First Concepts and Definitions of Chemistry

Chemistry - The science dealing with matter and its transformations.

Matter - Anything that has mass and occupies space.

Mass - The measure of the quantity of matter in anything.

Atoms - The fundamental building units of which all matter is composed.

Chemical symbol - One- or two-letter abbreviation for the name of an element. [Learn the names and symbols of the common elements on the hand-out "Some Common Elements".]

Molecule - Chemical entity composed of a certain number of atoms with a particular shape.

Molecular formula - Symbolic representation of the chemical composition of a molecule in which the number of atoms of each element is indicated by a subscript; e.g., H_2O = 2 H atoms + 1 O atom per molecule.

Heteronuclear molecule - Composed of atoms of two or more different elements; e.g.,
H_2O (water) CH_4 (methane) CH_3OH (methyl alcohol) H_2O_2 (hydrogen peroxide)

Homonuclear molecule - Composed of atoms of only one element; e.g.,
H_2 (hydrogen) Cl_2 (chlorine) S_8 (sulfur) P_4 (phosphorus)

Microscopic properties - Properties of the atoms and molecules (e.g., composition, shape.

Macroscopic properties - Large scale properties of matter, which are observed for bulk samples. Macroscopic properties of matter arise from the microscopic properties of the atoms and molecules of which they are composed.

State of Matter (Physical State) - Macroscopic form of a sample of matter as a solid, liquid, or gas.

Gas - Physical state in which the sample has no fixed volume or shape, but rather conforms to the volume and shape of its container. A **vapor** is the gas form of a substance that is more frequently encountered as a liquid or solid. The volume of a gas can be compressed or expanded readily.

Liquid - Physical state in which the sample has a fixed volume, but its shape depends upon the portion of the container it occupies. The volume of a liquid cannot be compressed or expanded appreciably.

Solid - Physical state in which the sample has both a fixed volume and shape. The volume of a solid cannot be compressed or expanded appreciably.

Pure substance (or **substance**) - Matter for which all samples have the same composition, regardless of source. A substance cannot be separated into other substances by physical means (e.g., physical separation, filtration, distillation). Substances may be either elements or compounds.

Element - A substance composed entirely of atoms of one type. A substance that cannot be decomposed into simpler substances by chemical means.

Compound - A substance composed of two or more elements joined in a fixed ratio by weight and having properties different from the individual elements.

Mixture - Combination of two or more substances in which each retains its own chemical composition and properties. Mixtures are separable into their component substances by physical means.

Homogeneous mixture - Mixture with uniform composition and properties throughout. A **solution** is a homogeneous mixture (e.g., sugar + water)

Heterogeneous mixture - Mixture with non-uniform composition having physically distinct parts (e.g., milk, oil-and-vinegar salad dressing).

Physical properties - Properties of matter having a particular composition (e.g., color, odor, hardness, density, physical state).

Chemical properties - Properties exhibited as composition changes (e.g., reactivity, flammability).

Intensive property - Property independent of the amount of matter in the sample (e.g., density, chemical composition).

Extensive property - Property dependent on the amount of matter in the sample (e.g., mass, volume, weight).

Physical change - Transformation in the state of matter (change of state) with no change in chemical composition (e.g., boiling, freezing).

Chemical change (reaction) - Transformation in the composition of matter.