

DEPARTMENT OF CHEMISTRY

Common Course Outline

CHEM 131 – Principles of Chemistry I

Course Description

First of two related courses (with CHEM 132). Includes concepts of atomic structure, periodic system, chemical bonding, nomenclature, stoichiometry, weight relationships, kinetic molecular theory, gases, liquids and solids, solutions, chemical reactions, and thermochemistry. (NSLD)

Pre-requisite(s): *Appropriate score on the chemistry placement test, or a grade of C or better in CHEM 099 within the past two years, or consent of department. Assessment levels: ELAI 990/ENGL 101/ENGL 101A, MATH 117 or higher, READ 120/ELAI 990.*

Credits – 4 semester hours; three hours lecture, one hour discussion, three hours laboratory each week.

General Education - Natural Science Laboratory Distribution (NSLD)

CHEM 131 fulfills a General Education Program Natural Science with Laboratory Distribution requirement. The General Education Program is designed to build skills, knowledge, and attitude necessary for success in work and personal life. Students have the opportunity to strengthen written and oral communication; scientific and quantitative reasoning; and critical analysis and reasoning.

Course scheduling

Sections offered at all campuses every Fall, Spring and Summer sessions. Saturday sections (Rockville and Takoma Park campus) and Blended section (Takoma Park) available.

Broad Course Outcomes:

Upon successful course completion, a student will be able to:

- Perform mathematical operations relevant to chemical problems.
- Describe the electronic structure of atoms, ions, and molecules.
- Analyze chemical problems involving various phases such as gases and solutions.
- Collect, analyze, and report experimental laboratory results.

Specific Course Objectives:

Upon successful course completion, a student will be able to:

- Use dimensional analysis as a technique for solving problems; report answers with the appropriate number of significant figures.
- Name and write symbols for elements, ions, and compounds.
- Analyze and solve multi-step problems that include a combination of concepts
- Predict the quantitative behavior of gases and solutions.
- Use types of chemical bonding and Lewis dot structures to predict the geometry, polarity, and properties of compounds.
- Calculate the magnitude and direction of heat flow for physical and chemical changes.
- Write balanced molecular, ionic, and net ionic equations

- Predict products of various types of reactions.
- Complete stoichiometric calculations.
- Use the Periodic table to predict relative properties of elements and formulas of compounds, formula masses, electron configuration, and periodic trends.
- Describe the major components of the atom and their location in the atom.
- Predict the qualitative behavior of gases, liquids, solids, and solutions.
- Identify chemical and physical properties.
- Predict the types of intramolecular forces within a substance and intermolecular forces between substances and in solution.
- Describe the chemical bonding between atoms on the basis of atomic structure.
- Determine solution concentrations and calculate the amounts of materials involved in solution reactions.

Lecture Topics

Atomic structure, bonding, periodicity, stoichiometry, chemical reactions, thermochemistry, and states of matter will be covered with an emphasis on problem solving.

Laboratory Topics

Measurements; significant figures; laboratory safety; stoichiometry; theoretical yield, actual yield, percent yield; empirical formula; activity series; titrations; percent error, percent deviation; gas laws; Hess's law; heat of reaction; colligative properties; kinetics; equilibria.

Course Requirements

Grading procedures will be determined by the individual faculty instructor of each section, but will include the following minimum criteria:

Lecture (75% of overall course grade):

- Minimum of three mid-semester examinations
- Homework, quizzes, other assignments or projects as assigned by the instructor
- Student Academic Plan for Completion, SAPC, assignment
- Final exam – American Chemical Society First-term General Chemistry Examination

Laboratory (25% of overall course grade):

- Laboratory safety assessment
- Pre-laboratory assignments
- Post-laboratory assignments, lab reports and/or worksheets
- Signature General Education Assignment: Laboratory report
- Common laboratory Final exam given during last lab meeting

All students are expected to complete a Student Academic Plan for Completion (SAPC), a semester-by-semester outline of planned courses to satisfy a student's academic degree program.

Attendance in laboratory is mandatory. Unexcused absence of three or more lab meetings will result in automatic failure. Students must pass lecture and lab components separately to receive a passing final course grade.

Grading Policy

The following letter grade policy will be used to determine the final course grade:

A 100 - 90% **B** 89 - 80% **C** 79 - 70% **D** 69 - 60% **F** <60%

Required Materials

- Textbook – two accepted options
 - *OpenStax Chemistry, Second Ed.*, 2019, available free online at openstax.org
 - *Chemistry: A Molecular Approach*, Nivaldo Tro, 4th Ed, Pearson
- Laboratory safety goggles
- Laboratory notebook

Textbook (Tro) Chapter Coverage

Chapter 1 – Matter, Measurement and Problem Solving
Chapter 2 – Atoms and Elements
Chapter 3 – Molecules, Compounds and Chemical Equations
Chapter 4 – Chemical Quantities and Aqueous Reactions
Chapter 5 – Gases
Chapter 6 – Thermochemistry
Chapter 7 – The Quantum-Mechanical Model of the Atoms
Chapter 8 – Periodic Properties of the Elements
Chapter 9 – Chemical Bonding I: The Lewis Model
Chapter 10 – Chemical Bonding II: Molecular Shapes, Valence Bond Theory and Molecular Orbital Theory
Chapter 11 – Liquids, Solids and Intermolecular Forces
Chapter 12 – Solids and Modern Materials

Example Laboratory Experiments (subject to change)

1. Safety in the Chemical Laboratory
2. Measurements in the Chemical Laboratory
3. Synthesis and Analysis of Alum Crystals – Part I
4. Synthesis and Analysis of Alum Crystals – Part II
5. Relative Chemical Reactivity: Qualitative Determination of an Activity Series
6. Preparation and Standardization of a Sodium Hydroxide Solution (Titration)
7. Determination of the Molar Mass of an Unknown Acid (Titration)
8. A Graphical Exploration of Boyle's Law and Gay-Lussac's Law
9. The Decomposition of KClO_3 and the Ideal Gas Constant
10. Enthalpy of Reaction and Hess's Law
11. Atomic Fingerprints: Emission Spectra and the Rydberg Constant
12. Bonding and Molecular Geometries
13. Guided Inquiry: The Scientific Method

MC Student Code of Conduct and Academic Honesty

Montgomery College Syllabus Information