

SOLUTIONS

Module - 1 / JEE-2022

Chemistry	Chapter - 1	Stoichiometry - I
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EXERCISE-A

1. (a) $\text{gm-atoms} = \frac{g}{A} \Rightarrow \text{gm-atoms in 24 gm Mg} = \frac{24}{24} = 1$
- (b) $\text{gm-atoms in 62 gm P}_4 = \frac{62}{31} = 2$
- (c) $\text{H}_3\text{PO}_4 \equiv n\text{-factor} = 3 \Rightarrow \text{moles} = \frac{196}{98} = 2$ and $\text{gm-eq} = \frac{196}{98/3} = 6$
- (d) $\text{Ca(OH)}_2 \equiv n\text{-factor} = 2 \Rightarrow \text{moles} = \frac{196}{74} = 2.65$ and $\text{gm-eq} = n\text{-factor} \times \text{moles} = 2 \times 2.65 = 5.30$
- (e) $1 \text{ mol Na}_2\text{CO}_3 \equiv M_o \text{ gm} = 106 \text{ gm}$
- (f) $\text{moles of SO}_2 = \frac{16}{64} = \frac{1}{4} \Rightarrow \text{No. of Molecules} = \text{moles} \times N_o = \frac{1}{4} \times 6.02 \times 10^{23} = 1.5 \times 10^{23}$
- (g) $(M_o)_{\text{H}_2\text{O}} = 18 \text{ gm} \equiv \text{Mass of } 6.02 \times 10^{23} \text{ H}_2\text{O molecules} \Rightarrow \text{Mass of 1 H}_2\text{O molecule} = 3 \times 10^{-23} \text{ gm}$
- 2.(C) $\text{No. of CO}_2 \text{ molecules} = 10^{21} = \frac{g_{\text{CO}_2}}{44} \times 6.02 \times 10^{23} \Rightarrow g_{\text{CO}_2} \text{ removed} = 73.3 \text{ mg}$
 $\Rightarrow \text{mass of CO}_2 \text{ left} = 200 - 73.3 = 126.7 \text{ mg} \approx 0.126 \text{ gm}$
- 3.(A) $\text{Volume of 1 mol atoms} = \frac{60}{10} \text{ cm}^3 \Rightarrow \text{Vol. of 1 atm} = \frac{60}{10} \times \frac{1}{6.02 \times 10^{23}} = \frac{4}{3} \pi r^3 = 1.0 \times 10^{-23} \text{ cm}^3$
4. (i) (B) Let weight of compound = 100 gm
- $\Rightarrow \begin{array}{c|c|c|c|c} \text{A} & 50 \text{ gm} & 50/10 \text{ moles} & 5 & 2 \\ \text{B} & 50 \text{ gm} & 50/20 \text{ moles} & 2.5 & 1 \end{array} \quad \text{Simplest Ratio} \Rightarrow \text{A}_2\text{B}$
- (ii) (A) Let density of $\text{H}_2\text{O} \equiv 1 \text{ gm/ml} \Rightarrow \text{gm in drop of H}_2\text{O} = 1 \times 0.0018 \text{ gm} \Rightarrow \text{moles} = \frac{0.0018}{18} = 10^{-4}$
 $\Rightarrow \text{molecules of H}_2\text{O} = 6.02 \times 10^{23} \times 10^{-4} = 6.02 \times 10^{19}$
- (iii) (B) (a) $\text{gm of N}_2 = 7 \times 2 = 14$ (c) $1 \text{ moles S} \equiv 32 \text{ gm}$
- (b) $\text{gm of C} = \frac{3 \times 10^{23}}{6 \times 10^{23}} \times 12 = 6$ (d) 7 gm Ag

EXERCISE-B

1. (a) Sugar $\equiv C_{12}H_{22}O_{11} \equiv 342 \text{ gm} \Rightarrow$ moles of sugar (n_B) $= \frac{1000}{342}$; moles of H_2O (n_A) $= \frac{2000}{18}$

$$\Rightarrow \chi_{\text{sugar}}(B) = \frac{n_B}{n_A + n_B} = 0.0256; \chi_A = 1 - \chi_B = 0.974$$

$$\% \text{ of sugar (by mass)} = \frac{g_B}{g_A + g_B} = \frac{1000}{1000 + 2000} = 33.3\% \Rightarrow \% \text{ of } H_2O \text{ (by mass)} = 66.7\%$$

(b) $n_{MgCl_2}(B) = \frac{x}{95}$; $n_{H_2O}(A) = \frac{750}{1000} \text{ kg} \Rightarrow m_{MgCl_2} = \frac{x/95}{0.75} = 1.05 \Rightarrow x = 74.8 \text{ gm}$

2.(C) $g_{H_2SO_4} = 49 \text{ gm} \Rightarrow n_{H_2SO_4} = \frac{49}{98} = \frac{1}{2}$; $V = 1 \text{ Lt} \Rightarrow g_{\text{solution}} = 1000 \times 1.049 = 1049 \text{ gm}$

$$\Rightarrow g_{H_2O} = 1049 - 49 = 1000 \text{ gm}$$

$$M_{H_2SO_4} = \frac{1/2}{1} = \frac{1}{2}; N_{H_2SO_4} = 2 \times \frac{1}{2} = 1; m_{H_2SO_4} = \frac{1/2}{1} = \frac{1}{2}$$

3. (a) $x\%$ by mass
 $x \text{ g of solute in } 100 \text{ g solution}$
 $(100-x) = \text{mass of solvent}$

$$\frac{\frac{x}{M_0}}{100 - x} \times 1000 = \frac{1000x}{(100 - x)M_0} = m$$

$$\frac{\frac{x}{M_0}}{d} \times 1000 = M \Rightarrow \frac{10xd}{M_0} = M$$

(b) $x\%$ volume
 $x \text{ g of solute in } 100 \text{ mL of solution.}$

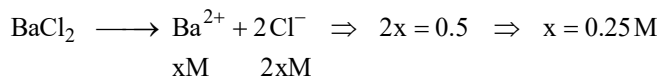
$$\frac{\frac{x}{M_0}}{100} \times 1000 = m \Rightarrow \frac{1000x}{M_0(100d - x)}; \quad \frac{\frac{x}{M_0}}{100} \times 1000 = M \Rightarrow 10 \frac{x}{M_0} = M$$

4. (a) Let the volume of solution $= 1 \text{ L} \Rightarrow$ moles of solute $= 1 \text{ mol}$

$$m = 0.8 = \frac{1}{g_A / 1000} \Rightarrow g_A = 1250, g_B = 1 \times 85 = 85 \text{ gm} \quad [M_{NaNO_3} = 85 \text{ gm/mole}]$$

$$\Rightarrow g_{\text{solution}} = 1250 + 85 = 1335 \text{ gm} \Rightarrow d_{\text{solution}} = \frac{1335}{1000} = 1.33 \text{ g/cm}^3$$

(b) $n_{NaCl} = \frac{29.2/58.5}{1} = 0.5 \Rightarrow [Cl^-] = 0.5 \text{ M (in 1 lit)} \quad [\text{Note : } 2.92 \text{ gm NaCl in } 100 \text{ ml. So, } 29.2 \text{ gm NaCl in } 1000 \text{ ml}]$



$$\text{Let 'n' be moles of BaCl}_2 \Rightarrow \frac{n_{BaCl_2}}{1/4} = 0.25 \Rightarrow n_{BaCl_2} = \frac{0.25}{4} \Rightarrow g_{BaCl_2} = n_{BaCl_2} \times 208.5 \text{ gm} = 12.75 \text{ gm}$$

$$5. (i) \quad M = \frac{10 \times d}{M_o} \Rightarrow 3 = \frac{10 \times x \times 1.2}{158} \Rightarrow x = 39.5\%$$

$$(ii) \quad \text{Let the volume of solution is 1L} \Rightarrow g_{H_2O} = 1200 - 474 = 726 \text{ g}$$

$$\chi_{Na_2S_2O_3} = \frac{3}{3 + \frac{726}{18}} = 0.069$$

$$(iii) \quad m_{Na_2S_2O_3} = \frac{3}{726/1000} = 4.13 \Rightarrow m_{Na^+} = 2 \times 4.13 = 8.26 \text{ and } m_{S_2O_3^{2-}} = 4.13 \quad [Na_2S_2O_3 \longrightarrow 2Na^+ + S_2O_3^{2-}]$$

$$6. (i) (A) \quad \text{Moles HCl req} = 0.2 \times 2 = 0.4 \text{ (n-factor HCl} = 1) \quad [\text{Moles} = \text{Molarity} \times \text{Volume of Solution (in L)}]$$

$$(a) \quad \text{Moles HCl} = 0.5 \times 0.5 + 0.1 \times 1.5 = 0.4$$

$$(b) \quad \text{Moles HCl} = 0.5 \times 1.5 + 0.1 \times 0.5 = 0.8$$

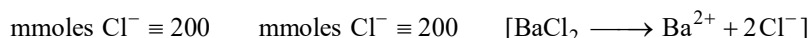
$$(c) \quad \text{Moles HCl} = 0.5 \times 1 + 0.1 \times 1 = 0.6$$

$$(d) \quad \text{Total volume} = 2L; \text{ Moles HCl} = 0.5 \times 0.75 + 0.1 \times 1.25 = 0.45$$

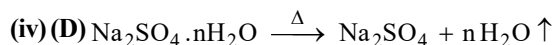
$$(ii) (B) \quad \text{Let volume of solution} = 1L \Rightarrow g_{\text{solution}} = 1000 \times 1.0585 = 1058.5 \text{ gm}$$

$$g_B = (1 \times 1) \times 58.5 = 58.5 \text{ gm} \Rightarrow g_A = 1058.5 - 58.5 = 1000 \text{ gm} \Rightarrow m = \frac{1}{1000/1000} = 1$$

$$(iii) (D) \quad \begin{array}{ccc} \text{mmoles HCl (from 0.2 mol HCl)} & \equiv & 200 \\ \downarrow & & \downarrow \\ \text{mmoles Cl}^- & \equiv & 200 \end{array} \quad \begin{array}{ccc} \text{mmoles BaCl}_2 & \equiv & 100 \\ \downarrow & & \downarrow \\ \text{mmoles Cl}^- & \equiv & 200 \end{array}$$



$$\Rightarrow [Cl^-] = \frac{400/1000}{500/1000} = 0.8M$$



$$(100 \text{ gm}) \equiv \frac{100}{142 + 18n} \text{ moles} \quad (55.9 \text{ gm}) \equiv \frac{55.9}{18} \text{ moles}$$

$$1 \text{ mol } Na_2SO_4 \cdot nH_2O \equiv n \text{ mol } H_2O \Rightarrow \frac{100n}{142 + 18n} = \frac{55.9}{18} \Rightarrow n = 10$$

$$(v) (C) \quad M_{H_2SO_4} = \frac{10 \times d}{M_o} = \frac{10 \times 90 \times 1.8}{98} = 16.5 \Rightarrow 16.5 \times V = 0.2 \times 1 \quad [M_1 V_1 = M_2 V_2] \Rightarrow V = 12 \text{ ml}$$

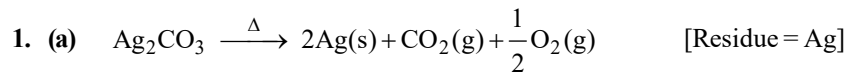
(vi) (AB) Molarity and Normality depends on the volume of solution ("V" dependent).

$$(vii) (C) \quad M_1 V_1 = M_2 V_2 \Rightarrow M_2 = 0.2 \times \frac{1}{1000} = 2 \times 10^{-4} \Rightarrow N_2 = 2 \times 2 \times 10^{-4} = 4 \times 10^{-4} N$$

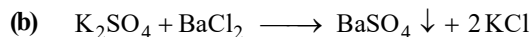
$$(viii) (D) \quad \text{Use : } m = \frac{\chi_B}{1 - \chi_B} \times \frac{1000}{M_A} \Rightarrow \chi_B = 0.051 \quad [M_A = 18 \text{ gm / mole}]$$

$$(ix) (D) \quad \text{Use : } A_{\text{Avg.}} = \sum X_i A_i \Rightarrow 63.546 = x \times 63 + (1 - x) \times 65 \Rightarrow x = 0.727$$

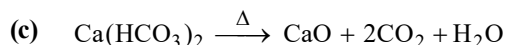
EXERCISE-C



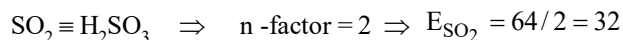
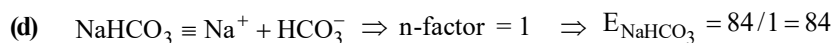
$$\frac{2.76}{276} \equiv 0.01 \text{ moles of } \text{Ag}_2\text{CO}_3 \Rightarrow \text{gm of Ag} = (2 \times 0.01) \times 108 = 2.16 \text{ gm}$$



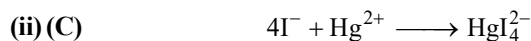
$$M_{\text{K}_2\text{SO}_4} = \frac{5/174}{1/4} = \frac{10}{87} \quad ; \quad \text{Moles } \text{BaSO}_4 = \frac{1.2}{233} = \text{Moles } \text{K}_2\text{SO}_4 = \frac{10}{87} \times V \Rightarrow V = 44.7 \text{ ml}$$



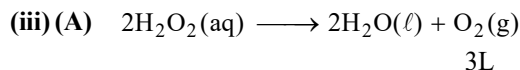
$$\text{Moles } \text{Ca}(\text{HCO}_3)_2 = 2 \Rightarrow \text{Moles } \text{CO}_2 = 2 \times 2 = 4 \Rightarrow \% \text{ yield } \text{CO}_2 = \frac{1}{4} = 25\%$$



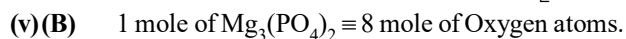
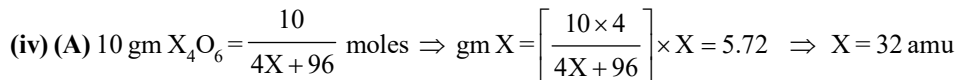
Initial moles	3	1.5	–	$\Rightarrow$	Both gets consumed completely (H_2 and O_2)
Final moles	–	–	3		



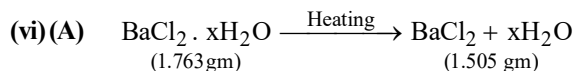
Initial moles	1	1		$\Rightarrow$	I^- is the limiting reactant
Final moles	–	$1 - \frac{1}{4}$	$\frac{1}{4} = 0.25$		



$$\text{Moles } \text{O}_2 = \frac{3}{24} = \frac{1}{2} \text{ moles } \text{H}_2\text{O}_2 \Rightarrow \text{Moles } \text{H}_2\text{O}_2 = \frac{1}{4} = 0.1 \times X \Rightarrow X = 2.5 \text{ M}$$

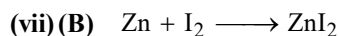


$$\begin{aligned} \Rightarrow \frac{1}{4} \text{ mole of oxygen atoms} &\equiv \frac{1}{8} \times \frac{1}{4} \text{ mole of } \text{Mg}_3(\text{PO}_4)_2 \\ &= 3.125 \times 10^{-2} \text{ mole of magnesium phosphate.} \end{aligned}$$



$$\Rightarrow \frac{1.763}{209 + 18x} \text{ mole of } \text{BaCl}_2 \cdot x\text{H}_2\text{O} = \frac{1.505}{209} \text{ mole of } \text{BaCl}_2 (\text{given})$$

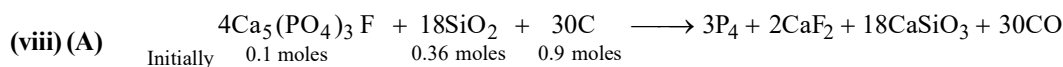
$$\Rightarrow \frac{1.763}{209 + 18x} = \frac{1.505}{209} \quad \Rightarrow \quad x \approx 2$$



Let 'g' grams of Zn & I_2 were taken initially.

$$\text{moles of Zn} = \frac{g}{65}; \text{ moles of } \text{I}_2 = \frac{g}{2 \times 127} = \frac{g}{254} \quad \Rightarrow \quad \text{moles of Zn left} = \frac{g}{65} - \frac{g}{254} = \frac{189g}{65 \times 254}$$

$$\therefore \text{fraction of Zn left} = \frac{\frac{189g}{65 \times 254}}{\frac{g}{65}} = 0.74$$

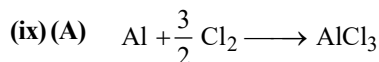


Using mole concept :

4 moles of $\text{Ca}_5(\text{PO}_4)_3\text{F} \equiv 18 \text{ moles of } \text{SiO}_2 \equiv 30 \text{ moles of C} \equiv 3 \text{ moles of P}_4$

Here : SiO_2 is limiting reagent.

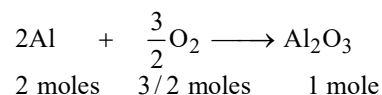
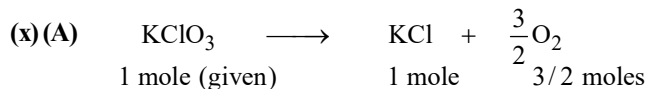
$$\text{So : moles of P}_4 \text{ formed} = \frac{3}{18} \times 0.36 = 0.06$$



1 mole of Al $\equiv$ 1 mole of AlCl_3

$$\text{moles of AlCl}_3 \text{ produced} = \frac{6.67}{133.5} = 0.05 \quad \Rightarrow \quad \text{moles of Al reacted} = 0.05$$

$$\text{Total moles of Al taken} = 0.05 + \frac{0.54}{27} = 0.07$$



EXERCISE-D

1. (a) $S_{\text{HCl}} = 3\text{g/L} \Rightarrow N_{\text{HCl}} = \frac{3}{36.5/1} \Rightarrow \text{Meq HCl} = \frac{3}{36.5/1} \times 2.5$

$$\text{Meq Al(OH)}_3 = \frac{4000 \times 10^{-3}}{78/3} \times x = \text{Meq HCl} [x = \text{No. of tablets}] \Rightarrow x \sim 14$$

(b) $N_{\text{Ca(OH)}_2} = \frac{10xd}{E} = \frac{10 \times 1.85 \times 1.025}{74/2} = 0.51$

$$\text{Meq Ca(OH)}_2 = \text{Meq HCl} \quad \Rightarrow \quad 0.51 \times 25 = (0.1 \times 1) \times V_{\text{HCl}} \Rightarrow V_{\text{HCl}} = 127.5 \text{ ml}$$

(c) $\text{Meq NaOH} = 0.1 \times 40 = 4 = \text{Meq H}_3\text{PO}_4 \text{ (in 25 ml)}$

$$\Rightarrow \text{Meq H}_3\text{PO}_4 = 4 \times \frac{250}{25} = 40 = \frac{g}{98/3} \times 1000 \Rightarrow g_{\text{H}_3\text{PO}_4} = 1.32 \Rightarrow d = \frac{1.32}{1} \text{ g/cm}^3$$

(d) $\text{Meq NaOH} = \frac{1}{15} \times 25 = \frac{5}{3} = \text{Meq oxalic acid in 16.68 ml.}$

$$\Rightarrow \text{Meq oxalic acid in 250 ml} = \frac{5}{3} \times \frac{250}{16.68} = \frac{1.575}{M_o/2} \times 1000$$

$$\Rightarrow M_o = 126 = 18n + 90 \Rightarrow n = 2 \Rightarrow \text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$$

(e) $\text{Meq H}_2\text{SO}_4 = \frac{1}{2} \times 40 = 20 = \text{Meq carbonate} = \frac{0.84}{E} \times 1000 \Rightarrow E = 42$

(f) $\text{Moles NH}_3 = \frac{2.24}{22.4} = 0.1 = \text{Meq NH}_3 (\equiv \text{NH}_4\text{OH}) = \text{Meq H}_2\text{SO}_4 = (M_{\text{H}_2\text{SO}_4} \times 2) \times \frac{100}{1000}$

$$\Rightarrow M_{\text{H}_2\text{SO}_4} = 0.5M$$

2. $\text{Meq acids} = \text{Meq HCl} + \text{Meq H}_2\text{SO}_4 = (1 \times 2) \times 500 + (2 \times 2) \times 100 = 1400$

$$\text{Meq base} = (1000 \times 1) = 1000 \Rightarrow \text{Meq acid}_{\text{left}} = 1400 - 400 \text{ (in 600 ml)}$$

$$\Rightarrow \text{Meq acid}_{\text{left}} \text{ in 30 ml} = 400 \times \frac{30}{600} = 20 = \text{Meq Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O} = \frac{143}{E (\equiv M_o/2)} \times 20$$

$$\text{Thus, } M_o = 286 = 106 + 8x \Rightarrow x = 10$$

3. $\underbrace{\text{NaCl} + \text{Na}_2\text{CO}_3}_{4\text{gm}} \xrightarrow{250\text{ml}} \xrightarrow{25\text{ml}} \equiv 50\text{ml, } \frac{N}{10} \text{HCl} \left(= \frac{1}{10} \times 50 = 5 \text{ meq HCl} \right)$

Thus, $\text{Meq Na}_2\text{CO}_3 \text{ in 25 ml} = 5$ [As HCl doesn't react with NaCl]

$$\Rightarrow \text{Meq Na}_2\text{CO}_3 \text{ in 250 ml} = 50 = \frac{g}{106/2} \times 1000 \Rightarrow g_{\text{Na}_2\text{CO}_3} = 2.65 \text{ gm}$$

$$\Rightarrow \% \text{ Na}_2\text{CO}_3 = \frac{2.65}{4} \times 100 = 66.25\% \text{ and } \% \text{ NaCl} = 33.75\%$$

4. (i) (D) In 30 ml $\left\{ \begin{array}{l} \text{Meq HCl} = 0.1 \times 100 = 10 \\ \text{Meq NaOH} = 0.2 \times 30 = 6 \end{array} \right\} \text{Meq HCl left} = 10 - 6 = 4 = \text{Meq KOH} = 0.25 \times V_{\text{KOH}} \Rightarrow V_{\text{KOH}} = 16 \text{ ml}$

(ii) (B) $\left\{ \begin{array}{l} \text{Meq H}_2\text{SO}_4 = (2 \times 0.2) \times 100 = 40 \\ \text{Meq NaOH} = (1 \times 0.2) \times 100 = 20 \end{array} \right\} \text{Meq H}_2\text{SO}_4 \text{ left} = 40 - 20 = 20 \Rightarrow [\text{H}^+] = \frac{20}{100 + 100} = 0.1N$

(iii) (C) $\text{Meq HCl} = (1 \times x) \times 20 = 20x$

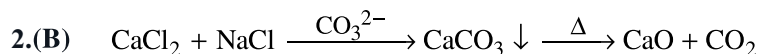
$$\text{Meq NaHCO}_3 + \text{Meq Na}_2\text{CO}_3 = (0.1 \times 1) \times 10 + (0.2 \times 2) \times 5 = 3 \Rightarrow 20x = 3 \Rightarrow x = 0.15 M$$

MISCELLANEOUS EXERCISE

1.(C) Moles $\text{H}_2\text{S} = \frac{17}{M_{\text{H}_2\text{S}}} = \frac{17}{34} = \frac{1}{2}$

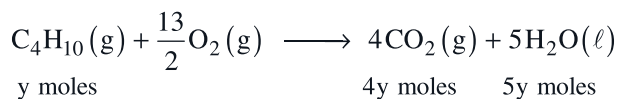
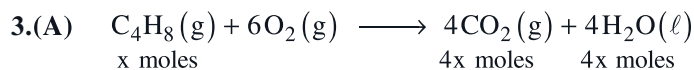
Also, 1 mol $\text{H}_2\text{S} \equiv 5$ moles H_2SO_4 [from Stoichiometry of reaction]

$$\Rightarrow \frac{1}{2} \text{ mol } \text{H}_2\text{S} \equiv \frac{5}{2} \text{ moles } \text{H}_2\text{SO}_4 = M \times V_L \Rightarrow V_L = \frac{2.5}{0.1} = 25 \text{ L}$$



$$\text{Moles of CaO} = \frac{1.62}{56} \equiv \text{Moles CaCO}_3 \equiv \text{Moles CaCl}_2 = \frac{g_{\text{CaCl}_2}}{111}$$

$$\Rightarrow g_{\text{CaCl}_2} = 3.21 \text{ gm} \Rightarrow \% \text{CaCl}_2 = \frac{3.21}{10} \times 100 = 32.1\%$$



Equate moles of CO_2 :

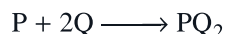
$$\Rightarrow 4x + 4y = \frac{35.2}{44} = 0.8 \Rightarrow x + y = 0.2 \quad \dots\dots(i)$$

and Equating moles of H_2O

$$\Rightarrow 4x + 5y = \frac{16.2}{18} = 0.9 \quad \dots\dots(ii)$$

Solve for x and y to get : $x = 0.1 \Rightarrow g_{\text{Butene}} = 0.1 \times 56 = 5.6 \text{ gm}$

$y = 0.1 \Rightarrow g_{\text{Butane}} = 0.1 \times 58 = 5.8 \text{ gm} \Rightarrow \% \text{ Butane} = \frac{5.8}{11.4} \times 100 = 50.8$

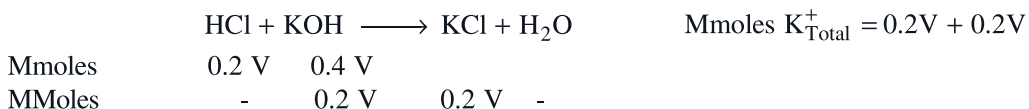


$$M_{\text{P}_2\text{Q}_3} = \frac{15.9}{0.15} = 2\text{P} + 3\text{Q} \quad \text{and} \quad M_{\text{PQ}_2} = \frac{9.3}{0.15} = \text{P} + 2\text{Q} \Rightarrow \text{P} = 26 \text{ and } \text{Q} = 18.$$



$\text{Meq HCl} = 1 \times 0.2 \times V = 0.2V$; $\text{Meq KOH} = 1 \times 0.4 \times V = 0.4V$

$\Rightarrow$ KOH is in excess



$$\Rightarrow M_{\text{moles K}^+_{\text{Total}}} = 0.2V + 0.2V$$

$$M_{\text{moles OH}^-} = 0.2V \text{ and } M_{\text{moles Cl}^-} = 0.2V \Rightarrow [\text{K}^+] = 0.2\text{M} ; [\text{OH}^-] = 0.1\text{M}, [\text{Cl}^-] = 0.1\text{M}$$

6.(A) NaCl doesn't react with HCl as it is a salt of strong acid and strong base.

$$\text{Meq of HCl} = \frac{1}{10} \times 120 = 12 = \text{Meq CaCO}_3 = \frac{g_{\text{CaCO}_3}}{100/2} \times 1000$$

$$\Rightarrow g_{\text{CaCO}_3} = 0.6 \Rightarrow \% \text{ NaCl} = \frac{0.4}{1} \times 100 = 40$$

7.(D) $\text{Z}_2\text{O}_3 + 3\text{H}_2 \longrightarrow 2\text{Z} + 3\text{H}_2\text{O}$

$$\text{Mmoles H}_2 = \frac{6}{2} = 3$$

$$\Rightarrow 3 \text{ mmoles H}_2 \equiv 1 \text{ mmoles Z}_2\text{O}_3 = \frac{0.16}{(2Z + 48)} \times 1000 \Rightarrow Z = 56 \text{ gm}$$

8.(A) Meq carbonate used for HCl = $(0.1 \times 1 \times 50) - (0.1 \times 1 \times 24) = 2.6$

$$\Rightarrow 2.6 = \frac{0.13}{E_{\text{Carbonate}}} \times 1000 \Rightarrow E_{\text{carbonate}} = 100 \Rightarrow \text{carbonate is CaCO}_3$$

9.(D) Note : NaOH absorbs CO_2

Only N_2 gas will remain as H_2O will become liquid at 25°C

$$n_{\text{urea}} = \frac{0.120}{60} \equiv 2 \text{ mmoles}$$

$$\text{From Stoichiometry, } n_{\text{N}_2} \equiv 2 \times 2 = 4 \text{ mmoles} \equiv 4 \times 24 \text{ cm}^3 = 96 \text{ cm}^3$$

10.(B) $M_1V_1 = M_2V_2$

$$1.5 \times V_1 = \frac{1.7}{17} \times 100 \left[M = \frac{S}{M_0} \right] \Rightarrow V_1 = 6.67 \text{ ml}$$

11.(B) Moles of anhydrous $\text{CaCl}_2 = \frac{222}{111} = 2 \Rightarrow \text{No. of CaCl}_2 \text{ molecules} = 2N_A$

$$\text{No. of ions} = 2N_A \quad \text{And} \quad \text{No. of ions} = 4N_A$$

12.(D) Let 100g/mol be molar mass of the compound

$$\text{Moles of atoms of element X} = \frac{76}{76} = 1 ; \text{ Moles of atoms of element Y} = \frac{24.2}{16} = 1.5$$

So, formula of compound is $\text{XY}_{1.5}$ or X_2Y_3

13.(A) Let x be valency of element M $\Rightarrow$ Formula of oxide is M_2O_x

$$\text{Now, } (2 \times x \times 14) + (x \times 16) = 44 \Rightarrow x = 1 \Rightarrow \text{Atomic weight of element} = 14 \times 1 = 14$$

14.(D) $2\text{NH}_3 + 5\text{F}_2 \longrightarrow \text{N}_2\text{F}_4 + 6\text{HF}$

$$\text{Initially} \quad \frac{2}{17} \text{ moles} \quad \frac{8}{18} \text{ moles} \quad - \quad -$$

$$\text{Finally} \quad - \quad \frac{8}{18} - \frac{5}{17} \text{ moles} \quad \frac{1}{17} \text{ moles} \quad -$$

$$= \frac{1}{17} \times 100\text{g} = 5.9\text{g}$$

$$\% \text{ yield} = \frac{3.56}{5.9} \times 100\% = 60\%$$

15.(B) Moles of H_2SO_4 used = $\frac{10}{1000} \times 0.5 = 0.005$

$\Rightarrow$ Moles of H^+ ions used = $2 \times 0.005 = 0.01$

$\Rightarrow$ Moles of NaOH used = 0.01 (As Na_2SO_4 is neutral being a salt of strong acid and strong base)

$\Rightarrow$ Mass of NaOH used = $0.01 \times 40 = 0.4\text{g}$

16.(D) $\frac{(20 \times 1) + (10 \times 0.25)}{40 + 20} = 0.75$ $\frac{(100 \times 1) + (50 \times 0.25)}{100 + 50} = 0.75$ Using : $M_{\text{new}} = \left(\frac{M_1 V_1 + M_2 V_2}{V_1 + V_2} \right)$

$\frac{(40 \times 1) + (20 \times 0.25)}{40 + 20} = 0.75$ $\frac{(50 \times 1) + (25 \times 0.25)}{50 + 25} = 0.75$

17.(A) Let M gm/mol be molar mass of acid

Now $\frac{6}{M} \times 2 \times 1000 \times \frac{12.5}{1000} = 10 \times 0.1 = 1$ (Decinormal means normality is 0.1 N)

$\Rightarrow M = 150$

18.(A) Mass of alcohol in 2nd solution = $\frac{10}{100} \times 80 \times 0.9 = 7.2\text{g}$

Mass of alcohol in 1st solution = $\frac{90}{100} \times V \times 0.8 = \frac{7.2V}{10}\text{g}$

Since same alcohol content is used.

So $7.2 = \frac{7.2V}{10} \Rightarrow V = 10\text{mL}$

19.(C) Strength of $\text{NH}_3 = 1.7\text{ g/L}$.

(100 mL)

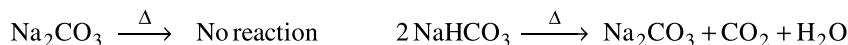
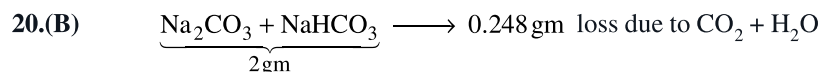
$\Rightarrow n_{\text{NH}_3}$ in 100 mL solution = $\frac{1.7}{17} \times \frac{100}{1000}$
 = 0.01 moles.

These many moles must be present is 1.5 M NH_3 .

So, volume of NH_3 required = V_{mL}

$V_{\text{mL}} \times 1.5 = 0.01 \times 10^3$

$V_{\text{mL}} = \frac{10}{1.5} = \frac{20}{3} = 6.7\text{ mL}$.



$x\text{ gm}$ $2-x\text{ gm}$ $\equiv \left(\frac{2-x}{84} \right) \times \frac{106}{2}\text{ gm}$

$\Rightarrow 1.752 (\text{Residue Na}_2\text{CO}_3) = x + \left(\frac{2-x}{84} \right) \times \frac{106}{2}\text{ gm} \Rightarrow x = 1.325\text{ gm} \Rightarrow \% \text{Na}_2\text{CO}_3 = \frac{1.325}{2} \times 100 = 66.6\%$

21.(A) Let meq of NaOH = x and meq of Na_2CO_3 = y

$$\text{Meq NaOH} + \frac{1}{2} \text{Meq Na}_2\text{CO}_3 = \text{Meq HCl}$$

$$\Rightarrow x + \frac{y}{2} = 0.5 \times 21 = 10.5 \quad \dots\dots\text{(i)}$$

and $\frac{\text{Meq Na}_2\text{CO}_3}{2} (\equiv \text{left}) = \text{Meq HCl}$

$$\Rightarrow \frac{y}{2} = 0.5 \times 7 \Rightarrow y = 7 \quad \dots\dots\text{(ii)} \quad \Rightarrow x = 7$$

$$\text{Now, } \frac{g_{\text{Na}_2\text{CO}_3}}{106/2} \times 1000 = y \Rightarrow g_{\text{Na}_2\text{CO}_3} = 0.371 \quad \Rightarrow \% \text{Na}_2\text{CO}_3 = \frac{0.371}{0.75} \times 100 = 49.5$$