

Chapter 3: Chemistry: Matter and Energy

These Notes are to SUPPLEMENT the Text, They do NOT Replace reading the Text Material. Additional material that is in the Text will be on your tests! To get the most information, READ THE CHAPTER prior to the Lecture, bring in these lecture notes and make comments on these notes. These notes alone are NOT enough to pass any test!

The author is providing these notes as an addition to the students reading the text book and listening to the lecture. Although the author tries to keep errors to a minimum, the student is responsible for correcting any errors in these notes.

Matter: Stuff the universe is composed of.

Characteristics It has mass and occupies space

States Solid Rigid, Fixed Shape

Liquid Definite volume, takes shape of container

Gas No fixed volume, takes shape of container

Physical Properties odor, color, volume, state (gas, liq, solid) density, MP, BP

Chemical Properties of a PURE SUBSTANCE - its ability to form new substances – ability to react

Vinegar reacts with sodium bicarbonate to produce carbon dioxide gas

Physical Changes

A. It does not affect the composition of the elements.

B. Involves a change in one or more physical properties, but no change in the fundamental components that make up the substance

Water goes from a Solid (ice) -> Liquid (water) -> Gas (steam) [and can go back to liquid or solid]

Chemical Change

A. It involves a change into a different substance

B. Involves a change in the fundamental components of the substance.

Electrolysis of water to Hydrogen and Oxygen

Example 3.2

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|--|-----------------|
| a. Iron goes from a solid to a liquid when heated – it melts | Physical change |
| b. Iron combines with oxygen to produce a red substance – rust | Chemical Change |
| c. Wood burns to produce water and carbon dioxide | Chemical Change |
| d. Break a rock into smaller pieces | Physical Change |
| e. Milk turns sour | Chemical Change |
| f. A Plant Grows | Chemical Change |

- Reaction** Involves a Chemical change
- Elements** Fundamental substances - cannot be broken down into other substances by chemical means.
- Compounds** Atoms of certain elements bind together in special ways to form a compound. Substances that have the same composition no matter where we find them. Compounds are made up of elements.
- Mixture** Something that has a variable composition.
It can "Usually" be separated into pure substances
Wood, Coffee, wine [red, white, sweet, dry]
- Pure Substance** Elements or compounds. Pure Substances will always have the same composition.
Pure Water is H₂O
Pure has the same Physical and Chemical Properties, made of same elements

Mixture

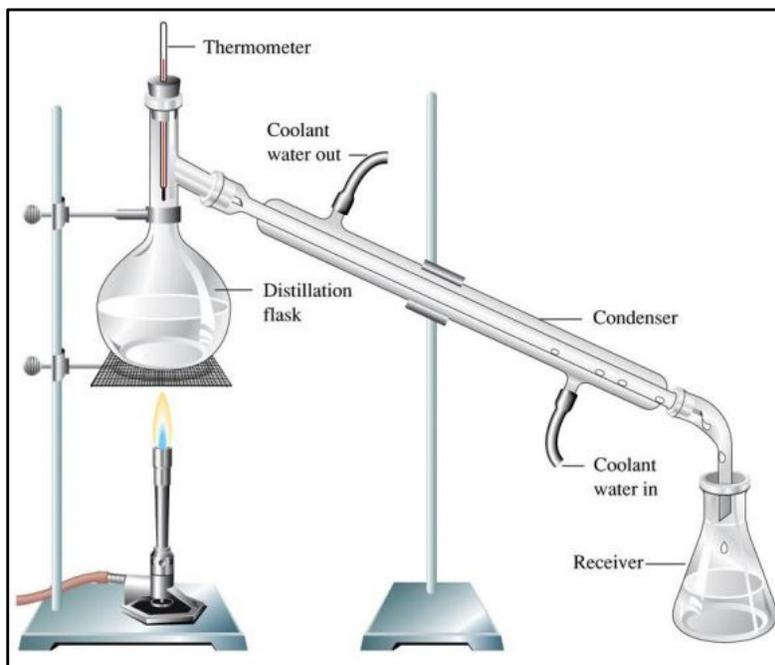
Homogeneous: same throughout - also called a Solution: Salt water, air

Heterogeneous: Contains regions that have different properties from those of other regions
Sand in water

Example 3.3 Hetero or Homogeneous Mixtures

- | | |
|--|---------------------------------|
| a. Gasoline | Homogeneous |
| b. A water stream with gravel on the bottom | Heterogeneous |
| c. Brass [mixture of copper and zinc] | Homogeneous |
| Not a pure substance as there are different kinds of brass depending on the amounts of copper and zinc | |
| d. Copper Metal | Pure substance – its an element |

Separation of Mixtures



Distillation: Boil Solid / Liquid -> Collect and cool the gas -> condenses to pure solid / liq
Distill sea water to give pure water [no salt]

Filtration: Separation of a heterogeneous mixture - sand and water [separate ppts]

Energy, Temperature and Heat ENERGY IS NOW CHAPTER 10

Energy is the capacity to do work

Heat is the flow of energy due to a temperature difference

Exothermic evolution of heat

Endothermic absorbs energy

Calorie energy required to raise the temp of 1 gram of water by 1 deg C - Metric System

Joule Energy unit in the SI System 1 cal = 4.184 J

Specific Heat Capacity Amount of energy to change the temp of one gram of a substance by 1 deg C
Also called the Specific Heat - Joules / Gram Deg C

Energy (heat) required = Specific Heat Capacity * Mass in Grams * Change in Temp in Deg C

Homework Problems:

Chapter 3, p66++ Q&P: 11, 12 – try some of them and ask questions if you have a problem!