Chemistry 201, Wright College

Student Learning Outcomes: This list of objectives is intended to cover the major topics covered by all instructors in this course. Any instructor may expand on some of these or add additional topics if time permits.

The student should be able to recall definitions of scientific terms, demonstrate an understanding and solve qualitative and quantitative problems which involve:

A. Matter and Measurement:

1. Understanding the scientific method.
2. The distinction between the various types of matter.
3. The use of significant figures, scientific notation, metric units and dimensional analysis.
4. The interconversion of mass, volume and density.
5. Converting metric unit involving length, mass, volume and temperature.

B. Atoms, Molecules and Ions:

1. The description of the structure of atoms in terms of protons, neutrons and electrons.
2. The use of chemical symbols, atomic number and mass number to express the subatomic composition of isotopes.
3. The organization of the periodic table.
4. The distinction between ionic and molecular compounds and how to name them.
5. Empirical and molecular formulas, including method of calculation.
6. The formation of ions from the gain or loss of electrons.

C. Calculations with Chemical Formulas and Equations:

1. Balancing equations.
2. Calculating molecular and formula weights.
3. Interconvert between mass, moles and number of particles using molar masses and Avogadro's number.
4. Calculating percent composition from a formula.
5. Calculating an empirical or molecular formula from percent composition of molecular weight.
6. Calculating amounts of reactants or products for a reaction, including a limiting reactant and a percent yield.

D. Aqueous Reactions and Solution Stoichiometry:

1. Recognizing compounds as acids, bases or salts, and strong, weak and nonelectrolytes.
2. Naming and knowing the formula of common polyatomic ions.
3. Various types of reactions, such as combination, decomposition, combustion, precipitation, acid/base and oxidation/reduction.
4. Calculating the oxidation number of a species.
5. Calculating the molarity of a solution and using molarity to solve stoichiometry and dilution problems.

E. Thermochemistry:

1. The terms and sign of heat, work, energy and enthalpy, including endothermic and exothermic processes.
2. Calorimetry and specific heat.
3. Calculation of change in enthalpy using Hess's Law and standard enthalpies of formation.

4. Understanding the enthalpy of a reaction.

F. Electronic Structure of Atoms

1. The concepts of wavelength, frequency and energy of electromagnetic radiation and photons.
2. Quantum numbers and how they relate to the number and type of atomic orbitals, including shapes.
3. Using the periodic table to write full and abbreviated electron configurations of atoms and determine the number of unpaired electrons in atoms.

G. Periodic Properties of Elements

1. Using the periodic table to predict the trend in atomic radii, ionic radii, ionization energy and electron affinity.
2. Using the periodic table to write full and abbreviated electron configurations of ions.

H. Basic Concepts of Chemical Bonding

1. Writing the Lewis structures of atoms, ions and molecules, including exceptions.
2. The electronegativity chart to identify nonpolar covalent, polar covalent and ionic bonds.
3. Calculating formal charges on atoms in Lewis structures.
4. Enthalpy of a reaction from bond enthalpies.

I. Molecular Geometry and Bonding Theories

1. Describing the arrangement of electrons and geometry of molecules according to the VSEPR theory.
2. Identifying the hybridization of atoms in molecules.
3. Identifying sigma and pi bonds in molecules.
4. The understanding of bonding and antibonding orbitals, including drawing of molecular orbital energy-level diagrams.

J. Gases

1. Identifying various pressure units.
2. Solving empirical gas law problems.
3. Solving ideal gas law problems, including reaction stoichiometry.
4. Calculating the molar mass or density of a gas.
5. Describing the Kinetic Molecular Theory of gases.

K. Intermolecular Forces of Liquids

1. Identifying the various types of intermolecular forces.
2. Understanding the kinetic molecular theory and the molecular description of liquids.
3. Knowing phase changes for pure substances.

L. Properties of Solutions

1. Understanding the properties of solubility.
2. Calculating various concentration units.
3. Describing colligative properties.

M. Acid and Bases

1. Understanding the various definitions and general properties of acids and bases.
2. Naming acids and obtaining acid formulas.
3. Evaluate acid/base reactions.