BLINN COLLEGE

MASTER COURSE SYLLABUS

CHEMISTRY 1412

CIP # 40.0501.5203

CIP Area: Physical Sciences

FALL, 2005

Prepared by:

_____

Bryan Campus / Date

Confirmed by:

_____

Division Chair, Brenham Campus / Date

_____

Division Chair, Bryan Campus / Date

_____

Brenham Academic Dean / Date

_____

Bryan Academic Dean / Date

_____

Vice President Academic Affairs / Date

Chem 1412 General Chemistry II

This course is in the core curriculum.

Purpose Statement

The purpose of the natural sciences component in the core curriculum is to enable the student to understand the basic concepts in the natural sciences and to apply that understanding to the analysis of current issues in society. In particular, mastering this course will make students more conscious of nature and composition of the world around them. The course is designed to meet the needs of students wishing to major in chemistry, biology, physics, and engineering as well as those pursuing pre-professional degrees in medicine, veterinary medicine, dentistry, pharmacy and other fields. It is a continuation of Chemistry 1411 and prepares students to enroll in Chemistry 2423, Organic Chemistry I.

Course Description

1. CHEM 1412 consists of the study of the fundamental laws, theories and concepts of chemistry including oxidation-reduction, electrochemistry, thermodynamics, chemical equilibria, nuclear, and organic chemistry. **Prerequisites:** Chem 1411 with a grade of "C" or better and Math 1314 or the equivalent. Three class hours and four laboratory hours per week. Credit: Four (4) semester hours.
2. The major areas which will be covered in lecture are:
    a. Chemical Thermodynamics
    b. Chemical Kinetics
    c. Chemical Equilibrium
    d. Ionic Equilibria I, Acids and Bases
    e. Ionic Equilibria II, Buffers and Titration Curves
    f. Ionic Equilibria III, Solubility Product Principle
    g. Electrochemistry
    h. Metals I: Metallurgy
    i. Metals II: Properties and Reactions
    j. Nonmetals and Metalloids
    k. Coordination Compounds
    l. Nuclear Chemistry
    m. Organic Chemistry I: Formulas, Names, and Properties
    n. Organic Chemistry II: Shapes, Selected Reactions, and Biopolymers

    The major areas which will be covered in lab are:
    a. Safety Orientation
    b. Laboratory Notebook
    c. Chemical Thermodyamics
    d. Factors Effecting Chemical Rates
    e. Determination of the Rate of Reaction
    f. pH and Acid/Base Indicators
    g. Dissociation Constants of Acids and Bases
    h. Solubility Products
    i. Electrochemical and Voltaic Cells
    j. Reactions of Metals and Metalloids
    k. Reactions of Nonmetals
    l. Preparation of an Organic Ester
3. Three lecture hours and three laboratory hours per week.

4. Chem 1412 earns four credit hours.
5. Prerequisite: CHEM 1411 with a grade of "C" or better and Math 1314 or the equivalent.
6. This is a Core Course in the 42-hour Core of Blinn College; more can be found at www.blinn.edu/corecurriculum/. As such, students will develop proficiency in the appropriate Intellectual Competencies, Exemplary Educational Objectives, and Perspectives, as follows:
    a. Intellectual Competencies
        i. **Reading:** The ability to analyze and interpret a variety of printed materials, books, documents and articles – above the 12^{th} grade level.
        ii. **Writing:** The ability to produce clear, correct and coherent prose adapted to purpose, occasion and audience – above the 12^{th} grade level.
        iii. **Listening:** The ability to analyze and interpret various forms of spoken communication, possess sufficient literacy skills of writing, reading – above 12^{th} grade level.
        iv. **Critical Thinking:** The ability to think and analyze at a critical level.
        v. **Computer Literacy:** The ability to understand our technological society; use computer-based technology in communications, solving problems, acquiring information.
    b. Exemplary Educational Objectives
        i. To understand and apply method and appropriate technology to the study of natural sciences.
        ii. To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
        iii. To identify and recognize the differences among competing scientific theories.
        iv. To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
        v. To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.
    c. Perspectives
        i. To recognize the importance of maintaining health and wellness.
        ii. To develop a capacity to use knowledge of how science and technology affect their lives.
        iii. To use logical reasoning in problem solving.
        iv. To integrate knowledge and understand the interrelationships of the scholarly disciplines.

Course Objectives and Student Learning Outcomes

Upon completion of the course, the student will have an overall average of ≥60% of the combined lecture and laboratory components of the course. This includes at least 3 to 4 major exams and chapter/weekly quizzes given at the discretion of the Instructor. In the laboratory the student will successfully complete the experiments with the accompanying reports. The student will demonstrate in the laboratory an understanding of the experiment through analysis of the data and being able to use this data to solve problems and predict the outcome of similar reactions and/or experiments.

These learning outcomes will include the student showing competence in the course objectives that are listed below: The course objectives are:

From Lecture:

1. Learn how chemical thermodynamics affect chemical reaction. This includes understanding the First and Second Laws of Thermodynamics, enthalpy, entropy, Hess's Law, Gibb's Free energy, and how these affect the spontaneity of physical changes and chemical reactions.

2. Learn how to determine the rate of a reaction and understand the factors that affect reaction rates.

3. Learn the basic concepts of chemical equilibrium.

4. Learn how to calculate pH and understand how ionic equilibria affect pH.

5. Learn how to predict the pH of a buffer solution and how a titration curve can be used to calculate K_a.

6. Learn how to use the Solubility Product principle to calculate the solubility of a compound in a solution.

7. Learn how to calculate electrode potential and develop and understanding of the principles of electrolysis, electrochemical and voltaic cells.

8. Understand the construction and use of batteries and how the choice of a metal can dictate the voltage and life of a battery.

9. Learn the general principles of metallurgy.

10. Learn the properties and reactions of alkali metals, alkaline earth metals, the transition metals and the rare earth metals.

11. Learn the properties and reactions of the nonmetals and metalloids.

12. Learn the properties of coordination compounds. Understand the principles of nomenclature and how hybridization affects the 3-D shape and properties of the compound.

13. Learn the principles of nuclear chemistry and to predict nuclear stability based upon the band of stability. Understand the kinetics of radioactive decay and be able to calculate the rate of radioactive decay based upon half-life.

14. Learn the nomenclature of simple organic compounds.

15. Learn to recognize general organic functional groups and the properties these give to the parent compound.

16. Learn selected organic reactions.

17. Learn to recognize biopolymers and understand how the functional groups present within these compounds dictate their properties.

From Lab:

1. Demonstrate familiarity with the fundamentals of laboratory safety.

2. Learn how to keep a laboratory notebook with required data and calculations.

3. Correctly use general laboratory equipment.

4. Demonstrate proficiency at general laboratory techniques, such as titration, gravimetric and spectrophotometric methods of analysis.

5. Use computer software and probes to perform experiments studying thermodynamics and pH changes during titrations.

6. Perform simple electrochemical experiments.

7. Demonstrate an ability to perform qualitative analysis of inorganic materials.

8. Synthesize an organic ester and perform simple organic chemical classification tests.

Course Requirements

1. The student should do each of the following:
    a. Read the assigned chapters in the textbook and laboratory manual.
    b. Attend all lectures and laboratory classes.
    c. Take notes in class.
    d. Participate in class discussions.
    e. Complete assigned outside reading material and homework.
    f. View audiovisual materials on selected topics.
    g. Use the computer software in the lab and/or classroom as it is assigned.
    h. Complete the exams on the assigned dates; the exams may include essay questions.

2. For laboratory the student should:
    a. Read and comprehend each experiment assigned in the laboratory manual and complete the prelab assignment before going into the lab.
    b. Successfully complete each experiment.
    c. Learn to use and/or analyze data from instruments which are needed to complete the experiments. (balance, spectrometer, pipets, burets, etc.)
    d. Complete the laboratory reports, including identifying any compounds that were synthesized and isolated and any unknowns which are assigned.

3. The Instructor should consider assigning a library assignment on topics relating to the course. The assignment should require both written and oral reports by the student. This may or may not be used for additional credit.

Grading System

The following areas will be clearly outlined by the Instructor in the Course Information Sheet given to the students in the first week of the semester:

1. Major Exams: Three or four major exams covering the lecture material, evenly distributed throughout the semester.
2. Laboratory: May be included on major exams or the instructor may give quizzes covering lab material or a laboratory final exam. Represents 25% of the total grade for the class.
3. Minor Exams/Quizzes/Homework: Given at the discretion of the instructor.
4. Additional Reports or projects: Given at the discretion of the instructor.
5. Final Exam: Comprehensive exam covering the entire course; required of all instructors.

Outcomes Inventory

Chemistry 1412 will be evaluated through the following methods:

1. A pre and post test instrument is used to determine the extent of improvement the class has gained during the semester.

2. Each Intellectual Competency listed above will be evaluated to measure its attainment:
    a. To measure reading:
        1. Exam or quiz over assigned textbook readings AND/OR
        2. Lab assignment or exam or quiz over lab book readings AND/OR
        3. Written assignment or exam over assigned journal articles.
    b. To measure writing:
        1. Written assignment or term paper AND/OR
        2. Essay question on exam.
    c. To measure listening:
        1. Exam or quiz over lecture material AND/OR
        2. Quiz over video viewed.
    d. To measure critical thinking:
        1. Lab assignment or exam or quiz involving problem solving.
    e. To measure computer literacy:
        1. Quiz over Internet/CD-Rom/DVD activities.

3. Grades of students completing the course will be compared with those who complete Chemistry 2423 in the following semester.

Calendar

The instructor will ensure that the course content is covered in a manner that fulfills the course objectives. The instructor will also provide Course Information Sheets to the students and the administration during the first week of the semester. Important details including tentative examination dates and due dates for assignments are provided.

Week	Lecture Topic
1	Thermochemical Equations
2	Chemical Kinetics
3	Rate Expressions
4	Chemical Equilibrium
5	Ionic Equilibria, pH
6	Buffers and Titration Curves
7	Solubility Product Principle
8	Electrochemistry
9	Metals I, Metallurgy
10	Metals II, Chemical Properties and Reactions
11	Nonmetals and Metalloids
12	Coordination Chemistry
13	Nuclear Chemistry
14	Organic Chemistry, Nomenclature and Functional Groups
15	Organic Chemistry, Reactions and Biopolymers

Week	Laboratory Topic
1	Lab Safety; Introduction to Chemical Literature and Calculations
2	Heats of Neutralization, Hess' Law
3	Factors Influencing the Rate of Reaction
4	Rates of Chemical Reactions
5	Spectrophotometric Determination of a Rate Constant
6	pH and Indicators
7	Determination of K_a
8	Analysis of Commercial Antacids
9	Determination of the Solubility of an Insoluble Salt
10	Voltaic and Electrochemical Cells
11	Nitrogen and Its Compounds
12	Qualitative Analysis of Ions
13	Commercial Esters
14	Completion of Laboratory Work

Materials Required

Lecture Materials:

General Chemistry, 6th Edition, Whitten, Davis and Peck, Harcourt, 2000 (required); Study Guide and Solutions Manual, 6th Edition, Whitten, Davis, and Peck, 2000 (non-required)

Laboratory Materials:

Standard and Microscale Experiments in General Chemistry, 4th Edition, Bishop, Bishop, and Whitten, Harcourt, 2000 (required); safety goggles (required); a scientific calculator (required); and a laboratory apron (not required).