Redox reactions

SOLUTIONS

Exercise-I (Conceptual Questions)

1. Ans. (2)

In metal carbonyl, O.S. of metal is always zero.

2. Ans. (3)

NH_2OH

$x + 2 + (-2) + 1 = 0$

$x = -1$

3. Ans. (2)

Fluorine always exhibits –1 O.S. in all compounds

4. Ans. (3)

O.S. of Fluorine is always –1

5. Ans. (3)

$\underline{C}H_4 = x + 4 = 0 \Rightarrow x = -4$

$\underline{C}H_3Cl = x + 3 - 1 = 0 \Rightarrow x = -2$

$CH_2Cl_2 \Rightarrow x + 2 - 2 = 0 \Rightarrow x = 0$

$CHCl_3 \Rightarrow x + 1 - 3 = 0 \Rightarrow x = 2$

$CCl_4 \Rightarrow x - 4 = 0 \Rightarrow x = +4$

6. Ans. (1)

In $H_2\underline{O}_2$; $+2 + 2x = 0$

$x = -1$,

O.S. of O is –1

7. Ans. (3)

O.S. of sulphur in H_2SO_5 is +6

(Max. O.S. of sulphur is +6)

8. Ans. (3)

Os & Ru shows highest O.S.

9. Ans. (4)

In always, O.S. of metal is always zero.

10. Ans. (1)

$\overset{+1}{H}-\overset{-2}{\underset{-1}{N}}\equiv\overset{+2}{C}$

O.S. of C is +2

11. Ans. (2)

$Fe_{0.94}O = 0.94x - 2 = 0$

$0.94x = 2$

$$x = \frac{2}{0.94} = \frac{200}{94}$$

12. Ans. (2)

C_3O_2

$3x + 2(-2) = 0$

$3x = 4$

$$x = \frac{4}{3}$$

13. Ans. (1)

$Na_2S_2O_3$

$+2 + 2x - 6 = 0$

$2x = 4$

$x = +2$

14. Ans. (1)

In $CaOCl_2$; O.S. of Cl is –1 & +1.

15. Ans. (2)

In $\underline{N}_3H$, O.S. of N & $\frac{-1}{3}$

$3x + 1 = 0$

$3x = -1$

$$x = \frac{-1}{3}$$

16. Ans. (1)

Y $Ba_2Cu_3O_7$

$+3 + 2(+2) + 3x - 14 = 0$

$3x = 7$

$$x = \frac{7}{3}$$

17. Ans. (1)

$H_4\underline{I}O_6^-$

$+4 + x - 12 = -1$

$x = +7$

18. Ans. (4)

$\underline{Cr}O_2Cl_2$, O.S. of Cr is +6

$x + 2(-2) + 2(-1) = 0$

$x = +6$

19. Ans. (3)

In $[Fe(CO)_5]$, iron has 'zero' Oxidation state.

20. Ans. (4)

$BaO_2 = 2 + 2x = 0$

$x = -1$

21. Ans. (1)

$K\underline{N}O_3 = 1 + x - 6 = 0 \Rightarrow x = +5$(e)

$H\underline{N}O_2 = 1 + x + 2(-2) = 0$

$\Rightarrow x = 3$(d)

$\underline{N}H_4Cl = x + 4 - 1 = 0$

$x = -3$ (b)

$Na\underline{N}_3 = 1 + 3x = 0$

$x = -\frac{1}{3}$ (a)

22. Ans. (1)

$K_3[Fe(CN)_6] = +3 + x - 6 = 0$

$x = +3$

$\underline{Fe}_2O_3 = 2x - 6 = 0$

$x = +3$

23. Ans. (1)

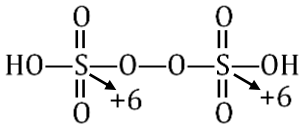
$\underline{Br}_2 \longrightarrow \underline{Br}O_3^-$

$x = 0 \quad x - 6 = -1$

$x = +5$

0 to +5

24. Ans. (4)



O.S. of sulphur in $H_2S_2O_8$ is +6

25. Ans. (3)

$\underline{Cr}O_2Cl_2 = x + 2(-2) + 2(-1)$

$= 0$

$x = +6$

26. Ans. (4)

$[\underline{Co}(NH_3)_4(H_2O)Cl]SO_4$

$x + 0 - 1 - 2 = 0$

$x = +3$

27. Ans. (1)

Oxidation no. of C in graphite (free state) is zero

28. Ans. (1)

$N_3H = 3x + 1 = 0$

$x = -\frac{1}{3}$

29. Ans. (1)

$H_3PO_3 = 3 + x + 3(-2) = 0$

$x = +3$

$H_3PO_4 = 3 + x + 4(-2) = 0$

$x = +5$

$HPO_3 = 1 + x + 3(-2) = 0$

$x = +5$

$H_4P_2O_7 = 4 + 2x + 7(-2) = 0$

$2x = 10$

$x = +5$

30. Ans. (4)

$H_3AsO_4 = +3 + x + 4(-2) = 0$

$x = +5$

31. Ans. (3)

$Mg(HXO_3) = 2 + 1 + x - 6 = 0$

$x = 3$

32. Ans. (4)

$PH_4^+ = x + 4 = +1 = x = -3$

$PO_2^{-3} = x - 4 = -3 \Rightarrow x = +1$

$PO_4^{-3} \Rightarrow x + 4(-2) = -3 \Rightarrow x = 5$

$PO_3^{-3} = x + (-6) = -3$

$x = +3$

33. Ans. (4)

$H_2\underline{S} = 2(+1) + x = 0$

$x = -2$

$H_2\underline{S}O_3 = 2(+1) + x + 3(-2) = 0$

$x = 4$

$H_2\underline{S}O_4 = 2(+1) + x + 4(-2) = 0$

$x = +6$

$H_2S_2O_3 = 2(+1) + 2x + 3(-2) = 0$

$x = 2$

$H_2S < H_2S_2O_3 < H_2SO_3 < H_2SO_4$

34. Ans. (4)

$K\underline{I} = +1 + x = 0 \Rightarrow x = -1$

$K\underline{I}_3 = 1 + 3x = 0 \Rightarrow x = -\frac{1}{3}$

$\underline{I}F_5 = x + 5(-1) = 0$

$x = +5$

$K\underline{I}O_4 = 1 + x + 4(-2) = 0$

$x = +7$

35. Ans. (1)

$C_6H_5\underline{C}HO = 7x + 6(1) + (-2) = 0$

$7x = -4$

Sum of oxidation state is –4

36. Ans. (2)

Reducing Agent :- Which oxidised itself & during oxidation, e^- are released/donate.

37. Ans. (1)

H_2O_2 oxidises sulphur from –2 to 0 hence it shows oxidising behaviour of H_2O_2.

38. Ans. (1)

It an element is in its lowest oxidation state it can Act as only reducing agent because it will undergo oxidation itself & reduces others.

39. Ans. (2)

C is oxidised to CO. Hence H_2O is the oxidising agent.

40. Ans. (2)

$H_2\underline{O}_2$:- Oxygen is in –1 oxidation state. So it can work both as an oxidising as well as reducing agent.

41. Ans. (2)

In H_2S, sulphur is in its lowest O.S. (–2). Hence HNO_2 can act only as an oxidant with H_2S.

42. Ans. (2)

In the reaction $Cl_2 + H_2O_2 \longrightarrow 2HCl + O_2$

Oxidation state of Cl changes from 0 to –1. Hence H_2O_2 act as reducing agent.

43. Ans. (1)

$\overset{0}{H}_2 + \overset{0}{Na} \longrightarrow 2\overset{+1}{Na}\overset{-1}{H}$

Oxidation of Na takes place which means H_2 act as O.A.

44. Ans. (2)

Oxidant mean oxidation of other & reduction of self. During reduction of itself it gains e^-.

45. Ans. (1)

$\overset{0}{C} + 4HNO_3 \longrightarrow \overset{+4}{CO}_2 + 2H_2O + 4NO_2$

Oxidation of C from 0 to +4 is carried with HNO_3 Hence HNO_3 will act as oxidising agent.

46. Ans. (3)

$A_3(BC_4)_2 = 3(+2) + 2[5 + 4(-2)] = 6 + (-6) = 0$

47. Ans. (1)

$\overset{0}{N}_2 \longrightarrow \overset{-3}{N}H_3$

n_f = no. of atoms x | change in O.S. |

$= 2 \times |0-(-3)| = 6$

$$E_w = \frac{M_w}{n_f} = \frac{28}{6}$$

48. Ans. (4)

$\overset{0}{N}_2 \longrightarrow \overset{-3}{N}H_3$

n_f = no. of atoms | change in O.S. |

$n_{NH_3} = 1 \times |-3-0| = 3$

$$E_W = \frac{M_W}{n_f} = \frac{17}{3}$$

49. Ans. (1)

$2S_2O_3^{-2} + I_2 \longrightarrow S_4O_6^{-2} + 2I^-$

$S_2O_3^{-2} = 2x + 3(-2) = -2$

$x = 2$

$S_4O_6^{-2} = 4x + 6(-2) = -2$

$x = 2.5$

n_f of $S_2O_3^{-2}$ = no. of atoms | change in O.S.

$= 2 \times |2-2.5| = 1$

E_w of $S_2O_3^{-2} = \frac{M_w}{n_f} = \frac{M_w}{1} = M_w$

50. Ans. (3)

$\overset{+2}{V}O + Fe_2O_3 \longrightarrow FeO + \overset{+5}{V}_2O_5$

n_f of $V_2O_5 = 2 \times |2-5| = 6$

$$E_w = \frac{M_w}{n_f} = \frac{M}{6}$$

51. Ans. (3)

$\overset{+5}{Br}O_3^- \longrightarrow \overset{-1}{B}r^-$

$n_{BrO_3^-}$ = no. of atoms | change in O.N.|

$= 1 \times |5-(-1)|$

$= 6$

$$E_w = \frac{M}{6}$$

52. Ans. (3)

$A^{-n_2} + xe^- \longrightarrow A^{-n_1}$

x = change in O.N.

$= -n_2-(-n_1)$

$= n_1-n_2$

53. Ans. (1)

$[Fe(CN)_6]^{-3} + H_2O_2 + 2OH^- \longrightarrow 2[Fe(CN)_6]^{4-} + 2H_2O + O_2$

Here O.S. of Fe changes from +3 to +2

Hence H_2O_2 is reducing agent.

E_w of H_2O_2 is 17 $\left\{\because E_w = \frac{M_w}{2} = \frac{34}{2} = 17\right\}$

54. Ans. (1)

$\overset{+2}{Fe}\overset{+3}{C_2}O_4 \longrightarrow Fe^{+3} + \overset{+4}{CO_2}$

$Fe^{+2} \longrightarrow Fe^{+3}$ $\qquad$ $\overset{+3}{C_2}\overset{-2}{O_4} \longrightarrow CO_2$

n_f = no. of atoms x | change in O.N.

= 1 | 2 – 3 | +2 | 3 – 4 | = 3

$E_w = \frac{M_w}{n_f} = \frac{M}{3}$

55. Ans. (3)

$(\text{no.of g eq})_{C_2O_4^{-2}} = (\text{no.of g eq})_{MnO_4^-}$

$(n_f \times \text{mole})_{C_2O_4^{-2}} = (n_f \times \text{mole})_{MnO_4^-}$

2 × mole = 5 × 1

Mole of oxalate ion = $\frac{5}{2}$

56. Ans. (2)

$\overset{5}{H}NO_3 \longrightarrow \frac{1}{2}\overset{+1}{N_2}O$

$n_f = 1 \times |5 - 1| = 4$

4 mole of e^- are transferred when 1 mole HNO_3 changes to N_2O

57. Ans. (2)

$\overset{+2}{Mn}SO_4 \longrightarrow \overset{+4}{Mn}O_2$ $\quad (\because n_f = 2)$

$E_w = \frac{M_w}{n_f} = \frac{M}{2}$

58. Ans. (2)

$3\overset{0}{Fe} + 4H_2O \longrightarrow \overset{8/3}{Fe_3}O_4 + 4H_2$

n_f of Fe = $1 \times \left|0 - \frac{8}{3}\right| = \frac{8}{3}$

$E_w = \frac{\text{At wt}}{n_f} = \frac{56}{\left(\frac{8}{3}\right)} = 7 \times 3 = 21$

59. Ans. (2)

$H^+ + \overset{+6}{Cr_2}O_7^{2-} + I^- \longrightarrow Cr^{+3} + I_2 + H_2O$

Here I^- is reductant

$E_w = \frac{M_w}{n_f}$

n_f of I^- = 1|–1–0| = 1

$E_w = \frac{M_w}{1} = \frac{127}{1} = 127$

60. Ans. (4)

In Acidic medium

$MnO_4^- \longrightarrow Mn^{+2}$ $\qquad$ $(n_f = 5)$

$FeC_2O_4 \longrightarrow Fe^{+3} + 2CO_2$ $\qquad$ $(n_f = 3)$

$(n_f \times \text{mole})_{MnO_4^-} = (n_f \times \text{mole})_{FeC_2O_4}$

5 × n = 3 × 1

$n = \frac{3}{5}$

61. Ans. (1)

Option (2), (3), (4) are ion exchange reaction,

In option (1), O.N. changes

$\overset{0}{H_2} + \overset{0}{Br_2} \longrightarrow 2\overset{+1}{H}\overset{-1}{Br}$

H_2 is oxidised & Br_2 is reduced.

62. Ans. (3)

In option (3)

O.N. does not change. Hence it is not a redox reaction

$\overset{+2}{Ba}\overset{-1}{O_2} + \overset{+1}{H_2}SO_4 \longrightarrow \overset{+2}{Ba}SO_4 + H_2\overset{-1}{O_2}$

63. Ans. (3)

$\overset{0}{Cl_2} + OH^- \longrightarrow \overset{-1}{Cl^-} + \overset{+7}{ClO_4^-}$

O.N. of Cl_2 is decreased as well as increased. Hence Cl_2 is oxidised as well as reduced.

64. Ans. (1)

$2\overset{+2}{Cu}\overset{-1}{I_2} \longrightarrow \overset{+1}{Cu}\overset{-1}{I} + \overset{0}{I_2}$ is a redox

Reaction because both oxidation & reduction occurs in the same reaction.

65. Ans. (1)

$\overset{+4}{Mn}O_2 + 4H\overset{-1}{Cl} \longrightarrow \overset{+2}{Mn}Cl_2 + \overset{0}{Cl_2} + 2H_2O$

This is a redox reaction because MnO_2 is reduced & HCl is oxidised.

66. Ans. (2)

$K\overset{+5}{Cl}\overset{-2}{O_3} \longrightarrow K\overset{-1}{Cl} + \overset{0}{O_2}$

This is an example of Intramolecular redox reaction because in this, different elements same compound are being oxidised & reduced.

67. Ans. (4)

All reaction are examples of disproportionation reaction, because, disproportionation reaction same elements in same compound undergoes oxidation & reduction both.

68. Ans. (3)

$\overset{+2}{X_2}H_4 \longrightarrow \overset{-1/2}{X}$

$n_f = 2\left|-2-\left(-\frac{1}{2}\right)\right| = 3$

3 mole of e^- will be liberated in the following conversion.

69. Ans. (1)

$\overset{+2}{Ca}\overset{+4}{C}\overset{-2}{O_3} \longrightarrow \overset{+2}{Ca}\overset{-2}{O} + \overset{+4}{C}\overset{-2}{O_2}$

This is not a redox reaction, because there is no change in O.N.

70. Ans. (3)

$H^+ + \overset{+7}{Mn}O_4^- + \overset{+4}{SO_3^{2-}} \longrightarrow \overset{+6}{SO_4^{-2}} + \overset{+2}{Mn^{+2}} + H_2O$

Here MnO_4^- is reduced to Mn^{+2} & SO_3^{-2} is oxidised to SO_4^{-2}.

71. Ans. (3)

$\overset{0}{I_2} + K\overset{-1}{I} \longrightarrow K\overset{-1/3}{I_3}$

Here I_2 is reduced to KI_3 & KI is oxidised to KI_3.

72. Ans. (4)

$2H\overset{-1}{I} + H_2SO_4 \longrightarrow \overset{0}{I_2} + SO_2 + 2H_2O$

Here HI is oxidised to I_2 by H_2SO_4. Hence H_2SO_4 act as oxidising agent.

73. Ans. (3)

$4\overset{+3}{H_3P}O_3 \longrightarrow \overset{-3}{P}H_3 + 3\overset{+5}{H_3P}O_4$

Here O.N. of phosphorous is decreased as well as increased in the same compound. Hence it is an example of disproportionation reaction.

74. Ans. (4)

$\overset{0}{H_2} + \overset{0}{Br_2} \longrightarrow 2\overset{+1}{H}\overset{-1}{Br}$

Here H_2 is oxidised to HBr & Br_2 is reduced. Hence it involves oxidation & reduction.

75. Ans. (1)

$\overset{0}{Cl_2} + 2K_2\overset{+6}{Mn}O_4 \longrightarrow 2K\overset{+7}{Mn}O_4 + 2K\overset{-1}{Cl}$

Here Cl_2 is reduced & K_2MnO_4 is oxidised. So it is an example of redox reaction.

76. Ans. (1)

$\overset{+6}{Cr}O_4^{-2} \longrightarrow \overset{+6}{Cr_2}O_7^{2-}$

Here O.N. of Cr does not change.

77. Ans. (2)

$\overset{0}{Zn} + H_2SO_4 \longrightarrow \overset{+2}{Zn}SO_4 + H_2$

Here O.N. of Zn is increased. So Zn undergoes oxidation.

78. Ans. (1)

$CrO_4^{-2} \longrightarrow CrO_2^- + OH^-$

$3e^- + \underbrace{\overset{+6}{Cr}O_4^{-2} \longrightarrow \overset{+3}{Cr}O_2^-}_{n_f=3}$

Balance oxygen atom by adding H_2O to the deficient side

$CrO_4^{-2} + 3e^- \longrightarrow CrO_2^- + 2H_2O$

Now add H^+ to balance Hydrogen atom.

$4H^+ + CrO_4^{-2} + 3e^- \longrightarrow CrO_2^- + 2H_2O$

Add 4 OH^- to both sides.

$4H_2O + CrO_4^{-2} + 3e^- \rightarrow CrO_2^- + 2H_2O + 4OH^-$

net reaction

$2H_2O + CrO_4^{-2} + 3e^- \longrightarrow CrO_2^- + 4OH^-$

79. Ans. (2)

$\underbrace{\overset{+6}{Cr_2}O_7^{2-} \longrightarrow 2Cr^{+3}}_{n_f=2|6-3|=6}$

Balance oxygen atom

$6e^- + Cr_2O_7^{2-} \longrightarrow 2Cr^{+3} + 7H_2O$

Balance Hydrogen atom

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

80. Ans. (1)

$\underbrace{\overset{+7}{Mn}O_4^- \longrightarrow Mn^{+2}}_{n_f=|7-2|=5}$

Gain of $5e^-$

$MnO_4^- + 5e^- \longrightarrow Mn^{+2}$

n = 5

81. Ans. (3)

$\underbrace{\overset{+7}{Mn}O_4^- + 2H_2O \longrightarrow \overset{+4}{Mn}O_2 + 4OH^-}_{n_f=|7-4|=3}$

Gain of $3e^-$; $3e^-$ must be added to LHS to balance charge

$3e^- + MnO_4^- + 2H_2O \longrightarrow MnO_2 + 4OH^-$

82. Ans. (1)

$2KMnO_4 + 5H_2S + 6H^+ \rightarrow 2Mn^{+2} + 2K^+ + 5S + 8H_2O$

Here reductant is H_2S

$\overset{-2}{H_2S} \longrightarrow \overset{0}{S}$

$n_f = 1 \mid -2-0 \mid = 2$

83. Ans. (1)

$$\underset{n_f=|7-2|=5}{\overset{+7}{Mn}O_4^- + 8H^+ + ne^- \longrightarrow Mn^{+2}} + 4H_2O$$

n = 5

84. Ans. (3)

$$\underset{n_f=|0-2|=2\times4}{4Zn + \overset{+5}{N}O_3^- \longrightarrow 4Zn^{+2} + \overset{-3}{N}H_4^+} \quad (n_f=|5-(-3)|=8)$$

$4Zn + NO_3^- \longrightarrow 4Zn^{+2} + NH_4^+$

Balance oxygen atom by adding H_2O to deficient side.

$4Zn + NO_3^- \longrightarrow 4Zn^{+2} + NH_4^+ + 3H_2O$

Add H^+ & then OH^- to neutralise it

$4Zn + NO_3^- + 10H^+ + 10\,OH^- \longrightarrow 4Zn^{+2} + 4NH_4^+ + 3H_2O + 10OH^-$

net balance

$4Zn + NO_3^- + 7H_2O \rightarrow 4Zn^{+2} + NH_4^+ + 10(OH^-)$

85. Ans. (4)

$$\underset{n_f=|0-2|=2\times4}{4Zn + \overset{+5}{N}O_3^- \longrightarrow 4Zn^{+2} + \overset{-3}{N}H_4^+} \quad (n_f=|5-(-3)|=8)$$

$6H^+ + 4Zn + NO_3^- \longrightarrow 4Zn^{+2} + NH_4^+ + 3H_2O$

Coefficient of $NH_4^+ = 1$

86. Ans. (4)

$$\overset{+7}{Mn}O_4^- + C_2O_4^{-2} \rightarrow Mn^{+2} + 2CO_2$$

($n_f = |7-2| = 5 \times 2$; $n_f = 2|3-4| = 2 \times 5$)

$2MnO_4^- + 5C_2O_4^{-2} \longrightarrow 2Mn^{+2} + 10CO_2$

Balance oxygen atom by adding H_2O to deficient side.

$2MnO_4^- + 5C_2O_4^{-2} \longrightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$

Now balance Hydrogen atom by adding H^+ to deficient side.

$2MnO_4^- + 5C_2O_4^{-2} \rightarrow 2Mn^{+2} + 10CO_2 + 8H_2O + 16H^+$

87. Ans. (3)

$$H_2O + \underset{n_f=|4-6|=2}{\overset{+4}{S}O_3^{-2} \longrightarrow \overset{+6}{S}O_4^{-2}} + 2H^+ + x$$

So x = $2e^-$

88. Ans. (2)

$$\underset{n_f=|5-2|=3}{\overset{+5}{N}O_3^- + 4H^+ \longrightarrow \overset{+2}{N}O} + 2H_2O$$

$3e^-$ on LHS

Exercise-II (Previous Year Questions)

1. Ans. (2)

Reduction

$MnO_4^- \longrightarrow Mn^{+2}$ (in Acidic medium)

$\overset{-1}{H_2O_2} \longrightarrow \overset{0}{O_2}$ (Oxidation)

2. Ans. (3)

Least amount of $KMnO_4$ will be required for which n_f is least.

$n_{f\,FeC_2O_4} = 3$ $\quad$ $n_{f\,FeSO_4} = 1$

$n_{f\,Fe(NO_2)_2} = 5$ $\quad$ $n_{f\,FeSO_3} = 3$

So, Ans will be $FeSO_4$.

3. Ans. (2)

In option (2), there is no change on O.N. so this does not show oxidising behaviour.

4. Ans. (2)

$$\overset{+7}{Mn}O_4^- + C_2O_4^{-2} \rightarrow Mn^{+2} + 2CO_2 \quad (n_f = 2|3-4| = 2\times5;\ n_f = 5\times2)$$

$2MnO_4^- + 5C_2O_4^{-2} \longrightarrow 2Mn^{+2} + 10CO_2$

Add H_2O to balance oxygen atoms

$2MnO_4^- + 5C_2O_4^{-2} \longrightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$

Add H^+ to balance Hydrogen atoms.

$16H^+ + 2MnO_4^- + 5C_2O_4^{-2} \rightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$

Coefficient of $MnO_4^- = 2$

$C_2O_4^{-2} = 5$

$H^+ = 16$

5. Ans. (1)

$2Cu^+ \rightarrow Cu^{+2} + Cu^0$

(Disproportionation reaction)

$\overset{+6}{M}nO_4^{-2} \rightarrow \overset{+7}{Mn}O_4^- + \overset{+4}{Mn}O_4$

(Disproportionation reaction)

6. **Ans. (4)**

$CH_4 \longrightarrow \underline{C}Cl_4$

$\downarrow$

$x + 4(1) = 0 \qquad x + 4(-1) = 0$

$x = -4 \qquad x = 4$

-4 to $+4$

7. **Ans. (4)**

$KHC_2O_4.H_2C_2O_4.4H_2O$; when it act as reducing agent $C_2O_4^{-2}$ will convert to CO_2.

$2\overset{+3}{C}_2O_4^{-2} \rightarrow 4\overset{+4}{C}O_2$

$\Rightarrow 4|3-4| = 4$

$$\boxed{E_W = \frac{M_W}{4}}$$

8. **Ans. (2)**

$\underline{Cr}_2O_3 + 2Al \longrightarrow \underline{Al}_2O_3 + 2Cr$

Al, more reactive metal displace less reactive metal from its compound.

9. **Ans. (1)**

$2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2$

is a decomposition redox reaction.

10. **Ans. (4)**

Reaction has to be balanced in acidic medium 'O' atoms are balanced by adding H_2O and then H-atom is balanced by adding H^+ ions and charge is balanced by e^1.

Oxidation: $SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2H^+ + 2e^{\ominus}]\times 3$

Reduction: $Cr_2O_7^{2-} + 14H^+ + 6e^{\ominus} \rightarrow 2Cr^{3+} + 7H_2O$

$Cr_2O_7^{2-} + 3SO_3^{2-} + 8H^{\oplus} \rightarrow 2Cr^{3+} + 3SO_4^{2-} + 4H_2O$

a = 1

b = 3

c = 8

11. **Ans. (4)**

$+2\ -1 \qquad +1\ +6\ -2 \qquad +2\ +6\ -2 \qquad +1\ -1$

$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$

As there is no change in oxidation state of any element therefore this is not a redox reaction.

12. **Ans. (4)**

$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

$\downarrow \qquad\qquad \downarrow \quad \downarrow$

$(+6) \qquad\qquad (+7) \quad (+4)$

incorrect oxidation state is +2 & +3

Exercise-III (Analytical Questions)

1. **Ans. (1)**

Addition of more EN elements and oxygen is oxidation while addition of hydrogen and electropositive element is known as reduction. Oxidation and reduction occures simultaneously.

2. **Ans. (1)**

$Zn \rightarrow Zn^{+2} + 2e^-$ (oxidation)

$Cu^{+2} + 2e^- \rightarrow Cu$ (reduction)

Here Zn is oxidised and Cu^{+2} is oxidising agent.

3. **Ans. (2)**

$H_2\underline{S}$:- S is in -2 oxidation state (lowest)

Hence it will act as Reducing agent.

$K\underline{Mn}O_4$:- Mn is in +7 oxidation state (maximum)

Hence it will act as oxidising agent.

$H_2\underline{O}_2$:- Oxygen is in -1 oxidation state (Intermediate)

Hence it can act as O.A. as well as R.A.

4. **Ans. (1)**

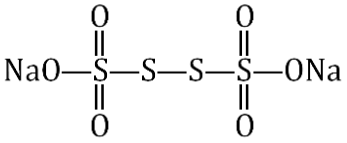
Fractional oxidation number is average of oxidation state.

5. **Ans. (2)**

In metal hydride, O.S. of hydrogen is -1.

6. **Ans. (1)**

Structure of $Na_2S_4O_6$:- Average oxidation number of sulphur is 2.5.



7. **Ans. (4)**

In disproportionation reaction, same element in same compound is oxidised and reduced.

8. **Ans. (4)**

$Br_3O_8 = 3x + 8(-2) = 0$

$$x = \frac{16}{3}$$

$C_3O_2 = 3x + 2(-2) = 0$

$3x = 4$

$$x = \frac{4}{3}$$

$S_4O_6^{2-} = 4x + 6(-2) = -2$

$4x = 10$

$x = 2.5$

oxidation state of hydrogen in metal hydride is –1.

$P_4 \Rightarrow 4x = 0;$

$x = 0$

Oxidation state of P is P_4 is zero.

(Homoatomic molecule)