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Chemistry Class 12 NCERT Solutions: Chapter 2 Solutions Part 6

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Q: 5. 10% w/w solution of glucose in water means that 10g of glucose is present in 100g of the solution i.e., 10 g of glucose is present in $(100 - 10) \text{ g} = 90 \text{ g}$ of water.

Molar mass of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) = $6 \times 12 + 12 \times 1 + 6 \times 16 = 180 \text{ g mol}^{-1}$

Then, number of moles of glucose = $\frac{10}{180} \text{ mol}$

$$= 0.056 \text{ mol}$$

\therefore Molality of solution = $\frac{0.056 \text{ mol}}{0.09 \text{ kg}} = 0.62 \text{ m}$

Number of moles of water = $\frac{90 \text{ g}}{18 \text{ g mol}^{-1}}$

$$= 5 \text{ mol}$$

$$(x_g) = \frac{0.056}{0.056 + 5}$$

\Rightarrow Mole fraction of glucose = 0.011

And, mole fraction of water $x_w = 1 - x_g$

$$= 1 - 0.011$$

$$= 0.989$$

If the density of the solution is 1.2 g mL^{-1} , then the volume of the 100g solution can be given as:

$$= \frac{100 \text{ g}}{1.2 \text{ g mL}^{-1}}$$

$$= 83.33 \text{ mL}$$

$$= 83.33 \times 10^{-3} \text{ L}$$

\therefore Molarity of the solution = $\frac{0.056 \text{ mol}}{83.33 \times 10^{-3} \text{ L}}$

$$= 0.67 \text{ M}$$

Q: 6. How many mL of 0.1M HCl are required to react completely with 1g mixture of Na_2CO_3 and NaHCO_3 containing equimolar amounts of both?

Ans:

Let the amount of Na_2CO_3 in the mixture be x g.

Then, the amount of NaHCO_3 in the mixture is $(1 - x)g$.

Molar mass of $\text{Na}_2\text{CO}_3 = 2 \times 23 + 1 \times 12 + 3 \times 16$

$$= 106 \text{ g mol}^{-1}$$

$$\therefore \text{Number of moles } \text{Na}_2\text{CO}_3 = \frac{x}{106} \text{ mol}$$

Molar mass of $\text{NaHCO}_3 = 1 \times 23 + 1 \times 1 \times 12 + 3 \times 16$

$$= 84 \text{ g mol}^{-1}$$

$$\therefore \text{Number of moles of } \text{NaHCO}_3 = \frac{1 - x}{84} \text{ mol}$$

According to the question,

$$\frac{x}{106} = \frac{1 - x}{84}$$

$$\Rightarrow 84x = 106 - 106x$$

$$\Rightarrow 190x = 106$$

$$\Rightarrow x = 0.5579$$

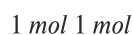
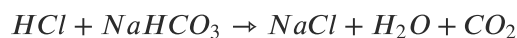
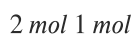
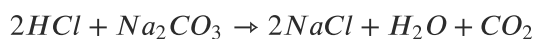
$$\text{Therefore, number of moles of } \text{Na}_2\text{CO}_3 = \frac{0.5579}{106} \text{ mol}$$

$$= 0.0053 \text{ mol}$$

$$\text{And, number of moles of } \text{NaHCO}_3 = \frac{1 - 0.5579}{84}$$

$$= 0.0053 \text{ mol}$$

HCl reacts with Na_2CO_3 and NaHCO_3 according to the following equation.



1 mol of Na_2CO_3 reacts with 2 mol of HCl .

Therefore, 0.0053 mol of Na_2CO_3 reacts with $2 \times 0.0053 \text{ mol} = 0.0106 \text{ mol}$.

Similarly, 1 mol of NaHCO_3 reacts with 1 mol of HCl .

Therefore, 0.0053 mol of NaHCO_3 reacts with 0.0053 mol of HCl .

Total moles of HCl required = $(0.0106 + 0.0053) \text{ mol}$

$$= 0.0159 \text{ mol}$$

In 0.1M of HCl

0.1mol of HCl is preset in 1000 mL of the solution.

Therefore, 0.0159 mol of HCl is present in $\frac{1000 \times 0.0159}{0.1} mol$

= 159 mL of the solution

Hence, 159 mL of 0.1 M of HCl is required to react with $1g$ mixture of Na_2CO_3 and $NaHCO_3$, containing equimolar amounts of both.

Q: 7. A solution is obtained by mixing 300 g of 25% solution and 400 g of 40% solution by mass. Calculate the mass percentage of the resulting solution.

Answer:

Total amount of solute present in the mixture is given by,

$$\begin{aligned} & 300 \times \frac{25}{100} + 400 \times \frac{40}{100} \\ &= 75 + 160 \\ &= 235g \end{aligned}$$

Total amount of solution = $300 + 400 = 700g$

Therefore, mass percentage (w/w) of the solute in the resulting solution, = $\frac{235}{700} \times 100\%$

$$= 33.57\%$$

And, mass percentage (w/w) of the solvent in the resulting solution,

$$= (100 - 33.57) \%$$

$$= 66.43\%$$