

Chapter 1. Some Basic Concepts of Chemistry

Question-1

Classify the following as pure substances or mixtures separate to pure substances into elements and compounds and divide the mixtures into homogeneous and heterogeneous categories:

(i) Bronze (ii) Smoke (iii) Pencil lead (iv) Antenna rod

Solution:

- (i) Bronze = a mixture of Cu & Sn - Homogenous mixture.
- (ii) Dust = a mixture of carbon particle and air - Heterogenous mixture.
- (iii) Pencil lead = Pure element - Graphite.
- (iv) Antenna rod = Aluminium.

Question-2

Calculate number of moles for the following ?

(i) 360 gms of H_2O (ii) 5.6 gms of Nitrogen (iii) 4 gms of $NaOH$.

Solution:

- (i) No. of moles of $H_2O = \frac{wt}{mwt} = \frac{360}{18} = 20$;
- (ii) Number of moles of $N_2 = \frac{5.6}{28} = 0.2$;
- (iii) Number of moles of $NaOH = \frac{4}{40} = 0.1$.

Question-3

Calculate the number of moles of H_2SO_4 present in 50 ml of 0.2m H_2SO_4 .

Solution:

0.2m means it contains 0.2 moles per litre.

1000 ml contains 0.2 moles at H_2SO_4

$$\therefore 50 \text{ ml contains} = \frac{0.2}{1000} \times 50 = \frac{2 \times 10^{-1} \times 50}{10^3} = 10 \times 10^{-2} = 0.01 \text{ moles.}$$

Question-4

What is molarity of a solution contain 5.84 gms of NaCl in 200 ml of solution?

Solution:

$$\text{Number of moles of NaCl} = \frac{\text{wt}}{\text{m.wt}} = \frac{5.84}{58.48} = 0.1$$

$$\text{Molarity} = \frac{\text{moles}}{\text{litre}}$$

$$\text{Volume of solution in litre} = \frac{200}{1000} = 0.2$$

$$\therefore \text{Molarity of the solution} = \frac{0.1}{0.2} = \frac{1 \times 10^{-1}}{2 \times 10^{-1}} = 0.5\text{M}.$$

Question-5

What is weight of NaOH present in 250 cc of a 2M solution?

Solution:

2M of NaOH solution means it contains 2 moles of NaOH per litre

$$1000\text{ml} = 2 \text{ moles of NaOH}$$

$$\text{Number of moles of NaOH present in 250cc} = \frac{2}{1000} \times 250 = \frac{2}{4} = 0.5$$

$$\text{Mole} = \frac{\text{wt}}{\text{m.wt}}; \text{wt} = \text{mole} \times \text{m.wt}$$

$$\therefore \text{Weight of NaOH present in 250 ml of solution} = 0.5 \times 40 = 20 \text{ gm.}$$

/ Through Formula /

$$\text{Weight of substance in 1 lit solution} = \text{Molarity} \times \text{m.wt}$$

$$\text{Weight of NaOH present in 1 lit solution} \downarrow = 2 \times 40 \text{ gms}$$

$$\therefore \text{Weight of NaOH present in 250cc solution} = \frac{2 \times 40 \times 250}{1000} = 20 \text{ gms.}$$

Question-6

In a reaction vessel 0.980 gm of H_2SO_4 is required to be added for completing the reaction. How many millilitre of 0.05 M H_2SO_4 solution should be added for this requirement?

Solution:

0.05 M H_2SO_4 means 0.05 moles of H_2SO_4 pressure in 1000 ml;

1 litre of 0.05 m H_2SO_4 contains = molarity \times m.wt = $0.05 \times 98 = 5 \times 10^{-2} \times 98 = 4.9$ gms of H_2SO_4

$$\therefore 1 \text{ ml contains} = \frac{4.9}{1000} = 4.9 \times 10^{-3} \text{ gms of } \text{H}_2\text{SO}_4$$

$$4.9 \times 10^{-3} \text{ of gms of } \text{H}_2\text{SO}_4 = 1 \text{ ml of solution}$$

$$\therefore 0.980 \text{ gms of } \text{H}_2\text{SO}_4 = \frac{1}{4.9 \times 10^{-3}} \times 0.980 = \frac{98 \times 10^{-2}}{49 \times 10^{-4}} = 2 \times 10^2 = 200 \text{ ml.}$$

Through formula :

Wt. of H_2SO_4 present in 1 lt = Molarity \times m.wt

Wt. of H_2SO_4 present in 1 lt of 0.05M = $0.05 \times 98 \text{ gm} = 98 \times 5 \times 10^{-2} \text{ gms} = 4.9 \text{ gms.}$

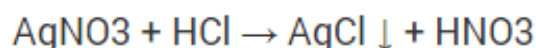
$\therefore 4.9$ gms is present in 1000 ml

$$\begin{aligned} \text{Hence, } 0.980 \text{ gms is present in } & \frac{1000}{4.9} \times 0.98 \\ & = \frac{1000 \times 98 \times 10^{-2}}{49 \times 10^{-1}} \\ & = 200 \text{ ml.} \end{aligned}$$

Question-7

How much AgCl will be formed by adding 200ml of 5M HCl to the solution containing 1.7 gms of AgNO_3 ?

Solution:



200 ml of 5M HCl contains 1.7g of AgNO_3

$$\therefore 1000 \text{ ml of 1M HCl will contain } - \frac{1.7 \times 1000}{200 \times 5} = 1.7 \text{g}$$

Hence 1M solution of HCl contains 1.7 g of AgNO_3 .

Question-8

Calculate the weight of HCl in 10 ml of con. HCl of density 1.2 gm L^{-1} container 35% HCl by weight. What is the molarity of the solution?

Solution:

35% HCl means 35 gm of HCl are present in 100 gms of HCl solution.

$$\therefore \text{Volume of 100 gms of given HCl solution} = \frac{\text{mass}}{\text{density}} = \frac{100}{1.2} = 83.3 \text{ ml}$$

83.3 ml of con. HCl contains 35 gms of HCl

$$\therefore 10 \text{ ml of con. HCl contains } \frac{35}{83.3} \times 10 = \frac{350}{83.3} = 4.20 \text{ gms of HCl.}$$

$$\text{Molarity of the solution} = \left(\frac{\text{wt}}{\text{mwt}} \right) \times \frac{1000}{10} \text{ (in litre)}$$

$$= \frac{4.2}{36.45} \times \frac{1000}{10}$$

$$= \frac{420}{36.45} = 1.15 \text{ M.}$$

Question-9

The molarity of con. HCl is 1.15M; what volume of con. HCl is required to make 1.00 of 0.1M HCl.

Solution:

Known Unknown

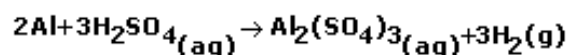
$$V_1 M_1 = V_2 M_2$$

$$1000 \text{ ml} \times 0.1 \text{ M} = V_2 \times 1.15 \text{ M}$$

$$V_2 = \frac{1000 \times 0.1}{1.15} \text{ ml} = \frac{100}{1.15} = \frac{100 \times 10^2}{115} = 86.9 \text{ ml.}$$

Question-10

Aluminium and Sulphuric acid react according to the reaction :



If 0.5 mol Al are added to H_2SO_4 solution containing 0.2 mole H_2SO_4 , how many moles of H_2 are produced.

Solution:

As per equation, 2 moles Al reacts with 3 moles of H_2SO_4 to produce 3 mole of H_2 .

$$\therefore 0.5 \text{ ml Al reacts with 3 mole of } \text{H}_2\text{SO}_4 \frac{3}{0.5} \text{ moles of } \text{H}_2.$$

$$\begin{aligned}\therefore 0.5 \text{ ml of Al reacts with 0.2 mole of } \text{H}_2\text{SO}_4 &= \frac{3}{0.5} \times \frac{1}{3} \times 0.2 \text{ mole of } \text{H}_2 \\ &= \frac{0.2}{0.5} \text{ moles of } \text{H}_2 \\ &= \frac{2}{5} = 0.4 \text{ moles of } \text{H}_2.\end{aligned}$$