CHE 106/107: General Chemistry Lecture

CHE 106
General Chemistry Lecture
(3 credits)
CHE 107
Laboratory (1 credit)
Class Size: 20-24

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Administrative Contact: David Tate, Associate Director, Project Advance

Course Catalog Description

CHE 106: Fundamental principles and laws underlying chemical action, states of matter, atomic and molecular structure, chemical bonding, stoichiometry, properties of solutions, chemical equilibria, and introductory thermochemistry. Shared Competencies Scientific Inquiry and Research Skills.

CHE 107: Experimental study of basic principles and techniques of chemistry. States of matter, determination of formulas and molecular weights, simple volumetric and gravimetric analysis, heats of reaction. Equilibrium, rates of reactions, and qualitative analysis.

Course Overview

Chemistry 106 and 107 are the introductory 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 necessary for continued study in chemistry and other professions requiring the subject—such as medicine, biology, engineering, and physics—are covered. In the laboratory course, CHE 107, basic laboratory procedures and techniques are taught.

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, and nonmetals; the Aufbau, or buildup of the Periodic Table of the Elements.
Trends in Periodicity: Atomic size; ionization energies; electron affinity; groups, metals, and non□metals; families of elements: alkali metals, alkaline earths, and 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’s 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, 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.

Pre- / Co-requisites

CHE 106 COREQ: CHE 107

Course Objectives

This course is intended to provide an introduction to understanding on a deeper level the role of chemistry in our world. This will be accomplished by providing a rational basis for interpreting and predicting chemical phenomena through examples of chemical behavior observed in nature. Thus, it is anticipated that students will be able to understand fundamental chemical processes and to be able to apply this understanding to solve new problems in chemical behavior.

Laboratory

The CHE 107 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.

Required Materials

CHEMISTRY: The Central Science by T.L. Brown, E. LeMay Jr., and B.E. Bursten, Prentice-Hall Publishing Co., Inc.

Loose Leaf with online component – ISBN: 9780134809663 (Pearson, 800-848-9500)

Other Texts (related books for this course which may be helpful):

Student's Guide to CHEMISTRY, J.C. Hill, Prentice-Hall Publishing Co., Inc.
Solutions to Exercises in CHEMISTRY, R. Wilson, Prentice-Hall Publishing Co., Inc.

Instructor Recommendations

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 (available from Chemical Education Resources, Inc., P.O. Box 357, 220 S. Railroad, Palmyra, PA 17078)