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Chemistry (CHEM) 2212 General Chemistry and Qualitative Analysis (5 Units) CSU:UC  
[formerly Chemistry 1B]

Prerequisite: Successful completion of Chemistry 2211 with a grade of "C" or better

Advisory: Eligibility for English 1500 strongly recommended

Prerequisite knowledge/skills: Before entering the course the student should be able to:

1. Solve computational problems related to general chemistry,
2. Describe the nature of matter and apply the principles of atomic theory,
3. Describe and interpret the periodic trends of elements and electron configuration,
4. Apply nomenclature rules, and determine the chemical formula of a compound,
5. Qualitatively and quantitatively describe processes involved in chemical reactions and stoichiometry,
6. Describe and analyze the behavior of solutions and gases,
7. Determine the type of bonding, molecular structure and polarity of a compound, and
8. Utilize molecular geometry and bond polarity to explain or predict properties of substances

Hours and Unit Calculations:

48 hours lecture (96 Outside of class hours); 96 hours lab (240 Total Student Learning Hours) 5 Units

Catalog Description: This is the second semester of a one-year course sequence in chemistry intended for majors in the natural sciences (chemistry, biochemistry, biology, physics, pre-medicine), mathematics and engineering. Special emphasis in the laboratory is placed on the theory and techniques of qualitative analysis. C-ID: CHEM 120S

Type of Class/Course: Degree Credit

Lecture Text: Kotz, John C., Paul M. Treichel and John Townsend. *Chemistry and Chemical Reactivity*. 10th ed. Belmont: Brooks/Cole. 2019.

Laboratory Manual: Slowinski, Emil and Wayne C. Wolsey. *Chemical Principles in the Laboratory with Qualitative Analysis*. 12<sup>th</sup> ed. Belmont: Brooks/Cole. 2020.

Course Objectives:

By the end of the course, a successful student will be able to

1. Solve computational problems related to general chemistry,
2. Describe and analyze processes involved in chemical kinetics,
3. Qualitatively and quantitatively describe and analyze principles of chemical equilibria, electrochemistry, and thermodynamics,
4. Demonstrate an understanding of acid base equilibria,

5. Describe and interpret processes involved in coordination chemistry and descriptive chemistry,
6. Quantitatively analyze processes, and predict products, of nuclear reactions, and
7. Demonstrate a basic understanding of organic functional group chemistry

Course Scope and Content:

- Unit I            Intermolecular Forces and Solutions
- A. Ion, dipole, and nonpolar interactions
  - B. Properties of water
  - C. Concentration and standardization of solutions
  - D. Colligative properties
- Unit II            Kinetics
- A. Rates of reactions
  - B. Rate Laws
  - C. Reaction mechanisms
  - D. Activation energy
- Unit III           Equilibria
- A. Dynamic equilibria
  - B. Common ion effect
  - C. Acid-base equilibria
  - D. Solubility product
  - E. Buffers
  - F. Titration Curves
- Unit IV           Thermodynamics
- A. Entropy
  - B. Free energy
  - C. Spontaneity
- Unit V            Electrochemistry
- A. Balancing redox reactions
  - B. Cell potentials
  - C. Voltaic cells
  - D. Nernst equation
- Unit VI           Descriptive Chemistry
- A. Main group elements
  - B. Transition elements
  - C. Coordination chemistry
- Unit VII          Nuclear Chemistry
- A. Types of radiation
  - B. Nuclear decay
  - C. Fission and fusion
  - D. Binding energy
- Unit VIII        Organic Chemistry
- A. Allotropes of carbon

- B. Hybridization of carbon
- C. Functional groups

#### Course Scope and Content: Laboratory

The laboratory component of this course provides hands-on practical experience with general chemistry. Laboratory exercises are designed to familiarize students with common equipment and instrumentation as they qualitatively and quantitatively explore and expand on principles presented in lecture.

- Unit I            Solution Chemistry
  - A. Solution Preparation and standardization
  - B. Titration
  - C. Spectrophotometry
  
- Unit II            Kinetics
  - A. Rate Laws
  - B. Concentration dependency
  - C. Temperature dependency
  
- Unit III           Equilibria
  - A. Le Chatelier's Principle
  - B. Equilibrium constants
  - C. pH Buffers
  - D. Solubility Products
  
- Unit IV           Qualitative Analysis
  - A. Qualitative analysis schemes
  - B. Anions
  - C. Cations

#### Learning Activities Required Outside of Class:

The students in this class will spend a minimum of 6 hours per week outside of the regular class time doing the following:

1. Studying text, chapter handouts and learning objectives.
2. Answering questions.
3. Skill practice.
4. Completing required reading.
5. Problem solving activity or exercise.
6. Written work.

#### Methods of Instruction:

1. Assign reading topics in the textbook and in the reference books present in our library.
2. Class lectures will be used to clarify and extend the theoretical and factual concepts present in the text.
3. Multimedia presentations, relative to some unit of study will be shown to supplement lecture materials.
4. Problem sets and questions from the text will be assigned.
5. Selected experiments will be assigned in the laboratory for individual student learning.

- Demonstration experiments and lecture demonstrations will be used in the classroom and laboratory.

Methods of Evaluation:

- Substantial writing assignments including:
  - Essay Exams
  - Laboratory reports
  - Research reports
- Computational or non-computational problem-solving demonstrations including:
  - Exams
  - Homework problems
  - Quizzes
  - Laboratory reports
- Other examinations, including:
  - Multiple choice
  - Matching items
  - True/false items

Laboratory Category: Extensive Laboratory

Pre delivery criteria: All of the following criteria are met by this lab.

- Curriculum development for each lab.
- Published schedule of individual laboratory activities.
- Published laboratory activity objectives.
- Published methods of evaluation.
- Supervision of equipment maintenance, laboratory setup, and acquisition of lab materials and supplies.

During laboratory activity of the laboratory: All of the following criteria are met by this lab.

- Instructor is physically present in lab when students are performing lab activities.
- Instructor is responsible for active facilitation of laboratory learning.
- Instructor is responsible for active delivery of curriculum.
- Instructor is required for safety and mentoring of lab activities.
- Instructor is responsible for presentation of significant evaluation.

Post laboratory activity of the laboratory: All of the following criteria are met by this lab.

- Instructor is responsible for personal evaluation of significant student outcomes (lab exercises, exams, practicals, notebooks, portfolios, etc.) that become a component of the student grade that cover the majority of lab exercises performed during the course.
- Instructor is responsible for supervision of laboratory clean up of equipment and materials.

Supplemental Data:

TOP Code:	190500 Chemistry
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SAM Priority Code:	E: Non-Occupational
Distance Education:	N/A
Funding Agency:	Y: Not Applicable
Program Status:	I: Program Applicable
Noncredit Category:	Y: Not Applicable
Special Class Status:	N: Course is not a special class
Basic Skills Status:	N: Not Applicable
Prior to College Level:	Y: Not Applicable
Cooperative Work Experience:	N: Course is not a part of a cooperative education program
Eligible for Credit by Exam:	No
Eligible for Pass/No Pass:	Yes
Discipline:	Chemistry