# SOLUTIONS AND SOLUBILITY

A solution is a uniform or homogenous mixture of a solute and a solvent. A solute is a dissolved substance which may be a solid, liquid, or gas. A solvent is a substance (usually a liquid, although it may be a solid or a gas) which dissolves a solute.

## Types of Solution

**True and False Solution.** Solutions could either be a *true* or *false* solution. A true solution is the kind of solution that has all its solute particles completely dissolved. The solute particles, which are simple molecules or ions, are too small to be seen by the naked eye and are called crystalloids. Examples of true solution are aqueous solution of NaCl and $CuSO_4$.

In false solutions or colloidal solution, the individual solute particles are larger than the solute particles of the true solution, but not large enough to be seen by the naked eye. Some

examples of colloids are starch, albumen, foam/lather, emulsions and sols/gels.

A **suspension** is not really a solution as its supposed solute (i.e. dispersed particles) do not dissolve at all but settle down if allowed to stand for a while. Simply put, a suspension is "a heterogenous mixture of undissolved particles in a given medium." The particles are usually large enough to be seen without the aid of an instrument and they eventually settle down if left standing. Harmattan is an example of a suspension of dust in air.

Some suspensions are too small to be seen. They appear to have dissolved in the medium and may not settle on any exposed surface. Such examples are described as colloidal suspension. They have the characteristics of both colloids and suspensions. Examples are clouds, fogs, smoke and aerosol sprays.

**Saturated, Unsaturated, and Supersaturated Solution.** A saturated solution of a solute at a particular temperature is one which contains as much solute as it can dissolve at that temperature in the presence of undissolved solute particles.

The composition of a saturated solution is not affected by the presence of excess solute particles. On the other hand, an unsaturated solution can continue to dissolve more solutes, if added, until the solution becomes saturated. The concentration of a saturated solution varies with the solute, the solvent and with the temperature (solubility varies directly as temperature).

Supersaturated solution is one which contains more of the solute than it can normally hold at that temperature.

## Solubility

The solubility of solute in a solvent at a particular temperature is the maximum amount of the solute in moles or grammes that will saturate $1dm^3$ of the solvent at that temperature.

The method of determining the solubility of a given solute involves two stages:

- Preparing a saturated solution of the given solute at the specified temperature;
- Taking a known mass of the saturated solution and heating it to dryness so that the exact mass of the solvent and the solute in the saturated solution at that temperature can be calculated.

When the solubilities of a solute in a given solvent are plotted against their respective temperatures, a *solubility graph* or *curve* will be obtained. This curve show the effect of temperature on the solubility of substance. Mathematically:

$$Solubility\ (mol/dm^3) = \frac{mass}{molar\ mass} \times \frac{1000}{vol/mass\ of\ H_2O}$$

$$Solubility\ (g/dm^3) = mass \times \frac{1000}{vol/mass\ of\ H_2O}$$