EXERCISE - 1 [A]

1. (C)

(a) $NH_3 = 0$ $N = -3$

(b) $O = -2$, $H = +1$ $N = -1$

(c) $N_2H_5 = +1$ $N = -2$

(d) $N = -3$

2. (C)

$ClO_4^{\ominus} \rightarrow ClO^{\ominus}$ (+7 → +1, n = 6)

$MnO_2 \rightarrow MnO_4^{-2}$ (+4 → +6, n = 2)

$ClO_4^{\ominus} + 3MnO_2 + \rightarrow ClO^{\ominus} + 3MnO_4^{-2}$

$+6H^{+} + 3H_2O$

$+6OH^{\ominus}$ $+6H^{+}$

$+6OH^{\ominus}$

$ClO_4^{\ominus} + 3MnO_2 + 6OH^{\ominus} \rightarrow ClO_4^{\ominus} + 3MnO_4^{-2} + 3H_2O$

$x = 1$, $y = 3$, $z = 6$

3. (A)

$Fe_2(C_2O_4)_3 \rightarrow 2Fe^{+3} + 6CO_2 + 6e^{\ominus}$

ferric oxalate, n = 6

$FeC_2O_4 \rightarrow Fe^{+3} + 2CO_2 + 3e^{\ominus}$

ferrous oxalate, n = 3

$6x$ moles of $Fe_2(C_2O_4)_3$ = $5x$ moles of $MnO_4^{\ominus}$

$x = \frac{6 \times 1}{5} = \frac{6}{5}$

$3x$ moles of FeC_2O_4 = $5x$ moles of $MnO_4^{\ominus}$

$y = \frac{3 \times 1}{5} = 3/5$

$\frac{x}{y} = \frac{2}{1}$

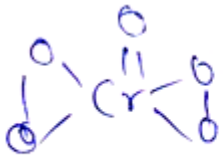
4. (B)

$MnO_4^{\ominus} \xrightarrow{n=5} Mn^{+2}$ (Mn^{+7})

5x moles of $KMnO_4$ = 5x moles of FeC_2O_4

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

5. (B)



$CrO_5 = Cr(O_2)_2O$

$Cr = +6$

6. (B)

$N_2H_4 \longrightarrow 2N^{+y}$ ($N_2^{-2}H_4$)

$[y - (-2)] \times 2 = 10$

$y + 2 = 5$

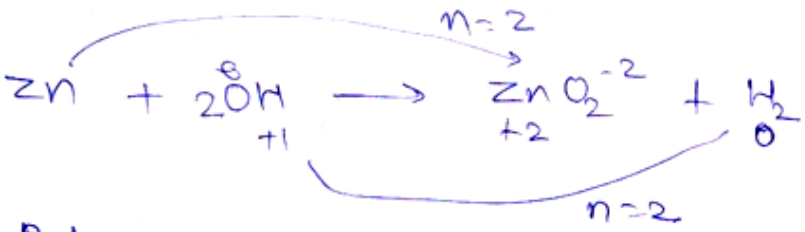
$y = 3$

7. (B)

$3Pb(N_3)_2 \longrightarrow Pb_3O_4 + HNO + 44H^+ + 44e^\ominus + 22H_2O$

So $e^\ominus$ change per mole $= \frac{44}{3}$

8. (C)



Balanced eqn:

$Zn + 2OH \longrightarrow ZnO_2^{-2} + H_2$

9. (B)

$4Zn + NaNO_3 \longrightarrow 4NaZnO_2 + NH_3$

$+5H_2O \quad +10H^+$

$+10OH \quad +10OH$

$4Zn + NaNO_3 + 10OH \longrightarrow 4NaZnO_2 + NH_3 + 5H_2O$

10. (B)

$CH_3Cl \quad C = -2$

$CCl_4 \quad C = +4$

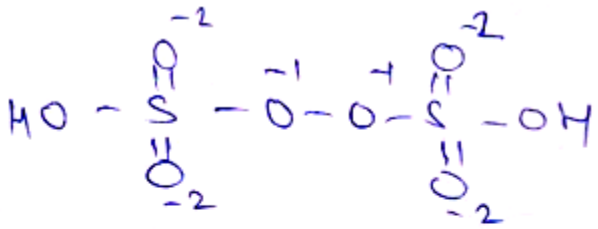
$CHCl_3 \quad C = +2$

$CH_2Cl_2 \quad C = 0$

11. (D)

$\overset{+5}{N_2O_5} \longrightarrow \overset{+5}{HNO_3}$

12. (C)



Marshall's acid

$H_2S_2O_6 (O_2)$

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

$x = +6$

13. (D)

(a) $MnO_4^{\ominus}$, $Mn = +7$ (b) $[Cr(CN)_6]^{-3}$ $Cr = +3$

(c) $[NiF_6]^{-2}$ $Ni = +4$ (d) CrO_2Cl_2 $Cr = +6$

14. (B)

$2 S_2O_3^{-2} \longrightarrow S_4O_6^{-2} + 2e^{\ominus}$

oxidised

reduced I_2 to $I^{\ominus}$

so a R.A.

15. (A)

(a) In peroxides $O = -1$

16. (B)

highest ox. states are

$Mn = +6$, $Cr = +6$, $Co = +6$, $Ni = +4$

17. (A)

0.1 gm metal gives

$= 34.2$ ml H_2 gas

$= \frac{34.2}{22400}$ moles of H_2 gas

x gm metal will give

$\frac{34.2}{22400} \times \frac{x}{0.1}$ moles

$= \frac{342x}{22400} \times 2 = 1.008$

$x = 32.7$ gm

18. (B)

0.5 gm combines with

$(0.79 - 0.5)$ gm oxygen

$= 0.29$ gm

x will combine with

$\frac{0.29}{0.5} \times x = 8$

$x = \frac{4}{0.29} = 13.79 \simeq 14$

19. (C)

74.5 gm metal chloride combined with 35.5 gm chlorine

So wt of metal in chloride

$= 74.5 - 35.5 = 39$ gm.

20. (C)

$PV = nRT$

$1 \times 0.1 = \frac{0.72}{M_w} \times 0.0821 \times 273$

$M_w = 7.2 \times 22.4 = 161.28$

moles of chlorine $= \frac{65.5}{100} \times \frac{161.28}{35.5}$

$\simeq 3$

So formula is MCl_3

21. (B)

Eq. wt of chloride $= 4.5 + 35.5$

$= 40$

So valency $= \frac{80}{40} = 2$

So at. wt $= 2 \times 4.5 = 9$

22. (B)

Metal is M^{+2}

eq of metal & sulphate will be same

$$\frac{42.2}{E} = \frac{(100-42.2)}{(96/2)} \qquad SO_4^{-2}$$

$$E \approx 35.04$$

23. (B)

eq. Wt of chloride = 9 + 35.5 = 39.5

$$\text{valency} = \frac{59.25 \times 2}{39.5} = 3$$

24. (C)

valency = +3

at. wt of metal = 9 × 3 = 27

25. (C)

eq. of Mg = eq of Cl

$$\frac{0.534}{12} = \frac{1.415}{E_{Cl}}$$

$$E_{Cl} = 31.8$$

26. (A)

no. of equivalents will be same

$$\frac{m_1}{E_1} = \frac{m_2}{E_2}$$

$$\therefore E_1 = \frac{m_1}{m_2} \times E_2$$

27. (A)

$$\frac{W}{12} = \frac{0.475}{12+35.5} = \frac{1}{100}$$

$$W = 0.12\ gm$$

28. (A)

Fe^{+3}

$$E = \frac{56}{3} = 18.6$$

29. (B)

$$\frac{1.5}{E} = \frac{4}{(64/2)} = \frac{4}{32} = \frac{1}{8}$$

$E = 12$ So at. wt $= 12 \times 2 = 24$

30. (A)

$KM\overset{+7}{n}O_4 \longrightarrow \overset{+2}{M}nSO_4$

$n = 5$

$E = M/5$

31. (D)

$$\frac{W_1}{E_1} = \frac{W_2}{E_2}$$

$$\frac{W_1}{W_2} = \frac{E_1}{E_2}$$

32. (D)

$$\frac{0.34}{E+1} = \frac{0.042}{1}$$

$E + 1$ = eq wt of metal hydride = 20

33. (A)

60 gm metal has 40 gm oxygen

so 12 gm " " 8 gm "

so eq. wt = 12 gm

34. (C)

on burning, combustion will take place

let 100 gm metal

so $\frac{100}{E} = \frac{124}{E+8}$

$100E + 800 = 124E$

$24E = 800$

$E = 33.3$

35. (A)

$$\frac{3}{E+8} = \frac{5}{E+35.5}$$

$3E + 106.5 = 5E + 40$

$2E = 66.5 \Rightarrow E = 33.25$

36. (D)

M^{+2} so M's wt = 24

MO M. wt = 24 + 16 = 40

37. (C)

n factor = 3

so eq. wt = $\frac{98}{3}$ = 32.66.

38. (C)

$16\,Cl^{\ominus} \longrightarrow$ ~~2Cl₂~~ + $5Cl_2$ + $6Cl^{\ominus}$

$+10e^{\ominus}$

n factor = $\frac{10}{16} = 5/8$

$E = \frac{8M}{5}$

39. (C)

eq of metal = eq of sodium sulphate

$n \times 50 \times 0.1 = 2 \times 25 \times 0.1$

$n = 1$

So metal will be reduced to +2

40. (A)

eq of $K_2Cr_2O_7$ = eq of $FeSO_4$

$Cr_2O_7^{-2} \rightarrow 2Cr^{+3}$ (+6 → n = 6)

$Fe^{+2} \rightarrow Fe^{+3}$ (n = 1)

$6 \times M_1V_1 = 1 \times M_2 \times V_2$

41. (B)

(n factor) $\times 28 \times 10^{-3} = 6 \times 1.68 \times 10^{-3}$

n factor = 3

so A^{-n} will be oxidised to

A^{-n+3} (A^{3-n})

42. (D)

$As_2S_3 \rightarrow 2H_3\overset{+5}{As}O_4 + 3H_2\overset{+8}{S}O_4$

(As_2S_3: +3 −2; n = 2 × 2 = 4; n = 8 × 3 = 24)

$H\overset{+5}{N}O_3 \rightarrow \overset{+2}{N}O$

n factor = 24 + 4 = 28

$28 \times x = 3 \times 1$

$x = 3/28$

43. (A)

n factor = 2 for reductant

so $2 \times M \times 25 = 5 \times 20 \times 0.01$

$M = 0.02 = \frac{2.52}{M_w}$

$M_w = \frac{2.52}{0.02} = 126$

44. (B)

$H_2O_2 \rightarrow 2H_2O$

$+2H^+ + 2e^\ominus$

eq of H_2O_2 = eq of Sn^{+2}

$100 \times M \times 2 = 2 \times 50 \times 0.2$

$M = 0.1$

if vol strength = x

$\text{molarity} = \frac{x}{11.2} = 0.1$

$x = 1.12$

45. (A)

eq of H_2O_2 = eq of KI = eq of I_2 = eq of hypo

$2 \times 10 \times M = 1 \times 20 \times 0.1$ { n factor for hypo = 1 }

$M = 0.1$

Vol. strength = 11.2×0.1

= ~~2.24~~ 1.12

46. (C)

$P^{0} \longrightarrow PO_4^{+5-3}$

5 × moles of P = 6 × moles of $Cr_2O_7^{-2}$

moles of P = $\frac{6 \times 0.2}{5} = \frac{1.2}{5} = 0.24$

47. (A)

$4Cl^{\ominus} \longrightarrow 2Cl^{0} + Cl_2 + 2e^{\ominus}$

n factor = $2/4 = 1/2$

48. (B)

$2Fe_3O_4 + H_2O \longrightarrow 3Fe_2O_3 + 2H^{+} + 2e^{\ominus}$

n factor = 1

$E = \frac{M}{1}$

49. (D)

$As_2S_3 + H_2O \longrightarrow 2AsO_4^{-3} + 3SO_4^{-2} + 40H^{+} + 28e^{\ominus}$

$E = \frac{M}{28}$

50. (B)

HNO_3 itself is getting reduced

$H\overset{+5}{N}O_3$ so final product will have N as +1.

In N_2O N = +1

51. (B)

n factor = 2

so N = 0.1 × 2 = 0.2

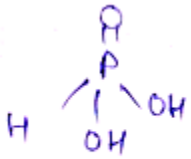
52. (A, C)

3 acidic hydrogens so n factor = 3

$E = M/3$

53. (D)

H_3PO_3



n factor = 2

N = 0.3 × 2 = 0.6

54. (B)

$\frac{0.52}{E} = 100 \times 10^{-3} \times 0.1$

$= 10 \times 10^{-3} = 10^{-2}$

$E = 52$

55. (D)

$Pb^{+2} + Cr_2O_7^{-2} \longrightarrow PbCrO_4$ yellow ppt

n factor = no. of cationic charge replaced

= 2

so N = 0.1 × 2 = 0.2

56. (A)

$\frac{3}{E+8} = \frac{5}{E+35.5}$

$E = 33.25$

57. (A)

Oxalic acid · dihydrate $H_2C_2O_4 \cdot 2H_2O$

Oxalic acid moles $= \frac{6.3}{110}$ so Molarity $= 0.23$

$2 \times 0.23 \times 10 = 0.1 \times V$

$V = 46$ ml

58. (B)

n factor $= 2$ $\quad E = \frac{98}{2} = 49.$

EXERCISE - 1 [B]

1. (B)

$2 \times \frac{x}{m_w} = 5 \times 0.1 \times 0.02$ | $1 \times \frac{y}{m_w} = 2 \times 0.1 \times 0.05$

$x = 5 \times 10^{-3}$ | $y = 10 \times 10^{-3}$

$2x = y$

2. (B)

$MnO_4^- \rightarrow Mn^{+2}$ $\quad n = 5$

$Cr_2O_7^{-2} \rightarrow Cr^{+3}$ $\quad n = 6$

$1 \times n_{Fe^{+2}} = 5 \times 1 \times V$ $\quad 1 \times n_{Fe^{+2}} = 6 \times 1 \times V$

$n_{Fe^{+2}} = 5V$ $\quad n_{Fe^{+2}} = 6V$

3. (B)

$0.1 \times 1 \times 5 = 2 \times 0.1 \times M_{H_2O_2}$

$M_{H_2O_2} = 5/2 = 2.5$

now $3 \times 1 \times V = 2 \times 2.5 \times 0.1$

$V = 0.5/3$ litre $= 500/3$ ml

4. (A)

$\frac{x}{11.2} \times 10 \times 2 = 10 \times 0.1$

$x = 0.56$

5. (C)

$20 \times x \times 1 = 10 \times 0.1 \times 1 + 5 \times 0.2 \times 2$

$x = 3/20 = 0.15$

6. (C)

$10 \times x \times 1 = 10 \times 0.1 \times 1$

$x = 0.1$

$2 \times x \times 10 = 5 \times 10 \times M_{KMnO_4}$

$M_{KMnO_4} = 2/50 = 0.04$

7. (A)

$Fe_2(C_2O_4)_3 \rightarrow 2Fe^{+3} + 6CO_2 + 6e^-$

$C \times L = 5 \times x$

$x = 6/5$

$FeC_2O_4 \rightarrow Fe^{+3} + 2CO_2 + 3e^-$

$3 \times 1 = 5 \times y$

$y = 3/5$

$\frac{x}{y} = \frac{2}{1}$

8. (A)

(2) moles of Sesquicarbonate $= 40 \times 0.05 \times 10^{-3}$

$= 2 \times 10^{-3}$

$1 \times 2 \times 10^{-3} = 1 \times 0.05 \times x$

$x = \frac{2 \times 10^{-3}}{0.05} = 2/50$

$2 \times 2 \times 10^{-3} + 1 \times 2 \times 10^{-3} = 1 \times 0.05 \times y$

$y = \frac{6 \times 10^{-5}}{0.05} = 6/50$

$y \cdot x = \frac{4}{50}$ litre $= \frac{4}{50} \times 1000 = 80$ ml

9. (A)

$x \times 1 = .5 \times 0.1 \times 2$

$= 1$

$x = 1$ mole fraction $= 1/3$

10. (A)

m.eq of M_2CO_3 = $150 \times 1 - 100 \times 0.5$

$= 100$

$\frac{5.3}{E} = 100 \times 10^{-3} = 0.1$

$E = 53$

11. (D)

$H_3\overset{+1}{P}O_2 \longrightarrow \overset{-3}{P}H_3 + H_3\overset{+3}{P}O_3$

$n = 4$ $\quad n = 2$

$n = \frac{2 \times 4}{2+4}$

$n = 4/3$

$E = 3M/4$

12. (A)

moles of $I_2 = \frac{1}{2} \times 0.1 \times 1 = 0.05$

$\overset{+2}{Cu}SO_4 \longrightarrow Cu^{+1}$

n factor = 1

Eq of $CuSO_4$ = Eq of I_2

$1 \times$ moles of $CuSO_4 = 2 \times 0.05 = 0.1$

13. (C)

$Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$

moles	0.05	0.1		
	–	0.05	0.05	0.05

$\text{Molarity} = \frac{0.05}{0.1} = 0.5$

14. (A)

$18 \times V = 1 \times 0.9$

$V = 0.9/18 = \frac{1}{20}$ litre $= 50$ ml

15. (D)

$1 \times V \times 0.5 = 2 \times 40 \times 0.05$

$V = \frac{80 \times 0.05}{0.5} = 8$ ml

16. (A)

$M = \frac{156 \times 6 + 256 \times 3}{400} = 4.125$

17. (B)

Molarity of oxalic acid $= \frac{0.9/90}{0.1} = 0.1$

$N_{C_2O_4^{-2}} = 0.2$, $N_{HC_2O_4^{\ominus}} = 0.1$

18. (D)

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

$n_{Cl_2} = \frac{0.1}{2} = 0.05 \Rightarrow n_{MnO_2} = 0.05$

$w_{MnO_2} = 0.05 \times 87 = 4.35$

% purity $= \frac{4.35}{10} \times 100 = 43.5$

19. (A)

$$2 \times \frac{0.106}{106} = 0.04 \times N$$

$$N = \frac{2 \times 10^{-3}}{40 \times 10^{-3}} = \frac{1}{20}$$

20. (C)

$$5 \times 0.02 \times V = 1 \times 40 \times 0.1$$

$$V = 40\ ml$$

21. (B)

$S^{+4}O_3^{-2} \rightarrow S^{+6}O_4^{-2}$ (n = 2)

$$2 \times 20 \times M = 6 \times 36 \times 0.01$$

$$M = \frac{180 \times 0.01}{40} = 0.045$$

22. (A)

$$2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$$

0.15 0.0112 - -

0.15 − 2×0.0112 - 0.0112 0.0112

moles of NaOH left = 0.1276

$$M = \frac{0.1276}{1} = 0.1276$$

23. (D)

$1 \times \frac{q}{M_w} = 1 \times 0.1 \times 0.2$ | $5 \times \frac{b}{M_w} = 5 \times 0.1 \times 0.2$

$q = 0.02\, M_w$ | $b = 0.05\, M_w$

$\frac{q}{b} = \frac{2}{5}$

24. (C)

$2A + 4B = 5 \times 0.1 \times V$ | $3B = 1 \times 0.1 \times V$

$2A + 4B = 0.5V$ | $3B = 0.1V$

$2A = 0.5B - \frac{0.4}{3}V$ | $A = 1.1V/6$

25. (D)

$FeCl_3 + 3NaOH \longrightarrow Fe(OH)_3 + 3NaCl$

$n_{Fe(OH)_3} = \frac{1.425}{107} = n_{FeCl_3}$

$M_{FeCl_3} = 0.133$

$N_{FeCl_3} = 0.4$

EXERCISE - 1 [C]

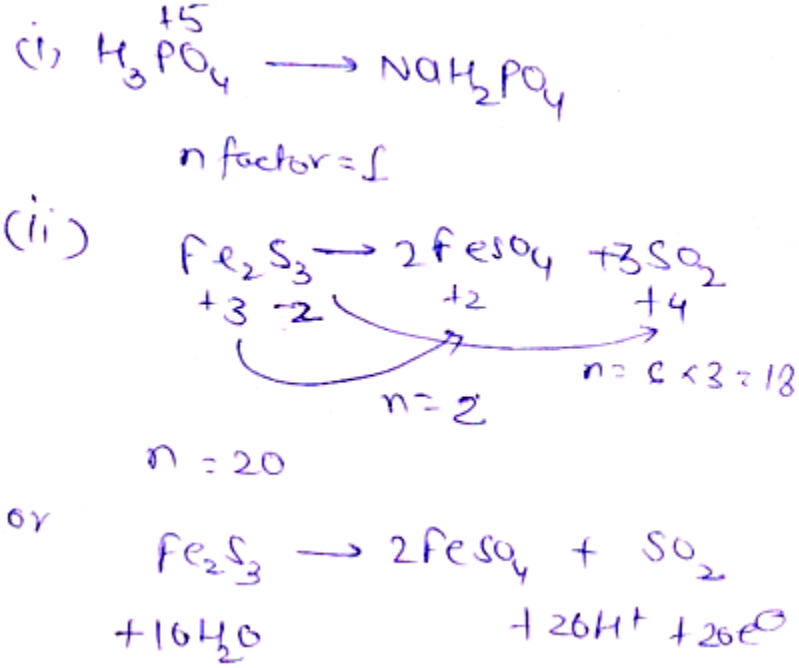
1. i) +1 ii) -1 iii) +2 iv) +2 v) +5
   vi) +6 vii) +6 viii) +5 ix) +5 x) +6

2. i) $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
   ii) $4Zn + 10HNO_3 \rightarrow 4Zn(NO_3)_2 + N_2O + 5H_2O$
   iii) $8KMnO_4 + 3NH_3 \rightarrow 3KNO_3 + 8MnO_2 + 5KOH + 2H_2O$
   iv) $S + 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$

3. i) $3I_2 + 5Cr_2O_7^{2-} + 34H^+ \rightarrow 10Cr^{3+} + 6IO_3^- + 17H_2O$
   ii) $3N_2O_4 + BrO_3^- + 3H_2O \rightarrow 6NO_3^- + Br^- + 6H^+$
   iii) $3Cu_2O + 14H^+ + 2NO_3^- \rightarrow 6Cu^{2+} + 2NO + 7H_2O$
   iv) $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$
   v) $3KClO_3 + 3H_2SO_4 \rightarrow 3KHSO_4 + HClO_4 + 2ClO_2 + H_2O$

4. i) $3C_2H_5OH + 2MnO_4^- + OH^- \rightarrow 3C_2H_3O^- + 2MnO_2 + 5H_2O$
   ii) $40HNO_3 + As_2S_5 \rightarrow 5H_2SO_4 + 2H_3AsO_4 + 40NO_2 + 12H_2O$
   iii) $4H_2O_2 + PbS \rightarrow PbSO_4 + 4H_2O$
   iv) $6Fe_3O_4 + 2MnO_4^- + H_2O \rightarrow 9Fe_2O_3 + 2MnO_2 + 2OH^-$
   v) $4S + 6OH^- \rightarrow 2S^{2-} + S_2O_3^{2-} + 3H_2O$

5. (i) 1 (ii) 20 (iii) 8 (iv) 8 (v) 1



(iii) $NH_3 \rightarrow NO_3^{\ominus}$ (-3 → +5, n = 8)

(iv) $CuS \rightarrow CuSO_4$ (-2 → +6, n = 8)

(v) $2S_2O_3^{-2} \rightarrow S_4O_6^{-2} + 2e^{\ominus}$

$n = 1$

6. 0.125 g

eq of metal = eq of hydrogen

$$\frac{W}{2} = 2 \times \frac{0.7}{22.4}$$

$W = 0.125 gm$

7. 9.01 g

$$\frac{5}{E} = \frac{9.44}{E+8}$$

$5E + 40 = 9.44E$

$E = 9.01 gm$

8. 56 g, 3.36 L

$$\frac{14.7}{(98/2)} = \frac{16.8}{E}$$

$E = 56 g$

eq of H_2 liberated $= \frac{16.8}{56}$

moles of H_2 $= \frac{16.8}{56} \times \frac{1}{2}$

volume of H_2 $= \frac{16.8}{1.12} \times 22.4 = 3.36 L$

9. 49 g

$H_3PO_4 \longrightarrow NaH_2PO_4$

n factor = 2

$E = 98/2 = 49$

10. 108 g

eq of Ag = eq of AgCl

$\frac{0.501}{E} = \frac{0.6655}{E+35.5}$

$E = 108$ gm

11. ≈ 5 Vol

Volume strength of $H_2O_2 = 5.6 \times N$

N_1 of 2.8 vol $H_2O_2 = \frac{2.8}{5.6} = 0.5$ N

N_2 of 5.6 vol $H_2O_2 = \frac{5.6}{5.6} = 1$ N

N_3 of 22.4 vol $H_2O_2 = \frac{22.4}{5.6} = 4$ N

$N_1V_1 + N_2V_2 + N_3V_3 = N_4V_4$ ($V_4 = 300 + 300 = 600$ mL)

$0.5 \times 100 + 1 \times 100 + 4 \times 100 = N_4 \times 600$

$\therefore N_4 = \frac{50 + 100 + 400}{600} = \frac{550}{600} = 0.91$ N

Volume strength $= 5.6 \times 0.91 = 5.09$ vol

12. (3)

In dilute basic medium, MnO_4^- is reduced to MnO_2. (n = 3)

$NO_2^- \longrightarrow NO_3^- + 2e^- (n = 2)$

$\therefore$ 2 mol of $MnO_4^- = 3$ mol of NO_2^-

PYQ : JEE Main

1. (C)

$\overset{(+3)}{Na_2HAsO_3} \longrightarrow \overset{(+5)}{H_3AsO_4}$ (oxidation)

Change in O.N. = +2

$\overset{(+5)}{NaBrO_3} \longrightarrow \overset{(-1)}{NaBr}$ (reduction)

Change in O.N. = –6

To balance the change in O.N., we will multiple first half reaction with 3 and add the second half reaction.

$3Na_2HAsO_3 + NaBrO_3 + 6H^+ \rightarrow 3H_3AsO_4 + NaBr$

On balancing Cl^- and Na^+

$3Na_2HAsO_3 + NaBrO_3 + 6H^+ + 6Cl^- \rightarrow 3H_3AsO_4 + NaBr + 6Na^+ + 6Cl^-$

$3Na_2HAsO_3 + NaBrO_3 + 6HCl \rightarrow 3H_3AsO_4 + NaBr + 6NaCl$

Hence, X = 3, Y = 1 and Z = 6

2. (C)

In SO_3^{2-}

$x + 3(-2) = -2;\ x = +4$

In $S_2O_4^{2-}$

$2x + 4(-2) = -2;\ x = +3$

In $S_2O_6^{2-}$

$2x + 6(-2) = -2;\ x = +5$

Hence the correct order is :

$S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

3. (A)

If an electronegative element is in its lowest possible oxidation state in a compound. It can function only as reduction agent, e.g., I^-.

4. (C)

The reaction given as

$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \longrightarrow Cr^{3+} + Fe^{3+} + CO_2$

$Cr_2O_7^{2-} \longrightarrow 2Cr^{3+}$

On balancing

$14H^+ + Cr_2O_7^{2-} + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O \quad ...(i)$

$Fe^{2+} \rightarrow Fe^{3+} + e^-]\times 2 \quad ...(ii)$

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-]\times 2 \quad ...(iii)$

On adding all three equations, we get

$Cr_2O_7^{2-} + 2Fe^{2+} + 2C_2O_4^{2-} + 14H^+ \longrightarrow 2Cr^{3+} + 2Fe^{3+} + 4CO_2 + 7H_2O$

Hence the total no. of electrons involved in the reaction = 6

5. (C)

$\overset{+4}{H_2SO_3}(aq) + Sn^{4+}(aq) + H_2O(l) \longrightarrow Sn^{2+}(aq) + \overset{+6}{HSO_4^-}(aq) + 3H^+$

Hence H_2SO_3 is the reducing agent because it undergoes oxidation.

6. (D)

CrO_2Cl_2

Let O. No. of Cr = x

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

$x - 4 - 2 = 0$; $x = +6$

7. (A)

Applying law of equivalence

Equivalent of acid = Equivalent of base

Equivalent of acid = Normality × volume = $0.1 \times V$

Another formula of equivalence = n factor × number of moles

$\therefore$ Equivalent of base = n factor of OH^- × mole of OH^-

$= 1 \times 0.04$

$\Rightarrow \quad 0.1 \times V = 1 \times 0.04$

$V = 0.4\,L = 0.4 \times 1000 = 400\,mL.$

8. (D)

(A) $\overset{+1}{H}O\overset{-1}{Cl} + \overset{-1}{H_2O_2} \rightarrow H_3O^+ + \overset{-1}{Cl^-} + \overset{0}{O_2}$

Oxidation (Cl: −1 → 0)

Reduction (Cl: +1 → −1)

(B) $\overset{0}{I_2} + \overset{-1}{H_2O_2} + 2OH^- \rightarrow 2\overset{-1}{I^-} + 2H_2O + \overset{0}{O_2}$

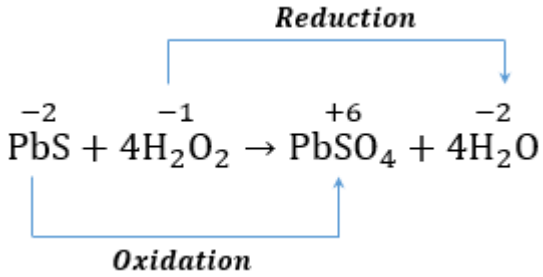
Oxidation (O: −1 → 0)

Reduction (I: 0 → −1)

(C) $2\overset{+7}{Mn}O_4^- + 3\overset{-1}{H_2O_2} \rightarrow 2\overset{+4}{Mn}O_2 + 3\overset{0}{O_2} + 2H_2O + 2OH^-$

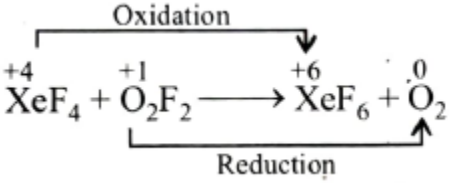
Oxidation (O: −1 → 0)

Reduction (Mn: +7 → +4)

(D) 

Notice that the oxidation of oxygen goes from –1 in the H_2O_2 to –2 in the H_2O means H_2O_2 is being reduced. On the other hand the oxidation state of sulphur is going from –2 in the PbS to +6 in the $PbSO_4$. i.e. Sulphur is being oxidised.

9. (A)
In the reaction



10. (A)
Reaction involved:

$$\overset{+3}{C_2}\,O_4^{2-} \longrightarrow 2\overset{+4}{C}O_2 + 2e^-$$

$\therefore$ The number of electrons involved in producing one mole of CO_2 is 1.

11. (D)

$$\overset{(+1)}{CuBr} \longrightarrow \overset{(0)}{Cu} + \overset{(+2)}{CuBr_2}$$

It is an example of disproportionation reaction, as Cu undergoes both oxidation and reduction.

12. (B)
Potassium shows +1 state in all its oxides, superoxides and peroxide.

13. (C)

$$NH_2CONH_2 + 2NaOH \longrightarrow Na_2CO_3 + 2NH_3$$

1 mol of urea $\equiv$ 2 mol of NH_3
60 g of urea $\equiv$ 2 mol of NH_3

$$0.6 \text{ g of urea} = \frac{2}{60} \times 0.6 \text{ mol} = 0.02 \text{ mol of } NH_3$$

For neutralisation: mol of NH_3 = mol of HCl in option (C), no. of moles of HCl = 0.1 × 0.2 = 0.02

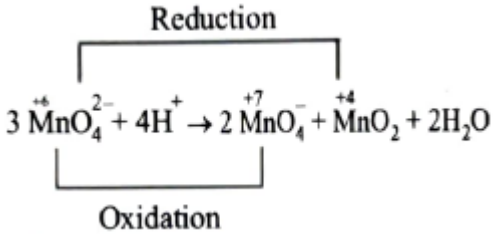
14. (A)
In H_3PO_4 oxidation state of P is +5, which cannot be oxidised further to a higher oxidation state. Hence, it cannot act as reducing agent.

15. (A)

In BrO_4^-, Br is in highest oxidation state (+7). So it cannot oxidise further and hence, it cannot show disproportionation reaction.

16. (A)

In disproportionation reaction one oxidation state is simultaneously oxidised and reduced.



17. (C)

In a disproportionation reaction, an element in one oxidation state is simultaneously oxidised and reduced.

$\underset{-1}{2H_2O_2} \longrightarrow \underset{-2}{2H_2O} + \underset{0}{O_2}$ (Disproportionation reaction)

- $\underset{+4}{2NO_2} + H_2O \longrightarrow \underset{+5}{HNO_3} + \underset{+3}{HNO_2}$ (Disproportionation reaction)
- $\underset{+7}{MnO_4^-} + 4H^+ + 3e^- \longrightarrow \underset{+4}{MnO_2} + 2H_2O$ (Reduction reaction)
- $\underset{+6}{MnO_4^{2-}} + 4H^+ \longrightarrow \underset{+7}{2MnO_4^-} + \underset{+4}{MnO_2} + 2H_2O$ (Disproportionation reaction)

18. (50)

M. eq. of $K_2Cr_2O_7$ = M.eq. of FeC_2O_4

$\overset{(+2)}{Fe}\ \overset{(+3)}{C_2}O_4 + \overset{(+6)}{Cr_2}\ O_7^{2-} \longrightarrow Fe^{3+} + \overset{(+4)}{CO_2} + Cr^{3+}$

n-factor of $K_2Cr_2O_7 = 2(6-3) = 6$

n-factor of $FeC_2O_4 = 1(3-2) + 2(4-3) = 3$

By law of equivalence,

n-factor of $K_2Cr_2O_7 \times$ no. of moles

= *n*-factor of $FeC_2O_4 \times$ no. of moles

$\Rightarrow \frac{V}{1000} \times 0.02 \times 6 = \frac{0.288}{144} \times 3 \Rightarrow V = 50$ mL

19. (19)

	Compound	**Oxidation state of transition element**
(i)	$K_2Cr_2O_7$	x = +6
(ii)	$KMnO_4$	y = +7
(iii)	K_2FeO_4	z = +6

So, $(x + y + z) = 6 + 7 + 6 = 19$.

20. (19)

$2Fe^{2+} + H_2O_2 \longrightarrow 2Fe^{3+} + 2OH^-$

$2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$

$\because\ x = 2,\ y = 2,\ x' = 2,\ y' = 8,\ z' = 5$

$\therefore\ x + y + x' + y' + z' = 19$

21. (18)

Milli-equivalent of Fe^{2+} = milli-equivalent of $K_2Cr_2O_7 \Rightarrow$ millimoles $\times\, n$-factor of Fe^{2+} = millimoles $\times$ n-factor of $K_2Cr_2O_7$.

$x \times 10 \times 1 = 0.02 \times 15 \times 6$

$x = 0.18 = 18 \times 10^{-2}$ M

22. (16)

Writing the half reaction,

Oxidation half reaction,

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

Balancing oxygen,

$MnO_4^- \rightarrow Mn^{2+} + 4H_2O$

Balancing hydrogen,

$MnO_4^- + 8H^+ \longrightarrow Mn^{2+} + 4H_2O$

Balancing charge,

$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

Reducing half reaction,

$C_2O_4^{2-} \longrightarrow CO_2$

Balancing carbon and charge,

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$

Balancing charge in both oxidation and reduction reaction,

$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O] \times 2$

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-] \times 5$

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

So, we get

$b = 5;\ c = 16;\ x = 2;\ y = 10;\ z = 8$

23. (12)

$16e^- + S_8 \longrightarrow 8S^{2-}$

$24OH^- + S_8 \longrightarrow 4S_2O_3^{2-} + 12H_2O + 16e^-$

$2S_8 + 24OH^- \longrightarrow 8S^{2-} + 4S_2O_3^{2-} + 12H_2O$

$\Rightarrow S_8 + 12OH^- \longrightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

24. (3)

Acid (A) + Base $\longrightarrow$ Salt + H_2O

0.1 M $(M(OH)_2)$
10 ml 0.05 M
30 ml

At equivalence point, equivalent of acid = equivalent of base

$0.1 \times 10 \times n = 30 \times 0.05 \times 2 \Rightarrow n = 3.$