1. Identify the substance that get reduced in the following reactions
   $Fe_2O_3(s) + 3co(g) \rightarrow 2Fe(s) + 3CO_2(g)$
2. Zn rod is immersed in $CuSO_4$ Solutions. What will you observe after an hour ? Explain your observations in terms of redox reactions.
3. Does the oxidations number of an element in any molecule or any polyatomic ion represent the actual charge on it ?
4. The compound $YBa_2Cu_3O_7$, Which shows superconductivity, has copper in x oxidations state. Assume that the rare earth element yttrium is in its usual + 3 oxidations state. Predict the value of x.
5. What is the most essential conditions that must be satisfied in a redox reactions ?
6. What are spectator ions ? Give one example.
7. Why is anode called oxidation electrode, whereas cathode is called reductions electrode ?
8. Can we use KCl as electrolyte in the salt bridge of the cell, Cu(s) | Cu^2 (aq) || Ag^+ (aq) | Ag(s) ?
9. What would happen if no slat bridge were used in the electrochemical cell (e.g., Zn- Cu cell) ?
10. Can Fe^{3+} oxidize Br^- to Br_2 at 1 M concentrations ?
    E^0 (Fe^{3+} | Fe^{2+}) = 0.77 V and E^0 (Br | Br^-) = 1.09 V
11. When magnesium ribbon is burnt in air, two products are formed, magnesium oxide and magnesium nitride. Point out the oxidizing and reducing agents.
12. At what concentration of Cu^{2+} (aq). Will its electrode potential ?
13. What is the relationship between directions of current and flow of electrons by convention ?
14. Can 1 M $FeSO_4$ solution be stored in nickel vessel?
15. The compound AgF_2 is unstable compound. However, if formed, the compound acts as a very strong oxidizing agent. Why?
16. What is the oxidation number of Xe is Ba_2XeO_2?
17. What is the oxidation number of Cr in (i) K_2Cr_2O
    (ii) K_2CrO_4.
18. Can oxidation number of an atom in a chemical species be fractional? Illustrate by an example.
19. What is the maximum and minimum oxidation no. of N?
20. What is a REDOX COUPLE?
21. On the basis of stoichiometry determine the oxidation no. of (i) Fe in Fe_3O_4, (ii) Cl in $CaOCl_2$.
22. How will you define (i) Oxidant and (ii) Reductant in terms of oxidation no.?
23. What is the oxidation number of S in S_2Cl_2 .
24. Why does the electrochemical cell working after some time?
25. What would if no salt bridge were used in the electrochemical cell (e.g., $Zn-Cu$ cell)?
26. The half cell reactions with their oxidation potentials are
    $Pb(s) \longrightarrow Pb^{2+}(aq) + 2e^-;\ E^o_{oxi} = +0.13\ V,\ Ag(s) \longrightarrow Ag^+(aq) + e^-;\ E^o_{oxi} = -0.80\ V$
    Write the cell reaction and calculate its EMF.
27. Define oxidation in terms of electronic concept.
28. What is meant by reduction ?
29. What are redox reactions ? Give an example.
30. Define an oxidizing agent. Name the best oxidizing agent.
31. What is meant by reducing agent ? Name the best reducing agent.
32. Define oxidation number.
33. What is oxidation number of alkali metals in their compounds ?
34. Define cathode and anode.
35. Why are positive ions called cations whereas negative ions are called anions ?
36. Why is anode called oxidation electrode whereas cathode is called reduction electrode ?
37. Calculate the oxidation number of P in PO_4^{3-}, HPO_3^{2-}.
38. What is oxidation number of S in Na_2S4O_6 and Na_2SO_3?
39. What is Daniell cell ?
40. What is meant by electrode potential ?
41. What is standard electrode potential of hydrogen electrode ?
42. How will you represent a Daniell cell ? Name the cathode and anode.
43. Why is reduction potential of zinc - 0.76 V?
44. How will you identify cathode and anode in electro-chemical cell ?
45. Fe decomposes steam while Cu does not, why ?
46. What is salt bridge ?
47. Why do we need salt bridge ?
48. What is the relationship between direction of current and flow of electrons by convention ?
49. A metal is higher than a particular metal in electro-chemical series. Will the metal be stronger reducing agent or weaker reducing agent ?

50. If SHE (Standard Hydrogen Electrode) acts as anode and given metal acts as cathode, what is sign of the reduction potential of metal ?
51. Write electrode reaction when hydrogen acts as (i) cathode, (ii) anode.
52. What is meant by inert electrolyte used in salt bridge ?
53. What is meant by oxidation potential of an electrode ?
54. What is relationship between standard oxidation potential and standard reduction potential ?
55. Dichromate ion in acidic medium reacts with ferrous ion to give ferric and chromic ions. Write the balanced chemical equation corresponding to the reaction.
56. Permanganate ion reacts with bromide ion in basic medium to give manganese dioxide and bromated ion. Write the balanced chemical equation for the reaction.
57. In passing chlorine gas through concentrated solution of alkali, we get chloride and chlorate ions. Obtain balanced chemical equation for this reaction.
58. What is oxidation number of Fe in $[Fe(CO)_5]$?
59. $2\ Cu_2S + 30s \rightarrow 2Cu_20 + 2S0_2$
    In this reactions which substance is getting oxidized and which substance is getting reduced ? Name reducing agent and oxidizing agent.
60. Nitric acid acts only as an oxidizing agent while nitrous acid acts both as an oxidizing as well as reducing agent. Explain.
61. Why does fluorine not show disproportinations reactions ?
62. Nitric acid is an oxidising agent and reacts with PbO but it does not react with PbO_2. Explain why ?
63. How would you know whether a redox reactions is taking place in an acidic, alkaline or neutral medium ?
64. A solutions of silver nitrate was stirred with iron rod. Will it cause any change in the concentrations of silver and nitrate ions ?
65. Two half cells are Al^{3+} (aq) /Al and Mg^{2+} (aq) Mg. The reductions potentials of these half cells are - 1.66 V and - 2.36 v respectively. Calculate the cell potential write the cell reaction also.
66. How many millimoles of potassium dichromate is required to oxidize 24 mL of 0.5 M Mohr's salt solution in acidic medium ?
67. Give the following information's concerning metal strips immersed in certain solutes, write the net ionic equations representing the reactions that occur.

Metal strip	Solutions	Reactions
Cd	$NiCl_2$	Ni coating fromed
Cd	$FeCl_2$	No reaction
Zn	$CdCl_2$	Cd coating formed
Fe	$CdCl_2$	No reaction

68. Balance the following equation $Br_2 + H_2O_2 \rightarrow BrO_3^- + H_2O$ (in acidic medium)
69. 2.48 g of $Na_2S_2O_3.xH_2O$ was dissolved per litre of the solution. 20 mL of this solutions required 10 mL of 0.01 M iodine solutions. Find out the value of X.
70. Calculate the concentrations of hypo ($Na_2S_2O_3.5H_2O$) Solutions in gL^{-1} if 10.00 mL of this solutions decolorized 25 mL of M/50 iodine solutions.
71. A cell is set up between copper and silver electrodes as follows :
    $Cu(s)\left|Cu^{2+}(aq)\right\|Ag^{2}(aq)\left|Ag(s)\right.$
    If the two half cells work under standard conditions calculate the EMF of the cell
    (Given $E^{o}_{Cu^{2+}/cu} = +0.34V; E^{o}_{Ag^{+}/Ag} = +0.80V$)
72. Calculate E.M.F. of the cell containing nickel and copper electrodes. Given
    $E^{o}_{Ni^{2+}/Ni} = -0.25V; E^{o}_{cu^{2+}/cu} = +0.34V.$
73. What will happen when chlorine is passed through an aqueous solution of potassium bromide?
74. What is the source of electrical energy in a galvanic cell?
75. Calculate the oxidation number of underlined atoms in the following compounds and ions :
    $\underline{Pb}SO_4$, $\underline{Br}F_3$, $\underline{Cr}O_4^{2-}$, $\underline{Mn}O_4^-$, $\underline{C}H_4$, $\underline{Sb}_2O_5$, $(\underline{N}H_4)_2\ SO_4$, $\underline{C}_6H_{12}O_6$.
76. Balance the following reaction :
    (i) $Cu + NO_3^- \rightarrow NO_2 + Cu^{2+}$
    (ii) $SnO_2 + C \rightarrow Sn + CO$.
77. Write correctly balanced half cell reactions and overall equations for the following equations by ion electron method :
    (i) $NO_3^- + Bi\ (s) \rightarrow Bi^{3+} + NO_2$ in acid solution
    (ii) $Cr_2O_7^{2-} + C_2H_4O^- \rightarrow C_2H_4O_2 + Cr^{3+}$ in acid solution
    (iii) $MnO_4^- + H_2C_2O_4 \rightarrow Mn^{2+} + CO_2$ in acid solution
    (iv) $Cr_2O_7^{-2} + Fe^{2+} \rightarrow Fe^{3+} + Cr^{3+}$ + in acid solution.

78. Starting with the correctly balanced half reactions write the overall net ionic reactions in the following changes :
(i) Chloride ion is oxidized to Cl_2 by MnO_4^- in acid solution.
(ii) HNO_2 reduces MnO_4^- in acid solution.
(iii) HNO_2 Oxidises I^- to I_2 in acid solution.
(iv) ClO^{3-} oxidizes Mn^{2+} to MnO_2(s) in acid solution.

79. Assign oxidation number to the underlined elements in each of the following species :
(a) $NaH_2\underline{P}O_4$ (b) $NaH\underline{S}O_4$
(c) $H_4\underline{P}_2O_7$ (d) $K_2\underline{Mn}O_4$
(e) $Ca\underline{O}_2$ (f) $Na\underline{B}H_4$
(g) $H_2\underline{S}_2O_7$ (h) $KAl(\underline{S}O_4)_2.12H_2O$

80. What are the oxidation number of the underlined elements in each of the following and how do you rationalize your results ?
(a) $K\underline{I}_3$ (b) $H_2\underline{S}4O_6$
(c) $\underline{Fe}_3O_4$ (d) $\underline{C}H_3\underline{C}H_2OH$
(e) $\underline{C}H_3\underline{C}OOH$

81. Suggest a list of the substances where carbon can exhibit oxidation states from -4 to +4 and nitrogen from -3 to +5.

82. While sulphur dioxide and hydrogen peroxide can act as oxidizing as well as reducing agents in their reactions, ozone and nitric acid act only as oxidants. Why ?

83. Describe the standard half cell that is used in electrochemistry to measure standard potentials. Write an equation for its half reaction and show its standard potential.

84. The standard reduction potentials of Al and Ni are -1.66 V and -0.28 V, respectively. Is Al a stronger or weaker reducing agent than Ni ? Explain.

85. The standard reduction potentials of Zn^{2+}, Mg^{2+} and Na^+ are -0.76 V, -2.37 V and -2.71 V respectively. Which of the following is the strongest oxidizing agent?
Zn^{2+}, Mg^{2+} or Na^+

86. Consider a voltaic cell constructed with the following substances :
$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$ $E° = -0.74$ V
$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$
$E° = +1.51$ V
(a) Which substances are oxidized and reduced in this cell ?
(b) Write the overall cell equation and calculate he cell potential.
(c) Which are the negative and positive electrodes ?
(d) Write the cell notation for this voltaic cell.

87. Which of the following is best reducing agent and why?
Li, Cu, Br_2, F_2, H_2, K

88. Calculate $E°_{cell}$ for the reaction $Cl_2(g) + 2I^- \rightarrow I_2(s) + 2Cl^-(aq)$ with the help of these half cell reactions :
$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$ $E° = +1.36$ V
$I_2(g) + 2e^- \rightarrow 2I^-(aq)$ $E° = +0.54$ V.

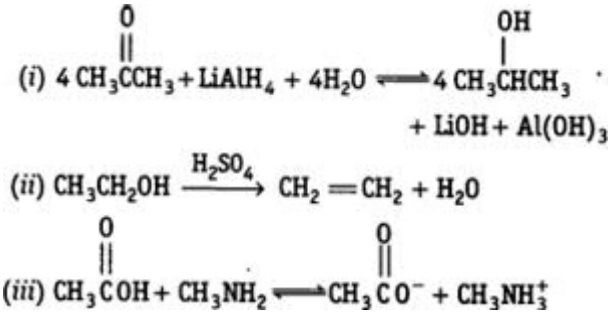
89. (a) Give one use of heavy water in nuclear reactor.
(b) Write down balanced chemical equations of the reaction of cone. Nitric acid with (i) Copper, and
(ii) Iodine.

90. (a) Find the oxidation number of (i) S in $S_2O_8^{2-}$, (ii) C in HCOOH.
(b) Identity the oxidant and reductant in the following chemical reaction :
$2I(aq) + Cl_2(g) \rightarrow 2Cl^-(aq) + I_2(s)$.

91. Balance the following ionic reaction with the help of oxidation number method :
$MnO_4^- + I^- \rightarrow MnO_2 + IO_3^-$ (alkaline medium).

92. Complete the following equations :
(a) $PbS(s) + H_2O(aq) \rightarrow$ .....
(b) $MnO_4^-(aq) + H_2O_2 \rightarrow$ .....'

93. Decide whether each of the following reaction involves oxidations-reductions. If it does, identify what is oxidized and what is reduced ?



94. Calculator the oxidations number of each sulphur atom in the following compounds
(i) $Na_2S_2O_3$ (ii) $Na_2S_4O_6$
(iii) Na_2SO_3 (iv) Na_2SO_4

95. Calculate the oxidations number of sulphur, chromium and nitrogen in H_2SO_5, $Cr_2O_7^{2-}$ and NO_3^-. Suggest the structures of these compounds. Count for the fallacy.

96. Comment upon the statement, "Paradox of fractional oxidation numbers".

97. How does Cu_2O act as both oxidant and reductant ? Explain with proper reactions showing the changes of oxidations number in each example.

98. Why do the following reactions proceed differently ?
$Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O$ and
$Pb_3O_4 + 4HNO_3 \rightarrow 2Pb(NO_3)_2 + PbO_2 + 2H_2O$

99. Whenever a reaction between an oxidizing agent and a reducing agent is carried out, a compound of lower oxidations state is formed if the reducing agent is in excess and a compound of higher oxidations state is formed if the oxidizing agent is in excess. Justify this statement giving three illustrations.

100. Write formulae for the following compounds.
(i) Mercury (II) Chloride (ii)Nickel (II) Sulphate
(iii) Tin (IV) Oxide (v) Iron (III) Sulphate

101. One mole of N_2H_4 losses 10 moles electrons to forms a new compound Y. Assuming that all the nitrogen appears in the new compound, what is the oxidations number of N in Y? There is no change in oxidations state of H.

102. Identify the type of redox reactions taking place in the following.
(i) $\overset{0}{3Mg}(s) + \overset{0}{N_2}(g) \rightarrow \overset{+2\ -3}{Mg_3N_2}(s)$
(ii) $\overset{+5\ -2}{V_2O_5}(s) + 5\overset{0}{Ca}(s) \rightarrow 2\overset{0}{V}(s) + 5\overset{+2\ -2}{CaO}(s)$
(iii) $\overset{+1\ +5\ -2}{2KClO_3}(s) \rightarrow 2\overset{+1\ -1}{KCl}(s) + 3\overset{0}{O_2}(g)$
(iv) $\overset{0}{Ca}(s) + 2\overset{+1-2}{H_2O}(l) \rightarrow \overset{+2\ -2\ +1}{Ca(OH)_2}(aq) + \overset{0}{H_2}(g)$
(v) $\overset{0}{Br_2}(l) + 2I^-(aq) \rightarrow 2\overset{-1}{Br^-}(aq) + \overset{0}{I_2}(s)$
(vi) $\overset{0}{Cl_2}(g) + 2OH^-(aq) \rightarrow \overset{-1}{ClO^-}(aq) + \overset{-1}{Cl^-}(aq) + H_2O(l)$

103. Refer to the periodic table given in your book and answer the following questions.
(i) Select the possible non-metals that can show disproportionation reaction.
(ii) Select three metals that can show disproportionations reaction.

104. Write balanced chemical equation for the following reactions.
(i) Permanganate ion (MNO_4^-) reacts with sulphur dioxide gas in acidic medium to produce Mn^{2+} and hydrogen sulphate ion. (Balance by ion electron method)
(ii) Reactions of liquid hydraxine (N_2H_6) with chlorate ion (ClO_3^-) in basic medium procures nitric oxide gas and chloride ion in gaseous state. (Balance by oxidation number method)

105. Which method can be used to find out strength of reluctant/oxidant in a solutions ? Explain with an example.

106. Copper dissolves in dilute nitric acid but not in dilute HCl. Explain.

107. Justify giving reactions that among halogens, fluorine is the best oxidant and among hydrohalic compounds, hydroiodic acid is the best reductant.

108. What is the oxidation number of nitrogen in
(i) Nitric acid (ii) Nitrous acid
(iii) Nitric oxide (iv) Nitrous oxide
(v) Ammonia (vi) N_2 ?

109. The standard electrodes potentials at 298 K are given below
$E^0_{Zn^{2+}/Zn} = -0.76V$, $E^0_{Fe^{2+}/Fe} = -0.44V$. $E^0_{H^+/H_2} = 0.0V$, $E^0_{Cu^{2+}/Cu} = +0.34V$
Which of the two electrodes should be combined to form a cell having highest emf ? Identify the cathode and the anode and write the cell reactions. Also mention the directions of flow of electrons in the external as well as the internal circuit.

110. What is the oxidation number of the metal atom in the following ions?
(i) $[Fe(CN)_6]^{3-}$ (ii) MnO_4^- (iii) $[Cr(H_2O)_6]^{3+}$

111. Point out the oxidizing and reducing agents in the following reactions :
(i) $SO_2 + 2HNO_3 \rightarrow H_2SO_4 + 2NO_2$
(ii) $SO_2 + 2H_2S \rightarrow 2H_2O + 3S$
(iii) $SO_2 + Cl_2 + 2H_2O \rightarrow 2HCl + H_2SO_4$

112. In the following chemical reactions, indicate the substances undergoing oxidation and reduction and also mention the oxidizing and reducing agents.
(i) $2HBr + Cl_2 \rightarrow 2HCl + Br_2$
(ii) $3CuO + 2NH_3 \rightarrow 3Cu + N_2 + 3H_2O$

113. Balance the following redox equations :
(i) $Cu + NO_3^- \rightarrow NO_2 + Cu^{2+}$ (Acidic medium)
(ii) $[Cr(OH)_4]^- + H_2O_2 \rightarrow CrO_4^{2-} + H_2O$
(Basic medium)
(iii) $MnO_4^- + Fe^{2+} \rightarrow Mn^{2+} + Fe^{3+} + H_2O$
(Acidic medium)

114. A cell is prepared by dipping a copper rod in 1M $CuSO_4$ solution and a nickel rod in 1M $NiSO_4$ solution. The standard reduction potentials of copper and nickel electrodes are +0.34 V and -0.25 V respectively.
(i) Which electrode will work as anode and which as cathode?
(ii) What will be the cell reaction?
(iii) How is the cell represented?
(iv) Calculate the EMF of the cell.

115. The blue colour of cooper sulphate solution is discharged when a rod of zinc is dipped in it. Explain.

116. Articles of iron are generally coated with zinc. Explain.

117. Knowing that :
Cu^{2+} (aq) + $2e^-$ → Cu (s); E^o = + 0.34 V
$2Ag^+$ (aq) + $2e^-$ → 2Ag (s); E^o = + 0.80 V
Reason out whether, 1M silver nitrate solution can be stored in copper vessel or 1M copper sulphate solution in silver vessel.

118. Phosphorus acid can act both as oxidizing agent as well as reducing agent while phosphoric acid is only an oxidizing agent. Explain.

119. H_2S acts only as reducing agent while SO_2 can act both as a reducing agent and an oxidizing agent. Discuss.

120. Write the formulas of the following compounds :
(a) Mercury (II) chloride
(b) Nickel (II) sulphate
(c) Tin (IV) oxide
(d) Thallium (I) sulphate
(e) Iron (III) sulphate
(f) Chromium (III) oxide.

121. Write four information's about the reaction :
$(CN)_2$ (g) + $2OH^-$ (aq) → CN^- (aq) + CNO^- (aq) + H_2O (l).

122. In the Ostwald process for the manufacture of nitric acid, the first step involves the oxidation of ammonia gas by oxygen gas to give nitric oxide and steam. What is the maximum weight of nitric oxide that can be obtained starting only with 10.0 g of ammonia and reacting with 20.0 g of oxygen?

123. Arrange the following metals in the order in which they displace each other from their salts.
A1, Cu, Fe, Mg and Zn.

124. Given the standard electrode potentials
K^+/K = - 2.93 V, Ag^+/Ag = 0.80 V
Hg^{2+}/Hg = 0.79 V; Mg^2/Mg = - 2.37 V,
Cr^{3+}/Cr = - 0.74 V
Arrange these metals in increasing order of their reducing power.

125. What is the nature of the reaction at the cathode?

126. What is the basic difference between a direct redox reaction and indirect redox reaction?

127. What is the O.N of all the atoms in the following :
(i) BrF_3 (ii) Sb_2O_5
(iii) Pb_3O_4 (iv) $(NH_4)_2SO_4$

128. What is the O.N of
(i) N in NO_3^-
(ii) P in H_3PO_4
(iii) Mn in K_2MnO_4?

129. How will you differentiate between valency and oxidation number?

130. Why it is not possible to determine the absolute reduction potential of an electrode?

131. What is the difference between e.m.f. and potential difference in a cell?

132. (a) What do you mean by Electrolytic cell?
(b) An electrochemical cell is made of nickel and copper electrodes with their standard reduction potentials as - 0.25 V and + 0.34 V respectively. Select the anode and cathode. Represent the cell and find e.m.f. of the cell.

133. (a) Standard reduction potentials of zinc and copper electrodes are - 0.76 V and 0.34 V respectively. Which electrode will undergo oxidation and which electrode reduction?
(b) Can we store copper sulphate in zinc vessel.?
Give explanation in support of your answer.

134. Identify the strongest and weakest reducing agent
Zn, Cu, Ag, Na, Sn.

135. Write the anode reaction, the cathode reaction and the net cell reaction in the following cells. Which electrode
would be positive terminal in each cell ?
(i) Zn(s) | Zn^{2+} ||| Br_2 | Br | Pt (s) (ii) Cr (s) | Cr^{3+} || I_2 | I^- | Pt (s)
(ii) Pt (s) | H_2(g) | H^+ (aq) || Cu^{2+} | Cu (s).

136. What is salt bridge ? What are its functions ?

137. What is meant by electro-chemical series ? What are characteristic of electro-chemical series ?

138. Write a short note on electro-chemical cell.

139. Explain the construction of standard hydrogen electrode. For what purpose is it used? How are the signs of oxidation potential and reduction potential decided by using SHE (standard hydrogen electrode) ?

140. Balance the following equations in basic medium by ion-electron method and oxidation number methods and identify the oxidizing agent and the reducing agent.
(a) $P_4(s) + OH^-(aq) \rightarrow PH_3(g) + H_2PO_2^-(aq)$
(b) $N_2H_4(l) + ClO_3^-(aq) \rightarrow NO(g)\ Cl^-(g)$
(c) $Cl_2O_7(g)\ H_2O_2(aq) \rightarrow ClO_2^-(aq) + O_2(g) + H^+$

141. How do you account for the following observations?
(a) Though alkaline potassium permanganate and acidic potassium permanganate both are used as oxidants, yet in the manufacture of benzoic acid from toluene we use alcoholic potassium permanganate as an oxidant. Why? Write a balanced redox equation for the reaction.
(b) When concentrated sulphuric acid is added to an inorganic mixture containing chloride, we get colourless pungent smelling gas HCl, but if the mixture contains bromide then we get red vapour of bromine. Why?

142. (a) Balance the following Redox reaction correctly
$Cr(OH)_4^- + H_2O_2 \rightarrow CrO_4^{2-} + H_2O$ in basic medium
(b) An electrochemical cell has the net cell reaction
$H_2(g) + M^{2+}(aq) \rightarrow 2H^+(aq) + M(s)$
If the standard emf of the cell is 0.45 volts, what is the value of $E°_{oxidation}$ of M/M^{2+}?

143. (a) Give two important functions of salt bridge.
(b) Balance the following equation by oxidation number method :
$Fe^{2+} + Cr_2O_7^{2-} + H^+ \rightarrow Fe^{3+} + Cr^{3+} + H_2O$

144. (a) Balance the following equation by oxidation number method :
$Bi + NO_3^- \rightarrow Bi^{3+} + NO_2$ (acidic medium)]
(b) A cell is prepared by dipping a copper rod in 1 M $CuSO_4$ solution and a nickel rod in 1 M $NiSO_4$ solution. The standard reduction potentials of copper and nickel are 0.34 V and -0.25 V respectively.
(i) Which electrode will work as anode and which as cthode ?
(ii) What will be the cell reaction ?
(iii) How is cell represented ?
(iv) Alculate emf of the cell.

145. Balance the following equations by ion electron method :
(i) $MnO_4(aq) + Br^-(aq) + H^+ \rightarrow Mn^{2+}(aq) + Br_2(aq) + H_2O$
(ii) $Cl_2 + OH^- \rightarrow ClO_3^- + Cl^- + H_2O$.

146. Whenever a reaction between an oxidizing agent and a reducing agent is carried out, a compound of lower oxidation state is formed if the reducing agent is in excess and a compound of higher oxidation state is formed if the oxidizing agent is in excess. Justify this statement giving three illustrations.

147. The Mn^{3+} ion is unstable in solution and undergoes disproportionation to give Mn^{2+}, MnO_2 and H^+ ion. Write a balanced ionic equation for the reaction.

148. Chlorine is used to purify drinking water. Excess of chlorine is harmful. The excess of chlorine is removed by treating with sulphur dioxide. Present a balanced equation for this redox change taking place in water.

149. Refer to the periodic table given in your book and now answer the following questions :
(a) Select the possible non metals that can show disproportionation reaction.
(b) Select three metals that can show disproportionation reaction.

150. Predict the products of electrolysis in each of the following :
(a) An aqueous solution of $AgNO_3$ with silver electrodes
(b) An aqueous solution $AgNO_3$ with platinum electrodes
(c) A dilute solution of H_2SO_4 with platinum electrodes
(d)An aqueous solution of $CuCl_2$ with platinum electrodes.

151. (i)Calculate the oxidation number of S in $S_2O_6^{-2}$ having $(-O-O-)^{2-}$ linkage and C in CH_3COOH
(ii) Balance the equation in basic medium by Half reaction method.
$P(s) \rightarrow PH_3(g) + H_2PO_2^-(aq)$

152. (a) Balance the following reaction by ion electron method :
$MnO_4^- + Fe^{2+} \rightarrow + Mn^{2+}$ (acidic medium)
(b) Write the anode, cathode and net cell reaction for the following cell :
$Zn(s) \mid Zn^{2+}(aq) \mid\mid Br^- \mid Br_2(g)$ Pt.
(c) Give two main functions of salt bridge.

153. (a) Calculate the oxidation number of
(i) C in CH_3COOH (ii)S in $S_2O_8^{-2}$
(b) Balanced the following equation in basic medium by half reaction method
$AsO_3^{3-} + MnO_4^- \rightarrow AsO_4^{3-} + Mn_2O_3$

154. (a) Find the oxidation number of sulphur in :
(i) $S_2O_3^{2-}$ (ii) $S_2O_4^{2-}$ (iii) $S_2O_8^{2-}$.
(b) Write a short note on Standard Hydrogen Electrode.
(c) Why it is not possible to store copper sulphate solution in a zinc vessel ?

155. Rahul was very angry because of the oil spot on his favourite shirt. His mother want to make his happy and doesn't know what to do. Her neighbor Mrs. Sharma advised him to use bleach (bleaching powder, $CaOCl_2$) to remove the oil spot.
(i) do you suggest the same thing to remove oil spot ? Why or why not ? Justify you answer.
(ii) What is the oxidations number of both the Cl atoms in the bleaching powder ?
(iii) Which substance, is available in the market to remove such sport ?
(iv) What values are associated with Mrs. Sharma ?

156. Rishi observed that many a times people mixed household chemicals for different uses. He called a meeting to discuss about this with the members of his colony and tell them the hazard of mixing the chemicals. He told them when bleach (ClO^-) is mixed with toilet cleaner (HCl), it is highly dangerous to human health, as this reactions produces water and the highly toxic chlorine gas.
(i) Write the half-reactions for the conversion of hypochlorite and chloride ions to chlorine gas.
(ii) Which half-reactions is oxidation half-reactions and which one is reductions half-reactions ?
(iii) Write a balanced chemical reaction and also which one is reductions half-reactions ?
(iv) What values are associated with Rish ?

157. Rahul and Rahan was friends. Father was great scientist. One day Rohan told Rahul that he is suffering from goitre so doctor advised him to use iodised salt in food. Rahul asked his father fow can we check the presence of iodine in the salt.
(i) In which form, iodine is present in iodised salt ?
(ii) Can you tell the method explained by Rahul's father to check the presence of iodine in salt ?
(iii) Find the oxidations state of each element in the reagent used to check the presence of iodine.
(iv) What are the other sources of iodine ?
(v) What values are associated with Rahul and his father ?

158. Answer the following :
(i) What is the O.N of iodine in HIO_4?
(ii) What is the O.N of Mg in Mg_3N_2?
(iii) What is the sum of the O.N of various elements in an anion?
(iv) What is the O.N of oxygen in Na_2O_2?

159. Justify giving reactions that among halogens, fluorine is the best oxidant and among hydrohalic compound, hydroiodic acid is the best reluctant.

160. What sorts of information's can you draw from the following reactions:
$$(CN)_2(g) + 2OH^-(aq) \rightarrow CN^-(aq) + CNO^-(aq) + H_2O(l)$$

161. (a) Identify the element that exhibits only negative oxidation state.
(b) Identify the element that exhibits only positive oxidation state.
(c) Identify the element that exhibits both positive and negative oxidation states.
(d) Identify the element which exhibits neither the negative nor does the positive oxidation state.

162. Refer to the periodic table given in your book and now answer the following questions.
(a) Select the possible non metals that can show disporoportionation reaction.
(b) Select three metals that can show disproportionation reaction.

163. Predict the products of electrolysis in each of the following:
(i) An aqueous solution of $AgNO_3$ with silver electrodes
(ii) An aqueous solution of $AgNO_3$ with platinum electrodes.
(iii) A dilute solution of H_2SO_4 with platinum electrodes.
(iv)An aqueous solution of $CuCl_2$ with platinum electrodes.

164. HNO_3 acts only as an oxidant whereas KHN_3 reacts both as an oxidant and reluctant. Why?

165. Indicate the oxidizing and reducing agents in the following reactions?

166. Which of the following redox reaction is oxidation and which is reduction?
(i) $Zn \rightarrow Zn^{2+} + 2e^-$ (ii) $Cl_2 + 2e^- \rightarrow 2Cl^-$
(iii) $Fe \rightarrow Fe^{2+} + 2e^-$ (iv) $Sn^{4+} + 2e^- \rightarrow Sn^{2+}$.

167. Balance the following reactions by ION - ELECTIONS method $Cl_2 + OH^-(aq) \rightarrow Cl^-(aq) + ClO_3^-(aq) + H_2O$

168. Arrange the molecules, NH_3, NO_2, HN_3, NO_2^- and N_2H_4 in the decreasing order of the oxidation states of nitrogen.

169. What are minimum and maximum oxidation numbers shown by sulphur?

170. What are the rules to balance redox reactions on the basis of Ion electron method?

171. Write the half reactions for the following redox reactions:
(a) $2Fe^{3+}(aq) + 2I^-(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(aq)$
(b) $Zn(s) + 2H^+(aq) \longrightarrow Zn^{2+}(aq) + H_2(g)$
(c) $Al(s) + 3Ag^+(aq) \longrightarrow Al^{3+}(aq) + 3Ag(s)$

172. Split the following redox reactions in to the oxidation and reduction half reactions:
(a) $2K(s) + Cl_2(g) \longrightarrow 2KCl(s)$
(b) $2Al(s) + 3Cu^{2+}(aq) \longrightarrow 2Al^{3+}(aq) + 3Cu(s)$

173. Determine the oxidations number of C in the following : C_2H_6, C_4H_{10}, CO, CO_2 and HCO^-_3.

174. Find out the oxidation number of Cl in HCl, HClO, ClO_4^- and ClO_2.

175. Identify the oxidant and reluctant in the following reactions:
(a) $10H^+(aq) + 4Zn(s) + NO_3^-(aq) \longrightarrow 4Zn^{2+}(aq) + NH_4^+(aq) + 3H_2O(l)$
(b) $I_2(g) + H_2S(g) \longrightarrow 2HI(g) + S(s)$

176. How many grams of potassium dichromate are required to oxidise 15.2 g of $FeSO_4$ in acidic medium?

177. Calculate the concentration of hypo $(Na_2S_2O_3.5H_2O)$ solution in g dm^{-3} if 10.0 of this solution decolourised 15 mL of M/40 iodine solution.

178. 0.5 g of an impure sample of oxalate was dissolved in water and the solution made to 100 mL. On titration, 10 mL of this solution required 15 mL of N/20 $KMnO_4$ solution. Calculate the percentage of pure oxalate in the sample.

179. Both $Cr_2O_7^{2-}$ (aq) and MnO_4^- (aq) can be used to titrate $Fe^{2+}(aq)$. If in a given titration, 24.50n cm^3 of 0.1 M $Cr_2O_7^{2-}$ were used, then what volume of 0.1 M MnO_4^- solution would have been used for the same titration?

180. A cell prepared by dipping a chromium rod in 1 M $Cr_2(SO_4)_3$ solutions and an iron rod in 1 M $FeSO_4$ solutions. The standard reductions potentials of chromium and iron electrodes are -0.75 V and - 0.45 V respectively.
(a) What will be the cell reactions ?
(b) Which electrode will act as anode?
(c) What will be the standard EMF of the cell.
(d) Which electrodes will act as cathode?

181. Write the cell reaction and calculate the standard E^o of the cell : $Zn|Zn^{2+}(1\ M)||Cd^{2+}(1\ M)Cd$
Given $E^o_{Zn.Zn^{2+}} = 0.763 \text{ volt}$, $E^o_{Cd,Cd^{2+}} = 0.403 \text{ volt}$.

182. The e.m.f. (E^o) of the following cells are
$Ag|Ag^+(1\ M)||Cu^{2+}(1\ M)Cu; E^o = -0.46\,V$, $Zn|Zn^{2+}(1\ M)||Cu^{2+}(1\ M)|Cu; E^o = +1.10\,V$
Calculate the e.m.f. of the cell
$Zn|Zn^{2+}(1\ M)||Ag^+(1\ M)|Ag$

183. Predict whether zinc and silver react with 1 M sulphuric acid to give out hydrogen or not. Given that the standard potentials of zinc and silver are -0.76 volt and +0.80 volt respectively.

184. Is it safe to sir 1 M $AgNO_3$ solution with a copper spoon? Given $E^{o}_{Ag^{+},Ag} = 0.80$ volt, and $E^{o}_{Cu,\ Cu^{2+}} = -0.34$ volt. Explain

185. The electrode potential of four metallic elements (A, B, C and D) are + 0.80, - 0.76 , + 0.12 and + 0.34 V respectively. Arrange them in order of decreasing electropositive character.

186. Explain the terms : oxidation and reduction in terms of electrons. Give one example in each case.

187. Define the terms : oxidising agent and reducing agents according to the electronic concept. Give on example in each case.

188. Comment upto the statement : oxidation and reduction reactions go side by side.

189. Explain what happens when a zinc rod is dipped in $CuSO_4$ solution?

190. What are half reactions? Explain with examples.

191. Define oxidation and reduction in terms of oxidation number. Give examples in each case to illustrate your answer.

192. Define oxidising and reducing agents in terms of oxidation number. Cite two examples in each case to support your answer.

193. H_2S acts only as a reluctant agents in terms of oxidant and reluctant both. Why?

194. H_2O_2 acts as reluctant as well as oxidant. Explain.

195. Explain the difference between valence and oxidation number.

196. Discuss briefly types of redox reactions. Give one example in each case.

197. Discuss briefly types of redox reactions :
(i) Combination reactions (ii) Decomposition reactions (iii) Displacement reactions (iv) Disproportionate reactions.]
Give one example in each case.

198. Comment upon in statement, Paradox of fractional oxidation numbers.

199. Starting with the correctly balanced half reactions, write the overall net ionic reaction in the following changes:
(i) Chloride ion is oxidised to Cl_2 by MnO_4^- (in acid solution)
(ii) Nitrous acid (HNO_2) reduces MnO_4^- (in acid solution)

200. Draw a labelled diagram for the Daniell cell. Discuss its working.

201. Discuss briefly the function of the salt bridge in an electrochemical cell.

202. What is an electrochemical series? How can this be used to explain the oxidising and reducing abilities of elements?

203. Arrange the following metals in increasing order of respectively. Which one be the shortest reducing elements?

204. Discuss the applications of redox reactions.

205. What do you understand by oxidation and reductions ? Classify the following substance into oxidizing and reducing agents.
(i) Carbon
(ii) Ozone
(iii) Nascent hydrogen
(iv) Nitric acid
(v) Chlorine
(vi) Sulphur dioxide

206. Using electron transfer concept, identify the oxidant and reductant in the following redox reactions.
(i) $Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$
(ii) $2[Fe(CN)_6]^{4-}(aq) + H_2O_2(aq) + 2H^+(aq) \rightarrow 2[Fe(CN)_6]^{3-}(aq) + 2H_2O(l)$
(iii) $2[Fe(CN)_6]^{3-}(aq) + 20\ H^-(aq) + H_2O_2(aq) \rightarrow 2[Fe(CN)_6]^{4-}(aq) + O_2(g) + 2H_2O(l)$
(iv) $BrO_3^-(aq) + F_2(g) + 2OH^-(aq) \rightarrow BrO_4^-(aq) + 2F^-(aq) + H_2O(l)$
(v) $2NaClO_3(aq) + I_2(aq) \rightarrow 2NaIO_3(aq) + Cl_2(g)$

207. What are the oxidation numbers of the underlined elements in each of the following and how do you rationalize you results ?

(i) KI_3 (ii) $\underline{H}_2\underline{S}_4O_6$

(iii) $\underline{Fe}_3O_4$

(iv) $\underline{C}H_3\underline{C}H_2OH$ (v) $\underline{C}H_3\underline{C}OOH$

208. Justify that the following reactions are redox rections

(i) $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(g)$

(ii) $Fe_2O_3(s) + 3CO(g) \rightarrow 2\,Fe\,(s) + 3CO_2(g)$

(iii) $4BCl_3\,(g) + 3\,LiAlH_4\,(s) \rightarrow 2B_2H_6(g) + 3LiCl\,(s) + 3AlCl_3(s)$

(iv) $2K\,(s) + F_2\,(g) \rightarrow 2K^+F^-\,(s)$

(v) $4\,NH_3(g) + 50_2\,(g) \rightarrow 4\,NO\,(g) + 6\,H_2O\,(g)$

209. Write correctly the balanced equations for the following redox reactions using half-reactions.

(i) $H_2S + Fe^{3+} \rightarrow Fe^{2+}+S+H^+$

(ii) $I^- + 10_3^- + H^+ \rightarrow I_2 + H_2O$

(iii) $Bi(s) + NO_3^- + H^+ \rightarrow NO_2+Bi^{3+} + H_2O$

(iv) $I^- + O_2(g) + H_2O \rightarrow I_2 + OH^-$

State what is oxidized to what and what and what is reduced to what in the reactions expressed by the equations ?

210. Use the following reactions to arrange the elements A,B,C and D in order of their redox reactivity

(a) $A + B^+ \rightarrow A^+ + B$

(b) $B + D^+ \rightarrow B^+ + D$

(c) $C^+ + D \rightarrow$ No reactions

(d) $B + C^+ \rightarrow B^+ + C$

(ii) On the basis of above redox activity series, predict which of the following reactions would you expect to occur ?

(a) $A^+ + C \rightarrow A + C^+$

(b) $A^+ + D \rightarrow A + D^+$

211. Using the standard electrode potentials given below, predict if the reactions between the following is feasible.

(i) Fe^{3+} (aq) and I^- (aq) (b) Ag^+ (aq) and Cu (s)

(iii) Fe^{3+} (aq) and Cu (s) (d) Ag (s) and Fe^{3+} (aq)

(v) Br_2 (aq) and Fe^{2+} (aq)

Given $E^0_{I_2/I^-}$ = 0.54 V, E^0_{Br2/Br^-} = 1.09 V

$E^0_{Fe^{3+}/Fe^{2+}} = 0.77V, E^0_{cu^{2+}/cu} = 0.34V$

$E^0_{Ag^+/Ag} = 0.80V,$

212. (i) On the basis of standard electrode potential values, suggest which of the following reactions would take place ?

E^0_{Cu2+Cu} = 0.34 V.$E^0_{Zn2+|Zn}$ = - 0.76 V.

$E^0\ Mg^{2+}|Mg$ = - 2.37 V, $E^0\ Fe^{2+}|Fe$=-074V.

$E^0_{Br2|Br^-}$=+1.08 V, $E^0_{Cl2|Cl^-}$= + 1.36 V,

$E^0_{Cd2+|Cd}$ = -0.44 V

(a) $Cu + Zn^{2+} \rightarrow Cu^{2+} + Zn$

(b) $Mg + Fe^{2+} \rightarrow Mg^{2+} + Fe$

(c) $Br_2 + 2Cl^- \rightarrow Cl_2 + 2Br^-$

(d) $Fe+Cd^{2+} \rightarrow Cd + Fe^{2+}$

(ii) Write redox couples involved in the reactins (a) to (d).

213. (i) Write short notes on

(a) Electrochemical series

(b) Redox titrations

(c) Fractional oxidations number and structures of compounds.

(ii) Calculate the oxidations number of sulphur in $S_2O_8^{2-}$ion.

214. Lodate ion reacts with sulphite ion to give sulphate ion and iodide ion.

(i) Write a balanced net ionic equations for the reactions.

(ii) How many grams of sodium sulphite are needed to react with 5.00 g of sodium iodate ?

215. Calculate the oxidation number of

(i) C in CH_4

(ii) Mn in $KMnO_4$

(iii) Cr in $K_2Cr_2O_7$

(iv) P in H_3PO_4

(v) N in HNO_3.

216. The reaction involves the oxidation of Sn^{2+} to Sn^{4+} ion. The skeleton equation for the reaction is : $Cr_2O_2^{2-} + Sn^{2+} + H^+ \rightarrow Cr^{3+} + Sn^{4+} + H_2O$ Balance the equation by ion-electron method.

217. What changes take place when a zinc plate is immersed in aqueous copper sulphate solution? Explain the light of electronic concept of oxidation and reduction.

218. Copper reacts with nitric acid to evolve a brown gas and the solution becomes blue. Write the chemical equation and balance the same.

219. Give the rules on the basis of which oxidation numbers are assigned to various elements.

220. What are the rules to balance redox reactions on the basis of oxidation number method?

221. In the following given below, identify the species undergoing oxidation and reaction:

(i) $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

(ii) $2H_2S(g) + O_2(g) \longrightarrow 2S(s) + 2H_2O(l)$

(iii) $CH_2 = CH_2(g) + H_2(g) \longrightarrow H_3C - CH_3(g)$

(iv) $2HgO(s) \xrightarrow{\Delta} 2Hg\ (l) + O_2(g)$

(v) $Mg(s) + S(s) \longrightarrow MgS(s)$

222. Calculate the oxidation number of (i) S in H_2S,(ii) C in CO_2, (iii) C in CH_2Cl_2, (iv) N in $(NH_4)_2SO_4$ and (v) P in Na_3PO_4.

223. Calculate the oxidation number of

(i) N in NO_3^-; (ii) P in $H_3P_2O_7^-$

(iii) C in CO_3^{2-} (iv) Cl in ClO_4^-

(v) Cr in $Cr_2O_7^{2-}$ (vi) Mn in MnO_4^- and

(vii) Fe in $[Fe(CN)_6]^{4-}$.

224. Dichromate ion in aqueous acidic medium reacts with ferrous ion to give ferric and chromium ions. Write the balanced chemical equation corresponding to the reaction.

225. Balance the equation ,

$As_2S_3(s) + NO_3^-(aq) + H^+(aq) \longrightarrow AsO_4^{3-}$

$(aq) + S(s) + NO(g) + H_2O(l)$

226. In passing chlorine gas through a concentrated solution of alkali, we get chloride and chlorate ions. Obtain balanced chemical equation for this reaction.

227. Explain the terms : (i) oxidation, (ii) reducing, (iii) oxidising agent and (iv) reducing agent in terms of electrons. Give two examples in each case to justify your answer.

228. Briefly discuss some redox reactions occurring in aqueous solutions.

229. Define oxidation number. How does it differ from valency? Write the general rules of assigning oxidation numbers to various atoms in ions and molecules.

230. Explain the terms : (i) oxidation, (ii) reduction (iii) oxidising agent and (iv) reducing agent in terms of oxidation number. Given two examples in each case to illustrate your answer.

231. What is an electrochemical cell? Briefly discuss its construction and working. How is it represented?

232. What is electrochemical series? How does it help up (i) in comparing the oxidising and reducing power of different elements and (ii) predicting whether a metal react with a mineral acid to give hydrogen gas or not?