CHEM G185: GENERAL CHEMISTRY B

Item	Value
Curriculum Committee Approval Date	12/03/2024
Top Code	190500 - Chemistry, General
Units	5 Total Units
Hours	162 Total Hours (Lecture Hours 54; Lab Hours 108)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	Yes
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)
Local General Education (GE)	• Area 5 Natural Sciences (GB1)
California General Education Transfer Curriculum (Cal-GETC)	• Cal-GETC 5A Physical Science (5A) • Cal-GETC 5C Laboratory Activity (5C)
Intersegmental General Education Transfer Curriculum (IGETC)	• IGETC 5A Physical Science (5A) • IGETC 5C Laboratory Activity (5C)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B1 Physical Science (B1) • CSU B3 Laboratory Activity (B3)

Course Description

This course is the second in a two-semester general chemistry sequence intended for majors in science and engineering. It provides an introduction to kinetics, principles and types of chemical equilibria, acids and bases, thermochemistry, electrochemistry, coordination compounds, nuclear chemistry and nomenclature of organic compounds. PREREQUISITE: CHEM G180. Transfer Credit: CSU; UC. C-ID: CHEM 120S.**C-ID:** CHEM 120S.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Kinetics: Students will be able to determine the activation energy, rate expression, rate law, rate constant, and mechanisms for a reaction.
3. Acids and Bases: Students will be able to solve for quantitative aspects of equilibrium: buffers, salts, titrations, solubility.
4. Electrochemistry: Compile REDOX reactions by the half-reaction method, calculate cell potentials, and understand applications in batteries, electroplating, and fuel cells.
5. Electrochemistry: Compile REDOX reactions by the half-reaction method, calculate cell potentials, and understand applications in batteries, electroplating, and fuel cells.
6. Nuclear Chemistry: Write and predict nuclear decay reactions, calculate nuclear energy, understand half-life and first order kinetics, discuss nuclear applications and radiation.
7. Thermodynamics: Describe the concepts of free energy, enthalpy, and entropy as they relate to chemical reactions, and perform thermodynamic computations.
8. Perform laboratory techniques proficiently, specifically using spectrophotometers to determine solution concentrations, pH meters and indicators to determine acid concentrations, quantitative analysis for accuracy, and descriptive chemistry to perform qualitative analysis on solutions.
9. Use scientific writing to write a lab report.
10. Write lab procedures using various methods as appropriate: observation columns, flow charts, data tables, summary columns.

Course Objectives

- 1. Relate the mechanisms and rate laws of elementary reactions.
- 2. Describe the differences and similarities in the various types of chemical equilibria.
- 3. Explain the concepts of free energy and entropy as they relate to chemical reactions.
- 4. Examine compounds formed by transition metals.
- 5. Interpret nuclear reactions and their energetics.
- 6. Recall basic organic nomenclature and functional groups.
- 7. Employ laboratory techniques.

Lecture Content

Chemical Kinetics Reaction rates and the different rate laws Reaction mechanisms Catalysts Introductory Concepts of Equilibrium The equilibrium condition Applications of the equilibrium constant Le Chatelier's principle Acids and Bases Acids base models Factors which determine acid strength Calculating acid strength Acid base properties of salts Applications of Aqueous Equilibria The common ion effect Buffers Titrations and pH curves Solubility equilibria Complex ion equilibria Thermodynamics Spontaneity and entropy Free energy Relation of free energy to equilibrium Relation of free energy to work Electrochemistry Galvanic and electrolytic cells Standard reduction potentials Cell potential, electrical work and free energy Electrolytic processes Coordination chemistry Structure and nomenclature of coordination compounds Isomerism Crustal field and valence bond theories of bonding Nuclear Chemistry Nuclear stability The kinetics of nuclear decay Nuclear transformations Detection and uses of nuclear decay Organic Chemistry Structure and nomenclature of carbon based compounds Isomerism Functional group behavior

Lab Content

Statistics of Measurements Estimation of accuracy and precision Computer treatment of data including pressure/volume data, equilibrium vapor pressure versus temperature measurements, reaction rate order and activation energy Linear Regression and interpretation of the square of the correlation constant, R2 Graphing Kinetics Measurement of rates of reactions. (Example: the bromination of acetone using a "clock" reaction with iodine, thiosulfate and starch solutions.) Determination of the overall rate law Measurement of the rate constant Measurement of the activation energy Effect of a catalyst on reaction rate Equilibrium Spectrophotometric determination of solubility product with student preparation of a calibration curve Spectrophotometric determination of complex ion equilibrium constant with student preparation of a calibration curve Observations and interpretations of LeChatelier s Principle Acids and Bases Use of titration as an analytical tool Use of the pH meter to determine hydrogen ion concentration in samples Use

of the pH meter to determine acid equilibrium constants Buffer design Transition Metal Chemistry Preparation of a complex ions of selected transition metals Determination of relative ligand strength Qualitative Analysis (approximately half of the laboratories for the semester) Given broad guidelines, design and implement a qualitative analysis scheme to determine the ion contents of several different samples Use common laboratory techniques such as pH control, centrifugation/ decantation, production of precipitates or distinctive solution colors t o make determinations

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Reading Assignments

Daily reading of textbook to complement lecture presentations. Twice weekly reading of laboratory book as preparation for laboratory assignments. Periodic reading of supplemental handout material to reinforce key concepts.

Writing Assignments

Writing definitions, explaining concepts and solving numerical problems on homework assignments, quizzes and exams. Demonstration of analysis of experimental data, safe laboratory practices and ability to use laboratory equipment properly.

Out-of-class Assignments

Homework assignments are used to reinforce key concepts and problem solving techniques. Twice weekly preparation of prelaboratory and postlaboratory assignments.

Demonstration of Critical Thinking

Clear, syntactically and grammatically correct explanation of chemical concepts and phenomena based on material presented in lecture and the text. Demonstration of how laboratory experiments complement lecture material through analysis of, and conclusions drawn from, laboratory experiments. Convert word problems into appropriate mathematical relationships, solve equations and interpret results.

Required Writing, Problem Solving, Skills Demonstration

Writing definitions, explaining concepts and solving numerical problems on homework assignments, quizzes and exams. Demonstration of analysis of experimental data, safe laboratory practices and ability to use laboratory equipment properly.

Eligible Disciplines

Chemistry: Master's degree in chemistry OR bachelor's degree in chemistry or biochemistry AND master's degree in biochemistry, chemical engineering, chemical physics, physics, molecular biology, or geochemistry OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Robinson, J., McMurry, J., Fay, R. Chemistry, 8th ed. Pearson, 2020 Rationale: -

Manuals Resources

1. Green, K. General Chemistry B Lab Manual, GWC Graphics , 01-01-2020

Other Resources

1. An electronic calculator with exponential notation, log, and trig function capabilities. 2. Laboratory safety glasses.