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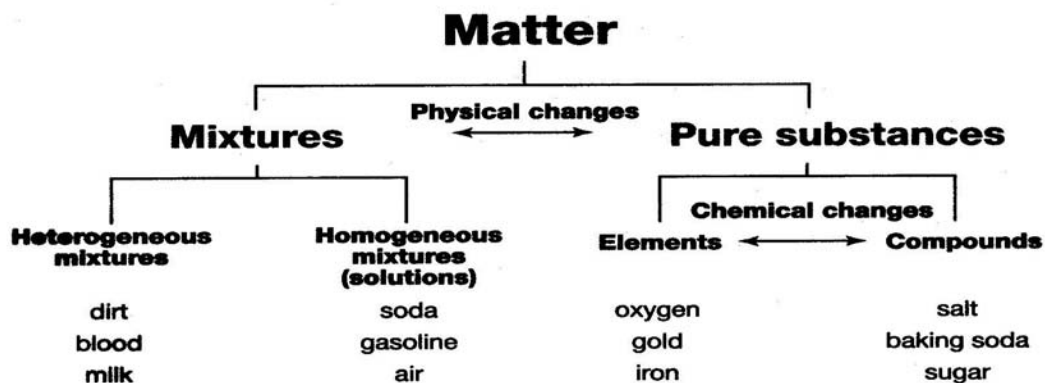
“Need to Know” Chapter 1 Matter and Change

Chemistry is the science that investigates and explains the structure and properties of matter.

Matter is anything that has mass and occupies space.

Mass is the measure of the amount of matter that an object contains. (The quantity of matter can be measured by determining the amount of matter.)

Properties of matter describe the characteristics and behavior of matter, including the changes that matter may undergo. Some properties can be observed just by looking at a sample (ex. color) but most properties are measured (ex. density) or tested (ex. flammability, reactivity with acids). **Macroscopic** observations (observable with your senses) of matter point toward its **submicroscopic** structure of atoms and molecules. Scientific models are used to connect macroscopic and submicroscopic views.



Classifying Matter by Composition (qualitative)

Qualitative observations are made without measurements of the amount.

“What is it but not how much”. *Example: Sucrose is made from hydrogen, carbon and oxygen.*

Quantitative observations include measurements of the amount.

“How much”. *Example: 100g sucrose contains 6.5g hydrogen, 42.1g carbon and 51.4g oxygen.*

Pure substances contain only one kind of matter. A substance can be an element or a compound.

Elements are the simplest form of matter and are made from only one type of atoms. Examples are carbon, sulfur, or oxygen and they are organized in the Periodic Table of the Elements. Each element is represented by a one- or two-letter **chemical symbol**, used to write chemical formulas of compounds. (C, N, Na...)

Compounds are made from more than one type of atoms and can be separated into simpler substances only by chemical methods, but not by physical methods. Each compound is made up of elements in exactly one specific ratio (as oppose to mixtures where the composition can vary). Properties of a compound are different from those of the elements composing it.

Mixtures

Mixtures are combinations of two or more substances that can be separated by physical methods, and have variable composition (e.g. saltwater may contain more or less salt). There are two types of mixtures:

Heterogeneous mixtures are not uniform in composition (different phases, different colors or types of particles can be distinguished, examples are oil-and-vinegar, or granite). Opaque liquids are also usually heterogeneous mixtures (ex. milk or orange juice).

Homogeneous mixtures, also called **solutions**, have uniform properties throughout and may be gases, liquids, or solids (examples are air, brass, sugar water, clear glass).

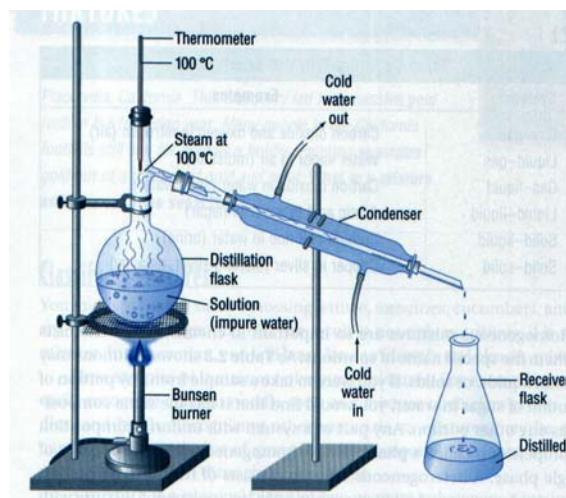
Alloys are solid solutions (homogenous mixtures) that contain different metals (brass, steel, bronze etc.).

When you dissolve sugar in water, sugar is the **solute** (the substance being dissolved) and water is the **solvent** (the substance that dissolves the solute). When the solvent is water, the solution is called an **aqueous solution**.

Examples of physical methods to separate mixtures: Filtering, sieving, evaporating, distilling, chromatography etc.

Physical Property of a substance can be observed or measured without changing the substance's composition. Examples: color, odor, hardness, boiling point, melting point, solubility, density...

Physical Change is a change of physical properties of matter without changing the chemical composition. Examples are boiling, freezing, evaporating, breaking, splitting, cutting, crushing...



Distillation set up

Chemical Property is the ability of a substance to undergo a chemical reaction (for example the ability to ignite (combustible), or being inert (non-reactive), reactivity with other substances like oxygen, acids or bases, corrosion, rusting, decomposition of organic matter, spoilage of food. A chemical property can only be observed when there is a chemical change.

Chemical Reaction or Chemical change is the change of one or more substances into other substances (or changing the chemical composition of a substance).

Conservation of matter: Mass is conserved in any physical or chemical change. The sum of masses of all reactants is equal to the sum of masses of all products. (In a chemical reaction atoms are neither created nor destroyed, but only rearranged.)

Exothermic and Endothermic

All chemical reactions involve some sort of energy change.

Chemical reactions that give off heat energy are called **exothermic** (exo = out) ex. dynamite

Chemical reactions that absorb heat energy are called **endothermic** (endo = into)

Ex: cooking; you need to heat up the food for it to be cooked, photosynthesis needs sunlight