

General Chemistry I
Course Objectives, by Chapter
(*Chemistry and Chemical Reactivity*, Kotz, Treichel, and Weaver. Sixth Edition)

Chapter 1 Matter and Measurement

Apply definitions of basic chemistry, scientific terms, and scientific method
Name selected elements given their symbols and vice versa
Identify and distinguish between chemical and physical properties and changes
Identify and distinguish between elements, compounds and mixtures, including solutions
Set up and solve problems by the factor label method or dimensional analysis
Graph data and solve for the slope and intercept of a line
Determine the number of significant figures in the result of a calculation and be able to write the result in scientific notation
Carry out conversions within the metric system

Chapter 2 Atoms and Elements

Discuss the composition of atoms
List the subatomic particles of the atom and their relative charges, masses, and their location in the atom, distinguish isotopes
Discuss the mole concept
Distinguish between formula mass, molecular weight, and molar mass
Carry out calculations involving moles, masses, and number of particles
Classify elements using terminology of the periodic table

Chapter 3 Molecules, Ions, and Their Compounds

Classify compounds as ionic or molecular
Write names and formulas for ions
Write names and formulas for ionic compounds
Write names and formulas for acids
Write names and formulas for simple molecular compounds
Calculate the formula masses (also called formula weights), molecular weights, and molar masses of compounds
Calculate empirical formulas from composition data
Distinguish between empirical formula, molecular formula, and structural formula
Determine the molecular formula for a molecular compound given the empirical formula and the molar mass
Distinguish between anhydrous and hydrated compounds

Chapter 4 Chemical Equations and Stoichiometry

Write and balance chemical equations from reaction descriptions and use common reaction abbreviations (s, l, aq, g)
Carry out stoichiometry calculations including percent yield and limiting reagent

Chapter 5 Reactions in Aqueous Solution

Classify substances as strong electrolytes, weak electrolytes, or non-electrolytes
Write the chemical equation for the dissociation of ionic compounds in water
Classify acids and bases as strong or weak

Determine whether or not a substance is soluble or not based on solubility rules
Write complete balanced, complete ionic and net ionic equations for precipitation and acid-base reactions
Use the solubility rules to determine whether or not solutions of two different substances will react to form a precipitate
Given a molecular equation, write the corresponding net ionic equation
Complete and balance equations for
a) the ionization of an acid
b) the hydrolysis of ammonia in water
c) the reaction of acids with carbonates and bicarbonates
Determine the oxidation numbers of elements in substances
Define oxidation and reduction, identify oxidizing and reducing agents
Carry out calculations involving molarities, amount of solute and volume of solution, and titrations
Carry out calculations involving dilutions
Calculate pH from hydronium ion concentration or vice versa
Carry out stoichiometry calculations involving solutions

Chapter 6 Principles of Reactivity: Energy and Chemical Reactions

Discuss the first Law of Thermodynamics
Distinguish between exothermic and endothermic reactions, system and surroundings, heat and temperature
Explain exothermic and endothermic equations in terms of either bond energies of reactants and products or relative energies of reactants and products
Carry out stoichiometry calculations in which heat is considered as either a reactant or product
Calculate the enthalpy of reaction from enthalpies of formation of reactants and products
Carry out calculations involving Hess's Law
Discuss the changes of state and the energy changes involved

Chapter 7 Atomic Structure

Discuss the Bohr Theory
Discuss the quantum numbers, their values, and their significance
Discuss the uncertainty principle
Describe an atomic orbital and the shapes of s and p orbitals

Chapter 8 Atomic Electron Configurations and Chemical Periodicity

Describe the magnetic properties of an atom as either paramagnetic or diamagnetic
Write the ground state electron configuration and orbital box diagram of the elements and their ions
Predict the relative magnitudes of atomic radii, ionization energies, and electron affinities of the elements and their ions
Discuss trends in chemical reactivity of the elements based on their location in the periodic table

Chapter 9 Bonding and Molecular Structure: Fundamental Concepts

Draw Lewis structures for ionic compounds
Describe the bonding in ionic compounds

Draw Lewis structures (including resonance structures) for polyatomic ions and covalent compounds

Define electronegativity and know the trends in electronegativity of the elements

Apply the rules of VSEPR to determine the shapes of polyatomic ions and molecules

Determine the formal charges on the atoms in a molecule or ion

Classify covalent bonds as polar or non-polar

Determine the polarity of a molecule and the direction of the dipole moment

Discuss bond order, bond length, bond energy and their relationship

Chapter 10 Bonding and Molecular Structure: Orbital Hybridization and Molecular Orbitals

Describe the bonding within simple molecules in terms of valence bond theory

Describe the hybridization of simple molecules

Describe the bonding within simple molecules in terms of molecular orbital theory

Write the molecular orbital configuration for simple diatomic molecules

Chapter 12 Gases and their Properties

Carry out gas law calculations using Boyle's law, Charles's law, the combined gas law, the ideal gas law, or Dalton's Law

Carry out stoichiometry calculations involving gases

Describe the Kinetic Molecular Theory as it applies to gases

Discuss the reasons for real gases deviating from ideal behavior

Qualitatively compare rates of diffusion and effusion for gases using Graham's Law

Discuss Avogadro's Principle and its applications.