Diablo Valley College Course Outline for CHEM-121

CHEM-121: General College Chemistry II

Description

This course is a continuation of Chemistry 120, General College Chemistry I. Subject matter includes: buffers, titration curves, solubility products, thermodynamics, electrochemistry, kinetics, molecular orbital theory, coordination complexes, nuclear chemistry, organic chemistry, spectroscopy, quantitative experiments, and qualitative analysis.

Prerequisite

CHEM - 120 or equivalent

General Information

Department: Chemistry, Physical Science and Engineering Division
Units: 5.00
Grade Code: Letter grade
Repeatability: none
Max class size: 26

Number of Hours

Per Semester
Lecture: 90.00
Laboratory: 72.00

Objectives

Students will be able to:

A. Apply the basic concepts of chemistry, both as ends in themselves and as bases for further study in chemistry.
B. Analyze and solve both quantitative and qualitative problems as well as be able to explain the results verbally or in a written fashion.
C. Apply the inductive-deductive process by which science evolves, apply theoretical models, and demonstrate awareness of the importance of science in the modern developed world.
D. Use basic laboratory skills and techniques beyond Chemistry 120; work independently in the lab, and use critical thinking in the qualitative analysis of unknown samples.

Content

A. Ionic equilibria
  1. Acid base review
  2. Buffers and titration curves
  3. Solubility product
  4. Selective precipitation
  5. Dissolving precipitates
  6. Formation constants for complex ions
B. Thermodynamics
  1. Three laws of thermodynamics
  2. Gibbs free energy
  3. Calculation of equilibrium constants
C. Electrochemistry
  1. Electrochemical cells
  2. Electrode potential
  3. Nernst equation
  4. Electrolysis and Faraday's laws
D. Molecular orbital theory
E. Coordination chemistry
  1. Formation and structure of complexes

2. Isomerism
3. Crystal field theory

F. Introduction to organic chemistry
1. Structure and isomerism
2. Classification of the basic functional groups

G. Spectroscopy - absorption spectra, visible, UV, IR, NMR

H. Chemical kinetics
1. Factors affecting reaction rate
2. Collision and transition state theories
3. Arrhenius equation
4. Rate laws
5. Reaction mechanism

I. Introduction to nuclear chemistry
1. Nuclear binding forces, nuclear instability
2. Radioactivity, nuclear equations including fission and fusion
3. Mass energy relationships

J. Qualitative analysis
1. Properties and qualitative analysis of selected ions
2. Application of principles of ionic equilibrium, redox, and complex ion formation to the separation and detection of ions.

K. Quantitative analysis
1. Quantitative spectrocopic instrumentation: eg. AA, UV/Vis
2. Calibration curves, statistical analysis of data

Methods

Lecture, Laboratory, Demonstration, Discussion

Assignments

Reading 1: Read the chapter on thermodynamics pertaining to enthalpy, entropy and Gibbís free energy. Discuss the effects of changes in these thermodynamic functions on the spontaneity of a reaction.

Reading 2: Read the section on corrosion in the electrochemistry chapter and explain how a sacrificial electrode works. Also be able to deduce what metal would make a suitable sacrificial electrode for an object made of metallic iron.

Writing, problem solving, performance 1: Calculate the solubility (in moles/L) of Fe(OH)3 in each of the following: a) water buffered at pH = 7.0, b) a solution buffered at pH = 5.0, c) a solution buffered at pH = 11.0.

Writing, problem solving, performance 2: How many grams of precipitate will form when 100.0mL of 0.020M Pb(NO3)3 is added to 100.0 mL of 0.020 M NaCl? What is the concentration of each ion that will remain in solution after the following two solutions are mixed together?

Lab, field activity, product or report: (1) Electrochemistry (four part experiment)
a. Measure cell potentials and ranked reductions potentials for cations
b. Measure voltage for silver concentration cell and calculate Ksp for a silver salt.
c. Observe electrolysis of water and salt solutions and write half-cell reactions.
d. Observe corrosion of iron in different environments and write half-cell reactions.
(2) Rate Law Determination for a chemical reaction
(3) Determination of values of Thermodynamic functions for chemical reaction
(4) Qualitative Analysis
(5) Visible Spectoscopic Analysis, including creating a Beer's Law plot

Other: Net ionic equations for all major reactions carried out in qualitative analysis scheme.

Evaluation

Sample One: Explain what is meant by: (a) the rate law of reaction; (b) the order of a reaction; (c) activation energy; (d) half-life

Sample Two: Solid Nal is slowly added to a solution that is 0.010 M in Cu+ and 0.010 M in Ag+, (a) Which compound will precipitate first? (b) Calculate [Ag+] when Cul just begins to precipitate. (c) What percent of Ag+ remains in solution?
Frequency of Evaluation: Evaluations will adhere to the DVC "Fairness in Grading" guidelines and will include as a minimum: (1) Evaluation of students within the first quarter of the course and notifying student of the results (2) Counting a final examination for no more than one-half the course grade (3) Basing final grades on at least three students' tests and/or reports
Additional: (1) A minimum of three closed-book, one hour in-class exams and a final exam are given each semester.
(2) Homework problems assigned and evaluated or short quizzes are given.
(3) Laboratory evaluation represents approximately 25% of course grade.
(4) Formal lab write ups, will include pages from student lab notebook.
(5) Web-based problems may be assigned.

Sample Textbook

See the current course syllabus or bookcenter.dvc.edu for the actual course textbook.
Book One
Author: Zumdahl, Steve and Susan Zumdahl
Title: Chemistry, 8th edition
Publisher: Houghton Mifflin Co
City: Boston, MA
Year: 2008
Book Two
Author: DVC Chemistry Dept
Title: Diablo Valley College Chemistry 121 Experiments
Publisher: Arbor Crest
City: California
Year: 2010

Other

(1) Scientific Calculator
(2) Safety eye protection
(3) Laboratory notebook
(4) Portable memory device

Approval Date

Oct 12 2010