

MT EDUCARE LTD.

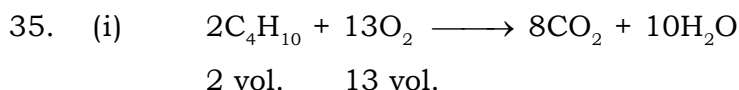
ICSE X

SUBJECT : **CHEMISTRY**

MOLE CONCEPT AND STOICHIOMETRY

Assignment Sheet

STEP UP ANSWERSHEET



2 vol. of butane require 13 vol. of oxygen (according to Gay Lussac's Law)

$$\therefore 90 \text{ dm}^3 \text{ of butane require} = \frac{13 \times 90}{2} = 585 \text{ dm}^3$$

Ans. 585 dm³ of oxygen is required.

(ii) Given (Vapour Density) VD = 8

$$\therefore \text{Mol. wt} = 2 \times \text{VD} = 2 \times 8 = 16$$

$$\text{No. of moles in 24.0 g of gas} = \frac{\text{wt}}{\text{mol. wt}} = \frac{24}{16}$$

$$= 1.5 \text{ moles}$$

At STP 1 mole of a gas occupies 22.4 l

$$\therefore 1.5 \text{ moles of the gas will occupy} = \frac{22.4 \times 1.5}{1} = 33.6 \text{ l}$$

(iii) 'X' number of molecules.

[2013]

36. (i) 3rd period, 16th group.

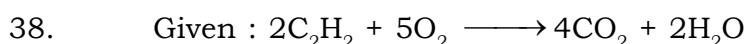
(ii) Z is a non-metal

(iii) H₂Z

[2014]

37. Vapour density

[2014]



$$2 \text{ vol.} \qquad \qquad \qquad 4 \text{ vol.}$$

$$\therefore \qquad \qquad 1 \text{ vol.} \qquad \qquad \qquad 2 \text{ vol.}$$

According to Gay Lussac's law :

2 volume of CO₂ is produced from 1 vol. of C₂H₂

\therefore 8.4 dm³ of CO₂ at S.T.P. is produced from

$$= \frac{1 \times 8.4}{2}$$

$$= 4.2 \text{ dm}^3 \text{ of C}_2\text{H}_2$$

Ans. At S.T.P. 4.2 dm³ of ethyne is required.

[2014]

39. (i) Avogadro's Law : "Under the same conditions of temperature and pressure equal volumes of all gases contain the same number of molecules".

(ii) 1. Molecular weight of $\text{NH}_3 = (14 + 3 \times 1) = 17\text{g}$
 17g of NH_3 at s.t.p. occupies a volume of 22.4dm^3

So 68g of NH_3 at s.t.p. occupies a volume of $\frac{22.4 \times 68}{17}$
 $= 89.6 \text{ dm}^3$

2. Number of moles of NH_3 in 68 g = $\frac{\text{wt.}}{\text{mol. wt.}}$
 $= \frac{68}{17} = 4 \text{ moles}$

3. No. of molecules present = $4 \times 6.023 \times 10^{23}$

[2014]

40. (D) 6.02×10^{23} atoms of carbon

[2015]

41. (i) 32 gm of sulphur contain = 6.023×10^{23} atoms

m 3.2 gm of sulphur contain = $\frac{6.023 \times 10^{23}}{32} \times 3.2 = 6.023 \times 10^{22}$ atoms

Now, 6.023×10^{23} atoms of calcium have mass = 40 g

m 6.023×10^{22} atoms of calcium have mass = $\frac{40}{6.023 \times 10^{23}} \times 6.023 \times 10^{22}$
 $= 4 \text{ g}$

Hence, the mass of calcium is 4 g.

(ii) $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$

1 vol 1 vol 2 vols

Since, 1 volume of chlorine reacts with 1 volume of hydrogen,
 m 4 litres of chlorine will react with only 4 volumes of hydrogen
 m (6 - 4) i.e., 2 litres of hydrogen will remain unreacted.

HCl formed will get dissolved in water.

m Volume of residual gas hydrogen is 2 litres.

(iii) Given,

Empirical formula = CH

Now, Empirical formula mass = $12 \times 1 + 1 \times 1 = 13$

Molecular mass = $2 \times \text{vapour density} = 2 \times 13 = 26$

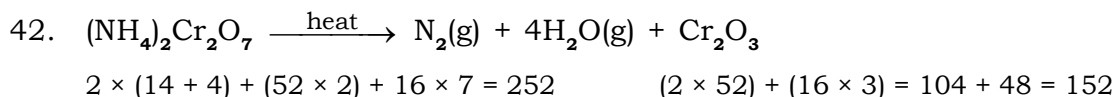
Molecular mass = $n \times \text{Empirical formula mass}$

$$n = \frac{\text{Molecular formula mass}}{\text{Empirical formula mass}} = \frac{26}{13} = 2$$

Molecular formula = $n \times \text{Empirical formula} = 2 (\text{CH}) = \text{C}_2\text{H}_2$

Hence, the molecular formula of the compound is C_2H_2 .

[2015]



(i) 252 gm of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 = 1$ mole

m 63 gm $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 = \frac{63}{252} = 0.25$ mole

Hence, 0.25 mole of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ is heated

(ii) From the chemical equation

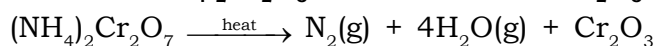
1 mole of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ liberates 1 mole of N_2

m 0.25 mole of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ liberates is 0.25 moles of N_2

(iii) Volume of 1 mole of N_2 at S.T.P. is 22.4 l

m 0.25 volume of 1 mole of N_2 at S.T.P. is $22.4 \times 0.25 = 5.6$ l

(iv) 252 g of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ forms is 38 g of Cr_2O_3 .



[2015]

43. (i) Given,

20 l of a gas at STP = 32g

\therefore 1 l of gas at STP would be = $\frac{32}{20}$ g

a we know that

A gas at STP has volume = 22.4 l

\therefore Gram molecular weight of the gas = $\frac{32}{20} \times 22.4 = 35.84$ g

(ii) $2\text{Ca}(\text{NO}_3)_2 \longrightarrow 2\text{CaO} + 4\text{NO}_2 + \text{O}_2$

$2 \times (164)\text{g} \longrightarrow 2(56)\text{g}$

From the above given chemical reaction

328 g of $\text{Ca}(\text{NO}_3)_2$ decomposes to form 112 g of CaO

\therefore 82 g of Ca $(\text{NO}_3)_2$ will decompose = $\frac{112}{328} \times 82 = 28$ g of CaO

329 g of $\text{Ca}(\text{NO}_3)_2$ gives 4×22.4 vol. of NO_2

\therefore 82 g of $\text{Ca}(\text{NO}_3)_2$ gives = $\frac{4 \times 22.4 \times 82}{328} = 22.4$ l

82 g of Ca $(\text{NO}_3)_2$ evolves = 22.4 l of NO_2 .

[2016]

44. (i) The mass of 6×10^{23} molecules of O_2 is 32 g

m The mass of 12×10^{24} molecules = $\frac{12 \times 10^{24} \times 32}{6 \times 10^{23}} = 640$ g

(ii) Volume of 6×10^{23} molecules of $O_2 = 22.4 \text{ l}$

$$\text{mVolume of } 12 \times 10^{24} \text{ molecules of } O_2 = \frac{22.4 \times 12 \times 10^{24}}{6 \times 10^{23}} = 448 \text{ l}$$

[2016]

45.

Element	% composition	At. Wt.	Relative No. of atoms	Simplest ratio
C	82.76	12	$\frac{82.76}{12} = 6.89$	$\frac{6.89}{6.89} = 1 \times 2 = 2$
H	17.24	1	$\frac{17.24}{1} = 17.24$	$\frac{17.24}{6.89} = 2.5 \times 2 = 5$

m Empirical formula = C_2H_5
 Empirical formula mass = $(12 \times 2) + (1 \times 5)$
 = $24 + 5 = 29$

Vapour density $\longrightarrow 29$

Molecular mass = $V.D \times 2 = 29 \times 2$
 = 58 gm

Molecular formula mass = $n \times \text{Empirical formula mass}$

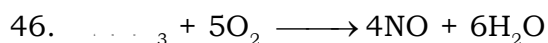
$$n = \frac{\text{Molecular Formula mass}}{\text{Empirical Formula mass}}$$

$$= \frac{58}{29}$$

$n \times \text{Empirical formula} = \text{Molecular formula}$

Molecular formula = $2 \times C_2H_5$
 = C_4H_{10}

[2016]



Given : Ammonia used = 100 cm^3

in the reaction,

From the equation 4 vols. of NH_3 requires 5 vols. of O_2 for its oxidation.

m 1 vol. will require = $\frac{5}{4}$

Thus 100 cm^3 of ammonia will require = $\frac{5}{4} \times 100 = 125 \text{ cm}^3$ of oxygen

[2016]

47. (i) For every 5 moles of O_2 , 1 mole of propane is burnt.
 20% of air contains oxygen.
 20% of 1000 = $20 \times 1000/100 = 200 \text{ cm}^3$ of O_2 .
 $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
 $\therefore 1\text{vol.} : 5\text{vol.} \rightarrow 3\text{vol.} : 4\text{vol.}$ According to Lussac's Law
 Thus, Volume of propane = 40 cm^3

- (ii) Mass of gas = 24 g
 Volume of gas = 11.6 litres
 22.4 L of gas at STP = 1 mole
 11.2 L of gas at STP = $11.2 / 22.4 = 0.5$ moles
 Mass of 0.5 moles of gas = 24 g
 Mass of 1 mole of gas or molar mass = $24/0.5 = 48 \text{ g}$

[2017]

48. (i) 1 kg = 1000 grams
 2g of hydrogen molecules = 1 mole
 1g of hydrogen molecules = $1/2$ mole
 $\therefore 1000 \text{ g}$ of hydrogen molecules = $1/2 \times 1000 = 500$ moles

- (ii) Molecular weight of Carbon dioxide = 44 g
 Vapour density = $44/2 = 22$

$$\text{Vapour density} = \frac{\text{Wt. of a certain volume of gas i.e } CO_2}{\text{Wt. of the same volume of } H_2 [\text{same condition}]}$$

- (iii) If the number of molecules of hydrogen is X, then number of molecules of carbon dioxide will also be X.
 (iv) This is according to the Avogadro's Law which states that "under similar conditions of temperature and pressure equal volumes of all gases contain the same number of molecules."

49. (i) Mass of sodium = 4.6g.
 Relative atomic mass of sodium = 23g.

$$\text{Gram atoms} = \frac{\text{Mass in grams}}{\text{Relative atomic mass [At.wt.]}}$$

$$= \frac{4.6}{23}$$

$$= 0.2 \text{ g atoms}$$

4.6 grams of sodium has 0.2 gram atoms

[2017]

(ii) Percentage composition

$$= \frac{\text{w.t. of the element in one molecule of the compound}}{\text{Gram molecular weight of the compound}} \times 100$$

Molecular weight of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} = 250 \text{ g}$

Weight of $5\text{H}_2\text{O} = 90\text{g}$

i.e 250 g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ contains 90 g of water of crystallization

$$\begin{aligned} \text{m} \quad \% \text{ composition of water of crystallization} &= \frac{90 \times 100}{250} \\ &= 36\% \end{aligned}$$

36 % of water of crystallization.

(iii) Molecular weight = $2 \times$ vapour density
= $2 \times$ empirical formula weight
(Vapour density = empirical formula weight)

Also, Molecular Weight = Empirical formula weight $\times n$

$$\text{m} \quad 2 \times \text{empirical formula weight} = \text{Empirical formula weight} \times n$$

$$\text{m} \quad n = 2$$

Therefore,

$$\begin{aligned} \text{Molecular Formula} &= (\text{Empirical Formula}) \times n \\ &= (\text{XY}_2)_2 \\ &= \text{X}_2\text{Y}_4 \end{aligned}$$

[2017]

