

General Chemistry Credit by Examination

Topics for CHEM 105 General Chemistry I

The CHEM 105 credit exam covers the topics that are typically covered in the first semester of a two-semester General Chemistry sequence. These topics include stoichiometry and the mole concept, chemical reactions, thermochemistry, electronic structure of atoms, periodic properties, chemical bonding, intermolecular forces, and the behavior of gases, liquids and solids. It is recommended that students review the material before taking the exam. Almost any college-level general chemistry textbook will serve as a satisfactory resource for review. Example textbooks include:

Moore, J. W.; Stanitski, C. L.; *Chemistry: The Molecular Science*, 5th edition; Cengage Learning, 2015.
(See Chapters 1 through 9.)

Brown, T. E.; LeMay, H. E.; Bursten, B. E.; *Chemistry: The Central Science*, 12th edition; Pearson, 2012.
(See Chapters 1 through 12.)

Other textbooks will serve equally well for review. A more detailed list of topics follows.

Nature of Chemistry

- Macroscopic & microscopic perspectives of matter
- Pure substances and mixtures; homogeneous vs. heterogeneous mixtures
- Recognize elements, atoms, compounds and molecules
- Physical & chemical properties; physical and chemical changes
- Relationship between mass, volume and density
- Kinetic molecular theory
- The elements and features of the periodic table
- Properties of key blocks and main groups in periodic table and groups of elements

Elements and Chemical Compounds

- Electrons, protons, neutrons and the structure of the atom
- Atomic symbol, atomic number, and mass number
- Isotopes, average atomic mass, and isotope abundance
- Ions and ionic compounds, common polyatomic ions, naming ions and ionic compounds
- Molecular compounds, characteristics, formulas, and naming
- Binary molecular compounds
- Concept of mole and Avogadro's number
- Molar mass and molecular weight
- Grams-to-moles and moles-to-grams calculations
- Empirical and molecular formulas
- Percent composition by mass

Chemical Reactions

- Types of reactions: precipitation, acid-base, oxidation-reduction, gas forming
- Balancing chemical equations
- Electrolytes and solubility rules for ionic compounds

- Net ionic equations
- Common acids and bases
- Oxidizing and reducing agents, oxidation numbers
- Acids, bases, and neutralization reactions
- Stoichiometric calculations for chemical reactions
- Limiting reagent
- Percent yield
- Solutions and molarity

Energy and Chemical Reactions

- Kinetic energy, potential energy, work, and state functions
- Energy, temperature, and heat
- Conservation of energy and chemical reactions
- Heat capacity
- Reaction enthalpy and bond enthalpy
- Exothermic and endothermic reactions
- Calorimetry
- Hess's Law
- Standard formation enthalpy

Atomic Structure

- Electromagnetic radiation and matter
- Planck's quantum theory
- Bohr model of the hydrogen atom
- Quantum mechanical model of the atom
- Quantum numbers, energy levels and atomic orbitals
- Shapes of atomic orbitals
- Electron configurations
- Period trends: atomic radii, ionic radii, ionization energy, electron affinity

Covalent Bonding

- Lewis structures and covalent bonding
- Multiple covalent bonds
- Bond properties: length, energy
- Polarity and electronegativity of bonds
- Formal charge
- Lewis structures and resonance
- Exceptions to the octet rule
- Aromatic compounds

Molecular Structure

- Molecular models and representations
- Molecular shapes and valence-shell electron-pair repulsion (VSEPR) model
- Multiple bonds and molecular geometry

- Hybridization of atomic orbitals
- Molecular polarity
- Induced dipoles and London (dispersion) forces
- Hydrogen bonds

Properties of Gases

- Kinetic molecular theory
- Behavior of ideal gases
- Ideal gas law
- Quantities of gases in molecular reactions
- Gas mixtures and partial pressures
- Behavior of non-ideal gases

Liquids, Solids and Materials

- Liquids, solids and intermolecular forces
- Vaporization and condensation
- Vapor pressure
- Melting and freezing
- Phase changes and phase diagrams
- Water and its unusual properties
- Crystalline and network solids