

CHEM 4B Course Outline as of Fall 2018**CATALOG INFORMATION**

Dept and Nbr: CHEM 4B Title: GEN CHEM WITH QUANT

Full Title: General Chemistry with Quantitative Analysis

Last Reviewed: 2/24/2014

| Units | | Course Hours per Week | | Nbr of Weeks | Course Hours Total | |
|---------|------|-----------------------|------|--------------|--------------------|--------|
| Maximum | 5.00 | Lecture Scheduled | 3.00 | 17.5 | Lecture Scheduled | 52.50 |
| Minimum | 5.00 | Lab Scheduled | 6.00 | 17.5 | Lab Scheduled | 105.00 |
| | | Contact DHR | 0 | | Contact DHR | 0 |
| | | Contact Total | 9.00 | | Contact Total | 157.50 |
| | | Non-contact DHR | 0 | | Non-contact DHR | 0 |

Total Out of Class Hours: 105.00

Total Student Learning Hours: 262.50

Title 5 Category: AA Degree Applicable

Grading: Grade Only

Repeatability: 00 - Two Repeats if Grade was D, F, NC, or NP

Also Listed As:

Formerly:

Catalog Description:

Second semester of an intensive one-year program covering physical, inorganic and analytical chemistry. Laboratory includes quantitative and instrumental analysis. Recommended for chemistry, chemical engineering, preprofessional, and physical or life science majors.

Prerequisites/Corequisites:

Course Completion of CHEM 4A

Recommended Preparation:**Limits on Enrollment:****Schedule of Classes Information:**

Description: Second semester of an intensive one-year program covering physical, inorganic and analytical chemistry. Laboratory includes quantitative and instrumental analysis.

Recommended for chemistry, chemical engineering, preprofessional, and physical or life science majors. (Grade Only)

Prerequisites/Corequisites: Course Completion of CHEM 4A

Recommended:

Limits on Enrollment:

Transfer Credit:

Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

| | | | | |
|----------------------------|----------------------|---|-------------------|------------------|
| AS Degree: | Area | | Effective: | Inactive: |
| | C | Natural Sciences | Fall 1981 | Fall 2018 |
| CSU GE: | Transfer Area | | Effective: | Inactive: |
| | B1 | Physical Science | Fall 1981 | Fall 2018 |
| | B3 | Laboratory Activity | | |
| IGETC: | Transfer Area | | Effective: | Inactive: |
| | 5A | Physical Sciences | Fall 1981 | Fall 2018 |
| | 5C | Fulfills Lab Requirement | | |
| CSU Transfer: | | | Effective: | Inactive: |
| UC Transfer: | | | Effective: | Inactive: |
| CID: | | | | |
| CID Descriptor: | CHEM 120S | General Chemistry for Science Majors Sequence A | | |
| SRJC Equivalent Course(s): | | CHEM1A AND CHEM1B OR CHEM4A AND CHEM4B OR CHEM3A AND CHEM3AL AND CHEM3B | | |

Certificate/Major Applicable:

Major Applicable Course

COURSE CONTENT

Outcomes and Objectives:

Upon completion of this course, students will be able to:

1. Solve for the concentrations or pressures of various species in a chemical equilibrium.
2. Apply the concepts of chemical equilibrium to acids and bases, buffers, titration, solubility, electrochemistry and metal complex formation.
3. Determine the free energy change for a physical or chemical process at nonstandard conditions.
4. Apply the principles of electrochemistry in the construction and analysis of voltaic and electrolytic cells.
5. Use kinetics to describe the rate and possible mechanisms of a reaction.
6. Describe isomerism and bonding in transition metal complexes.
7. Describe the kinetics and other phenomena related to nuclear chemistry and radioactivity.
8. Recognize, name, and draw the structures of some organic compounds.
9. Identify and control factors that influence experimental error in gravimetric and volumetric analysis.
10. Use advanced instrumentation, such as UV-Visible and infrared (IR) spectroscopy, gas chromatography (GC) and atomic absorption (AA) in analysis of unknowns.
11. Analyze experimental error qualitatively and with statistical methods.
12. Apply chemical principles to real world situations.

Topics and Scope:

- I. Chemical Equilibrium
 - A. Equilibrium constants (K) and quotients (Q)
 - B. Le Chatelier's principle
 - C. Relationship to free energy
 - D. Dependence on temperature
 - E. Methods and approximations for solving equilibrium systems
- II. Aqueous Equilibria
 - A. Weak acids and bases
 - B. pH, pKa, buffers and titration
 - C. Polyprotic acids
 - D. Very dilute and very weak acids and bases
 - E. Solubility equilibria
 - F. Common ion effect
 - G. Complex ion equilibria
- III. Electrochemistry
 - A. Balancing oxidation-reduction reactions
 - B. Voltaic cells
 - C. Standard reduction potentials
 - D. Concentration cells and the Nernst equation
 - E. Batteries
 - F. Electrolysis
- IV. Kinetics
 - A. Reaction rates and rate laws
 - B. Determining rate laws
 - C. Integrated rate laws
 - D. Activation energy and the Arrhenius equation
 - E. Reaction mechanisms
 - F. Catalysis
- V. Coordination Chemistry of Transition Metals
 - A. Coordination compounds
 - B. Types of isomerism
 - C. Ligand Field Theory
- VI. Nuclear Chemistry
 - A. Types of radioactive decay
 - B. Kinetics of decay
 - C. Applications
 - D. Fission and fusion
- VII. Introduction to Organic Chemistry
 - A. Basic structures and nomenclature
 - B. Isomerism
 - C. Functional groups

Laboratory material:

1. Lab safety and maintaining a lab notebook
2. Determining an equilibrium constant
3. Buffers
4. Indicators
5. Potentiometric titration
6. Solubility products
7. Determination of an unknown
8. Voltaic Cells
9. Electrolytic Cells

10. Determining rate law and activation energy
11. Synthesis and analysis of a metal complex
12. Nuclear chemistry
13. Techniques and skills
 - a. Use of spreadsheet software
 - b. Instrumental analysis
 - c. Use of calibration curves
 - d. Internal standards
 - e. Writing laboratory reports

Assignment:

1. Specific reading and study assignments from the lecture textbook (10-30 pages per week)
2. Homework: Completion of recommended end-of-chapter problems (15-20 per week)
3. Laboratory experiments and lab reports (13-18 per semester)
4. Midterm Exams (2-5), Quizzes (0-4), Final Exam

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

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| Lab reports | Writing 20 - 35% |
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Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

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| Homework | Problem solving 0 - 20% |
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Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

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| Lab technique and accuracy of results | Skill Demonstrations 0 - 10% |
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Exams: All forms of formal testing, other than skill performance exams.

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| Exams, Quizzes and Tests | Exams 45 - 80% |
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Other: Includes any assessment tools that do not logically fit into the above categories.

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| None | Other Category 0 - 0% |
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Representative Textbooks and Materials:

Chemical Principles, 7th Ed., Zumdahl and DeCoste (Cengage, 2013).

Chemical Principles: The Quest for Insight, 6th Ed., Atkins and Jones (Freeman, 2012).

General Chemistry: Principles and Modern Applications, 10th Ed., Petrucci, Herring, Madura,

Bissonnette (Pearson, 2010).

Chemistry: The Molecular Nature of Matter and Change, 6th Ed, Silberberg (McGraw-Hill, 2011).

Principles of Modern Chemistry, 7th Ed., Oxtoby, Gillis and Campion, (Cengage, 2011).

Lab Manuals

Instructor Prepared Materials

Laboratory Experiments for Chemistry: The Central Science, 12th Ed., Brown, Nelson, Kemp and Stoltzfus (Pearson, 2011).

Quantitative Chemical Analysis, 8th Ed., Daniel Harris, (Freeman, 2010).

Fundamentals of Analytical Chemistry, 9th Ed., Skoog, West, Holler and Crouch (Cengage, 2013).