

408 **(c)**

Area of cross section

$¿\frac{22}{7}\times0.24\times0.24\,mm^2=018\,mm^2$

409 **(b)**

Given, 1 eV=1.6×10^{-19}J

13.6 eV=$13.6\times1.6\times110^{-19}$J

$¿21.76\times10^{-19}$J

410 **(b)**

We will use the general rule of addition by making the powers same.

ie, we will add 3.8×10^{-6} and 42×10^{-6} we get

$¿45.8\times10^{-6}=4.58\times10^{-5}$

As least number of significant figures in given values are 2, so

We round off the result to 4.6×10^{-5}.

411 **(b)**

Both force constant and surface tension represent force per unit length.

412 **(c)**

$$E=h\nu\Rightarrow[ML^2T^{-2}]=[h][T^{-1}]\Rightarrow[h]=[ML^2T^{-1}]$$

413 **(c)**

$[X]=[F]\times[\rho]=[MLT^{-2}]\times¿$

414 **(b)**

[Force] $¿[M]$[Acceleration] $\Rightarrow[F]=[M^1L^1T^{-2}]$

415 **(a)**

From Coulomb's law

$$F=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

$$\Rightarrow\left[\frac{1}{4\pi\varepsilon_0}\right]=\frac{[F\times r^2]}{[q]^2}$$

$$¿\frac{[newton][metre]^2}{[coulomb]^2}$$

¿ $Nm^2 C^{-2}$

416 **(a)**

Time defined in terms of the rotation of the earth is called universal time (UT).

417 **(d)**

$[h] = ¿$Angular momentum] $= [M L^2 T^{-1} ¿$

418 **(c)**

$\Delta R_s = \Delta R_1 + \Delta R_2 = \left[\frac{10}{100} \times 10 + \frac{20}{100} \times 20\right] k\Omega = 5 k\Omega$

$\frac{\Delta R_s}{R_s} \times 100 = \frac{5}{30} \times 100 = \frac{50}{3} = 17$

419 **(a)**

Volume $V = l^3 = (1.2 \times 10^{-2} m)^3 = 1.728 \times 10^{-6} m^3$

$\because$length $l$has two significance figures. Therefore, the correct answer is

$V = 1.7 \times 10^{-6} m^3$

420 **(a)**

Let $\upsilon \propto \sigma^a \rho^b \lambda^c$

Equating dimensions on both sides,

$[M^0 L^1 T^{-1}] \propto [M T^{-2}]^a [M L^{-3}]^b [L]^c$

$\propto [M]^{a+b} [L]^{-3b+c} [T]^{-2a}$

Equating the powers of M, L, T on both sides, we get

$a + b = 0$

$-3b + c = 1$

$-2a = -1$

Solving, we get

$a = \frac{1}{2}, b = \frac{-1}{2}, c = \frac{-1}{2}$

$\therefore \upsilon \propto \sigma^{1/2} \rho^{-1/2} \lambda^{-1/2}$

$\therefore \upsilon^2 \propto \frac{\sigma}{\rho\lambda}$

421 **(a)**

According to Coulombs law $F = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2}$

$\therefore \frac{1}{4\pi\varepsilon_0} = \frac{F r^2}{q_1 q_2} = \frac{(newton)(meter)^2}{(coulomb)(coulomb)}$

$¿ \frac{N m^2}{C^2} = C^{-2} N m^2$

423 **(b)**

$\frac{dQ}{dt} = -KA\left(\frac{d\theta}{dx}\right)$

$\Rightarrow [K] = \frac{[M L^2 T^{-2}]}{[T]} \times \frac{[L]}{[L^2][K]} = MLT^{-3} K^{-1}$

424 **(c)**

Quantity C has maximum power. So it brings maximum error in P

425 **(a)**

Linear momentum = $Mass \times Velocity = [MLT^{-1}]$

Moment of a force = Force $\times Distance = [ML^2 T^{-2}]$

426 **(a)**

Young's modulus $Y = \frac{stress}{strain} = N/m^2$ or pascal (in SI system)

And $Y = \frac{dyne}{cm^2}$ (in CGS system)

Then, Nm^{-1} is not the unit of Young's modulus.

427 **(b)**

$Kg\text{-}m/sec$ is the unit of linear momentum

428 **(a)**

Let $v \propto \sigma^a \rho^b \lambda^c$

Equating dimensions on both sides.

$[M^0 L T^{-1}] \propto [M T^{-2}]^a [M L^{-3}]^b [L]^c$

$\propto [M]^{a+b} [L]^{-3b+c} [T]^{-2a}$

Equating the powers of M, L, T on both sides, we get

$a + b = 0$

$-3b + c = 1$

$-2a = -1$

Solving, we get

$a = \frac{1}{2}, b = \frac{-1}{2}, c = \frac{-1}{2}$

$\therefore v \propto \sigma^{1/2} \rho^{-1/2} \lambda^{-1/2}$

$\therefore v^2 \propto \frac{\sigma}{\rho\lambda}$

429 **(c)**

Volume of sphere is given by

$v = \frac{4}{3}\pi R^3$

Where R is radius of sphere

$$\therefore \frac{\Delta V}{V}=3\frac{\Delta R}{R}$$

Hence, percentage error in volume

$$\frac{\Delta V}{V}\times 100=3\left(\frac{\Delta R}{R}\times 100\right)\%$$

$$¿3\times 3\%=9\%$$

430 **(b)**

$1\,Oersted=1$Gauss $¿10^{-4}\,Tesla$

432 **(c)**

Einstein's mass-energy equivalence is $E=mc^2$.

433 **(a)**

$[MLT^{-2}]=[L^{2a}][L^bT^b][M^cL^{-3c}]=[M^cL^{2a+c-3c}T^{-b}$

Comparing powers of M, L and T, we get

$c=1, 2a+b-3c=1, -b=-2$ or $b=2$

$2a+2-3(1)=1\Rightarrow 2a=2$ or $a=1$.

434 **(c)**

Velocity is given by

$$v=\frac{1}{\sqrt{\mu_0\varepsilon_0}}$$

$$\therefore v^2=\frac{1}{\mu_0\varepsilon_0}=[LT^{-1}]^2$$

$$\therefore \frac{1}{\mu_0\varepsilon_0}=[L^2T^{-2}]$$

435 **(c)**

Given, $L=2.331\,cm$

$¿2.33$ (correct upto two decimal places)

And $B=2.1\,cm=2.10\,cm$

$\therefore L+B=2.33+2.10=4.43\,cm=4.4\,cm$

Since minimum significant figure is 2

436 **(d)**

$$\frac{\Delta g}{g}=\frac{\Delta l}{l}+2\frac{\Delta T}{T}$$

In option (d) error in Δg is minimum and number of observations made are maximum. Hence, in this case error in g will be minimum.

437 **(c)**

Tension = $[M¿^{-2}]$,Surface Tension =$[MT^{-2}]$

438 **(c)**

Mean time period $T=2.00\,sec$

& Mean absolute error = $\Delta T=0.05\,sec$

To express maximum estimate of error, the time period

should be written as $(2.00\pm 0.05)\,sec$

439 **(d)**

Dimensions of $\beta^3=dimensions\ of\ density=[ML^{-3}]$

$$\beta=[M^{1/3}L^{-1}]$$

Also $\alpha=force\times density$

$$¿[MLT^{-2}][ML^{-3}]$$

$$¿[M^2L^{-2}T^{-2}]$$

440 **(b)**

One light year

$¿3\times 10^8$ m/s year

$¿\frac{3\times 10^8}{s}\times 365\times 24\times 60\times 60$s

$¿3\times 10^8\times 365\times 24\times 60\times 60$m

$¿9.461\times 10^{15}$m

441 **(d)**

The dimensional formula of

$$Work=Energy=Torque=[ML^2T^{-2}]$$

442 **(c)**

$$v=\frac{P}{2l}\left[\frac{F}{m}\right]^{1/2}$$

$$\Rightarrow v^2=\frac{P^2}{4l^2}\left[\frac{F}{m}\right]$$

$$\therefore m\propto\frac{F}{l^2v^2}$$

$$\Rightarrow[m]=\left[\frac{MLT^{-2}}{L^2T^{-2}}\right]=[ML^{-1}T^0]$$

443 **(b)**

New unit of mass is $\frac{1}{6.67\times 10^{-11}}$kg ie ,1.5×10^{10} kg.

444 **(b)**

$(2.3+0.035+0.035)$g=2.37 g

But we have to retain only one decimal place.

So, the total mass is 2.4 g.

447 **(a)**

Power = $\frac{Energy}{Time}$

448 **(d)**

$P=\frac{F}{A}=\frac{F}{l^2}$, so maximum error in pressure (P)

¿¿

$¿4\%+2\times2\%=8\%$

449 **(d)**

$\frac{Energy}{mass\times length}=\frac{[ML^2T^{-2}]}{[M][L]}=[LT^{-2}]$

450 **(a)**

Since percentage increase in length =2%

Hence, percentage increase in area if square sheet $=2\times2\%=4\%$

451 **(c)**

Maximum percentage error in $P=4\%+2\times2\%$

$¿8\%$

452 **(c)**

$Impulse=Force\times time=(kg-m/s^2)\times s=kg\text{-}m/s$

453 **(b)**

$1\,dyne=10^{-5}\,newton,1\,cm=10^{-2}\,m$

$70\frac{dyne}{cm}=\frac{70\times10^{-5}}{10^{-2}}\frac{N}{m}$

$¿7\times10^{-2}\,N/m$

454 **(a)**

Here, $\frac{2\pi}{\lambda}(ct-x)$ is dimensionless. Hence, $\frac{ct}{\lambda}$ is also dimensionless and unit of ct is same as that of x. Therefore, unit of λ is same as that of x. Also unit of y is same as that of A, which is also the unit of x.

455 **(d)**

We know that

$$Q=\frac{KA(\theta_1-\theta_2)t}{d}$$

$$\Rightarrow K=\frac{Qd}{A(\theta_1-\theta_2)t}$$

So, the unit of $K=\frac{cal\times metre}{metre^2\times K\times sec}$

$¿\frac{cal}{m}.K.sec\ldots(i)$

And density $d=\frac{m}{V}$, where $m=¿$ mass, $V=¿$ volume.

So, the unit of $d=\frac{kg}{m^3}\ldots(ii)$

Also, we know that $Q=mc\Delta\theta$

$$\Rightarrow c=\frac{Q}{m.\Delta\theta}$$

So, the unit of $c=\frac{cal}{kg.K}\ldots(iii)$

Hence, the unit of $X=\frac{K}{dc}$

On putting the values of unit from Eqs. (i), (ii) and (iii), the unit of

$$X=\frac{cal/mK-sec}{kg/m^3\times cal/kg.K}$$

$$\Rightarrow=m^2/s$$

So, the unit of X in CGS system is cm^2s^{-1}.

456 **(b)**

The action of impulse is to change the momentum of a body or particle and the impulse of force is equal to the change in momentum.

Thus, the dimensions of impulse are same as that of momentum.

457 **(b)**

$y=r\sin(\omega t-kx)$

There $\omega t=¿$angle $\therefore\omega=\frac{1}{T}=T^{-1}$

Similarly $kx=¿$angle $\therefore k=\frac{1}{x}=L^{-1}$

$\therefore\frac{\omega}{k}=\frac{[T^{-1}]}{[L^{-1}]}=[LT^{-1}]$

458 **(a)**

Energy density $¿\frac{Energy}{Volume}=\frac{ML^2T^{-2}}{L^3}=[ML^{-1}T^{-2}]$

Young' s modulus

$¿\frac{Stress}{Strain}=\frac{ML^{-1}T^{-2}}{M^0L^0T^0}=[ML^{-1}T^{-2}]$

Both have the same dimensions

460 **(b)**

Solar constant is energy received per unit area per unit time i.e. $\frac{[ML^2T^{-2}]}{[L^2][T]}=[M¿¿1T^{-3}]¿$

461 **(c)**

According to Faraday's first law of electrolysis,

$m=Zq$ or $Z=\frac{m}{q}$, so, SI unit of Z is kg C^{-1}

462 **(c)**

$Curie=disintegration/second$

464 **(b)**

$\frac{Energy}{Volume}=\frac{ML^2T^{-2}}{L^3}=[ML^{-1}T^{-2}]=¿$ Pressure

465 **(c)**

Impulse = change in momentum so dimensions of both quantities will be same and equal to MLT^{-1}

466 **(b)**

In general, moment (M) of force (F) is

$M=r\times F$

$\therefore$ Dimensions of $M=[L][MLT^{-2}]$

$¿[ML^2T^{-2}]$

468 **(c)**

S_{nth} represents the distance covered in nth sec.

469 **(c)**

According to Stefan's law, the energy radiated per second or power radiated is given by

$P=\sigma AT^4$

$\therefore\sigma=\frac{P}{AT^4}$

Therefore, unit of $\sigma=\frac{W}{m^2K^4}=Wm^{-2}K^{-4}$

470 **(c)**

Light year is a distance which light travels in one year

471 **(c)**

We can derive this equation from equations of motion so it is numerically correct

$S_1=¿$distance trvelled in t^{th} second =

$\frac{Distance}{time}=[LT^{-1}]$

$u=¿$ velocity $=[LT^{-1}]$ and $\frac{1}{2}a(2t-1)=[LT^{-1}]$

As dimensions of each term in the given equation are same, hence equation is dimensionally correct also

472 **(a)**

$\frac{h}{I}=\left[\frac{ML^2T^{-1}}{ML^2}\right]=[T^{-1}]$

474 **(b)**

Gravitational potential $¿\frac{work}{mass}$

Hence, SI unit gravitational potential

$¿\frac{unit\ of\ work}{unit\ of\ mass}$

$¿\frac{J}{kg}=Jkg^{-1}\vee ms^{-2}$

476 **(d)**

Volume $\times r^3$

So, error is $3\times2\%=6\%$

477 **(b)**

Volume $¿(2.1\times10^{-2})^3m^3=9.261\times10^{-6}m^3$.

Rounding off two significant figures, we get $9.3\times10^{-6}m^3$.

479 **(b)**

Power$¿\frac{Work}{Time}$

$\therefore$ [Power] $¿\frac{[Work]}{[Time]}=\frac{[ML^2T^{-2}]}{[T]}$

$¿[ML^2T^{-3}]$

480 **(d)**

$\because$ Density,$\rho=\frac{M}{V}=\frac{M}{\pi\gamma^2L}$

$\Rightarrow\frac{\Delta\rho}{\rho}=\frac{\Delta M}{M}+2\frac{\Delta r}{r}+\frac{\Delta L}{L}$

$¿\frac{0.003}{0.3}+2\times\frac{0.005}{0.5}+\frac{0.06}{6}$

$¿0.01+0.02+0.01=0.04$

$\therefore Percentage\,error=\frac{\Delta\rho}{\rho}\times100=0.04\times100=4\%$

481 **(d)**

Dimensions of $\varepsilon_0=[M^{-1}L^{-3}T^4A^2]$

Dimensions of $L=[L]$

Dimensions of $\Delta V=[ML^2T^{-3}A^{-1}]$

Dimensions of $\Delta t=[T]$

As $X=\varepsilon_0 L\frac{\Delta V}{\Delta t}$

Dimensions of

$X=\frac{[M^{-1}L^{-3}T^4A^2][L][ML^2T^{-3}A^{-1}]}{[T]}$

$¿[A]$

483 **(d)**

$CV^2=Energy$

The dimensional formula is $[ML^2T^{-2}]$.

484 **(c)**

$x=\frac{1\,gcm\,s^{-1}}{T^2}=\frac{1\,gcm\,s^{-1}}{1\,kg\times1\,m\,s^{-1}\times1\,s}$

$¿\frac{1\,gcm\,s^{-1}}{10^3g\times10^2cm\,s^2\times1\,s}=10^{-5}$

485 **(d)**

$e=\frac{Ldi}{dt}\Rightarrow[e]=[ML^2T^{-2}A^{-2}]\left[\frac{A}{T}\right]$

$[e]=[ML^2T^{-2}Q^{-1}]$

486 **(c)**

$\omega=\frac{d\theta}{dt}=[T^{-1}]$ and frequency $[n]=[T^{-1}]$

487 **(d)**

Poisson's ratio is a unitless quantity

488 **(b)**

$1\,kW\,h=1\times10^3\times3600\,W\times sec=36\times10^5\,J$

489 **(a)**

Required time $¿\frac{5000\times86400\times365.25}{10^{11}}s=1.6\,s$

490 **(b)**

$RC=T$

$\because[R]=ML^2T^{-3}A^{-2}¿$ and $[C]=[M^{-1}L^{-2}T^4A^2]$

491 **(c)**

Given equation is dimensionally correct because both sides are dimensionless but numerically wrong because the correct equation is $\tan\theta=\frac{v^2}{rg}$

492 **(a)**

Percentage error in $X=a\alpha+b\beta+c\gamma$

493 **(a)**

Couple = Force × Arm length =

$[MLT^{-2}][L]=[ML^2T^{-2}]$

494 **(d)**

$v=\sqrt{\frac{T}{m}}=\left[\frac{m'g}{\frac{M}{t}}\right]^{1/2}=\left[\frac{m'lg}{M}\right]^{1/2}$

It follows from here, $\frac{\Delta v}{v}=\frac{1}{2}\left[\frac{\Delta m'}{m}+\frac{\Delta l}{l}+\frac{\Delta M}{M}\right]$

$¿\frac{1}{2}\left[\frac{0.1}{3.0}+\frac{0.001}{1.000}+\frac{0.1}{2.5}\right]$

$¿\frac{1}{2}[0.03+0.001+0.04]$

$¿0.036$

Percentage error in the measurement=3.6

495 **(c)**

Given, voltage $V=(100\pm5)\,volt$,

Current $I=(10\pm0.2)\,A$

From Ohm's law $V=IR$

$\therefore Resistance\,R=\frac{V}{I}$

Maximum percentage error in resistance

$\left(\frac{\Delta R}{R}\times100\right)=\left(\frac{\Delta V}{V}\times100\right)+\left(\frac{\Delta I}{I}\times100\right)$

$¿\left(\frac{5}{100}\times100\right)+\left(\frac{0.2}{10}\times100\right)$

¿5+2=7%

496 **(b)**

By substituting the dimension of given quantities

$[ML^{-1}T^{-2}]^x[MT^{-3}]^y[LT^{-1}]^z=[MLT]^0$

By comparing the power of M, L, T in both sides

$x+y=0$ ...(i)

$-x+z=0$ …(ii)

$-2x-3y-z=0$ …(iii)

The only values of x, y, z satisfying (i), (ii) and (iii) corresponds to (b)

497 **(c)**

Solar constant ¿ $\frac{energy}{cm^2 min}$

∴The dimensions of solar constant

¿ $\frac{[ML^2T^{-2}]}{[L^2T]}=[ML^0T^{-3}]$

498 **(a)**

$[a]=[T^2]$ and $[b]=\frac{[a-t^2]}{[P][X]}=\frac{T^2}{[ML^{-1}T^{-2}][L]}$

$\Rightarrow [b]=[M^{-1}T^4]$

So $\left[\frac{a}{b}\right]=\frac{[T^2]}{[M^{-1}T^4]}=[MT^{-2}]$

499 **(c)**

Both are the formula of energy.

$\left(E=\frac{1}{2}CV^2=\frac{1}{2}LI^2\right)$

500 **(b)**

Let $m \propto E^x v^y F^z$

By substituting the following dimensions:

$E=[ML^2T^{-2}], [v]=[LT^{-1}], [F]=[MLT^{-2}]$

and by equating the both sides

$x=1, y=-2, z=0$. So $[m]=[Ev^{-2}]$

501 **(b)**

As $x=k a^m \times t^n$

$[M^0LT^0]=[LT^{-2}]^m[T]^n=[L^mT^{-2m+n}]$

$\therefore m=1$ and $-2m+n=0 \Rightarrow n=2$

502 **(a)**

$E=[ML^2T^{-2}], G=[M^{-1}L^3T^{-2}], I=[MLT^{-1}]$

$\therefore \frac{GIM^2}{E^2}=\frac{[M^{-1}L^3T^{-2}][MLT^{-1}][M^2]}{[ML^2T^{-2}]^2}=[T]$

503 **(c)**

Least count ¿ $\frac{Pitch}{No.of \div . \in circular\,scale}$

¿ $\frac{0.5}{50}=0.01\,mm$

Actual reading ¿ $0.01\times 35+3=3.35\,mm$

Taking error into consideration

¿ $3.35+0.03=3.38\,mm$

504 **(a)**

Given that,

Time period, $T\propto p^a d^b E^c \ldots (i)$

The dimensions of these quantities are given as

$p=[M\,L^{-1}T^{-2}]$

$d=[M\,L^{-3}]$

$E=[M\,L^2T^{-2}]$

In Eq. (i), on writing the dimensions on both sides.

$[M^0L^0T]\propto[ML^{-1}T^{-2}]^a[ML^{-3}]^b[M\,L^2T^{-2}]^c$

$\Rightarrow[M^0L^0T]\propto[M^{a+b+c}L^{-a-3b+2c}T^{-2a-2c}]$

On comparing the powers of M, L, T on both sides.

$\Rightarrow a+b+c=0\ldots(ii)$

$-a-3b+2c=0\ldots(iii)$

$-2a-2c=1\ldots(iv)$

Solving, we get value of

$a,b\wedge c,-\frac{5}{6},\frac{\frac{1}{2}\wedge 1}{3}\,repectively.$

505 **(b)**

According to question

$F=\propto m^a v^b r^c$

$F=k\,m^a v^b r^c$

k, being a dimensionless constant.

From homogeneity of dimensions,

LHS=RHS

$[ML\,T^{-2}]=[M]^a[L\,T^{-1}]^b[L]^c$

Or $[ML\,T^{-2}]=[M^aL^{b+c}T^{-b}]$

Comparing the powers, we obtain

$a=1$

$b+c=1$

$-b=-2\Rightarrow b=2$

$\therefore 2+c=1$

$\Rightarrow c=-1$

Therefore, $F=km\,v^2r^{-1}=\frac{km\,v^2}{r}$

The experimental value of k is found to be 1 here

$\therefore F=\frac{m\,v^2}{r}$

507 **(d)**

$F=\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q_1Q_2}{r^2}$

$\Rightarrow\varepsilon_0\propto\frac{Q^2}{F\times r^2}$

So ε_0 has units of $coulomb^2/newton-m^2$

508 **(b)**

The difference in the sidereal year and solar year is about 1 day (¿ $24\times 60=1440\,min$)

∴ Difference in sidereal day and solar day is about

$\frac{1440}{365}\cong 4\,min$

$i.e.$, sidereal day is $4\,min$ smaller than the solar day

509 **(c)**

$Y=\frac{F}{A}\cdot\frac{L}{\Delta L}=\frac{dyne}{c\,m^2}=\frac{10^{-5}\,N}{10^{-4}\,m^2}=0.1\,N/m^2$

510 **(a)**

Dimensions of Planck's constant

$h=Dimensions\,of\,\frac{E}{v}$

¿ $\frac{[M\,L^2T^{-2}]}{[T^{-1}]}=[M\,L^2T^{-1}]$

Dimensions of angular momentum

¿ $Dimension\,of\,mvr$

¿ $[ML\,T^{-1}].[L]$

¿ $[M\,L^2T^{-1}]$

511 **(a)**

By substituting the dimensions in $T=2\pi\sqrt{\frac{R^3}{GM}}$ ¿ ¿ we

get $\sqrt{\frac{L^3}{M^{-1}L^3T^{-2}\times M}}=T¿$
¿

512 **(d)**

ct^2 must have dimensions of L

$\Rightarrow c$ must have dimensions of $L/T^2 i.e. LT^{-2}$

513 **(d)**

$1T=1\ Wbm^{-2}$

514 **(c)**

% error in velocity = % error in $L+$%error in t

$¿\frac{0.2}{13.8}\times 100+\frac{0.3}{4}\times 100$

$¿1.44+7.5=8.94\%$

515 **(c)**

Zero error $¿5\times\frac{0.5}{50}=0.05\,mm$

Actual measurement

$¿2\times 0.5\,mm+25\times\frac{0.5}{50}-0.05\,mm$

$¿1\,mm+0.25\,mm-0.05\,mm=1.20\,mm$

516 **(d)**

Angular momentum,

$[J]=[I\omega]=[ML^2T^{-1}]$

Planck's constant, $[h]=\frac{[E]}{[v]}=[ML^2T^{-1}]$

517 **(d)**

$n_2=n_1\left[\frac{L_1}{L_2}\right]^1\left[\frac{T_1}{T_2}\right]^{-2}=10\left[\frac{m}{km}\right]^2\left[\frac{sec}{hr}\right]^{-2}$

$n_2=10\left[\frac{m}{10^3 m}\right]^1\left[\frac{sec}{3600\,sec}\right]^{-2}=129600$

518 **(d)**

Strain has no dimensions

519 **(b)**

Here αt^2 is a dimensionless. Therefore, $\alpha=\frac{1}{t^2}$ and has the dimension of $[T^{-2}]$.

520 **(a)**

$F=\frac{dp}{dt}\Rightarrow dp=Fdt$

521 **(a)**

Formula for viscosity $\eta=\frac{\pi p r^4}{8Vl}\Rightarrow V=\frac{\pi p r^4}{8\eta l}$

522 **(b)**

$V=\frac{W}{m}$ so, SI unit = $\frac{joule}{kg}$

523 **(a)**

$W=\frac{1}{2}kx^2\Rightarrow[k]=\frac{[W]}{[x^2]}=\left[\frac{ML^2T^{-2}}{L^2}\right]=[MT^{-2}]$

524 **(a)**

Angle of banking: $\tan\theta=\frac{v^2}{rg}$. i.e. $\frac{v^2}{rg}$ is dimensionless

525 **(a)**

Given, $a=3bc^2$

$\Longrightarrow b=\frac{a}{3c^2}$

Writing dimensions for a and c, we have

$[b]=\frac{[Q/V]}{[B]^2}=\frac{[Q][ML^2T^{-2}Q^{-1}]}{[MT^{-1}Q^{-1}]^2}$

$¿[M^{-3}L^{-2}T^4Q^4]$

526 **(b)**

[Pressure]=[stress]= $[ML^{-1}T^{-2}]$

528 **(a)**

Stefan's constant

$\sigma=\frac{Energy}{Area\times Time\times(Temperature)^4}$

$\therefore\sigma=\frac{[ML^2T^{-2}]}{[L^2][T][K]^4}=[ML^0T^{-3}K^{-4}]=[MT^{-3}K^{-4}]$

529 **(b)**

Magnetic energy $¿\frac{1}{2}Li^2=\frac{LQ^2}{2t^2}$

$[L=inductance, i=current.]$

Energy has the dimensions $¿[ML^2T^{-2}]$.

Equate the dimensions, we have

$[ML^2T^{-2}]=(henry)\times\frac{[Q^2]}{[T^2]}$

$\Rightarrow[henry]=\frac{[ML^2]}{[Q^2]}$

530 **(c)**

$F \propto v \Rightarrow F = kv$

$k = \frac{F}{v} \Rightarrow [k] = \frac{[kgm\,s^{-2}]}{[m\,s^{-1}]} = kg\,s^{-1}$

531 **(a)**

$\rho = \frac{RA}{l}$ $i.e.$ dimension of resistivity is [

$M L^3 T^{-1} Q^{-2}$¿

532 **(a)**

Momentum = $mv = [M\,L T^{-1}]$

Impulse = Force× Time = [

$ML\,T^{-2}$¿ $\times [T] = [ML\,T^{-1}]$

534 **(a)**

In given equation, $\frac{\alpha z}{k\theta}$ should be dimensionless

$\therefore \alpha = \frac{k\theta}{z}$

$\Rightarrow [\alpha] = \frac{[M L^2 T^{-2} K^{-1} \times K]}{[L]} = [ML\,T^{-2}]$

And $P = \frac{\alpha}{\beta}$

$\Rightarrow [\beta] = \left[\frac{\alpha}{P}\right] = \frac{[ML\,T^{-2}]}{[M\,L^{-1} T^{-2}]}$

$\Rightarrow [\beta] = [M^0 L^2 T^0]$

535 **(c)**

$[x] = [b\,t^2] \Rightarrow [b] = [x/t^2] = km/s^2$

537 **(a)**

$[h] = [M\,L^2 T^{-1}]$

$[c] = [L\,T^{-1}]$

$[G] = [M^{-1} L^3 T^{-2}]$

538 **(b)**

$L \propto v^x A^y F^z \Rightarrow L = k\,v^x A^y F^z$

Putting the dimensions in the above relation

$[M\,L^2 T^{-1}] = k[LT^{-1}]^x [LT^{-2}]^y [MLT^{-2}]^z$

$\Rightarrow [M\,L^2 T^{-2}] = k[M^z L^{x+y+z} T^{-x-2y-2z}]$

Comparing the powers of M, L and T

$z = 1$ …(i)

$x + y + z = 2$ …(ii)

$-x - 2y - 2z = -1$ …(iii)

On solving (i), (ii) and (iii) $x = 3, y = -2, z = 1$

So dimension of L in terms of v, A and f

$[L] = [F\,v^3 A^{-2}]$

539 **(d)**

The number of significant figures in all of the given number is 4

540 **(c)**

Linear momentum ¿$[ML\,T^{-1}]$

Angular momentum ¿$[M\,L^2 T^{-1}]$

541 **(a)**

Henry is a unit of coefficient of self induction (L)

Dimension of coefficient of self induction

¿$[M\,L^2 T^{-2} A^{-2}] = [M\,L^2 Q^{-2}]$

542 **(c)**

$\frac{[planc\,k'\,s\,constant]}{[linear\,momentum]} = \frac{[M\,L^2 T^{-1}]}{[MLT^{-1}]} = [M^0 L\,T^0]$

543 **(d)**

$E = F/q$ = Newton/coulomb

545 **(a)**

Using the relation $R = \frac{pV}{\theta}$

Dimensions of gas constant R

¿ $\frac{dimensions\,of\,pressure \times dimensions\,of\,volume}{dimension\,of\,temperature}$

¿ $\frac{[M\,L^{-1} T^{-2}][L^3]}{\theta}$

¿$[M\,L^2 T^{-2} \theta^{-1}]$

546 **(c)**

New unit of distance = speed in new units × 500 s

547 **(b)**

$\frac{watt}{ampere} = volt$

548 **(b)**

By Stefan's law,

$E = \sigma T^4$

Where σ is the Stefan's constant

$\sigma = \frac{E}{T^4}$

$[\sigma]=\frac{[E]}{T^4}=\frac{[ML^2T^{-2}]}{[K^4]}$

¿ $[ML^2T^{-2}K^{-4}]$

549 **(a)**

RD¿ $\frac{w_1}{w_1-w_2}, \frac{\Delta(RD)}{RD}\times 100$

¿ $\frac{\Delta w_1}{w_1}\times 100+\frac{D(w_1-w_2)}{w_1-w_2}\times 100$

¿ $\frac{0.05}{5.00}\times 100+\frac{0.05+0.05}{1.00}\times 100=1+10=11\%$

550 **(d)**

$Y=\frac{X}{3Z^2}=\frac{M^{-1}L^{-2}T^4A^2}{[MT^{-2}A^{-1}]^2}=[M^{-3}L^{-2}T^8A^4]$

551 **(d)**

Time period of a simple pendulum is

$T=2\pi\sqrt{\frac{L}{g}}\Rightarrow g=\frac{4\pi^2L}{T^2}$

$\therefore \frac{\Delta g}{g}\times 100=\left(\frac{\Delta L}{L}+2\frac{\Delta T}{T}\right)\times 100=1\%+2\times 2\%=$

553 **(a)**

$Q=[ML^2T^{-2}]$ (All energies have same dimensions)

554 **(d)**

Surface tension is defined as the force per unit length and hence its unit is newton $metre^{-1}$ or $N m^{-1}$

555 **(c)**

The dimensions of angular momentum are

$J=[ML^2T^{-1}]$

When units of mass, length and time are doubled, than

$J'=[2M(2L)^2(2T)^{-1}]$

$\Rightarrow J'=4[ML^2T^{-1}]=4J$

Unit of angular momentum is quadrupled.

556 **(c)**

As $I=MR^2=kg-m^2$

557 **(d)**

$e=L\frac{di}{dt}\Rightarrow[e]=[ML^2T^{-2}A^{-2}]\left[\frac{A}{T}\right]$

$[e]=\left[\frac{ML^2T^{-2}}{AT}\right]=[ML^2T^{-2}Q^{-1}]$

558 **(c)**

$\frac{\Delta l}{l}\times 100=\frac{0.01}{15.12}\times 100=0.07,$

$\frac{\Delta b}{b}\times 100=\frac{0.01}{10.15}\times 100=0.1,$

$\frac{\Delta t}{t}\times 100=\frac{0.01}{5.28}\times 100=0.2$

Required percentage ¿ $0.07+0.1+0.2=0.37\%$

559 **(b)**

The height of a tree, building tower, hill etc, can be determined with the help of a sextant.

561 **(c)**

$V=2.34\times 11.11111$ volt ¿ 26.0 volt.

[Because the final result should contain three significant figure.]

562 **(d)**

Charge ¿ $Current\times Time=[AT]$

563 **(b)**

Time constant in an $R-C$ circuit

$\tau=R-C$

$[\tau]=[R][C]$

¿ $[ML^2T^{-3}A^{-2}][M^{-1}L^{-2}T^4A^2]$

¿ $[M^0L^0T]$

564 **(b)**

$Force=Mass\times acceleration$

$\therefore$ Dimensions of force ¿ $[M][LT^{-2}]=[MLT^{-2}]$

$Power=\frac{Work}{Time}$

$\therefore$ Dimensions of power ¿ $\frac{[ML^2T^{-2}]}{[T]}=[ML^2T^{-3}]$

$Torque=Force\times displacement$

$\therefore$ Dimensions of torque

¿ $[MLT^{-2}][L]=[ML^2T^{-2}]$

And dimensions of energy ¿ $[ML^2T^{-2}]$

Hence, torque and energy have same dimensions.

565 **(d)**

The number of significant figures in all of the given numbers is 4.

566 **(b)**

Power of lens $P=\frac{1}{f}$

$\therefore[P]=\frac{1}{[f]}=\frac{1}{[L]}=[M^0L^{-1}T^0]$

567 **(a)**

Dimension of $\alpha t=[M^0L^0T^0]\therefore[\alpha]=[T^{-1}]$

Again $\left[\frac{v_0}{\alpha}\right]=[L]$ so $[v_0]=[LT^{-1}]$

568 **(c)**

$KE=\frac{1}{2}mv^2$

$\therefore[KE]=[M][LT^{-1}]^2=[ML^2T^{-2}]$

569 **(a)**

Physical quantity$(p)=¿$ Numerical value $(n)\times Unit\,(u)$

If physical quantity remains constant then $n\propto 1/u$

$\therefore n_1u_1=n_2u_2$

570 **(b)**

Pyrometer is used the for measurement for temperature

571 **(c)**

Force $\vec{F}=q\vec{v}\times\vec{B}$

Or $F=qvB\sin\theta$

$\therefore[B]=\left[\frac{F}{qv}\right]=\frac{[MLT^{-2}]}{[ATLT^{-1}]}=[MT^{-2}A^{-1}]$

572 **(d)**

Velocity gradient $¿\frac{v}{x}=\frac{[LT^{-1}]}{[L]}=[T^{-1}]$

Potential gradient

$¿\frac{V}{x}=\frac{[ML^2T^{-3}A^{-1}]}{[L]}=[MLT^{-3}A^{-1}]$

Energy gradient $¿\frac{E}{x}=\frac{[ML^2T^2]}{[L]}=[MLT^{-2}]$

And pressure gradient

$¿\frac{P}{x}=\frac{[ML^{-1}T^{-2}]}{[L]}=[ML^{-2}T^{-2}]$

573 **(a)**

Volume of cube $=a^3$

Surface area of cube = $6a^2$

according to problem $a^3=6a^2\Rightarrow a=6$

$\therefore V=a^3=216\,units$

574 **(b)**

In mathematical operation, involving addition the result would be correct up to minimum number of decimal places in any of the quantity involve.

Given, L=2.3331 cm and B=2.10 cm.

Taking correct up to decimal places and since, can be rounded off less than 5, the preceding digit is unaffiliated.

$\therefore L=2.33\,cm, B=2.10\,cm$

$L+B=2.33+2.10=4.43\,cm$

575 **(a)**

The mass of electron $¿\frac{9.1\times10^{-31}}{1.67\times10^{-27}}$

$\therefore E=\frac{9.1\times10^{-31}}{1.67\times10^{-27}}\times931\text{MeV}$

$¿0.5073$ MeV

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