

General Chemistry I

Syllabus

I. Matter and Measurement

- A. The universe and matter
- B. Introduction to the periodic table
- C. Physical properties of matter
- D. Physical and chemical changes to matter
- E. Homogenous and heterogeneous mixtures
- F. Physical measurements and SI units
- G. Uncertainty in measurements and significant figures
- H. Error propagation in calculations
- I. Dimensional analysis and unit conversion

II. Atoms, Molecules, and Ions

- A. Dalton's atomic theory of matter
- B. Conservation of matter and the laws of proportions
- C. Atomic structure
- D. Radioactivity and atomic decay
- E. Chemical and structural formulas of molecules
- F. Ions and ionic compounds
- G. Nomenclature of molecular and ionic compounds

III. Chemical Reactions and Stoichiometry

- A. Chemical reaction equations and stoichiometry
- B. Types of reactions
- C. Avogadro's number, the mole, and molar mass
- D. Percent composition of a compound
- E. Empirical and molecular formulas
- F. Limiting reactants, yields, and experimental error

IV. Reactions in Aqueous Solutions

- A. Solvents, solutes, and solutions
- B. Electrolytes and aqueous ions
- C. Solubility and precipitation reactions
- D. Molecular, total ionic, and net ionic equations
- E. Acids, bases, and neutralization reactions
- F. Oxidation numbers and redox reactions
- G. The oxidation of metals and the activity series
- H. Molarity and solution dilution
- I. Titrations

V. Thermodynamics and Thermochemistry

- A. Thermodynamics and thermochemistry
- B. Energy transfer through work and heat
- C. The system and surroundings
- D. State functions and path functions
- E. Internal energy
- F. Enthalpy
- G. Calorimetry
- H. Enthalpies of reaction/formation and Hess's law

VI. Electronic Structure of Atoms

- A. The electronic structure of atoms
- B. Electromagnetic radiation
- C. Blackbody radiation and the quantization of light
- D. The photoelectric effect of solid metals
- E. Line spectra of the elements and the Bohr model of the atom
- F. De Broglie wavelength and Heisenberg's uncertainty principle
- G. Schrödinger's wave equation and the quantum numbers
- H. Atomic orbital shapes and energies
- I. Multi-electron atoms and the Pauli exclusion principle
- J. Electron configurations and Hund's rule

VII. Periodic Properties of the Elements

- A. Development of the period table
- B. Effective nuclear charge of the nucleus
- C. Atomic radii
- D. Ionization energy
- E. Electron affinity
- F. Isoelectric series
- G. Characteristics of metals, nonmetals, and metalloids

VIII. Chemical Bonding

- A. Lewis theory of bonding and the octet rule
- B. Lewis dot symbols of atoms
- C. Ionic bonds and lattice energy
- D. Covalent bonds and Lewis structures of molecules
- E. Formal charge and resonance structures
- F. Electronegativity and bond polarity
- G. Classifying bonds based on electronegativity difference
- H. Percent ionic character
- I. Strengths of covalent bonds

IX. Molecular Geometry and Orbitals

- A. Molecular geometry and the VSEPR model
- B. Molecular polarity
- C. Covalent bonding and valence bond theory
- D. Hybridization and hybrid atomic orbitals
- E. Double/triple bonds and electron delocalization
- F. Molecular orbitals, bond order, and molecular magnetism

X. Gases

- A. Properties of gases
- B. Gas pressure
- C. Ideal gases and the gas laws
- D. Real gases and deviations from ideal behavior
- E. Gas mixtures, partial pressures, and mole fraction
- F. Kinetic-molecular theory of gases
- G. Molecular speeds and average kinetic energy
- H. Speed distribution of gases
- I. Effusion, diffusion, and the mean-free path