Degree Applicable
Course ID 004010

Glendale Community College
March 2015

COURSE OUTLINE

**Chemistry 102 (C-ID Number: CHEM 120S)**
**General Chemistry (C-ID Title: General Chemistry for Science Majors Sequence A)**

## I. Catalog Statement

Chemistry 102 is the second course in a two-semester sequence which covers important chemistry concepts including physical properties of matter, chemical reactions, stoichiometry, electronic structure of atoms, quantum mechanics, chemical bonding, and the three phases of matter. Lecture and laboratory activities are integrated into one cohesive lecture-lab section. The latter part of the course covers solution chemistry with emphasis on chemical kinetics, thermodynamics, and electrochemistry. Laboratory activities supports the above-mentioned topics, including both qualitative and quantitative analysis of data and propagation of errors.

Total Lecture Units: 3.0
Total Laboratory Units: 2.0
**Total Course Units: 5.0**

Total Lecture Hours: 48.0
Total Laboratory Hours: 96.0
Total Laboratory Hours To Be Arranged: 0.0
**Total Faculty Contact Hours: 144.0**

Prerequisites: CHEM 101 with a grade of “C” or better.

## II. Course Entry Expectations

Prior to enrolling in the course, the student should be able to:

- describe the scientific method and apply it to the development of the science of chemistry;
- evaluate past and present atomic theories with respect to experimental observations;
- describe chemical processes in terms of chemical equations and be able to use the equations to answer quantitative questions concerning the process described;
- describe the relationship between matter and energy and the inter-conversion of the two;
- analyze modern theories of atomic motion, especially as they apply to gasses;
- use quantum theory to predict electronic structures of the atom;
- analyze the properties of the elements and develop algorithms for the classification of the elements into logical groups;
- utilize bonding theories to describe the chemical nature of ions and molecules;

- demonstrate an understanding of intermolecular forces and apply those forces to the nature of solids and liquids;
- demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.

## III. <u>Course Exit Standards</u>

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

- describe the fundamental properties of solutions and apply theories of colligative properties;
- apply principles of electron transfer to understand oxidation and reduction processes;
- distinguish between the rate of a reaction and the potential for a reaction to occur;
- apply the fundamentals of collision theory to the rate at which a reaction proceeds;
- analyze the effects of changes in system conditions on the amount of reactants and products present in the system;
- identify acids and bases, and evaluate the effects that they may have on the properties of a solution;
- analyze the composition of solutions based on properties of the components, including solubility, complex ion formation and redox;
- apply the laws of thermodynamics to chemical systems and predict the direction in which chemical reactions proceed;
- apply the laws of thermodynamics to analyze the ability to obtain work from a chemical process;
- describe the method by which electrical energy may be obtained from chemical systems;
- apply redox properties of substances to the development and understanding of batteries, corrosion, and fuel cells;
- evaluate the interactions by which coordination compounds are stabilized;
- identify nuclear reactions and predict nuclear stability as well as recognize the dangers of radioactivity;
- continue to demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.

## IV. <u>Course Content</u> **Total Faculty Contact Hours = `**

A. Properties of Solutions **(Lecture 10 hours, Lab 6 hours)**
   1. The dissolving process
   2. Concentration units
   3. Temperature and solubility
   4. Colligative properties

B. Acid and Bases **(Lecture: 10 hours, Lab 6 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 **(Lecture 10 hours Lab 6 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 **(Lecture 10 hours, Lab 6 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 equilibriums

E. Coordination Compounds **(Lecture, 10 hours, Lab 6 hours)**
1. Nomenclature
2. Isomerims
3. Valence Bond and crystal field theories

F. Thermodynamics **(Lecture 10 hours, Lab 6 hours)**
1. Definitions
2. Entropy
3. Gibbs free energy
4. Free energy and equilibrium

G. Electrochemistry **(Lecture: 10 hours, Lab 6 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 **(Lecture 10 hours, Lab 6 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 **(Lecture 10 hours, Lab 6 hours)**
1. Hydrocarbons
2. Functional groups

## V. Methods of Instruction

The following methods of instruction may be used in the course:
- traditional white board and lecture format;
- laboratory demonstrations.

## VI. Out of Class Assignments

The following out of class assignments may be used in the course:
- laboratory reports;
- supplementary readings from handouts;

## VII. Methods of Evaluation

The following methods of evaluation may be used in the course:
- four to six one-hour exams;
- quizzes;
- laboratory reports;
- final exam with essay questions.

## VIII. Textbook(s)

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

Brown, T.E. and H. E. LeMay. *Chemistry The Central Science*. 11$^{th}$ edition. Prentice Hall/ Pearson, 2009. Print.
13th Grade Textbook Reading Level, ISBN 0-13-600617-5

## IX. Student Learning Outcomes

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

- solve quantitative chemistry problems including problems in solutions, chemical equilibriums, chemical kinetics, and electrochemistry.
- demonstrate reasoning in solving chemistry problems;
- integrate multiple ideas in the problem solving process;
- apply models of atomic behavior to explain general properties of matters such as colligative properties of solutions, crystal field theory, collision theory, and entropy;
- identify ions in solution using qualitative analysis;
- integrate concepts of equilibriums, electrochemistry, and thermodynamics into explaining the spontaneity and direction of chemical reactions;
- apply chemical principles to practical applications such as batteries, electrolysis, corrosion, colors of compounds, and biological processes;
- analyze experimental data sets and graphs to obtain quantities related to kinetics, equilibrium, and acid-base chemistry.