# Chapter - 1 (some basic concept of chemistry)

**Q1 : Calculate the molecular masses of the following**:

**(i) H2O (ii) CO2 (iii) CH4**

**Answer :**

(i) H2O:

H2O = (2 x Atomic mass of hydrogen) + (1 x Atomic mass of oxygen)

= [2(1.0084) + 1(16.00 u)]

= 2.016 u + 16.00 u

= 18.016 = 18.02 u

(ii) CO2:

CO2 = (1 x Atomic mass of carbon) + (2 x Atomic mass of oxygen)

= 12.011 u + 32.00 u = 44.01 u

(iii) CH4: The molecular mass of methane,

CH4 = (1 x Atomic mass of carbon) + (4 x Atomic mass of hydrogen)

= 12.011 u + 4.032 u = 16.043 u

**Q2 : Calculate the mass percentage% of different elements present in the compound of sodium sulphate (Na2SO4).**

**Answer:**

The molecular formulae for the sodium sulphate is $Na_2SO_4$

Molar mass of sodium sulphate is = [(2 × 23.0) + (32.066) + 4 (16.00)]

= 142.066 g

Mass percentage of element $= \frac{\text{Mass of that element in the compound}}{\text{Molar mass of the compound}} \times 100$

Therefore mass percentage of sodium :

$$= \frac{46.0\,\text{g}}{142.066\,\text{g}} \times 100$$
$$= 32.379$$
$$= 32.4\%$$

Mass percent of sulphur:

$$= \frac{32.066\text{g}}{142.066\text{g}} \times 100$$
$$= 22.57$$
$$= 22.6\%$$

Mass percent of oxygen:

$$= \frac{64.0\text{g}}{142.066\text{g}} \times 100$$
$$= 45.049$$
$$= 45.05\%$$

**Q3 : Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% dioxygen by mass.**

**Answer :**

% of iron by mass = 69.9 % [Given]

% of oxygen by mass = 30.1 % [Given]

Relative moles of iron in iron oxide:

$$= \frac{\%\text{ of iron by mass}}{\text{Atomic mass of iron}}$$
$$= \frac{69.9}{55.85}$$
$$= 1.25$$

Relative moles of oxygen in iron oxide

$$= \frac{\%\text{ of oxygen by mass}}{\text{Atomic mass or oxygen}}$$
$$= \frac{30.1}{16.00}$$
$$= 1.88$$

Simplest molar ratio of iron to oxygen:

= 1.25: 1.88

= 1: 1.5 2: 3

empirical formula is Fe2O3.

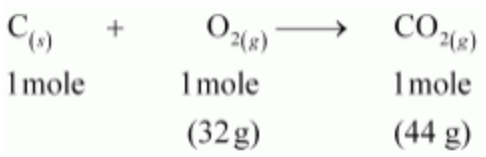
**Q4 : Calculate amount of carbon dioxide(CO2) that produced when**

**(i) 1 mole of carbon burnt in the air.**

**(ii) 1 mole of carbon burnt in 16 g of dioxygen.**

**(iii) 2 moles of carbon burnt in 16 g of dioxygen.**

**Answer :** The reaction of combustion of carbon can be:




(i) 1 mole of carbon burns in 1 mole of dioxygen to produce 1 mole of (CO2).

(ii) only 16 g of dioxygen react with 0.5 mole of carbon to give 22 g of carbon dioxide. Hence, it is a limiting reactant.

(iii) only 16 g of dioxygen are available. It is a limiting reactant.16 g of dioxygen can combine with the only 0.5 mole of carbon atoms which give 22 g of carbon dioxide.

**Q5 : Calculate the molecular mass of sodium acetate (CH3COONa) which is required to make the 500 mL of 0.375 molar aqueous Solution. Molar mass of the sodium acetate is 82.0245 g mol -1**

**Answer:**

0.375 M aqueous solution of sodium acetate

Ã¢â€°Â¡ 1000 mL of solution containing 0.375 moles of sodium acetate

∴Number of the moles of the sodium acetate in 500 mL

$$= \frac{0.375}{1000} \times 500$$
$$= 0.1875 \text{ mole}$$

Molar mass of thesodium acetate is 82.0245 g mole-1

∴ Required mass of the sodium acetate = (82.0245 gmol-1) (0.1875 mole)

= 15.38 g

## Q6 : Calculate the concentration of the nitric acid in the moles per litre in a sample which have a density of 1.41 g mL -1 and the mass percent % of nitric acid into it being 69%.

## Answer :

Mass percent nitric acid = 69 %

100 g of nitric acid contained 69 g of the nitric acid by mass.

Molar mass of nitric acid (HNO3)

= {1 + 14 + 3(16)} g mol-1

= 1 + 14 + 48

= 63 g mol-1

$$= \frac{69\,\text{g}}{63\,\text{g mol}^{-1}}$$
$$= 1.095\,\text{mol}$$

Volume of 100g of nitric acid solution

$$= \frac{\text{Mass of solution}}{\text{density of solution}}$$
$$= \frac{100\,\text{g}}{1.41\,\text{g mL}^{-1}}$$
$$= 70.92\,\text{mL} \equiv 70.92 \times 10^{-3}\,\text{L}$$

Concentration of nitric acid

$$= \frac{1.095\,\text{mole}}{70.92 \times 10^{-3}\,\text{L}}$$
$$= 15.44\,\text{mol/L}$$

∴Concentration of nitric acid = 15.44 mol/L

## Q7 : How much of the copper can be obtained from the 100 g of the copper sulphate (CuSO4)?

## Answer :

Molar mass of CuSO4

= 63.5 + 32.00 + 4(16.00)

= 63.5 + 32.00 + 64.00

= 159.5 g

159.5 g (CuSO4) contains = 63.5 g of copper.

⇒ 100 g of the CuSO4 will contains $\frac{63.5 \times 100\,g}{159.5}$ of copper

Amount of the copper that obtained from 100 g CuSO4

= 39.81 g

## Q8 : Determine molecular formula of the oxide of the iron in which the mass per cent% of iron and oxygen is 69.9 and 30.1 . Given that the molar mass of an oxide is 159.69 g mol -1 .

## Answer :

Mass percent of iron (Fe) = 69.9%

Mass percent of oxygen (O) = 30.1%

moles of iron present in the oxide $= \frac{69.90}{55.85}$

moles of oxygen present in the oxide $= \frac{30.1}{16.0}$

Ratio of the iron to oxygen in the oxide is given as,

$$= 1.25 : 1.88$$

$$= \frac{1.25}{1.25} : \frac{1.88}{1.25}$$

$$= 1 : 1.5$$

$$= 2 : 3$$

The empirical formula Fe2O3.

mass of Fe2O3

= 2(55.85) + 3(16.00)]

Molar mass of Fe2O3 = 159.69 g

$$\therefore n = \frac{\text{Molar mass}}{\text{Emprical formula mass}} = \frac{159.69\ \text{g}}{159.7\ \text{g}}$$
$$= 0.999$$
$$= 1\,(\text{approx})$$

Molecular formula of the compound is obtained by the multiplying of the empirical formula by n.

the empirical formula of oxide is Fe2O3 and n is 1.

the molecular formula is Fe2O3

## Q9 : Calculate the Atomic Mass (average) of the chlorine using the following data:

## Answer :

The average atomic mass of chlorine

$$= \left[ \begin{pmatrix} \text{Fractional abundance} \\ \text{of } {}^{35}\text{Cl} \end{pmatrix} \begin{pmatrix} \text{Molar mass} \\ \text{of } {}^{35}\text{Cl} \end{pmatrix} + \begin{pmatrix} \text{Fractional} \\ \text{abundance} \\ \text{of } {}^{37}\text{Cl} \end{pmatrix} \begin{pmatrix} \text{Molar mass} \\ \text{of } {}^{37}\text{Cl} \end{pmatrix} \right]$$

$$= \left[ \left\{ \left( \frac{75.77}{100} \right) (34.9689\,\text{u}) \right\} + \left\{ \left( \frac{24.23}{100} \right) (36.9659\,\text{u}) \right\} \right]$$

= 26.4959 + 8.9568

= 35.4527 u

The average atomic mass of chlorine = 35.4527 u

## Q10 : In the three moles of ethane i.e (C2H6), calculate of the following:

**(i) Number of moles of carbon atoms.**

**(ii) Number of moles of hydrogen atoms.**

**(iii) Number of molecules of ethane.**

## Answer :

(i) 1 mole (C2H6) contains the 2 moles of the carbon atoms.

Number of the moles of carbon the atoms in 3 moles of (C2H6)

= 2 × 3 = 6

(ii) 1 mole of the (C2H6) contains 6 moles of the hydrogen atoms.

moles of the carbon atoms in the3 moles of C2H6

= 3 × 6 = 18

(iii) 1 mole of C2H6 contains 6.023 × 10^23 molecules of ethane.

molecules in 3 moles of (C2H6)

= 3 × 6.023 × 10^23 = 18.069 × 10^23

## Q11. What is the concentration of sugar ($C_{12}H_{22}O_{11}$) in mol $L^{-1}$ if its 20 g are dissolved in enough water to make a final volume up to 2L?

## Answer :

Molar mass of sugar ($C_{12}H_{22}O_{11}$) = (12 ×12) +(1 ×22)+ (11×16) = 342 g $mol^{-1}$
Number of moles in the 20g of sugar = 20/342

= 0.0585 mole

Volume of Solution = 2L (given)

Molar concentration=Moles of solute/Volume of solution in Litre

= 0.0585mol /2L

= 0.0293 mol L-1

= 0.0293 M

**Q12 : If the density of methanol is 0.793 kg L -1 , what is its volume needed for making 2.5 L of its 0.25 M solution?**

**Answer :**

Molar mass of the methanol (CH3OH) = 1 × 12 + 4 × 1 + 1 × 16

= 32 g mol â€“1

= 0.032 kg mol â€“1

Molarity of methanol solution $= \frac{0.793 \text{ kg L}^{-1}}{0.032 \text{ kg mol}^{-1}}$

= 24.78 mol L â€“1

M1V1 = M2V2

(Given solution) (Solution to be prepared)

(24.78 mol L â€“1 ) V1 = (2.5 L) (0.25 mol L â€“1 )

V1 = 0.0252 L

V1 = 25.22 mL

**Q13. Pressure is defined as the force acting per unit area of the surface. The SI unit of the pressure is pascal as shown below :**
**$1Pa = 1N\ m^{-2}$**
**If mass of the air at the sea level is 1034 g $cm^{-2}$, calculate the pressure in (pascal).**

**Answer :**

Pressure is the force (i.e. weigh) acting per unit area.
P= F/A = 1034g × 9.8ms $^{-2}$/$cm^2$
= 1034g × 9.8$ms^{-2}$ /$cm^2$ × 1kg /1000g × 100cm /1m × 100cm /1m

= 1.01332 ×105 N
Now,

$1Pa = 1N\ m^{-2}$

$\therefore 1.01332 \times 10^5\ N \times m^{-2} = 1.01332 \times 10^5\ Pa$

## Q14. What is the SI unit of mass? How is it defined?

## Answer :

Kilogram Kg is SI unit of mass.

It is defined as the mass of platinum-iridium Pt-Ir cylinder .which is stored in the air-tight jar at the International Bureau of Weigh and Measures in France.

## Q15. Match the following prefixes with their multiples:

| | Prefixes | Multiples |
|---|---|---|
| (a) | femto | 10 |
| (b) | giga | $10^{-15}$ |
| (c) | mega | $10^{-6}$ |
| (d) | deca | $10^{9}$ |
| (e) | micro | $10^{6}$ |

## Answer :

| | Prefixes | Multiples |
|---|---|---|
| (a) | femto | $10^{-15}$ |
| (b) | giga | $10^{9}$ |
| (c) | mega | $10^{6}$ |
| (d) | deca | 10 |
| (e) | micro | $10^{-6}$ |

**Q16. What do you mean by the significant figures ?**

**Answer :**

They are meaningful digits which are known with the certainty including the last digit whose value is uncertain.

**Q17. A sample of the drinking water is found to be severely contaminated with the chloroform, $CHCl_3$, supposed to be the carcinogenic in nature. The level of the contamination was around15 ppm (by mass).**
**(i) Express this in percent by mass.**
**(ii) Determine the molality of the chloroform in the sample of water.**

**Answer :**

(i) 15 ppm means the 5 parts in a million($10^6$) parts.
$\therefore$ % by mass = $15/10^6 \times 100 = 15 \times 10^{-4} = 1.5\times10^{-3}$ %
(ii) Molar mass of chloroform($CHCl^3$)

= $12+1+ (3\times35.5) = 118.5$ g $mol^{-1}$
100g of sample contain chloroform

= 1.5×10-3g
$\therefore$ 1000 g of sample will contain the chloroform

= $1.5\times10^{-2}$ g
= $1.5\times10^{-2}$/ 118.65 mole

= $1.266 \times10^{-4}$ mole
$\therefore$ Molality = $1.266\times10^{-4}$ m.

**Q18. Express the following in scientific notations:**
**(i) 0.0048**
**(ii) 234,000**
**(iii) 8008**
**(iv) 500.0**
**(v) 6.0012**

**Answer :**

(i) $0.0048 = 4.8\times 10^{-3}$
(ii) $234, 000 = 2.34\times 10^5$
(iii) $8008 = 8.008\times 10^3$

(iv) $500.0 = 5.000 \times 10^2$
(v) $6.0012 = 6.0012 \times 10^0$

**Q19. How many significant figure are present in the following?**
**(i) 0.0025**
**(ii) 208**
**(iii) 5005**
**(iv) 126,000**
**(v) 500.0**
**(vi) 2.0034**

**Answer :**

(i) 2
(ii) 3
(iii) 4
(iv) 3
(v) 4
(vi) 5

**Q20. Round up following upto the three significant figures:**
**(i) 34.216**
**(ii) 10.4107**
**(iii) 0.04597**
**(iv) 2808**

**Answer :**

(i) 34.2

(ii) 10.4

(iii) 0.046

(iv) 2810

**Q21. The following data obtained when dinitrogen and dioxygen react together to form different compound:**

| Mass of Dinitrogen | Mass of Dioxygen |
|---|---|
| (i)14 g | 16 g |
| (ii)14 g | 32 g |
| (iii)28 g | 32 g |
| (iv)28 g | 80 g |

**(a) Which of the following law of chemical combination is obeyed by the experiment data given above ? Given its statement.**

**(b) Fill in the blank in the following conversion-**

**(i) 1 km = ..... mm = ..... pm**

**(ii) 1 mg =..... kg = ..... ng**

**(iii) 1 ml = ...,..... L = ,..... $dm^3$**

a) Fixing the mass of the Dinitrogen as 28 g, masses of the Dioxygen combined will be as 32, 64, 32 and 80 g in given four oxide. These masses of the dioxygen bear a simple whole numbers ratio as follows 2:4:2:5. the data given obey the law of multiple proportions.
The statement as follows two elements always combine with a fixed mass of other bearing a simple ratio to another to form two or more chemical compounds.
(b) (i) 1 km = 1km× 1000m/ 1km ×100cm /1m/ 10mm /1cm = $10^6$ mm
1 km = 1km× 1000m / 1km × 1pm/ $10^{-12}$m = $10^{15}$ pm
(ii) 1 mg = 1mg ×1gm/ 1000mg × 1kg / 1000gm = 10-6 kg
1 mg = 1mg ×1gm/ 1000mg × 1ng/ $10^{-9}$gm = $10^{-6}$ ng
(iii) 1 mL = 1mL×1L/ 1000mL = $10^{-3}$ L
1 mL = 1$cm^3$ = 1$cm^3$× (1dm × 1dm × 1dm/ 10cm × 10cm × 10cm) = $10^3dm^3$

**Q22. If speed of light is 3.0 × 108 ms-1, calculate distance covered by the light in 2.00 ns.**

**Answer :**

Distance covered = Speed × Time

= 3.0 × 108 × 2.00 ns

= 3.0 × 108 × 2.00 ns ×$10^{-9}$s /1ns

= 6.00×$10^{-1}$m = 0.600m

**Q23.**

**In a reaction** $A + B_2 \longrightarrow AB_2$

**Identify limiting reagent, if there are any in following reaction mixtures.**

1. **300 atom of A + 200 molecule of B**
2. **2 mol A + 3 mol B**
3. **100 atom of A + 100 molecules of B**
4. **5 mole A + 2.5 mol B**
5. **2.5 mole A + 5 mol B**

**Answer :**

A limiting reagent determine the extent of a reaction. It is the reactant which is first to get consumed during reaction, thereby causing reaction to stop and limiting amount of product formed.

**(i)** According to given reaction, 1 atom of A react with the 1 molecule of B. 200 molecules of B reacts with 200 atoms of A, leaving 100 atoms of A unused. Hence, B is the limiting reagent. Here atom of B is in lesser amount(200).

**(ii)** According to reaction, 1 mol of A react with 1 mol of B. 2 mol of A will reacts with only 2 mol of B. As the result, 1 mol of A will not consumed. Hence, A is the limiting reagent.

**(iii)** According to given reaction, 1 atom of A combine with 1 molecule of atom B. all 100 atom of A will combine to all 100 molecules of B. the mixture is stoichiometric there is no limiting reagent is present.

**(iv)** 1 mol of atom of A combine with the 1 mol of molecule of B. 2.5 mol of atom B will combines with only 2.5 mol of atom A. 2.5 mol of A will left as such. B is limiting reagent because atom B is less as compared to the atom A.

**(v)** According to reaction, 1 mol of atom of A combine with 1 mol of molecule of B. 2.5 mol of A will combines with the only 2.5 mol of atom B and remaining 2.5 mol of atom B will left as such. Hence, A is limiting reagent

**Q24. Dinitrogen and Dihydrogen react with the each other and produce ammonia according to following chemical equation:**

**$N_2(g) + H_2(g) \rightarrow 2NH_3(g)$**
**(i) Calculate the mass of ammonia produced if $2.00\times10^3$g dinitrogen reacts with $1.00\times10^3$g of dihydrogen.**
**(ii) Will any of two reactants will remain unreacted?**
**(iii) If yes then which one and what will be its mass?**

**Answer :**

1 mole of dinitrogen reacts with 3 mole of dihydrogen to give 2 mole of ammonia .

∴ 2000 g of $N_2$ react with $H_2$

= 6/28 × 200g

= 428.6g

Thus, here $N_2$ is limiting reagent $H_2$ is in excess.

28g of $N_2$ produce 34g of $NH_3$.

∴2000g of $N_2$ will produce = 34/28 × 2000g = 2428.57 g of $NH_3$.

(ii) $N_2$ is limiting reagent H2 is excess reagent. Hence, $H_2$ will remain unreacted.

(iii) Mass of the dihydrogen left unreacted

= 1000g - 428.6g

= 571.4 g

**Q25. How are 0.50 mol $Na_2CO_3$ and 0.50 M$Na_2$ $CO_3$ different?**

**Answer :**

Molar mass of $Na_2CO_3$ = (2×23) +12.00+(3×16) = 106 g $mol^{-1}$

∴0.50 mol $Na_2CO_3$ means 0.50 ×106g = 53g

0.50 M Na2CO3 means 0.50 mol of Na2$CO_3$ i.e. 53g of $Na_2CO_3$ is present in 1L of the solution.

**Q26. If ten volumes of dihydrogen gas reacts with five volumes of dioxygen gas, how many volumes of water vapour would be produced?**

**Answer :**

Dihydrogen gas reacts with dioxygen gas as,

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

Thus, two volume of dihydrogen reacts with one volume of the Dihydrogen to produce two volume of the water vapour. Hence ten volume of Dihydrogen will reacts with five volumes of Ddioxygen to produce ten volume of the water vapour.

**Q27. Convert the following into basic units:**
**(i) 28.7 pm**
**(ii) 15.15 pm**
**(iii) 25365 mg**

**Answer :**

(i) 28.7 pm:
$1\ pm = 10^{-12}\ m$
$\therefore\ 28.7\ pm = 28.7 \times 10^{-12}\ m$
$= 2.87 \times 10^{-11}\ m$
(ii) 15.15 pm:
$1\ pm = 10^{-12}\ m$
$\therefore\ 15.15\ pm = 15.15 \times 10^{-12}\ m$
$= 1.515 \times 10^{-12}\ m$
(iii) 25365 mg:
$1\ mg = 10^{-3}\ g$
$25365\ mg = 2.5365 \times 10^{4} \times 10^{-3}\ g$
Since,
$1\ g = 10^{-3}\ kg$
$2.5365 \times 10^{1}\ g = 2.5365 \times 10^{-1} \times 10^{-3}\ kg$
$\therefore 25365\ mg = 2.5365 \times 10^{-2}\ kg$

**Q28 . Which one of the following have largest number of atoms?**
**(i) 1 g Au (s)**
**(ii) 1 g Na (s)**
**(iii) 1 g Li (s)**
**(iv) 1 g of $Cl_2$ (g)**

**Answer :**

(i) 1 g of Au (s) $= \frac{1}{197}$ mol of Au (s)

$= \frac{6.022 \times 10^{23}}{197}$ atoms of Au (s)

$= 3.06 \times 10^{21}$ atoms of Au (s)

(ii) 1 g of Na (s) $= \frac{1}{23}$ mol of Na (s)

$= \frac{6.022 \times 10^{23}}{23}$ atoms of Na (s)

$= 0.262 \times 10^{23}$ atoms of Na (s)

$= 26.2 \times 10^{21}$ atoms of Na (s)

(iii) 1 g of Li (s) $= \frac{1}{7}$ mol of Li (s)

$= \frac{6.022 \times 10^{23}}{7}$ atoms of Li (s)

$= 0.86 \times 10^{23}$ atoms of Li (s)

$= 86.0 \times 10^{21}$ atoms of Li (s)

(iv) 1 g of $Cl_2$ (g) $= \frac{1}{71}$ mol of $Cl_2$ (g)

(Molar mass of $Cl_2$ molecules $= 35.5 \times 2 = 71$ g $mol^{-1}$)

$= \frac{6.022 \times 10^{23}}{71}$ atoms of $Cl_2$ (g)

$= 0.0848 \times 10^{23}$ atoms of $Cl_2$ (g)

$= 8.48 \times 10^{21}$ atoms of $Cl_2$ (g)

Hence, 1 g of Li (s) will have the largest number of atoms.

**Q29. Calculate the molarity of a solution of ethanol in water in which the mole fraction of ethanol is 0.040 (assume the density of water to be one).**

**Answer :**

$$\text{Mole fraction of } C_2H_5OH = \frac{\text{Number of moles } C_2H_5OH}{\text{Number of moles of solution}}$$

$$0.040 = \frac{n_{C_2H_5OH}}{n_{C_2H_5OH} + n_{H_2O}} \quad \ldots\ldots\ldots(1)$$

Number of moles present in 1 L water:

$$n_{H_2O} = \frac{1000\,g}{18\,g\,mol^{-1}}$$

$$n_{H_2O} = 55.55\,mol$$

Substituting the value of $n_{H_2O}$ in equation (1),

$$\frac{n_{C_2H_5OH}}{n_{C_2H_5OH} + 55.55} = 0.040$$

$$n_{C_2H_5OH} = 0.040\, n_{C_2H_5OH} + (0.040)(55.55)$$

$$0.96 n_{C_2H_5OH} = 2.222\,mole$$

$$n_{C_2H_5OH} = \frac{2.222}{0.96}\,mole$$

$$n_{C_2H_5OH} = 2.314\,mole$$

$$\therefore \text{ Molarity of solution } = \frac{2.314\,mol}{1L}$$

$$= 2.314 \text{ M}$$

**Q30. What will be the mass of one 12C atom in g ?**

**Answer :**

1 mol of 12C atoms = $6.022 \times 10^{23}$ atoms = 12g

∴ Mass of 1 atom 12C = $12 / 6.022 \times 10^{23}$ g = $1.9927 \times 10^{-23}$ g

**Q31. How many significant figures be present in answer of the following calculations?**

**(i) 0.02856 × 298.15 × 0.112 /0.5785**

**(ii) 5 × 5.364**

**(iii) 0.0125 + 0.7864 + 0.0215**

**Answer :**

(i) $= \frac{0.2856 \times 298.15 \times 0.112}{0.5785}$

Least precise number of calculation = 0.112

∴ Number of significant figures in the answer

= Number of significant figures in the least precise number

= 3

(ii) 5 × 5.364

Least precise number of calculation = 5.364

∴ Number of significant figures in the answer = Number of significant figures in 5.364

= 4

(iii) 0.0125 + 0.7864 + 0.0215

Since the least number of decimal places in each term in four, the number of significant figures in the answer is also 4.

**Q32. Use data given in the following table and calculate the molar mass of the naturally occuring argon of isotopes:**

| Isotope | Isotopic molar mass | Abundance |
|---|---|---|
| 36Ar | 35.96755 g $mol^{-1}$ | 0.337% |
| 38Ar | 37.96272 g $mol^{-1}$ | 0.063% |
| 40Ar | 39.9624 g $mol^{-1}$ | 99.600% |

**Answer :**

Molar mass of argon

$$= \left[\left(35.96755 \times \frac{0.337}{100}\right) + \left(37.96272 \times \frac{0.063}{100}\right) + \left(39.9624 \times \frac{90.60}{100}\right)\right] \text{ gmol}^{-1}$$

$$= \left[0.121 + 0.024 + 39.802\right] \text{ gmol}^{-1}$$

= 39.947 gmol -1

**Q33. Calculate number of atoms in each of following**

**(i) 52 moles of Ar**
**(ii) 52 u of He**
**(iii) 52 g of He.**

**Answer :**

(i) 1 mole of Ar = $6.022 \times 10^{23}$ atoms of Ar

$\therefore$ 52 mole of Ar = $52 \times 6.022 \times 10^{23}$ atoms of Ar

$= 3.131 \times 10^{25}$ atoms of Ar

(ii) 1 atom of He = 4 u of the

Or,

4 u of He = 1 atom of He

1 u of He $= \frac{1}{4}$ atom of He

52u of He = $= \frac{52}{4}$ atom of He

= 13 atoms of He

(iii) 4 g of He = $6.022 \times 10^{23}$ atoms of He

$\therefore$ 52 g of He = $= \frac{6.022 \times 10^{23} \times 52}{4}$ atoms of He

$= 7.8286 \times 10^{24}$ atoms of He

**Q34. A Welding fuel gas contains the carbon and hydrogen only. Burning of a small sample of it in oxygen give 3.38 gm carbon dioxide , 0.690 gm of water and no other product. A Volume of 10.0 L (Measured at STP) of this Welding gas is found weigh 11.6 g. Calculate**

**(i) empirical formula**
**(ii) molar mass of the gas**
**(iii) molecular formula.**

**Answer :**

Amount of carbon in 3.38 g of $CO_2$ = 12/44 × 3.38 g = 0.9218 g
Amount of hydrogen in 0.690 g $H_2O$ = 2/18 × 0.690 g = 0.0767 g
The compound contains only C and H, therefore total mass of the compound = 0.9218 + 0.0767 = 0.9985 g
% of C in the compound = (0.9218 /0.9985 )×100 = 92.32
% of H in the compound = (0.0767 /0.9985 )×100 = 7.68
(i) Calculation of empirical formula,
Moles of carbon in the compound = 92.32/12 = 7.69
Moles of hydrogen in the compound = 7.68/1 = 7.68
Simplest molar ratio = 7.69 : 7.68 = 1(approx)
∴ Empirical formula CH
(ii) 10.0 L of gas at STP weighs = 11.6 g

∴ 22.4 L of the gas at STP = 11.6/10.0 × 22.4 = 25.984 = 26 (approx)
∴ Molar mass of gass = 26 g mol-1
(iii) Mass of empirical formula CH = 12+1 = 13

∴ n = Molecular Mass/Empirical Formula = 26/13 = 2

∴ Molecular Formula = $C_2H_2$

**Q35. Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and $CO_2$ according to the reaction, $CaCO_3$ (s) + 2HCl (aq) → $CaCl_2$(aq) + $CO_2$(g) + $H_2O$(l)**
**What mass of the $CaCO_3$ is required to reacts completely with the 25 mL of 0.75 M HCl?**

**Answer :**

0.75 M of HCl ≡ 0.75 mol of HCl are present in 1 L of water

$\equiv \left[(0.75\,mol)\times(36.5\,gmol^{-1})\right]$ HCl is present in 1 L of water
≡ 27.375 g of HCl is present in 1 L of water
Thus, 1000 mL of solution contains 27.375 g of HCl.
∴ Amount of HCl present in 25 mL of solution

$$=\frac{27.375\,g}{1000\,mL}\times 25\,mL$$

= 0.6844 g
From the given chemical equation,

$$CaCO_{3(s)}+2HCl_{(aq)}\rightarrow CaCl_{2(aq)}+CO_{2(g)}+H_2O_{(l)}$$

2 mol of HCl (2 × 36.5 = 71 g) react with 1 mol of $CaCO_3$ (100 g).
∴ Amount of $CaCO_3$ that will react with 0.6844 g $=\frac{100}{71}\times 0.6844\,g$
= 0.9639 g

**Q36. Chlorine is prepared in laboratory by treating the manganese dioxide ($MnO_2$) with the aqueous hydrochloric acid and according to the reaction**
**4HCl + $MnO_2$(s) → 2$H_2O$ + MnCl2 + $Cl_2$(g)**
**How many gram of HCl reacts with the 5.0 g of Manganese dioxide?**

**Answer :**

1 mol [55 + 2 × 16 = 87 g] MnO2 reacts completely with 4 mol [4 × 36.5 = 146 g] of HCl.

5.0 g of $MnO_2$ will react with

$$= \frac{146\ g}{87\ g} \times 5.0\ g$$ of HCl

= 8.4 g of HCl

Hence, 8.4 g of HCl will react completely with 5.0 g of manganese dioxide.