

## General Chemistry I Final Exam Study Guide

### I. Introduction: Matter

#### A. The Study of Chemistry

- i. **Chemistry** is the study of matter and the changes that matter undergoes
- ii. **Matter** is anything that has a mass and occupies space

#### B. *What Is Matter and What Is It Made Of?*

- i. Matter is classified into three states: solid, liquid, and gas
  - a. There are pure materials and mixtures for each form
- ii. **Atoms** are the building blocks of matter
  - a. Each **element** is made of the same kind of atom
  - b. A compound is made of two or more kind of elements

#### C. Classification of Matter

- i. A **substance** is a form of matter that has definite composition and distinct properties (i.e.: salt, water, carbon dioxide, oxygen)
- ii. A **mixture** is a physical combination of two or more substances
  - a. A **homogenous mixture** (substance) is uniform throughout
  - b. A **heterogeneous mixture** is not uniform throughout

#### D. Properties of Matter

- i. Physical properties - such as boiling point, density, mass, and volume - can be observed without changing a substance into another substance
- ii. Chemical properties – such as flammability, corrosiveness, and reactivity with acid – can only be observed when a substance is changed into another substance

## E. Types of Properties

- i. Intensive properties – density, boiling point, color – are independent of the amount of the substance present
- ii. Extensive properties – mass, volume, energy – does depend on the amount of substance present

## II. Atoms, Molecules, And Ions

### A. Atomic Structure (Dalton's Atomic Theory)

- i. Atoms are the building blocks of matter
  - a. Each element is composed of atoms
  - b. All atoms of a given atom are identical, but atoms of one element are different from the atoms of another
  - c. Atoms of one element cannot be changed into atoms of another element; atoms are neither created nor destroyed in chemical reactions
  - d. Compounds are formed when atoms of more than one element combine; a given compound always has the same relative number and kinds of atoms

### B. Symbols of Elements

- i. Elements are symbolize by one or two letters X
- ii. Atoms of a given element has the same atomic number Z (number of protons)
- iii. The mass of an atom in atomic mass units (amu) is the total number of protons and neutrons in the element: Mass Number A
- iv. Example:  ${}^A_Z X^{20}Ne$

### C. Isotopes

- i. Isotopes are atoms of the same element with different masses
  - a. They have the same number of protons but different numbers of protons + neutrons

#### D. Ions

- i. When atoms lose or gain electrons, they become *ions*
  - a. *Cations* are positive and formed by elements on the left side of the periodic table
  - b. *Anions* are negative and formed by elements on the right side of the periodic table
- ii. Atoms lose and gain electrons in order to have a complete outer shell and achieve the electron configuration of a noble gas

### III. Stoichiometry

#### A. Chemical Equations

- i. Chemical equations are concise representations of chemical reactions
  - a. Reactants are listed on the left side of equation and products on the right
  - b. Stoichiometric coefficients are inserted to balance the equation and states of each compound is written to the right in parenthesis
  - c. Example:  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$

B. A diagram conveying stoichiometric conversions is included in this guide

#### C. Types of Reactions

- i. Two or more substances react to form one product in a *combination* reaction
  - a. Example:  $\text{C}_3\text{H}_6(\text{g}) + \text{Br}_2(\text{l}) \rightarrow \text{C}_3\text{H}_6\text{Br}_2(\text{l})$