Degree Applicable

Glendale Community College
January 2010

COURSE OUTLINE

Chemistry 102
General Chemistry

I. Catalog Statement

Chemistry 102 is a continuation of the study of the basic concepts of general chemistry introduced in Chemistry 101, with an emphasis on the theory and technique of qualitative analysis.

Units - 5.0
Lecture Hours - 3
Laboratory Hours - 6

Prerequisite: Chemistry 101 with a grade of "C" or better.

II. Course Entry Expectations

Skills Expectations: Reading - 5; Writing - 5; Listening/Speaking - 5 Math - 5

Prior to enrolling in the class the student should be able to:
1. describe the scientific method and apply it to the development of the science of chemistry;
2. evaluate past and present atomic theories with respect to experimental observations;
3. describe chemical processes in terms of chemical equations and be able to use the equations to answer quantitative questions concerning the process described;
4. describe the relationship between matter and energy and their interconversion;
5. analyze kinetic molecular theory, especially as it applies to gases;
6. use quantum theory to predict electronic structures of the atom;
7. analyze the properties of the elements and develop algorithms for the classification of the elements into logical groups;
8. utilize bonding theories to describe the chemical nature of ions and molecules;
9. demonstrate an understanding of intermolecular forces and apply those forces to the nature of solids and liquids;
10. demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.

III. Course Exit Standards

Upon successful completion of the required course work, the student will be able to:

1. describe the fundamental properties of solutions and apply theories of colligative properties;
2. apply principles of electron transfer to understand oxidation and reduction processes;
3. distinguish between the rate of a reaction and the potential for a reaction to occur;
4. apply the fundamentals of Collision Theory to the rate at which a reaction proceeds;
5. analyze the effects of changes in system conditions on the amount of reactants and products present in the system;
6. identify acids and bases and evaluate the effects that they may have on the properties of a solution;
7. analyze the composition of solutions based on properties of the components, including but not limited to, solubility, complex ion formation and redox;
8. apply the laws of thermodynamics to chemical systems and predict the direction in which chemical reactions proceed;
9. apply the laws of thermodynamics to analyze the ability to obtain work from a chemical process;
10. describe the method by which electrical energy may be obtained from chemical systems;
11. apply redox properties of substances to the development and understanding of batteries, corrosion, and fuel cells;
12. evaluate the interactions by which coordination compounds are stabilized;
13. identify nuclear reactions and predict nuclear stability as well as recognize the dangers of radioactivity;
14. continue to demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.

IV. <u>Course Content</u>

A. Properties of Solutions — 16 hours
   1. The dissolving process
   2. Concentration units
   3. Temperature and solubility
   4. Colligative properties

B. Acid and bases — 16 hours
   1. Properties of acids and bases
   2. Arrhenius definitions
   3. Bronsted-Lowry definitions
   4. Lewis definitions
   5. Autoionization of water
   6. the pH scale
   7. Strengths of acids and bases

C. Chemical kinetics — 16 hours
   1. Rate defined

2. First and second order differential rate laws
3. First and second order integrated rate laws
4. Activation energy and temperature
5. Catalysis
6. Orientation leading to successful reactions
7. Equilibrium - when the net rate equals zero
8. Mechanisms

D. Chemical equilibrium 16 hours

1. Writing the equilibrium constant expression
2. Writing the equilibrium constants and concentrations
3. Le Chatelier's Principle
4. Weak acids and weak bases
5. Diprotic and polyprotic acids
6. Salts containing acidic and basic ions that hydrolyze
7. Common ion effect and buffer solutions
8. Titrations and indicators
9. Solubility products
10. Molar solubility
11. Predicting the formation of precipitates ~~precipitation reactions~~
12. Fractional precipitation
13. Solubility in solutions containing a common ion
14. pH and solubility
15. Complex ion equilibria

E. Coordination compounds 16 hours

1. Nomenclature
2. Isomerims
3. Valence Bond and crystal field theories

F. Thermodynamics 16 hours

1. Definitions
2. Entropy
3. Gibbs free energy
4. Free energy and equilibrium

G. Electrochemistry 16 hours

1. Balancing redox reactions
2. Galvanic cells
3. Standard electrode potentials
4. Cell potential, electromotive force
5. Nernst equation and concentration cells
6. Batteries
7. Corrosion

8. Electrolysis

H. Nuclear chemistry 16 hours

1. Elementary particles
2. Nuclear binding energy
3. Radioactivity
4. Dating by radioactive decay
5. Fission
6. Fusion
7. Biological effects of radiation

I. Organic Chemistry 16 hours

1. Hydrocarbons
2. Functional groups

V. Methods of Presentation

The following instructional methodologies may be used in the course:

1. Traditional white board lecture format.
2. Laboratory demonstrations

VI. Assignments and Methods of Evaluation

1. Four to six one hour exams
2. Quizzes and laboratory reports
3. Supplementary readings from handouts
4. Library work may be assigned
5. Final Exam of 2 1/2 hours that contains essay questions.

VII. Textbook

James M. Postma, et al, Chemistry in the Laboratory, 7th edition
New York, NY: W.H. Freeman, 2009
13th Grade Textbook Reading Level. ISBN 1429219548

Theodore E. Brown, H. Eugene LeMay, Chemistry The Central Science, 11th edition
Prentice Hall, Pearson, 2009
13th Grade Textbook Reading Level. ISBN 0-13-600617-5

VIII. Student Learning Outcomes

1. Solve quantitative chemistry problems and demonstrate reasoning clearly and completely as applied to solutions, chemical equilibria, chemical kinetics, and electrochemistry. Integrate multiple chemical concepts in the problem solving process.

2. Apply models of atomic behavior to explain general properties of matters such as colligative properties of solutions, crystal field theory, collision theory, and entropy.
3. Identify ions in solution using qualitative analysis.
4. Integrate concepts of equilibria, electrochemistry, and thermodynamics into explaining the spontaneity and direction of chemical reactions.
5. Apply chemical principles to practical applications such as batteries, electrolysis, corrosion, colors of compounds, and biological processes.
6. Analyze experimental data sets and graphs to obtain quantities related to kinetics, equilibrium, and acid-base chemistry.