



CHEMISTRY • CLASS 12

CHAPTER 1

Solutions

NCERT SOLUTIONS

SOLUTION TYPES: GASES & LIQUIDS

1.1 Define solution. How many types of solutions are formed? Briefly describe each type with an example.

Solution:

A solution is a homogeneous mixture of two or more components. Its composition is uniform throughout. The solvent determines the physical state of the solution.

There are three main classes: gaseous, liquid and solid solutions. Each can contain a gas, liquid or solid solute, giving nine combinations.

Solvent / solution state	Solute state	Example
Gas	Gas	Oxygen in nitrogen
Gas	Liquid	Chloroform vapour in nitrogen
Gas	Solid	Camphor vapour in nitrogen
Liquid	Gas	Oxygen dissolved in water
Liquid	Liquid	Ethanol in water
Liquid	Solid	Glucose in water

The three solid-solution combinations continue on the next image.

SOLID SOLUTIONS

1.1 Continued: Describe solid solutions with examples.

A solid solution has a solid solvent. Its solute may be a gas, liquid or solid.

Solute state	Solid solvent	Example
Gas	Palladium	Hydrogen in palladium
Liquid	Sodium	Amalgam of mercury with sodium
Solid	Gold	Copper in gold

1.2 Give an example of a solid solution in which the solute is a gas.

Answer: Hydrogen dissolved in palladium.

Hydrogen is the gaseous solute. Palladium is the solid solvent, so the resulting solution is solid.

CONCENTRATION TERMS

1.3 Define (i) mole fraction, (ii) molality, (iii) molarity and (iv) mass percentage.

(i) Mole fraction:

Moles of one component divided by the total moles of all components.

$$x_i = \frac{n_i}{\sum n_i} \quad \text{No unit}$$

(iii) Molarity:

Moles of solute per litre of solution.

$$M = \frac{n(\text{solute})}{\text{volume of solution in L}} \quad \text{Unit: mol L}^{-1}$$

(ii) Molality:

Moles of solute per kilogram of solvent.

$$m = \frac{n(\text{solute})}{\text{mass of solvent in kg}} \quad \text{Unit: mol kg}^{-1}$$

(iv) Mass percentage:

Mass of a component as a percentage of the total solution mass.

$$\text{mass \%} = \frac{\text{mass of component}}{\text{mass of solution}} \times 100$$

For molality use solvent mass. For molarity use solution volume.

MOLARITY OF NITRIC ACID

1.4 Concentrated aqueous nitric acid is 68% by mass. Find its molarity if the solution density is 1.504 g mL^{-1} .

Solution

Take one litre of solution.

$$V = 1 \text{ L} = 1000 \text{ mL}$$

$$\text{Mass of solution} = \rho V = 1.504 \times 1000 = 1504 \text{ g}$$

$$\text{Mass of HNO}_3 = \frac{68}{100} \times 1504 = 1022.72 \text{ g}$$

$$\text{Molar mass of HNO}_3 = 1 + 14 + 3(16) = 63 \text{ g mol}^{-1}$$

$$n(\text{HNO}_3) = \frac{1022.72}{63} = 16.23 \text{ mol}$$

$$M = \frac{n}{V} = \frac{16.23}{1} = 16.23 \text{ mol L}^{-1}$$

$$\text{Molarity} \approx 16.2 \text{ M}$$



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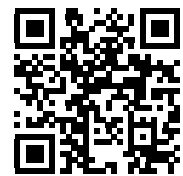


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