Chapter 1

Nature and composition of substances

Substance (or chemical substance): A "substance" is a kind of matter that can not be separated into other kinds of matter by any physical process. e.g. gold, silver, iron, sodium chloride, calcium carbonate etc.

Pure substance: is one that is a single substance and has a uniform composition. Such a substance always have the same texture and taste. e.g. water, salt, sugar etc.

Types of pure substances :

Two different types of pure substances are

(i) Element: An element is a substance which can not be split up into two or more simpler substances by usual chemical methods of applying heat, light or electric energy. e. g. hydrogen, oxygen, sodium, chlorine etc.

(ii) Compound: A compound is a substance made up of two or more elements chemically combined in a fixed ratio by weight e.g. H_2O (water), NaCl (sodium chloride) etc.

Mixture: A mixture is a substance which consists of two or more elements or compounds not chemically combined together. e.g. Air is a mixture of nitrogen, oxygen, inert gases, water vapour, carbon dioxide etc.

Types of mixtures : Mixtures are impure substances. They are of two types:

(i) Homogeneous mixture: It has a uniform composition throughout and its components can not be distinguished visually.
E.g. A well mixed sample of vinegar.

(ii) Heterogeneous mixture: It is one that is not uniform throughout. Different samples of a heterogeneous mixture may have different composition. e.g. a mixture of salt and pepper.

Solution : It is a homogeneous mixture of two or more substances whose composition can be varied.
e.g. Solution of common salt in water, solution of ammonia in water.

Separating the components of a mixture : Various methods are used for separating the constituents of a mixture.

1. Insoluble solid in solvent - Sedimentation followed by filtration. In case of a fine solid centrifugation is used instead of filtration
2. Solution of solid in liquid - Evaporation, crystallization, distillation
3. Miscible mixture of liquids - Fractional distillation
4. Immiscible mixture of liquids - Separating funnel
5. Mixture of two solids one of which is sublime - Sublimation
6. Mixture of substances in solution - Chromatography

Solute : The component of solution that is dissolved and present in smaller quantities in a solution is known as solute. e.g. common salt in case of solution of common salt in water and ammonia in case of solution of ammonia in water.

Solvent : The component of solution in which solute is dissolved is known as solvent. It is always present in larger amount in a solution. e.g. water in case of the solution of common salt or ammonia in water.

Saturated Solution : A solution in which no more solute can be dissolved at the same temperature is called Saturated solution.

Unsaturated Solution : It is a solution in which more solute can be dissolved at the same temperature.

Super-saturated Solution : It is a solution which contains more mass of the dissolved solute than the saturated solution at the same temperature and pressure.

Alloys : Alloys are homogeneous mixtures of metal and can not separated into their components by physical methods.
e.g. Brass is a mixture of copper (Cu) and zinc (Zn).

Concentration of a solution : Concentration of a solution is the amount of solute present in a given amount (mass or volume) of a solution or the amount of solute dissolved in a given mass or volume of a solvent.
Amount of solute Concentration = Amount of solvent
Solubility : It is defined as the amount of solute dissolved in 100g of solvent to form a saturated solution.

Suspension : It is a non-homogeneous mixture in which solids are dispersed in liquids. In it the solute particles do not dissolve but remains suspended through out the bulk of the medium.

Colloids or colloidal solution : Colloid is a heterogeneous mixture. The size of particles of a colloid is intermediate between true solutions and suspensions (i.e between 1nm and 100 nm). The particles of a colloid can not be seen with naked eye.
Types of colloidal solution : Since colloidal solution is heterogeneous mixture it consists of two phases. These are
(i) dispersed phase (colloidal particles)
(ii) dispersion medium (The medium in which colloidal particles are dispersed).

Emulsion : Emulsions are liquid-liquid colloids.
Types of Emulsion : Emulsions are of two types :
(i) water in oil
(ii) oil in water
Emulsifiers are those substances that help in forming stable emulsions of oil and water, e.g. milk, cod-liver oil, cold creams, vanishing creams, moisturising cream, paints, etc.

Elements - Elements are a type of pure substances. An element is a substance that can not be split into two or more simpler substances by usual chemical methods of applying heat, light or electric energy.

Types of elements : Elements have been divided into metals and non-metals. All metals (except mercury) are solids. e.g. sodium, potassuim, gold, silver etc.
All non-metals are solids or gases (Bromine is an exception as it is a liquid non-metal) e.g. hydrogen, oxygen, carbon, bromine, chlorine, iodine etc.

Compound : A compound is a substance made up of two or more elements chemically combined in a fixed ratio by weight. e.g. water (H_2O) is a compound made up of two
Elements. Hydrogen and Oxygen chemically combined in a fixed proportion of 1: 8 by weight.