

A. CATALOG DESCRIPTION (include prerequisites)

Course Title: Chemical Principles II
Credits: 4
Hours/Week: 3 hours lecture and 3 hours lab per week
Semester Offered: Fall, Spring
Prerequisites: CHEM 1127 or equivalent, College Algebra highly recommended

This course meets requirements for the Minnesota Transfer Curriculum in NS (Natural Science) and CT (Critical Thinking).

The second semester of a two-semester study of general chemistry for the science major covering basic terminology, chemical principles and laws pertaining to the areas of basic thermodynamics, reaction kinetics, gaseous and solution equilibria, acid-base chemistry, solubility products and oxidation-reduction reactions.

B. DATE LAST REVISED (use current date): December, 2004

C. RECOMMENDED ENTRY SKILLS/KNOWLEDGE:

College-level reading and writing skills and working knowledge of college algebra

D. OUTLINE OF MAJOR CONTENT AREAS:

1. Reaction Kinetics
 - a. Thermo decomposition
 - b. Collision mechanisms
 - c. 1st, 2nd and zero order reactions and calculations
2. Gaseous Equilibria
 - a. Relation of K_p and K_c and equilibria calculations
3. Solution Equilibria Calculations
4. Acid-Base Chemistry and Titrations
 - a. Titration (acid/base)
 - b. pH calculation
 - c. K_a , K_b and K_h calculations, common ion problem
5. Precipitation Reactions
 - a. K_{sp} problems
 - b. Common ion problems
 - c. Complex ion equilibria
 - d. Qualitative analysis
6. Basic Thermodynamics
 - a. Thermochemistry review of enthalpy
 - b. Entropy and calculation
 - c. Gibbs free energy calculation

D. OUTLINE OF MAJOR CONTENT AREAS (continued):

7. Oxidation Reduction
 - a. Electron transfer
 - b. Balancing complex redox equations
 - c. Equivalents in redox
 - d. Redox titration
 - e. Half cell potential
 - f. Electrochemistry
 - g. The Nernst Relation and calculation

The laboratory activities are used to enhance, correlate and demonstrate a variety of methods and equipment used in scientific inquiry and as verification of various scientific laws and theories. Laboratory measurement are obtained and recorded by students during the lab period. The results are analyzed and certain specified calculations are required to demonstrate and verify related laws and relationships. Reports and/or quizzes are handed in for evaluation.

E. LEARNING OUTCOMES (GENERAL):

1. Be cognizant of the basic chemical vocabulary
2. Be reasonably knowledgeable of the chemical principles and laws related to basic thermodynamics, reaction kinetics, acid-base and gaseous equilibria and oxidation-reduction chemistry
3. Be able to solve problems using experimental and/or simulated data and relate them to the chemical principles and laws involved
4. Gain a perception of the uncertainty of the laboratory and/or simulated data and values calculated from these values and the related chemical principles and laws
5. Gain insight as to how chemistry relates to one's everyday activities.

F. LEARNING OUTCOMES (MNTC):

Critical Thinking

- a. Gather factual information and apply it to a given problem in a manner that is relevant, clear, comprehensive and conscious of the bias in the information selected.
- b. Imagine and/or seek out a variety of possible goals, assumptions or perspectives which can give meaning to a given problem.
- c. Analyze the logical connections between facts, goals and assumptions relevant to a problem, and evaluate claims which may be said to follow from them.
- d. Recognize and articulate the value of assumptions, which underlie and affect decisions, interpretations, analyses, and evaluations made by oneself and others.

Natural Sciences

- a. Demonstrate understanding of Scientific theories and the ways in which scientists develop, express, and question theories in the field of chemistry.
- b. Formulate and test hypotheses by performing laboratory experiments requiring collection of data, its statistical and/or graphical analysis and an appreciation of uncertainty and sources of error.
- c. Communicate their findings, analysis and interpretations both orally and in writing.

G. METHODS FOR EVALUATION OF STUDENT LEARNING:

Several broad coverage unit tests covering terminology, relationships of various laws and theories and problem solving are given for the major part of the grade. Also, several problem quizzes are given over smaller but similar areas. Weekly laboratory reports constitute the remainder of the evaluation.

H. SPECIAL INFORMATION (fees, directives on hazardous materials, etc.):

During the pre-lab discussion, the hazardous characteristics and handling of the chemicals used during the lab are discussed. The students will be instructed on the proper disposal of any hazardous products. The instructor will direct all students to wear necessary protective equipment while working with the chemicals. A copy of Material Safety Data Sheets for chemicals used is available in the lab.