CHEM 1A Course Outline as of Fall 1999

CATALOG INFORMATION

Dept and Nbr: CHEM 1A 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:
An introduction to the fundamental facts and principles of chemistry including atomic structure, nomenclature, bonding, stoichiometry, oxidation-reduction reactions, properties of ideal and real gases, kinetic-molecular theory, properties of solutions, liquids and solids, phase equilibria, colligative properties, acid-base reactions, molecular geometry and chemical bonding theories.

Prerequisites/Corequisites:
Chem 51 (formerly Chem 110) or Chem 55 or placement on the Chemistry Diagnostic Test AND Math 155 or two years of high school algebra or equivalent.

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: First semester of a one year program of general chemistry. (Grade Only)
Prerequisites/Corequisites: Chem 51 (formerly Chem 110) or Chem 55 or placement on the Chemistry Diagnostic Test AND Math 155 or two years of high school algebra or equivalent.
Recommended:

Limits on Enrollment:
Transfer Credit: CSU;UC. (CAN CHEM2)(CHEM 1A+CHEM 1B=CHEM SEQ A)
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

			Effective:	Inactive:
AS Degree:	**Area**			
	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 110	General Chemistry for Science Majors I, with Lab
SRJC Equivalent Course(s):	CHEM1A OR CHEM4A OR CHEM3A AND CHEM3AL
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. solve problems involving the concepts listed under Course Content;
2. solve problems using SI units and dimensional analysis;
3. write concise explanations describing various chemical phenomena studied;
4. write and interpret balanced chemical equations;
5. describe and identify various types of colloids;
6. write balanced chemical equations for oxidation-reduction reactions;
7. write balanced chemical equations for precipitation reactions;
8. write balanced chemical equations for acid-base reactions;
9. express numerical data and results to the proper number of significant figures;
10. describe different models of atomic structure;
11. use standard chemical notation and nomenclature;
12. predict the outcomes of combination, decomposition, single-displacement, metathesis, and combustion reactions;
13. identify strong electrolytes, weak electrolytes and nonelectrolytes;
14. apply the Arrhenius, Bronsted-Lowry and Lewis models of acid-base theory;

15. calculate the mass percentages of the elements from the formula of a compound;
16. determine the empirical formula of a compound from elemental composition data;
17. derive the molecular formula of a compound from the empirical formula;
18. predict the amounts of reactants and products involved in a chemical reaction;
19. solve limiting-reactant problems;
20. calculate theoretical and actual percentage yields;
21. perform calculations involving mass percentage, molarity, normality, molality and mole fraction units;
22. solve solution stoichiometry problems;
23. derive predictions of total pressure partial pressures, volume, temperature, moles or mass utilizing the ideal gas laws;
24. relate properties of gases to the kinetic-molecular theory;
25. predict deviations from ideal behavior in real gases;
26. calculate molecular weights of gases from Graham's Law and the Dumas method;
27. apply the First Law of Thermodynamics;
28. describe colligative properties of solutions;
29. write and interpret thermochemical equations;
30. use Hess's Law to calculate enthalpies of reaction from standard heat of formation;
31. derive enthalpies of reaction from calorimetric data;
32. calculate wavelength, frequency, speed and energy of electromagnetic radiation;
33. describe quantum effects of atoms and photons;
34. describe the energy level diagram and spectral series for atomic hydrogen;
35. calculate wavelength and momentum using the deBroglie relationship;
36. use the Heisenberg principle to predict uncertainty in position or momentum;
37. explain the basis of operation of chromatographic separation, mass spectrometry, scanning tunneling microscopy, x-ray diffractometry, nuclear magnetic resonance, and infrared spectroscopy;
38. describe the significance of the four quantum numbers n, l, m and s;
39. use the Aufbau Principle to derive the ground-state electronic configurations of the elements;
40. apply Hund's Rule and predict the number of unpaired electrons in an atom;
41. distinguish between diamagnetic and paramagnetic behavior;
42. describe the relationship between electronic configuration and atomic radius, ionization energy, electron affinity and electronegativity;
43. define ionic bonding, and apply the Born-Haber cycle to predict the stability of ionic crystalline solids;
44. define covalent bonding utilizing Lewis dot structures;
45. predict the existence of polar bonds and dipole moments in molecules;
46. describe delocalized bonding and resonance structures;
47. explain the factors that affect solubility;
48. calculate formal charges, bond orders, oxidation numbers and coordination numbers;

49. calculate enthalpies of reaction using bond dissociation energies;
50. apply the valence-shell electron-pair repulsion model to predict molecular geometries;
51. describe covalent bonding using the Valence Bond Theory;
52. use Molecular Orbital Theory to describe bonding in homonuclear diatomic molecules;
53. describe the nature of solids, liquids, gases and phase changes;
54. construct and interpret phase diagrams;
55. describe intermolecular forces;
56. relate atomic radii to unit cell dimensions;
57. describe the metallic bonding, covalent network solids and semiconductors;
58. recognize the shapes of the unit cells for the seven fundamental crystal systems;

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

1. observe all of the fundamental safety procedures;
2. properly dispose of waste chemicals;
3. manipulate standard laboratory apparatus;
4. perform gravimetric and titrimetric analyses
5. collect and analyze scientific data using graphical and statistical methods;
6. summarize lab results in both formal and informal report formats;
7. use a Macintosh personal computer (or equiv) to perform word processing, spreadsheet computations, graphing and statistical calculations for lab reports.

Topics and Scope:

LECTURE MATERIAL

1. Introduction to Scientific Method & Measurements
   a. Significant figures
   b. SI units
   c. Factor-label method of problem solving
2. Atoms, Molecules & Ions
   a. atomic theory & structure
   b. isotopes
   c. atomic weights
   d. periodic table
   e. chemical formulas
   f. nomenclature of binary compounds
   g. balancing chemical equations
3. Types of Chemical Reactions
   a. molecular & net-ionic equations
   b. oxidation-reduction reactions
   c. acid-base neutralization reactions
   d. precipation reactions
   e. gas formation reactions
   f. combustion reactions
4. Calculations with Chemical Fromulas and Equations
   a. molecular and formula weights
   b. the mole concept

c. mass percentages
d. empirical and molecular formulas
e. stoichiometric calculations
f. limiting reactants & theoretical and percentage yields
g. molarity & dilution
h. solution stoichiometry
i. equivalents & normality

5. The Gaseous State of Matter
   a. Measurement of gas pressure
   b. Fundamental gas laws (Boyle, Charles, Gay-Lussac, Avogadro)
   c. Ideal gas law
   d. Stoichiometry involving gases
   e. kinetic-molecular theory & gaseous diffusion and effusion
   f. real gases
6. Thermochemistry
   a. energy units and measuring heats of chemical reactions
   b. enthalpy and enthalpy change
   c. thermochemical equations and stoichiometry
   d. Hess's Law & standard enthalpies of formation
7. Quantum Theory of the Atom
   a. wave nature of light & particles
   b. quantum effects (photolectric effect, black body radiation & atomic spectra)
   c. Bohr's theory of the hydrogen atom
   d. quantum mechanics & atomic orbitals
8. Electron Configuration and Periodicity
   a. electron spin & Pauli exclusion principle
   b. Hund's rule & Aufbau principle
   c. predicting electronic configurations
9. Ionic and Covalent Bonding
   a. electronic configurations of ions
   b. ionic bond formation
   c. ionic radii
   d. covalent bond formation
   e. electronegativity & polar covalent bonds
   f. Lewis electron-dot formulas and formal charge
   g. resonance structures & delocalized bonding
   h. bond length, bond order & bond energy
10. Molecular Geometry and Chemical Bonding Theories
   a. delocalized bonding and MO theory
   b. valence-shell electron-pair repulsion model
   c. molecular geometry & dipole moments
   d. valence bond theory
   e. multiple bond descriptions
   f. molecular orbital theory
   g. homonuclear and heteronuclear diatomic molecules
11. Solid and Liquid States of Matter
   a. x-ray diffraction & crystal structure
   a. phase transitions and equilibria
   b. phase diagrams
   c. intermolecular forces & properties of liquids
   d. classification of solids (molecular, network, metallic, ionic)

e. crystal lattices & unit cells
f. calculations involving unit cell dimensions

12. Solutions
a. colligative properties
b. types of solutions
c. effects of temperature & pressure on solubility
d. mass percentage, mole fraction and molality
e. colloids

LABORATORY MATERIAL

1. Laboratory safety, techniques and maintaining data notebooks
2. Limiting reactant
3. Empirical formula of a compound
4. Nomenclature
5. Qualitative analysis
6. Graphing experimental data and statistical analysis
7. Atomic emission spectroscopy
8. Writing laboratory reports
9. Intro to MS Word, MS Excel & CricketGraph for the Macintosh computer
10. Gravimetric analysis
11. Titrimetric analysis (acid-base and oxidation-reduction)
12. Calorimetry
13. Gas laws
14. Molecular geometry

Assignment:

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 TECH/ACCUR LAB RSLTS	Skill Demonstrations 5 - 20%

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

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

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

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

Representative Textbooks and Materials:
LECTURE MANUALS
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 by Chang, McGraw-Hill, 1998.
LABORATORY MANUALS
CHEMISTRY IN THE LABORATORY by Jo Beran, Wiley, 1993.
EXPERIMENTS IN GENERAL CHEMISTRY by R. Wentworth, Houghton Mifflin, 1993.
EXPERIMENTS IN THE LABORATORY by Roberts, Hollenberg, and Postma, Freeman, 1997.
EXPERIMENTAL CHEMISTRY by James F. Hall, D.C. Heath, 1993.
SPECIAL STUDENT MATERIALS
Safety goggles
Laboratory apron
Scientific calculator
Laboratory data notebook