

DEPARTMENT OF CHEMISTRY

Common Course Outline

CHEM 132 – Principles of Chemistry II

Course Description

A continuation of CHEM 131. Topics include solutions, chemical reactions, acid-base theories, electrochemistry, equilibrium, kinetics, nuclear chemistry, and thermodynamics. (NSLD)

Pre-requisite(s): *A grade of C or better in CHEM 131 or consent of department.*

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

General Education - Natural Science Laboratory Distribution (NSLD)

CHEM 132 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 campuses) and blended section (Takoma Park) available.

CHEM 132 Broad Course Outcomes

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

- Perform mathematical operations relevant to chemical problems.
- Solve chemical problems involving kinetics, equilibria, thermodynamics and electrochemistry.
- Collect, analyze, and report experimental laboratory results.

CHEM 132 Course Objectives

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

- Write and apply kinetics rate expressions in terms of reactants and products; perform chemical kinetics calculations, including determination of rate laws, reaction rate constants, applications of 1st and 2nd order integrated rate laws.
- Calculate effect of temperature on reaction rate, determine the activation energy, and apply the Arrhenius expression; interpret and construct potential energy diagrams; catalysis; analyze mechanisms of simple chemical reactions.
- Understand and apply relationships between reaction rates and chemical equilibrium.
- Write equilibrium constant relationships, determine equilibrium constants, determine whether equilibrium has been established, and calculate equilibrium concentrations.
- Use Le Châtelier's Principle to predict the effects of concentration, pressure, and temperature changes on equilibrium mixtures.

- Determine and apply K_a , K_b , and K_w , and their relationship, calculate species concentrations and pH in aqueous acid and base solutions, solutions of weakly acidic or basic salts, and buffers; calculate effect on pH of acid or base addition to buffer solutions.
- Understand enthalpy, entropy, free energy concepts and relationships, and determine and apply thermodynamic quantities to chemical reactions; describe and calculate dependence of chemical equilibria on ΔH , ΔS , and ΔG values.
- Determine and apply K_{sp} values to calculate solubility, concentrations, and related quantities for insoluble substances in aqueous neutral, basic, and acidic solutions.
- Recognize the differences between galvanic and electrolytic cells; determine standard and non-standard cell potentials; calculate equilibrium constants from cell potential data.
- Describe basic types of nuclear reactions; apply concepts to predict isotope stability; write equations for nuclear reactions.

Lecture Topics

Kinetics, chemical equilibria, acids and bases, thermodynamics, electrochemistry, and nuclear chemistry.

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
- Final exam - American Chemical Society Second Semester 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

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 Course 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 12 Solids and Modern Materials
- Chapter 13 Solutions
- Chapter 14 Chemical Kinetics
- Chapter 15 Chemical Equilibrium
- Chapter 16 Acids and Bases
- Chapter 17 Aqueous Ionic Equilibrium
- Chapter 18 Free Energy and Thermodynamics
- Chapter 19 Electrochemistry

Additional sections and chapters may be included at the discretion of the individual faculty instructor.

Example Laboratory Experiments (subject to change)

1. Safety in the Chemical Laboratory
2. Equilibrium and LeChâtelier's Principle
3. Kinetics: The Iodine Clock Reaction I
4. Kinetics: The Iodine Clock Reaction II
5. Determination of K_f for FeSCN^{2+}
6. Spectrophotometry and Beer's Law: Quantitative Analysis of Food Dyes
7. Acids/Bases, pH, Buffers, and Hydrolysis
8. pH Titration of a Diprotic Acid: Determination of Molar Mass, K_{a1} , K_{a2} , and Molar Mass
9. Qualitative Analysis of Cations (*multi-week investigation*)
10. Qualitative Analysis of Cations in an Unknown Mixture
11. Electrolysis of Water

MC Student Code of Conduct and Academic Honesty

Montgomery College Syllabus Information