

BUTTE COLLEGE

COURSE OUTLINE

I. CATALOG DESCRIPTION

CHEM 2 - General Chemistry II

5 Unit(s)

Prerequisite(s): CHEM 1

Recommended Prep: NONE

Transfer Status: CSU/UC

51 hours Lecture

102 hours Lab

This course is a continuation of CHEM 1, General Chemistry I. Topics include chemical kinetics and equilibrium, acid-base and solubility equilibria, thermodynamics, oxidation-reduction, electrochemistry, coordination compounds, nuclear chemistry, introduction to organic chemistry and qualitative analysis. This is the second semester of a one-year course in chemistry intended for majors in the natural sciences (chemistry, biochemistry, biology, physics, pre-medicine), mathematics, and engineering. The two-semester sequence of CHEM 1 and CHEM 2 provides the basic chemical background needed for further investigations into our physical environment. (C-ID CHEM 120S) (C-ID CHEM 120S = CHEM 1 and CHEM 2). Graded only.

II. OBJECTIVES

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

- A. Demonstrate basic experimental knowledge by employing standard laboratory techniques for data gathering, judging the accuracy and reliability of data, creating informative graphs, and discussing the limitations of experimental designs.
- B. Demonstrate basic analytical skills by interpreting graphs and schematics and diagnosing realistic physical problems.
- C. Demonstrate conceptual understanding by being able to describe qualitatively the underlying causes of basic physical and chemical phenomena.

III. COURSE CONTENT

A. Unit Titles/Suggested Time Schedule

Lecture	
<u>Topics</u>	<u>Hours</u>
1. Chemical Kinetics	6.00
2. Chemical Equilibrium	5.00
3. Acids and Bases	6.00
4. Applications of Aqueous Equilibria: Buffers and Titrations	5.00
5. Applications of Aqueous Equilibria: Solubility and Complex Ion Equilibria	3.00
6. Spontaneity, Entropy and Free Energy	6.00
7. Electrochemistry	4.00
8. Descriptive Chemistry	3.00
9. Transition Metals and Coordination Chemistry	5.00
10. Nuclear Chemistry	5.00
11. Organic Chemistry	3.00
Total Hours	51.00

Lab

<u>Topics</u>	<u>Hours</u>
1. Organic Chemistry Background for Lab Research	6.00
2. Research Methods Project: Physical Properties of Organic Liquids	6.00
3. Research Methods Project: Spectroscopy and Spectrometry of an Organic Compound	12.00
4. Research Methods Project: Chemical Analysis of Organic Compounds	3.00
5. Research Methods Project: Written Reports	6.00
6. Research Methods Project: Group Analysis and Reporting	12.00
7. Research Methods Project: Oral Reports	3.00
8. Kinetics of a Chemical Reaction	3.00
9. Chemical Equilibria: Determining K; LeChâtelier's Principle	6.00
10. Acid-Base Titrations and Properties of Salts and Buffers	9.00
11. Thermodynamics and Spontaneity	3.00
12. Electrochemistry and Galvanic Cells	6.00
13. Inorganic Qualitative Analysis	18.00
14. Complex Ions and Inorganic Synthesis	3.00
15. Redox Titrations	3.00
16. Nuclear Chemistry: Measuring Types of Radiation	3.00
Total Hours	102.00

IV. METHODS OF INSTRUCTION

- A. Lecture
- B. Reading Assignments
- C. Laboratory Experiments
- D. Demonstrations and visual aids
- E. Directed discussions
- F. Laboratory exercises
- G. Homework: Students are required to complete two hours of outside-of-class homework for each unit of credit.

V. METHODS OF EVALUATION

- A. Quizzes
- B. Written examinations
- C. Laboratory reports and exercises

VI. EXAMPLES OF ASSIGNMENTS

- A. Reading Assignments
 1. Read the section on integrated rate laws in the text, and be prepared to participate in discussions of the derivation of these laws and be able to apply them to zero, first and second order reactions.
 2. In your text, read the sections on the common ion effect and acid/base equilibrium. Be prepared to answer examination questions regarding applications of the common ion effect, in particular with respect to determining the acid dissociation constant, and the pH of buffered solutions.
- B. Writing Assignments
 1. For the experiment to determine the rate law for a chemical reaction, create a properly formatted report in your lab notebook. The report must include the title, date, any

partners, a clear statement of purpose, an overview or procedure, complete data results tables, and a conclusion based on your observations.

2. For the experiment to determine the K_a of a weak acid, write a report that includes a purpose, your relevant data, appropriate graphs, any results from your research and your conclusions based on those results.

C. Out-of-Class Assignments

1. After reading the experiment for determining the rate law for a chemical reaction, complete the prelab and use the method of initial rates to calculate the order of the reaction with respect to the assigned species.
2. After reading the experiment for determining the acid dissociation constant for a chemical reaction, complete the prelab and calculate the K_a for a reaction using the graph of a titration curve.

VII. **RECOMMENDED MATERIALS OF INSTRUCTION**

Textbooks:

- A. Zumdahl, S.S. & Zumdahl, S.A. Chemistry. 9th Edition. Brooks Cole, Belmont, CA, 2013.
- B. Wren, A., Sincoff, S., & Wannenmacher, E.. Laboratory Manual for General Chemistry-CHEM 2. Current Edition. Butte College Department of Physical Sciences, Oroville, CA, 2015.

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