GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: CHEM 1B DIVISION: 10 ALSO LISTED AS:

TERM EFFECTIVE: Fall 2021 CURRICULUM APPROVAL DATE: 12/14/2021

SHORT TITLE: GEN CHEMISTRY L/L

LONG TITLE: General Chemistry

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
5	18	Lecture:	4	72
		Lab:	3	54
		Other:	0	0
		Total:	7	126

COURSE DESCRIPTION:

This is the second semester of a year-long general chemistry course designed as a continuation of Chemistry 1A. Topics include solutions, thermodynamics, chemical kenetics, the equilibria of acids and bases, solubility systems, complex ions, electrochemistry, the chemistry of metals and nonmetals, as well as nuclear chemistry. (C-ID: CHEM 120S: Chem 1A + Chem 1B) PREREQUISITE: Chemistry 1A with a grade of C or better.

PREREQUISITES:

Completion of CHEM 1A, as UG, with a grade of C or better.

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion
03 - Lecture/Laboratory
04 - Laboratory/Studio/Activity
04B - Laboratory - LEH 0.75
05 - Hybrid
71 - Dist. Ed Internet Simultaneous
72 - Dist. Ed Internet Delayed
73 - Dist. Ed Internet Delayed LAB
73B - Dist. Ed Internet LAB-LEH 0.75

STUDENT LEARNING OUTCOMES:

By the end of this course, a student should:

1. Describe and explain the properties of chemical reactions based on the laws of thermodynamics, equilibrium constants, and acid-base chemistry.
2. Compare and contrast Arrhenius, Lewis and Bronsted-Lowry acids and bases, and solve problems involving buffer solution calculations and the ionization of a weak acid or weak base.
3. Perform stoichiometric calculations involving electrolysis, reduction potentials, and other electrochemical processes.
4. Identify and describe the formation and structure of complex-ions and coordination compounds, and the valence bond theory and the crystal field theory of complexes.
5. Compare and contrast the different types of radiation, and explain nuclear reaction equations based on radioisotope decay rates.

COURSE OBJECTIVES:

By the end of this course, a student should:

1. Describe the effects of temperature and pressure on the solubility of solutions.
2. Compare and contrast the colligative properties of solutions including osmotic pressure.
3. Explain the First, Second and Third Laws of Thermodynamics and solve problems based on the laws of thermodynamics.
4. Determine the spontaneity of a reaction and relate the free energy of a reaction to its equilibrium constant.
5. Determine the rate law for a reaction based on the reaction mechanism and explain the dependence of reaction rate on concentration and temperature.
6. Compare and contrast the Collision and Transition-State Theories and solve problems based on the Arrhenius equation.
7. Determine the extent of a molecular reaction through the study of chemical equilibria.
8. Apply Le Chatelier's Principle to chemical equilibria and solve problems based on equilibria data.
9. Compare and contrast Arrhenius, Lewis and Bronsted-Lowry acids and bases.
10. Solve problems based on the ionization of a weak acid or weak base, as well as salt solutions.
11. Describe the preparation of a buffer and perform buffer solution calculations.
12. Determine the solubility product expressions for sparingly soluble ionic solids.
13. Perform calculations based on solubility product expressions.
14. Compare and contrast electrolytic cells with voltaic cells and use standard reduction potentials to calculate a specific cell's potential.
15. Solve stoichiometric calculations based on electrolysis.
16. Describe the formation and structure of complex-ions and coordination compounds as well as determining the nomenclature of complex-ions and coordination compounds.
17. Describe the Valence Bond Theory and the Crystal Field Theory of complexes.
18. Define radioactivity and describe the different types of radiation.
19. Balance nuclear reaction equations and solve problems based on the rate of the radioactive decay of an isotope.
20. Collect and analyze laboratory experimental data and solve related chemical problems.

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Curriculum Approval Date: 12/14/2021

LECTURE CONTENT:

8 Hours

Solutions

Solubility and the effect of temperature and pressure on solubilities of gases. Effects of solutes on vapor pressures, as well as freezing and boiling points of solutions. Colligative properties of solutions of electrolytes. Osmotic pressure.

8 Hours

Thermodynamics

Enthalpy changes and spontaneity. The Second Law of Thermodynamics and Gibbs free energy. The Third Law of Thermodynamics. Free energy and maximum work. Calculating equilibrium constants from thermodynamic data. Bond energies and heats of reaction.

8 Hours

Kinetics: The Study of Rates of Reactions.

Factors that affect reaction rates. Measuring the rate of a reaction. Concentration and rate. Concentration and time. Theories about reaction rates and mechanisms. Measuring the activation energy. Catalysts in a reaction.

8 Hours

Chemical Equilibrium-General Concepts

Dynamic equilibrium in chemical systems. Reaction reversibility. The equilibrium law. Significance of the magnitude of K. Relationship between Kp and Kc. Le Chatelier's principle and chemical equilibria.

8 Hours

Acids and Bases: A Second Look

Strengths of Bronsted-Lowry acids and bases and their periodic trends. Lewis acids and bases. Acid-Base properties of the elements and their oxides. Ionization of water and the pH concept. Solutions of strong acids and bases.

8 Hours

Equilibria in Solutions of Weak Acids and Bases

Ionization constants and equilibrium calculations for weak acids and bases. Solutions of salts and ions as weak acids and bases. Buffers and the control of pH. Polyprotic acids. Acid-Base solution titrations.

6 Hours

Solubility and Simultaneous Equilibria

Solubility equilibria for salts, metal oxides and sulfides. Separating metal ions by selective precipitation. Complex-ions and their equilibria in aqueous solutions.

6 Hours

Electrochemistry

Stoichiometric relationships in electrolysis. Galvanic cells. Cell potentials and reduction potentials. Calculations using standard reduction potentials. Cell potentials and thermodynamics. Effect of concentration on cell potentials.

6 Hours

Properties of Metals and Metal Complexes

Preparation of metals from compounds. Covalent / Ionic nature of metal compounds. Complex-ions of different metals. Nomenclature, coordination numbers, and structure. Isomers of coordination complexes. Bonding in transition metal complexes. The role of metal ions in biological systems.

4 Hours

Nuclear Reactions and Their Role in Chemistry

Conservation of mass-energy. Nuclear binding energies. Radioactivity and transmutation. The three naturally occurring types of radiation. Detecting and measuring radiation. Application of radioactivity. Half-life calculations. Nuclear fission.

2 Hours

Final Exam

LAB CONTENT:

3 Hours

Laboratory Experiment: Locker Check-In and Safety.

6 Hours

Laboratory Experiment: Isolation of Caffeine from Tea.

6 Hours

Laboratory Experiment: Molar Mass Determination / Freezing Point Depression.

6 Hours

Laboratory Experiment: Rate Law Determination / Kinetics.

6 Hours

Laboratory Experiment: Le Chatelier's Principle / Chemical Equilibrium.

6 Hours

Laboratory Experiment: Acid-Base Titrations.

6 Hours

Laboratory Experiment: Solubility Constant and Common-Ion Effect.

6 Hours
Laboratory Experiment: The Electrolytic Cell / Electrochemistry.
6 Hours
Laboratory Experiment: Coordination Compounds / Metal Complexes.
3 Hours
Laboratory Experiment: Locker Check-Out and Lab Exam

METHODS OF INSTRUCTION:
Instruction is by lecture, class discussion, lecture demonstration, small group problem solving, laboratory work projects and homework.

OUT OF CLASS ASSIGNMENTS:
Required Outside Hours 78
Assignment Description
Assigned reading, homework, other written assignments
Required Outside Hours 30
Assignment Description
Lab-based projects

METHODS OF EVALUATION:
Writing assignments
Evaluation Percent 25
Evaluation Description
Written Homework
Lab Reports
Other: Extra credit report on a Chemistry topic.
Problem-solving assignments
Evaluation Percent 75
Evaluation Description
Homework Problems
Lab Reports
Quizzes
Exams

REPRESENTATIVE TEXTBOOKS:
Chemistry: The Molecular Nature of Matter, 8e., N.E. Jespersen, A. Hyslop, J. Wiley Publishing, 2021.
ISBN: 9781119741831 (eText)

D. Clark, G. Burce, E. Kilby. Gavilan College Chem 1B Laboratory Manual. Premium Source Publishing. Updated periodically. ISBN 9781634341424

RECOMMENDED MATERIALS:
Chemistry: The Molecular Nature of Matter, Study Guide, 7e., N.E. Jespersen, J.E. Brady, A. Hyslop, J. Wiley Publishing, 2017.
ISBN: 9781119360889 (eText)

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:

GAV B1, effective 201070

GAV B3, effective 201070

CSU GE:

CSU B1, effective 201070

CSU B3, effective 201070

IGETC:

IGETC 5A, effective 201070

IGETC 5C, effective 201070

CSU TRANSFER:

Transferable CSU, effective 201070

UC TRANSFER:

Transferable UC, effective 201070

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN: CHEM4
CAN Sequence: CHEM SEQ A
CSU Crosswalk Course Department: CHEM
CSU Crosswalk Course Number: 120S
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Maximum Hours:
Minimum Hours:
Course Control Number: CCC000322648
Sports/Physical Education Course: N
Taxonomy of Program: 190500