

Chapter 1: Basic Concepts of Matter

Section 1.1 Chemistry: The Study of Matter

- Chemistry - field of study concerned w/ the characteristics, composition, and transformations of matter
 - o Includes all naturally occurring things
 - Living and nonliving
 - Things that can be seen (dirt, plants, etc.)
 - Things that cannot be seen (air, bacteria, etc.)
 - o Also includes materials that do not occur naturally
 - Things that are made in a laboratory using naturally occurring starting materials

Section 1.2 Physical States of Matter

- 3 physical states exist
 - o Solid - characterized by a definite shape and a definite volume
 - o Liquid - characterized by an indefinite shape and a definite volume
 - o Gas - characterized by an indefinite shape and an indefinite volume
- State of matter seen for a particular substance depends on...
 - o Its temperature (e.g. water)
 - o Surrounding pressure
 - o Strength of the forces holding its structural particles together

Section 1.3 Properties of Matter

- Different kinds of matter are distinguished from each other by their properties
- Property - a distinguishing characteristic of a substance that is used in its identification and description
- Are of 2 general types
 - o Physical
 - A characteristic of a substance that can be observed w/out changing the basic identity of the substance

- e.g.: color, physical state, melting pt., boiling pt., and hardness
- o Chemical
 - A characteristic of a substance that describes the way the substance undergoes or resists change to form a new substance
 - e.g.: flammability (or non-flammability), decomposition of a high temperature (or lack of decomposition), and reaction w/ Cl (or lack of reaction w/ Cl)

Section 1.4 Changes in Matter

- Changes in matter are classified into 2 categories:
 - o Physical change – a process in which a substance changes its physical appearance but not its chemical composition
 - New substance **never** formed as a result
 - Most common type = change in physical state
 - o Chemical change – a process in which a substance undergoes a change in chemical composition
 - New substance made has properties and a composition that is distinct/different from those of original materials

Section 1.5 Pure Substances and Mixtures

- Pure substance – a single kind of matter that cannot be separated into other kinds of matter by any physical means
 - o e.g. water, sucrose (table sugar)
 - o Always has a definite and constant composition
- Mixture – a physical combination of 2 or more pure substances in which each substance retains its own chemical identity
 - o ex. mixture of salt and sand
 - o Cannot be separated by physical means
 - o Variable composition
 - o Sub classified as 2 types

- Heterogeneous mixture - a mixture that contains visibly different phases/parts, each of which has different properties
 - e.g. chocolate chip cookie, blueberry muffins, rocks, soil, wood
- Homogeneous mixture - a mixture that contains only one visibly distinct phase/part, which has uniform properties throughout
 - e.g. sugar-water mixture, air, 14-karat gold

Section 1.6 Elements and Compounds

- 118 elements out of 9 million pure substances
 - o All the rest are compounds
- Element - a pure substance that cannot be broken down into simpler pure substances by chemical means such as a chemical reaction, an electric current, heat, or a beam of light
 - o e.g. copper, silver, gold, oxygen (O_2)
- Compound - a pure substance that can be broken down into 2 or more simpler pure substances by chemical means
 - o e.g. water (H_2O), hydrochloric acid (HCl)

Section 1.7 Discovery and Abundance of the Elements

- 1800s was the most active period for discovery of elements
- 88 of the 118 elements occur naturally
- 30 have been synthesized in a lab by bombarding samples of naturally occurring elements
 - o Are all unstable (radioactive)
 - o Usually revert quickly back to naturally occurring elements
- Naturally occurring elements are not evenly distributed on Earth and in the universe
- Oxygen and silicon (Si) account for 80% of the atoms in the human body

Section 1.8 Names and Chemical Symbols of the Elements

- Chemical symbol - a one or two-letter designation of an element derived from the element's name
 - o e.g. Au for gold, O for oxygen