CHEM 1B Course Outline as of Fall 1999

CATALOG INFORMATION

Dept and Nbr: CHEM 1B Title: GENERAL CHEMISTRY
Full Title: General Chemistry
Last Reviewed: 5/13/2019

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	5.00	Lecture Scheduled	4.00	17.5	Lecture Scheduled	70.00
Minimum	5.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	7.00		Contact Total	122.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 140.00 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:
Continuation of Chemistry 1A. Topics include acid-base and oxidation- reduction reactions, kinetics, chemical equilibrium (gaseous, acid-base, solubility, complex-ion), first, second and third laws of thermodynamics, electrochemistry, nuclear chemistry, descriptive chemistry of the elements, coordination compounds and organic chemistry.

Prerequisites/Corequisites:
Chem 1A or equivalent with a grade of "C" or better.

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: 2nd semester of a one yr program of general chemistry. (Grade Only)
Prerequisites/Corequisites: Chem 1A or equivalent with a grade of "C" or better.
Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC. (CAN CHEM4)(CHEM 1A+CHEM 1B=CHEM SEQ A)

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	
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B1	Physical Science	Fall 1981	
	B3	Laboratory Activity		
IGETC:	**Transfer Area**		Effective:	Inactive:
	5A	Physical Sciences	Fall 1981	
	5C	Fulfills Lab Requirement		

CSU Transfer:	Transferable	Effective:	Fall 1981	Inactive:	Fall 2020
UC Transfer:	Transferable	Effective:	Fall 1981	Inactive:	Fall 2020

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:
Not Certificate/Major Applicable

COURSE CONTENT

Outcomes and Objectives:
Upon completion of the course, the student should be able to:
1. compare Arrhenius, Bronsted-Lowery and Lewis acids and bases.
2. predict relative acid and base strengths.
3. assign oxidation numbers.
4. balance oxidation-reduction reactions by the half-reaction method and the oxidation number method.
5. solve acid-base and oxidation-reduction stoichiometric problems.
6. determine the rate of a reaction.
7. explain the dependence of reaction rate on concentration and temperature.
8. describe and explain collision theory and transition-state theory.
9. solve problems based on the Arrhenius equation.
10. determine the order of a chemical reaction.
11. describe the influence of a catalyst on reaction rate.
12. determine the rate law for a reaction based on the reaction mechanism.
13. determine the extent of molecular reactions through the study of chemical equilibria.
14. apply Le Chatelier's principle to chemical equilibria.
15. describe the self-ionization of water.
16. compute the pH of a solution of a strong acid or strong base.
17. solve problems based on the ionization of a weak acid or weak base.
18. predict the acid-base properties of salt solutions.
19. describe the preparation of a buffer.

20. perform buffer calculations.
21. calculate points on a titration curve.
22. predict the appearance of a titration curve.
23. determine the solubility product expressions for sparingly soluble ionic solids.
24. perform calculations based on solubility product expressions.
25. apply equilibrium concepts to complex-ions.
26. use qualitative analysis schemes to determine the identities of the substances present in a mixture.
27. explain the first, second and third laws of thermodynamics.
28. solve problems based on the laws of thermodynamics.
29. determine the spontaneity of a reaction.
30. relate the free energy of a reaction to the reaction's equilibrium constant.
31. describe the construction of voltaic cells.
32. use standard reduction potentials to compute a cell's potential.
33. compute the equilibrium constant for a voltaic cell form the cell's emf.
34. describe some commercial voltaic cells.
35. compare electrolytic cells with voltaic cells.
36. solve stoichiometric calculations based on electrolysis.
37. define radioactivity and describe the different types of radiation.
38. balance nuclear reaction equations.
39. solve problems based on the rate of the radioactive decay of an isotope.
40. describe the detection and biological effects of radiation.
41. describe the applications of radioactive isotopes.
42. solve mass-energy calculations for nuclear reactions.
43. describe nuclear fusion and nuclear fission.
44. describe the basic steps involved in metallurgy.
45. describe the different models of metallic bonding.
46. describe the chemistry of the alkali metals, the alkaline earth metals, and the metals of groups IIIA and IVA.
47. describe the chemistry of the nonmetals of groups IVA-VIIIA.
48. describe and explain the periodic trends in the transition elements.
49. describe the formation and structure of complex-ions and coordination compounds.
50. name coordination compounds.
51. describe the valence bond theory and the crystal field theory of complexes.
52. describe the structures of alkanes, cycloaalkanes, alkenes, alynes, aromatic hydrocarbons, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines and amides.
53. use standard nomenclature of alkanes, cyloalkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, ethers, aldehydes,ketones, carboxylic acids, esters, amines and amides.
54. predict reactions of hydrocarbons.
55. predict reactions of oxygen-containing organic compounds.
56. predict reactions of nitrogen-containing organic compounds.
57. describe the structures of organic polymers.

In the laboratory upon completion of the course, the student should be able to:

1. observe all of the fundamental safety procedures elucidated at the beginning of the course and repeated throughout the semester;
2. properly dispose of waste chemicals;
3. manipulate standard laboratory apparatus including chemical dispensers,
4. perform gravimetric analysis;
5. perform titrimetic analysis;
6. collect and analyze scientific data using graphical and statistical methods;
7. summarize laboratory results in both formal and informal report formats;
8. use a Macintosh personal computer (or equivalent) to perform word-processing, spreadsheet computations, graphing and statistical calculations for laboratory reports;
9. use microcell plates and micropipettes

Topics and Scope:

Lecture Material
1. Chemical Reactions: Acid-base and Oxidation-Reduction Concepts
   a) Arrhenius concept
   b) Bronsted-Lowery concept
   c) Lewis concept
   d) Relative strengths of acids and bases
   e) Oxidation numbers
   f) Describing oxidation-reduction reactions
   g) Acid-base and oxidation reduction stoichiometry
2. Rates of Reactions
   a) Reaction rates
   b) Collision and transition-state theories
   c) Arrhenius equation
   d) Reaction mechanisms
3. Chemical equilibrium; Gaseous Reactions
   a) The equilibrium constant
   b) Qualitative and quantitative aspects of the equilibrium constant
   c) Le Chatelier's principle
4. Acid-base Equilibria
   a) Self-ionization of water
   b) Strong and weak acids and bases
   c) Solution pH
   d) Acid and base ionization equilibria
   e) Polyprotic acids
   f) Hydrolysis
   g) Buffers
   h) Acid-base titration curves
5. Solubility and Complex-Ion Equilibria
   a) Solubility product constant
   b) Precipitation calculations
   c) Complex-ion formation
   d) Qualitative analysis
6. Thermodynamics and Equilibria
   a) Enthalpy and entropy
   b) First, second and third laws of thermodynamics

c) Free-energy
7. Electrochemistry
a) Construction and notation of voltaic cells
b) Electromotive force
c) Cell potential
d) Free-energy and equilibrium constants from emf's
e) Electrolytic cells
f) Stoichiometry of electrolysis
8. Nuclear Chemistry
a) Radioactivity and its detection
b) Nuclear reactions and equations
c) Rate of radioactive decay
d) Mass-energy calculations
e) Nuclear fission and nuclear fusion
f) Applications of radioactive isotopes
9. Metallurgy and Chemistry of the Main-Group Elements
a) Metallurgy
b) Bonding in metals
c) The alkali metals
d) The alkaline earth metals
e) The metals of groups IIIA and IVA
10.Chemistry of the Nonmetals
a) The carbon family
b) The nitrogen family
c) The oxygen family
d) The halogens
e) The noble gases
11.The Transition Elements
a) Properties of the transition elements
b) Complex-ions and coordination compounds
c) Naming coordination compounds
d) Structure
e) Valence bond theory and crystal theory
12.Organic Chemistry
a) Hydrocarbons
b) Derivatives of hydrocarbons
c) Organic polymers

Laboratory Material

1. Volumetric analysis
2. Titrimetric analysis
3. Chemical kinetics
4. Acid-base chemistry
5. Oxidation-reduction chemistry
6. Electrochemistry
7. Chemical equilibria
8. Synthesis
9. Instrumental analysis
10.Spectroscopy

Assignment:

Assignments for Chemistry 1B include:

1. Specific reading and study assignments from the lecture textbook (averaging 25-30 pages per week).
2. Completion of recommended end-of-chapter problems (averaging 15-20 per week).
3. Writing an average of one laboratory report per week, previewing the upcoming laboratory experiment, and completing the required pre-laboratory assignment.

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.

Written homework, Lab reports, Essay exams	Writing 10 - 30%

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

Homework problems, Lab reports, Exams	Problem solving 40 - 70%

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

Class performances, LAB SKILL EVAL, PARTICIPATION	Skill Demonstrations 5 - 20%

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

Multiple choice, PROB SOLVING & SHORT ESSAY	Exams 15 - 25%

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

ATTENDANCE, ASSIGNEMENTS SUBMITTED ON TIME, IMPROVEMENT DEMONSTRATED ON FINAL EXAM	Other Category 0 - 5%

Representative Textbooks and Materials:
LECTURE TEXTS:
GENERAL CHEMISTRY by Darrell Ebbing, Houghton Mifflin, 1996.
CHEMISTRY: by Steven Zumdahl, D.C. Heath, 1997
CHEMISTRY: SCIENCE OF CHANGE by Oxtoby, Nachtrieb & Freeman, Saunders,1994
CHEMISTRY: THE STUDY OF MATTER AND ITS CHANGES by Brady & Holum,Wiley,1993
LABORATORY MANUALS:
CHEMISTRY IN THE LABORATORY by Roberts, Hollenberg, Postma, Freeman, 1997.
CHEMISTRY IN THE LABORATORY by Jo Beran, Wiley, 1993

EXPERIMENTS IN GENERAL CHEMISTRY by R. Wentworth, Houghton Mifflin, 1993
EXPERIMENTAL CHEMISTRY by James F. Hall, D.C. Heath, 1993
SPECIAL STUDENT MATERIALS:
Laboratory apron
Scientific calculator
Laboratory data notebook
Safety goggles