1. No. of equivalent = mole n-factor
(तुल्यांक की संख्या = मोल n-कारक)
$SO_3^{-2} + H_2O \longrightarrow SO_4^{-2} + 2H^+ + 2e^-$ ...(1)
n-factor for R N (1) is (2)

$\Rightarrow$ 50 .1 n = 25 .1 2

$n = \frac{2.5 \times 2}{5}$

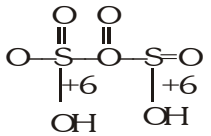
n = 1

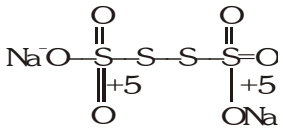
$\Rightarrow$ Final oxidation state will be (3 – 1) = 2
(अन्तिम ऑक्सीकरण अवस्था (3 – 1) = 2 होगी।)

2. Meq.(मिली तुल्यांक) of $K_2Cr_2O_7$ = Meq.(मिली तुल्यांक) of ABD
n-factor of $K_2Cr_2O_7$ in acidic medium = 6.
(अम्लीय माध्यम में $K_2Cr_2O_7$ का n गुणांक = 6)
6 1.68 10^{-3} = x 3.26 10^{-3}
x = 3

$\Rightarrow$ New oxidation state of A^{-n} will be = –n + 3
(A^{-n} की नयी ऑक्सीकरण अवस्था = –n + 3 होगी)

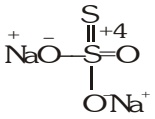
3. (A)



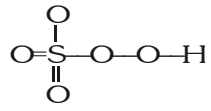


$H_2S_2O_7$ (6, 6) $Na_2S_4O_6$ (5, 0, 0, 5)

(B)



$Na_2S_2O_3$



H_2SO_5

(4, 0) (6)

(C) $SO_3 > SO_2 > H_2S > S_8$
$\downarrow \quad \downarrow \quad \downarrow \downarrow$
+6 +4 –2 0

(D) $H_2SO_4 > SO_2 > H_2S > H_2S_2O_8$.
+6 +4 –2 (6, 6)

4. $(NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + 4H_2O$
Decomposition (विघटन) R N

5. $NaN_3 \longrightarrow N_3^- \longrightarrow N \longrightarrow -1/3$
$N_2H_2 \longrightarrow N \longrightarrow -1$
$NO \longrightarrow N \longrightarrow +2$ $\Rightarrow$ 5(A)
$N_2O_5 \longrightarrow N \longrightarrow +5$

6. $S_2O_5^{-2} + I_2 \longrightarrow S_4O_6^{-2} + I^-$

$\Rightarrow$ Redox R N (रिडॉक्स) $I_2^{\circ} \xrightarrow{\text{Redn}} I^-$

$S_2O_3^{-2} \xrightarrow{\text{Oxd.}} S_4O_6^{-2}$
(4, 0) (5, 0, 0, 5)

8. $xHI + yHNO_3 \longrightarrow NO + I_2 + H_2O$

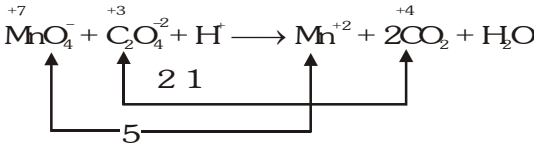
$$\begin{bmatrix} (2I^- \longrightarrow I_2 + 2e) \times 3 \\ (\overset{+5}{NO_3^-} + 3C \longrightarrow \overset{+2}{N}O) \times 2 \end{bmatrix} \begin{matrix} .....(1) \\ .....(2) \end{matrix}$$

Adding (1) and (2)

$\Rightarrow$ $6I^- + 2NO_3^- \longrightarrow 2NO + 3I_2$
$6HI + 2HNO_3 \longrightarrow 2NO + 3I_2 + 4H_2O$

$\Rightarrow$ x = 6 , y = 2

9.



$2MnO_4^- + 5C_2O_4^{-2} + H^+(6) \rightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$

$\Rightarrow$ (A) 2, 5, 16

10. Molarity (मोलरता) $= \frac{\text{Normality(नार्मलता)}}{\text{n factor(कारण)}}$

$\Rightarrow$ (e) 1 M H_3PO_4 = 1/3 M H_3PO_4

11. $M = \frac{\text{No. of equivalent(तुल्यांक की संख्या)}}{\text{Volume of sol(विलयन का आयतन)(in L)}}$

$\Rightarrow$ Meq. = 50 2 = 10

M mole = $\frac{10}{2} = 5$

$M_{H_2C_2O_4.2H_2O}$ = 24 + 16 4 + 2 + 2 18= 126gm.

$\Rightarrow$ Mass of $H_2C_2O_4.2H_2O$ (का द्रव्यमान)
= 126 5 10^{-3} = .63gm

12. 63 % (w/v) $H_2C_2O_4.2H_2O$

$\Rightarrow$ 100 mL contain = 63 gm

125 mL $\longrightarrow$ = $\frac{63}{100} \times 125$gm

Mole of $H_2C_2O_4 = \frac{63 \times 125}{126 \times 100} = \left(\frac{5}{8}\right)$

$\frac{40}{100} = \frac{x}{125}$

Mole of NaOH = $\frac{125 \times 40}{100 \times 40} = \left(\frac{5}{4}\right)$

$H_2C_2O_4 + 2NaOH \longrightarrow Na_2C_2O_4 + 2H_2O$
2 mole of Acid (अम्ल) = Mole of NaOH

$2 \times \frac{5}{8} = \frac{5}{4}$

And will have $\left(\frac{5}{4}\right)$ mole of NaOH (और NaOH के $\left(\frac{5}{4}\right)$ मोल रखेगें)

$\Rightarrow$ Sol. is neutral (विलयन उदासीन है)

13. $CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_2$ (224 mL)

CO_2 mole = $\frac{224}{22400} = 10^{-2}$

HCl M = HCl N = $\frac{10^{-2}}{200 \times 10^{-3}} = \frac{1}{20} = .05$

M. eq. (मिलीतुल्यांक) of H_3PO_4 = M. eq. (मिलीतुल्यांक) of $Ba(OH)_2$

$1.5 \times v \times 3 = 90 \times .5 \times 2$

$v = \frac{90 \times 2 \times .5}{3 \times 1.5} = 20$ mL

15. $KMnO_4$ n factor in Acidic medium = 5

($KMnO_4$ अम्लीय माध्यम में n कारक)

$K_2Cr_2O_7$ n factor in acidic medium = 6

($K_2Cr_2O_7$ अम्लीय माध्यम में n कारक)

6 0.1 V_1 = 5 0.3 V_2

$\frac{6}{15}V_1 = V_2$

$V_2 = \frac{2}{5}V_1$

16. $K_2Cr_2O_7$ have greater n factor as compaire $KMnO_4$ so same volume of $K_2Cr_2O_7$ will oxidise more amount of Fe^{+2}.

($K_2Cr_2O_7$ के लिए n कारण $KMnO_4$ से अधिक है अत: $K_2Cr_2O_7$ का समान आयतन Fe^{+2} की अधिक मात्रा को ऑक्सीकृत करेगा।)

17. Mole of $V_2O_5 = \frac{10}{51 \times 2 + 5 \times 16} = \frac{10}{102 + 80} = \frac{10}{182} = .055$

Mole of V^{+2} = .055 2

= .1098 mole $\tilde{-}$ 0.11

$V^{+2} \longrightarrow \overset{+4}{V}O^{+2} + 2e$

$I_2 + 2e \longrightarrow 2I^-$

$\Rightarrow$ Mole of I_2 = Mole of V^{+2} = .11

18. $Cl_2 + S_2O_3^{-2} \longrightarrow SO_4^{-2} + Cl^- + S$

50 .01 n factor (कारक) = 5 10^{-4} 2 10^3

n factor $S_2O_3^{-2} = \frac{10 \times 10^{-4} \times 10^3}{.5} = 2$ 10^{-3} 10^3

n factor = 2

$\Rightarrow$ (i) $Cl_2 + H_2O + Na_2S_2O_3 \longrightarrow Na_2SO_4 + S + 2HCl$

Balanced equation

(ii) Mole of $S_2O_3^{-2}$ = 50 10^{-3} 10^{-2} = .0005

(iii) Equivalent of oxidising agent (ऑक्सीकारक के तुल्यांक) = 5 10^{-4} 2 = .001

(iv) Molarity of Na_2SO_4 (की मोलरता) = $\frac{5 \times 10^{-4}}{50 \times 10^{-3}}$

= 10^{-2} = .01 M

19. M eq.(मिली तुल्यांक) of $KMnO_4$ = M eq. (मिली तुल्यांक) of $C_2O_4^{-2}$

$90 \times \frac{1}{20}$ = 100 $N_{C_2O_4^{-2}}$

M mole of oxalate = $\frac{9}{2 \times 2} = \frac{9}{4}$

Wt of oxalate = $\frac{9}{4} \times 88 \times 10^{-3} = 22 \times 9$ 10^{-3}=198 10^{-3}

% $C_2O_4^{-2}$ = $\frac{.198}{.300} \times 100$ = 66 %

20. M eq. of $KMnO_4$=M eq. of $C_2O_4^{-2}$ = M eq. of $CaCO_3$

40 .25 = M eq. of CaO

$\frac{10 \times 10^{-3}}{2}$ = Mole of CaO

% CaO = $\frac{5 \times 10^{-3} \times 56 \times 100}{.518}$

CaO = 54 %

21. $2CrO_5 + 3H_2SO_4 \longrightarrow Cr_2(SO_4)_3 + 3H_2O + 7/2O_2$

1 mole CrO_5 Liberate (मुक्त) $\longrightarrow$ 7/4 mole of O_2

22. $\overset{+3}{AsO_4^{-3}} + 2H^+ + 2I^- \longrightarrow \overset{+3}{AsO_3} + H_2O + I_2$

2

molar mass (मोलर द्रव्यमान) Na_3AsO_4

= 23 3 + 75 + 15 4

molar mass (मोलर द्रव्यमान) = 208

eq.(तुल्यांक) of AsO_4^- = $\frac{1}{\left(\frac{208}{2}\right)} = \left(\frac{1}{104}\right)$

equivalent (तुल्यांक) of Na_3AsO_4= equivalent (तुल्यांक) of I_2

= equivalent (तुल्यांक) of $Na_2S_2O_3$.

$\frac{1}{104} = .2 \times V$

$\frac{1}{104 \times .2} L = V$ = 48.1 mL

23. M eq. of $KMnO_4$ = 25 .2 = 5

(A) M eq. of $FeSO_4$ = $\frac{25 \times .2}{1} = 5$

(C) M eq. of H_2O_2 = $25 \times .1 \times 2 = 2.5 \times 2 = 5$

(D) M eq. of $SnCl_2$ = $25 \times .1 \times 2 = 5$

24. $N = \left(\frac{N_1V_1 + N_2V_2}{V_1 + V_2}\right) = \frac{3 \times 250 + 750 \times 1}{1000} = \frac{1500}{1000} = 1.5$

Molarity (मोलरता) = $\frac{1.5}{2} = 0.75 = \frac{3}{4}$

$\Rightarrow$ $H_2O_2 \longrightarrow H_2O + \frac{1}{2}O_2$

1L H_2O_2, 1 Mole H_2O_2 give O_2 = 11.2 L

1L H_2O_2, 0.75 H_2O_2 $\longrightarrow$ = 11.2 $\frac{3}{4}$

$\longrightarrow$ = 8.4 V O_2

$\Rightarrow$ Volume strength(आयतन सामर्थ्य) = 8.4 V

Alternative(अन्य तरीका) V_S=5.6 N=5.6 1.5=8.4V

25. M eq. of $KMnO_4$ = .2 50 5 = 50

M eq. of H_2O_2 = 2 25 .5 = 25

M eq. of $KMnO_4$ remaining ($KMnO_4$ के शेष मिलीतुल्यांक) = (50 – 25) = 25

Mole of $KMnO_4$ = $\frac{25}{5}\times10^{-3}=5\times10^{-3}$ = .005

26. $\frac{100x}{1000}=\left(\frac{3}{24}\right)\times2$

$x=\frac{20}{8}=2.5$

27. $Ca(HCO_3)_2 + CaO \longrightarrow 2CaCO_3 + H_2O$

2 100

56 gm 2 gm

$\frac{200}{56}=\frac{2}{x}$

x = .56 gm

28. (320 mL, 10V H_2O_2) + (80 mL, 5NH_2O_2)

(A) (B)

$N_A=\left(\frac{10}{5.6}\right)$

$\Rightarrow \quad N_C=\frac{N_AV_A+N_BV_B}{V_A+V_B}=\frac{\frac{10}{5.6}\times320+5\times80}{320+80}$

$N_C=\frac{400+\frac{1000\times4}{7}}{400}=11+\frac{10}{7}=(17/7)$

$\Rightarrow \quad V_S=5.6\times\frac{17}{7} \qquad V_S=13.6V$

$M_C=\frac{17}{7\times2}$ Mol/L $\qquad M_C=\frac{17}{14}$Mole/L

$C=\frac{17\times34}{14}$gm/Ltr.

Concentration (सान्द्रता) = 41.285 gm/Ltr.

REDOX REACTION EXERCISE # 2

1. $Fe + \frac{1}{2}O_2 \longrightarrow FeO$

1 0.65

0 0.15 1

$2FeO + \frac{1}{2}O_2 \longrightarrow Fe_2O_3$

1 0.15

(1–0.60) 0.30

0.4 0.30

Mole ratio (मोल अनुपात) $\frac{FeO}{Fe_2O_3}=\frac{0.40}{0.30}\Rightarrow\frac{4}{3}$

2. $FeSO_4$

1 mole of SO_4^{2-} than 1 mole Fe^{2+}

In $Fe_2(SO_4)_3$

3 mole of SO_4^{2-} than = 2 mole Fe^{3+}

1 mole of SO_4^{2-} than = $\frac{2}{3}$ mole Fe^{3+}

ratio (अनुपात) = $\frac{Fe^{2+}}{Fe^{3+}}=\frac{1}{\frac{2}{3}}=\frac{3}{2}$

3. $2Fe + \frac{3}{2}O_2 \longrightarrow Fe_2O_3$

Let assume n mole of Iron

Initial n 0

n – x $\left(\frac{x}{2}\right)$

wt. (n – x) 56 + $\left(\frac{x}{2}\right)$ 160 = n 56 1.1

24x = 5.6 n

$\left(\frac{x}{n}\right)$ = 0.2323

% total Iron = 23.3%

5. $HNO_3 + NH_4^+ \longrightarrow N_2 + NO_2$

Meq of HNO_3 = Meq of NH_4^+

mole n-factor = mole n-factor

1 mole = 1 6

mole of HNO_3 = 6

6. $Z^{+x} + KMnO_4 \xrightarrow{H^+} Mn^{2+} + Z^{+y}$

Meq of Z^{+x} = Meq of $KMnO_4$

25 0.1 (y – x) = 25 0.04 5

$(y-x)=\frac{0.04\times5}{0.1}=2$

$Z^{2+} \longrightarrow Z^{4+}$

(4 – 2) = 2

7. $Cl^- + KMnO_4 \longrightarrow Mn^{2+} + Cl_2$

Meq of NaCl = Meq of $KMnO_4$

mole n-factor = $\frac{10}{158}\times\frac{5}{2}$

mole 1 = $\frac{10}{158}\times\frac{5}{2}$

volume of $Cl_2=\frac{10}{158}\times\frac{5}{2}$ 22.4 = 3.54 L

8. $I_2 \longrightarrow I^- + IO_3^-$

$I_2 \rightarrow 2I^-$

$2e^- + I_2 \rightarrow 2I^-$ 5

$10e^- + 5I_2 \rightarrow 10I^-$

$\longrightarrow 2IO_3^- + 12H_2O$

$I_2 \longrightarrow 2IO_3^-$

$I_2 + 6H_2O \longrightarrow 2IO_3^-$

$I_2 + 6H_2O + 12OH^-$

$I_2 + 12OH^- \longrightarrow 2IO_3^- + 6H_2O + 10e^-$

$12OH^- + 6I_2 \longrightarrow 10I^- + 2IO_3^- + 6H_2O$

ratio of $\frac{IO_3^-}{I^-}=\frac{2}{10}=1:5$

9. Eq. mass (तुल्यांकी द्रव्यमान)

$$= \frac{\text{molecular mass (आण्विक द्रव्यमान)}}{\text{n – factor (कारण)}}$$

$As_2^{+3} \longrightarrow 2As^{+5}$ n-factor 4

$S_3^{-2} \longrightarrow 3S^{+6}$ 24

total n-factor (कुल n-कारक) = 28

Eq. mass (तुल्यांकी द्रव्यमान) = $\frac{\text{m.wt.}}{28}$

10. $\overset{+2}{Zn}\overset{-2}{S} + H\overset{+5}{N}O_3 \longrightarrow \overset{+2}{Zn}(\overset{+5}{N}O_3)_2 + H_2\overset{+6}{S}O_4 + \overset{+4}{N}O_2$

change in O.N. of Zn (Zn की ऑक्सीकरण संख्या में परिवर्तन)

Zn = 0

S = 6–(–2) = 8

N = 5 – 4 = 1

14. From Hit and trial method

$3H_2O + CN^- \longrightarrow NO + CO_2 + 6H^+ + 7e^-$ ...(i)

$3CN^- + 9H_2O \longrightarrow 3NO + 3CO_2 + 18H^+ + 21e^-$

$21e^- + 7NO_3^- + 28H^+ \longrightarrow 7NO + 14H_2O$

Balance equation (संतुलित समीकरण)

$3CN^- + 7NO_3^- + 10H^+ \rightarrow 10NO + 3CO_2 + 5H_2O$

15. $K_2Cr_2O_7 + Sn^{2+} \longrightarrow Sn^{4+} + Cr^{3+}$

$Sn^{4+} + Fe^{2+} \longrightarrow Fe^{3+}$

meq. of Sn^{4+} = meq of $K_2Cr_2O_7$

meq. of Sn^{4+} = meq of Fe^{3+}

meq. of Fe^{3+} = meq of $K_2Cr_2O_7$

$N_{K_2Cr_2O_7} = \frac{4.9 \times 6}{294 \times 0.1} = 1$

millimol (मिलीमोल) n -factor = 1 10

millimol (मिलीमोल) = 10

17. Vol. of O_2 at NTP

$V_{O_2} = \frac{500 \times 1 \times 273}{300}$

V_{O_2} = 455 mL

35 mL of H_2O_2 gives 455 mL at N.T.P.

(35 mL H_2O_2, N.T.P.पर 455 mL देता है)

$\therefore$ 1 mL of H_2O_2 gives = $\frac{455}{35} = 13$

= 13 mL of O_2 at NTP

hence volume strength of H_2O_2 = '13 V'

(अत: H_2O_2 का आयतन सामर्थ्य)

18. Half meq of salt (Na_2CO_3) in neutralize using Hph indicator

(लवण (Na_2CO_3) के आधे तुल्यांक Hph सूचक द्वारा उदासीन हो जाता है।)

$\frac{1}{2}$ meq of salt = meq of HCl

$\frac{1}{2}$ (20 0.1 2) = 0.05 x .....(i)

complete meq of salt ($Na_2CO_3 . NaHCO_3 . 2H_2O$) is neutralise using MeOH indicator

(लवण ($Na_2CO_3 . NaHCO_3 . 2H_2O$) के सभी मिली तुल्यांक MeOH सूचक द्वारा उदासीन हो जाते हैं)

Meq. of salt = Meq of HCl

20 0.1 3 = 0.05 y .....(ii)

eq (ii) – eq (i)

0.05 (y – x) = (6 – 2)

$(y - x) = \frac{4}{0.05}$ (y – x) = 4 20

(y – x) = 80 mL

19. Meq of I_2 = Meq of Hypo solution (हाइपो विलयन)

= 20 2.5 10^{-3}

Meq of 10ml I^-=Meq of I_2 = 20 2.5 10^{-3} = 0.05

Meq of 100 mL I^- = 0.5

Meq of $CaCO_3$ = 0.5

$\frac{w}{123.5} \times 1000 = 0.5$ w = 0.06175

% = purity (शुद्धता) = $\frac{0.06175}{0.1} \times 100 = 61.75\%$

20. $I_2 + Na_2S_2O_3 \rightarrow I^- + S_4O_6^{2-}$

let x mL of I_2 react with Hypo (माना x mL, I_2 हाइपो के साथ क्रिया करता है।)

meq of I_2 = meq of Hypo

xN = 15 0.4 xN = 6 .....(i)

meq of H_2SO_4 used by base (क्षार द्वारा प्रयुक्त H_2SO_4 के मिलीतुल्यांक) = 10 0.3 2 = 6

meq of NaOH used by I_2 (I_2 क्षार द्वारा प्रयुक्त NaOH के मिलीतुल्यांक) = (30 – 6)

(150 – x) N = 24 ..(ii)

from eq (i) & eq (ii)

$\frac{150 - x}{x} = 4 \quad \Rightarrow \quad 5x = 150$

x = 30 mL

30 N = 6

N = $\frac{1}{5}$ N = M n-factor

$\frac{1}{5}$ = M 2

M = $\frac{1}{10} = 0.1$

21. Let a gm H_2SO_4 and (3.185 – a) g $H_2C_2O_4$

Meq of 10 mL mixture = 0.3

meq of 1000 mL mixture = 0.3 1000 = 30

meq of H_2SO_4 + meq of $H_2C_2O_4$ = 30

$$\frac{a}{49}\times1000+\frac{(3.185-a)}{45}\times1000=30 \quad \text{.....(i)}$$

In another ex.

meq of 100 mL mixture = meq of $KMnO_4$

= 4 0.02 5

meq of 100 mL mixture = 0.4

meq of 1000 mL mixture = 4

meq of $H_2C_2O_4$ = 4

$$\frac{3.185-a}{45}\times1000=4 \quad \text{.....(ii)}$$

22. $K_2Cr_2O_7 + KI \longrightarrow I_2 + Cr^{3+}$

$I_2 + Na_2S_2O_3 \longrightarrow I_2 + S_4O_6^{2-}$

$Na_2S_2O_3 + K_2Cr_2O_7 \longrightarrow$

meq of $Na_2S_2O_3$ $\longrightarrow$ meq. of $K_2Cr_2O_7$

30 N = 15 $\frac{1}{20}$ N = $\frac{1}{40}$

meq. of I_2 = meq. of Hypo

meq. of I_2 =meq. of KI

meq of KI = meq. of $K_2Cr_2O_7$

24 $\frac{1}{40}$ = meq. of 25 mL $K_2Cr_2O_7$

meq. of 500 mL $K_2Cr_2O_7$ = $\frac{24}{40}\times\frac{500}{25}$

$$\frac{w\times6}{294}\times1000=12 \qquad w = 0.588$$

$$\%\text{ purity (शुद्धता)} = \frac{0.588}{0.8}\times100=73.5\%$$

REDXO REACTION — EXERCISE # 3

COMPREHENSION BASED QUESTIONS

Comprehension # 1

1. $H_2O + SO_3 \longrightarrow H_2SO_4$;

18 g water combines with 80 g SO_3

(18 g जल 80 g SO_3 से संयोग करता है)

$\therefore$ 4.5 g of H_2O combines with 20 g of SO_3

(4.5 g H_2O, 20 g SO_3 से संयोग करता है।)

$\therefore$ 100 g of oleum contains 20 g of SO_3 or 20% free SO_3

(100g ओलियम में 20g SO_3 या 20% मुक्त SO_3 है)

2. Initial moles of free SO_3 present in oleum

$$=\frac{12}{18}=\frac{2}{3}\text{moles}$$

(ओलियम में उपस्थिति मुक्त SO_3 के प्रारम्भिक मोल)

= moles of water that can combines with SO_3

combined with water $=\frac{9}{18}=\frac{1}{2}\text{mole}$

(SO_3 के साथ संयोग करने वाले जल के मोल)

$\therefore$ moles of free SO_3 remains(मुक्त SO_3 के शेष मोल)

$$=\frac{2}{3}-\frac{1}{2}=\frac{1}{6}\text{mole}$$

$\therefore$ volume of free SO_3 at STP (STP पर मुक्त SO_3 का आयतन) = $\frac{1}{6}\times22.4=3.73L$

3. $Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O + CO_2$

moles of CO_2 formed = moles of Na_2CO_3 reacted

$=\frac{5.3}{106}$ = 0.05

volume of CO_2 formed at 1 atm pressure and 300 K = 0.05 24.63 = 1.23 L

4. eq. of H_2SO_4 + eq. of SO_3 = eq. of NaOH

$$\frac{x}{98}\times2+\frac{(1-x)\times2}{80}=54 \quad 0.4 \quad 10^{-3}$$

$$\%\text{ of free } SO_3 = \frac{1-0.74}{1}\times100=26\%$$

Comprehension # 2

1. 1 L of H_2O_2(aq) provide 11.2 L of O_2 at STP

$$\text{moles of } O_2 = \frac{11.2}{22.4}=0.5$$

$n_{H_2O_2}$ required 0.5 2

$$M_{H_2O_2}=\frac{n_{H_2O_2}}{V_{solution}}=1M$$

2. Strength in percentage mean how many g H_2O_2 present per 100 mL

(प्रतिशत में सामर्थ्य का अर्थ प्रति 100 mL में उपस्थित g H_2O_2 की संख्या है)

$\because$ M $\Rightarrow$ 1 and mol. wt. of H_2O_2 = 34

$\therefore$ 34 H_2O_2 present per litre of solution or 3.4 H_2O_2 present per 100 mL of solution.

(34 H_2O_2 प्रति लीटर विलयन में उपस्थित है या 3.4 H_2O_2 प्रति 100 mL विलयन में उपस्थित है)

3. m.eq. of H_2O_2 = m.eq. of $KMnO_4$

20 N = 0.05 5 80 $\Rightarrow$ N = 1

$$N=\frac{\text{volume strength (आयतन सामर्थ्य) of } H_2O_2}{5.6}$$

$\Rightarrow$ volume strength of H_2O_2 = 5.6

4. m-eq. of $Ba(MnO_4)_2$ = m. eq. of H_2O_2

$$\left(\because M = \frac{33.6}{11.2} \Rightarrow 3\right)$$

$$\frac{w}{375} \quad 10 \quad 1000 = 3 \quad 125 \quad 2 \; ; \; w = 28.125$$

$$\% \text{ purity (शुद्धता)} = \frac{w}{40} \times 100 = \frac{28.125}{40} \times 100 = 70.31$$

Comprehension # 3

1. n-factor (कारक) = 5 2 =10

2. H_3PO_2 is a monobasic acid (एकक्षारीय अम्ल)
$\therefore$ n-factor =1

3. n-factor = $\left(3 - \frac{2}{0.95}\right)$ 0.95 = 0.8075

$$\therefore \text{ eq. wt.} = \frac{M}{0.8075}$$

4. n-factor of VO = 3; Fe_2O_3= 1 2 =2 ;
$\therefore$ x and y are 2 and 3

REDOX REACTION — EXERCISE # 4[A]

4. $KMnO_4 + X^{+n} \longrightarrow XO_3^- + Mn^{+2}$
$1.61\ 10^{-3}$mole $2.63\ 10^{-3}$mole
Eq. (तुल्यांक) of $KMnO_4$ = Eq. of X^{+n}
$1.61 \quad 10^{-3} \quad 5 = 2.63 \quad 10^{-3} \quad (5 - n)$

$$n = 2 \qquad \Rightarrow 56 = \frac{M}{2} + 35.5 \qquad M = 41$$

6. $CuS + Cu_2S + KMnO_4 \longrightarrow Mn^{+2} + Cu^{+2} + SO_2$
6 8 5
Eq. wt. (तुल्यांकी भार) of CuS = $M_1/6$
Eq. wt. (तुल्यांकी भार) of Cu_2S = $M_2/8$
Eq. wt. (तुल्यांकी भार) of $KMnO_4$ = $M_3/5$

8. $N = \left(\frac{5 \times 3}{250}\right) = 0.06$
n-factor = 2

$$M = \frac{0.06}{2} = 0.03$$

9. $H_2SO_4 + 2\ NH_3 \longrightarrow (NH_4)_2SO_4$
(30 – 25) Meq. 25 Meq.
(30 0.2) Meq.

$$V_{NH_3} = 25 \quad 10^{-3} \quad 22400 = 537.6 \text{ ml}$$

10. $n_1 \quad 56 + n_2 \quad 74 = 4.2$ ....(1)
$n_1 \quad 1 + n_2 \quad 2 = 0.1$ ....(2)

$$\% \text{ of KOH} = \frac{n_1 \times 56}{4.2} \times 100 = 35\%$$

$Ca(OH)_2$ = 65%

11. $n \quad 106 + n \quad 84 = 1$ ....(1)
$n \quad 2 + n \quad 1 = 0.1 \quad V \quad 1000$ ....(2)
V = 157.89 ml

12. Eq. of H_2SO_4 = Eq. of NaOH
$n \quad 2 = 0.0267 \quad 0.4$
n = [0.0267 0.2] mole of H_2SO_4 total.
[N 98 – 0.5] = mass of H_2O added
mole of H_2O = mole of SO_3
% of SO_3 = 20.72 %

13. $CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$
0.1 mole 0.25
– 0.05
$HCl + KOH \longrightarrow KCl + H_2O$
0.05 2 V

$$V = \frac{0.05}{2} L = 25 \text{ mL}$$

14. $2NaOH + NaH_2PO_4 \longrightarrow Na_3PO_4 + 2H_2O$

$$1 \quad V \qquad \frac{12}{120} = 0.1 \text{ Mole}$$

V 1 = 0.1 2
V = 0.2 lit = 200 ml.

15. $CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$
x mole 2x
$MgCO_3 + 2HCl \longrightarrow MgCl_2 + H_2O + CO_2$
y mole 2y

$$2x + 2y = \frac{(50 \times 0.8 - 16 \times 0.25)}{1000} \Rightarrow x + y = 0.018 \ldots (1)$$

$x \quad 100 + y \quad 84 = 1.64$ ...(2)

$$\% \ CaCO_3 = \frac{x \times 100}{1.64} \times 100 = 48.78\%$$
$$\% \ MCO_3 = 51.22\%$$

16. M Eq.(मिलीतुल्यांकी) of $CaCO_3$ = M Eq. of HCl – M Eq. of NaOH

$$\frac{w}{(100/2)} \times 1000 = 10 \quad 4 - 4 \quad 18.75 \quad 0.2 = 25$$

w = 1.25 gm

$$\% \ CaCO_3 = \left(\frac{1.25}{1.5}\right) \times 100 = 83.33\%$$

17. $Na_2CO_3 + NaHCO_3$
x g milli mole
x = 4 1 ....(1)
2x + 4 = 10.5
y = 2.5, x = 4
Na_2CO_3 = 4 106 mg = 0.424 mg
$NaHCO_3$ = 0.21 gm

18. Na_2CO_3 NaOH

x y m mole

$x + y = 19.5 \quad 0.995 = 19.4025$ ... (1)

$2x + y = 25.0.995 = 24.875$ ... (2)

$x = 5.4775$ m mole

$$Na_2CO_3 = \frac{5.4725 \times 106}{25} = 23.2 \text{ gm/lit.}$$

NaOH = 22.28 gm/lit.

19. NaOH + Na_2CO_3

x y m mole

$$x + y = \frac{1}{10} \quad 17.5 = 1.75 \qquad \text{... (1)}$$

$y = 0.25$ ... (2) $x = 1.5$, $y = 0.25$ m mole

$$\left.\begin{aligned} NaOH &= \frac{1.5 \times 40}{1000} \text{ gm} = 0.06 \text{ gm} \\ Na_2CO_3 &= \frac{0.25 \times 106}{1000} = 0.0265 \text{ gm} \end{aligned}\right\}$$

20. Na_2CO_3 $NaHCO_3$

x y Meq.

$x = 2 \quad 0.2 = 0.4$ ... (1)

$y + x = 2.5 \quad 0.4$ ... (2)

= 1

$y = 0.6 \quad x = 0.4$

21. Same as 19.

22. $Ce^{+4} + Sn^{+2} \longrightarrow Sn^{+4} + Ce^{+2}$

40.05 + 20 ml

1 M 1 M

Meq. of Ce^{+4} = Meq. Sn^{+2}

$40.05 \quad 1 \quad (4 - n) = 20 \quad 1 \quad 2$

$$(4 - n) = \frac{20 \times 2}{40.05} \simeq 1$$

$n = 3$

23. $\overset{+4}{Se}O_2 + CrSO_4 \longrightarrow Cr^{+3} + Se^{+2}$

Meq. of SeO_2 = Meq. of $CrSO_4$

$12.53 \quad 0.05093 \quad (4 - n) = 25.52 \quad .1 \quad 1$

$4 - n \simeq 4 \Rightarrow n = 0$

24. $K_2C_2O_4.3H_2C_2O_4.4H_2O + MnO_4^- \rightarrow Mn^{+2} + \overset{+4}{C}O_2$

V ml, 0.1 M

$$\left[\frac{1}{508}\right] \times 8 \times 1000 = V \quad 0.1 \quad 5$$

$\Rightarrow V = 31.68$ ml

25. $H_2O_2 + KMnO_4 \longrightarrow Mn^{+2} + O_2$

$$\frac{1 \times x/100}{(34/2)} \quad 1000 = x \quad N$$

$$N = \frac{20}{34} = 0.5882$$

26. $Sn + K_2Cr_2O_7 \longrightarrow SnCl_4 + Cr^{+3}$

1 0.1 N V ml

$$\left(\frac{1}{M/4}\right) \quad 1000 = 0.1 \quad V \Rightarrow V = 337 \text{ ml}$$

27. Meq. of Cu = $\frac{1000}{20}$ [20 0.0327] = 32.7

$$\frac{w}{(63.5/1)} \times 1000 = 32.7 \Rightarrow w = 2.07645 \text{ gm}$$

$$\% \text{ Cu} = \frac{2.07645}{5} \times 100 = 41.53\%$$

28. Meq. of Fe = Meq. of $K_2Cr_2O_7$

$$\frac{0.84 \times x/100}{56} \times 1000 = x \quad N$$

$N = 0.15$

29. $H_2C_2O_4.2H_2O + KHC_2O_4.H_2O + NaOH \rightarrow$ product

x mole y mole 18.9ml, 0.5 N

$H_2C_2O_4.2H_2O + KHC_2O_4.H_2O + KMnO_4 \rightarrow Mn^{+2} + CO_2$

$\frac{x}{4}$mol $\frac{y}{4}$mol 21.55ml, 0.25N

$$x \quad 2 + y \quad 1 = \frac{18.9 \times 0.5}{1000} \quad \text{.... (1)}$$

$$\left(\frac{x}{4} + \frac{y}{4}\right) \quad 2 \quad 1000 = 21.55 \quad 0.25 \quad \text{....(2)}$$

$\% \ H_2C_2O_4.2H_2O = 14.36\%$

$\% \ KH_2C_2O_4.H_2O = 81.7\%$

30. Meq. of $Ca(OH)_2$ = Meq of HCl

$$\left(\frac{w}{74/2}\right) \quad 1000 = (50 \quad 0.5 - 0.3 \quad 20)$$

$$\% \text{ Ca(OH)}_2 = \frac{w}{50} \quad 100 = 1.406$$

31. Meq. of Na_2CO_3 = Meq of HCl

$$\frac{w}{106/2} \quad 1000 = 50 \quad 0.1 - 10 \quad 0.16$$

$$\% \text{ purity} = \frac{w}{1} \quad 100 = 90.1\%$$

32. x gm substance (पदार्थ)

0.6 x gm NaCl, 0.37 x gm KCl

$$\left(\frac{0.6x}{58.5} + \frac{0.37x}{74.5}\right) \quad 1000 = 25 \quad 0.1 - 5.5 \quad 0.1$$

$x = 0.1281$ gm

33. $12 = 5.6 \quad N \Rightarrow N = 2.1428.57$

$700 \quad 2.1428 = 1000 \quad N$

$N_1 = 1.5 = M_1 \quad 2$

$M_1 = 0.75 \quad \Rightarrow \text{gm/lit} = 0.75 \quad 34 = 25.5$

Volume strength of final solution (अन्तिम विलयन का आयतन सामर्थ्य) = $5.6 \quad 1.5 = 8.4$

34. 50 N = 20 0.1
N = 0.04 = M 2
M = 0.02 $\Rightarrow$ gm/ℓ = 0.02 34
gm/ℓ = 0.68

35. $\frac{5}{100\ \ 10^3}\times10^6$ =41.66 ppm

36. $\frac{\left(\frac{1}{111}+\frac{1}{120}\right)\times10^{-3}\times100}{1000}\times10^6$ = 1.734 ppm

37. $\frac{0.001\times100}{1000}\times10^6$ =100 ppm

38. Meq. of H_2O_2 = Meq. of $KMnO_4$

$\frac{x}{34/2} = \frac{0.632}{158/5}$

% Purity (शुद्धता) = $\frac{x}{0.4}\times100$ = 85%

39. 5 x = 5.5 N $\frac{28}{5.5}$ = 5.6 N

5 x = 5.5 0.909 N = 0.909

x = 1

40. 100 ml $\longrightarrow$ 1.62 mg $Ca(HCO_3)_2$

60 10^3 ml $\longrightarrow$ $\frac{1.62}{100}$ 60 10^3 = 972 mg

$Ca(OH)_2 + Ca(HCO_3)_2 \longrightarrow 2\ CaCO_3 + 2\ H_2O$

$\frac{w}{74}$ $\left[\frac{0.972}{162}\right]$

w = $\left(\frac{0.972}{162}\right)$ 74 = 0.444 gm

41. Bleaching powder + Mohr salt excess $\longrightarrow$ product.
(विरजंक चूर्ण + आधिक्य में मोहर लवण $\longrightarrow$ उत्पाद)
Mohr salt (मोहर लवण) + $KMnO_4$ $\rightarrow$ product (उत्पाद).

42. Meq. of SeO_3^{-2} = Meq. of BrO_3^- used

$\frac{w}{M}\times2\times1000 = \left[20\times\frac{1}{60}\times5 - 5\times\frac{1}{25}\times2\right]$

w = 0.084 gm = 84 mg

43. $\frac{1\times0.552}{M}$ 1000 = $\frac{100}{25}$ 17 0.0167 n

n = 6 = No. of electron taken up by oxidant.
(ऑक्सीकारक द्वारा लिये गये इलेक्ट्रॉन की संख्या)

REDOX REACTION — EXERCISE # 4[B]

1. meq. of Hypo = 5 = meq. of I_2
(हाइपो के मिलीतुल्यांक = 5 = I_2 के मिलीतुल्यांक)
moles of I_2 = 2.5 m moles
(I_2 के मोल = 2.5 m moles)
$2CuSO_4 + 4KI \longrightarrow Cu_2I_2 + 2K_2SO_4 + I_2$
from reaction moles of $CuSO_4$ (समीकरण से $CuSO_4$ के मोल) = 2.5 2 = 5 m moles
M_w of hydrated $CuSO_4$ (जलयोजित $CuSO_4$ का M_w) = 159.5 + 18x
so (अत:) $\frac{1.2475}{159.5+18x}$ = 5 10^{-3} x = 5.

2. meq. of Hypo = 100 $\frac{1}{10}$ = 10 = meq. of I_2
(हाइपो के मिलीतुल्यांक) (I_2 के मिलीतुल्यांक)
meq of ClO_3^- (ClO_3^- के मिलीतुल्यांक) = 10
m moles of ClO_3^- (ClO_3^- के m moles) = 2
$6H_2O + 6Cl_2 \longrightarrow 10Cl^- + 2ClO_3 + 12H^+$
2 m moles
so moles of Cl_2 = 6 m moles
(अत: Cl_2 के मोल = 6 m moles)
$6e^- + 14H^+ + Cr_2O_7^{-2} \longrightarrow 2Cr^{+3} + 7H_2O$
$(2Cl^- \longrightarrow Cl_2 + 2e^-)$ 3
$14H^+ + Cr_2O_7^{-2} + 6Cl^- \longrightarrow 3Cl_2 + 2Cr^{+3} + 7H_2O$
6 m moles
m moles of $Cr_2O_7^{-2}$ = 2 m moles
wt. of $Cr_2O_7^{-2}$ = 2 10^{-3} 294 = 0.588 g
($Cr_2O_7^{-2}$ का भार) % purity (शुद्धता) = 58.8 %

3. Let $H_2C_2O_4 \cdot 2H_2O \rightarrow$ x g in 100 mL
(माना $H_2C_2O_4 \cdot 2H_2O \rightarrow$ 100 mL में x g है।)
On reaction with NaOH with phenolphthalein
(फिनॉफ्थेलीन के साथ NaOH की अभिक्रिया पर)
g Eq. of acid in 50 mL (50 mL में अम्ल के ग्राम तुल्यांक)
= $\frac{x\times2}{2\times126}$
g Eq. of NaOH (NaOH के ग्राम तुल्यांक)
= $\frac{1}{10}\times0.11905$
so $\frac{x\times2}{2\times126} = \frac{0.11905}{10} \Rightarrow$ x = 1.5 g
so mass of $Na_2C_2O_4$ = 2.5 – 1.5 = 1 g
अत: $Na_2C_2O_4$ का द्रव्यमान
Now, in 0.5g of same mixture(अब, समान मिश्रण के 0.5gमें)
$H_2C_2O_4 \cdot 2H_2O \longrightarrow$ 0.3 g
$Na_2C_2O_4 \longrightarrow$ 0.2 g
g Eq. of $H_2C_2O_4.2H_2O$($H_2C_2O_4.2H_2O$ के ग्राम तुल्यांक)
= $\frac{0.3\times2}{126}$
g Eq. of $Na_2C_2O_4$ ($Na_2C_2O_4$ के ग्राम तुल्यांक) = $\frac{0.2\times2}{134}$
g Eq. of $KMnO_4$ ($KMnO_4$ के ग्राम तुल्यांक) = $\frac{V}{10}\times10^{-3}$
so $\frac{0.3\times2}{126} + \frac{0.2\times2}{134} = \frac{V\times10^{-3}}{10}$ V = 77.46 mL

4. First HCl will react with KIO_3 to from I_2 & Cl_2 then this Cl_2 produced will again react with KI to form I_2. (पहले HCl, KIO_3 के साथ क्रिया करके I_2 व Cl_2 का निर्माण करेगा तथा उत्पन्न Cl_2, KI के साथ क्रिया करके I_2 का निर्माण करेगी।)

Let initially x moles of KIO_3 were mixed with y moles of HCl then(मानाकि प्रारम्भ में KIO_3 के x मोल ने HCl के y मोल के साथ क्रिया की तो)

$2IO_3^- + 10Cl^- \longrightarrow I_2 + 5Cl_2$

x y

$- \quad \frac{y}{10} \quad \frac{y}{2}$

$Cl_2 + 2KI \longrightarrow I_2 + 2KCl$

$\frac{y}{2}$

$- \quad \frac{y}{2}$

Total moles of I_2 formed (निर्मित I_2 के कुल मोल) = $\frac{y}{10}+\frac{y}{2} = \frac{3y}{5}$

so $\frac{3y}{5}=\frac{0.021\times24\times10^{-3}}{2} \Rightarrow y = 0.00042$ mole

so concentration of HCl (अत: HCl की सान्द्रता) $=\frac{0.00042}{0.025} = 0.0168\ M = 0.0168\ N$

moles of KIO_3 consumed (प्रयुक्त KIO_3 के मोल) $=\frac{0.00042}{5}$

volume of KIO_3 consumed (प्रयुक्त KIO_3 का आयतन) $=\frac{0.00042\times5}{5} = 0.00042\ L = 0.42\ mL$

5. $As_2O_3 + 6HCl \longrightarrow 2AsCl_3 + 3H_2O$

$AsCl_3 + 2H_2O \longrightarrow HAsO_2 + 3H^+ + 3Cl^-$

gram equivalent of I_2 = gram Eq. of $HAsO_2$

I_2 के ग्राम तुल्यांक = $HAsO_2$ के ग्राम तुल्यांक

= gram Eq. of $AsCl_3$

($AsCl_3$ के ग्राम तुल्यांक)

= gram Eq. of As_2O_3

(As_2O_3 के ग्राम तुल्यांक)

gram equivalent of As_2O_3 = 2 0.04134 23.04 10^{-3} = 0.9524 10^{-3} 2

(As_2O_3 के ग्राम तुल्यांक)

gram equivalent of $KMnO_4$ = 0.9524 10^{-3} 2

($KMnO_4$ के ग्राम तुल्यांक)

Let amount of $KMnO_4$ used = w g then

(मानाकि प्रयुक्त $KMnO_4$ की मात्रा = w g तो)

$\frac{w\times5}{158.5} = 0.9524 \quad 10^{-3} \quad 2$

w = 0.06 g

6. $4OH^- + 2H_2O + SO_2 \longrightarrow SO_4^{2-} + 4H_2O + 2e^-$

$4OH^- + SO_2 \longrightarrow SO_4^{2-} + 2H_2O + 2e^-$ ...(1)

$2H_2O + H_2O_2 + 2e^- \longrightarrow 2H_2O + 2OH^-$

$H_2O_2 + 2e^- \longrightarrow 2OH^-$ ...(2)

Eq. (समी.) (1) + (2)

$2OH^- + H_2O_2 + SO_2 \longrightarrow SO_4^{2-} + 2H_2O$ ...(3)

$\because$ NaOH + HCl $\longrightarrow$ NaCl + H_2O

Meq. 30 0.04 0.024 22.48

1.2 ~ 0.53952

0.66048 10^{-3} –

From equation (3) (समीकरण (3) से)

$2OH^- + H_2O_2 + SO_2 \longrightarrow SO_4^{2-} + 2H_2O$

0.66048 10^{-3} 0.33024 10^{-3}

$\therefore$ moles of SO_2 = 0.33024 10^{-3}

(SO_2 के मोल)

wt. (भार) = 0.33024 10^{-3} 32=10.5676 10^{-3}

% of S sample(नमूने में S का %)$=\frac{10.5676\times10^{-3}}{0.6}$ 100 =1.76%

7. $(Mn^{2+} \longrightarrow Mn^{3+} + e^-)$ ... (1)

$4e^- + 8H^+ + MnO_4^- \rightarrow Mn^{3+} + 4H_2O$ ... (2)

equation(समीकरण) (1) 4 + equation(समीकरण) (2)

$8H^+ + 4Mn^{2+} + MnO_4^- \longrightarrow 4Mn^{3+} + Mn^{3+} + 4H_2O$

or $8H^+ + 4Mn^{2+} + MnO_4^- \longrightarrow 5Mn^{3+} + 4H_2O$ ...(1)

$2e^- + 8H^+ + Mn_3O_4 \longrightarrow 3Mn^{2+} + 4H_2O$ ...(2)

from equation (1) milli equivalent of MnO_4^- =N V

(समीकरण (1) से MnO_4^- के मिली तुल्यांक)

= M V.f. V = 31.1 11.7 5 = 0.72774

milli equivalent of Mn^{2+} = milli equivalent of MnO_4^- 4

(Mn^{2+} के मिली तुल्यांक = MnO_4^- के मिली तुल्यांक 4)

= 0.72774 4 = 2.91096

from equation (3) milli eq. of $Mn_3O_4 = \frac{1}{3}$ milli equivalent of Mn^{2+}

(समीकरण (3) से Mn_3O_4 के मिली तुल्यांक = $\frac{1}{3}Mn^{2+}$ के मिलीतुल्यांक) = $\frac{1}{3}$ 2.91096 = 0.97032

$\therefore$ equivalent of Mn_3O_4 = 0.97032 10^{-3}

(Mn_3O_4 के तुल्यांक)

$\frac{W}{229} = 0.97 \quad 10^{-3}$

W = 222.20 10^{-3}

% of Mn_3O_4 in the sample (नमूने में Mn_3O_4 का %)

$=\frac{222.20}{0.545}\times10^{-3}$ 100 = 40.77%

8. H_2S + SO_2

x y

$S^{-2} \longrightarrow SO_4^{2-}$ (n -factor = 6) ((n-कारक = 6))

for H_2S (H_2S के लिए) $\frac{x}{34} \times 6 = 0.534975$

10^{-3} =(20 0.0066 6 – 7.45 0.0345) 10^{-3}

x = 3.031525 10^{-3}

$SO_2 \longrightarrow SO_4^{2-}$ (n -factor = 2) (n-कारक = 2)

for SO_2 (SO_2 के लिए) $\frac{y}{64} \times 2$

$\frac{2y}{64}$ = (25 0.396 – 12.44 0.0345) 10^{-3}

$\frac{2y}{64}$ = 0.56082 10^{-3}

y = 17.94624 g

concentration of H_2S(H_2S की सान्द्रता)

$= \frac{3.031525}{25}$ 10^{-3} = 0.1212mg

concentration of SO_2 (SO_2 की सान्द्रता)

$= \frac{17.94624}{25}$ = 0.7178 mg SO_2/L

9. Let mass of $KClO_3$ (मानाकि $KClO_3$ का द्रव्यमान)→ xg

Let mass of KCl (मानाकि KCl का द्रव्यमान) → yg

$KClO_3 \longrightarrow$ x/122.5 AgCl = 108 + 35.5

$KCl \longrightarrow$ y/74.5 = 143.5

$6e^- + 6H^+ + ClO_3^- \longrightarrow Cl^- + 3H_2O$

$\frac{x}{1225} + \frac{y}{745} = \frac{0.1435}{143.5}$ = 0.001 ... (i)

for complete oxidation of an oxidizing agent = reacted $FeSO_4$ solution – unreacted $FeSO_4$

(ऑक्सीकारक के पूर्ण ऑक्सीकरण के लिए = अभिकृत $FeSO_4$ विलयन – अनअभिकृत $FeSO_4$)

= $N_1V_1 - N_2V_2$

= 30 0.6 – 37.5 0.8 N = 3 milli eq.(मिली तुल्यांक)

$\frac{x}{1225} = \frac{0.003}{6}$ = 0.0005

put above value in eq. (i) (उपरोक्त मान समीकरण (i) में रखने पर)

$\frac{y}{745}$ = 0.0005 ... (ii)

moisture(नमी)=1–(1225+745) 0.0005 = 0.015g

10. $BaCrO_4 \longrightarrow$ 0.0549 g

Cr → $\frac{0.0549}{253}$ 52 25 = 0.282 g

% of Cr (Cr का %) = 0.282 $\frac{100}{10}$ = 2.82%

$Cr_2O_7^{-2} \longrightarrow \frac{0.282}{52 \times 2}$ = 0.002711 mole

g Eq. of MnO_4^- (MnO_4^- के ग्राम तुल्यांक) = 15.95

10^{-3} 0.075 25 – 0.002711 6 = 0.01364

wt. (भार) = 0.01364 $\frac{158.5}{5}$ = 0.432388

wt. of Mn (Mn का भार) = $\frac{0.01364}{5} \times 55$ = 0.15 g

% of Mn (Mn का %) = 0.15 $\frac{100}{10}$ = 1.5%

11. $CH_3(CH_2)_nCOOH$ + $O_2 \longrightarrow$ (n + 2)CO_2 + H_2O

a (n + 2)a

CO_2 + 2NaOH $\longrightarrow$ Na_2CO_3

(n + 2)a b

– b – 2(n + 2)a (n + 2)a

solution has (विलयन रखता है) =

NaOH → b – 2(n + 2)a

Na_2CO_3 → (n + 2)a

On dividing in equal part moles get halfed.

(समान भाग में विभाजित करने पर मोल आधे रह जाते हैं।)

Part - I (भाग-I) :

$\frac{b-2(n+2)a}{2} + \frac{(n+2)a}{2}$ = 0.05 ... (i)

Part - II (भाग-II) :

$\frac{b-2(n+2)a}{2} + 2 \quad \frac{(n+2)a}{2}$ = 0.08 ... (ii)

(ii) – (i)

$\frac{(n+2)a}{2} = 0.03$

(n + 2)a = 0.06 ... (iii)

and $\frac{1.16}{60+14n}$ = a ... (iv)

from equation (iii) & (iv)

(समीकरण (iii) व (iv) से)

$\frac{1.16}{60+14n} = \frac{0.06}{(n+2)}$

19.33n + 38.66 = 60 + 14 n

5.33n = 21.33 ⇒ n = 4

from equation (iii) (समीकरण (iii) से)

6a = 0.06

a = 0.01

from equation (i) (समीकरण (i) से)

$\frac{b}{2}$ – 0.06 + 0.03 = 0.05

$\frac{b}{2}$ = 0.08 moles of NaOH (NaOH के 0.08 मोल)

b = 0.16

mass (द्रव्यमान) = 0.16 40 = 6.4 g

12. Total m mol of AgCl from 20 mL solution $= \frac{0.4305 \times 1000}{143.5} = 3$

(20 mL विलयन से प्राप्त AgCl के कुल m mol)

m moles of AgCl from HCl = 0.8 $\Rightarrow$ m moles of AgCl from $CaCl_2$ = 2.2

(HCl से प्राप्त AgCl के m mol = 0.8 $\Rightarrow$ $CaCl_2$ से प्राप्त AgCl के m मोल = 2.2)

$\Rightarrow$ 1.1 m mole of $CaCl_2$ was consumed for precipitation of oxalate from 20 mL solution.

(20 mL विलयन से ऑक्सेलेट के अवक्षेपण के लिए 1.1 m मोल $CaCl_2$ प्रयुक्त हुए।)

Hence, total m mol of oxalic acid in 250 mL solution = $\frac{1.1}{20}$ 250 = 13.75

(अत:, 250 mL विलयन में ऑक्सेलिक अम्ल के कुल m मोल)

m % of oxalic acid (ऑक्जेलिक अम्ल का द्रव्यमान %) $= \frac{13.75 \times 10^{-3} \times 90}{1.5} \times 100 =$ **82.5**

13 In presence of methyl orange, the whole NaOH and Na_2CO_3 are neutralized

(मेथिल ऑरेन्ज की उपस्थिति में सम्पूर्ण NaOH व Na_2CO_3 उदासीनीकृत हो जाते है।)

$\Rightarrow$ meq of HCl = 16 0.25 = 4 = meq of (NaOH + Na_2CO_3) = meq. of NaOH original

(HCl के मिली तुल्यांक = 16 0.25 = 4 = (NaOH + Na_2CO_3) के मिली तुल्यांक = वास्तविक NaOH के मिली तुल्यांक)

$\Rightarrow$ Total meq of NaOH in original 1.0 g sample = 4 5 = 20

(वास्तविक 1.0 g नमूने में NaOH के मिली तुल्यांक)

$\Rightarrow$ mass % of NaOH (original) (NaOH (वास्तविक) का द्रव्यमान %) $= \frac{20 \times 40 \times 100}{1000} = 80$

Now, let us assume that in 20 mL, x m mol of NaOH has got converted to Na_2CO_3

(अब, मानाकि 20 mL में, x m mol NaOH, Na_2CO_3 में परिवर्तित होता है,)

$\Rightarrow$ In 20 mL, m mol of NaOH = 4 – x

m mol of $Na_2CO_3 = \frac{x}{2}$

In 2nd titration, HCl used in titration of NaOH + Na_2CO_3 = 5 0.1 – 9 0.2 = 3.2

(2nd अनुमापन में, NaOH + Na_2CO_3 के अनुमापन में उपयोग में लिया गया HCl)

$\Rightarrow$ upto phenolphthalein end point, m mol of HCl required = $4 - x + \frac{x}{2} = 4 - \frac{x}{2} = 3.2$

(फिनॉफ्थेलीन अन्त बिन्दु तक, आवश्यक HCl के m mol)

$\Rightarrow$ x = 1.6

$\Rightarrow$ Total Na_2CO_3 formed (निर्मित कुल Na_2CO_3) $= \frac{x}{2}$ 5 $= \frac{5x}{2} = 4$

m mol of NaOH left unreacted (अनअभिकृत रहे NaOH के m mol) = 20 – 4 2 = 12

$\Rightarrow$ weight of 1.0 g of exposed sample = $1 - \frac{8 \times 40}{1000} + \frac{4 \times (106 + 18)}{1000}$ = 1.176 g

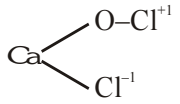
(वायुमण्डल में रखे गये नमूने के 1.0 g का भार)

$\Rightarrow$ weight % of Na_2CO_3 in exposed sample = $\frac{4 \times 106}{1000 \times 1.176}$ 100 = 36.05 %

(वायुमण्डल में रखे गये नमूने में Na_2CO_3 का भार %)

REDOX REACTION — EXERCISE # 5[A]

1. (i) 7 – 2 = 5
(ii) 7 – 6 = 1
(iii) 7 – 4 = 3
(iv) 7 – 3 = 4

2. 

3. In this oxidation number of N is changing

4. $+4 + x - 6 = 0 \Rightarrow x = 2$

5. $x + 4(0) - 2 = +1$
$x = 3$

6. Final product will be Cr_2O_3 in this oxidation state of Cr is +3

REDOX REACTION — EXERCISE # 5[B]

1. $2 + 2(2 + x - 4) = 0$ [$\because$ $Ba(H_2PO_2)$ is neutral molecule] or $2x - 2 = 0 \Rightarrow x = +1$

4. **TIPS/Formulae :**
(i) Write balance chemical equation for given change. oxidation state.
(ii) Identify most electronegative element in the reaction and has the oxidation states of –1 (in H_2O_2) and –2(in $BaSO_4$). In H_2O_2, peroxide ion is present.

5. **TIPS/formulae :**
Balanced the reaction by ion electron method
Oxidation reaction : $C_2O_4^{-2} \rightarrow 2CO_2 + 2e^{-1}]$ 5
Reduction reaction :
$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O]$ 2
Net reaction :
$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \rightarrow$
$2Mn^{2+} + 10CO_2 + 8H_2O$

11. **TIPS/Formulae :**
(i) In an ion sum of oxidation states of all atoms is equal to charge on ion and in a compound sum of oxidation states of all atoms is always zero.
Oxidation state of Min in MnO_4^- = +7
Oxidation state of Cr in $Cr(CN)_6^{3-}$ = +3
Oxidation state of Ni in NiF_6^{2-} = +4
Oxidation state of Cr in CrO_2Cl_2 = +6

14. **TIPS/Formulae :**
(i) Mass of one electron = 9.108 10^{-31}
(ii) 1 mole of electron = 6.023 10^{23} electrons
weight of 1 mole of electron
= Mass of one electron Avogadra number
= 9.108 10^{-31} 6.023 10^{23} 10^{23} kg
$\therefore$ No. of moles of electrons in 1 kg

17. **TIPS/Formulae :**
The highest O.S. of an element is equal to the number of its valence electrons
(i) $[Fe(CN)_6]^{3-}$, O.N. of Fe = +3
$[Co(CN)_6]^{3-}$, O.N. Of Co = +3
(ii) CrO_2Cl_2, O.N. of Cr = +6,
(Highest O.S. of Cr)
$[MnO_4]^-$ O.N. of Mn = +7,
(Highest O.S. of Mn)
(iii) TiO_3, O.N. of Ti = +6,
MnO_2 O.N. of Mn = +4
(iv) $[Co(CN)_6]^{3-}$, O.N. of Co = +3
MnO3, O.N. of Mn = +6

24. **TIPS/formulae :**
Use molarity equation to find volume of H_2SO_4 solutions.

$$\underset{63.5+12+48.98=123.5\,g}{CuCO_3} + \underset{98\,g}{H_2SO_4} \longrightarrow CuSO_4 + H_2O + CO_2\uparrow$$

$\therefore$ For 123.5 gms of Cu(II) carbonate 98 g of H_2SO_4 are required. For 0.5 gms of Cu(II) carbonate weight

of H_2SO_4 reqd. = $\frac{98 \times 0.5}{123.5}$ g = 0.39676 g H_2SO_4

Weight of required H_2SO_4 = 0.39676 g
Weight of solution in grams

$$= \frac{\text{mol.wt.} \times \text{Molarity} \times \text{Volume in mL}}{1000}$$

$$0.39676 = \frac{98 \times 0.5 \times V}{1000}$$

$$\text{or } V = \frac{0.39676 \times 1000}{90 \times 0.5}\text{ml}$$

Volume of H_2SO_4 solution = 8.097 ml