EXERCISE 8.1 THEORETICAL PROBLEMS

1. Oxidation is a process which involves:
(a) de-electronation (b) electronation
(c) addition of hydrogen (d) addition of metal

2. Reduction is a process which involves:
(a) electronation
(b) addition of hydrogen or removal of oxygen
(c) addition of metal or removal of non-metal
(d) all of the above

3. Oxidants are substances which:
(a) show a decrease in their oxidation number during a change
(b) gain electrons during a change
(c) oxidise others and reduce themselves
(d) all of the above

4. Reductants are substances which:
(a) show an increase in their oxidation number during a change
(b) lose electrons during a change
(c) reduce others and oxidise themselves
(d) all of the above

5. In a conjugate pair of reductant and oxidant, the oxidant has:
(a) higher ox. no. (b) lower ox. no.
(c) same ox. no. (d) either of these

6. In a conjugate pair of reductant and oxidant, the reductant has:
(a) lower ox. no. (b) higher ox. no.
(c) same ox. no. (d) either of these

7. The decomposition of $KClO_3$ to KCl and O_2 on heating is an example of :
(a) intermolecular redox change
(b) intramolecular redox change
(c) disproportionation or auto redox change
(d) none of the above

8. Conversion of $PbSO_4$ to PbS is:
(a) reduction of S (b) oxidation of S
(c) dissociation (d) none of these

9. In the following reaction :
$4P + 3KOH + 3H_2O \longrightarrow 3KH_2PO_2 + PH_3$:
(a) P is oxidised only
(b) P is reduced only
(c) P is oxidised as well as reduced
(d) none of the above

10. In which SO_2 acts as oxidant, while reacting with:
(a) acidified $KMnO_4$ (b) acidified $K_2Cr_2O_7$
(c) H_2S (d) acidified C_2H_5OH

11. Which of the following shows highest ox. no. in combined state?
(a) Os (b) Ru
(c) Xe (d) All of these

12. Which is not a redox reaction?
(a) $BaO_2 + H_2SO_4 \longrightarrow BaSO_4 + H_2O_2$
(b) $2BaO + O_2 \longrightarrow 2BaO_2$
(c) $4KClO_3 \longrightarrow 4KClO_2 + 2O_2$
(d) $SO_2 + 2H_2S \longrightarrow 2H_2O + 3S$

13. Fluorine is a strong oxidising agent because:
(a) it has several isotopes
(b) it is very small and has 7 electrons in valency shell
(c) its valency is one
(d) it is the first member of the halogen series

14. Oxidation number of carbon in C_3O_2, Mg_2C_3 are respectively:
(a) $-4/3, +4/3$ (b) $+4/3, -4/3$
(c) $-2/3, +2/3$ (d) $-2/3, +4/3$

15. It is found that V forms a double salt isomorphous with Mohr's salt. The oxidation number of V in this compound is:
(a) +3 (b) +2
(c) +4 (d) – 4

16. Which acts as a reducing agent?
(a) HNO_3 (b) $KMnO_4$
(c) H_2SO_4 (d) $(COOH)_2$

17. In the reaction,
$NaH + H_2O \longrightarrow NaOH + H_2$:
(a) H^- is oxidised
(b) Na^+ is reduced
(c) both NaH and H_2O are reduced
(d) none of the above

18. Stronger is oxidising agent, more is;
(a) standard reduction potential of that species
(b) the tendency to get itself oxidised
(c) the tendency to lose electrons by that species
(d) standard oxidation potential of that species

19. H_2S is passed through an acidified solution of copper sulphate and a black precipitate is formed. This is due to:
(a) oxidation of Cu^{2+} (b) reduction of Cu^{2+}
(c) double decomposition (d) reduction and oxidation

20. Which can act only as oxidising agent?
(a) Oxygen (b) Fluorine
(c) Iodine (d) H_2O_2

21. In which iron has the lowest oxidation state?
(a) $Fe(CO)_5$
(b) Fe_2O
(c) $K_4Fe(CN)_6$
(d) $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$

22. $Co(s) + Cu^{2+}(aq) \longrightarrow Co^{2+}(aq) + Cu(s)$. This reaction is:
(a) oxidation reaction (b) reduction reaction
(c) redox reaction (d) none of these

23. The colour of $K_2Cr_2O_7$ changes from red-orange to lemon-yellow on treatment with $KOH(aq)$ because of:
(a) reduction of Cr (VI) to Cr (III)
(b) formation of chromium hydroxide
(c) conversion of dichromate into chromate ion
(d) oxidation of potassium hydroxide to potassium peroxide

24. Which combination is odd with respect to oxidation numbers of S, Cr, N and H respectively :
(a) $H_2SO_5, H_2S_2O_8, H_2SO_4, SF_6$
(b) $K_2Cr_2O_7, K_2CrO_4, CrO_5, CrO_2Cl_2$
(c) $NH_3, NH_4^+, N_3H, NO_2^-$
(d) CaH_2, NaH, LiH, MgH_2

25. Carbon reacts with oxygen to form two oxides, CO and CO_2. This is because:
(a) carbon has two crystalline forms
(b) carbon has two oxidation states
(c) oxygen donates as well as accept electrons
(d) oxygen has a strong affinity for carbon

26. The oxidation number and covalency of sulphur in the sulphur molecule (S_8) are respectively:
(a) 0 and 2 (b) +6 and 8
(c) 0 and 8 (d) +6 and 2

27. The most common oxidation state of an element is –2. The number of electrons present in its outermost shell is:
(a) 2 (b) 4
(c) 6 (d) 8

28. In the reaction;
$2Ag + 2H_2SO_4 \longrightarrow Ag_2SO_4 + 2H_2O + SO_2, H_2SO_4$
acts as:
(a) oxidising agent (b) reducing agent
(c) dehydrating agent (d) none of these

29. In the reaction,
$2Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI$,
the oxidation state of sulphur is :
(a) decreased (b) increased
(c) unchanged (d) none of these

30. In which reaction is hydrogen acting as an oxidising agent?
(a) With iodine to give hydrogen iodide
(b) With lithium to give lithium hydride
(c) With nitrogen to give ammonia
(d) With sulphur to give hydrogen sulphide

31. The burning of hydrogen is called:
(a) hydrogenation (b) hydration
(c) oxidation (d) reduction

32. In the reaction between acidified $K_2Cr_2O_7$ and iron (II) ions shown by the equation:
$Cr_2O_7^{2-}(aq) + 6Fe^{2+}(aq) + 14H^+(aq) \longrightarrow 2Cr^{3+}(aq) + 7H_2O(l) + 6Fe^{3+}(aq)$
(a) the colour of the solution changes from green to blue
(b) the iron (II) ions are reduced
(c) the dichromate ions are reduced
(d) hydrogen ions are reduced

33. Sulphurous acid can be used as :
(a) oxidising agent (b) reducing agent
(c) bleaching agent (d) all of these

34. The violent reaction between sodium and water is an example of:
(a) reduction (b) oxidation
(c) redox reaction (d) neutralisation reaction

35. The compound that can work both as an oxidising and reducing agent is:
(a) $KMnO_4$ (b) H_2O_2
(c) $Fe_2(SO_4)_3$ (d) $K_2Cr_2O_7$

36. In which reaction the underlined substance has been reduced?
(a) Carbon monoxide + copper oxide $\longrightarrow$ carbon dioxide + copper
(b) Copper oxide + hydrochloric acid $\longrightarrow$ water + copper chloride
(c) Steam + iron $\longrightarrow$ hydrogen + iron oxide
(d) Hydrogen + iron oxide $\longrightarrow$ water + iron

37. Which statement is incorrect?
(a) Oxidation of a substance is followed by reduction of another
(b) Reduction of a substance is followed by oxidation of another
(c) Oxidation and reduction are complementary reactions
(d) It is not neccessary that both oxidation and reduction should take place in the same reaction

38. Which change occur when lead monoxide is converted into lead nitrate ?
(a) Oxidation
(b) Reduction
(c) Neither oxidation nor reduction
(d) Both oxidation and reduction

39. Which of the following change represents a disproportionation reaction (s)?

(a) $Cl_2 + 2OH^- \longrightarrow ClO^- + Cl^- + H_2O$

(b) $Cu_2O + 2H^+ \longrightarrow Cu + Cu^{2+} + H_2O$

(c) $2HCuCl_2 \xrightarrow[\text{water}]{\text{Dilution with}} Cu + Cu^{2+} + 4Cl^- + 2H^+$

(d) All of the above

40. When SO_2 is passed through acidified solution of potassium dichromate, then chromium sulphate is formed. The change in oxidation number of chromium is :

(a) +4 to +2 (b) +5 to +3

(c) +6 to +3 (d) +7 to +2

41. In the reaction,

$$Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+} + 7H_2O + 3I_2,$$

which element is reduced?

(a) I (b) O

(c) H (d) Cr

42. If H_2S is passed through an acidified $K_2Cr_2O_7$ solution, the colour of the solution :

(a) will remain unchanged

(b) will change to deep red

(c) will change to dark green

(d) will change to dark brown

43. Change of hydrogen into proton is :

(a) oxidation of hydrogen (b) acid-base reaction

(c) reduction of hydrogen (d) displacement reaction

44. A student states that heating of limestone is an oxidation process, the reason he gives that an oxide of the metal is produced on heating. Which one is correct?

(a) The statement and reason are true

(b) The statement and reason are wrong

(c) The statement is true but the reason is false

(d) None of the above

45. The correct order of reducing power of halide ions is:

(a) $Cl^- > Br^- > I^- > F^-$ (b) $Cl^- > I^- > Br^- > F^-$

(c) $Br^- > Cl^- > I^- > F^-$ (d) $I^- > Br^- > Cl^- > F^-$

46. In the preparation of chlorine from HCl, MnO_2 acts as :

(a) reducing agent (b) oxidising agent

(c) catalytic agent (d) dehydrating agent

47. What would happen when a small quantity of H_2O_2 is added to a solution of $FeSO_4$?

(a) Colour disappears

(b) H_2 is evolved

(c) An electron is added to Fe^{2+}

(d) An electron is lost by Fe^{2+}

48. In the reaction ,

$$Zn + 2H^+ + 2Cl^- \longrightarrow Zn^{2+}2Cl^- + H_2,$$

the spectator ion is :

(a) Cl^- (b) Zn^{2+}

(c) H^+ (d) all of these

49. Aqueous solution of SO_2 reacts with H_2S to precipitate sulphur. Here SO_2 acts as :

(a) catalyst (b) reducing agent

(c) oxidising agent (d) acid

50. Which acts as reducing agent as well as oxidising agent?

(a) O_3 (b) ClO_4^-

(c) F_2 (d) MnO_4^-

51. The reaction; $H_2S + H_2O_2 \longrightarrow 2H_2O + S$ shows :

(a) acidic nature of H_2O_2

(b) alkaline nature of H_2O_2

(c) oxidising action of H_2O_2

(d) reducing action of H_2O_2

52. When NaCl is dissolved in water, the sodium ion becomes:

(a) oxidised (b) reduced

(c) hydrolysed (d) hydrated

53. In the reaction;

$$3Br_2 + 6CO_3^{2-} + 3H_2O \longrightarrow 5Br^- + BrO_3^- + 6HCO_3^-$$

which statement is correct?

(a) Br_2 is oxidised

(b) Br_2 is reduced

(c) Br_2 is neither oxidised nor reduced

(d) Br_2 is oxidised and reduced as well

54. In the reaction of O_3 and H_2O_2, the later acts as:

(a) oxidising agent

(b) reducing agent

(c) bleaching agent

(d) both oxidising and bleaching agent

55. Fluorine exhibits only –1 oxidation state, while iodine exhibits oxidation states of –1, +1, +3, +5 and +7. This is due to :

(a) fluorine being a gas

(b) available *d*-orbitals in iodine

(c) non-availability of *d*-orbitals in iodine

(d) none of the above

56. Magnesium reacts with acids producing hydrogen and corresponding magnesium salts. In such reactions magnesium undergoes:

(a) oxidation

(b) reduction

(c) neither oxidation nor reduction

(d) simple dissolution

57. In which transfer of five electrons takes place?
(a) $MnO_4^- \longrightarrow Mn^{2+}$ (b) $CrO_4^{2-} \longrightarrow Cr^{3+}$
(c) $MnO_4^- \longrightarrow MnO_2$ (d) $Cr_2O_7^{2-} \longrightarrow 2Cr^{3+}$

58. When H_2SO_3 is converted into H_2SO_4 the change in the oxidation state of sulphur is from :
(a) 0 to + 2 (b) + 2 to + 4
(c) + 4 to + 2 (d) + 4 to + 6

59. In the conversion of $K_2Cr_2O_7$ to K_2CrO_4 the oxidation number of chromium:
(a) increases (b) remains the same
(c) decreases (d) none of these

60. In the reaction, $C + 4HNO_3 \longrightarrow CO_2 + 2H_2O + 4NO_2$, HNO_3 acts as:
(a) an oxidising agent
(b) an acid
(c) an acid as well as oxidising agent
(d) a reducing agent

61. Which reaction involves neither oxidation nor reduction?
(a) $CrO_4^{2-} \longrightarrow Cr_2O_7^{2-}$ (b) $Cr \longrightarrow CrCl_3$
(c) $Na \longrightarrow Na^+$ (d) $2S_2O_3^{2-} \longrightarrow S_4O_6^{2-}$

62. In the aluminothermic process, aluminium acts as:
(a) an oxidising agent (b) a flux
(c) a reducing agent (d) a solder

63. The reaction; $KI + I_2 \longrightarrow KI_3$ shows:
(a) oxidation (b) reduction
(c) complex formation (d) all of these

64. Saline hydrides are:
(a) strong oxidants
(b) strong reductants
(c) strong dehydrating agents
(d) strong bleaching agents

65. The oxoacid which acts both as oxidising and reducing agent is:
(a) H_2SO_4 (b) H_3PO_4
(c) HNO_2 (d) $HClO_4$

66. Which is not correct in case of Mohr's salt?
(a) It decolourises $KMnO_4$
(b) It is primary standard
(c) It is a double salt
(d) Oxidation state of Fe is +3 in the salt

67. Respiration is:
(a) oxidation (b) reduction
(c) both (a) and (b) (d) none of these

68. When an acidified solution of ferrous ammonium sulphate is treated with $KMnO_4$ solution, the ion which is oxidised is:
(a) Fe^{2+} (b) SO_4^{2-}
(c) NH_4^+ (d) MnO_4^-

69. The best oxidising agent of the oxygen family is:
(a) tellurium (b) selenium
(c) sulphur (d) oxygen

70. Elements which generally exhibit multiple oxidation states and whose ions are coloured are known as:
(a) metalloid (b) non-metals
(c) metals (d) transition metals

71. The stable oxidation states of Mn are:
(a) + 2, +3 (b) +3, + 7
(c) +2, + 7 (d) +3, +5

72. Which reaction does not involve either in oxidation or reduction?
(a) $VO^{2+} \longrightarrow V_2O_3$ (b) $Na \longrightarrow Na^+$
(c) $CrO_4^{2-} \longrightarrow Cr_2O_7^{2-}$ (d) $Zn^{2+} \longrightarrow Zn$

73. The halogen that shows same oxidation state in all its compounds with other elements is:
(a) I_2 (b) F_2
(c) Cl_2 (d) Br_2

74. Which is not a redox change?
(a) $CaCO_3 \longrightarrow CaO + CO_2$
(b) $2H_2 + O_2 \longrightarrow 2H_2O$
(c) $Na + H_2O \longrightarrow NaOH + \frac{1}{2}H_2$
(d) $MnCl_3 \longrightarrow MnCl_2 + \frac{1}{2}Cl_2$

75. HBr and HI reduce H_2SO_4, HCl can reduce $KMnO_4$ and HF can reduce:
(a) H_2SO_4 (b) $K_2Cr_2O_7$
(c) $KMnO_4$ (d) none of these

76. The most stable oxidation state of copper is:
(a) +2 (b) +1
(c) +3 (d) +4

77. In which reaction H_2O_2 acts as a reducing agent?
(a) $Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$
(b) $2KI + H_2O_2 \longrightarrow 2KOH + I_2$
(c) $PbS + 4H_2O_2 \longrightarrow PbSO_4 + 4H_2O$
(d) $H_2O_2 + SO_2 \longrightarrow H_2SO_4$

78. In $C + H_2O \longrightarrow CO + H_2$; H_2O acts as:
(a) oxidant (b) reductant
(c) both (a) and (b) (d) none of these

79. In the course of chemical reaction, an oxidant:
(a) loses electron (b) gains electron
(c) either of these (d) none of these

80. In the reaction; $As_2S_3 + HNO_3 \longrightarrow H_3AsO_4 + H_2SO_4 + NO$, the element oxidised is/are:

(a) As only (b) S only
(c) N only (d) As and S both

81. In which of the following processes nitrogen is oxidised?
(a) $NH_4^+ \longrightarrow N_2$ (b) $NO_3^- \longrightarrow NO$
(c) $NO_2 \longrightarrow NO_2^-$ (d) $NO_3 \longrightarrow NH_4^+$

82. One gas bleaches the colour of the flowers by reduction while the other by oxidation. The gases are :
(a) CO, Cl_2 (b) H_2S, Br_2
(c) SO_2, Cl_2 (d) NH_3, SO_3

83. Which is the reducing agent in the reaction,
$8H^+ + 4NO_3^- + 6Cl^- + Sn(s) \longrightarrow SnCl_6^{2-} + 4NO_2 + 4H_2O$?
(a) Sn(*s*) (b) Cl^-
(c) NO_3^- (d) $NO_2(g)$

84. In the reaction,
$2KMnO_4 + 16HCl \longrightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$,
the reduction product is :
(a) Cl_2 (b) $MnCl_2$
(c) KCl (d) H_2O

85. Ozone tails mercury. The reaction is ...of Hg.
(a) reduction (b) oxidation
(c) substitution (d) none of these

86. Which change requires a reducing agent?
(a) $CrO_4^{2-} \longrightarrow CrO_7^{2-}$
(b) $BrO_3^- \longrightarrow BrO^-$
(c) $H_2O_2 \longrightarrow O_2$
(d) $Al(OH)_3 \longrightarrow Al(OH)_4^-$

87. A sulphur containing species that cannot be an oxidising agent is :
(a) H_2SO_4 (b) H_2S
(c) SO_2 (d) H_2SO_3

88. The missing term in following equation is :
$2Fe^{3+}(aq) + Sn^{2+}(aq) \longrightarrow 2Fe^{2+}(aq) + ?$
(a) Sn^{4+} (b) Sn^{2+}
(c) Sn (d) none of these

89. The oxidation state of Ni in $Ni(CO)_4$ is :
(a) zero (b) +4
(c) +8 (d) +2

90. Which is strongest oxidising agent?
(a) O_3 (b) O_2
(c) Cl_2 (d) F_2

91. Which metal exhibits more than one oxidation states?
(a) Na (b) Mg
(c) Al (d) Fe

92. Stannous chloride gives a white precipitate with a solution of mercuric chloride. In this process mercuric chloride is :
(a) oxidised
(b) reduced
(c) converted into a complex compound containing Sn and Hg
(d) converted into a chloro complex of Hg

93. In the reaction,
$H_2O_2 + Na_2CO_3 \longrightarrow Na_2O_2 + CO_2 + H_2O$,
the substance undergoing oxidation is :
(a) H_2O_2 (b) Na_2CO_3
(c) Na_2O_2 (d) None of these

94. Which can have both +ve and –ve oxidation states?
(a) F (b) I
(c) Na (d) He

95. In the equation,
$NO_2^- + H_2O \longrightarrow NO_3^- + 2H^+ + ne^-$
n stands for :
(a) H^+ (b) e^-
(c) $2e^-$ (d) $3e^-$

96. Which is a redox reaction?
(a) $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$
(b) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$
(c) $CH_3COOH + C_2H_5OH \longrightarrow CH_3COOC_2H_5 + H_2O$
(d) $2FeCl_3 + SnCl_2 \longrightarrow 2FeCl_2 + SnCl_4$

97. $LiAlH_4$ is used as :
(a) oxidising agent (b) reducing agent
(c) a mordant (d) water softner

98. In presence of moisture SO_2 can :
(a) gain electrons
(b) lose electrons
(c) act as oxidising agent
(d) does not act as reducing agent

99. Starch iodide paper is used to test for the presence of:
(a) iodine (b) iodide ion
(c) reductant (d) none of these

100. The equivalent mass of a reductant or an oxidant is given by:
(a) Eq. mass $= \dfrac{\text{molar mass of reductant or oxidant}}{\text{no.of electrons lost or gained by 1 molecule of reductant or oxidant}}$
(b) Eq. mass $= \dfrac{\text{molar mass}}{\text{valence}}$
(c) Eq. mass $= \dfrac{\text{molar mass}}{\text{total charge on cation or anion}}$
(d) All of the above