

Chapter 8: Volumetric analysis

Q1.

Sol: Strength in g / lit = density = ?

We have, $N_{HCl} = 3$

$$M_{HCl} = \frac{3}{1} = 3 \quad (\because \text{v.f.} = 1)$$

$$N_{H_2SO_4} = \frac{1}{2}$$

$$\therefore M_{H_2SO_4} = \frac{N_{H_2SO_4}}{\text{v.f.}} = \frac{1/2}{2} = 1/4$$

$$\text{wt. of HCl / lit} = 3 \times \text{Mol. wt} = 3 \times 36.5 = 109.5 \text{ g / lit} \quad \text{Ans}$$

$$\frac{\text{moles of H}_2\text{SO}_4}{\text{lit}} = \frac{1}{4} \Rightarrow \frac{\text{wt of H}_2\text{SO}_4 / \text{lit}}{\text{Mol. wt H}_2\text{SO}_4} = 1/4$$

$$\text{wt. of H}_2\text{SO}_4 / \text{lit} = \frac{1}{4} \times 98 = 24.5 \text{ g / lit} \quad \text{Ans}$$

Q2.



10 ml 1 M

1 M.

meq. of NaOH = meq. of H_2SO_4

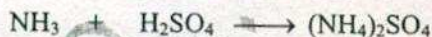
$$10 \times 1 \times 1 = V \times 1 \times 2$$

$$V = \frac{10}{2} = 5 \text{ mL} \quad \text{Ans}$$

Q3.

Sol: $V = 2 \text{ lit of NH}_3$, $T = 13^\circ\text{C} = 286 \text{ K}$, $P = 0.9 \text{ atm}$

$$\text{moles} = \frac{PV}{RT} = \frac{0.9 \times 2}{0.821 \times 286} = 0.076 \text{ mole}$$

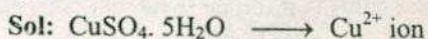


meq of NH_3 = meq of H_2SO_4

$$76 \times 1 = \text{Volume (ml)} \times N$$

$$\frac{76}{134} = N \Rightarrow N = 0.57 \text{ N.} \quad \text{Ans}$$

Q4.



0.5 lit & 0.01 M

$$\therefore \text{Moles of Cu}^{2+} \text{ formed} = \text{Volume} \times \text{Molarity} = 0.5 \times 0.01 = 0.005$$

$$\therefore \text{Moles of CuSO}_4 \cdot 5\text{H}_2\text{O} = \text{moles of Cu}^{2+} = 0.005$$

$$\frac{\text{weight CuSO}_4 \cdot 5\text{H}_2\text{O}}{(63.5 + 96 + 90)} = 0.005$$

$$\text{wt. of CuSO}_4 \cdot 5\text{H}_2\text{O} = 0.005 \times (249.5) = 1.2475 \text{ g} \quad \text{Ans}$$

Q5.

Sol: (a)

$$\frac{\text{weight}}{\text{volume}} = \frac{0.365\text{g}}{\frac{100}{1000}\text{lit}} = 3.65\text{ gm/lit}$$

$$\therefore \text{Mole/lit} = \frac{\text{weight/lit}}{\text{Mol.wt}} = \frac{3.65}{36.5} \text{M} = 0.1\text{M}$$

(b)

$$\frac{\text{moles}}{\text{wt}_{\text{H}_2\text{O}}} \times \frac{3}{30} = \frac{1}{\frac{10}{1000}} = \frac{4}{10} = 0.4 \text{ m} \quad \text{Ans}$$

Q6.

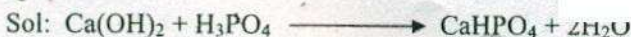
Sol: From principle of dilution

Moles of solute before = moles of solute after dilution

$$V_1 M_1 = (V_1 + V_2) M_2 \quad (V_f = V_1 + V_2)$$

$$\therefore \text{Volume of water added } (V_2) = \frac{V_1(M_1 - M_2)}{M_2} \quad \text{Ans}$$

Q7.



Since only two hydrogens are removed from H_3PO_4 its valency factor is 2.

$$\therefore \text{Eq. wt.} = \frac{\text{Mol.wt}}{\text{V.f}} = \frac{98}{2} = 49 \quad \text{Ans}$$

Q8.

Sol: $V_f = 250 \text{ ml}$

$M_f = 0.2 \text{ M}$

$M_i = 11.7 \text{ M}, V_i = ?$

$$V_i M_i = V_f M_f$$

$$V_i \times 11.7 = 250 \times 0.2 = 250 \times \frac{2}{10} = 50$$

$$V_i = \frac{50}{11.7} = 4.27 \text{ mL} \quad \text{Ans}$$

Q9.

Sol: Let volume of 12 N HCl is taken x ml

then volume of 3N HCl will be = (1000-x)

\therefore From law of dilution

$$(1000 - x) \times 3 + x \times 12 = 1000 \times 6$$

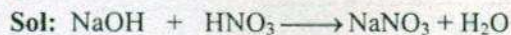
$$3000 + 9x = 6000 \quad \Rightarrow 9x = 3000$$

$$x = 333.33 \text{ mL}$$

Volume of 12 N HCl = 333.33 mL

Volume of 3N HCl = 666.67 mL } Ans

Q11.



$$\begin{array}{cc} 3.2 \text{ g} & 18.9 \text{ g} \\ 1 \text{ lit} & 1 \text{ lit} \end{array}$$

Let V_1 volume of NaOH & V_2 volume of HNO_3 is taken for having neutral solution

meq. of NaOH = meq. of HNO_3

$$V_1 \times \frac{32}{400} \times 1 = V_2 \times \frac{18.9}{63} \times 1$$

$$V_1 \times \frac{4}{50} = V_2 \times \frac{3}{10}$$

$$\frac{V_1}{V_2} = \frac{3 \times 5}{4} = \frac{15}{4} = \frac{3.75}{1} \quad \text{Ans}$$

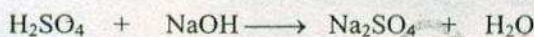
Q12.

Sol: Density = sp. gravity = 1.84 g / lit

$$V = 10 \text{ ml}$$

% by weight = 98%

$$\therefore \text{Normality} = \frac{\% \text{ by wt} \times \text{density} \times 10}{\text{Eq. wt. H}_2\text{SO}_4} = \frac{98 \times 1.84 \times 10}{\frac{98}{2}} = 36.8 \text{ N}$$



$$36.8 \text{ N} \quad 2.5 \text{ N}$$

$$V = 10 \text{ ml} \quad V = ?$$

meq. of H_2SO_4 = meq. of NaOH

$$36.8 \times 10 = 2.5 \times V$$

$$\text{Volume} = \frac{36.8 \times 10}{2.5} = 147.2 \text{ mL}$$

Q13.

Sol: $\text{Molarity} = \frac{\% \text{ by wt} \times \text{density} \times 10}{\text{Mol. wt}} = \frac{13 \times 1.09 \times 10}{98} = 1.446 \text{ M.}$

$$\text{Molarity (m)} = \frac{\text{mole of H}_2\text{SO}_4}{\text{weight of solvent}}$$

$$\% \text{ by wt} = \frac{13}{100}$$

$$\frac{\text{wt of H}_2\text{SO}_4}{\text{wt of solution}} = \frac{13}{100}$$

$$\Rightarrow \frac{\text{W H}_2\text{SO}_4}{\text{W H}_2\text{O} + \text{W H}_2\text{SO}_4} = \frac{13}{100}$$

$$\text{W H}_2\text{SO}_4 = (\text{W H}_2\text{O} + \text{W H}_2\text{SO}_4) \frac{13}{100}$$

$$\text{WH}_2\text{SO}_4 \left(1 - \frac{13}{100} \right) = \frac{13}{100} \text{WH}_2\text{O}$$

$$\frac{\text{WH}_2\text{SO}_4}{\text{WH}_2\text{O}} = \frac{13}{87}$$

$$\therefore \frac{\text{wt H}_2\text{SO}_4}{\text{WH}_2\text{O}} = \frac{13}{98 \times 87}$$

Let V_f is the final volume, then

$$V_i M_i = V_f M_f$$

$$100 \times 1.446 \times 2 = V_f \times 1.5$$

$$V_f = \frac{144.5 \times 2}{1.5} = 193.3 \text{ mL} \quad \text{Ans}$$

Q14.

Sol: $N_f = \frac{1.8 \times 98 \times 10}{49} = 36.8 \text{ N}$

\therefore From principle of dilution

$$V_f N_f = V_i N_i$$

$$V_f = \frac{200 \times 0.5}{38.8} = 2.71 \text{ mL} \quad \text{Ans}$$

Q15.



$$V = 26 \text{ mL} \quad 10 \text{ mL}$$

$$N = 1 \text{ N}$$

From principle of chemical equivalence

$$\text{meq. of Na}_2\text{CO}_3 = \text{meq. of A}$$

$$26 \times 1 = 10 \times N_A$$

$$N_A = \frac{26}{10} = 2.6 \text{ N}$$



$$V = 26 \text{ mL} \quad 40 \text{ mL}$$

$$N = 1 \text{ N}$$

$$26 \times 1 = 40 \times N_B$$

$$N_B = \frac{26}{40} \text{ N} = \frac{2.6}{4} \text{ N}$$

Let V_1 ml of A & V_2 ml of B is required to make 1 lit of 1 N solⁿ then

$$V_1 + V_2 = 1 \text{ lit} = 1000 \text{ mL} \quad (1)$$

$$\text{Also, } V_1 N_A + V_2 N_B = V_f N_f$$

$$V_1 \times 2.6 + (1000 - V_1) \frac{2.6}{4} = 1000 \times 1$$

$$V_1 \times 2.6 \times \frac{3}{4} = 1000 - \frac{2.6}{4} \times 1000$$

$$\frac{\text{mole of H}_2\text{SO}_4}{\text{WH}_2\text{O (gm)}} = \frac{13}{98 \times 87}$$

$$\therefore \text{molarity} = \frac{\text{mole of H}_2\text{SO}_4}{\text{wt H}_2\text{O (gm)}} \times 1000$$

$$= \frac{13 \times 1000}{98 \times 87} = 1.525 \text{ m}$$

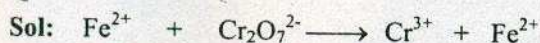
$$V_1 \times \frac{2.6 \times 3}{4} = 1000 \times \frac{1.4}{4}$$

$$V_1 = \frac{1000 \times 1.4}{2.6 \times 3} = 179.5 \text{ mL}$$

Volume of A required = 179.4 ml

Volume of B required = $1000 - 179.4 = 820.6 \text{ mL}$ } Ans

Q16.



25 ml 32.4 ml

v.f = 1 0.0154 M

M = ? (v.f = 6)

meq of Fe^{2+} = meq of $\text{Cr}_2\text{O}_7^{2-}$

$$25 \times M \times 1 = 32.45 \times 0.0153 \times 6$$

$$M = \frac{32.45 \times 0.0153 \times 6}{25} = 0.1192 \text{ M} \quad \text{Ans}$$

Q17.

Sol: Initial weight of HCl present in $\frac{N}{2}$ of 1 lit solution

$$= \frac{1}{2} \times 1 \times 1 \times 36.5 = 18.25 \text{ gm}$$

weight lost = 2.675 gm

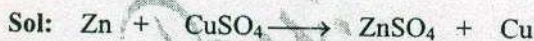
\therefore weight remained = $18.25 - 2.675 = 15.575 \text{ g}$

volume final = 750 mL

$$(i) N_f = \frac{15.575 \text{ g}}{\frac{36.5 \text{ g}}{750}} \times 1000 = 0.569 \text{ N.}$$

$$(ii) \text{ no. of meq in 100 ml solution} = 100 \times \frac{1}{2} = 50 \text{ meq}$$

Q18.



10 gm 200 ml

Let x gm of Zn has reacted

$$\text{Then wt of Cu produced} = \frac{x}{65.4} \times 63.5 \text{ g}$$

\therefore (mole of Zn reacted = mole of Cu produced)

A/q, wt of Zn remained + wt of Cu produced = 9.810 g

$$(10 - x) + \frac{63.5x}{65.4} = 9.810 \text{ g}$$

$$\frac{654 - 65.4x + 63.5x}{65.4} = 9.810 \text{ g}$$

$$654 - 1.9x = 641.57$$

$$1.9x = 12.426$$

NEWTON CLASSES

JEE (MAIN & ADV.), MEDICAL + BOARD

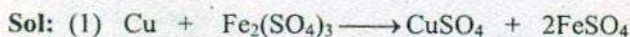
By: Er. Rishi Kumar (B.Tech. IIT Kanpur) Rishi Chemistry Classes, Naya Tola, Patna -4

$$x = \frac{12.426}{1.9} = 6.54$$

(i) The weight of Cu deposited = $\frac{63.5}{65.4} \times 6.54 = 6.35 \text{ g}$

(ii) Molarity = $\frac{6.35}{\frac{63.5}{200} \times 1000} = \frac{5}{20} = 0.5 \text{ M}$

Q19.



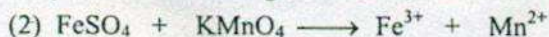
0.108 g excess

(If it is assumed that this is the reaction one)

meq. of FeSO_4 = meq. of CuSO_4

$$= \frac{0.108 \times 1000}{63.5/2} = 3.38$$

Only FeSO_4 can undergo oxidation, because it is only in lower oxidation State.



33.7

0.1 N

meq of FeSO_4 = meq of KMnO_4

$$= 33.7 \times 0.1 = 3.37$$

Since meq in reaction (1) = meq of reaction (2)

\therefore v.f. of FeSO_4 in (1) = v.f. of FeSO_4 in (2)

In reaction (1)

In reaction (2)



So, the assumed reaction (1) is the correct one.

Q20.



Let x g of Na_2CO_3 is present in the commercial sample

\therefore wt of $\text{NaOH} = (2.013 - x) \text{ g}$

\therefore The amount is dissolved in 250 mL

\therefore Quartz present in 10 ml = $\left(\frac{2.031}{250} \right) \times 10 = \frac{2.031}{25} \text{ g}$

\therefore wt. of Na_2CO_3 in 10 ml = $\frac{x \times 10}{250} = \frac{x}{25} \text{ g}$

wt. of NaOH in 10 ml = $\frac{2.013 - x}{250} \times 10 = \frac{2.013 - x}{25} \text{ g}$



(v.f.=1)



(v.f. = 2)

meq of NaOH + meq of Na_2CO_3 = meq of H_2SO_4

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$$\frac{(2.013-x)}{\frac{25}{40} \times \frac{1}{1}} \times 1000 + \frac{x}{\frac{25}{106} \times \frac{1}{2}} \times 100 = 20 \times 0.1$$

$$\Rightarrow \frac{(2.013-x)}{25 \times 40} \times 1000 + \frac{x}{25 \times 43} \times 1000 = 2$$

$$\Rightarrow (2.03 - x) + 0.93x = 2$$

$$\Rightarrow 0.07x = 2.013 - 2 = 0.013$$

$$x = \frac{0.013}{0.069} = 0.186$$

$$\therefore \% \text{ of } \text{Na}_2\text{CO}_3 = \frac{x}{2.013} \times 100 = 9.26\%$$

Q21.



120 ml

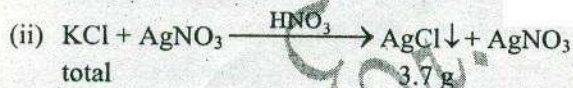
0.12 N

meq. of KOH = meq of HCl (Only KOH will react with HCl)

$$\frac{\text{wt}}{\text{Eq. wt. of KOH}} \times 1000 = 120 \times 0.12$$

$$\frac{\text{wt}}{\frac{56}{1}} \times 1000 = 120 \times 0.12$$

$$\text{wt} = \frac{120 \times 0.12 \times 56}{1000} = 0.8064 \text{ g}$$



total

3.7 g

$$\therefore \frac{\text{wt of KCl}_{\text{total}}}{\frac{74.5}{1}} = \frac{3.7}{143.5}$$

$$\text{wt of KCl}_{\text{total}} = \frac{3.7 \times 74.5}{143.5} = 1.921 \text{ g}$$

$$\text{Also wt of KCl produced from KOH} = \frac{0.8064}{56} \times 74.5 = 1.0728 \text{ g}$$

$$\therefore \text{wt. of KCl originally present} = 1.921 - 1.0728 = 0.8482 \text{ g}$$

$$\therefore \text{total wt. initially} = 0.8482 + 0.8064 = 1.6546 \text{ g}$$

$$\therefore \% \text{ of KOH} = \frac{\text{wt of KOH}}{\text{total Wt.}} \times 100 = \frac{0.8064 \text{ g}}{1.6546} \times 100 = 48.74\% \text{ Ans}$$

Q22.

Sol: 10.03 g of vinegar (contain CH_3COOH)

The solution is made upto 100 ml and out of which 25 ml is taken out for the experiment.



$$V = 25 \text{ ml} \quad 0.0176 \text{ M}$$

$$v.f = 1 \quad 34.30 \text{ ml}$$

$$v.f = 2$$

$$\frac{\text{wt of CH}_3\text{COOH}}{\text{eq.wt}} \times 1000 = 34.30 \times 0.0176 \times 2 = 1.2074$$

$$\frac{\text{wt of CH}_3\text{COOH}}{60/1} \times 1000 = 1.2074$$

$$\text{wt CH}_3\text{COOH in 25 ml} = \frac{1.2074 \times 60}{1000} = 0.0724$$

$$\therefore \text{wt of CH}_3\text{COOH in 100 ml} = \frac{0.0724}{25} \times 100 = 0.290\%$$

$$\therefore \% \text{ of CH}_3\text{COOH in vinegar} = \frac{0.296}{10.3} \times 100 = 2.90\% \quad \text{Ans}$$

Q23.



$$1.5432 \text{ g} \quad 0.1043 \text{ M}$$

$$(\text{Impure}) \quad 34.68 \text{ ml}$$

From balanced reaction coefficient (stoichiometry)

$$3 \text{ mole of Zn}^{2+} \equiv 2 \text{ mole of K}_4[\text{Fe}(\text{CN})_6]$$

$$2 \times \text{mole of Zn}^{2+} = 3 \times \text{mole of K}_4[\text{Fe}(\text{CN})_6]$$

$$2 \times \frac{\text{wt}}{64.5} = 3 \times 0.1043 \times \frac{34.68}{1000}$$

$$\text{wt actually present} = 0.35 \text{ g}$$

$$\therefore \% \text{ of Zn}^{2+} = \frac{0.35}{1.5432} \times 100 = 22.7\% \approx 23\%$$

Q24.



$$(v.f = 1) \quad 5.4 \text{ ml}$$

$$0.1 \text{ N}$$

$$\text{meq of FeSO}_4 \cdot 7\text{H}_2\text{O} = \text{meq. of KMnO}_4$$

$$\frac{\text{wt}}{278/1} \times 1000 = 5.4 \times 0.1$$

$$\text{wt} = \frac{0.54 \times 278}{1000} = 0.15 \text{ g}$$

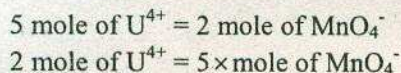
$$\therefore \text{wt of Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O in the sample} = 5.5 - 0.15 = 5.35 \text{ g}$$

$$\therefore \text{Moles of Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O} = \frac{5.35}{535} = 0.0095 \text{ mole; Ans}$$

Q25.



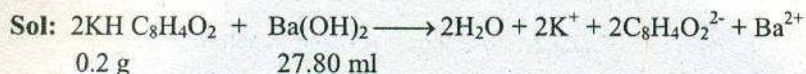
Balance reaction is given, so it is better to use Mole – stoichiometric relationship.



$$2 \times \frac{0.5}{238} = 5 \times \frac{50}{1000} \times M$$

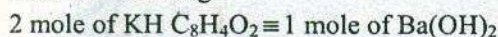
$$M = \frac{2 \times 5 \times 100}{2380 \times 5 \times 5} = \frac{4}{238} = 0.0168 \text{ M} \quad \text{Ans}$$

Q26.



$$0.2 \text{ g} \quad 27.80 \text{ ml}$$

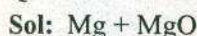
$$\text{Mol. wt} = 204.2 \text{ g}$$



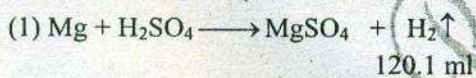
$$\frac{0.2}{204.2} = 2 \times \frac{27.80}{1000} \times M$$

$$M = \frac{200}{204.2 \times 2 \times 27.80} = 0.0176 \text{ M} \quad \text{Ans}$$

Q27.



Dissolved in H_2SO_4 (125 ml & 0.1 N H_2SO_4)



$$120.1 \text{ ml}$$

$$\text{At } T = 27.3^\circ \text{C, } P = 1 \text{ atm}$$



$$\text{H}_2\text{SO}_4 \text{ remained} = 0.02 \text{ N}$$

$$\therefore \text{H}_2\text{SO}_4 \text{ reacted} = (0.1 - 0.02) = 0.08 \text{ N.}$$

From equation (1)

$$\text{mole of H}_2 \text{ evolved} = \text{mole of Mg} = \text{mole of H}_2\text{SO}_4 \text{ used in (1)}$$

$$\frac{\frac{120.1}{1000} \times 1}{0.821 \times 300.3} = \frac{\text{Wt Mg}}{24}$$

$$\text{wt of Mg} = 0.117 \text{ g}$$

$$\text{Mole of H}_2\text{SO}_4 = 4.871 \times 10^{-3} \text{ (reacted in reaction (1))}$$

$$\text{Moles of H}_2\text{SO}_4 \text{ reacted in reaction (2)}$$

$$= \text{Total moles reacted} - \text{moles reacted reaction (1)}$$

$$= \frac{125}{1000} \times 0.08 / 2 - 4.871 \times 10^{-3}$$

$$= (5 - 4.871) \times 10^{-3} = 0.129 \times 10^{-3}$$

$$\therefore \text{Moles of MgO in reaction (2)} = \text{mole of H}_2\text{SO}_4 \text{ reacted in (2)}$$

$$\frac{\text{wt MgO}}{40} = 0.129 \times 10^{-3}$$

$$\text{wt MgO} = 0.00516 \text{ g}$$

$$\therefore \text{Total wt (Mg - 1000)} 0.1178 \text{ g} + 0.00516 \text{ g} = 0.123 \text{ g}$$

$$\% \text{ by wt of Mg} = \frac{0.1170}{0.123} \times 100 = 95.9\% \quad \text{Ans}$$

Q28.

$$\text{Sol: } \text{MH}_2\text{SO}_4 \frac{1.18 \times 24.7 \times 10}{98} = 2.97 \text{ M}$$

$$\text{Volume} = 75 \text{ mL}$$

$$\text{Weight of Al} = 2.7 \text{ g}$$



$$2.7 \text{ g} \quad 75 \text{ ml}$$

$$2.97 \text{ M}$$

$$v.f=3 \quad (v.f=2)$$

$$\text{meq of Al} = \text{meq of H}_2\text{SO}_4 \text{ reacted.}$$

$$\frac{2.7}{\frac{27}{3}} \times 1000 = \text{mmole of H}_2\text{SO}_4 \times 2$$

$$\frac{300}{2} = \text{mole of H}_2\text{SO}_4 \text{ reacted.}$$

$$\therefore \text{mole of H}_2\text{SO}_4 \text{ remained} = 75 \times 2.97 - 150 = 73 \text{ mole}$$

$$\therefore \text{Molarity} = \frac{73}{400} = 0.18 \text{ M} \quad \text{Ans}$$

Q29.

$$\text{Sol: } 4 \text{ g of NaCl} + \text{Na}_2\text{CO}_3 \text{ is dissolved in 250 ml}$$

25 ml is taken for reaction



$$V = 25 \text{ ml} \quad 50 \text{ ml}$$

$$V.f=2 \quad \frac{1}{10} \text{ N}$$

$$\text{Mol. wt.} = 106$$

$$\text{meq. of Na}_2\text{CO}_3 = \text{meq of HCl used}$$

$$\frac{\text{wt. in 25 ml}}{106/2} \times 1000 = 50 \times \frac{1}{10}$$

$$\text{wt in 25 ml} = \frac{5 \times 53}{1000}$$

$$\therefore \text{wt in 250 ml} = \frac{5 \times 53}{1000} \times \frac{250}{25} = 2.65 \text{ g}$$

$$\therefore \% \text{ of Na}_2\text{CO}_3 = \frac{2.65}{4} \times 100 = 66.25\%$$

$$\% \text{ of NaCl} = \frac{1.35}{4} \times 100 = 33.75\% \quad \text{Ans}$$

Q30.

Sol: M_2CO_3 & M'_2CO_3 (suppose the two carbonates of univalent metal are)

Say x gm $(1-x)$ g

Let At. Wt. of $M = 7g$ & M' is y gm, then meq of Metal carbonates = meq of HCl

$$\frac{x}{74/2} \times 1000 + \frac{1-x}{(2y+60)/2} \times 1000 = 44.4 \times 0.5 \text{----- (1)}$$

Also A/q, moles of M_2CO_3 = moles of M'_2CO_3

$$\frac{x}{74} = \frac{1-x}{(2y+60)}$$

$$(1) \Rightarrow \frac{2x}{74} \times 1000 + \frac{2x}{74} \times 1000 = 22.2$$

$$\Rightarrow \frac{4x}{74} \times 1000 = 22.2 \Rightarrow x = \frac{22.2 \times 70}{4 \times 1000} = 0.41g$$

\therefore Wt of $M_2CO_3 = 0.41$ g

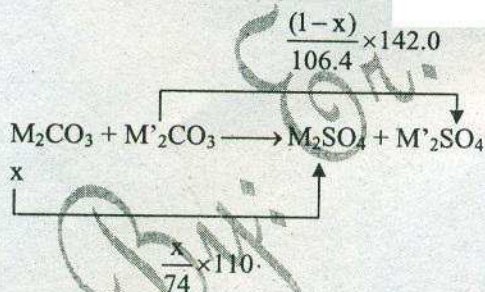
Wt of $M'_2CO_3 = 0.59$ g

$$\text{Also, } \frac{x}{74} = \frac{1-x}{24+60} \Rightarrow \frac{0.41}{74} = \frac{0.59}{2y+60}$$

$$\Rightarrow 2y+60 = \frac{0.59 \times 74}{0.41}$$

$$Y = 23.2 \text{ g}$$

\therefore At. Wt. of $M' = 23.2$ g; **Ans**



$$\begin{aligned} \therefore \text{wt of } SO_4^{2-} \text{ formed} &= \frac{x}{74} \times 110 + \frac{1-x}{106.4} \times 142.4 \\ &= \frac{0.41}{74} \times 110 + \frac{0.59}{106.4} \times 142.4 \\ &= 0.61 \text{ g} + 0.789 \text{ g} = 1.4 \text{ g} \quad \text{Ans} \end{aligned}$$

Q31.

Sol: $W(Na_2CO_3 + K_2CO_3) = 1.22$ g

dissolved in 100 ml



20 ml extracted

$$\text{mole of AgCl} = \frac{0.1435}{143.5} = 0.001 \text{ mole}$$

$$\therefore \text{mole of Cl} = 0.001 \text{ mole}$$

\therefore All of the chlorine comes from ClO_3^- & Cl^-

$$\therefore (\text{mole of KCl} + \text{mole of Cl in KClO}_3) \text{ in } 25 \text{ ml} = \text{mole of Cl in AgCl}$$

(By POAC principle)

$$\therefore (\text{mole of KCl} + \text{mole of KClO}_3) \text{ in } 25 \text{ ml} = \text{mole of AgCl}$$

$$\frac{x/10}{74.5} + \frac{y/10}{122.5} = 0.001$$

$$\frac{x}{74.5} + \frac{y}{122.5} = 0.01 \text{ -----(1)}$$

Also



$$v.f = 6 \quad v.f = 1$$

meq of ClO_3^- = meq of Fe^{2+} (used in the reac-ⁿ)

$$\frac{y/10}{122.5/6} \times 1000 = 30 \times 0.2 - 37.5 \times 0.08$$

$$\frac{y}{204.16} \times 1000 = (6 - 3)$$

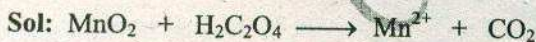
$$\Rightarrow Y = 0.6125 \text{ g}$$

$$\therefore \text{moles of KClO}_3 = \frac{y}{122.5} = 5 \times 10^{-3}$$

$$\text{moles of KCl} = \frac{x}{74.5} = 5 \times 10^{-3} \text{ moles} \quad \text{Ans}$$

From ----(1)

Q33.



$$0.6 \text{ g} \quad 200 \text{ ml}$$

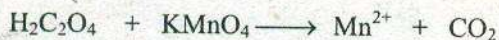
$$(\text{impure}) \quad \frac{1}{10} \text{ N}$$

Let x gm of MnO_2 of present in the reaction, then

$$\text{meq of MnO}_2 = \text{meq of H}_2\text{C}_2\text{O}_4(\text{reacted})$$

$$\frac{x}{87/2} \times 1000 = \text{meq of H}_2\text{C}_2\text{O}_4(\text{reacted})$$

$$\text{meq of H}_2\text{C}_2\text{O}_4 (\text{remained}) \text{ in } 500 \text{ ml} = 200 \times \frac{1}{10} - \frac{2x \times 1000}{87} = 20 - \frac{2000x}{87}$$



$$\text{remained} \quad 50 \text{ ml}$$

$$\text{in } 100 \text{ ml} \quad \frac{1}{30} \text{ N}$$

meq of $\text{H}_2\text{C}_2\text{O}_4$ in 100 ml = meq of KMnO_4 used.

$$\frac{20 - \frac{2000x}{87}}{5} = 50 \times \frac{1}{30} = \frac{5}{3}$$

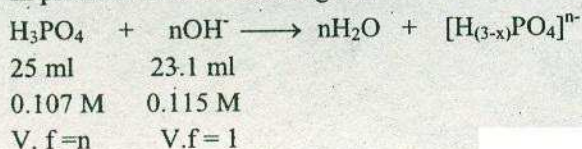
$$\frac{2000x}{87} = 20 - \frac{25}{3} = \frac{60 - 25}{3} = \frac{35}{3}$$

$$x = \frac{35 \times 87}{3 \times 2000} = 0.5075 \text{ gm}$$

$$\therefore \% \text{ of } \text{MnO}_2 \text{ in the sample of ore} = \frac{x}{0.6} \times 100 = \frac{0.5075}{0.6} \times 100 = 84.58\% \text{ Ans}$$

Q34.

Sol: In presence of bromocresol green



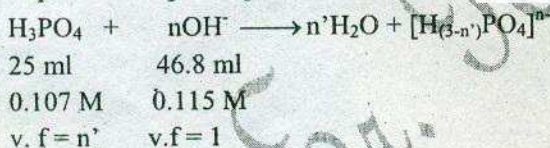
{3-(3-n)} = no. of replaced hydrogen

meq of H_3PO_4 = meq of NaOH

$$25 \times 0.107 \times n = 23.1 \times 0.115 \times 1$$

$$n = \frac{23.1 \times 0.115}{25 \times 0.107} = 1 \text{ Ans}$$

In presence of phenolphthalein indicator



meq of H_3PO_4 = meq of OH^-

$$25 \times 0.107 \times n' = 46.8 \times 0.115$$

$$n' = \frac{46.8 \times 0.115}{25 \times 0.107} = 2 \text{ Ans}$$

Q35.

Sol: $\text{FeSO}_4(\text{NH}_4)_2 \cdot \text{SO}_4 \cdot x\text{H}_2\text{O}$

9.8 g in 250 ml



20 ml extracted

$$\text{wt. of } \text{FeSO}_4(\text{NH}_4)_2 \cdot \text{SO}_4 \cdot x\text{H}_2\text{O} \text{ present in 20 ml of solution} = \frac{9.8}{250} \times 20 = 0.784 \text{ g}$$



0.784 g	3.53 g/ lit
v. f = 1	90% pure
	20 ml

meq of $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot x\text{H}_2\text{O}$ = meq of KMnO_4

$$\left(\frac{0.784}{\frac{284+18x}{1}} \right) \times 1000 = \left(\frac{3.53 \times \frac{90}{100}}{\frac{158}{5}} \right) \times 1000 \times \frac{20}{100}$$

$$\frac{0.784}{(284+18x)} = \frac{0.1}{50}$$

$$284 + 18x = \frac{0.784 \times 50}{0.1} = 7.84 \times 50 = 392$$

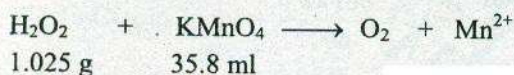
$$18x = 392 - 284$$

$$x = \frac{108}{18} = 6 \text{ Ans}$$

Q36.

Sol: 10 ml of Solution containing 10.25 g of H_2O_2 diluted to 250 ml, which will contain same mass of H_2O_2

$$\text{Now 25 ml is extracted which will contain} = \frac{10.25}{250} \times 25 = 1.025 \text{ g}$$



$$1.025 \text{ g} \quad 35.8 \text{ ml}$$

$$(\text{v.f} = 2) \quad \frac{1}{10} \text{ N}$$

meq of H_2O_2 in 25 ml = meq of KMnO_4 used

$$\frac{\text{wt}}{34/2} \times 1000 = 35.8 \times \frac{1}{10} = 3.58$$

$$\text{wt of } \text{H}_2\text{O}_2 \text{ in 25 ml} = \frac{3.58 \times 17}{1000} = 0.06086 \text{ g}$$

$$\therefore \text{wt of 250 ml (Diluted)} = 0.06086 \times 10 = 0.6086 \text{ g}$$

$$\therefore \text{wt of original 10 ml solution} = 0.6086 \text{ g}$$

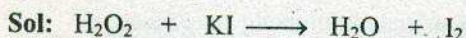
$$\therefore \text{wt in original 100 ml solution} = 0.6086 \times 10 \text{ g} = 6.086 \text{ g}$$

Volume strength = Normality of solution $\times 5.6$

$$= \frac{6.086/17}{100} \times 1000 \times 5.6 \quad [\therefore 5.6 \text{ N } \text{H}_2\text{O}_2 \text{ solution} = 1 \text{ volume of } \text{H}_2\text{O}_2 \text{ solution}]$$

$$= 20 \text{ volume} \quad \text{Ans}$$

Q37.



$$50 \text{ ml} \quad (\text{excess}) \quad (\text{v.f.} = 2)$$

meq of I_2 liberated = meq of H_2O_2 -----(1)



$$(\text{v.f} = 2)$$

$$\text{meq of } I_2 = \text{meq of } Na_2S_2O_3 \text{ -----(2)}$$

Since v.f. of I_2 in both (1) & (2) are same, so (1) & (2) \Rightarrow

$$\text{meq of } H_2O_2 = \text{meq of } Na_2S_2O_3$$

$$50 \times N = 20 \times 0.1$$

$$N = \frac{2}{50} = \frac{4}{100} = 0.04 N$$

$$\text{Also, } \frac{\text{gm.eq}}{\text{lit}} = N = 0.04 N$$

$$\frac{\text{wt}/17}{\text{lit}} = 0.04 N \Rightarrow \frac{\text{wt}}{\text{lit}} = 0.04 \times 17 = 0.68 \text{ g / lit} \quad \text{Ans}$$

Q38.

Sol: 3.546 g dissolved in bleaching powder $[Ca(OCl)Cl]$



25 ml

v.f. = 2

(v.f. = 2)

$$\text{meq. of } Ca(OCl)Cl = \text{meq of } I_2 \text{ evolved -----(1)}$$



(v.f. = 2)

$$\text{meq of } I_2 \text{ (reacted)} = \text{meq of } Na_2S_2O_3 \text{ -----(2)}$$

(1) & (2) \Rightarrow

$$\text{Meq of } Ca(OCl)Cl = \text{meq. of } Na_2S_2O_3 \\ = 20 \times 0.125$$

$$\frac{\text{wt of } Ca(OCl)Cl}{127/2} \times 1000 = 20 \times 0.125$$

$$\text{wt of } Ca(OCl)Cl \text{ present in 25 ml} = 0.15875 \text{ g}$$

$$\frac{\text{wt of } Cl_2 \text{ evolved}}{71/2} \times 1000 = 20 \times 0.125$$

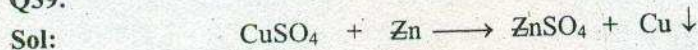
(meq of Cl_2 = meq of I_2 = meq of hypo)

$$\text{wt of } Cl_2 \text{ evolved from 25 ml} = \frac{20 \times 0.125 \times 35.5}{1000} = 0.08875 \text{ g}$$

$$\therefore \text{wt of } Cl_2 \text{ evolved from 100 ml sol}^n = \frac{0.08875}{25} \times 100 = 0.355$$

$$\therefore \% \text{ available chlorine} = \frac{0.355}{3.546} \times 100 = 10.01\% \quad \text{Ans}$$

Q39.



Initially: 100 ml 25 g

1 M

After reaction 0.8 M

$$\therefore \text{Morality of } SO_4^{2-} \text{ after reaction} = 0.8 + 0.2 = 1.0 M$$

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(SO_4^{2-} ion comes from ZnSO_4 & CuSO_4 both)

Also, moles of Zn consumed = moles of CuSO_4 reacted

$$\frac{\text{wt. consumed}}{65.4 \text{ g}} = \frac{100 \times 0.2}{1000}$$

$$\text{wt. consumed} = 6.54 \text{ g} \times 0.2 = 1.308 \text{ g}$$

$$\therefore \text{wt. of Zn rod after reaction} = (25 - 1.308) \text{ g} = 23.692 \text{ g} \quad \text{Ans}$$

(b)



25 g 2M (Cu is very less electropositive than Zn so can't replace Zn from ZnSO_4)

Zn^{2+} after reaction = 2M Ans

Q40.

Sol: In the case of phenolphthalein as indicator only Na_2CO_3 reacts with HCl to give NaHCO_3



$$25 \text{ ml} \quad 12 \text{ ml} \quad \& \quad \frac{1}{20} \text{ N}$$

$$\text{mmole of Na}_2\text{CO}_3 \text{ in } 25 \text{ ml} = \text{mmole of HCl} = 12 \times \frac{1}{20} = 0.6$$

$$\frac{\text{wt}}{106} \times 1000 = 0.6$$

$$\text{Wt Na}_2\text{CO}_3 \text{ in } 25 \text{ ml} = \frac{0.6 \times 106}{1000} = 0.0636 \text{ g}$$

$$\therefore \text{wt Na}_2\text{CO}_3 \text{ in } 1 \text{ lit} = \frac{0.0636}{25} \times 1000 = 2.544 \text{ g} \quad \text{Ans}$$

In presence of methyl orange as indicator



mmole of Na_2CO_3 + meq of NaHCO_3 = meq of HCl

$2 \times \text{mmole of Na}_2\text{CO}_3 + \text{mmole of NaHCO}_3 = \text{mmole of HCl}$

$$2 \times 0.6 + \text{mmole of NaHCO}_3 = 30 \times \frac{1}{20} \times 1$$

$$\text{mmole of NaHCO}_3 = 1.5 - 1.2 = 0.3$$

$$\therefore \frac{\text{wt of NaHCO}_3}{84} \times 1000 = 0.3$$

$$\text{wt of NaHCO}_3 \text{ in } 25 \text{ ml} = 0.3 \times \frac{84}{1000} = 0.0252$$

$$\therefore \text{wt. of NaHCO}_3 \text{ in } 1 \text{ lit} = \frac{0.0252}{25} \times 1000 = 1.008 \text{ g} \quad \text{Ans}$$

Q41.

Sol: In presence of phenolphthalein as indicator



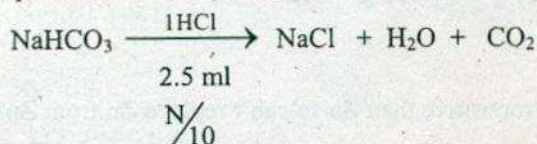
meq of Na_2CO_3 + meq of NaOH = meq of HCl used

$$\text{mmole of Na}_2\text{CO}_3 + \text{mmole of NaOH} = 17.5 \times \frac{1}{20} \text{-----(1)}$$

(Because v.f. of Na_2CO_3 & $\text{NaOH} = 1$, in the above reaction).

$$(1) \Rightarrow \text{Also mmole of NaHCO}_3 \text{ formed} = \text{mmole of Na}_2\text{CO}_3 \text{-----}(2)$$

Also in presence of Methyl orange



\therefore meq of NaHCO_3 = meq of HCl

$$\text{mmole of NaHCO}_3 = 2.5 \times \frac{1}{10} = 0.25$$

$$\therefore (2) \Rightarrow \text{mmole of Na}_2\text{CO}_3 = 0.25$$

$$\therefore \frac{\text{wt}}{106} \times 1000 = 0.25$$

$$\text{Wt. of Na}_2\text{CO}_3 = \frac{0.25 \times 106}{1000} = 0.0265 \text{ g} \quad \text{Ans}$$

$$(1) \Rightarrow \text{mmole of NaOH} = 1/75 = 0.25 = 1.5$$

$$\frac{\text{wt NaOH}}{40} = \frac{1.5 \times 4}{100} = 0.06 \text{ g} \quad \text{Ans}$$

Q42.

Sol:- Let the chloride is MCl_m



$$0.2 \text{ g} \qquad \qquad 0.47 \text{ g}$$

meq of MCl_m = meq of AgCl

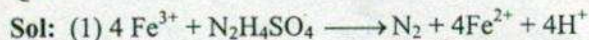
$$\frac{0.29}{\text{Eq. wt. MCl}_m} \times 1000 = \frac{0.47 \text{ g}}{\text{Eq. wt. AgCl}} \times 1000$$

$$\text{Eq. wt MCl}_m = \frac{0.2 \times 143.5}{0.47} = 61.06 \text{ g}$$

$$\text{Eq. wt of M} + \text{Eq. wt of Cl} = 61.06 \text{ g}$$

$$\text{Eq. wt of M} = 61.06 - 35.5 = 25.56 \text{ g} \quad \text{Ans}$$

Q43.



(v.f = 4)



In 10 ml solution :-

From reaction (1)

$$\text{meq of Fe}^{3+} = \text{meq of N}_2\text{H}_4\text{SO}_4 = \text{Fe}^{2+} \text{ formed -----(1)}$$

From reaction (2)

$$\text{meq of Fe}^{2+} = \text{meq of MnO}_4^- \text{ (used) -----(2)}$$

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(1) & (2) \Rightarrow meq of $\text{N}_2\text{H}_4\text{SO}_4 = \text{meq of MnO}_4^-$ (because $V.F \text{ Fe}^{2+}(1) = V.f \text{ Fe}^{2+}(2)$)

$$= \frac{\text{wt}}{128/4} \times 1000 = 20 \times \frac{1}{50} \times 5 = 2$$

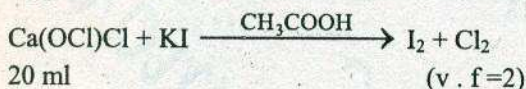
$$\text{wt of N}_2\text{H}_4\text{SO}_4 \text{ in } 10 \text{ ml} = \frac{2 \times 32}{1000} = 0.064 \text{ g}$$

$$\therefore \text{N}_2\text{H}_4\text{SO}_4 \text{ in } 100 \text{ ml} = 0.64 \text{ g}$$

$$\therefore \text{wt N}_2\text{H}_4\text{SO}_4 \text{ in } 1 \text{ lit} = \frac{0.64 \times 1000}{100} = 6.4 \text{ g} \quad \text{Ans}$$

Q44.

Sol: 5 g present in 500 ml of which 20 ml extracted



meq of $\text{Cl}_2 = \text{meq of I}_2 - (1)$

Also meq of $\text{I}_2 = \text{meq of hypo solution used} - (2)$

$$= 20 \times \frac{1}{10} = 2$$

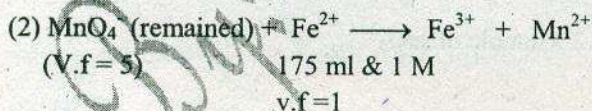
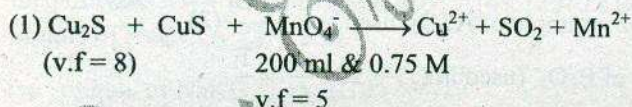
$$\therefore \text{meq of Cl}_2 = 2 \Rightarrow \frac{\text{wt Cl}_2}{71/2} \times 1000 = 2 \Rightarrow \text{Wt Cl}_2 = \frac{71}{1000} = 0.071 \text{ g}$$

$$\text{In } 20 \text{ ml wt of Ca(OCl)Cl present} = \frac{5}{500} \times 20 = 0.2 \text{ g}$$

$$\therefore \% \text{ available chlorine} = \frac{0.071}{0.2} \times 100 = \frac{7.1}{0.2} = 35.5\% \quad \text{Ans}$$

Q45.

Sol:



meq of $\text{Cu}_2\text{S} + \text{meq of CuS} = \text{meq of MnO}_4^- (\text{used})$

$$\text{mmole of Cu}_2\text{S} \times 8 = \text{mmole of CuS} \times 6 = (200 \times 0.75 \times 5 - 175 \times 1 \times 1)$$

Let x g of CuS is present, then wt of Cu_2S (10-x) g

$$\therefore \frac{10-x}{159} \times 1000 \times 8 + \frac{x}{95.5} \times 1000 \times 6 = 575$$

$$\frac{8(10-x)}{159} + \frac{6x}{95.5} = 0.575$$

$$\frac{7640 - 764x + 954x}{159 \times 95.5} = 0.575$$

$$\frac{7640 + 190x}{159 \times 95.5} = 0.575$$

$$190x = 8731.08 - 7640 = 1091.08$$

$$X = 5.74 \text{ g}$$

$$\therefore \% \text{ of CuS} = \frac{x}{10} \times 100 = 57.4\% \quad \text{Ans}$$

Q46.

Sol: 0.518 g sample

$$\text{meq of MnO}_4^- = \text{meq of CaC}_2\text{O}_4$$

$$400 \times 0.25 = 2 \times \text{mmole of CaC}_2\text{O}_4$$

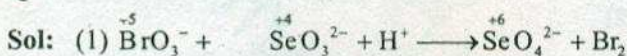
$$\text{Mm mole of CaC}_2\text{O}_4 = \frac{40 \times 25}{2 \times 100} = \frac{10}{2} = 5$$

$$\therefore \text{mmole of Ca} = \text{mmole of CaO} = 5 \quad (\text{By POAC})$$

$$\therefore \frac{\text{wt of CaO}}{56} \times 1000 = 5$$

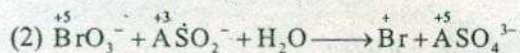
$$\text{wt CaO} = \frac{56 \times 5}{1000} = 0.28 \text{ g} \quad \therefore \% \text{ of CaO} = \frac{0.28}{0.518} \times 100 = 54.1\% \quad \text{Ans}$$

Q47.



$$20 \text{ ml} \quad \frac{1}{60} \text{ M}$$

$$(\text{v.f.}=5) \quad (\text{v.f.}=2)$$



$$(\text{excess}) \quad 5.1 \text{ ml}$$

$$(\text{v.f.}=6) \quad \frac{1}{25} \text{ M}$$

$$(\text{v.f.}=2)$$

$$(1) \Rightarrow \text{meq of BrO}_3^- (\text{reacted}) = \text{meq of SeO}_3^{2-}$$

$$5 \times \text{mmole of BrO}_3^- (\text{used}) = 2 \times \text{mmole of SeO}_3^{2-} \quad \text{-----(1)}$$

$$(2) \Rightarrow \text{meq of BrO}_3^- (\text{excess}) = \text{meq of AsO}_2^- \text{ used.}$$

$$6 \times \text{m mole of BrO}_3^- (\text{excess}) = 2 \times \text{mmole of AsO}_2^- \text{ used} \quad \text{-----(2)}$$

$$\text{Also mmole of BrO}_3^- (\text{excess}) + \text{mole of BrO}_3^- (\text{used in (1)}) = 20 \times \frac{1}{60} = \frac{1}{3}$$

$$(1) \Rightarrow 5 \times \left(\frac{1}{3} - \text{m mole of BrO}_3^- \text{ excess} \right) = 2 \times \text{mmole of SeO}_3^{2-}$$

$$\Rightarrow 5 \times \left(\frac{1}{3} - \frac{2 \times 5.1 \times \frac{1}{25}}{6} \right) = 2 \times \text{m mole of SeO}_3^{2-}$$

$$\Rightarrow \text{mmole of BrO}_3^- \text{ excess} = \frac{2 \times 5.1 \times \frac{1}{25}}{6} \Rightarrow 5 \left(\frac{1}{3} - 0.068 \right) = 2 \times \frac{\text{wt}}{(79 + 16 \times 3)} \times$$

$$\Rightarrow 0.6633 = \frac{\text{wt}}{127} \times 1000 \Rightarrow \text{Wt SeO}_3^{2-} = \frac{127 \times 0.6633}{1000} = 0.084 \text{ g} \quad \text{Ans}$$

Note:- Here v.f. of BrO₃⁻ in both reaction are different, so meq. of BrO₃⁻ can't equated.

Q48.

Sol: Normality of concentrated HCl solution = $\frac{37 \times 1.19 \times 10}{36.5} = 12.06 \text{ N}$

By principle of dilution

$$V_1 N_1 = V_2 N_2$$

$$4.5 \times 12.06 = 100 \times N_f \quad \& \quad N_f = \frac{4.5 \times 12.6}{100} = 0.543 \text{ N}$$



$$10 \text{ ml} \quad 0.108 \text{ M}$$

$$0.543 \text{ N} \quad V = ?$$

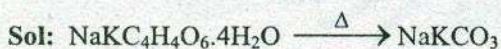
For complete precipitation

$$\text{meq of HCl} = \text{meq of AgNO}_3$$

$$10 \times 0.543 = 0.108 \times V_{\text{AgNO}_3}$$

$$V_{\text{AgNO}_3} = 50.26 \text{ ml} \quad \text{Ans}$$

Q49.



By POAC

$$\text{mmole of NaKCO}_3(\text{produced}) = \text{mmole of NaKC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O} - (1)$$



$$41.72$$

$$0.1307 \text{ N}$$

$$\text{excess H}_2\text{SO}_4 \text{ required} = 1.91 \text{ ml of } 0.1297 \text{ N NaOH}$$

$$\text{meq of NaKCO}_3 = \text{meq of H}_2\text{SO}_4 \text{ used} = (41.72 \times 0.1307 - 1.91 \times 0.1297)$$

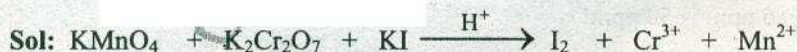
$$\text{mmole of NaKCO}_3 \times 2 = 5.21$$

$$(1) \Rightarrow \text{mmole of NaKC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O} = \frac{5.21}{2}$$

$$\Rightarrow \frac{\text{wt}}{282} \times 1000 = \frac{5.21}{2} \Rightarrow \text{Wt} = 0.73361$$

$$\therefore \% \text{ purity} = \frac{0.73461}{0.9546} \times 100\% = 76.9\% \text{ Ans}$$

Q50.

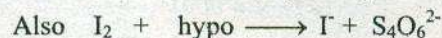


$$\text{v.f} = 5$$

$$\text{v.f} = 6$$

$$(\text{v.f} = 1)$$

$$\text{v.f} = 2$$



$$(\text{v.f} = 2) \quad (\text{Na}_2\text{S}_2\text{O}_3)$$

$$\therefore \text{meq of KMnO}_4 + \text{meq of K}_2\text{Cr}_2\text{O}_7 = \text{meq of I}_2 = \text{meq of hypo solution}$$

$$= 60 \times 0.1 = 6$$

$$\text{mmole of KMnO}_4 \times 5 + \text{mmole of K}_2\text{Cr}_2\text{O}_7 \times 6 = 6$$

$$\frac{\text{wt KMnO}_4}{158} \times 5 \times 1000 + \frac{(0.24 - \text{wt}_{\text{KMnO}_4})}{294} \times 6 \times 1000 = 6$$

$$\text{wt KMnO}_4 = x \text{ (say)}$$

$$\text{wt K}_2\text{Cr}_2\text{O}_7 = (0.24 - x) y$$

$$\frac{5x}{158} + \frac{6(0.24 - x)}{294} = \frac{6}{1000}$$

$$\frac{1470x - 948x + 227.52}{158 \times 294} = \frac{6}{1000}$$

$$552x = 279.712 - 227.52 = 52.19$$

$$x \frac{51.19}{552} = 0.0937$$

$$\text{wt of KMnO}_4 = 0.0937 \text{ g}$$

$$\text{wt of K}_2\text{Cr}_2\text{O}_7 = 0.146 \text{ g}$$

$$\text{wt of Cr} = \frac{0.146}{294} \times 2 \times 52 = 0.051 \quad \& \quad \text{wt of Mn} = \frac{0.0937}{158} \times 55 = 0.034$$

$$\% \text{ of Cr} = \frac{0.051}{0.24} \times 100 = 20.8\% \quad \& \quad \% \text{ of Mn} = \frac{0.034}{0.24} \times 100 = 14.17\% \quad \text{Ans}$$

Q51.

Sol: 50 ppm = 50 ml NH₃ per 10⁶ ml of air
Density NH₃ at Room temp = 0.771 g / lit



100 ml

0.0105 M

In 10 min, volume of air passed = 10 lit / min \times 10 min = 100 lit air

\therefore meq of NH₃ present in 100 lit air = meq of HCl reacted = 100 \times 0.105 = 13.1 \times 0.058

mmole of NH₃ in 100 lit air = 0.2797

$$\frac{\text{wt}}{17} \text{ in } 10^5 \text{ ml air} = 0.2797$$

$$(a) \text{ wt of NH}_3 \text{ drawn to acid solution} = 0.2797 \times 17 = 4.755 \text{ g} \quad \text{Ans}$$

$$\text{wt of NH}_3 \text{ in } 10^5 \text{ ml air} = 0.2797 \times 10 \times 17 = 47.55 \text{ g}$$

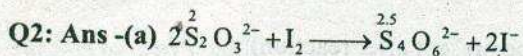
$$\therefore \text{Volume of NH}_3 \text{ present} = \frac{\text{wt}}{\text{density}} = \frac{47.55}{0.771} = 61.6 \text{ ml}$$

$$(b) \therefore \text{ppm of NH}_3 = 61.6 \text{ ppm} \quad \text{Ans}$$

$$(c) \text{ No, because max.}^m \text{ allowed ppm is 50 ppm}$$

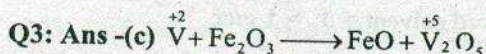
Objective Questions

Q1: Ans-(a) Normality = $\frac{\text{no. of equivalent}}{\text{litre of solution}}$



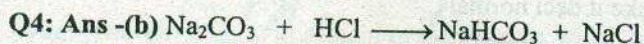
$V.f = 0.5 \times 2 = 1$

$\therefore \text{eq. Wt.} = \frac{\text{Mol. wt}}{v.f} = \text{Mol wt}$



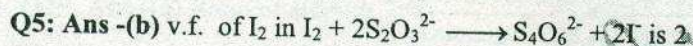
$v.f = 3 \times 2 = 6$

$\therefore \text{eq. wt} = \frac{\text{Mol. wt}}{6}$

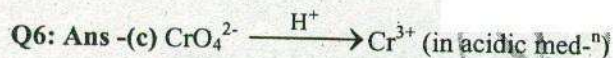


$v.f = 1$, because it reacts with one mole of H

$\therefore \text{eq. wt} = \frac{\text{Mol. wt}}{v.f} = \frac{106}{1} = 106$



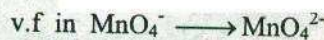
$\therefore \text{eq. wt} = \frac{\text{Mol. wt}}{2}$



$V.f = 3$

$\therefore \text{Eq. Wt.} = \frac{\text{Mol. wt}}{3}$

Q7: Ans -(b) $\text{eq. wt} = \frac{\text{Mol. wt}}{v.f} = \frac{158}{1}$



$V.f = 1$

Q8: Ans -(d) meq of acid = meq of base

$\frac{126}{M.w} = 20 \times 0.1 \Rightarrow \text{Mol. wt} = \frac{126}{2} = 63$



$v.f = 2$ because 2 H^+ are removed from NaH_2PO_4

$\therefore \text{meq of acid} = \text{meq of base}$

$\frac{12}{120/2} \times 1000 = V \times 1 \times 1$

$\frac{100}{5} = V \Rightarrow V = 20 \text{ ml}$

Q10: Ans -(b) meq of acid = meq of base

$\frac{2}{40} = \frac{3}{\text{Eq. wt}}$

Eq. wt of acid 60 g

Q11: Ans -(b) 1 mole of HNO_3 when take 4 mole of e^- , oxidation state of nitrogen decrease by 4.

In HNO_3 , oxidation state of N = +5

Final oxidation state of N = +1.

Which is in N_2O . (Also it should be $\frac{1}{2}$ mole be present after reaction).

Q12: Ans -(c) $N = \frac{\% \text{ by wt} \times \text{density} \times 10}{\text{Eq. wt}} = \frac{1 \times 10 \times 1}{98/2}$ (\therefore For very dilute solution we can take)

d solution \approx d solvent = $d_w = 1 \text{ g/cc}$

Q13: Ans -(a) $0.1 \times V = \frac{6.3}{6.3} \times 1000$

$V = 1000 \text{ ml} = 1 \text{ lit}$

Q14: Ans -(d) Let V is the volume required to make it deci normal

Q15: Ans -(b) meq of $\text{H}_2\text{O}_2 = \text{meq of KMnO}_4$

$$\frac{W}{\frac{34}{2}} \times 1000 = 10 \times 1 \text{ (because v.f of } \text{H}_2\text{O}_2 = 2)$$

$$W = \frac{170}{1000} = 0.17 \text{ g } \therefore \% \text{ by wt} = 85\%$$

Q16: Ans -(c) meq of $\text{NaOH} = 100 \times 0.5 = 50$

meq of $\text{H}_2\text{SO}_4 = 10 \times 3 = 30$

meq of $\text{HCl} = 20 \times 1 = 20$

\therefore meq of base (NaOH) = meq of acid = meq of $\text{H}_2\text{SO}_4 + \text{meq of HCl}$

\therefore the sol.ⁿ will be neutral.

Q17: Ans -(c) Normality = Molarity \times v.f

(a) V. f $\text{H}_2\text{SO}_4 = 2$

(b) V. f $\text{H}_3\text{PO}_3 = 2$

(c) V. f $\text{H}_3\text{PO}_4 = 3$

(d) V. f $\text{HNO}_3 = 1$

\therefore Normality will be higher if v.f will be larger

as acid

Q18: Ans -(d) meq. of metal = gm eq. of acid

$$\frac{xg}{\text{eq. wt}_{\text{metal}}} = 1$$

eq. wt. (metal) = x g

Q19: Ans -(b) $M = \frac{98 \times 1.8 \times 10}{98} = 18$

Q20: Ans -(c) meq of $\text{Na}_2\text{CO}_3 \cdot x \text{H}_2\text{O}$ in 20 ml = meq of HCl (used)

$$\frac{0.7}{\left(\frac{106 + 18x}{2}\right)} \times \frac{20}{100} = 19.8 \times 0.1$$

Calculating the value of x, we have

$$X = 2$$

Q21: Ans -(b) 1 N H_2SO_4 sol.ⁿ 5.6 volume of H_2O sol.ⁿ

$$\therefore 5.6 \text{ volume of } \text{H}_2\text{O}_2 \text{ has normality } 1 \text{ N}$$

$$\therefore 1 \text{ ————— } \frac{1}{56}$$

$$\therefore 20 \text{ ————— } \frac{20}{5.6} = 3.58$$

Q22: Ans -(d) $V_1 N_1 = V_f N_f$

$$8.3 \times 36 = (441.7 + 8.8) \times N_f$$

$$N_f = \frac{8.3 \times 36}{999.0} = 0.29 \text{ N} = 0.3 \text{ N}$$

Q23: Ans -(a) meq of HCl = meq of AgCl precipitated

$$10 \times N = \frac{0.1435 \times 1000}{143.5/1} = 1$$

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

Q24: Ans -(b) NO_3^- will remain in the solution which has now volume = 1 lit

$$\therefore \frac{500}{1000} \times 0.1 = 1 \times N_f \Rightarrow V_f = \frac{0.1}{2} = 0.05 \text{ N}$$

Q25: Ans -(a) Ratio of amount = $\frac{\text{Amount of } \text{H}_2\text{S} \text{ for ppt. of } \text{AgNO}_3}{\text{Amount of } \text{H}_2\text{S} \text{ for ppt. of } \text{CuSO}_4}$

For same, moles of AgNO_3 & CuSO_4 present in the solution;

$$\begin{aligned} \text{Meq of } \text{H}_2\text{S} \text{ required} &= \text{meq of } \text{AgNO}_3 \\ &= \text{mmole of } \text{AgNO}_3 \times 1 \end{aligned}$$

$$\begin{aligned} \text{meq of } \text{H}_2\text{S} \text{ required} &= \text{meq of } \text{CuSO}_4 \\ &= \text{mmole of } \text{CuSO}_4 \times 2 \end{aligned}$$

$$\therefore \text{Ratio of amount of } \text{H}_2\text{S} = \frac{\text{mmole of } \text{AgNO}_3 \times 1}{\text{mmole of } \text{CuSO}_4 \times 2} = \frac{1}{2}$$

Q26: Ans -(d) $2\text{Na}_3\text{PO}_4 + 3\text{BaCl}_2 \rightarrow \text{Ba}_3(\text{PO}_4)_2 + 6\text{NaCl}$

$$0.2 \text{ mole} \quad 0.5 \text{ mole}$$

2 mole of Na_3PO_4 reacts with 3 mole of BaCl_2

$$\therefore 0.2 \text{ ————— } 0.3 \text{ mole of } \text{BaCl}_2$$

$\therefore 0.5 \text{ mole of } \text{BaCl}_2 \text{ is given in excess amount}$

$\therefore \text{Na}_3\text{PO}_4 \text{ is the limiting reagent}$

$$\therefore \text{mole of } \text{Ba}_3(\text{PO}_4)_2 \text{ formed} = \frac{0.2}{2} = 0.1 \text{ mole}$$

Q27: Ans -(b) meq of acid = meq of base (caustic potash (KOH))

$$\frac{0.45 \times 1000}{20/v.f} = 20 \times 0.5$$

$$\frac{450}{90} \times v.f = 20 \times \frac{5}{10}$$

$v.f = 2$, basicity of acid = 2

Q28: Ans -(d) $1 \times 18 = 100 \times M$

$$M = 0.18 \text{ M}$$

$$\therefore N = 0.18 \times v.f. = 0.18 \times 2 = 0.36 \text{ N}$$

Q29: Ans -(d) For weak acid & strong base titration, final solution will be basic i.e, $\text{PH} > 7$

\therefore only those indicators can be used which shown and point at $\text{PH} > 7$,

So (d) is the correct option

Q30: Ans -(b) Eq of A = Eq. of B = Eq. of A_xB_y

Q31: Ans -(b) Volume strength = $1.5 \times 5.6 = 8.4$ volume

Q32: Ans -(a):- mole \times v.f. = mole of $\text{FeSO}_4 \times \text{V.f.}$

$$\text{mole of } \text{KMnO}_4 \times 5 = 1 \times (1+2)$$

$$\text{mole of } \text{KMnO}_4 = \frac{3}{5}$$

Q33: Ans -(a) mole of $\text{KMnO}_4 \times 5 = 1 \text{ mole of } \text{SO}_3^{2-} \times 2 \quad (\text{SO}_3^{2-} \rightarrow \text{SO}_4^{2-})$

$$\therefore \text{mole of } \text{KMnO}_4 = \frac{2}{5}$$

Q 34: Ans -(b) In disproportionation reaction, same substance oxidises as well as reduces. In (b)

Cl_2 is reducing to HCl and oxidising to HClO