# CHEM 0001B - GENERAL CHEMISTRY II

## Catalog Description

Prerequisite: Completion of CHEM 1A or 3B with grade of "C" or better
Advisory: Eligibility for ENGL 1A strongly recommended
Hours: 162 (54 lecture, 108 laboratory)
Description:A continuation of CHEM 1A. Includes chemical kinetics, equilibrium, acid-base theory, thermodynamics, electro-chemistry, modern theories of bonding, and nuclear chemistry through related lecture and laboratory exercises. Note: CHEM 1A/1B sequence may be started any semester. (combined with CHEM 1A or CHEM 3A/3B, C-ID CHEM 120S) (CSU, UC-with unit limitation)

## Course Student Learning Outcomes

- CSLO #1: Demonstrate proficiency in solving problems and analyzing data related to molecular structure and bonding.
- CSLO #2: Demonstrate proficiency in solving problems and analyzing data related to chemical and physical equilibrium.
- CSLO #3: Demonstrate proficiency in solving problems and analyzing data related to chemical kinetics (dynamics) and thermodynamics (energetics).
- CSLO #4: Demonstrate proficiency in solving problems and analyzing data related to electrochemistry (redox) and transition metal ion bonding.
- CSLO #5: Demonstrate proficiency in scientific communication.

## Effective Term

Fall 2022

## Course Type

Credit - Degree-applicable

## Contact Hours

162

## Outside of Class Hours

108

## Total Student Learning Hours

270

## Course Objectives

Given a periodic chart, an ion chart, a strong and weak electrolyte chart, and a calculator, students will perform the following on written examinations, on laboratory exercises, or in laboratory experiments:
Lecture Objectives:
1. solve for the rate equation given appropriate kinetic data;
2. evaluate proposed mechanisms using rate laws;
3. solve rate problems using the rate equation;
4. compute the equilibrium constant for a reaction;
5. calculate the concentrations of reactants and products for an equilibrium reaction;
6. determine the result of disturbing a chemical equilibrium;
7. identify the acid and base in an acid-base chemical equation;
8. solve acid-base equilibrium problems involving buffers;
9. compute the pH of a water solution;
10. calculate the equilibrium constant for a precipitation reaction; and
11. compute the concentrations of reactants and products for a precipitation reaction.
12. solve thermodynamic problems involving enthalpy, entropy, and free energy;
13. solve problems involving thermodynamics and chemical equilibrium;
14. solve problems using Coulomb's Law;
15. solve problems involving chemical potential and free energy;
16. compute the cell voltage using standard potentials;
17. compute the cell voltage in non-standard conditions using the Nernst equation;
18. explain corrosion using oxidation-reduction reactions;
19. explain the chemistry of the main group elements using appropriate balanced equations and basic chemical principles;
20. explain the chemistry of the transition elements using appropriate balanced equations and basic chemical principles;
21. solve nomenclature problems involving coordination compounds;
22. solve problems involving the geometry, color, structure, etc., of coordination compounds using the bonding theories that explain their behavior;
23. demonstrate nuclear reactions by completing and balancing nuclear equations;
24. solve half-life problems;
25. explain nuclear fusion and fission using words and appropriate equations;
26. solve problems involving rate of nuclear decay;
27. solve problems involving isotopic dilution.
Laboratory Objectives:
1. perform laboratory experiments to reinforce the concepts presented in lecture;
2. exhibit cooperative and individual skills in the collection and analysis of data;
3. develop clear, cogent reporting of experimental observations, analysis, and conclusions;
4. investigate factors that determine reaction rates;
5. determine the rate equation and the activation energy for a specific reaction using the initial rates data collected;
6. investigate factors influencing equilibrium;
7. Determine the equilibrium constant of chemical system
8. investigate the use pH indicators to determine the pH of a solution;
9. explore properties of acids and bases; observe the behavior of buffer solutions;
10. determine dissociation constant of an monoprotic acid;
11. students will calculate and prepare buffer solutions to a given pH value;
12. determine the solubility constant of a solid using titration methods;
13. investigate relative oxidizing/reducing strength of species to create an activity series
14. measure cell voltages and diagram the resulting cells;
15. use measured cell voltages to determine Ksp and Kf values;
16. investigate corrosion using oxidation-reduction reactions to explain the observations;
17. investigate the chemistry of various transition elements using appropriate balanced equations and basic chemical principles to explain the observations;
18. verify the relationship between the observed colors of transition compounds, the recorded visible spectrum, and the splitting energy predicted by the ligand field theory;
19. verify the identity of unknown ionic species using qualitative analysis.

A minimum of 20 of the 32 (maximum) lab sessions during the semester will be experiments which require the student to obtain, record, and analyze observations and measurements. A range of 22-24 lab sessions of this type is most commonly scheduled.

# General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Physical Sciences
  - AS - Physical Science Lab
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B1 Physical Science
  - CSUGE - B3 Lab Activity
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 5A Physical Science
  - IGETC - 5C Laboratory Science

# Articulation Information

- CSU Transferable
- UC Transferable

# Methods of Evaluation

- Objective Examinations
  - Example: Students will be given quizzes and unit examinations throughout the semester, which may include multiple choice, fill in the blank, short answer, essay, and problem solving questions. For example, “what does a rate constant greater than one imply about a chemical reaction?”
- Problem Solving Examinations
  - Example: Students will be given quizzes and unit examinations throughout the semester, which may include multiple choice, fill in the blank, short answer, essay, and problem solving questions. For example, “The rate constant for a given reaction is 2.57/M-s at 700K and is 567/M-s at 900 K. What is the activation energy for this reaction?
- Reports
  - Example: Students will turn in laboratory reports for experiments performed in class. For example students will turn in a laboratory report on a chemical kinetics experiment.
- Skill Demonstrations
  - Example: Students will be asked to perform laboratory experiments which will require successful completion of tasks after the instructor has clearly demonstrated the activity and has answered student questions concerning the activity. For example, students will be evaluated on accurately determining the pKa of ammonium chloride from a potentiometric titration.

# Repeatable

No

# Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. Laboratory Notebook:
2. On a weekly basis, the instructor will provide instructions and examples of maintaining a laboratory notebook for an experiment involving topics such as chemical kinetics, and the students will maintain their laboratory notebook for the semester, recording all experiments performed. Students will be evaluated on the clarity of scientific communication in addition to their performance of the experiment (Lab Objective 3:Develop clear, cogent reporting of experimental observations, analysis, and conclusions ).

Lecture:

1. In Class or Distance Learning:
2. A multimedia slide presentation is used to present the concepts of chemical kinetics in detail utilizing graphics and video segments for emphasis and clarity. Example problems are demonstrated by the instructor at appropriate times throughout the presentation. Students are always encouraged to ask questions during the lecture. In the online modality, the information is presented to the students through the LMS using video lectures or a multimedia slide presentation. Students will participate through LMS discussion board. (Lecture Objectives 1-3: chemical kinetics). In Class or Distance Learning:
3. A classroom demonstration is used to illustrate concepts of chemical equilibrium in action, followed by the students performing an experiment to explore and learn about the topic covered. This is followed up by the students completing a lab report of their lab experiment. In the online modality, students may watch a video of the demonstration and of the experimental procedure, followed up by students completing a lab report. In the online modality lab reports would be submitted through LMS (Lecture and Lab Objective 6: chemical equilibrium ).

Distance Learning

1. A classroom discussion covering chemical thermodynamics is followed by a worksheet that students will complete working in small groups while the instructor roams the room, offering guidance to facilitate learning. In the online modality, this will be accomplished using breakout groups or discussion boards. The instructor will facilitate problem-solving through the discussion board or the breakout groups (Lecture Objective 12: chemical thermodynamics).

# Typical Out of Class Assignments Reading Assignments

1. Read a section from the textbook. Be prepared to use the content to participate in the classroom and to complete assigned problems from the textbook. For example: Read the section on colligative properties from the textbook. Be prepared to use the content to participate in the classroom and to complete assigned problems from the textbook. 2. Read a laboratory and prepare a prelaboratory report. For example: Read the iodine clock reaction laboratory and prepare a prelaboratory report.

# Writing, Problem Solving or Performance

1. Write the prelaboratory report for a laboratory. For example: Write the prelaboratory report for the iodine clock reaction laboratory. 2. Solve problems. For example: Determine the rate order of iodide in the experiment. 3. Perform laboratory experiments and determine the percent error. For example: Perform the calcium hydroxide solubility product constant laboratory and determine the percent error in the equilibrium constant value.

## Other (Term projects, research papers, portfolios, etc.)

## Required Materials

- Chemistry a Molecular Approach
  - Author: Tro
  - Publisher: Pearson
  - Publication Date: 2020
  - Text Edition: 5th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Experiments in General Chemistry Lab
  - Author: Wentworth and Munk
  - Publisher: Cengage Learning
  - Publication Date: 2012
  - Text Edition: 10th
  - Classic Textbook?:
  - OER Link:
  - OER:

## Other materials and-or supplies required of students that contribute to the cost of the course.

Calculator, Laboratory Packet, Laboratory goggles, Laboratory coat, and Laboratory Notebook.