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.

Lab reports	Writing 20 - 35%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework	Problem solving 0 - 20%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Lab technique and accuracy of results	Skill Demonstrations 0 - 10%

Exams: All forms of formal testing, other than skill performance exams.

Exams, Quizzes and Tests	Exams 45 - 80%

Other: Includes any assessment tools that do not logically fit into the above categories.

None	Other Category 0 - 0%

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).