Single Correct Answer Type

1. The oxygen carrying pigment, oxy-haemocyanin, containing two copper ions is diamagnetic, because
   a) The two copper ions are in $+1$ oxidation state
   b) One of the copper ions is in $+1$ oxidation state and the other is in $+2$ oxidation state
   c) There are strong anti-ferromagnetic interactions between the two copper ions
   d) There are ferromagnetic interactions between the two copper ions
2. Select the correct statement
   a) $ZnSO_4 \cdot 7H_2O$ is called epsom salt
   b) $ZnSO_4 \cdot 7H_2O$ is isomorphous with Glauber's salt
   c) $ZnSO_4 \cdot 7H_2O$ with BaS is called lithopone
   d) All the above are correct statement
3. Which of the following is paramagnetic as well as coloured ion?
   a) Cu^+ b) Cu^{2+} c) Sc^{3+} d) Ti^{4+}
4. Which one of the following nitrates will leave behind a metal on strong heating?
   a) Ferric nitrate b) Copper nitrate c) Manganese nitrate d) Silver nitrate
5. Out of $SiCl_4, TiCl_4, PO_4^{3-}, SO_4^{2-}, CrO_4^{2-}, CCl_4$ isostructural are
   a) $SiCl_4, TiCl_4$ b) SO_4^{2-}, CrO_4^{2-} c) Both (a) and (b) d) None of these
6. Ln^{3+} (trivalent lanthanides ions) have EC
   a) $[Xe]4f^1$ to $[Xe]4f^{14}$ b) $[Xe]4d^14f^1$ to $[Xe]4d^1\ 4f^{14}$
   c) $[Xe]4d^2\ 4f^0$ to $[Xe]4d^1\ 4f^{14}$ d) $[Xe]4f^0$ to $[Xe]4f^{14}$
7. Stainless steel is an alloy of
   a) Cu b) Ni and Cr c) Mn d) Zn
8. Hypo ($Na_2S_3O_3$)
   a) Dissolves AgBr in photographic plate
   b) Gives white precipitate with $AgNO_3$; white precipitate changes to black on dilution
   c) Gives both reactions
   d) Gives none of the above reactions
9. Calomel (Hg_2Cl_2) on reaction with ammonium hydroxide gives
   a) HgO b) Hg_2O c) $NH_2 - Hg - Hg - Cl$ d) $HgNH_2Cl$
10. Which forms protective and non-corrosive oxide layer?
    a) Cr b) Ni c) Zn d) Cu
11. What are the species A and B in the following
    $CrO_3 + H_2O \rightarrow A \xrightarrow{OH^-} B$?
    a) $H_2CrO_4, H_2Cr_2O_7$ b) $H_2Cr_2O_7, Cr_2O_3$ c) $CrO_4^{2-}, Cr_2O_7^{2-}$ d) $H_2Cr_2O_7, CrO_4^{2-}$
12. The metal present in vitamin B_{12} is
    a) Cobalt b) Iron c) Manganese d) Magnesium
13. Of the following transition metals, the maximum number of oxidation states are exhibited by
    a) Chromium ($Z = 24$) b) Manganese ($Z = 25$) c) Iron ($Z = 26$) d) Titanium ($Z = 22$)
14. The correct order of ionic radii of Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is
    (Atomic number of $Y = 39, La = 57, Eu = 63, Lu = 71$)
    a) $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$ b) $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$
    c) $Y^{3+} < La^{3+} < Eu^{3+} > Lu^{3+}$ d) $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$
15. Coagulation of blood takes place by
    a) Ferric alum b) Potash alum c) Both (a) and (b) d) None of these
16. $KMnO_4$ spot can be bleached by
    a) H_2O_2/H^+ b) SO_2/H^+ c) $C_2O_4^{2-}/H^+$ d) All of these
17. If $FeCl_3 \cdot 6H_2O$ would exist as a complex, one mole of it in aqueous solution on reaction with excess of

$AgNO_3$ forms

a) 1 mole of AgCl (white precipitate) b) 2 moles of AgCl

c) 3 moles of AgCl d) No reaction

18. A certain metal will liberate hydrogen from dilute acids. It will react with water to form hydrogen only when the metal is heated and the water is in the form of steam. The metal is probably

a) Iron b) Potassium c) Copper d) Mercury

19. Most transition metals

I. forms sets of compounds which display different oxidation states of the metal

II. form coloured ions in solution

III. burn vigorously in oxygen

IV. replace H_2 from dilute acids

a) I, II, III are correct b) II, III, IV and correct c) I, II are correct d) All are correct

20. On passing Cl_2 gas into alkaline hydrated Fe_2O_3 solution

a) Red purple solution of Na_2FeO_4 is formed

b) Colourless $NaFeO_2$ is formed due to dissolution of Fe_2O_3 into NaOH

c) $Fe(OH)_3$ is formed

d) No reaction takes place

21. The number of moles of $KMnO_4$ reduced by one mole of KI in alkaline medium is

a) One fifth b) Five c) One d) Two

22. The electronic configuration of (Gd) (At. no. 64) is

a) $[Xe]4f^8, 5d^9, 6s^2$ b) $[Xe]4f^7, 5d^1, 6s^2$ c) $[Xe]4f^6, 5d^2, 6s^2$ d) $[Xe]4f^3, 5d^3, 6s^2$

23. Iron is dropped in very dil. HNO_3, it gives

a) Ferric nitrate b) Ferric nitrate and NO_2

c) Ferrous nitrate and ammonium nitrate d) Ferrous nitrate and nitric oxide

24. The element Ds lies in

a) s-block b) p-block c) d-block d) f-block

25. The reactivity of transition elements decreases with

a) The decrease in the atomic number b) The increase in the atomic umber

c) Low heat of hydration d) None of the above

26. Which of the following is used as purgative?

a) Hgs b) Hg_2Cl_2 c) $HgCl_2$ d) $ZnSO_4$

27. Which of the following are sets of diamagnetic species?

a) $TiCl_4, O_2, [Ni(CN)_4]^{2-}, [Ni(H_2O)_4]^{2+}$ b) $TiCl_4, [Ni(CN)_4]^{2-}, CO, [Ni(H_2O)_4]^{2+}$

c) $TiCl_4, [Ni(CN)_4^{2-}], CO$ d) $TiCl_4, [Ni(CN)_4]^{2-}, O_2$

28. Which forms interstitial compound?

a) Fe b) Co c) Ni d) All of these

29. Europium is

a) s-block element b) p-block element c) d-block element d) f-block element

30. Which of the following is not an actinoid?

a) Am b) Cm c) Fm d) Tm

31. The methods chiefly used for the extraction of lead and tin from their ores are respectively

a) Self reduction and carbon reduction b) Self reduction and electrolytic reduction

c) carbon reduction and self reduction d) Cyanide process and carbon reduction

32. Cementite is

a) Interstitial compound of iron and carbon b) An alloy of Fe and Cr

c) A compound resembling cement d) An ore of iron

33. Which is the correct statement?

a) Ammoniacal CuCl is used to measure the amount of CO in gas samples

b) Ammoniacal CuCl gives red ppt with $CH \equiv CH$

c) Both (a) and (b) are correct

d) None of the above is correct

34. The diamagnetic species is
a) $[Ni(CN)_4]^{2-}$ b) $[NiCl_4]^{2-}$ c) $[CoCl_4]^{2-}$ d) $[CoF_6]^{2-}$

35. Rust contains $Fe_2O_3 \cdot H_2O$. Rust spots can be removed by
a) $Na_2S_2O_3$ (hypo) b) SO_2 c) $H_2C_2O_4$ (oxalic acid) d) $KMnO_4$

36. Which of the following exists as white salt in anhydrous state?
a) CuF_2 b) $CuSO_4$ c) Both (a) and (b) d) None of theses

37. When $(A)NH_4VO_3$ is heated
$(B)(NH_4)_2Cr_2O_7$ is heated
a) In both cases N_2 is formed b) In both cases NH_3 is formed
c) In $(A)NH_3$ and in $(B)N_2$ are formed d) In $(A)N_2$ and in $(B)NH_3$ are formed

38. Which is the correct statement?
a) In less acidic solution $K_2Cr_2O_7$ and H_2O_2 give violet coloured diamagnetic $[CrO(O_2)(OH)]^-$ ion
b) In alkaline H_2O_2, K_3CrO_8 (with tetraperoxo species) $[Cr(O_2)_4]^{3-}$ is formed
c) In ammoniacal solution, $K_2Cr_2O_7$ gives $(NH_3)_3CrO_4$
d) All of the above are correct statements

39. Sugar in urine sample can be detected by
I. Fehling's solution
II. Benedict's solution
III. Tollen's solution
Select the correct alternate
a) I, II, III b) I, III c) I, II d) II, III

40. Haemoglobin and chlorophyll contain respectively
a) Fe, Co b) Fe, Mn c) Mg, Fe d) Fe, Mg

41. Traces of MnO_4^- in conc. H_2SO_4 may change to
a) $Mn_2O_7^-$ b) MnO_3^+ c) MnO_2 d) MnO_4^{2-}

42. Which is not blackened by atmosphere H_2S?
a) $Pb(CH_3COO)_2$ b) $Zn(CH_3COO)_2$ c) $Cu(CH_3COO)_2$ d) $Hg(CH_3COO)_2$

43. In $[Fe(CN)_5(NO^+)]^{2-}$, Fe has +3 state. It can be decided by
a) Magnetic measurement b) Colligative property
c) Colour d) Hybridization

44. Which among the following is consumed by humans in the elemental form?
a) Cu b) Pb c) Ag d) Hg

45. Anhydrous ferric chloride is prepared by
a) Heating hydrated ferric chloride at a high temperature in a stream of air
b) Heating metallic iron in a stream of dry chlorine gas
c) Reaction of ferric oxide with HCl
d) Reaction of metallic iron with HCl

46. Select the correct relative stability
a) $[Cu(CN)_4]^{3-} > [Cd(CN)_4]^{3-}$ b) $PtCl_4^{2-} > NiCl_4^{2-}$
c) $[NiCl_6]^{2-} > [PtCl_6]^{2-}$ d) $[Cd(CN)_4]^{2-} > [Cu(CN)_4]^{3-}$

47. Which is wrongly matched?
a) Duralumin – Al + Cu + Mg + Mn b) Alnico – Fe + Al + Ni + Cu
c) German silver – Cu + Zn + Ni d) Monel metal – Cu + Zn + Sn

48. Which of the following is not correct?
a) $La(OH)_3$ is less basic than $Lu(OH)_3$
b) In lanthanide series ionic radius of Ln^{3+} ion decreases
c) La is actually an element of transition series rather lanthanide
d) Atomic radius of Zr and Hf are same because of lanthanide contraction

49. The atomic numbers of vanadium (V), chromium (Cr), manganese (Mn) and iron are respectively 23, 24,

25 and 26. Which one of these may be expected to have the highest second ionization enthalpy?

a) V b) Cr c) Mn d) Fe

50. In context with the transition elements, which of the following statements is incorrect?
    a) In addition to the normal oxidation state, the zero oxidation state is also shown by these elements in complexes.
    b) In the highest oxidation state, the transition metal shows basic character and form cationic complexes.
    c) In the highest oxidation state of the first five transition elements (Sc to Mn), all the $4s$ and $4d$ electrons are used for bonding.
    d) Once the d^5 configuration is exceeded, the tendency to involve all the $3d$ electrons in bonding decreases.
51. Ti^{2+} is purple while Ti^{4+} is colourless because
    a) There is no crystal field effect in Ti^{4+}
    b) Ti^{2+} has $3d^2$ configuration
    c) Ti^{4+} has $3d^2$ configuration
    d) Ti^4 is a very small cation when compared to Ti^{2+} and hence, does not absorb any radiation
52. In dilute alkaline solution MnO_4^- changes to
    a) MnO_4^{2-} b) MnO_2 c) Mn_2O_3 d) MnO
53. Among the following pair of ions, the lower oxidation state in aqueous solutions is more stable than the other in
    a) Ti^+, Ti^{3+} b) Cu^+, Cu^{2+} c) Cr^{2+}, Cr^{3+} d) V^{2+}, VO^{2+}
54. Interstitial compound is formed by
    a) Fe, Co b) Co, Ni c) Fe, Ni d) All of these
55. Which of the following compounds is amphoteric?
    a) $Cr(OH)_2$ b) $Fe(OH)_2$ c) $Cr(OH)_3$ d) $Fe(OH)_3$
56. $CuSO_4$ can be estimated volumetrically
    a) By reaction with KI followed by reaction with $Na_2S_2O_3$
    b) By reaction with $BaCl_2$
    c) By reaction with $K_4Fe(CN)_6$
    d) None of the above is correct
57. The atomic size of cerium and promethium is quite close, due to
    a) They are in same period in Periodic Table
    b) Their electronic configuration is same
    c) f-electrons have poor shielding effect
    d) Nuclear charge is higher on cerium than promethium
58. The basic and amphoteric oxides of transition metals are
    a) Soluble in oxidizing acids forming hexa-aquo ions $[MH_2O_6]^{n+}$
    b) Insoluble in oxidizing acids forming hexa-aquo ions $[M(H_2O)_6]^{n+}$
    c) Soluble in non-oxidising acids forming hexa-aquo ions $[M(H_2O)_6]^{n+}$
    d) Insoluble in non-oxidising acids forming hexa-aquo ions $[M(H_2O)_6]^{n+}$
59. Most common oxidation state of lanthanides is
    a) $+2$ b) $+3$ c) $+4$ d) $+5$
60. Which of the following alloys is used for making magnets for heating aids?
    a) Alnico b) German silver c) Invar d) Monel metal
61. Which of the following is not an actinide?
    a) Curium b) Californium c) Uranium d) Terbium
62. Select the correct statement
    a) PH_3 reduces $AgNO_3$ to metallic Ag
    b) Organic tissues turn $AgNO_3$ black by reducing it to Ag
    c) AgCN is soluble in KCN
    d) All of the above are correct statements

63. When MnO_2 is fused with KOH, a coloured compound formed, the product and its colour is
a) K_2MnO_4, purple colour b) $KMnO_4$, purple c) Mn_2O_3, brown d) Mn_3O_4, black
64. VO_2 is an amphoteric oxide and in acidic medium it forms
a) VO^{2+} b) VO_2^+ c) V^{3+} d) VO_2^{2+}
65. Which of the following does not react with AgCl?
a) NH_4OH b) $NaNO_3$ c) $Na_2S_2O_3$ d) Na_2CO_3
66. In acidic medium H_2O_2 changes $K_2Cr_2O_7$ to CrO_5 (deep violet solution in ether) having two peroxy linkage. Oxidation number of Cr in CrO_5 is
a) $+10$ b) -10 c) $+4$ d) $+6$
67. Solder is an alloy of
a) 70% lead, 30% tin b) 30% lead, 70% tin c) 80% lead, 20% tin d) 90% copper, 10% tin
68. In acidic medium MnO_4^{2-}
a) Disproportionates to MnO_2 and MnO_4^- b) Is oxidized to MnO_4^-
c) Is reduced to MnO_2 d) Is reduced to Mn^{2+}
69. Green vitriol is formed by
a) $FeS_2 + H_2O + O_2$ b) $FeS_2 + H_2O + CO_2$ c) $FeS_2 + CO + CO_2$ d) $FeS_2 + CO$
70. The lanthanide contraction is responsible for the fact that
a) Zn and Y have about the same radii
b) Zr and Nb have similar oxidation state
c) Zr and Hf have about the same radii
d) Zr and Zn have the same oxidation state
71. MnO_4^{2-} can be converted to MnO_4^-
a) By oxidation with Cl_2 b) By electrochemical oxidation at anode
c) By both (a) and (b) methods d) By none of the above methods
72. Bell-metal is an alloy of
a) Cu + Pb b) Cu + Sn c) Cu + Zn d) Cu + Ni
73. When KCN comes in contact with blood, one dies immediately, it is due to
a) CN^- forms stable complex with iron of haemoglobin of blood
b) CN^- combines with H_2O of blood causing it poison
c) Both (a) and (b) are correct
d) None of the above is correct
74. The ability of d-block elements to form complexes is due to
a) Small and highly charged ions
b) Vacant low energy orbitals to accept lone pair of electrons from ligands
c) Both (a) and (b) are correct
d) None of the above is correct
75. $K_2Cr_2O_7$ on heating with aqueous NaOH, gives
a) CrO_4^{2-} b) $Cr(OH)_3$ c) $Cr_2O_7^{2-}$ d) $Cr(OH)_2$
76. Fehling's solution consists of two separate alkaline solutions. One solution contains $CuSO_4$. The other solution contains
a) $NaHCO_3$ b) $KNaC_4H_4O_6$ c) $KHCO_3$ d) K_2CO_3
77. Aluminium appears like gold when mixed with
a) 90% Cu b) 75% Ni c) 80% Sn d) 80% Co
78. In $3d$ transition series, if nuclear charge increases, the screening effect
a) Increases b) Decreases
c) First decreases and then increases d) First increases and then decreases
79. Which of the following factors may be regarded as the main cause of lanthanide contraction?
a) Greater shielding of $5d$-electron by $4f$-electrons
b) Poorer shielding of $5d$-electron by $4f$-electrons
c) Effective shielding of one $4f$-electrons by another in the subshell

d) Poor shielding of one of $4f$-electrons by another in the subshell

80. Lanthanoids are
    a) 14 elements in the sixth period (atomic number $= 90$ to 103) that are filling $4f$-sublevel
    b) 14 elements in the seventh period (atomic no. $= 90$ to 103) that are filling $5f$-sublevel
    c) 14 elements in the sixth period (atomic no. $=58$ to 71) that are filling $4f$-sublevel
    d) 14 elements in the seventh period (atomic no. $= 58$ to 71) that are filling $4f$-sublevel
81. Finely divided iron combines with CO to give
    a) $Fe(CO)_5$ b) $Fe_2(CO)_9$ c) $Fe_2(CO)_{12}$ d) $Fe(CO)_6$
82. Cerium ($Z = 58$) is an important member of lanthanides. Which of the following statements about cerium is incorrect?
    a) The common oxidation states of cerium are $+3$ and $+4$
    b) The $+3$ oxidation states of cerium is more stable than the $+4$ state
    c) The $+4$ oxidation state of cerium is not known in solutions
    d) Cerium (IV) acts as an oxidizing agent
83. At pH $= 12$, $Cr_2O_7^{2-}$ changes to
    a) CrO_3 b) CrO_2^{2+} c) CrO_4^{2-} d) No change
84. Arrange VO_2^+, $Cr_2O_7^{2-}$ and MnO_4^- in increasing oxidizing power
    a) $MnO_4^- < Cr_2O_7^{2-} < VO_2^+$ b) $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$
    c) $VO_2^+ < MnO_4^- < Cr_2O_7^{2-}$ d) $Cr_2O_7^{2-} < MnO_4^- < VO_2^+$
85. Hg_2Cl_2 ionises as…. and cation bus….. unpaired electron(s)
    a) $2Hg^+$ and $2Cl^-$, two b) Hg_2^{2+} and $2Cl^-$, two c) Hg_2^{2+} and $2Cl^-$, one d) Hg_2^{2+} and $2Cl^-$, no
86. The colourless species is
    a) VCl_3 b) $VOSO_4$ c) Na_3VO_4 d) $[V(H_2O)_6]SO_4 \cdot H_2O$
87. Which of the following is called white vitriol?
    a) $ZnCl_2$ b) $MgSO_4 \cdot 7H_2O$ c) $ZnSO_4 \cdot 7H_2O$ d) $Al_2(SO_4)_3$
88. To protect iron against corrosion, the most durable metal plating on it, is
    a) Nickel plating b) Tin planting c) Copper plating d) Zinc plating
89. Which represents correct comparison of the stability of ions?
    a) $MnO_4^- < Mn^{2+}$ b) $Cr^{2+} < Cr^{3+}$ c) $CrO_4^{2-} < Cr^{3+}$ d) All of these
90. Increasing value of magnetic moments of
    I: $Ni(CO)_4$, II: $[Ti(H_2O)_6]^{2+}$, III: $[V(H_2O)_6]^{3+}$
    IV: $[V(H_2O)_6]^{2+}$ is
    a) $I < II < III < IV$ b) $IV < III < II < I$ c) $II < III < I < IV$ d) $II < I < III < IV$
91. Ni^{2+}, in traces, can be tested using
    a) Sodium nitroprusside b) Dimethyl glyoxime
    c) Ammonium sulphocyanide d) Potassium ferrocyanide
92. The main reason for larger number of oxidation state exhibited by the actinides than that corresponding lanthanides, is
    a) Lesser energy difference between $5f$ and $6d$ orbitals than between $4f$ and $5d$-orbitals
    b) Larger atomic size of actinides than the lanthanides
    c) More energy difference between $5f$ and $6d$ orbitals than between $4f$ and $5d$-orbitals
    d) Greater reactive nature of the actinides than the lanthanides
93. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is
    a) 3 b) 4 c) 5 d) 6
94. At pH $= 4$, $Cr_2O_4^{2-}$ exists as
    a) CrO_4^{2-} b) CrO_3 c) CrO_2^{2+} d) $Cr_2O_7^{2-}$
95. Which is not the true statement?
    a) Ions of d-block elements are coloured due to d-d transition
    b) Ions of f-block elements are coloured due to f-f transition

c) $[Sc(H_2O)_6]^{3+}$, $[Ti(H_2O)_6]^{4+}$ are coloured complexes
d) Cu^+ is colourless ion

96. The oxides, CrO_3, MoO_3 and WO_3 are strongly
a) Neutral b) Acidic c) Basic d) None of these

97. Which of the following transition element shows the highest oxidation state?
a) Mn b) Fe c) V d) Cr

98. Magnetic moment of Fe is similar to that of
a) $[Fe(H_2O)_6]^{2+}$ b) $[Cr(H_2O)_6]^{2+}$ c) Both (a) and (b) d) None of these

99. On addition of $AgNO_3$ to four different test tubes containing different solutions, one of them gave a white precipitate. It may be
a) $CHCl_3$ b) $CaCl_2$ c) KNO_3 d) CCl_4

100. $K_3[Fe(CN)_6]$ is used as an external indicator in the dichromate estimation of Fe^{2+}. Following change is observed
a) Colourless to blue b) Blue to red c) Colourless to red d) Blue to colourless

101. A solution of a metal ion when treated with KI gives a red precipitate which dissolves in excess KI to give a colourless solution. Moreover, the solution of metal ion on treatment with a solution of cobalt (II) thiocyanate gives rise to a deep blue crystalline precipitate. The metal ion is
a) Pb^{2+} b) Hg^{2+} c) Cu^{2+} d) Co^{2+}

102. The oxide Cr_2O_3 is
a) Acidic b) Amphoteric c) Basic d) Ozonide

103. Which alloy contains Cu, Sn and Zn?
a) Gun metal b) Solder c) Type metal d) Bronze

104. By annealing, steel
a) Become soft b) Becomes liquid
c) Becomes hard and brittle d) Is covered with a thin film of Fe_3O_4

105. Spin only magnetic moment of the compound $Hg[Co(SCN)_4]$ is
a) $\sqrt{3}$ b) $\sqrt{15}$ c) $\sqrt{24}$ d) $\sqrt{8}$

106. Match column I with Column II and select the correct answer using the codes given below the Columns

	Column I (Metals)	Column II (Ores)
A.	Zinc	Azurite
B.	Tin	Carnallite
C.	Copper	Calamine
D.	Magnesim	Cassiterite

Codes
A B C D
a) 3 4 2 1 b) 3 4 1 2
c) 4 1 3 2 d) 4 3 2 1

107. Select the correct statement(s)
a) Colour of the ion arises due to d-d^* transition
b) Colour we observe is the complimentary colour absorbed by the compound
c) Both (a) and (b) are correct
d) None of the above is correct

108. The colour imparted by Co(II) compounds to glass is
a) Green b) Deep blue c) Yellow d) Red

109. Extraction for zinc from zinc blende is achieved by
a) Electrolytic reduction
b) Roasting followed by reduction with carbon
c) Roasting followed by reduction with another metal
d) Roasting followed by self reduction

110. Which of the following is colourless?

a) $[Zn(H_2O)_6]^{2+}$ b) $[V(H_2O)_6]^{2+}$ c) $[Mn(H_2O)_6]^{3+}$ d) $[Fe(H_2O)_6]^{2+}$

111. If H_2S gas is passed into a solution of Cu^{2+}, Cd^{2+} having excess of KCN
   a) CuS and CdS both are precipitated
   b) Soluble complex $[Cu(CN)_4]^{3-}$ and $[Cd(CN)_4]^{2-}$ are formed and no effect of passing H_2S gas
   c) Soluble complex $[Cu(CN)_4]^{3-}$ and $[Cd(CN)_4]^{2-}$ as are formed, of which CdS is precipitated as yellow ppt
   d) Soluble complex $[Cu(CN)_4]^{3-}$ and $[Cd(CN)_4]^{2-}$ are formed of which CuS is precipitate as black ppt
112. Some of the following reagents are used as **primary standard**
   I: $KMnO_4$; II: NaOH; III: $K_2Cr_2O_7$;
   IV: $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$ V: $H_2C_2O_4 \cdot 2H_2O$
   Select the primary standard
   a) All except II, IV b) All except I, II c) All except I, II, III d) Only IV
113. MnO_4^{2-} (1 mol) in neutral aqueous medium disproportionate to
   a) $\frac{2}{3}$ mol of MnO_4^- and $\frac{1}{3}$ mol of MnO_2 b) $\frac{1}{3}$ mol of MnO_4^- and $\frac{2}{3}$ mol of MnO_2
   c) $\frac{1}{3}$ mol of Mn_2O_7 and $\frac{1}{7}$ mol of MnO_2 d) $\frac{2}{3}$ mol of Mn_2O_7 and $\frac{1}{3}$ mol of MnO_2
114. Which pair of compounds is expected to show similar colour in aqueous medium?
   a) $FeCl_3$ and $CuCl_2$ b) $VOCl_2$ and $CuCl_2$ c) $VOCl_2$ and $FeCl_2$ d) $FeCl_2$ and $MnCl_2$
115. An extremely hot copper wire reacts with steam to produce
   a) Cu_2O b) CuO_2 c) Cu_2O_2 d) CuO
116. A red solid is insoluble in water. However, it becomes soluble if some KI is added to water. Heating the red solid in a test tube results in liberation of some violet coloured fumes and droplets of a metal appear on the cooler parts of the test tube. The red solid is
   a) $(NH_4)_2Cr_2O_7$ b) HgI_2 c) HgO d) Pb_3O_4
117. Select the correct order of sizes of different species
   a) $Zr = Hf; Nb = Ta; Fe = Co = Ni$
   b) $Zr^{4+} < Zr; Nb^{3+} < Ta^{3+}, Fe^{3+} < Fe^{2+} < Fe$
   c) $Zr^{4+} = Hf^{4+}; Nb^{3+} = Ta^{3+}; Fe < Co < Ni$
   d) $Zr^{4+} < Hf^{4+}, Nb^{3+} = Ta^{3+}, Ni < Cu < Co$
118. Stainless steel does not rust because
   a) Chromium and nickel combine with iron
   b) Chromium forms an oxide layer and protects iron from rusting
   c) Nickel present in it, does not rust
   d) Iron forms a hard chemical compound with chromium present in it
119. AgCl and NaCl are colourless. NaBr and NaI are also colourless but AgBr and AgI are coloured. This is due to
   a) Ag^+ polarises Br^- and I^- b) Ag^+ has unpaired d-orbital
   c) Ag^+ depolarises Br^- and I^- d) None of the above is correct
120. Among K, Ca, Fe and Zn the element which can form more than one binary compound with chlorine is
   a) Fe b) Zn c) K d) Ca
121. NH_4Cl is used to clear metal surface because
   a) It dissociates into NH_3 and HCl on heating
   b) NH_3 forms soluble complexes with the metal
   c) HCl forms a volatile
   d) None of the above
122. Stainless steel contains
   a) Fe + Cr + Cu b) Fe + C + Ni c) Fe + Cr + Ni d) Fe + Ni + Cu
123. Select the correct statement
   a) Fe and Mo atoms are present in nitrogen fixing enzymes
   b) A cobalt atom lies at the centre of the vitamin B_{12} coenzyme
   c) Fe atoms are involved in the ferrodoxins of photosynthetic process
   d) All of the above are correct statements

124. Lanthanide and actinides resemble in
    a) Electronic configuration
    b) Oxidation state
    c) Ionization energy
    d) Formation of complexes
125. In $Na_2[Fe(CN)_5NO]$, sodium nitroprusside,
    a) Oxidation state of Fe is $+2$
    b) This has NO^+ as ligand
    c) Both (a) and (b)
    d) None of the above is correct
126. The reactivity of transition elements decreases with
    a) The decrease in the atomic number
    b) The increase in the atomic number
    c) Low heat of hydration
    d) None of the above
127. Which of the following arrangements does not represent the correct order of the property stated against it?
    a) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behavior
    b) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size
    c) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution
    d) $Sc < Ti < Cr < Mn$: number of oxidation states
128. There are three unpaired electrons in $[Co(H_2O)_6]^{2+}$ and calculated value of magnetic moment is 3.87 BM which is quite different from the experimental value of 4.40 BM. This is because of
    a) Increase in number of unpaired electrons
    b) Some contribution of the orbital motion of the electron to the magnetic moment
    c) Change in orbital spin of the electron
    d) d-d^* transition
129. First IE of $5d$-elements are higher than those of $3d$ and $4d$-elements. This is due to
    a) Greater effective nuclear charge acting on outer valence electrons
    b) Greater effective nuclear charge is experienced because of the weak shielding of the nucleus by $4f$-electrons
    c) Both (a) and (b)
    d) None of the above
130. Which is most soluble in water?
    a) AgBr
    b) AgCl
    c) AgF
    d) AgI
131. The incorrect configuration is
    a) $K = [Ar]4s^1$
    b) $Cr = [Ar]3d^5, 4s^1$
    c) $Cr = [Ar]3d^4, 4s^2$
    d) $Cu = [Ar]3d^{10}, 4s^1$
132. $FeCl_3 \cdot 6H_2O$ is actually
    a) $[Fe(H_2O)_6]Cl_3$
    b) $[Fe(H_2O_5)Cl]Cl_2 \cdot H_2O$
    c) $[Fe(H_2O)_4Cl_2]Cl \cdot 2H_2O$
    d) $[Fe(H_2O)_3Cl_3] \cdot 3H_2O$
133. MnO_4^- is of intense pink colour, though Mn is in $(+7)$ oxidation state. It is due to
    a) Oxygen gives colour to it
    b) Charge transfer when Mn gives its electron to oxygen
    c) Charge transfer when oxygen gives its electron to Mn making it Mn(+VI) hence, coloured
    d) None of the above is correct
134. Aqueous ZnO can neutralize HCl as well as NaOH solution. Thus. ZnO is an
    a) Acidic oxide
    b) Basic oxide
    c) Amphoteric oxide
    d) Amphiprotic oxide
135. Maximum oxidation state is shown by
    a) Os
    b) Mn
    c) Cr
    d) Co
136. Match the Column I with Column II and select the correct answer using the codes given below the Columns

	Column I (Alloys)	**Column II** (Constituents)
A.	Gun metal	Lead + tin
B.	German silver	Copper + tin + zinc
C.	Brass	Copper + zinc

D.	Solder	Copper + zinc + nickel

Codes

A B C D

a) 1 3 4 2 b) 4 2 1 3

c) 2 4 3 1 d) 3 1 2 4

137. Reason of passivity of iron is

a) Fe_2O_3 b) Fe_3O_4 c) FeO d) $Fe_2O_3 \cdot 3H_2O$

138. Match the compounds of Column I with oxidation state of Column II

	Column I	**Column II**
A.	$[Cr(H_2O)_6]Cl_3$	5
B.	CrO_5	2
C.	K_3CrO_8	6
D.	$(NH_3)_3CrO_4$	3

Codes

A B C D

a) 3 6 5 4 b) 3 4 5 6

c) 4 5 6 3 d) 6 5 4 3

139. Brown glass and cement have, which element common in them?

a) Fe b) Al c) Na d) All of these

140. Effective atomic number (EAN) of Fe in brown ring complex $[Fe(H_2O)_5NO]^{2+}$

a) 36 b) 37 c) 38 d) 39

141. Match the catalysts in Column I with their uses in Column II

	Column I	Column II
A.	$TiCl_4$	Adams catalyst in reduction
B.	$PdCl_2$	In preparation of $(CH_3)_2SiCl_2$
C.	Pt/PtO	Reppe synthesis
D.	Cu	Used as the Ziegler-Natta catalyst in polythene production
E.	Ni-complexes	Wacker process for converting C_2H_4 to CH_3CHO

Codes

A B C D E

a) 4 5 1 2 3 b) 4 5 2 1 3

c) 5 4 1 3 2 d) 2 1 3 5 4

142. Which is not the true statement about FeO?

a) It is non-stoichiometric and is metal deficient

b) It is basic oxide

c) Its aqueous solution change to $Fe(OH)_3$ and then to $Fe_2O_3 \cdot (H_2O)_n$ by atmospheric oxygen

d) It gives red colour with KCNS

143. A white solid *Y*, on heating gives off a gas which turns lime water milky; the residue is yellow when hot; white when cold. The solid *Y* is probably

a) $ZnCO_3$ b) $PbCO_3$ c) $ZnSO_4$ d) $Zn(NO_3)_2$

144. Which is the set of non-stoichiometric compound?

a) NaCl, FeO, $MgCl_2$ b) FeO, CuS, VSe c) Fe_3O_4, NaCl, CuS d) CuCl, CuS, MgO

145. The composition of duralumin is

a) Al 94%, Mg 6% b) Cu 56%, Zn 24%, Ni 20%

c) Cu 95, Al 5%
d) Al95%, Cu 4%, Mn 0.5%, Mg 0.5%

146. $K_2Cr_2O_7/H^+$ changes to green by
a) Fe^{2+} b) SO_3^{2-} c) Both (a) and (b) d) None of thee

147. The pair of compounds having metals in their highest oxidation state of
a) $MnO_2, FeCl_3$
b) $[MnO_4]^-, CrO_2Cl_2$
c) $[Fe(CN)_6]^{3-}, [Co(CN)_3]$
d) $[NiCl_4]^{2-}, [CoCl_4]^-$

148. $[Fe(H_2O)_5NO]^{2+}$ is brown-ring complex in NO_3^- . In this complex
a) NO transfers its electron to Fe^{2+} so that there are three electrons unpaired making iron as Fe(I) and nitrosyl as NO^+
b) Magnetic moment of Fe is 3.87 BM
c) The colour is due to charge transfer
d) All of the above are correct statements

149. Four successive members of the first row transition elements are listed below with their atomic numbers. Which one of them is expected to have the highest third ionization enthalpy?
a) Vanadium ($Z = 23$) b) Chromium ($Z = 24$) c) Iron ($Z = 26$) d) Manganese ($Z = 25$)

150. In alkaline H_2O_2, $Cr_2O_7^{2-}$ changes to tetraperoxo species… having oxidation number of Cr as…
a) CrO_4^{2-} 6 b) CrO_5 6 c) CrO_8^{3-} 5 d) CrO_8^{3-} 11

151. $4K_2Cr_2O_7 \xrightarrow{\text{Heat}} 4K_2CrO_4 + 3O_2 + X$; in the above reaction X is
a) CrO_3 b) Cr_2O_7 c) Cr_2O_3 d) CrO_5

152. Elements after atomic number 92 are called
a) Lanthanoids
b) Actinoids
c) Inner-transition elements
d) Transuranium elements

153. The lanthanoid contraction is due to
a) Filling of $4f$ before $4d$
b) Filling of $4d$ before $4f$
c) Filling of $4f$ before $5d$
d) Filling of $5d$ before $4f$

154. Which of the following types of metals form the most efficient catalysts?
a) Alkali metals b) Alkaline earth metals c) Transition metals d) All of the above

155. In reduction of dichromate by Fe(II), the number of electrons involved per chromium atom is
a) 2 b) 3 c) 4 d) 1

156. Which is the coloured ion
a) $[Cu(CN)_4]^{3-}$ b) $[Sc(H_2O)_6]^{3+}$ c) $[Mn(H_2O)_6]^{3+}$ d) All of these

157. The compound that get oxidized even on exposure to air is
a) Fe_2O_3 b) $FeCl_2$ c) $FeCl_3$ d) $Fe_2(SO_4)_3$

158. If zinc pieces are added yellow $FeCl_3$ solution, it turns to very light green. It is because
a) $FeCl_3$ solution is acidic due to hydrolysis and zinc added produces nascent hydrogen causing reduction of $FeCl_3$ to $FeCl_2$
b) $FeCl_3$ solution is basic and zinc added produces H_2 which reduces $FeCl_3$ to $FeCl_2$
c) Zinc reduces $FeCl_3$ to $FeCl_2$
d) None of the above is correct

159. When MnO_2 is fused with KOH and KNO_2, a coloured compound is formed, the product and its colour is
a) K_2MnO_4, green b) $KMnO_4$, purple c) Mn_2O_3, brown d) Mn_3O_4, black

160. Mixture is supposed to contain nitrates of Pb^{2+} and Hg_2^{2+}. On adding dil. HCl both are precipitated as white precipitate
Select the correct statement(s)
a) $PbCl_2$ (white precipitate) is soluble in hot water and formation of yellow precipitate on adding KI to hot solution confirms Pb^{2+}
b) Hg_2Cl_2 is blackened by NH_3, and change to $HgCl_2$ by aqua-regia. $HgCl_2$ can be detected by KI is formed
c) Both tests are conclusive
d) None of the tests is conclusive

161. $(NH_4)_2Cr_2O_7$ on heating gives a gas which is also given by

a) Heating NH_4NO_2 b) Heating NH_4NO_3 c) $Mg_3N_2 + H_2O$ d) $Na + H_2O_2$

162. Ferromagnetism is shown by
a) Zn, Cu, Cd b) Fe, Co, Ni c) Zn, Hg, Se d) All of these

163. Magnetic moment of $Cr(Z = 24)$, $Mn^+(Z = 25)$ and $Fe^{2+}(Z = 26)$ are x, y, z. They are in order
a) $x < y < z$ b) $x = y < z$ c) $z < x = y$ d) $x = y = z$

164. The trivalent ion having largest size is
a) Ti b) Zr c) Hf d) La

165. The nature of Fe_2O_3 is
a) Acidic b) Basic c) Amphoteric d) None of these

166. Amongst the following, identify the species with an atom in +6 oxidation state
a) MnO_4^- b) $Cr(CN)_6^{3-}$ c) NiF_6^{2-} d) CrO_2Cl_2

167. Select the coloured and paramagnetic ions
a) Cu^+, Zn^{2+}, Cd^{2+} b) Sc^{3+}, Ti^{4+}, V^{5+} c) $Cu^{2+}, Cr^+, Mn^{2|}$ d) Ni^{2+}, Cu^+, Hg^{2+}

168. In $Cr_2O_7^{2-}$ every Cr is linked to
a) Two O atom b) Three O atoms c) Four O atoms d) Five O atoms

169. Silver ornaments turn black by atmospheric
a) O_2 b) N_2 c) Cl_2 d) H_2S

170. The highest magnetic moment will be shown by
a) Ni b) Co c) Fe d) Sc

171. Which one of the following elements shows maximum number of different oxidation states in its compounds?
a) Eu b) La c) Cd d) Am

172. Which is not the true statement about $KMnO_4$?
a) Its solution is unstable in acidic medium
b) Its small quantity added to conc. H_2SO_4, a green coloured solution containing MnO_3^+ ions is formed
c) MnO_4^- changes to Mn^{2+} in basic solution
d) It is self-indicator in Fe^{2+} or $Cr_2O_4^{2-}$ titration

173. Addition of $SnCl_2$ to $HgCl_2$ give precipitate
a) White turning to red b) White turning to grey
c) Black turning to white d) None of the above

174. Due to lanthanide contraction
a) Fe, Co, Ni have equal size b) Zr and Hf have equal size
c) All f-block ions have equal size d) All isoelectronic ions have equal size

175. Only +2, +3, +4 oxidation states are shown by
a) Sc, Ti b) Fe, Ni c) Ti, Ni d) Zn, Ni

176. Pyrolusite in MnO_2 is used to prepare $KMnO_4$. Steps are
$MnO_2 \xrightarrow{I} MnO_4^{2-} \xrightarrow{II} MnO_4^-$
I and II are
a) Fuse with KOH/air, electrolytic oxidation
b) Fuse with KOH/air, electrolytic reduction
c) Fuse with conc HNO_3/air, electrolytic reduction
d) All the above are correct

177. Which catalyst is matched according to its name and function

	Catalyst	Name	Function
a)	$TiCl_4$	Fenton's reagent	Oxidation of alcohols
b)	$FeSO_4/H_2O_2$	Ziegler-Natta	Polythene preparation
c)	Pd/C	Lindlar	Hydrogen

d)

		to give *cis*-alkene
Pt/PtO	Adam	Synthesis of CH_3OH

178. The radii of the elements from chromium ($Z = 24$) to copper ($Z = 29$) are very close to one another. This is due to
   a) Lanthanide contraction
   b) The fact that successive addition of d-electrons screen the outer electrons ($4s$) from the inward pull of the nucleus
   c) Increase in radii due to increase in n is compensated by decrease in radii due to increase in Z
   d) Atomic radii do not remain constant but decrease in a normal gradation
179. Guigret's green is
   a) $NiO \cdot 2H_2O$ b) $Cr_2O_3 \cdot 2H_2O$ c) $CuSO_4 \cdot 2H_2O$ d) $CrO \cdot 2H_2O$
180. Which of the following pair of element cannot form an alloy?
   a) Zn, Cu b) Fe, Hg c) Fe, C d) Hg, Na
181. The outer electronic configuration of transitional elements is
   a) $(n-1)s^2nd^{1-2}$ b) $(n+1)s^2nd^{1-5}$
   c) $(n-1)s^2p^6(n-1)d^{1-10}, ns^{1,2}$ d) $ns^2(n+1)d^{1-10}$
182. Magnetic moment of $[Ni(CN)_4]^{2-}$ is zero but that of $[Ni(H_2O)_4]^{2+}$ is 2.83 BM
   It is because of
   a) Different oxidation state of Ni in two complexes
   b) CN^- is a strong ligand making two unpaired electrons in Ni^{2+} paired while in $[Ni(H_2O)_4]^{2+}$, two electrons remain unpaired H_2O being weak ligand
   c) Both (a) and (b)
   d) None of the above
183. In which case(s) there is change in oxidation number
   a) Aqueous solution of CrO_4^{2-} is acidified b) SO_2 gas is passed into $Cr_2O_7^{2-}/H^+$
   c) $Cr_2O_7^{2-}$ solution is made alkaline d) CrO_2Cl_2 is dissolved in NaOH
184. The mercury is the only metal which is liquid at 0°C. This is due to its
   a) Weak metallic bond b) High ionization energy
   c) High vapour pressure d) Both (a) and (b)
185. Consider the following statement
   I. The size the lanthanide M^{3+} ions decreases as the atomic number of M increase
   II. Electronic spectra of lanthanides show very broad bands
   III. As with transition metals, coordination number six is very common in lanthanide complexes
   Which of the statements given above is/are correct?
   a) I only b) I and II c) I and III d) III only
186. Which shows maximum magnetic moment among the bivalent ions of the first transition series?
   a) Fe^{2+} b) Co^{2+} c) Ni^{2+} d) Mn^{2+}
187. There are three electrons unpaired in $[Co(H_2O)_6]^{2+}$ and calculated value of magnetic moment is 3.87 BM which is quite different from the experimental value of 4.40 BM. This is because of
   a) Increase in number of unpaired electrons
   b) Some contribution of the orbital motion of the electron to the magnetic moment
   c) Change in orbital spin of the electron
   d) d-d^* transition
188. Select the correct statement(s)
   a) α-Fe_2O_3 has hexagonally close-packed lattice of O^{2-} ions with Fe^{3+} ions in two-thirds of the octahedral holes
   b) γ-Fe_2O_3 has cubic close-packed arrangement of O^{2-} ion with Fe^{3+} ions randomly distributed in both the octahedral and tetrahedral sites
   c) Fe_3O_4, Fe_2O_3 and FeO all and tend to be non-stoichiometric

d) All the above are correct statements

189. CrO_2^{2+} is the cation from
a) CrO b) Cr_2O_3 c) CrO_5 d) CrO_3

190. The most abundant element is
a) Cu b) Hg c) Cd d) Fe

191. Which of the following chloride is water insoluble?
a) HCl b) AgCl c) Both (a) and (b) d) None of these

192. KI and $CuSO_4$ solutions on mixing produce
a) $Cu_2I_2 + K_2SO_4$ b) $Cu_2I_2 + KI_3 + K_2SO_4$ c) $CuI_2 + K_2SO_4$ d) $CuI_2 + KI_3 + K_2SO_4$

193. Fe is made passive by
a) dil. H_2SO_4 b) dil. HCl c) Aqua-regia d) conc. H_2SO_4

194. The Mohr;s salt is shown by
a) $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ b) $FeSO_4(NH_3)_2SO_4 \cdot 6H_2O$
c) $K_2SO_4Al_2(SO_4)_3 \cdot 24H_2O$ d) $FeSO_2(NH_2)_4SO_4 \cdot 6H_2O$

195. $Cr_2O_7^{2-} \xrightarrow{pH=x} CrO_4^{2-} \xrightarrow{pH=y} Cr_2O_7^{2-}$ pH values x and y can be
a) 4 and 5 b) 4 and 8 c) 8 and 4 d) 8 and 9

196. The incorrect statement for d-block element is
a) It shows magnetic property
b) It has variable valency
c) It has tendency of formation of coloured ions
d) It has complete d-orbitals

197. German silver is an alloy of
a) Fe, Cr, Ni b) Ag, Cu, Au c) Cu, Zn, Ni d) Cu, Zn, Sn

198. Among the following the coloured compound is
a) CuCl b) $K_3[Cu(CN)_4]$ c) CuF_2 d) $[Cu(CH_3CN)_4]BF_4$

199. Which oxides will not give metal on heating?
a) HgO b) ZnO c) Ag_2O d) All of these

200. The magnetic moment μ, of transition metals is related to the number of unpaired electrons, n as
a) $\mu = n(n+2)^2$ b) $\mu = n^2(n+2)$ c) $\mu = \frac{n}{(n+2)}$ d) $\mu = \sqrt{n(n+2)}$

201. Following elements do not show the properties characteristic of d-block elements
a) Cu, Ag, Au b) Zn, Hg, Cd c) Sc, Ti, V d) Fe, Co, Ni

202. Impure metal form volatile compound (X) with CO and then (X) gives pure metal on heating. Metal is
a) Cu b) Fe c) Ni d) Pt

203. Which of the following lanthanide is commonly used?
a) Lanthanium b) Nobelium c) Thorium d) Cerium

204. The transition metal used as a catalyst is
a) Nickel b) Platinum c) Cobalt d) All of these

205. $Na_2S_2O_3$
a) Reduces Cu^{2+} to Cu^+ b) Reduces I_2 to I^-
c) Complexes AgBr as $[Ag(S_2O_3)_2]^{3-}$ d) Undergoes all the above are correct

206. Select the correct statement(s)
a) Pu^{4+} disproportionates to Pu^{3+} and PuO_2^{2+} in strongly acidic solution
b) Maximum oxidation state of Np is +7
c) UO_2^{2+} is stable
d) All of the above are correct statements

207. Which of the following elements is responsible for oxidation of water to O_2 is biological processes?
a) Fe b) Cu c) Mn d) Mo

208. An aqueous solution of $CoCl_2$ on addition of excess of concentrated HCl turn blue due to formation of
a) $[Co(H_2O)_4Cl_2]$ b) $[Co(H_2O)_2Cl_4]^{2-}$ c) $[CoCl_4]^{2-}$ d) $[Co(H_2O)_2Cl_2]$

209. Out of $[Fe(CN)_6]^{4-}$, $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]$
   a) All have identical geometry
   b) All are paramagnetic
   c) All are diamagnetic
   d) $[Fe(CN)_6]^{4-}$ is diamagnetic but $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]$ are paramagnetic

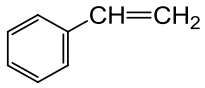
210. When I^- is oxidized by MnO_4^- in alkaline medium, I^- convets into
   a) IO_3^- b) I_2 c) IO_4^- d) IO^-

211. Factors which affect the stability of the compounds are
   a) The energy of sublimation b) The lattice energy
   c) The salvation energy d) All of the above

212. Select the incorrect statement(s)
   a) Ionisation energies of $5d$-elements are greater than those of $3d$ and $4d$ elements
   b) Cu(I) is diamagnetic while Cu(II) is paramagnetic
   c) $[Ti(H_2O_6)]^{3+}$ is coloured while $[Sc(H_2O)_6]^{3+}$ colourless
   d) Transition elements cannot form complexes

213. Second ionization energies of chromium and copper are larger than those of their neighbouring elements (V, Mn, Ni, Zn). It is due to the fact that
   a) Second electron in each case is removed from $4s$ orbital
   b) Second electron is removed from stable half-filled $3d$ sub-orbit in case of chromium and from stable completely filled $3d$ sub-robit in case of copper
   c) Electrode potential of these elements (Cr and Cu) are higher than those of their neighbouring elements
   d) Their atomic radii are different due to screening effect

214. Alkaline $KMnO_4$ (Baeyer's reagent) can be used to test unsaturation in (A)



(A)

   In this case
   a) Unsaturation in side-chain is affected
   b) Unsaturation in benzene nucleus is affected
   c) Unsaturation in both is affected
   d) Baeyer's reagent cannot be used

215. Increasing basic properties of TiO_2, ZrO_2 and HfO_2 are in order
   a) $TiO_2 < ZrO_2 < HfO_2$ b) $HfO_2 < ZrO_2 < TiO_2$ c) $HfO_2 < TiO_2 < ZrO_2$ d) $ZrO_2 < TiO_2 < HfO_2$

216. Which of the following dissolves in hot conc. NaOH solution?
   a) Fe b) Zn c) Cr d) Ag

217. Fulminating gold is
   a) $AuCl_3$ b) Au_2S c) $Au(NH_2) = NH$ d) $H[Au(Cl)_4]$

218. The stability of ferric ion is due to
   a) Half filled f-orbitals b) Half filled d-orbitals
   c) Completely filled f-orbitals d) Completely filled d-orbitals

219. Cuprous ion is colourless while cupric ion is coloured because
   a) Both have half-filled p-and d-orbitals
   b) Both have unpaired electrons in d-orbitals
   c) Cuprous ion has incomplete d-orbital and cupric ion has a complete d-orbital
   d) Cuprous ion as a complete d-orbital and cupric ion has an incomplete d-orbital

220. Select the correct statement for the lesser number of oxidations states in $3d$-series
   a) In the beginning of the series it can be due to the presence of too few electrons to loose or share
   b) Towards the end of the series, it can be ascribed to the presence of too many electrons and thus fewer empty orbitals to share electrons with the ligands
   c) Both (a) and (b) are correct

d) None of the above is correct

221. The common oxidation state of the elements of lanthanide series is
a) $+1$ b) $+3$ c) $+4$ d) $+6$

222. The element which forms ions in dimeric state is
a) Iron b) Mercury c) Cadmium d) nickel

223. At 300°C, $FeCl_3$
a) Decomposes into $FeCl_2$ and Cl_2
b) Decomposes into Fe and Cl_2
c) Sublimes to give liquid $FeCl_3$
d) Sublimes to give gaseous dimer $(FeCl_3)_2$

224. Formula of green vitriol oil is
a) $FeSO_4 \cdot 7H_2O$ b) $MgSO_4 \cdot 7H_2O$ c) $ZnSO_4 \cdot 7H_2O$ d) $CuSO_4 \cdot 5H_2O$

225. CrO_2Cl_2 is formed while testing
a) NO_3^- b) Cl^- c) Cr^{3+} d) Fe^{3+}

226. Given below, catalyst and corresponding process/ reaction are matched. The mismatch is
a) $[RhCl(PPh_3)_2]$: Hydrogenation
b) $TiCl_4 + Al(C_2H_5)_3$: Polymerisation
c) V_2O_5 : Haber-Bosch process
d) Nickel : Hydrogenation

227. Atoms of the transition elements are smaller than those of the s-block elements. This is because of
a) Usual contraction in size across a horizontal period
b) Orbital electrons added to the penultimate d-shell rather than to the outer shell of the atom
c) Both (a) and (b)
d) None of the above

228. Transition metals show paramagnetism due to
a) Characteristic configuration b) High lattice energy
c) Variable oxidation states d) Unpaired electrons

229. Which one of the following statements is not correct?
a) Zinc dissolves in sodium hydroxide solution
b) Carbon monoxide reduces iron (III) oxide to iron
c) Mercury (II) iodide dissolves in excess of potassium iodide solution
d) Tin (IV) chloride is made by dissolving tin solution in concentrated hydrochloric acid

230. Cl_2 gas is obtained by various reactions but not by
a) $KMnO_4 + \text{conc. } HCl \xrightarrow{\Delta}$ b) $KCl + K_2Cr_2O_7 + \text{conc. } H_2SO_4 \xrightarrow{\Delta}$
c) $MnO_2 + \text{conc. } HCl \xrightarrow{\Delta}$ d) $KCl + F_2 \rightarrow$

231. Which is called chromic acid?
a) CrO b) Cr_2O_3 c) CrO_3 d) CrO_2

232. Which of the following statements concerning lanthanides elements is false?
a) Lanthanides are separated from one another by ion-exchange method
b) Ionic radii of trivalent lanthanides steadily increase with increase in the atomic number
c) All lanthanides are highly dense metals
d) More characteristic oxidation state of lanthanides elements is $+3$

233. Paramagnetism is given by the relation $\mu = 2\sqrt{s(s+1)}$ magnetons where 's' is the total spin. On this basis, the paramagnetism of Cu^+ ion is
a) 3.88 magnetons b) 2.83 magnetons c) 1.41 magnetons d) Zero

234. Isomorphous salts are
a) Green vitriol, blue vitriol and Epsom salt b) Green, vitriol, white vitriol and blue vitriol
c) Green vitriol, white vitriol and Epsom salt d) Blue vitriol, white vitriol and Epsom salt

235. Cu^{2+} has a stronger polarizing power than that of Ca^{2+} because
a) Cu^{2+} ion has smaller than Ca^{2+} ion

b) Ca^{2+} has inert gas configuration whereas Cu^{2+} ion does not
c) Copper shows variable valency, calcium does not
d) Cu^{2+} is smaller than Ca^{2+} ion and the d-electrons in Cu^{2+} ion shield the nucleus poorly

236. Which of the following is most stable among Cu^{+}, Fe^{+}, Fe^{2+} and Fe^{3+}?
a) Cu^{+} b) Fe^{+} c) Fe^{2+} d) Fe^{3+}

237. $KMnO_4$ is the oxosalt of
a) MnO_2 b) Mn_2O_7 c) MnO_3 d) Mn_2O_3

238. Lanthanide for which +II and +III oxidation states are common is
a) La b) Nd c) Ce d) Eu

239. What would happen when as solution of potassium chromate is treated with an excess of dilute nitric acid?
a) Cr^{3+} and $Cr_2O_7^{2-}$ are formed b) $Cr_2O_7^{2-}$ and H_2O are formed
c) CrO_4^{2-} is reduced to +3 state of Cr d) None of the above

240. Which are not blackend by atmospheric H_2S?
a) TiO_2 b) ZnO c) $ZnSO_4 + BaS$ d) All of these

241. $(NH_4)_2Cr_2O_7$ on heating gives a gas which is also given by
a) Heating NH_4NO_2 b) Heating NH_4NO_3 c) $Mg_3N_2 + H_2O$ d) Na(Comp.)+ H_2O_2

242. In the following reaction
$nCH_2 = CH_2 \rightarrow [-CH_2 - CH_3 -]_n$
Catalyst is
a) Adam b) Ziegler-Natta c) Ni/Pd d) Fe/Mo

243. When K_2CrO_4 is added to $CuSO_4$ soluble, there is formation of $CuCrO_4$ as well as $CuCr_2O_7$. Formation of $CuCr_2O_7$ is due to
a) Basic nature of $CuSO_4$ solution which converts CrO_4^{2-} to $Cr_2O_7^{2-}$
b) Acidic nature of $CuSO_4$ solution which converts CrO_4^{2-} to $Cr_2O_7^{2-}$
c) $CuSO_4$ has the typical property of converting $CuCrO_4$ is formed to $CuCr_2O_7$
d) No $CuCr_2O_7$ is formed

244. Catalyst used in making H_2SO_4 in contact process is
a) V_2O_5 b) Fe_2O_3 c) Cr_2O_3 d) CrO_3

245. Which of the following is a highly corrosive salt?
a) $FeCl_2$ b) $PbCl_2$ c) Hg_2Cl_2 d) $HgCl_2$

246. Which pair of compounds is expected to show similar colour in aqueous medium?
a) $FeCl_3$ and $CuCl_2$ b) $VOCl_2$ and $CuCl_2$ c) $VOCl_2$ and $FeCl_2$ d) $FeCl_2$ and $MnCl_2$

247. Oxidation state of Fe in Fe_3O_4 is
a) $\frac{3}{2}$ b) $\frac{4}{5}$ c) $\frac{5}{4}$ d) $\frac{8}{3}$

248. If a person is asked to prepare the blue print of a building plan, he can use
a) $FeCl_3 + K_4[Fe(CN)_6]$
b) $FeCl_2 + K_3[Fe(CN)_6]$
c) $FeCl_2 + K_4[Fe(CN)_6]$
d) $Fe(Ct) + K_3[Fe(CN)_6]$Ct is citrate

249. Most oxidizing agent is
a) $[WO_4]^{2-}$ b) $[CrO_4]^{2-}$ c) $[CeO_4]^{2-}$ d) $[MnO_4]^{2-}$

250. $HgCl_2$ is soluble in
a) Cold water b) NaCl solution due to formation of $HgCl_4^{2-}$
c) Both (a) and (d) d) None of the above

251. The colour of light absorbed by an aqueous solution of $CuSO_4$ is
a) Orange-red b) Blue-green c) Yellow d) Violet

252. Maximum magnetic moment is shown by
a) d^5 b) d^6 c) d^7 d) d^8

253. Transition elements does not show

a) Paramagetism b) Colour c) Fixed valency d) All of these

254. When KI (excess) is added to

I. $CuSO_4$ II. $HgCl_2$ III. $Pb(NO_3)_2$

a) A white ppt of CuI in I, a orange ppt HgI_2 in II and a yellow ppt PbI_2 in III

b) A white ppt of CuI in I, an orange ppt. dissolving to HgI_4^{2-} in II, and a yellow ppt of PbI_2 in III

c) A white ppt of CuI, HgI_2 and PbI_2 in each case

d) None of the above is correct

255. Philospher's wool on treatment with cobalt nitrate, produces

a) $CoBaO_2$ b) $CoZnO_2$ c) $CoSrO_2$ d) $CoMgO_2$

256. Magnetic moment of $[Ti(H_2O)_6]^{3+}$ is

a) 1.73 BM b) 2.83 BM c) 3.87 BM d) 4.90 BM

257. Which of the following is not a member of $3d$-transition series?

a) Fe b) Co c) Au d) Cu

258. The purest form of Fe is

a) Stainless steel b) Steel c) Cast iron d) Wrought iron

259. $FeSO_4$ solution gives brown colour ring in testing nitrates or nitrite. This is

a) $[Fe(H_2O)_5NO]^{2+}$ b) $[Fe(H_2O)_5NO_2]^{2+}$ c) $[Fe(H_2O)_4(NO)_2]^{2+}$ d) $[Fe(H_2O)_4NO]^{2+}$

260. Different (variable) oxidation state is shown by transition elements. It is due to the fact

a) $(n-1)d$ electrons may be excited to ns orbital

b) ns electrons may be excited to $(n-1)d$ orbitals

c) $(n-1)d$-electron may get involved along with ns electrons in bonding

d) None of the above facts is correct

261. Ag is obtained from $AgNO_3$ with

a) NH_3 b) PH_3 c) AsH_3 d) Na_2CO_3

262. Which ore contains both iron and copper?

a) Cuprite b) Chalcocite c) Chalcopyrite d) Malachite

263. When H_2O_2 is added to an acidified solution of $K_2Cr_2O_7$

a) Solution turns green due to formation of Cr_2O_3

b) Solution turns yellow due to formation of K_2CrO_4

c) A deep blue-violet coloured compound $CrO(O_2)_2$ is formed

d) Solution gives green ppt of $Cr(OH)_3$

264. In an atmosphere with industrial smog, Cu corrodes to

a) Basic sulphate $Cu_2(OH)_2SO_4$ b) Basic carbonate $Cu_2(OH)_2CO_3$

c) Both (a) and (b) d) None of the above

265. For CrO_3 following is not true statement

a) It is called chromic acid

b) It is colourless due to $3d^{10}$ configuration

c) It is bright orange solid and colour arises due to charge transfer

d) It is toxic and corrosive

266. Misch metal is

a) An alloy of lanthanide and copper

b) An alloy of lanthanide and nickel

c) An alloy of lanthanide, iron and carbon

d) An alloy of calcium and copper

267. $FeCr_2O_4$ (chromite) is converted to Cr by following steps

$\text{Chromite} \xrightarrow{\text{I}} Na_2CrO_4 \xrightarrow{\text{II}} Cr_2O_3 \xrightarrow{\text{III}} Cr$

I, II and III are

	I	II	III
a)	Na_2CO_3/air, Δ	C	C
b)	NaOH/air Δ	C, Δ	Al, Δ
c)	NaOH/air, Δ	C, Δ	Mg, Δ
d)	conc. H_2SO_4, Δ	NH_4Cl, Δ	C, Δ

268. Which of the following mixture is chromic acid
a) $K_2Cr_2O_7 + HCl$ b) $K_2SO_4 + \text{conc. } H_2SO_4$
c) $K_2Cr_2O_7 + \text{conc. } H_2SO_4$ d) $H_2SO_4 + HCl$

269. A transition element X has a configuration $[Ar]3d^4$, in its $+3$ oxidation state. Its atomic number is
a) 25 b) 26 c) 22 d) 19

270. ZnO in CH_3COOH gives bluish white ppt with X. X is
a) $K_4[Fe(CN)_6]$ b) $K_3[Fe(CN)_6]$ c) $Na_2[Fe(CN)_5NO]$ d) $Fe(CO)_5$

271. A jeweler is selling 22-carat gold articles with 95% purity, it is approximately
a) Exact b) 3.5% higher c) 3.5% lower d) 5% lower

272. Out of $AgNO_3$, AgF and $AgClO_4$, water soluble salts are
a) AgF b) AgF, $AgNO_3$ c) AgF, $AgNO_3$, $AgClO_4$ d) None of these

273. Fe_3O_4 is called
a) Haematite b) Magnetite c) Casserite d) Dolomite

274. Cr^{2+} and Mn^{3+} both have d^4 configuration. Thus
a) Both are reducing agents
b) Both are oxidizing agents
c) Cr^{2+} is an oxidizing agent while Mn^{3+} is a reducing agent
d) Mn^{3+} is an oxidizing agent while Cr^{2+} is a reducing agent

275. An^{3+} (trivalent actinoid ions) have configuration
a) $5f^0$ to $5f^{14}$ b) $5f^1$ to $5f^{14}$ c) $5f^2$ to $5f^{14}$ d) $5f^0$ to $5f^{13}$

276. $TiCl_4$ is a
a) Bronsted-Lowry acid b) Bronsted-Lowry base c) Lewis acid d) Lewis base

277. CrO_3 liberates CO_2 with Na_2CO_3 solution. Thus, CrO_3 is
a) An acidic oxide b) A basic oxide
c) An amphoteric oxide d) A non-stoichiometric oxide

278. A blue solution of copper sulphate becomes darker when treated with excess of ammonia. This is because
a) Ammonia molecules replace water molecules in the solution
b) Ammonia is stronger ligand than water
c) Ammonia forms a stable complex ion $[Cu(NH_3)_4]^{2+}$ with Cu^{2+} ions
d) All of the above are correct

279. The oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 is
a) 2 b) 3 c) 4 d) 6

280. Uranium reacts with conc. HNO_3
a) To give $U(NO_3)_4$ and H_2 b) To give $U(NO_3)_2$ and NO_2
c) $UO_2(NO_3)_2$ and H_2 d) To make metal passive

281. Four successive members of the first row transition elements listed below with atomic numbers. Which one of them is expected to have the highest $E^\circ_{M^{3+}/M^{2+}}$ value?
a) Cr($Z = 24$) b) Mn($Z = 25$) c) Fe($Z = 26$) d) Co($Z = 27$)

282. Which one of the following characteristics of the transition metals is associated with their catalytic activity?
a) Colour of hydrated ions b) Variable oxidation states
c) High enthalpy of atomization d) Paramagnetic behavior

283. The basic character of the transition metal monoxide follows the order
(Atomic number Ti = 22, V = 23, Cr = 24, Fe = 26)
a) TiO $> FeO > VO > CrO$ b) TiO $> VO > CrO > FeO$
c) TiO $> CrO > TiO > FeO$ d) CrO $> VO > FeO > TiO$

284. For Ni and Pt different IP in MJ mol^{-1} are give below

	$\frac{(IP)_1 + (IP)_2}{2.49}$	$\frac{(IP)_3 + (IP)_4}{8.80}$
Ni		
Pt	2.60	6.70

Hence

a) Nickel (II) compounds tend to be thermodynamically more stable than platinum (II)
b) Platinum (IV) compounds tend to be more stable than nickel (IV)
c) Both (a) and (b) are correct
d) None of the above is correct

285. Silver nitrate solution is kept in brown bottles in the laboratory because
a) It reacts with ordinary bottles
b) Ordinary bottles catalyst the decomposition
c) The materials of brown bottles doo not react with it
d) Brown bottles cut the passage of light through it

286. Stability of Cu^+ and Ag^+ halide complexes are in the order
a) $I > r > Cl > F$ b) $F > Cl > Br > I$
c) $Cl > F > I > Br$ d) $Br > I > Cl > F$

287. Based on the following equilibria
$Fe^{2+} \rightleftharpoons Fe^{3+} + e^-; \quad E° = -0.771$ V
$[Fe(CN)_6]^{4-} \rightleftharpoons [Fe(CN)_6]^{3-} + e^-; \; E° = -0.36$ V
Select the correct statements
a) Iron in $+2$ state is more stable than in $+3$ state
b) Unstable ion can be stabilized by complexing it with a suitable ligand
c) Both (a) and (b)
d) None of the above are correct statements

288. Which one of the following ionic species will impart colour to an aqueous solution?
a) Ti^{4+} b) Cu^+ c) Zn^{2+} d) Cr^{3+}

289. Non-stoichiometry is shown
a) Due to variable valency of transition elements
b) Due to defects in solid structures
c) Due to both (a) and (b)
d) Due to none of the above

290. Which of the following statements is not correct?
a) $La(OH)_3$ is less basic than $Lu(OH)_3$
b) In lanthanide series ionic radius of Ln^{3+} ion decreases
c) La is actually an element of transition series rather lanthanide
d) Atomic radius of Zr and Hf are same because of lanthanide contraction

Multiple Correct Answers Type

291. The transition metals that do not form amalgam are
a) Zn b) Fe c) Pt d) Cd

292. Select the correct statement(s) about $[CoCl_6]^{4-}$ complex
a) It is paramagnetic b) It is a low-spin complex
c) Oxidation number of cobalt is -4 d) The coordination number of cobalt is 6

293. Select the correct statement(s) about oxides of d-block elements
a) MO type oxides have NaCl-type structure
b) All oxides are thermodynamically stable, their heats of formation being negative ($\Delta H_f^\circ < 0$)
c) Oxides of the same metal in different oxidation state have different stabilities
d) The oxides are basic in low oxidation states and acidic in high oxidation states

294. The species that undergoes disproportionation in an alkaline medium are
a) MnO_4^{2-} b) NO_2 c) Cl_2 d) ClO_4^-

295. Which are correct statements?
a) In less acidic solution $K_2Cr_2O_7$ and H_2O_2 gives violet coloured diamagnetic $[CrO(O_2)(OH)]^-$ ion

b) In alkaline H_2O_2, K_2CrO_8 (with tetraperoxo species $[Cr(O_2)_4]^{3-}$) is formed
c) In animoniacal solution, $(NH_3)_2CrO_4$ is formed
d) CrO_4^{2-} changes to $Cr_2O_7^{2-}$ by oxidation

296. When KCN is added to $CuSO_4$ solution
a) KCN acts as a reducing agent
b) KCN acts as a complexing agent
c) Complex $K_3[Cu(CN)_4]$ is formed
d) Complex $K_2[Cu(CN)_4]$ is formed

297. Chromium trioxide (CrO_3)
a) Is soluble in water forming dichromate
b) Is soluble in alkali forming chromate
c) Has peroxy linkage
d) Is oxidized to CrO_5 by H_2O_2 in alkali solution

298. Colour of transition metal ions are due to
a) Variable valency
b) $d-d$ transition
c) Incompletely filled d-orbitals
d) Charge transfer

299. Which will not give metal on heating?
a) Ag_2CO_3 b) $ZnCO_3$ c) HgO d) CuO

300. Which of the following are coloured due to charge transfer?
a) $KMnO_4$ b) CrO_3 c) $CuSO_4$ d) $FeCl_3$

301. Reduction of the metal centre in aqueous permanganate ion involves
a) Three electrons in neutral medium
b) Five electrons in neutral medium
c) Three electrons in alkaline medium
d) Five electrons in acidic medium

302. Lanthanoids are
a) 14 elements in the sixth period (atomic no. = 90 to 103) that are filling $4f$-sublevel
b) 14 elements in the seventh period (atomic no. = 90 to 103) that are filling $5f$-sublevel
c) 14 elements in the sixth period (atomic no. = 58 to 71) that are filling $4f$-sublevel
d) 14 elements in the seventh period (atomic no. = 58 to 71) that are filling $4f$-sublevel

303. For CrO_3 following is not true statement
a) It is called chromic acid
b) It is colourless due to $3d^0$ configuration
c) It is bright orange solid and colour arises due to charge transfer
d) It is toxic and corrosive

304. Standard reduction electrode potential at Zn^{2+}/Zn is -0.76 V. This means
a) ZnO is reduced to Zn by H_2
b) Zn liberates H_2 with conc. Acids
c) Zn is generally the anode in an electrochemical cell
d) Zn is generally the cathode in an electrochemical cell

305. Why does aqueous Fe(III) ion develop intense red colour when it reacts with SCN^- ion while Fe(II) ion does not?
a) Fe(III) ion forms a charge transfer complex with SCN^- ions
b) Fe(III) is reduced to Fe(I) which is deep red in colour
c) SCN^- ion is oxidized to CN^- which forms red coloured complex with Fe(III) ion
d) SCN^- does not form any complex with Fe(III) ion

306. Which are correct statements about $KMnO_4$?
a) Its solution is unstable in acidic medium
b) Its small quantity added to conc. H_2SO_4, a green coloured solution containing MnO_3^+ ions is formed
c) MnO_4^- changes to Mn^{2+} in basic solution
d) It is self-indicator in Fe^{2+} or $C_2O_4^{2-}$ titration

307. Which of the following chemical reactions is/are involved in the developing of photographic plate?

a) $AgBr + 2NH_3(aq) \rightarrow [Ag(NH_3)_2]Br$ b) $AgBr + 2Na_2S_2O_3 \rightarrow Na_3[Ag(S_2O_3)_2] + NaBr$

c) $2AgBr + 2Na_2S_2O_3 \rightarrow Ag_2S_2O_3 + 2NaBR$ d) $C_6H_4(OH)_2 + 2AgBr \rightarrow 2Ag + C_6H_4O_2 + 2HBr$

308. When CO_2 is passed into aqueous

a) Na_2CrO_4 solution, its yellow colour changes to orange

b) K_2MnO_4 solution, it disproportionate to $KMnO_4$ and MnO_2

c) $Na_2Cr_2O_7$ solution, its orange colour changes to green

d) $KMnO_4$ solution, its pink colour changes to green

309. Electron transfer from $Fe(H_2O)_6^{2+}$ to $Fe(H_2O)_6^{3+}$ is likely to occur *via*

a) d-d transition b) Inner sphere electron transfer

c) S_N1 mechanism d) Outer sphere electron transfer

310. $FeSO_4$ on heating gives

a) SO_3 b) SO_2 c) Fe_2O_3 d) S

311. Which of the following halides react(s) with $AgNO_3(aq)$ to give a precipitate that dissolves in $Na_2S_2O_3(aq)$?

a) HCl b) FF c) HBr d) HI

312. Select the correct statement(s)

a) When $FeCl_3$ solution is added to $K_4[Fe(CN)_6]$ solution, in addition to $Fe^{III}[Fe^{II}(CN)_6]^-$, $Fe^{II}[Fe^{III}(CN)_6]^-$ is also formed due to side redox reaction

b) When $FeCl_2$ solution is added to $K_3[Fe(CN)_6]$ solution, in addition to $Fe^{II}[Fe^{II}(CN)_6]^-$ $Fe^{III}[Fe^{II}(CN)_6]^-$ is also formed due to side redox reaction

c) $Fe^{III}[Fe^{II}(CN)_6]^-$ is paramagnetic while $Fe^{II}[Fe^{III}(CN)_6]^-$ is diamagnetic

d) $Fe^{III}[Fe^{II}(CN)_6]^-$ is diamagnetic while $Fe^{II}[Fe^{III}(CN)_6]^-$ is paramagnetic

313. Select the correct statement(s)

a) Stabilities of variable oxidation states can be explained by standard electrode potential

b) Cr^{2+} is unstable and Cr^{3+} is stable in aqueous solution

c) Fe^{2+} is stable and Fe^{3+} is unstable in aerated water

d) All of the above are correct statements

314. N_2 gas can be obtained by heating

a) $(NH_4)_2Cr_2O_7$ b) NH_4NO_2 c) NH_4VO_3 d) NH_4NO_3

Assertion - Reasoning Type

This section contain(s) 0 questions numbered 315 to 314. Each question contains STATEMENT 1(Assertion) and STATEMENT 2(Reason). Each question has the 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

a) Statement 1 is True, Statement 2 is True; Statement 2 **is** correct explanation for Statement 1

b) Statement 1 is True, Statement 2 is True; Statement 2 **is not** correct explanation for Statement 1

c) Statement 1 is True, Statement 2 is False

d) Statement 1 is False, Statement 2 is True

315

Statement 1: $CuSO_4.5H_2O$ on heating to 250°C loses all the five H_2O molecules and becomes anhydrous

Statement 2: All the five H_2O molecules are coordinated to the central Cu^{2+} ion

316

Statement 1: Oxalates and carbonates of lanthanides are almost insoluable in water

Statement 2: Salts of lanthanides usually contains water of crystallisation

317

Statement 1: Mercury is liquid at room temperature

Statement 2: In mercury, there is no unpaired d-electron and thus, metallic bonding is weakest

318

Statement 1: Chromium is hard but mercury is soft.

Statement 2: Chromium is a 3d transition elements.

319

Statement 1: Equivalent mass of $KMnO_4$ is equal to one third of its molecular mass when it acts as an oxidising agent in an alkaline medium

Statement 2: Oxidation number of Mn is $+7$ in $KMnO_4$

320

Statement 1: Magnetic moments values of actinides are lesser than the theoretically predicted values.

Statement 2: Actinide elements are strongly paramagnetic.

321

Statement 1: Tungsten has the highest melting point

Statement 2: Tungsten is a covalent compound

322

Statement 1: Mercury vapour is shining silvery in appearance.

Statement 2: Mercury is a metal with shining silvery appearance.

323

Statement 1: Europium(II) is more stable than cerium(II).

Statement 2: Cerium salts are used as a catalyst in petroleum cracking.

324

Statement 1: The free gaseous Cr atom has six unpaired electrons.

Statement 2: Half filled s- orbital has greater stability.

Matrix-Match Type

This section contain(s) 0 question(s). Each question contains Statements given in 2 columns which have to be matched. Statements (A, B, C, D) in **columns I** have to be matched with Statements (p, q, r, s) in **columns II**.

325. Match the neutral coordination compounds (in Column I) with metals therein (in Column II)

Column-I		Column- II
(A)	Nitrogenases	(1) Cu
(B)	Cytochrome oxidase	(2) Mo
(C)	Cytochrome C	(3) Zn
(D)	Carboxy peptidase	(4) Fe

CODES :

	A	B	C	D
a)	1	2	3	4
b)	2	1	4	3
c)	4	3	2	1
d)	3	4	1	2

326. Match the alloys (in Column I) with their constituents (in Column II)

Column-I		Column- II
(A)	Invar	(1) 70% Cu + 30% Zn
(B)	Brass	(2) 66% Ni + 33% Cu
(C)	Monel	(3) 36% Ni
(D)	Coinage metal	(4) 60% Ni + 20% Fe + 20% Cr
(E)	Nichrome	(5) 75% Cu + 25% Ni

CODES :

	A	B	C	D	E
a)	3	1	2	5	4
b)	2	3	4	1	4
c)	4	5	3	2	4
d)	5	2	1	3	4

327. Match the compounds in Column I with their uses in Column II

Column-I		Column- II
(A)	Hg_2Cl_2	(1) Metallurgical extraction of Ag
(B)	ZnO	(2) Electrode
(C)	$ZnSO_4$	(3) Luminous paints
(D)	Zn	(4) Lithopone

CODES :

	A	B	C	D
a)	2	3	4	1
b)	3	2	1	4
c)	4	1	2	3
d)	1	4	3	2

328. Match List I with List II and select the correct answer using the codes given below the lists.

Column-I	Column- II
(A) Cr^{3+}	(p) $\sqrt{35}$
(B) Fe^{2+}	(q) $\sqrt{30}$
(C) Ni^{2+}	(r) $\sqrt{24}$
(D) Mn^{2+}	(s) $\sqrt{15}$
	(t) $\sqrt{8}$

CODES :

	A	B	C	D
a)	p	r	t	s
b)	q	r	t	p
c)	s	r	t	p
d)	s	t	r	p

329. Match the complex ion (Column I) with its spin-only magnetic moment (Column II)

Column-I	Column- II
(A) $[Co(NH_3)_6]^{3+}$	(1) 1.73 BM
(B) $[Fe(CN)_6]^{3-}$	(2) 5.92 BM
(C) $[Mn(H_2O)_6]^{2+}$	(3) 0.0 BM
(D) $[Ni(H_2O)_6]^{2+}$	(4) 2.83 BM

CODES :

	A	B	C	D
a)	1	2	4	3
b)	3	1	2	4
c)	2	4	3	1

d)	4	3	1	2

330. Match the lanthanide ions (Ln^{3+}, in Column I) with their calculated magnetic moments (in Column II)

Column-I	Column- II
(A) Ce^{3+}	(1) 7.94 BM
(B) Nd^{3+}	(2) 4.90 BM
(C) Gd^{3+}	(3) 1.73 BM
(D) Pm^{3+}	(4) 3.87 BM

CODES :

	A	B	C	D
a)	4	3	2	1
b)	2	1	3	4
c)	3	4	1	2
d)	1	2	4	3

331. Match the catalysts in Column I with their uses in Column II

Column-I	Column- II
(A) $TiCl_4$	(1) Adams catalyst in reduction
(B) $PdCl_2$	(2) In preparation of $(CH_3)_2SiCl_2$
(C) Pt/PtO	(3) Reppe synthesis
(D) Cu	(4) Used as the Natta catalyst in polythene production
(E) Ni	(5) Wake process for converting C_2H_4 to CH_3CHO

CODES :

	A	B	C	D	E
a)	1	2	3	4	5
b)	5	4	2	3	5
c)	3	1	4	5	5
d)	4	5	1	2	5

332. Match the species in Column I that can react (oxidize, reduce, give ppt) species in Column II

Column-I	Column- II
(A) Fe^{2+}	(1) $Cr_2O_7^{2-}$
(B) $C_2O_4^{2-}$	(2) CrO_4^{2-}

(C) Pb^{2+} (3) $[Fe(CN)_6]^{3-}$

(D) Ag^{+} (4) MnO_4^{-}

(E) SO_2 (5) $S_2O_3^{2-}$

CODES :

	A	B	C	D	E
a)	1,3,4	1,4	2	2,5	1,4
b)	1,4	2	2,5	1,3,4	1,4
c)	2	2,5	1,3,5	1,4	1,4
d)	2,5	1,3,4	2,4	1,4	1,4

333. Match the alloys (in Column I) with their constituents (in Colum II)

Column-I **Column- II**

(A) Invar (1) 70% Cu + 30% Zn

(B) Brass (2) 66% Ni + 33% Cu

(C) Monel (3) 36% Ni

(D) Coinage metal (4) 60% Ni + 20% Fe + 20% Cr

(E) Nicrome (5) 75% Cu + 25% Ni

CODES :

	A	B	C	D	E
a)	3	1	2	5	4
b)	1	2	3	4	4
c)	4	5	1	2	4
d)	2	3	4	1	4

334. Match the alloys (in Column I) with the constituents metal (in Column II)

Column-I **Column- II**

(A) Gun metal (1) Pb, Sn

(B) German silver (2) Cu, Sn, Z

(C) Brass (3) Cu, Zn

(D) Solder (4) Cu, Zn, Ni

CODES :

A	B	C	D

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

335. Match the underlined atoms in Column I with oxidation number in Column II

Column-I	**Column- II**
(A) $\underline{Mn}O_4^-$	(1) 1
(B) $\underline{Cr}O_4^{2-}$	(2) 2
(C) $\underline{Fe}\,[Fe^{II}(CN)_6]^-$	(3) 3
(D) $\underline{Zn}O_2^{2-}$	(4) 6
(E) $\left[\underline{Ag}(CN)_2\right]^-$	(5) 7

CODES :

	A	**B**	**C**	**D**	**E**
a)	4	5	2	1	2
b)	3	2	1	5	2
c)	5	4	3	2	2
d)	2	1	4	3	2

336. Match the compounds of Column I with oxidation state of Column II

Column-I	**Column- II**
(A) $[Cr(H_2O)_6]Cl_3$	(1) 5
(B) CrO_5	(2) 4
(C) K_3CrO_8	(3) 6
(D) $(NH_3)_3CrO_4$	(4) 3

CODES :

	A	**B**	**C**	**D**
a)	3	2	4	1
b)	4	3	1	2
c)	1	4	3	2
d)	2	1	4	3

Linked Comprehension Type

This section contain(s) 20 paragraph(s) and based upon each paragraph, multiple choice questions have to be answered. Each question has atleast 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 337 to -337

The colour of the compounds of transition metals may be attributed to the presence of incomplete $(n-1)d$ sunshell. When an electron from a lower energy of d-orbital is excited to a higher energy d-orbital, the energy of excitation corresponds to the frequency of light absorbed. This frequency generally lies in the visible region. The colour observed. The frequency to complementary colour of the light absorbed. The frequency of the light absorbed is determined by the nature of the ligand. Paramagnetism is a property due to the presence of unpaired electrons. Paramagnetism increases with increase in number of unpaired electrons. Magnetism moment is calculated from the formula

$\mu = \sqrt{n(n+2)}$ BM

337. The colourless species is

a) Na_3VO_4 b) VCl_3 c) $VOSO_4$ d) VH_3

Paragraph for Question Nos. 338 to - 338

The first triad metals iron, cobalt and nickel are known as ferrous metals. Iron and cobalt exhibit oxidation states +3 and +2 in their compounds, while nickel compounds are generally in the +2 oxidation state. The elements of the second and third triad are collectively known as platinum metals. These elements give halides having metals in divalent as well as trivalent states

338. The maximum oxidation state exhibited by manganese is

a) +3 b) +7 c) +4 d) +6

Paragraph for Question Nos. 339 to - 340

From the data given in the table, answer the following questions

Covalent radii of the Transition Elements (pm)

K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
203	174	144	132	122	117	117	117	116	115	117	125
			Zr	Nb							
			145	134							
			Ht	Ta							
			144	134							

339. Atoms of the transition elements are similar than those of the s-block elements. This is because of

a) Usual contraction in size across a horizontal period
b) Orbital electrons added to the penultimate d-shell rather than to the outer shell of the atom
c) Both (a) and (b)
d) None of the above

Paragraph for Question Nos. 340 to - 341

Read the following short write-up and answer the questions given
"The transition elements have an unparalleled tendency to form coordination compound with Lewis base that is with groups which are able to donate an electron pair (called ligands)"

340. The tendency to form complexes by transition metal compared to s and p-block elements is due to
a) Their smaller size
b) Higher nuclear charge
c) Presence of low energy vacant orbitals to accept lone pair of electrons donated by ligands
d) All of the above

Paragraph for Question Nos. 341 to - 342

Taking into account the following experimental fact answer the questions given at the end
"When metallic copper is heated with concentrated sulphuric acid, in addition to copper(II) sulphate and sulphur dioxide, some copper (II) sulphide is also formed"

341. In which reaction, SO_2 is formed?
a) $SO_4^{2-} + 2e^- \rightarrow$ b) $SO_4^{2-} + 8e^- \rightarrow$ c) $SO_4^{2-} + 6e^- \rightarrow$ d) In all of these

Paragraph for Question Nos. 342 to - 343

Read the following short write-up and answer the questions given at the end
Recent X-ray work, IR and other spectroscopic methods have proved that Turnbull's blue is identical to Prussian blue

342. What is the common formula of Turnbull's blue and Prussian blue?
a) $Fe_3[Fe(CN)_6]_2$ b) $Fe_4[Fe(CN)_6]_3$ c) $KFe[Fe(CN)_6]$ d) $KFe_2[Fe(CN)_6]$

Paragraph for Question Nos. 343 to - 343

Based on the following statements answer the questions given at the end
Statement The mercurous ion is written as Hg_2^{2+} while the cuprous ion is written as Cu^+
Statement Cu^+ is d^{10} ion and colourless but Cu_2O is red and Cu_2S is black

343. Mercurous ion is written as Hg_2^{2+} because
a) Magnetic moment of mercurous ion is zero and thus, $6s$ unpaired electron has been used in bonding to make Hg_2^{2+}
b) In aqueous solution two Hg^+ ions are solvated forming Hg_2^{2+}
c) $HgCl_2$ disproportionates to Hg_2Cl_2 and Hg
d) None of the above is correct

Paragraph for Question Nos. 344 to - 344

Based on the following experimental facts answer the questions given at the end
"Green solution of potassium manganate (VI), turns purple and a brown solid is precipitated when CO_2 is bubbled into the solution"

344. Purple colour is due to formation of
a) Manganese dioxide (IV)
b) Potassium permanganate (VII)
c) Manganese (II) ion
d) None of the above

Paragraph for Question Nos. 345 to - 345

Read the following passage and answer the questions at the end of it
When a piece of iron is dipped in conc. HNO_3, a slight reaction takes place which then ceases completely. There is no change in the appearance of the iron, but this does not displace Cu from $CuSO_4$ solution which is however a common property of Fe. This behavior is also observed with Cr and Al when in contact with HNO_3

345. Above phenomenon is called
a) Corrosion
b) Rusting
c) Passivity
d) Reduction

Paragraph for Question Nos. 346 to - 346

Based on the following qualitative test of chromium, answer the questions given at the end of it
In qualitative analysis, a confirmatory test for chromium involves the formation of a blue transient peroxo species, CrO_5. It is formed when H_2O_2 is added to on acidic solution containing $Cr_2O_7^{2-}$

346. Select the correct statement about CrO_5
a) It has two types of oxygen-peroxide and oxide
b) Oxidation number of Cr is $+10$
c) It is formed by oxidation of $Cr_2O_7^{2-}$
d) All of the above are correct statements

Paragraph for Question Nos. 347 to - 347

Read the following observation and answer the questions given at the end
In an atmosphere with industrial smog, Cu corrode to a basic sulphate $Cu_2(OH)_2SO_4$ and basic carbonate $Cu_2(OH)_2CO_3$

347. Basic sulphate is generally formed during acid rain with a reaction
a) $2Cu + 2H_2O + SO_3 \rightarrow Cu_2(OH)_2SO_4$
b) $2Cu + H_2O + SO_3 + O_2 \rightarrow Cu_2(OH)_2SO_4$
c) $2Cu + H_2O + SO_2 + O_2 \rightarrow Cu_2(OH)_2SO_4$
d) All of the above

Integer Answer Type

348. When CrO_5 is treated with H_2O_2 and KOH, a red-brown compound $K_3[Cr(O_2)_x]$ is formed
349. Complex when dimethyl-glyoxime (in alcohol) added to ammoical nickel chloride solution
350. 2.78 g of $FeSO_4 \cdot xH_2O$ on treatment with excess of $BaCl_2$ solution gives 2.33 g of white precipitate of $BaSO_4$. What is value of x? $(Ba = 137, S = 32, Fe = 56, O = 16)$
351. How many oxygen atoms are directly attached to one chromium in dichromate ion?
352. Complex when KCNS is added to $FeCl_3$ solution
353. Magnetic moment of Mn in $MnSO_4$ is 5.91 BM. Thus is has …… electrons in $3d$-orbitals

354. What is the serial number of the colour formed when $K_2Cr_2O_7$ is made alkaline?

V	I	B	G	Y	O	R
1	2	3	4	5	6	7

355. How many H_2O molecules are in coordination sphere in $FeCl_3 \cdot 6H_2O$
356. When CrO_5 is treated with H_2O_2 and KOH, a red-brown compound $K_3[Cr(O)_x]$ is formed. x is ……
357. 2.67 g of $CoCl_3 \cdot 6NH_3$ (molar mass = 267.4 g mol^{-1}) in aqueous solution gave 4.305 g of white precipitate of AgCl (molar mass = 143.5 g mol^{-1}). On reaction with excess of $AgNO_3$ solution. Thus, Cl atoms in outer sphere of the complex is……
358. CrO_5 has…… peroxy linkage(s)
359. How many of the following are amphoteric?
$ZnO, Al_2O_3, VO_2, V_2O_5, P_2O_5, Cr_2O_3, CrO_3$
360. How many of the following pairs have approximately equal radii?
$(Zr, HF); (Nb, Ta); (Cr, Mn); (Mn, Fe); (Nb^{3+}, Ta^{3+}); (Zr^{4+}, Hf^{4+})$
361. How many of the following also forms dimer?
$NO_2, AlCl_3, FeCl_3, N_2O_5, CuSO_4, PCl_3$
362. There are 24 electron in Mn^+, Cr, Co^{3+}, Fe^{2+}, Ni^{4+}
How many of these have d^5 configuration?
363. Compound when SO_2 gas is passed into acidified $K_2Cr_2O_7$ solution
364. What is van't Hoff factor of $Hg_2(NO_2)_2$ if it is 100% ionized in aqueous solution?
365. Compounds when $K_2Cr_2O_7$ solution is made alkaline
366. Complex when NH_3 is added to $CuSO_4$ solution
367. Complex when $K_4[Fe(CN)_6]$ is added to $FeCl_3$ solution
368. Compound when Cl_2 gas is passed into K_2MnO_4 solution
369. Cr^+ (23 electrons) has…… electrons in $(n-1)d$ orbitals
370. How many mole(s) of AgCl(s) are precipitated per mole of $FeCl_3 \cdot 6H_2O$ on reaction with excess $AgNO_3$?
371. What is the sum of oxidation number of iron in Prussian blue?
372. How many of the following are paramagnetic a well as coloured species?
$O_2, NO_2, Cu^{2+}, Hg_2^{2+}, Fe^{2+}, Fe^{3+}, [Fe(CN)_6]^{4-}, [Fe(CN)_6]^{3-}, [Ni(H_2O)_6]^{2+}, [Ni(CN)_4]^{2-}$
373. Compound when $CuSO_4$ is treated with KI and then titrated with $Na_2S_2O_3$ solution
374. Number of oxygen atom(s) between two chromium atoms in $Cr_2O_7^{2-}$ is…..
375. How many of the following pairs have approximately equal radii
$(Zr, Hf), (Nb, Ta), (Cr, Mn), (Mn, Fe), (Nb^{3+}, Ta^{3+})(Zr^{4+}, Hf^{4+})$
376. Maximum oxidation state shown by manganese is…..
377. How many of the following have underlined atoms in different oxidation states?
$\underline{Hg}I_4^{2-}, \underline{S_2}O_3^{2-}, \underline{S_4}O_6^{2-}, Cr\underline{O_5}, \underline{Fe_3}O_4, \underline{Pb_3}O_4$
378. How many of the following use outer d-orbital in complex formation?
$[Ni(H_2O)_4]^{2+}, Ni(CO)_4, [Ni(CN)_4]^{2-}, [Fe(CN)_6]^{4-}, [Fe(H_2O)_6]^{2+}, [Cr(NH_3)_6]^{3+}$
379. Compound when K_2CrO_4 solution is made acidic
380. Fe^{2+} (24 electrons) has…… electrons in $3d$-orbitals

: ANSWER KEY :

1)	a	2)	c	3)	b	4)	d	189)	d	190)	b	191)	b	192)	b
5)	c	6)	a	7)	b	8)	c	193)	c	194)	a	195)	c	196)	d
9)	d	10)	a	11)	d	12)	a	197)	c	198)	c	199)	b	200)	d
13)	b	14)	d	15)	c	16)	d	201)	b	202)	c	203)	d	204)	d
17)	a	18)	a	19)	c	20)	a	205)	d	206)	d	207)	c	208)	c
21)	d	22)	b	23)	c	24)	c	209)	c	210)	a	211)	d	212)	d
25)	b	26)	b	27)	c	28)	a	213)	b	214)	a	215)	a	216)	b
29)	d	30)	d	31)	a	32)	a	217)	c	218)	b	219)	d	220)	c
33)	c	34)	a	35)	c	36)	c	221)	b	222)	b	223)	d	224)	a
37)	c	38)	d	39)	a	40)	d	225)	a	226)	c	227)	c	228)	d
41)	b	42)	b	43)	a	44)	c	229)	d	230)	b	231)	c	232)	b
45)	b	46)	a	47)	d	48)	a	233)	d	234)	c	235)	d	236)	a
49)	b	50)	b	51)	b	52)	a	237)	b	238)	d	239)	b	240)	d
53)	b	54)	d	55)	c	56)	a	241)	a	242)	b	243)	b	244)	a
57)	c	58)	c	59)	b	60)	a	245)	d	246)	b	247)	d	248)	a
61)	d	62)	d	63)	a	64)	a	249)	b	250)	b	251)	a	252)	a
65)	b	66)	d	67)	b	68)	a	253)	c	254)	b	255)	b	256)	a
69)	a	70)	c	71)	c	72)	b	257)	c	258)	d	259)	a	260)	c
73)	a	74)	c	75)	a	76)	b	261)	b	262)	c	263)	c	264)	c
77)	a	78)	a	79)	d	80)	c	265)	b	266)	c	267)	b	268)	c
81)	a	82)	c	83)	c	84)	b	269)	a	270)	a	271)	b	272)	c
85)	d	86)	c	87)	c	88)	d	273)	b	274)	d	275)	b	276)	c
89)	d	90)	a	91)	b	92)	a	277)	a	278)	d	279)	d	280)	d
93)	d	94)	d	95)	c	96)	b	281)	d	282)	b	283)	b	284)	c
97)	a	98)	c	99)	b	100)	d	285)	d	286)	a	287)	c	288)	d
101)	b	102)	b	103)	a	104)	a	289)	c	290)	a	1)	b,c	2)	
105)	b	106)	b	107)	c	108)	b		a,d	3)	a,b,c,d	4)	b,c		
109)	b	110)	a	111)	c	112)	b	5)	a,b,c	6)	a,b,c	7)	a,b,d	8)	
113)	a	114)	b	115)	d	116)	b		b,c,d						
117)	a	118)	b	119)	a	120)	a	9)	b,d	10)	a,b	11)	c,d	12)	c
121)	b	122)	c	123)	d	124)	b	13)	b	14)	c	15)	a	16)	
125)	c	126)	b	127)	a	128)	a		a,b,d						
129)	b	130)	c	131)	c	132)	c	17)	b,d	18)	a,b	19)	b	20)	
133)	c	134)	c	135)	a	136)	c		a,b,c						
137)	b	138)	a	139)	a	140)	b	21)	a,c,d	22)	a,b,d	23)	a,b	24)	
141)	a	142)	d	143)	a	144)	b		a,b						
145)	d	146)	c	147)	b	148)	d	1)	c	2)	a	3)	a	4)	b
149)	d	150)	c	151)	c	152)	d	5)	b	6)	b	7)	c	8)	d
153)	c	154)	c	155)	b	156)	c	9)	b	10)	c	1)	b	2)	a
157)	b	158)	a	159)	a	160)	c		3)	a	4)	c			
161)	a	162)	b	163)	c	164)	d	5)	b	6)	c	7)	d	8)	a
165)	b	166)	d	167)	c	168)	c	9)	a	10)	a	11)	c	12)	b
169)	d	170)	c	171)	d	172)	c	1)	a	2)	b	3)	c	4)	d
173)	b	174)	b	175)	c	176)	a	5)	a	6)	c	7)	a	8)	b
177)	c	178)	b	179)	b	180)	b	9)	c	10)	a	11)	b	1)	4
181)	c	182)	b	183)	b	184)	a		2)	9	3)	7	4)	4	
185)	b	186)	d	187)	b	188)	d	5)	7	6)	5	7)	5	8)	4

9)	**8**	**10)**	**3**	**11)**	**2**	**12)**	**5**	**25)**	**7**	**26)**	**0**	**27)**	**1**	**28)**	**6**
13)	**6**	**14)**	**3**	**15)**	**2**	**16)**	**4**	**29)**	**7**	**30)**	**5**	**31)**	**2**	**32)**	**6**
17)	**3**	**18)**	**5**	**19)**	**2**	**20)**	**8**	**33)**	**6**						
21)	**1**	**22)**	**0**	**23)**	**1**	**24)**	**5**								

: HINTS AND SOLUTIONS :

4 **(d)**

$AgNO_3 \xrightarrow{\Delta} Ag_2O \xrightarrow{\Delta} 2Ag + O_2$

9 **(d)**

$Hg_2Cl_2 + 2NH_3 \rightarrow \underset{\text{white}}{HgNH_2Cl} + \underset{\text{black}}{Hg} + NH_4Cl$

11 **(d)**

$CrO_3 + H_2O \rightarrow \underset{(A)}{H_2CrO_4} \xrightarrow{OH^-} \underset{(B)}{CrO_4^{2-}}$

17 **(a)**

$[Fe(H_2O)_4Cl_2]Cl \cdot 2H_2O$

20 **(a)**

$Fe_2O_3 + OH^- + Cl_2 \rightarrow [FeO_4]^{2-}$

21 **(d)**

In alkaline solution, $KMnO_4$ is reduced to MnO_2 (black)

$2KMnO_4 + 2H_2O \rightarrow 2MnO_2 + 2KOH + 3[O]$

$KI + 3[O] \rightarrow KIO_3$

$2KMnO_4 + 2H_2O + KI \rightarrow 2MnO_2 + 2KOH + KIO_3$

Hence, 2 moles of $KMnO_4$ are reduced to MnO_2 by 1 mole of KI

23 **(c)**

Nascent H reduces NO to NH_3 which changes to NH_4NO_3

31 **(a)**

The methods chiefly used for the extraction of lead and tin from their ores are respectively self reduction and carbon reduction. (Because the process of heating the ore strongly in the presence of excess of air is called roasting. It is mainly used in case of sulphide ores and the process of extracting a metal by fusion of the oxide ore with carbon is known as smelting.)

35 **(c)**

Fe^{3+} forms soluble complex with oxalic acid

42 **(b)**

Zns is white

49 **(b)**

Cr^{3+}: $[Ar]3d^5$ stable

50 **(b)**

As oxidation state increases, electronegativity increases thus acidic characteristic increases not basic.

51 **(b)**

Ti(22): $[Ar]4s^2\ 3d^2$

1	1			

Ti^{2+}: $[Ar]3d^2$

Ti^{4+}: $[Ar]3d^0$

Ti^{2+} has two unpaired electrons in $3d$ and thus d-d^* transition is possible due to absorption of light in visible region

52 **(a)**

$MnO_4^- \rightarrow MnO_4^{2-} + e^-$

53 **(b)**

Cu^+: $[Ar]3d^{10}$ all electrons paired

56 **(a)**

$2CuSO_4 + 4KI \rightarrow K_2SO_4 + Cu_2I_2 + I_2$

$I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$

58 **(c)**

Non-oxidising acids (as HCl) dissolve basic and emphoteric oxides, e.g., Cr_2O_3

$Cr_2O_3 + 6HCl \rightarrow 2CrCl_3 + 3H_2O$

$CrCl_3$ is hydrated in aqueous solution existing as $[Cr(H_2O_6)]^{3+}$

63 **(a)**

$2MnO_2 + 4KOH + O_2 \longrightarrow \underset{\text{purple colour}}{2K_2MnO_4} + 2H_2O$

64 **(a)**

$VO_2 + 2H^+ \rightarrow VO^{2+} + H_2O$

68 **(a)**

$2MnO_4^{2-} \xrightarrow{H^+} MnO_2 + MnO_4^-$

83 **(c)**

$Cr_2O_7^{2-} + 2OH^- \rightarrow 2CrO_4^- + H_2O$

84 **(b)**

This is due to increasing stability of the lower species to which they are reduced

$VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$

Oxidation state $+5$ $+6$ $+7$

91 **(b)**

$Ni^{2+} + DMG \rightarrow \underset{\text{Cherry red ppt}}{[Ni(DMG)_2]^{2+}}$

93 **(d)**

$6Fe^{2+} + Cr_2O_7^{2-} \rightarrow 6Fe^{3+} + 2Cr^{3+}$

94 **(d)**

$2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

96 **(b)**

$CrO_3 + H_2O \rightarrow H_2CrO_4$ (acidic)

105 **(b)**

$[Co(SCN)_4]^{2-}$, cobalt is +2 with three unpaired electrons in $3d$. Thus, $\mu = \sqrt{15}$ BM

109 **(b)**

Zinc blende is roasted and then treated with coke for the reduction.

$2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2 \uparrow$

$ZnO + C \xrightarrow{\Delta} Zn + CO \uparrow$

113 **(a)**

$3MnO_4^{2-} \rightarrow MnO_2 + 2MnO_4^-$

114 **(b)**

Colour of transition metal ion salt is due to $d - d$ transition of unpaired electrons of d -orbital. Metal ion salt having similar number of unpaired electrons in d-orbitals shows similar colour in aqueous medium.

In $VOCl_2$ vanadium is present as V^{4+} and in $CuCl_2$, copper is present as Cu^{2+}.

So, ${}_{23}V = 1s^2, 2s^2\ 2p^6, 3s^2\ 3p^6 3d^3, 4s^2$

$V^{4+} = 1s^2, 2s^2 2p^6, 3s^2\ 3p^6\ 3d^1$

$3d^1$

1				

Number of unpaired electrons $=1$

and ${}_{29}Cu = 1s^2, 2s^2\ 2p^6, 3s^2\ 3p^6\ 3d^{10}, 4s^1$

$Cu^{2+} = 1s^2, 2s^2 2p^6, 3s^2\ 3p^6\ 3d^9$

$3d^9$

1↓	1↓	1↓	1↓	1

Number of unpaired electron $=1$

Hence, $VOCI_2$ and $CuCI_2$ show similar colour.

116 **(b)**

$HgI_2 + 2KI \rightarrow K_2HgI_4$

$HgI_2 \rightarrow Hg + I_2$ (violet)

125 **(c)**

$NO \rightarrow NO^+ + e^-$

$Fe^{3+} + e^- \rightarrow Fe^{2+}$

Oxidation state of Fe is $+2$ and NO^+ is ligand

131 **(c)**

$[Ar]4s^1 3d^5$

140 **(b)**

$NO \rightarrow NO^+ + e^- \quad 25 + 12 \rightarrow 37$

$Fe^{2+} + e^- \rightarrow Fe^+(25e)$

142 **(d)**

Fe(III) gives red colours with KCNS

148 **(d)**

$NO \rightarrow NO^+ + e^-$

$Fe^{2+} + e^- \rightarrow Fe^+$ (three unpaired electrons)

$3d^6 \qquad 3d^7$

1↓	1	1	1	1

1↓	1↓	1	1	1

Magnetic moment $= \sqrt{N(N+2)} = \sqrt{15}$ BM

149 **(d)**

Third electron which is removed in third ionization potential enthalpy belongs to $3d^3$ subshell in V

In ${}_{23}V = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$

Third electron which is removed in third ionization potential enthalpy belongs to $3d^4$ subshell

${}_{24}Cr = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

Third electron which is removed in third ionization potential enthalpy belongs to $3d^6$ subshell

${}_{29}Fe = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$

Third electron which is removed in third ionization potential belongs to $3d^5$ subshell

In all elements shell and subshells are same. Required amount of energy is based upon the stability of d-subshell. Hence, Mn shows highest third ionization potential or enthalpy

${}_{25}Mn = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$

155 **(b)**

$Cr_2O_7^{2-} \xrightarrow{6e^-} 2Cr^{3+}$

6 electrons for two Cr

3 electrons per Cr

161 **(a)**

$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2O_3 + N_2 + 4H_2O$

$NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H_2O$

162 **(b)**

Ferromagnetism is permanent magnetism in the atom/ion. It is due to unpaired electrons

$Fe(26) = [Ar]3d^6\ 4s^2$

1↓	1	1	1	1

$3d^6$

$Co(27) = [Ar]3d^7\ 4s^2$

1↓	1↓	1	1	1

$3d^7$

$Ni(28) = [Ar]3d^8\ 4s^2$

1↓	1↓	1↓	1	1

$3d^8$

163 **(c)**

Magnetic moment $\mu = \sqrt{N(N+2)}$BM

Where, $N =$ unpaired electrons

$Cr(24) \quad [Ar]3d^5 4s^1 \quad N = 6, \mu = \sqrt{48}\ \text{BM} = x$

$Mn^+ \quad [Ar]3d^5 4s^1 \quad N = 6, \mu = \sqrt{48}\ \text{BM} = y$

$Fe^{2+} \quad [Ar]3d^6 \quad N = 4, \mu = \sqrt{24}\ \text{BM} = z$

1↓	1	1	1	1

$N = 4$

Thus, $z < x = y$

167 **(c)**

Ion is coloured if there are unpaired electrons in

d-suborbit

Paramagnetic nature is also due to unpaired electrons

Thus, every coloured ion is also paramagnetic

$Cu^{2+} = [Ar]3d^9$ one unpaired electron in $3d$

$Cr^{+} = [Ar]3d^5$; five unpaired

$Mn^{2+} = [Ar]3d^5$ electrons in $3d$

169 **(d)**

$2Ag^+ + H_2S \rightarrow Ag_2S$ (black)

170 **(c)**

Fe has 4 unpaired electrons

172 **(c)**

MnO_4^- charges to MnO_4^{2-} or MnO_2 in basic medium

173 **(b)**

$$SnCl_2 + HgCl_2 \rightarrow Hg_2Cl_2 \xrightarrow{SnCl_2} Hg$$

white grey

183 **(b)**

$$Cr_2O_7^{2-} + SO_2 \rightarrow SO_4^{2-} + Cr^{3+}$$

$+6 \quad +4 \quad +6 \quad +3$

186 **(d)**

Mn^{2+} (d^5)

1	1	1	1	1

189 **(d)**

$CrO_3 + 2H^+ \rightarrow CrO_2^{2+} + H_2O$

192 **(b)**

$2CuSO_4 + 4KI \rightarrow Cu_2I_2 + K_2SO_4 + I_2$

$I_2 + KI \rightarrow KI_3$

195 **(c)**

$Cr_2O_7^{2-} + 2OH^- \rightarrow 2CrO_4^{2-} + H_2O$

$pH > 7$ $(x > 7)$

$2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

$pH < 7 (y < 7)$

198 **(c)**

In CuF_2, Cu^{2+} ion exist, having d^9 configuration. Unpaired electron causes colour ($d - d$ transition). In the crystalline form, CuF_2 is blue coloured.

199 **(b)**

Metals lying above H in electrochemical series are not obtained from their oxides by heating

$HgO \rightarrow Hg + O_2$

$ZnO \rightarrow Zn + O_2$

$Ag_2O \rightarrow Ag + O_2$

201 **(b)**

Generally salts are colourless due to d^{10}-configuration

210 **(a)**

When I^- is oxidised by MnO_4^- in alkaline medium I^- converts into IO_3^-.

$$2KMnO_4 + 2KOH \longrightarrow 2K_2MnO_4 + H_2O + [O]$$
$$2KMnO_4 + 2H_2O \longrightarrow 2MnO_2 + 3KOH + 2[O]$$

$$2KMnO_4 + H_2O \xrightarrow{\text{alkaline}} 2MnO_2 + 2KOH + 3[O]$$
$$KI + 3[O] \longrightarrow KIO_3$$

Hence,

$$2KMnO_4 + KI + H_2O \longrightarrow 2KOH + 2MnO_2 + KIO_3$$

213 **(b)**

(*b*) Cr(24) = [Ar] | 1 | 1 | 1 | 1 | 1 | | 1 |

$3d^5$ $4s^1$

Cr^+ = [Ar] | 1 | 1 | 1 | 1 | 1 | ← Completely half-filled $3d$-subshell configuration

$3d^5$

Cu(29) = [Ar] | ↿⇂ | ↿⇂ | ↿⇂ | ↿⇂ | ↿⇂ | | 1 |

$3d^{10}$ $4s^1$

$Cu^+(28)$ = [Ar] | ↿⇂ | ↿⇂ | ↿⇂ | ↿⇂ | ↿⇂ | ← Completely filled $3d$-subshell configuration

$3d^{10}$

Both are stable configuration and removal of next electron requires very high energy. Thus, second IE is very high

V^+ $[Ar]3d^3\ 4s^1$) Second electron is removed for Mn^+ $[Ar]3d^5\ 4s^1$) $4s$ subshell, thus, second IE is Ni^+ $[Ar]3d^8\ 4s^1$) low

Zn^+ $[Ar]3d^{10}\ 4s^1$)

216 **(b)**

$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

230 **(b)**

In this base CrO_2Cl_2 is formed

233 **(d)**

$Cu^+, [Ar]3d^{10}$

No unpaired electron, thus $s = 0$

236 **(a)**

$Fe^{3+}: [Ar]3d^5$; $Cu^+: [Ar]3d^{10}$

239 **(b)**

$CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

241 **(a)**

Ammounium dichromate on heating gives N_2 gas which is also given by heating of NH_4NO_2.

$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2O_3 + 4H_2O + N_2 \uparrow$

$NH_4NO_2 \xrightarrow{\Delta} 2H_2O + N_2 \uparrow$

243 **(b)**

$CuSO_4 + 2H_2O \rightleftharpoons Cu(OH)_2 + H_2SO_4$

$2CrO_4^{2-} + 2H^+ \rightleftharpoons Cr_2O_7^{2-} + H_2O$

252 **(a)**

Maximum unpaired electrons

1	1	1	1	1

d^5

254 **(b)**

I. $2CuSO_4 + 4KI \rightarrow Cu_2I_2 + I_2 + K_2SO_4$

White ppt

II. $HgCl_2 + 2KI \rightarrow 2KCl + HgI_2 \downarrow$

Orange ppt

$HgI_2 + 2KI \rightarrow K_2HgI_4$

soluble

III. $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 \downarrow + 2KNO_3$

Yellow ppt

259 **(a)**

Ring is formed by charge transfer

$NO \rightarrow NO^+ + e^-$

$Fe^{2+} + e^- \rightarrow Fe^{2+}$

262 **(c)**

Ore	Chemical composition
Cuprite	Cu_2O
Chalcocite	Cu_2S
Chalcopyrite	$CuFeS_2$
Malachite	$Cu(OH)_2.CuCO_3$

In these ores, chalcopyrite ($CuFeS_2$) Contains both iron and copper.

271 **(b)**

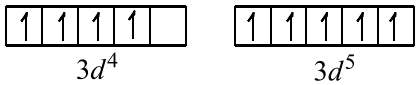
24 carat gold is 100%

Thus, 22-carat gold is 91.67%

Thus, 3.5% higher

274 **(d)**

$Mn^{3+} + e^- \rightarrow Mn^{2+}$

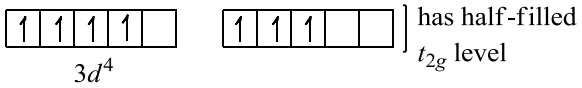


$3d^4$ $3d^5$

$3d^5$

Extra stability is gained when Mn^{3+} is reduced to Mn^{2+} and is thus an oxidizing agent

$Cr^{2+} \rightarrow Cr^{3+} + e^-$



$3d^4$ has half-filled t_{2g} level

279 **(d)**

$2MnO_2 + 4\,KOH + O_2 \xrightarrow{\text{Fusion}} 2K_2MnO_4 + 2H_2O$

Oxidation number of Mn in K_2MnO_4 is

$2 \times (1) + x + 4(-2) = 0$

$x = +6$

281 **(d)**

E^{o}_{red} increases left to right

286 **(a)**

Larger anion stabilizes to a greater extent

287 **(c)**

$E° < 0$, it means forward equilibria are not spontaneous

Thus, Fe^{2+} is more stable than Fe^{3+}

In $[Fe(CN)_6]^{4-}$ oxidation number of Fe $= +2$

and in $[Fe(CN)_6]^{3-}$ oxidation number of Fe $= +3$

Due to complex ion, $E°$ decreases, thus stability can be increased by complexing ion

291 **(b,c)**

On heating $FeSo_4$ gives

$2FeSO_4 \xrightarrow{\Delta} Fe_2O_3 + SO_2 + SO_3$

294 **(b,c)**

MnO_4^{2-}, Cl_2 and NO_2 undergo disproportionation, *ie*, oxidation and reduction of same element simultaneously, in the alkaline medium

$Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$

$2NO_2 + 2NaOH \rightarrow NaNO_2 + NaNO_3 + H_2O$

MnO_4^{2-} is stable in strong alkali solution and disproportionate into MnO_4^- and MnO_2 in less basic, acidic and neutral medium

298 **(b,c,d)**

Transition metals show colour due $d - d$ transition, charge transfer and incompletely filled d-orbitals

307 **(b,d)**

Following reactions are involved in developing the photographic plate

$2AgBr + C_6H_4(OH)_2 \rightarrow 2Ag + 2HBr + C_6H_4O_2$

quinol(developer)

quinine(developing)

$AgBr + 2Na_2S_2O_3 \rightarrow Na_3[Ag(S_2O_3)_3] + NaBr$

(soluble)

(fixing the image)

310 **(a,b,c)**

The transition metals that do not form amalgams with Hg are Fe and Pt

315 **(c)**

$CuSO_4.5H_2O \xrightarrow[\text{efflorescence}]{\text{Air}} CuSO_4.3H_2O \xrightarrow{100^oC} CuSO_4.H_2O \xrightarrow{250^oC} CuSO_4$

One water molecular is hydrogen bonded to coordinated water molecules and SO_4^{2-} ion and remaining four are coordinated to the central Cu^{2+} ion

316 **(a)**

The solubility of many salts of lanthanides follows the pattern of group II elements

317 **(a)**

Statement II is the correct explanation of statement I

318 **(b)**

Chromium has maximum number of unpaired d-electrons. While Hg does not have any unpaired d-

electron.

319 **(b)**
In alkaline medium, $KMnO_4$ is reduced to MnO_2 which involves $3e^-$

Thus, its eq. wt $= \frac{M}{3}$

320 **(b)**
The magnetic moments are lesser than the theoretically predicted values. This is due to the fact that $5f$ electrons of actinides are less effectively shielded which results in quenching of orbital contribution.

322 **(d)**
Both assertion and reason are false. Mercury vapour are visible as no metallic bounding is possible in vapour state.

323 **(b)**
$Eu^{2+}[Xe]4f^7\ 5d^{10}$ (more stable)

$Ce^{2+}[Xe]4f^1\ 5d^1$

324 **(c)**
The free gaseous Cr atom has six unpaired electrons due to following electronic configuration $(Ar)3d^5\ 4s^1$. This is because half filled d-orbitals are more stable than incompletely filled d-orbitals. So, one electron jumps from $4s^2$ to $3d$ orbital.

328 **(c)**
$\therefore\ \mu = \sqrt{n(n+2)}$

$Cr^{3+}(Z = 24): 3d^3 4s^0, \mu = \sqrt{3(3+2)} = \sqrt{15}$

$Fe^{2+}(Z = 26): 3d^6 4s^0, \mu = \sqrt{4(4+2)} = \sqrt{24}$

$Ni^{2+}(Z = 28): 3d^8\ 4s^0, \mu = \sqrt{2(2+2)} = \sqrt{8}$

$Mn^{2+}(Z = 25): 3d^5\ 4s^0, \mu = \sqrt{5(5+2)} = \sqrt{35}$

337 **(a)**
Na_3VO_4 contains V in +5 oxidation state, which has all d-orbitals vacant and thus, colourless

338 **(b)**
Mn has $3d^5 4s^2$ outer electronic configuration. Therefore, by losing all s and d-elelctrons, the maximum oxidation state achieved is +7