



## SYRACUSE UNIVERSITY

### **CHE 106 General Chemistry Lecture (3 credits)**

### **CHE 107 Laboratory (1 credit)**

**2020-2021**

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**Chemistry 106 and 107** are the lecture and laboratory courses, respectively, of a four-credit course sequence in general chemistry taught at Syracuse University. In the lecture course, **CHE 106**, the basic concepts of chemistry necessary for continued study in chemistry and other professions requiring chemistry, such as medicine, biology, engineering, and physics, are covered. In the laboratory course, **CHE 107**, basic laboratory procedures and techniques are taught.

The grades for the lecture part of the course are based on four exams and a comprehensive final examination. Laboratory grades are based on students' performance on individual laboratory exercises and a comprehensive laboratory final examination.

### **Course Outline**

**Basic Concepts:** States of matter, energy, physical and chemical changes, units, measurement, significant figures, and precision and accuracy.

**Atoms:** Atomic weight, atomic number, mass number, nucleus, protons and neutrons, isotopes.

**Molecules:** Chemical formulas, molecular mass, the mole, chemical reactions, chemical equations, and stoichiometry.

**Charged Particles:** Ions, cations, anions, electrolytes (strong and weak), ionic equations.

**Atomic Structure:** Historical development, wave and particle duality of radiant energy, quantum theory, the uncertainty principle, orbitals, the quantum mechanical model of the atom, quantum numbers, the exclusion principle.

**Periodic Table:** Historical development, Periodic law, groups, periods, metals, nonmetals. The Aufbau, or buildup of the Periodic table of the elements.

**Trends in Periodicity:** Atomic size, ionization energies, electron affinity, groups, metals and nonmetals. Families of elements: alkali metals, alkaline earths, halogens.

**Chemical Bonding:** The Lewis octet rule, ionic bonding, covalent bonding, bond polarity and electronegativity, Lewis structures, resonance structures, covalent bond strength and bond length.

**Molecular Geometry:** Valence shell electron pair repulsion model, predicting the structure of molecules, effect of bonding and nonbonding electrons on structure, hybrid orbitals, sigma and pi bonds, delocalized bonds, molecular orbitals, dia- and paramagnetism.

**Gases:** Pressure, Boyle's and Charles' Laws, Avogadro's Law, the Ideal Gas Law, standard conditions of temperature and pressure, density of gases, partial pressures and mole fractions, vapor pressure of water and collecting gases over water. Stoichiometric calculations with gases, molar volume.

**Kinetic Molecular Theory:** Average kinetic energy of molecules, absolute temperature, distribution of molecular speeds, molecular effusion and diffusion, Graham's Law, mean free path, deviations from ideal behavior, van der Waals equation.

**Intermolecular Forces:** Ion-ion, ion-dipole, dipole-dipole, and London dispersion forces, hydrogen bonding.

**Properties of Liquids:** Viscosity and surface tension, changes of state, phase changes, critical temperature and pressure. Vapor pressure and boiling point, phase diagrams. Structure of solids.

**Solutions:** Composition, concentration, molarity, mole fraction, molality. Colligative properties: effect of temperature and pressure on solutions, Henry's Law, vapor pressure lowering, Raoult's Law, boiling point elevation and freezing point depression, osmosis.

### Laboratory

The laboratory course focuses on developing the skills needed for the safe handling of chemicals and equipment and on teaching the correct procedures for manipulating and reporting experimental data. No specific laboratory manual is recommended for use in this course; however, many Project Advance instructors use the companion lab manual: Laboratory Experiments by J. Nelson and K. Kemp. In some cases, individual experiments are adapted from Chemical Separates, a collection of chemistry laboratory experiments prepared by a team of expert teachers under the aegis of the American Chemical Society [Chemical Education Resources, Inc., P.O. Box 357, 220 S. Railroad, Palmyra, PA 17078.]

Title/Author (Publisher)	Price Per Copy	Ordering Source
<i>Chemistry: The Central Science with Mastering Chemistry</i> , 14 <sup>th</sup> Edition; Brown & LeMay (Prentice Hall) Loose Leaf with online component- ISBN: 9780134809663	\$231.50	Pearson Phone: 800-848-9500

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