Introductory Chemistry
52.101

• Welcome!
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  Web Chat: T: 6:00 - 9:00 PM
  Office: MW: 10:00 - 10:50 AM
  T: 2:00 - 2:50 PM
  Th: 1:00 - 1:50 PM
  F: 9:00 - 9:50 AM

Introduction

• Why study chemistry?

  Nature of Living Organisms
  Personal Health Perspective
  Environmental Issues
  Relation to Other Science Disciplines
  Forensic Science (CSI- pick a city!)
Chemistry Defined

- **Chemistry** - The field of study that deals with the composition, properties and changes of **matter**.

- **Matter** - Any physical entity that you
  - Can see
  - Can feel
  - Can taste
  - Can smell

  OR

- Any physical entity that has
  - Mass and Volume
What Are Properties?

• Substances are characterized by their properties.
• **Physical Properties** - Properties that do not involve a change in composition of a substance
  – Physical state (solid, liquid or gas), i.e., states of matter
  – Color
  – melting point
  – boiling point
  – density
• **Chemical Properties** - Properties that involve a change of composition of a substance
  – Chemical Reactions

Types of Changes of Matter

• Physical- does not alter chemical composition
• Chemical- does alter chemical composition
• Examples- Problems: 1.2, 1.18, 1.19
Demonstration of a Chemical Reaction

Chemical Reaction:
a chemical change

Water into Wine!
And
Back Again!

Smoke on the Water!

Classification of Matter - a closer look
• **Homogeneous** - Consists of only a single visible phase
  – Constant composition throughout
  – Often called a solution.
• **Heterogeneous** - Consists of two or more visible phases.

**Classification Examples**

- Problem 1.5
- Problem 1.6
- Problem 1.25
- Problem 1.28
• **Element** - A substance that cannot be decomposed into simpler substances by chemical means.

• **Compound** - A substance composed of two or more elements held together by chemical bonds.

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**Compounds**

• **Law of Definite Proportions** – A compound always contains the same elements in the same proportions by weight (mass).
  – Mass – the amount of material in an object
  – Weight = mass x gravitational acceleration
  – As long as the measurements are being carried out at the same place, either weights or masses may be used for comparisons.
    • Traditionally chemists have used the term "weight" for comparing quantities of materials.
    • "Pounds" corresponds to weight.
    • "Grams" corresponds to mass.
Atoms and Molecules

- **Atom** - The smallest particle of an element that can exist and still undergo the characteristic chemical reactions of the element.
- **Molecule** - A neutral, independent unit containing two or more atoms joined together by covalent bonds.
- **Chemical Formula** – Gives the number of atoms of each element in a given chemical compound.
- **Diatomic Molecule** - A molecule that contains two atoms.
  - Diatomic molecular elements: H₂, N₂, O₂, F₂, Cl₂, Br₂, I₂
  - Some diatomic molecular compounds: HCl, CO, NO
- **Polyatomic Molecule** - A molecule that contains three or more atoms.
  - P₄, S₈, H₂O, SO₂

Elements

- Each element has a **name** and a **symbol**.
  - The symbol starts with a CAPITAL letter. Some have a second lower case letter.
- Elements names and symbols can be based on:
  - Latin names (cuprum -> Cu (copper), aurum -> Au (gold), natrium -> Na (sodium))
  - Modern names (carbon -> C, oxygen -> O)
  - See Table 1.2 for additional examples
- Elements are combined to form chemical formulas
- Elements usually arranged in a table called the **Periodic Table**
  - Divided into metals and non-metals
  - 90 occur in nature
The Periodic Table

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Metals | Metalloids | Nonmetals