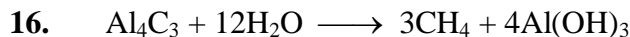


**HINT & SOLUTIONS : MOLE CONCEPT**
**EXERCISE # S-I**

1.  $10^{10}$  grains are distributed in 1 sec  
 $\Rightarrow 6.023 \times 10^{23}$  grains are distributed in  $\frac{6.023 \times 10^{23}}{10^{10}}$  sec  
 $= 6.023 \times 10^{13}$  seconds.
2. Mass of  $6.023 \times 10^{23}$  atom = 12 gm  
 $\Rightarrow$  Mass of 1 atom =  $\frac{12}{6.023 \times 10^{23}}$  gm  
 $= 1.99 \times 10^{-23}$  gm
3. Weight of  $6.023 \times 10^{23}$  atoms = 12 gm  
 $\Rightarrow$  Weight of  $12.046 \times 10^{23}$  atom =  $\frac{12 \times 12.046 \times 10^{23}}{6.023 \times 10^{23}} = 24$  gm
4. (i) Number of moles of Cu atom in  $10^{20}$  atoms of Cu =  $\left(\frac{10^{20}}{N_A}\right)$  moles  
 (ii) Mass of 200 atoms of  $^{16}_8\text{O}$  in amu  $\rightarrow$  Mass of 1 atom = 16 amu  
 $\Rightarrow$  Mass of 200 atoms =  $16 \times 200$  amu = 3200 amu  
 (iii) Mass of 100 atoms of  $^{14}_7\text{N}$  in gm  $\rightarrow$  Mass of 1 atom of  $^{14}_7\text{N}$  in gm =  $14 \times 1.66 \times 10^{-24}$  gm  
 $\Rightarrow$  Mass of 100 atom of  $^{14}_7\text{N}$  =  $14 \times 100 \times 1.66 \times 10^{-24}$  gm i.e.  $1400 \times 1.66 \times 10^{-24}$  gm  
 (iv) Number of molecules in 54 gm  $\text{H}_2\text{O}$  =  $\left(\frac{54}{18} \times N_A\right) = 3N_A$   
 Number of atoms in 54 gm  $\text{H}_2\text{O}$  =  $(3N_A) \times 3 = 9N_A$   
 (v) Number of atoms in 88 gm  $\text{CO}_2$  =  $\left(\frac{88}{44}\right) \times 3N_A$  i.e.  $6N_A$
5. Mass of O atoms in 6 gm  $\text{CH}_3\text{COOH}$  =  $n_{\text{CH}_3\text{COOH}} = \frac{6}{60}$  i.e.  $\frac{1}{10}$   
 In 1 mole of  $\text{CH}_3\text{COOH}$ , mass of O atom = 32 gm  
 $\Rightarrow$  Mass of O atom in  $\frac{1}{10}$  mole  $\text{CH}_3\text{COOH}$  =  $\frac{32}{10}$  i.e. 3.2 gm
6.  $n_{\text{CuSO}_4 \cdot 5\text{H}_2\text{O}} = \frac{499}{249.5} = 2$  mole  
 1 mole of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  contains 90 gm  $\text{H}_2\text{O}$   
 $\Rightarrow$  2 mole of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  contains  $(90 \times 2)$  i.e. 180 ;gm  $\text{H}_2\text{O}$ .

7. 1 mole of  $\text{Na}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$  contains  $11N_A$  'O' atoms  
 $\Rightarrow 6.023 \times 10^{22}$  atom of 'O' are present in  $\frac{6.023 \times 10^{22}}{11 \times N_A} = \frac{6.023 \times 10^{22}}{11 \times 6.022 \times 10^{23}} = \frac{1}{110}$  mole  
 i.e. 2.5 gm
8. Number of Nucleon present in 12 gm of  $^{12}\text{C}$  atoms =  $12 N_A$   
 $= 12 \times 6.023 \times 10^{23}$   
 $= 7.227 \times 10^{24}$
9. In 1 mole of  $^{16}\text{O}^{-2}$  ions  
 Number of Electrons =  $10N_A$  i.e.  $10 \times 6.023 \times 10^{23}$   
 Number of Protons =  $8N_A$  i.e.  $8 \times 6.023 \times 10^{23}$   
 Number of Neutrons =  $8N_A$  i.e.  $8 \times 6.023 \times 10^{23}$
10. Mass of liquid mercury = 13.6 gm  
 $\Rightarrow$  Moles of liquid mercury =  $\frac{13.6}{200}$  i.e. 0.068  
 $\Rightarrow$  Moles of liquid mercury in 1 lit of the metal =  $0.068 \times 1000 = 68$  mole
11. Mass of  $\text{C}_2\text{H}_6$  sample =  $\left(\frac{10^7}{N_A}\right)$  moles of  $\text{CH}_4$  i.e.  $\left(\frac{16 \times 10^7}{N_A}\right)$  g  
 $\Rightarrow$  Mole of  $\text{C}_2\text{H}_6$  sample =  $\left(\frac{16 \times 10^7}{N_A \times 30}\right)$   
 $\Rightarrow$  Number of  $\text{C}_2\text{H}_6$  molecules in sample =  $\left(\frac{16 \times 10^7}{N_A \times 30}\right) \times N_A$  i.e.  $5.34 \times 10^6$
12. Number of H-atom removed =  $(30N_A + 10N_A) = 40 N_A$   
 $\Rightarrow$  Number of  $\text{H}_2$  molecules formed =  $(20 N_A)$
13.  $\text{MnO}_{2(s)} + 4\text{HCl} \longrightarrow \text{Cl}_{2(g)} + \text{MnCl}_{2(aq)} + 2\text{H}_2\text{O}(l)$   
 1 mole  $\text{Cl}_2$  is produced from 4 mole HCl  
 $\Rightarrow$  142 gm  $\text{Cl}_2$  or 2 mole  $\text{Cl}_2$  is produced from 8 mole HCl i.e.  $(8 \times 36.5) = 292$  gm HCl
14.  $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$   
 $n_C \rightarrow \frac{1.2 \times 10^3}{12}$  i.e. 100 mole.  
 Mole of  $\text{O}_2$  needed for 1 mole C = 1 mole  
 $\Rightarrow$  Mole of  $\text{O}_2$  needed for 100 mole C = 100 mole  
 $\Rightarrow$  Volume of  $\text{O}_2$  needed =  $100 \times 22.7 = 2270$  lits.
15.  $\text{C}_5\text{H}_{12}\text{O} + \frac{15}{2} \text{O}_2 \longrightarrow 5\text{CO}_2 + 6\text{H}_2\text{O}$   
 $\Rightarrow$  Moles of  $\text{O}_2$  required to burn 1 mole of this compound completely is 7.5 moles.



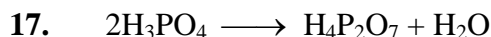
$$n_{\text{CH}_4} = \frac{11.35}{22.70} = \frac{1}{2} \text{ mole}$$

3 mole  $\text{CH}_4$  is produced from 1 mole  $\text{Al}_4\text{C}_3$ .

$$\Rightarrow \frac{1}{2} \text{ mole } \text{CH}_4 \text{ is produced from } 1 \text{ mole } \left( \frac{1}{3} \times \frac{1}{2} \right) \text{ mole } \text{Al}_4\text{C}_3$$

$$\text{i.e. } \frac{1}{6} \text{ mole } \text{Al}_4\text{C}_3 \quad \text{or} \quad \frac{1}{6} \times 144$$

$$\text{i.e. } 24 \text{ gm } \text{Al}_4\text{C}_3$$



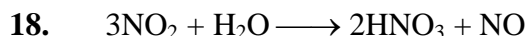
$$n_{\text{H}_4\text{P}_2\text{O}_7} \longrightarrow \frac{53.4}{178} = 0.3 \text{ mole}$$

1 mole  $\text{H}_4\text{P}_2\text{O}_7$  is obtained from 2 mole  $\text{H}_3\text{PO}_4$

$$\Rightarrow 0.3 \text{ mole } \text{H}_4\text{P}_2\text{O}_7 \text{ is obtained from } (2 \times 0.3) \text{ mole } \text{H}_3\text{PO}_4$$

$$= 0.6 \text{ mole } \text{H}_3\text{PO}_4$$

$$\text{i.e. } (0.6 \times 98) = 58.5 \text{ g } \text{H}_3\text{PO}_4$$



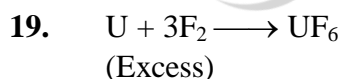
$$n_{\text{HNO}_3} = \frac{25.2}{63} = 0.4$$

2 mole  $\text{HNO}_3$  is produced from 3 mole  $\text{NO}_2$

$$\Rightarrow 0.4 \text{ mole } \text{HNO}_3 \text{ is produced from } \left( \frac{3}{2} \times 0.4 \right) = 0.6 \text{ mole } \text{NO}_2$$

$$\text{or } (0.6 \times 46) \text{ g } \text{NO}_2$$

$$\text{i.e. } 27.6 \text{ g } \text{NO}_2$$



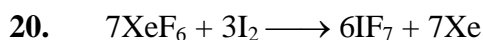
$$n_{\text{UF}_6} = \frac{2 \times 10^{-3}}{352} \Rightarrow n_{\text{UF}_6} = 5.6 \times 10^{-6}$$

1 mole  $\text{UF}_6$  is obtained from 3 mole  $\text{F}_2$

$$\Rightarrow 5.6 \times 10^{-6} \text{ mole } \text{UF}_6 \text{ is obtained from } \longrightarrow 5.6 \times 10^{-6} \times 3 \times 6.023 \times 10^{23}$$

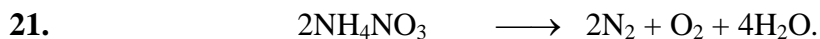
$$= 101.1 \times 10^{17}$$

$$= 1 \times 10^{19}$$



7 mole  $\text{XeF}_6$  produces 6 mole  $\text{IF}_7$

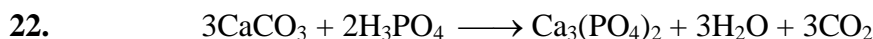
$$\Rightarrow 3.5 \times 10^{-3} \text{ mole } \text{XeF}_6 \text{ produces } \left( \frac{6}{7} \times 3.5 \times 10^{-3} \right) \quad \text{i.e. } 3 \text{ m mol } \text{IF}_7$$



mole initial	$\frac{1}{5}$	0	0	0
moles final	0	$\frac{1}{5}$	$\frac{1}{10}$	$\frac{2}{5}$

$$\Rightarrow n_T = \left( \frac{1}{5} + \frac{1}{10} + \frac{2}{5} \right) = \left( \frac{7}{10} \right)$$

$$\text{Apply } Pv = nRT \Rightarrow v = \frac{nRT}{P} = \left( \frac{7}{10} \times 0.0821 \times 873 \right) = 50.14 \text{ litre}$$



$$\text{Moles} \rightarrow \frac{50}{100} \quad \frac{73.5}{98}$$

$$= \frac{1}{2} \quad \frac{3}{4}$$

$$\frac{\text{moles}}{\text{S.C}} \rightarrow \frac{1}{6} \quad \frac{3}{8}$$

$\Rightarrow \text{CaCO}_3$  is L. R

(i) Amount of  $\text{Ca}_3(\text{PO}_4)_2$  formed =  $\frac{1}{6}$  mole

(ii) Amount of unreacted reagent =  $\left( \frac{3}{4} - \frac{1}{3} \right) = \frac{9-4}{12} = \left( \frac{5}{12} \right)$  moles.

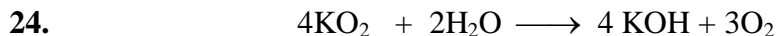


$$\text{Moles} \quad 2 \quad 1.2 \quad 1.44$$

$$\frac{\text{moles}}{\text{S.C}} \rightarrow \frac{2}{4} \quad \frac{1.2}{1} \quad \frac{1.44}{3}$$

$\Rightarrow \text{C}$  is L.R

$$\Rightarrow \text{moles of product formed} = \frac{1.44}{3} = 0.48 \text{ moles.}$$

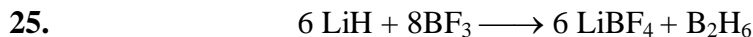


$$\text{Moles} \rightarrow 0.158 \quad .10$$

$$\frac{\text{moles}}{\text{S.C}} \rightarrow \frac{0.158}{4} \quad \frac{.10}{2}$$

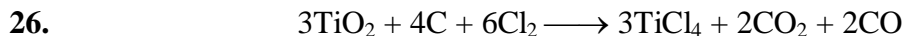
$\Rightarrow \text{KO}_2$  is L.R.

$$\Rightarrow \text{Moles of } \text{O}_2 \text{ produced is } \frac{3 \times 0.158}{4} \text{ i.e. } 0.1185 \text{ mole}$$



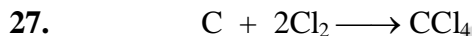
$$\begin{array}{l} \text{Moles :} \quad 2 \quad 2 \\ \frac{\text{moles}}{\text{S.C}} \rightarrow \quad \frac{2}{6} \quad \frac{2}{8} \\ \Rightarrow \quad \text{BF}_3 \text{ is L.R.} \end{array}$$

$$\Rightarrow \text{Moles of B}_2\text{H}_6 \text{ prepared} = \frac{1}{8} \times 2 = \frac{1}{4} \text{ moles} \quad \text{i.e. 0.25 mol}$$



$$\begin{array}{l} \text{moles} \quad \frac{4.32}{80} \quad \frac{5.76}{12} \quad \frac{7.1}{71} \\ \text{i.e.} \quad 0.054 \quad 0.48 \quad 0.1 \\ \frac{\text{moles}}{\text{S.C}} \rightarrow \quad \frac{0.054}{3} \quad \frac{0.48}{4} \quad \frac{0.1}{6} \\ \Rightarrow \quad \text{Cl}_2 \text{ is L.R.} \end{array}$$

$$\Rightarrow \text{Amount of TiCl}_4 \text{ obtained} = \left( \frac{3}{6} \times 0.1 \right) \times 190 = 9.5 \text{ g}$$

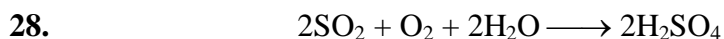


$$\begin{array}{l} \text{moles} \rightarrow \frac{36}{12} \quad \frac{142}{71} \\ \text{i.e.} \quad 3 \quad 2 \\ \frac{\text{moles}}{\text{S.C}} \rightarrow 3 \quad 1 \end{array}$$

$\Rightarrow \text{Cl}_2$  is L.R.

(i) Mass of  $\text{CCl}_4$  produced =  $1 \times 154$  i.e. 154 gm

(ii) Remaining mass of reactants =  $(3 - 1) \times 12 = 24$  gm



$$\begin{array}{l} \text{moles} \rightarrow \quad 5.6 \quad 4.8 \text{ (excess)} \\ \frac{\text{moles}}{\text{S.C}} \rightarrow \quad \frac{5.6}{2} \quad \frac{4.8}{1} \end{array}$$

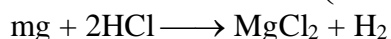
$\Rightarrow \text{SO}_2$  is L.R.

$\Rightarrow$  maximum number of moles of  $\text{H}_2\text{SO}_4$  that can be obtained = 5.6 mole.



$$\text{Moles} \quad \frac{x}{27} \text{ (excess)}$$

$$\Rightarrow \text{moles of H}_2 \text{ obtained} = \left( \frac{3}{2} \times \frac{x}{27} \right) \quad \dots\dots(1)$$



$$\text{Moles} \rightarrow \frac{(1-x)}{24} \text{ (excess)}$$

$$\Rightarrow \text{moles of H}_2 \text{ obtained} = \left( \frac{1-x}{24} \right) \dots\dots(2)$$

$$\Rightarrow \text{Total moles of H}_2 \text{ obtained} = \left( \frac{3x}{54} + \frac{1-x}{24} \right) \dots\dots(3)$$

Now,

$$\Rightarrow n_{\text{H}_2} = \frac{1.12}{22.4} \text{ i.e. } 0.05 \dots\dots(4)$$

Now, equation (3) & (4)

$$\frac{3x}{54} + \frac{1-x}{24} = 0.05$$

$$\Rightarrow \frac{12x + 9 - 9x}{216} = 0.05$$

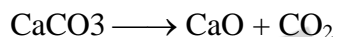
$$m = 10.8 - 9 = \frac{1.8}{3} = 60\%$$

$$3x + 9 = 10.8$$

$$\Rightarrow 3x = 1.8 \Rightarrow x = 0.6$$

$$\Rightarrow \% \text{ by mass Al} \rightarrow 60\% \quad \& \quad \% \text{ by mass mg} \rightarrow 40\%$$

30.



$$\begin{array}{ccc} \text{moles} \rightarrow a & 0 & 0 \\ - & a & a \end{array}$$



$$\begin{array}{ccc} \text{moles} \rightarrow b & 0 & 0 \\ - & b & b \end{array}$$

Now, According to question,

Mass of oxide produced is exactly half as much as the original sample.

$$\Rightarrow a \times 56 + b \times 80 = \frac{1}{2} (100a + 84b)$$

$$\Rightarrow b = 3a$$

$$\Rightarrow \% \text{ weight of CaCO}_3 = \left( \frac{100a}{100a + 84b} \right) \times 100$$

$$= \left( \frac{100a}{352a} \times 100 \right) = 28.4 \%$$

$$\% \text{ weight of MgCO}_3 = (100 - 28.4) \text{ i.e. } 71.6 \%$$

31.  $\text{Na}_2\text{CO}_3 \xrightarrow{\Delta} \text{x}$  Let mass of  $\text{Na}_2\text{CO}_3$  be x gm 2 mass of  $\text{NaHCO}_3$  be (2-x) gm



$$\text{mole} \rightarrow \frac{2-x}{84} \quad \frac{1.89-x}{406}$$

$$\text{Now, } \frac{\text{moles of NaHCO}_3}{2} = \frac{\text{moles of Na}_2\text{CO}_3}{1}$$

$$\frac{(2-x)}{84 \times 2} = \frac{1.89-x}{106}$$

$$\Rightarrow 212 - 106x = 84 \times 2 (1.89 - x)$$

$$\Rightarrow 212 - 106x = 317.52 - 168x$$

$$\Rightarrow 168x - 106x = 317.52 - 212$$

$$\Rightarrow 62x = 105.52$$

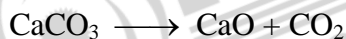
$$\Rightarrow x = \frac{105.52}{62} = 1.70 \text{ g}$$

$$\% \text{ by mass of Na}_2\text{CO}_3 = \frac{1.70}{2} \times 100 = 85.1 \%$$

$$\% \text{ by mass of NaHCO}_3 = 14.9\%$$

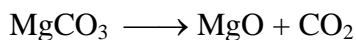
32. let  $\text{CaCO}_3$  be x gm

2  $\text{MgCO}_3$  be (92 - x) gm



$$\text{Mole: } \frac{x}{100} \quad 0 \quad 0$$

$$- \quad \frac{x}{100} \quad \frac{x}{100}$$



$$\text{Mole} \rightarrow \left( \frac{92-x}{84} \right) \quad - \quad -$$

$$- \quad \left( \frac{92-x}{84} \right) \quad \left( \frac{92-x}{84} \right)$$

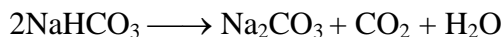
Now, weight of residue = 48

$$\Rightarrow \frac{x}{100} \times 56 + \left( \frac{92-x}{84} \right) \times 40 = 48$$

$$\Rightarrow \text{on solving we get } x = 50$$

$$\Rightarrow \text{weight of MgCO}_3 = 42 \text{ gm.}$$

33.  $\text{NaCl} \longrightarrow x$  Let NaCl be x gm &  $\text{NaHCO}_3$  be (4 - x) gm



$$\text{Mole} \rightarrow \frac{4-x}{84} \quad 0 \quad 0 \quad 0$$

$$- \quad \frac{(4-x)}{84 \times 2}$$

Now, According to question

$$44 \times \frac{(4-x)}{84 \times 2} = 0.66$$

$$\Rightarrow (4-x) = \frac{0.66 \times 84}{22 \times 100}$$

$$\Rightarrow x = 1.48 \text{ gm} \quad \& \quad \text{Weight of NaHCO}_3 = 2.52 \text{ gm}$$

$$\Rightarrow \% \text{ by mass of NaCl} \rightarrow \frac{1.48}{4} \times 100 = 37 \%$$

$$\& \quad \% \text{ by mass of NaHCO}_3 \text{ is } 63\%$$

34.  $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$

$$n_{\text{CO}_2} = \frac{11.35}{22.70} \rightarrow \frac{1}{2} \text{ mole}$$

$$n_{\text{CaCO}_3} \longrightarrow 2 \text{ mole}$$

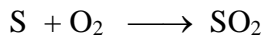
$$\Rightarrow 1 \text{ mole CaCO}_3 \text{ produces } 1 \text{ mole CO}_2$$

$$\Rightarrow 2 \text{ mole CaCO}_3 \text{ produces } 2 \text{ mole CO}_2$$

$$\text{But produced mole is } \frac{1}{2} \text{ mole}$$

$$\Rightarrow \% \text{ of Ca in lime stone sample} = \left( \frac{20}{200} \times 100 \right) \quad \text{i.e. } 10\%$$

35. Sulphur present in 1.30 gm per 100g of coal.



$$\text{Moles} \rightarrow \frac{1.30}{32} \text{ (excess)}$$

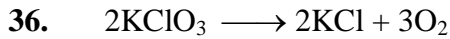
$$- \quad \left( \frac{1.30}{32} \right)$$

$$\Rightarrow \text{weight of SO}_2 \text{ produced} = \left( \frac{1.30}{32} \times 64 \right) = 2.60 \text{ gm}$$

$$100 \text{ g coal sample produced } 2.60 \text{ gm SO}_2$$

$$\Rightarrow 474 \text{ tons will produced } \frac{2.60}{100} \times 474 \quad \text{i.e. } (12.3 \text{ tons})$$



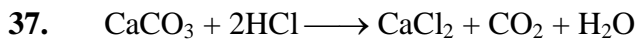


The loss in weight of sample is because of  $O_2$  gas produced.

$$\therefore \quad 2 \text{ mole KClO}_3 \text{ is producing } 3 \text{ mole O}_2$$

i.e. for 1 mole loss is  $\left(\frac{3}{2} \times 32\right)$  i.e 48g O<sub>2</sub>.

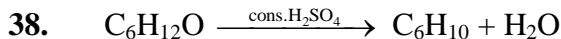
$$\Rightarrow \% \text{ loss in weight} = \left( \frac{48}{122.5} \right) \times 100 = 39.18 \%$$



1 mole  $\text{CaCO}_3$  will produce 1 mole  $\text{CO}_2$

i.e.  $\left(.8 \times \frac{1}{4}\right)$  mole will produce  $\left(.8 \times \frac{1}{4}\right)$  mole  $\text{CO}_2$

$$\Rightarrow \text{Volume of CO}_2 \text{ produced} = .2 \times 22.4 \text{ litres} = 4.48 \text{ litres.}$$



1	-	-
.25	.75	.75

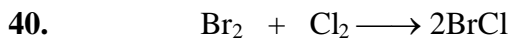
$$\Rightarrow 1 \text{ mole C}_6\text{H}_{12}\text{O produces } 0.75 \text{ mole C}_6\text{H}_{10}.$$
$$\Rightarrow 100 \text{ gm C}_6\text{H}_{12}\text{O produces } (.75 \times 82)\text{g C}_6\text{H}_{10}$$

$\Rightarrow$  61.5 g  $\text{C}_6\text{H}_{10}$  is produced.



$$\Rightarrow x \times .75 = \frac{30}{119.5} \quad x(0.75)$$

$$\Rightarrow x = \frac{30}{119.5 \times 0.75} \Rightarrow x = 0.334 \text{ mole}$$

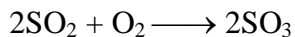
$$\Rightarrow \text{Mass of CH}_3\text{COCH}_3 = 0.334 \times 58 \quad \text{i.e. } 19.4 \text{ gm}$$


mole.	0.025	0.025
-------	-------	-------

$$(0.025 \times 2) \times .8 = 0.04$$

(i) amount of BrCl formed = 0.04

(ii)  $\text{Br}_2$  left unchanged =  $0.025 - 0.02 = 0.005$



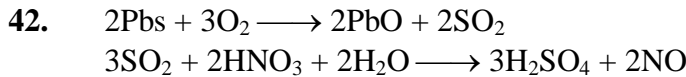
$$1 \text{ mole S}_8 = 8 \text{ mole SO}_2 \quad \dots\dots(1)$$

$$\Rightarrow 2 \text{ mole SO}_2 = 2 \text{ mole SO}_3$$

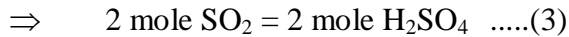
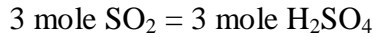
i.e.  $8 \text{ mole SO}_2 = 8 \text{ mole SO}_3$  .....(2)

From (1) & (2)

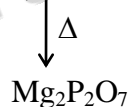
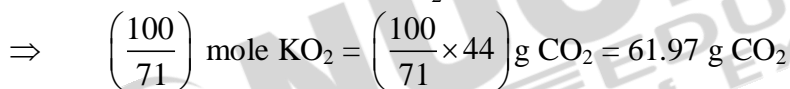
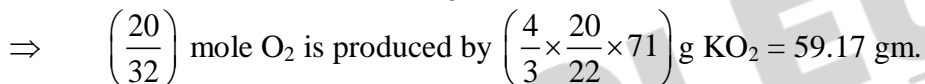
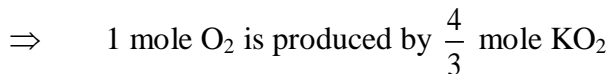
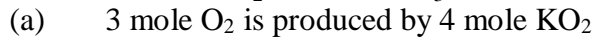
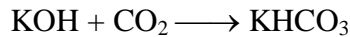
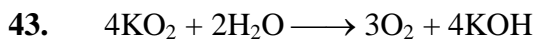
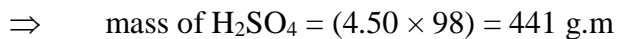
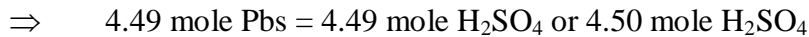
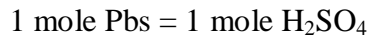
$$\text{SO}_3 \text{ obtained from 1 mol of S}_8 = (8 \times 80)\text{g SO}_3 \quad \text{i.e. } 640\text{g SO}_3$$



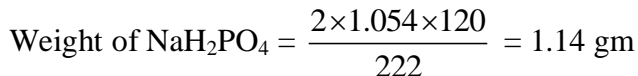
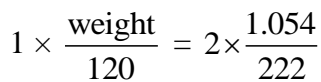
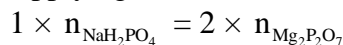
$$n_{\text{Pbs}} = \frac{1075.5}{239.2} = 4.49$$



From (1) & (3)



### Applying P.O.A.C on 'P' atom



$$n_{\text{H}_2\text{O}} = \left( \frac{40 \times .9}{18} \right) = 2$$

$$n_{\text{SO}_3} = \left( \frac{1 \times 50}{0.0821 \times 300} \right) = 2.03 = 2$$





$$n_{Pt} = \frac{0.262}{195}$$

$$\Rightarrow \text{moles of salt} = \frac{0.80}{2A + 410}$$

$$\Rightarrow \frac{0.80}{2A + 410} = \frac{0.262}{195}$$

$$\Rightarrow A = \left( \frac{.80 \times 195}{0.262} - 410 \right) \times \frac{1}{2}$$

$$\Rightarrow A = 92.70 \text{ gm/mole.}$$

47. Atomic mass of chlorine =  $\frac{75.77 \times 34.9689 + 24.23 \times 36.9659}{100}$   
 $= \frac{2649.59355 + 895.683757}{100} = 35.4527$

48.  $24.31 = \frac{79 \times 24 + (21 - x) \times 25 + x \times 26}{100}$

$$\Rightarrow 2431 = 1896 + 525 - 25x + 26x$$

$$\Rightarrow x = 10$$

49.

%	Atomic mass	Relative number of atom = $\frac{\%}{\text{At mass}}$	Simplest atomic ratio	Simplest whole number ratio
C → 49%	12	$\frac{49}{12} = 4.08$	3	3
H → 2.7%	1	$\frac{2.7}{1} = 2.70$	1.98 = 2	2
Cl → 48.3%	35.5	$\frac{48.3}{35.5} = 1.36$	1	1

$$\Rightarrow \text{Empirical formula} = C_3H_2Cl$$

$$\Rightarrow n = \frac{147}{73.5} = 2$$

$$\Rightarrow \text{molecular formula} = (C_6H_4Cl_2)$$

50.  $.25 = \frac{x \times 56}{89600} \times 100$

$$\Rightarrow x = \frac{.25 \times 89600}{56 \times 100} \Rightarrow x = 4$$

EXERCISE # S-II

$$1. \quad \frac{\text{mole of HCl}}{16} = \frac{\text{mole of Cl}_2}{5}$$

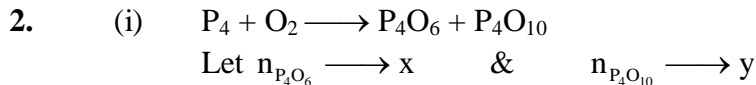
$$\frac{\text{mole of Cl}_2}{6} = \frac{\text{mole of Ca(ClO}_3)_2}{1}$$

$$\frac{\text{mole of Ca(ClO}_3)_2}{1} = \frac{\text{mole of NaClO}_3}{2}$$

Also, moles of HCl in 100 ml = 1.164

$$\Rightarrow \text{moles of NaClO}_3 = \left( \frac{5 \times 1.164 \times 2}{16 \times 6} \right)$$

$$\Rightarrow \text{mass of NaClO}_3 \text{ produced} = \left( \frac{5 \times 1.164 \times 2}{16 \times 6} \right) \times 106.5 = 12.9 \text{ g}$$



P.O.A.C on P:

$$4 \times n_{\text{P}_4} = 4 \times n_{\text{P}_4\text{O}_6} + 4 \times n_{\text{P}_4\text{O}_{10}}$$

$$\Rightarrow 4 \times 1 = 4x + 4y$$

$$\Rightarrow 4 = 4x + 4y \quad \text{i.e. } x + y = 1 \quad \dots(1)$$

P.O.A.C on O:

$$2 \times n_{\text{O}_2} = 6x + 10y$$

$$2 \times 4 = 6x + 10y$$

$$\Rightarrow 3x + 5y = 4 \quad \dots(2)$$

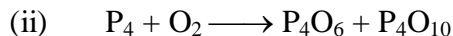
Solving equation (1) & (2)

$$3x + 3y = 3$$

$$3x + 5y = 4$$

$$\frac{-}{y = \frac{1}{2}} \quad \& \quad x = \frac{1}{2}$$

$$\Rightarrow \text{moles of P}_4\text{O}_6 \text{ obtained} = 0.5 \quad \& \quad \text{moles of P}_4\text{O}_{10} \text{ obtained} = 0.5$$



P.O.A.C on P:

$$3 \times 4 = 4x + 4y$$

$$\Rightarrow x + y = 3 \quad \dots(1)$$

P.O.A.C on O:

$$2 \times 11 = 6x + 10y$$

$$\Rightarrow 3x + 5y = 11 \quad \dots(2)$$

Solving equation (1) & (2)

$$3x + 3y = 9$$

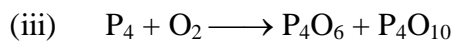
$$3x + 5y = 11$$

—

$$-2y = -2$$

$$\Rightarrow y = 1 \quad \& \quad x = 2$$

$$\Rightarrow \text{moles of } P_4O_6 = 2 \quad \& \quad \text{moles of } P_4O_{10} = 1$$



P.O.A.C on P:

$$4 \times 3 = 4x + 4y$$

$$\Rightarrow x + y = 3 \quad \text{.....(1)}$$

P.O.A.C on O:

$$2 \times 13 = 6x + 10y$$

$$\Rightarrow 3x + 5y = 13 \quad \text{.....(2)}$$

Solving equation (1) & (2)

$$3x + 3y = 9$$

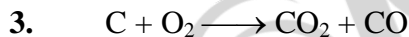
$$3x + 5y = 13$$

—

$$-2y = -4$$

$$\Rightarrow y = 2$$

$$\Rightarrow \text{moles of } P_4O_6 = 1 \quad \& \quad \text{moles of } P_4O_{10} = 1$$



Let moles of CO be x

& moles of  $CO_2$  be y.

P.O.A.C on C:

$$1 = x + y \quad \text{.....(1)}$$

P.O.A.C on O:

$$2 \times \frac{20}{22} = x + 2y \quad \text{.....(2)}$$

Solving equation (1) & (2), we get

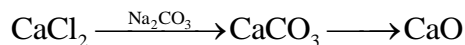
$$x \rightarrow 0.75 \quad \& \quad y = 0.25$$

$$\text{mass \% of CO} \rightarrow \frac{.75 \times 28}{0.75 \times 28 + 0.25 \times 44} \times 100 = \frac{21}{32} \times 100 = 65.625\%$$

$$\text{mass \% of } CO_2 = 34.375\%$$

4.	N	:	$P_2O_5$	:	$K_2O$
mole:	$\frac{30}{14}$	:	$\frac{10}{142}$	:	$\frac{10}{94}$
For	N	:	P	:	K
mole:	$\frac{30}{14}$	:	$\frac{10}{71}$	:	$\frac{10}{47}$
Simplest:	10	:	0.66	:	1
ratio					

5. Let  $\text{CaCl}_2$  be  $x$  gm &  $\text{NaCl}$  be  $(10 - x)$  gm



$$\text{moles: } \frac{x}{111} \qquad \frac{x}{111} \qquad \frac{x}{111}$$

$$\text{As, } \frac{x}{111} = \frac{1.12}{56}$$

$$\Rightarrow x = 2.22 \text{ gm}$$

$$\% \text{ NaCl} = \frac{7.78}{10} \times 100 = 77.8 \%$$

6. (a)  $\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$   
(b)  $\text{Fe}_2\text{O}_3$  &  $\text{Al}$  reacts in mole ratio 1 : 2

$$\Rightarrow \text{ratio of mass} = \frac{100}{54} \text{ or } 80 : 27$$

- (c)  $n\text{Fe}_2\text{O}_3 \longrightarrow 100$

$$\text{moles of } \text{Fe}_2\text{O}_3 \text{ reacted} = 50 \text{ moles}$$

$$\Rightarrow \text{energy released} = 50 \times 200 = 10,000 \text{ units}$$

7.  $2\text{KClO}_3 \longrightarrow 2\text{KCl} + 3\text{O}_2$

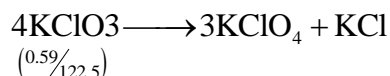
$$\text{mole: } \left( \frac{x}{122.5} \right) \qquad \frac{x}{122.5} \qquad \left( \frac{3x}{2 \times 122.5} \right)$$

$$n_{\text{O}_2} = \frac{112}{22400} = \frac{3x}{2 \times 122.5}$$

$$\Rightarrow x = 0.41 \text{ gm}$$

$$\Rightarrow \text{mass of KCl obtained from 0.41 gm KClO}_3$$

$$= \left( \frac{2 \times 74.5}{2 \times 122.5} \times 0.41 \right) = 0.25 \text{ gm KCl}$$



$$\& \text{ mass of KCl obtained from 0.59g KClO}_3$$

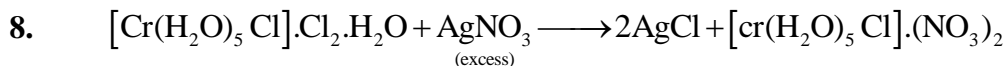
$$= \frac{74.5 \times 0.59}{4 \times 122.5} = 0.089 \text{g KCl}$$

$$\& \text{ mass of KClO}_4 \text{ obtained from 0.59g KClO}_3$$

$$= \frac{3 \times 138.5}{4 \times 122.5} \times 0.59 = 0.500 \text{ gm}$$

$$\Rightarrow \% \text{ by weight of KClO}_4 \text{ in residue}$$

$$= \left( \frac{0.500}{.84} \right) \times 100 = 59.72 \%$$



moles of  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\cdot\text{Cl}_2\cdot\text{H}_2\text{O}$  is  $\frac{5.33}{266.5}$  i.e. 0.02 moles

$\Rightarrow$  moles of AgCl obtained =  $2 \times 0.02 = 0.04$  mole  
mass of AgCl obtained =  $0.04 \times 143.5 = 5.74$  gm

9. Let the metal carbonate be  $\text{M}_2\text{CO}_3$

As, mass % of O =  $48 = \frac{48}{2x + 60} \times 100$

$\Rightarrow x = 20$   
i.e. molar mass of metal = 20gm/mole

$\Rightarrow$  moles of  $\text{M}_2\text{CO}_3 = \frac{5 \times 10^{-3}}{(20 \times 2 + 60)} = 5 \times 10^{-5}$  mole.

$\Rightarrow$  moles of metal is  $10^{-4}$  mole

$\Rightarrow$  Number of atoms of metal present =  $10^{-4} \times 6 \times 10^{23}$   
i.e.  $6 \times 10^{19}$  atoms

10.  $\text{A}_x\text{B}_y + \text{O}_2 \longrightarrow \text{AO} + \text{oxide of B.}$

Apply P. O. A. C on A,

$x \times \frac{2.5}{24x + 14y} = 1 \times \frac{3}{40}$

$\Rightarrow x : y = 3 : 2$

$\Rightarrow$  Empirical formula of compound is 3 : 2

11.  $\text{Ca} + \text{Cl}_2 \longrightarrow \text{CaCl}_2$

moles  $\rightarrow \left( \frac{2.4 \times 10^{24}}{6 \times 10^{23}} \right) \left( \frac{380 \times 96}{760 \times 0.08 \times 300} \right)$   
 $\approx 4 \quad \approx 2$

$\Rightarrow \text{Cl}_2$  is L.R.

$\Rightarrow$  mass of  $\text{CaCl}_2 = 2 \times 111 = 222$  gm

12.  $\text{P}_4\text{S}_3 + 8\text{O}_2 \longrightarrow \text{P}_2\text{O}_{10} + 3\text{SO}_2$

mole:  $\left( \frac{1}{64} \times \frac{1}{3} \right) \quad \frac{1}{284} \quad \frac{1}{64}$

$\Rightarrow$  mass of  $\text{P}_4\text{S}_3$  required =  $\frac{1}{64 \times 3} \times 220 = 1.1458$  gm

13.  $\text{H}_4\text{P}_2\text{O}_7 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{H}_2\text{P}_2\text{O}_7 + 2\text{H}_2\text{O}$

moles: 3 5

$\Rightarrow$  NaOH is L.R.

$\Rightarrow$  number of molecules  $\text{Na}_2\text{H}_2\text{P}_2\text{O}_7$  formed =  $(2.5) N_A$   
& number of molecules  $\text{H}_2\text{O}$  formed =  $(5) N_A$

$\Rightarrow$  Total number of molecules formed in product is  $(7.5)N_A$ .

EXERCISE # O-I

- (A) 1 of - atom of c = 12 g  
 (B)  $\frac{1}{2}$  mole  $\text{CH}_4 = 8$  g  
 (C) 10 ml of  $\text{H}_2\text{O} = 10$  g  
 (D)  $3.011 \times 10^{23}$  atoms of oxygen = 8g  
 $\Rightarrow$  option (A) is
- $n_{\text{CO}_2} = \frac{44}{44} = 1$  mole  
 $\Rightarrow$  the molecules of  $\text{CO}_2 = N_A$  i.e.  $6 \times 10^{23}$ .  
 $\Rightarrow$  correct option is (A)
- $n_{\text{NH}_3} = \frac{4.25}{17}$  i.e. mole  
 $\Rightarrow$  option (B) is correct.
- Charge on 1 gram ions of  $\text{Al}^{+3}$  is  $3N_A e$  Coulomb  
 $\Rightarrow$  option (D) is correct.
- Atomic weight of A = 40 u  
 & Atomic weight of B = 80 u  
 $\frac{x}{40} \times N_A = y$  .....(1)  
 $\frac{2x}{80} N_A \rightarrow ?$  .....(2)  
 Comparing (1) and (2), we get  $2x$  of B = y  
 $\Rightarrow$  option (C) is correct
- $n_{\text{Al}} \longrightarrow \frac{54}{27} = 2$  mole.  
 $\Rightarrow$  mass of same number of magnesium atoms = 48 gm  
 $\Rightarrow$  Correct option is (C).
- Weight of molecule of compounds  $\text{C}_{60}\text{H}_{22}$   
 $= (60 \times 12 + 22 \times 1) \text{ amu} = (720 + 22) \text{ amu}$   
 $= 742 \times 1.66 \times 10^{-24} \text{ g} = 1.24 \times 10^{-21} \text{ gm}$   
 $\Rightarrow$  Option (B) is correct.
- $n_{\text{NO}_3^-} = \frac{3.1 \times 10^{-3}}{62 \times 10}$   
 $= 0.5 \times 10^{-4}$   
 $= 5 \times 10^{-5}$   
 Number of electron in 3.1 mg  $\text{NO}_3^- = 5 \times 10^{-5} \times 32 \times 6.022 \times 10^{23} = 9.6 \times 10^{20}$ .  
 $\Rightarrow$  Correct option is (C)



9. Ratio of number of molecules of  $\text{CO}_2$  &  $\text{N}_2\text{O}$

$$= \frac{2x}{44} \times N_A \times \frac{44}{5x \times N_A} = 2 : 5$$

$\Rightarrow$  correct option is (B)

10. (A)  $n_{\text{C}_2\text{H}_6} = \frac{15}{30} = \frac{1}{2}$  mole

$$\Rightarrow \text{number of carbon atoms} = \frac{N_A}{2} \times 2 \quad \text{i.e. } N_A$$

(B)  $n_{\text{Na}_2\text{C}_2\text{O}_4} = \frac{40.2}{134} = 0.3$  mole

$$\Rightarrow \text{number of carbon atoms} = 0.3 \times 2N_A = 0.6 N_A$$

(C)  $n_{\text{glucose}} = \frac{72}{180} = 0.4$

$$\Rightarrow \text{number of carbon atoms} = 0.4 \times 6N_A = 2.4 N_A$$

(D)  $n_{\text{C}_5\text{H}_{10}} = \frac{35}{70} = 0.5$

$$\Rightarrow \text{number of carbon atoms} = 0.5 \times 5N_A = 2.5 N_A$$

$\Rightarrow$  Correct option is (D)

11. number of H-atom in 0.9 gm glucose =  $\frac{0.9}{180} \times 12N_A = 0.06 N_A$

(A)  $n_{\text{N}_2\text{H}_4} = \frac{0.048}{32}$

$$\Rightarrow \text{number of H-atoms} = \frac{0.048}{32} \times 4 N_A = 0.006 N_A$$

(B)  $n_{\text{NH}_3} = \frac{0.17}{17}$

$$\Rightarrow \text{number of H-atom} = 0.01 \times 3N_A = 0.03 N_A$$

(C)  $n_{\text{C}_2\text{H}_6} = \frac{0.30}{30} = 0.01$

$$\Rightarrow \text{number of H-atoms} = 0.06 N_A.$$

(D)  $n_{\text{H}_2} \longrightarrow \frac{0.03}{2} = \frac{0.03}{2}$  mole

$$\Rightarrow \text{number of H-atoms} = \frac{0.03}{2} \times 2 N_A = 0.03 N_A$$

$\Rightarrow$  Correct option is (C)

12.  $n_{\text{CuSO}_4 \cdot 5\text{H}_2\text{O}} = \left( \frac{1 \times 10^{22}}{6.022 \times 10^{23}} \right) = 1.66 \times 10^{-2}$  mole

$$\Rightarrow \text{weight} = 1.66 \times 10^{-2} \times 249.5 = 4.159 \text{ gm}$$

$\Rightarrow$  Correct option is (C)

13.  $n_C \longrightarrow \frac{1.2 \times 10^{-3}}{12} \text{ mole}$

$\Rightarrow$  number of carbon atoms =  $\frac{1.2 \times 10^{-3}}{12} \times N_A$

=  $6.02 \times 10^{19}$  atoms

$\Rightarrow$  Correct option is (B).

14. mass of 1.2 mole ethanol =  $(1.2 \times 46) \text{ g}$

$\Rightarrow$  Volume =  $\frac{\text{mass}}{\text{density}} = \frac{1.2 \times 46}{0.8} = 69 \text{ ml}$

$\Rightarrow$  Correct option is (C).

15.  $n_{\text{NO}_2} = \frac{112}{22.4 \times 10^3}$

$\Rightarrow$  number of molecules =  $\frac{112}{22.4 \times 10^3} \times 6.02 \times 10^{23} = 3.1 \times 10^{21}$

Now, volume =  $\frac{\text{mass}}{\text{density}} = \frac{5 \times 10^{-3} \times 46}{1.15}$

=  $200 \times 10^{-3} = 0.20 \text{ ml}$

$\Rightarrow$  Correct option is (B).

16. Let the molecule be  $A_x B_y$

Molecular weight of compounds formed =  $\left( \frac{XN_A + MY}{5} \right)$

$\Rightarrow$  Correct option is (A).

17. By Avogadro's Hypothesis,

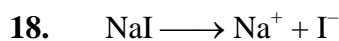
for gas A,  $P \cdot v_A = n_A \cdot RT$

for gas B,  $P \cdot v_B = n_B \cdot RT$

If  $n_A = n_B$

$\Rightarrow v_A = v_B$

$\Rightarrow$  Correction option is (B).



As, 100 g salt contains 0.5 g NaI

$\Rightarrow$  3g salt contains  $\left( \frac{.5}{100} \times 3 \right) \text{ g NaI.}$

= 0.015 g NaI.

$n_{\text{NaI}} \longrightarrow \frac{0.015}{150} \text{ mole}$

$\Rightarrow$  number of  $\text{I}^-$  ions =  $\frac{0.015}{150} \times 6.02 \times 10^{23}$

=  $6.02 \times 10^{19}$ .

$\Rightarrow$  Correct option is (C).

19. By Avogadro's hypothesis

$$n_{O_2} = n_{\text{unknown gas}}$$

$$\Rightarrow \frac{1}{32} = \frac{2.375}{M} \quad (M \rightarrow \text{molar mass of unknown gas})$$

$$\Rightarrow M = 2.375 \times 32 \quad \Rightarrow \quad M = 76$$

$\Rightarrow$  correct option is (C)

20. Ratio of number of atoms = 2 : 1 : 2 : 3

$\Rightarrow$  Correct option is (C).

21.  $2P + Q \longrightarrow R$

mole : 8 (Excess)      0

0      4

$\Rightarrow$  Correct option is (C).

22.  $4 \text{ Al} + 3 \text{ O}_2 \longrightarrow 2 \text{ Al}_2\text{O}_3$

(Excess) 1.5      0

0      1

$\Rightarrow$  weight of Al = 54 gm.

23.  $\text{C}_x\text{H}_y\text{O}_z + \left( x + \frac{y}{4} - \frac{z}{2} \right) \text{ O}_2 \longrightarrow x \text{ CO}_2 + \frac{y}{2} \text{ H}_2\text{O}$

$$n_{\text{CO}_2} = \frac{132}{44} = 3$$

$$\Rightarrow X = 3$$

$$n_{\text{H}_2\text{O}} \longrightarrow \frac{54}{18} = 3$$

$$\Rightarrow Y = 6.$$

$\Rightarrow$  Correct option is (C).

24.  $\text{C}_2\text{H}_4\text{O}_2 + 2 \text{ O}_2 \longrightarrow 2 \text{ CO}_2 + 2 \text{ H}_2\text{O}.$

1 mole  $\text{C}_2\text{H}_4\text{O}_2$  & 2 mole  $\text{O}_2$  produces 2 mole  $\text{CO}_2$

i.e. 124 g mixture produces 88 gm  $\text{CO}_2$

$$\Rightarrow 620 \text{ g mixture will produce } \frac{88}{124} \times 620 = 440 \text{ gm}$$

$\Rightarrow$  Correct option is (C)

25.  $5 \text{ A}_2 + 2 \text{ B}_4 \longrightarrow 2 \text{ AB}_2 + 4 \text{ A}_2\text{B}.$

5 mole  $\text{A}_2$  produce 2 mole  $\text{AB}_2$

$\Rightarrow (2 \times 250) \text{ g AB}_2$  is produced from 100g  $\text{A}_2$

$$\Rightarrow 1000 \text{ g AB}_2 \text{ is produced from } \left( \frac{100}{2 \times 250} \right) \times 1000 \text{ g of A}_2$$

$$= 200 \text{ g of A}_2$$

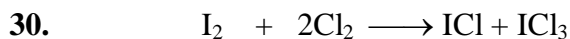
Also, 2 mole  $AB_2$  is produced from 2 mole  $B_4$   
 $\Rightarrow (2 \times 250)g$   $AB_2$  is produced from  $(2 \times 120 \times 4) g$  of  $B_4$   
 $\Rightarrow 1000 g$   $AB_2$  is produced from  $\left(\frac{2 \times 120 \times 4}{2 \times 250}\right) \times 1000 = 1920$  gm.  
 $\Rightarrow$  Minimum mass of mixture of  $A_2$  &  $B_2$  is  $(1920 + 200)$   
 i.e. 2120 gm  
 $\Rightarrow$  Correct option is (A)

26.  $3Mg + 2NH_3 \longrightarrow Mg_3N_2 + 3H_2$   
 Mole :  $\frac{48}{24} \quad \frac{34}{17}$   
 $= 2 \quad = 2$   
 $\Rightarrow$  Mg is L. R.  
 $\Rightarrow$  mass of  $Mg_3N_2$  produced is  $\frac{2}{3} \times (100)g = \frac{200}{3} g$   
 $\Rightarrow$  Correct option is (A)

27.  $P_4S_3 + 8O_2 \longrightarrow P_4O_{10} + 3SO_2$   
 Mole :  $\frac{440}{220} \quad \frac{384}{32}$   
 $= 2 \quad = 12$   
 $\Rightarrow O_2$  is L.R.  
 $\Rightarrow$  mass of  $P_4O_{10}$  produced =  $\frac{(12 \times 284)}{8} g = 426$  gm.  
 $\Rightarrow$  Correct option is (B).

28.  $12C + 11H_2 + \frac{11}{2}O_2 \longrightarrow C_{12}H_{22}O_{11}$   
 Mole :  $\frac{84}{12} \quad \frac{12}{2} \quad \frac{56}{22.4}$   
 $= 7 \quad 6 \quad 2.5$   
 $\Rightarrow O_2$  is L.R.  
 $\Rightarrow$  Mass of sucrose produced =  $\left(\frac{2}{11} \times 2.5\right) \times 342 g = 155.5 g$   
 $\Rightarrow$  Correct option is (B).

29.  $H_2SO_4 + Ca(OH)_2 \longrightarrow CaSO_4 + 2H_2O$   
 Mole .5 0.2  
 $Ca(OH)_2$  is L.R.  
 $\Rightarrow$  number of moles of  $CaSO_4$  formed = 0.2  
 $\Rightarrow$  Correct option is (A)



$$\text{Mole: } \frac{25.4}{254} \quad \frac{14.2}{71}$$

$$= \quad 0.1 \quad 0.2$$

$$\text{No.} \quad \text{L. R}$$

$$\Rightarrow \text{moles of ICl produced} = 0.1$$

$$\& \text{ moles of ICl}_3 \text{ produced} = 0.1$$

$$\Rightarrow \text{Correct option is (A)}$$



$$\text{Mole : } \frac{31}{124} \quad \frac{32}{32}$$

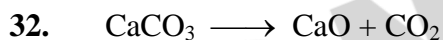
$$= \quad \frac{1}{4} \quad 1$$

$$\text{No.} \quad \text{L. R}$$

$$\Rightarrow \text{Weights of } P_4O_6 \text{ produced} = \frac{1}{2} \times \frac{1}{4} \times 220 = 27.5 \text{ g}$$

$$\& \text{ weight of } P_4O_{10} \text{ produced} = \frac{1}{8} \times 284 = 35.5 \text{ g}$$

$$\Rightarrow \text{Correct option is (B)}$$



$$n_{Na_2CO_3} = \frac{21.2 \times 10^3}{106} = 2 \times 10^2 \text{ moles.}$$

$$\text{Moles of } CaCO_3 = \text{mole of } CO_2 \quad \dots(1)$$

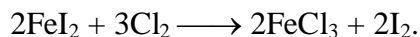
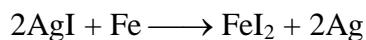
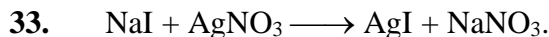
$$\text{Moles of } CO_2 = \text{mole of } Na_2CO_3 \quad \dots(2)$$

From (1) & (2)

$$\text{Mole of } CaCO_3 = 2 \times 10^2$$

$$\Rightarrow \text{Mass of } CaCO_3 = 2 \times 10^2 \times 100 = 20 \text{ kg}$$

$$\Rightarrow \text{Correct option is (B).}$$



$$n_{I_2} = (1 \times 10^3)$$

$$\frac{\text{mole of } AgNO_3}{1} = \frac{\text{mole of } AgI}{1} \quad \dots(1)$$

$$\frac{\text{mole of } AgI}{2} = \frac{\text{mole of } FeI_2}{1} \quad \dots(2)$$

$$\frac{\text{mole of } FeI_2}{2} = \frac{\text{mole of } I_2}{2} \quad \dots(3)$$

From (1), (2) & (3)

$$\therefore \text{Mole of } I_2 = \text{mole of } FeI_2 = \frac{\text{mole of AgI}}{2}$$

$$= \frac{\text{mole of AgNO}_3}{2}$$

$$\Rightarrow 10^3 = \frac{\text{wt of AgNO}_3}{170 \times 2}$$

$$\Rightarrow \text{wt. of AgNO}_3 = 340 \text{ kg}$$

$\Rightarrow$  Correct option is (A)

34. Let  $CaCl_2$  be  $x$  g &  $NaCl$  be  $(10 - x)$  g



$$\text{Moles } \frac{x}{111} \quad \frac{x}{111} \quad \frac{x}{111}$$

$$\text{moles of CaO} \longrightarrow \frac{1.62}{56}$$

$$\Rightarrow \text{moles of } CaCl_2 = \frac{1.62}{56}$$

$$\Rightarrow \frac{1.62}{56} = \frac{x}{111}$$

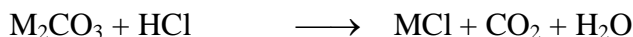
$$\Rightarrow x = \frac{111 \times 1.62}{56}$$

$$\Rightarrow x = 3.21$$

$$\Rightarrow \% \text{ by mass of } CaCl_2 = \frac{3.21}{10} \times 100 = 32.1 \%$$

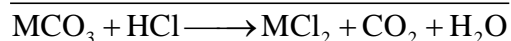
$\Rightarrow$  Correct option is (A)

35. for Alkali metal carbonate

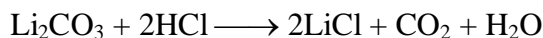


(Excess)

For Alkaline Earth metal carbonate



$$n_{CO_2} = \frac{1 \times 12.315}{0.0821 \times 300} = 0.5 \text{ mole}$$



1 mole  $CO_2$  is produced from 1 mole  $Li_2CO_3$

$$\Rightarrow 0.5 \text{ mole } CO_2 \text{ is produced from } .5 \text{ mole } Li_2CO_3 \quad \text{OR} \quad = .5 \times (74)$$

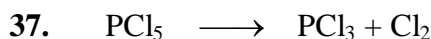
$$= 37 \text{ gm. of } Li_2CO_3 \quad \& \quad \text{mass of impurity} = 3 \text{ gm}$$

$\Rightarrow$  Correct option is (B)

36.  $M = \frac{99 \times 20 + \frac{1}{2} \times (21 + 22)}{100} = 20.002$

⇒ Correct option is (A)

20.015  
या 20.015



$$M_{\text{Avg.}} = \frac{M_{\text{Theo.}}}{1 + (n-1)\alpha} = \frac{208.5}{1 + 0.5} = 139$$

$$\Rightarrow \% \text{ change in } M_{\text{Avg.}} \text{ of the mixture} = \left( \frac{208.5 - 139}{208.5} \right) \times 100 = 33.33 \%$$

⇒ Correct option is (C)

38.  $8 = \frac{1 \times 32}{M} \times 100$

$$\Rightarrow M = 400$$

⇒ Correct option is (B).

39.  $n = \frac{\text{molecular formula mass}}{\text{Empirical formula mass}}$

$$\Rightarrow n = \frac{120}{30} = 4$$

$$\Rightarrow \text{molecular formula} = (\text{CH}_2\text{O}) \times 4 \text{ i.e. } (\text{C}_4\text{H}_8\text{O}_4)$$

⇒ Correct option is (B)

40.

Element	%	Relative number of atoms	Simplest atomic Ratio	Simplest whole Number ratio
Ca	20	$\frac{20}{40} = \frac{1}{2}$	1	1
Br	80	$\frac{80}{80} = 1$	2	2

⇒ Empirical formula is  $\text{CaBr}_2$

$$\text{As, } n = \frac{200}{200} = 1$$

⇒ Molecular formula is  $\text{CaBr}_2$

⇒ correct option is (B).

41.  $69.98 = \frac{21 \times 12}{M} \times 100$

$$\Rightarrow M = \frac{21 \times 12}{69.98} \times 100 \quad \Rightarrow M = 360.1$$

$\Rightarrow$  Correct option is (D)

42. **Method-1**

Let the compound be  $C_xH_yO_z$

Now, weight % of C =  $8 \times$  (weight % of H)

$$\Rightarrow \frac{x}{y} = \frac{2}{3}$$

Also, weight % of C =  $\frac{1}{2} \times$  (weight % of O)

$$\Rightarrow \frac{x}{z} = \frac{2}{3}$$

$\Rightarrow$  The correct option is (B)

**Method-2**

$Ag_2A \longrightarrow Ag$

P.O. A.C. on Ag

$$2 \times \frac{1}{216 + M_A} = \frac{0.5934}{108} \times 1$$

$$\Rightarrow M_A \rightarrow 148$$

$\Rightarrow$  molar mass of Acid = 150

	C	H	O
weight %	8	1	16
mole %	2	3	3

$\Rightarrow$  Empirical formula =  $C_2H_3O_3$

$\Rightarrow n = 2 \quad \Rightarrow$  molecular formula is  $C_4H_6O_6$

$\Rightarrow$  Correct option is (B)

43. Let % of  $NO_2$  be x

$NO$  % of number be  $(100 - x)$

$$\Rightarrow 34 = \frac{x \times 46 + (100 - x) \times 30}{100} \quad \Rightarrow x = 25 \%$$

$\Rightarrow$  Correct option is (A)



**EXERCISE # O-II**

1. For  $(\text{NH}_4)_3\text{PO}_4$ :

$$\text{Ratio of number of O atoms to number of H atoms} = \frac{4}{12} \quad \text{i.e. (1 : 3)}$$

$$\text{Ratio of number of cations to number of anions} = 3 : 1$$

$$\text{Number of gm-atoms of nitrogen to atoms of oxygen} = \frac{3}{4}$$

$$\text{Total number of atoms in 1 mole of } (\text{NH}_4)_3\text{PO}_4 = 20N_A$$

$\Rightarrow$  Correct options are (A), (B)

2.  $2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$

$$\text{moles: } \frac{12}{24} \quad \frac{32}{32}$$

$\Rightarrow$  Mg is L.R, So is 100% consumed

i.e. number MgO is left unburnt

$$\text{Amount of O}_2 \text{ left unreacted} = 0.75 \text{ gm molecule}$$

$$\text{Amount of MgO formed} = 0.5 \times 40 \quad \text{i.e. 20 gm}$$

The mixture at the end will weight 44 gm.  $\Rightarrow$  Correct option (A)

3.  $3\text{CaCO}_3 + 2\text{H}_3\text{PO}_4 \longrightarrow \text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{O} + 3\text{CO}_2$

$$\text{moles: } \frac{50}{100} = 0.5 \quad \frac{68.6}{98} = 0.7 \quad \Rightarrow \quad \text{CaCO}_3 \text{ is L.R.}$$

$$\text{Amount of salt formed} = \left( \frac{1}{3} \times 0.5 \times 310 \right) = 35.93 \text{ gm}$$

$$n_{\text{CO}_2} = 0.5$$

$\Rightarrow$  Correct option are (A), (B), (C)

4.  $\text{C}_7\text{H}_8 + 3\text{HNO}_3 \longrightarrow \text{C}_7\text{H}_5\text{N}_3\text{O}_6 + 3\text{H}_2\text{O}$

As,  $\text{C}_7\text{H}_8$  &  $\text{HNO}_3$  reacts in 1 : 3 ratio

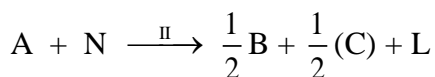
$$\Rightarrow x \times 92 + 3x \times 62 = 140.5 \quad \Rightarrow \quad x = 0.5$$

$$\Rightarrow \text{Maximum weight of } \text{C}_7\text{H}_5\text{N}_3\text{O}_6 \text{ which can be produced is } 0.5 \times 227 \quad \text{i.e 113.5 gm}$$

Correct option is (B).

5.  $\text{A} + \text{N} \xrightarrow{\text{I}} \text{B} + \text{L}$

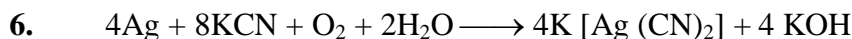
$$4 \qquad \qquad 4$$



$$4 \qquad \qquad 2 \qquad 2$$

$\Rightarrow$  B will always be greater than C & If 2 moles of C are formed the total 6 mole of B are also formed

$\Rightarrow$  Correct option are (A), (D)



$$\Rightarrow 4 \times 108\text{g of Ag reacts with } 8 \times 65\text{g of KCN } 100\text{g of Ag reacts with } \frac{8 \times 65}{4 \times 108} \times 100$$

Hence statement A is correct

$$\Rightarrow 4 \times 108\text{g of Ag require } 32\text{ gm of O}_2$$

$$\Rightarrow 100\text{g of Ag require} = \frac{32}{4 \times 108} \times 100 = 7.40\text{ gm}$$

Hence option (C) is correct.

$$\text{Volume of O}_2 \text{ required} = \frac{7.4}{32} \times 22.4 = 5.20\text{ liters}$$



(A) Find product contains 85%  $\text{CaC}_2$  & 15%  $\text{CaO}$ .

Let mass of product = 100 gm

$$\therefore \text{mass of CaC}_2 = 85\text{ gm}$$

$$\text{mass of CaO} = 15\text{ gm}$$

$$\text{used mole of CaO} = \text{mole of CaC}_2 \text{ produced} = \left( \frac{85}{64} \right)$$

$$\therefore \text{mass of CaO producing } 85\text{ gm CaC}_2 = \frac{85}{64} \times 56 = 74.375\text{ gm}$$

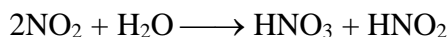
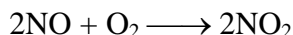
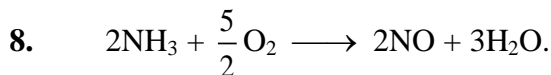
$$\therefore \text{Initial mass of CaO} = (74.375 + 15) = 89.375$$

$$85\text{ gm CaC}_2 \text{ obtained from } 89.38\text{ gm CaO}$$

$$1000\text{ kg CaC}_2 \text{ obtained from } \frac{89.38}{85} \times 10^3\text{ kg CaO} = 1051.47\text{ kg CaO}.$$

$$(B) 100\text{ gm produced requires CaO} = 89.38\text{g}$$

$$\Rightarrow 10^3\text{ kg product requires CaO} = \frac{89.38}{100} \times 10^3 = 893.8\text{ kg CaO}.$$



(A) Moles of  $\text{HNO}_3$  produced is half of moles of Ammonia used if  $\text{HNO}_2$  is not used to produce  $\text{HNO}_3$  by reaction (IV) .

(B) Incorrect

(C)  $\frac{1}{4}$  th of total  $\text{HNO}_3$  is produced by reaction (IV) if  $\text{HNO}_2$  is used to produce  $\text{HNO}_3$ .

(D) Moles of number produced in reaction (IV) is 50% of moles of total  $\text{HNO}_3$  produced.

9. mass of substance = 0.42 gm.

$$\text{Volume of N}_2 = \frac{100}{11} \text{ ml}$$

$$\text{Temperature} = 250 \text{ K}$$

$$\text{Pressure} = 860 - 24 = 836 \text{ mm Hg}$$

**Step (1)**

$$\text{Volume of N}_2 \text{ at S.T.P.} \quad \text{i.e. } V_2 = \frac{P_1 V_1}{T_1} \times \frac{T_2}{P_2}$$

$$\Rightarrow V_2 = \frac{836 \times 100 \times 273}{760 \times 11 \times 250} \quad \Rightarrow V_2 = 10.92 \text{ ml}$$

**Step (2)**

$$\% \text{ of N}_2 \text{ in organic compound} = \frac{28 \times 10.92}{22700 \times 0.42} \times 100 = \frac{10}{3} \%$$

$\Rightarrow$  Correct option is (A)

10.  $2A + 3B \longrightarrow C$   
moles: 3      4

$\Rightarrow$  B is L.R. & C formed is  $\frac{4}{3}$  moles only if the yield is 100%.

$\Rightarrow$  Correct option (C).

11.  $Y_3Al_5O_{12}$

$$\text{weight \% of Y} \longrightarrow \frac{89 \times 3}{594} \times 100 = 44.95 \%$$

$$\text{weight \% of Al} \longrightarrow \frac{27 \times 5}{594} \times 100 = 22.73 \%$$

$$\text{weight \% of O} \longrightarrow \frac{12 \times 6}{594} \times 100 = 32.32 \%$$

12.  $n_{C_6H_8O_6} = \frac{17.6 \times 10^{-3}}{176} = 10^{-4} \text{ moles}$

$$\text{O - atoms present} = 6 \times 6 \times 10^{23} \times 10^{-4} = 3.6 \times 10^{20}$$

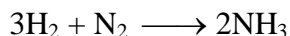
$$\text{moles of vitamin C in 1 gm of vitamin C} = 5.68 \times 10^{-3}$$

$$\text{moles of vitamin C that should be consumed daily} = 10^{-4}$$

13.  $2H_2 + O_2 \longrightarrow 2H_2O$

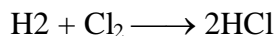
$$\text{moles: } \frac{1}{2} \quad \frac{1}{32} \quad \Rightarrow \quad O_2 \text{ is L.R.}$$

$$\Rightarrow \text{mass of H}_2\text{O produced} = \frac{1}{32} \times 2 \times 18 = 1.125 \text{ g}$$



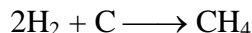
$$\text{moles: } \frac{1}{2} \quad \frac{1}{28} \Rightarrow \text{H}_2 \text{ is L.R.}$$

$$\Rightarrow \text{mass of NH}_3 \text{ produced} = \frac{1}{28} \times 2 \times 17 = 1.214 \text{ g}$$



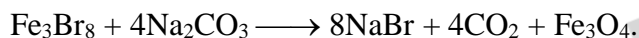
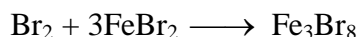
$$\text{moles: } \frac{1}{2} \quad \frac{1}{71} \Rightarrow \text{Cl}_2 \text{ is L.R.}$$

$$\Rightarrow \text{mass of HCl produced} = 2 \times 36.5 \times \frac{1}{71} = 10028 \text{ g}$$



$$\text{moles: } \frac{1}{2} \quad \frac{1}{12} \Rightarrow \text{C is L. R.}$$

$$\Rightarrow \text{Mass of CH}_4 \text{ produced} = \frac{1}{12} \times 16 = 1.333\text{g} \quad \text{Correct option is (A)}$$



$$(a) \quad n_{\text{NaBr}} = \frac{2.06 \times 10^3 \times 10^3}{103} = 2 \times 10^4$$

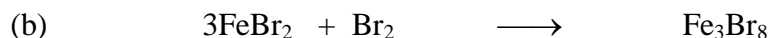
$$\frac{\text{moles of Fe}}{1} = \frac{\text{moles of FeBr}_2}{1}$$

$$\frac{\text{moles of FeBr}_2}{3} = \frac{\text{moles of Fe}_3\text{Br}_8}{1}$$

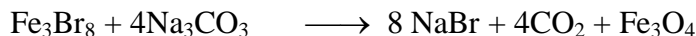
$$\& \quad \frac{\text{moles of Fe}_3\text{Br}_8}{1} = \frac{\text{mole of NaBr}}{8}$$

$$\Rightarrow \text{moles of Fe} = \frac{\text{moles of NaBr}}{8} \times 3 = \frac{2 \times 10^4}{8} \times 3$$

$$\Rightarrow \text{mass of Fe required} = \frac{6 \times 10^4 \times 56}{8} = 420 \text{ kg} \Rightarrow \text{Correct option is (B)}$$



$$\text{mole : } \frac{3}{8} \times 2 \times 10^4 \times \frac{100}{70} \times \frac{100}{60} \quad \frac{1}{8} \times 2 \times 10^4 \times \frac{100}{70}$$



$$\text{mole : } \frac{1}{8} \times 2 \times 10^4 \times \frac{100}{70} \quad 2 \times 10^4$$

$$\Rightarrow \frac{10^6}{8 \times 7} = 0.01786 \times 10^6$$

$$= 1.786 \times 10^4 \text{ moles}$$

$$\Rightarrow \text{mass of Fe required} = \frac{1.786 \times 10^4 \times 56}{10^2} = 17.86 \times 56$$

$$= 1000 \text{ kg} \quad \text{or} \quad 10^3 \text{ kg}$$

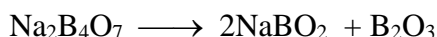
$\Rightarrow$  Correct option is (C)

(c) moles of  $\text{CO}_2$  formed  $= \frac{1}{2} \times 2 \times 10 = 10$  moles

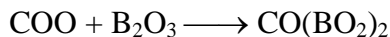
$\Rightarrow$  Correct option is (B).



$$\left( \frac{3}{200} \times \frac{10^2}{32.2} \times \frac{100}{60} \right) \times 100 \times 100 \quad \left( \frac{3}{200} \times \frac{10^2}{32.2} \times 100 \right) \times 100$$



$$\left( 100 \times \frac{3}{200} \times \frac{10^2}{32.2} \times 100 \right) \quad \left( \frac{10^2}{32.2} \right) \times 100$$



$$\left( \frac{10^2}{32.2} \right) \times 100 \quad 10^2$$

$$n_{\text{CO}(\text{BO}_2)_2} = \frac{14.5 \times 10^3}{1450} = 10^2 \text{ moles}$$

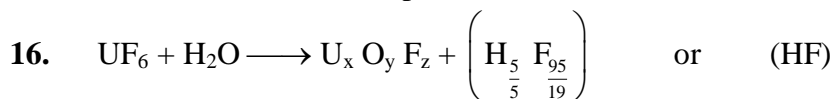
$\Rightarrow$  mass of  $\text{Ca}_2\text{B}_6\text{O}_{11}$  required  $= 10^2 \times (80 + 66 + 176) = 322 \times 10^2 \text{ g} = 32.2 \text{ kg}$

$\Rightarrow$  correct option is (A)

(b) mass of  $\text{Ca}_2\text{B}_6\text{O}_{11}$  obtained  $= \frac{3 \times 10^8}{200 \times 32.2 \times 60} \times 3220 = \frac{10^8}{400} \text{ g}$

$$= \frac{10^6}{4 \times 10^3} \text{ kg} = \frac{1000}{4} \text{ kg} = 250 \text{ kg}$$

$\Rightarrow$  correct option is (A)

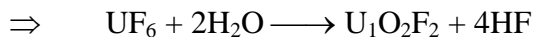


(a) The empirical formula of gas is HF

$\Rightarrow$  Correct option is (C)

(b) Mass of  $\text{H}_2\text{O} = 3.88 - 3.52 = 0.36 \text{ gm}$

$\Rightarrow$  moles of  $\text{H}_2\text{O} = 0.2$



$\Rightarrow$  Empirical formula of solid is  $\text{UF}_2\text{O}_2$

$\Rightarrow$  Correct option is (A)

(c) 1 mole  $\text{UF}_6$  gives 4 more HF

$\Rightarrow$  % of fluorine converted in gaseous product

$$= 100 - \left( \frac{114 - 76}{114} \right) \times 100 = 66.66 \%$$

$\Rightarrow$  Correct option is (C)

EXERCISE # JEE-MAINS

1. Moles pg CO =  $\frac{2.01 \times 10^{23}}{6.02 \times 10^{23}} = 0.33$

Mass of CO =  $0.33 \times 28$   
= 9.3 gm

2.

	C	H	N
WT	9	1	3.5
Moles	$\frac{9}{12}$	$\frac{1}{1}$	$\frac{3.5}{14}$
	$\frac{3}{4}$	1	$\frac{1}{4}$
	3	4	1

EF = C<sub>3</sub>H<sub>4</sub>N<sub>1</sub> ⇒ Mass (54)

MF = n (EF)

108 = n (54)

n = 2

MF = C<sub>6</sub>H<sub>8</sub>N<sub>2</sub>

3. Remain unchanged

The mass of 1 mole of the substance will remain unchanged.

⇒ Correct option is (2)

4. 8 mole oxygen atom is present in 1 mole Mg<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>

⇒ 0.25 mole oxygen atom is present in  $\left(\frac{1}{8} \times .25\right) = 3.125 \times 10^{-2}$  mole.

⇒ Correct option is (1)

5. V.D = 94.8 ⇒ molar mass =  $2 \times 94.8 = 189.6$  gm

⇒ mass of chlorine = 74.75% of 189.6 = 141.726 gm

⇒ mole of Cl =  $\frac{141.726}{35.5} = 4$

⇒ Formed of metal chloride will be MCl<sub>4</sub>.

⇒ Correct option is (2)

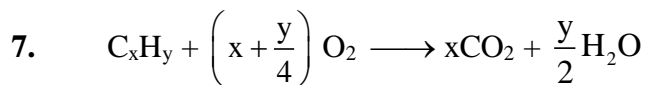
6.  $n_{O_3} \longrightarrow \frac{16}{48} = \frac{1}{3}$  mole

$n_{CO} \longrightarrow \frac{28}{28} \sim 1$  mole

$n_{O_2} \longrightarrow \frac{16}{32} = \frac{1}{2}$  mole

⇒ Ratio of oxygen atoms = 1 : 1 : 1

⇒ Correct option is (D)



$$n_{CO_2} \rightarrow \frac{3.08}{44} = 0.07$$

$$n_{H_2O} \rightarrow \frac{.72}{18} = 0.04$$

$$\therefore C : H = 0.07 : 0.04 = 7 : 8$$

$\Rightarrow$  The empirical formula of compounds is  $(C_7H_8)$

$\Rightarrow$  Correct option is (4)

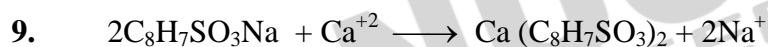


$$\text{ratio of mole} \longrightarrow \frac{1}{16} : \frac{4}{14}$$

$$\text{ratio of molecules} \longrightarrow \frac{N_A}{16} : \frac{4N_A}{14}$$

$\Rightarrow$  Ratio of number of molecules = 7 : 32

$\Rightarrow$  Correct option is (D)



$$\text{mole} : \frac{1}{206}$$

$$\Rightarrow \text{maximum uptake of } Ca^{+2} \text{ ions} = \frac{1}{412}$$

$\Rightarrow$  Correct option is (4).

10. By carius method,

$$\% Br = \frac{80 \times \text{weight of AgBr}}{188 \times \text{Weight of organic Halide}} \times 100$$

$$= \frac{80}{188} = \frac{141 \times 10^{-3}}{250 \times 10^{-3}} \times 100 = 24$$

$\Rightarrow$  Correct option is (1)

11.  $100 \text{ kg} \longrightarrow (10\text{kg}^1 \text{ H})$

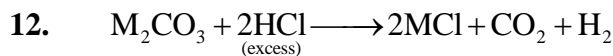
$$\downarrow$$

$$(20\text{kg}^2 \text{ H})$$

$$\Delta W = 10 \text{ kg}$$

$\Rightarrow$  weight gain is 10% of 75 kg i.e. 7.5 kg

$\Rightarrow$  Correct option is (3)



$$n_{\text{CO}_2} \longrightarrow 0.01186$$

1 mole  $\text{CO}_2$  is produced by 1 mole  $\text{M}_2\text{CO}_3$

$$\Rightarrow 0.01186 \text{ mole } \text{CO}_2 \text{ is produced by } \left( \frac{1 \times 0.01186}{1} \right) \text{ mole } \text{M}_2\text{CO}_3$$

$$\Rightarrow \frac{1}{M_{(\text{M}_2\text{CO}_3)}} = 0.01186$$

$$\Rightarrow M_{\text{M}_2\text{CO}_3} = \frac{1}{0.01186} = 84.3 \text{ gm} \quad \Rightarrow \text{Correct option is (2)}$$

13.

Element	C	:	H
Mass ratio	6	:	1
Mole ratio	1	:	2

So, empirical formula :  $\text{CH}_2$

For burning  $\text{CH}_2$  unit ; oxygen required is  $\frac{3}{2}$  mole

$\Rightarrow$  Empirical formula is  $(\text{CH}_2\text{O}_{3/2})$  i.e.  $\text{C}_2\text{H}_4\text{O}_3$

$\Rightarrow$  Correct option is (1)

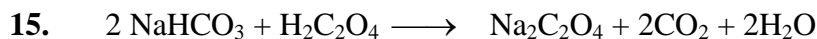
14. Moles of  $\text{C}_{57}\text{H}_{110}\text{O}_6 = \frac{445}{890} = 0.5 \text{ moles}$

From 2 moles of  $\text{C}_{57}\text{H}_{110}\text{O}_6 \longrightarrow 110 \text{ moles of } \text{H}_2\text{O} \text{ is produced}$

$$0.5 \text{ moles of } \text{C}_{57}\text{H}_{110}\text{O}_6 \longrightarrow 110 \times \frac{0.5}{2} \text{ moles } \text{H}_2\text{O}$$

$$\Rightarrow 27.5 \text{ moles}$$

$$\begin{aligned} \text{Mass of } \text{H}_2\text{O} &= 27.5 \times 18 \text{ gram} \\ &= 495 \text{ gram} \end{aligned}$$



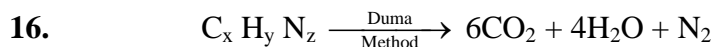
$$\begin{aligned} \text{Moles of } \text{CO}_2 &= \frac{0.25 \times 10^{-3}}{25} \\ &= 10^{-5} \text{ moles} \end{aligned}$$

$$\text{Moles of } \text{NaHCO}_3 = \frac{2}{2} \times 10^{-5} = 10^{-5}$$

$$\text{wt. of } \text{NaHCO}_3 = 10^{-5} \times 84$$

$$\% \text{ Mass} = \frac{84 \times 10^{-5}}{10 \times 10^{-3}} \times 100 = 8.4\%$$





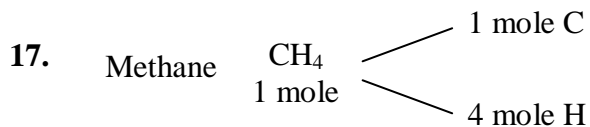
Clearly,

$$x = 6$$

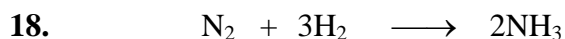
$$y = 8$$

$$z = 2$$

Hence  $C_6H_8N_2$



$$\% \text{ mole of C} = \frac{1}{1+4} \times 100$$



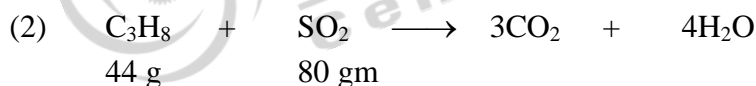
Option B  $56 \text{ gm } N_2 = 2 \text{ moles}$

$10 \text{ gm } H_2 = 5 \text{ moles}$

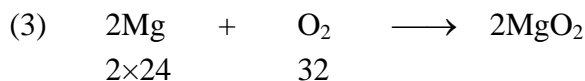
Clearly  $H_2$  is limiting



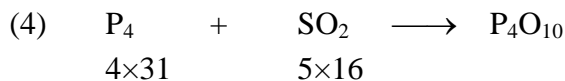
$$1 \text{ gm} \quad \frac{3 \times 32}{4 \times 56} = \frac{3}{7} \text{ gram}$$



$$1 \text{ gram} \quad \frac{80}{44} = \frac{20}{11} \text{ gram}$$



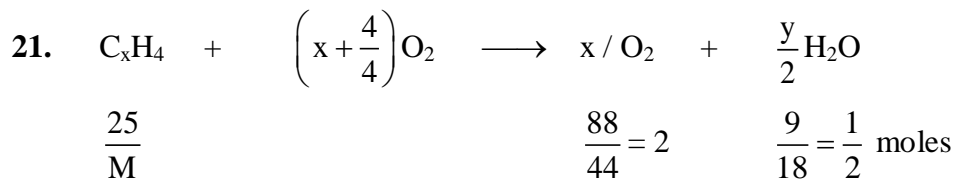
$$1 \text{ gram} \quad \frac{32}{2 \times 24} = \frac{2}{3} \text{ gram}$$



$$1 \text{ gram} \quad \frac{80}{124} = \frac{20}{31} \text{ gram}$$

Ans. (1)

20. Mass of 1 mol of  $AB_2 = M_A + 2M_B = 25 \times 10^{-3} \text{ kg}$   
 Mass of 1 mol of  $A_2B_2 = 2M_A + 2M_B = 30 \times 10^{-3} \text{ kg}$   
 $M_A = 5 \times 10^{-3} \text{ kg / mol}$   
 $M_B = 10 \times 10^{-3} \text{ kg / mol}$



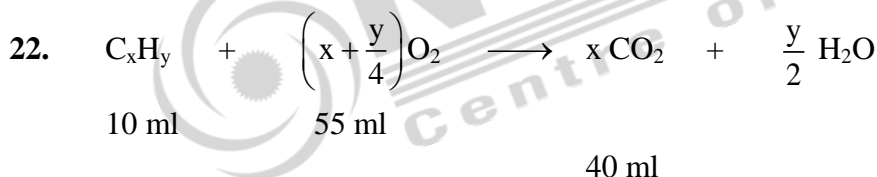
$$\text{Moles of } CO_2 = \frac{25}{M} \times x = 2$$

$$\text{Moles of } H_2O = \frac{25}{M} \times \frac{y}{2} = \frac{1}{2}$$

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

$$\text{E.F.} = C_{x_y} H_y$$

$$\text{Also } \begin{array}{ccc} 2y \times 12 & + & y \\ \text{gm Carbon} & & \text{gram H} \end{array} \Rightarrow 24 : 1$$



For gases, volume is proportional to moles

$$\frac{10}{55} = \frac{1}{x + \frac{4}{4}} \qquad \dots\dots (1)$$

$$\frac{1}{x} = \frac{10}{40} \qquad \dots\dots (2)$$

$$x = 4$$

$$y = 6$$



**EXERCISE # JEE-ADVANCED**

1. Mass of  $1\text{ e}^- = 9.1 \times 10^{-31}\text{ kg}$

$$\Rightarrow \text{moles of } \text{e}^- \text{ weighing } 1\text{ kg} = \frac{1}{9.108 \times 10^{-31}} \times \frac{1}{N_A} = \frac{1}{9.108 \times 6.023} \times 10^8$$

$\Rightarrow$  Correct option is (D)

2.  $6\text{CaO} + \text{P}_4\text{O}_{10} \longrightarrow 2\text{Ca}_3(\text{PO}_4)_2$

$$n\text{P}_4\text{O}_{10} \longrightarrow \frac{852}{284} = 3\text{ mole}$$

1 mole  $\text{P}_4\text{O}_{10}$  reacts with 6 mole  $\text{CaO}$

$\Rightarrow$  3 mole  $\text{P}_4\text{O}_{10}$  reacts with 18 mole  $\text{CaO}$  or  $18 \times 56\text{ CaO}$   
 i.e. 1008g  $\text{CaO}$ .

3. Atomic mass of  $\text{Fe} = \frac{54 \times 5 + 56 \times 90 + 57 \times 5}{100} = 55.95$

$\Rightarrow$  Correct option is (B)