GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: CHEM 1A 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 first semester of a year-long general chemistry course designed for science, engineering and pre-professional majors. Topics include properties of matter, atomic structure, the Periodic Table, stoichiometry, elements and compounds, bonding, molecular structure, chemical reactions, states of matter, as well as the properties of gases and solutions. (C-ID: CHEM 110) (C-ID: CHEM 120S: Chem 1A + Chem 1B)
ADVISORY: High school-level reading and writing skills. PREREQUISITE: CHEM 30A with a grade of 'C' or better, or high school chemistry with a grade of 'B' or better completed within the last five years; and skills equivalent to those of an Intermediate Algebra course.

PREREQUISITES:
CAPP CHEM1A Requisite

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 the modern theory of atomic structure, its relation to the periodic table, and subsequently modern theories and models of molecular structure.
2. Identify and describe the classifications of chemical reactions, reaction balancing, and stoichiometry.
3. Perform and solve chemical calculations that involve conversions from masses to moles and vice versa.
4. Describe and explain the fundamental properties of gases, liquids, and solids.
5. Describe and explain the nature of aqueous solutions and chemical thermodynamics.

COURSE OBJECTIVES:

By the end of this course, a student should:

1. Use the periodic table to gain information about atoms, elements and predict their properties and reactivities.
2. Demonstrate proficiency in using scientific notation, significant figures, and measurement units.
3. Differentiate among the three basic classifications of matter: elements, compounds and mixtures as well as their formation and physical properties.
4. Design strategies to approach and solve problems using dimensional analysis.
5. Demonstrate and analyze the concepts of moles and molarity.
6. Identify the major class of reactions, balance equations and predict their products.
7. Determine and write the chemical names and formulas of ionic and molecular compounds.
8. Develop strategies to approach, comprehend and solve problems involving stoichiometry.
9. Evaluate the chemical properties of electrolytes, acids and bases.
10. Demonstrate and analyze the formation, products and properties of solutions.
11. Recognize oxidation-reduction reactions and assignment of oxidation numbers.
12. Writing and balancing equations for oxidation-reduction reactions for both acidic and basic solutions.
13. Distinguish between exothermic/endothermic reactions and evaluate chemical systems and thermal properties.
14. Prepare, manipulate and interpret thermochemical equations, enthalpy diagrams and use Hess's Law to calculate enthalpy changes.
15. Distinguish the main features of atomic theory and apply the fundamental organization of the atom including the electron orbitals.
16. Relate the electron configuration of elements to their location in the periodic table and the element's corresponding properties.
17. Determine how ionic and molecular compounds are formed from their elements and what factors cause elements to form an ionic or molecular compound.
18. Draw Lewis diagrams for the structures of molecules and polyatomic ions and deter-mine the polarity of bonds based upon the difference in electronegativity.
19. Compare and contrast the Valence Bond and VSEPR theories and predict the geometries of molecules.
20. Compare and contrast Hybrid Orbital and Molecular Orbital theories to explain multiple bonds and the shapes of molecules.
21. Use the Empirical Gas Laws to quantitatively describe gaseous behavior.
22. Explain the Kinetic-Molecular theory of gases and relate it to the properties of gases.
23. Describe the differences between the intermolecular forces and predict which forces will affect a given sample and determine its properties.
24. Apply Le Chatelier's principle of dynamic equilibrium to chemical reactions.
25. Explain how atoms, ions or molecules can be arranged in crystalline solids and predict their properties.
26. Collect and analyze laboratory experimental data and solve related chemical problems.
27. Examine chemical concepts through peer interaction and written laboratory reports.
28. Relate classroom and laboratory experiences to phenomena outside the classroom.

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

Curriculum Approval Date: 12/14/2021

LECTURE CONTENT:

4 Hours

Fundamentals of Chemical Change

The scientific method. Matter, energy and chemical changes. Measured quantities and their units. Computations, dimensional analysis and significant figures. Properties of substances; density and specific gravity.

6 Hours

The Periodic Table and Some Properties of the Elements

Elements, compounds and mixtures. Atoms, chemical symbols, formulas and equations. The structure of matter; atoms and subatomic particles. Periodic law and the periodic table. Metals, nonmetals and metalloids. Reactions of the elements; formation of ionic and molecular compounds. Properties of ionic and molecular compounds. Ionic and molecular nomenclature.

8 Hours

Stoichiometry: Quantitative Chemical Relationships

The mole concept. Measuring moles of elements and compounds. Empirical and molecular formulas. Percentage composition. Writing and balancing chemical equations. Using chemical equations in calculations. Limited reactant calculations. Theoretical yield and percentage yield. Reactions in solutions and molar concentration. Stoichiometry of reactions in solution.

4 Hours

Reactions Between Ions in Aqueous Solutions

Electrolytes and nonelectrolytes. Equations for ionic reactions. Predicting reactions that produce precipitates. Strong and weak acids and bases. Acid-Base neutralization. Ionic reactions that produce gases. Predicting when ionic reactions actually occur. Stoichiometry of ionic reactions.

4 Hours

Oxidation-Reduction Reactions

Oxidation-reduction reactions. Balancing redox equations by the ion-electron method. Reactions of metals with acids. Displacement of one metal by another from compounds. Molecular oxygen as an oxidizing agent. Stoichiometry and redox reactions.

8 Hours

Energy and Thermochemistry

Kinetic and potential energy. The kinetic theory of matter. Energy changes in chemical reactions. The First Law of Thermodynamics: heat and work. Measuring energy changes; calorimetry. Enthalpy changes in chemical reactions. Combining thermochemical equations; Hess's Law. Standard heats of formation and Hess's Law.

6 Hours

Atomic and Electronic Structure

Electromagnetic radiation. Atomic spectra and the Bohr model of the hydrogen atom. Wave properties of matter and wave mechanics. Electron spin and the Pauli Exclusion Principle. Electronic structures of multi-electron atoms. Electron configurations and the periodic table. Unexpected electron configurations. Shapes of the atomic orbitals. Variation of atomic properties with electronic structure.

8 Hours

Chemical Bonding: General Concepts

Electron transfer and the formation of ionic compounds. Electron bookkeeping and Lewis symbols. Electron sharing and the formation of covalent bonds. Some important compounds of carbon. Electronegativity and the polarity of bonds. Electronegativity and the reactivities of metals and nonmetals. Drawing Lewis structures and the Octet Rule. Formal charge and the selection of Lewis structures. Resonance; when a single Lewis structure fails. Coordinate covalent bonds.

6 Hours

Chemical Bonding and Molecular Structure

Common molecular structures and geometry. Predicting the shapes of molecules; VSEPR Theory. Molecular shapes and molecular polarity. Wave mechanics and covalent bonding; Valence Bond Theory. Hybrid orbitals. Double and triple bonds. The Molecular Orbital Theory. Delocalized molecular orbitals. Bonding in solids.

8 Hours

Properties of Gases

Properties common to all gases. Pressure; its measurement and units. Pressure-, Volume-, Temperature-relationships for a fixed amount of gas. The Ideal Gas Law. Stoichiometry of chemical reactions between gases. Dalton's Law of Partial Pressure. Graham's Law of Effusion. Kinetic theory and the gas laws. Real gases; deviations from the Ideal Gas Law.

8 Hours

Intermolecular Attractions and the Properties of Liquids and Solids

Why gases differ from liquids and solids. Intermolecular attractions. Some general properties of liquids and solids. Changes of state and dynamic equilibrium. Vapor pressures of liquids and solids. Boiling points of liquids. Energy changes during a change of state. Dynamic equilibrium and Le Chatelier's Principle. Phase diagrams. Crystalline solids and X-ray diffraction. Crystal types and their physical properties. Non-crystalline solids.

2 Hours

Final Exam

LAB CONTENT:

3 Hours

Laboratory Experiment: Locker Check-In and Safety.

3 Hours

Laboratory Experiment: Techniques and Measurements.

3 Hours

Laboratory Experiment: Empirical Formula of an Oxide.

6 Hours

Laboratory Experiment: Limiting Reagents.

Chemical properties of electrolytes, acids and bases. Formation, products, and properties of solutions.

6 Hours

Laboratory Experiment: Reaction Types.

Oxidation-reduction reactions and assignment of oxidation numbers. Writing and balancing equations for oxidation-reduction reactions for both acidic and basic solutions.

3 Hours

Laboratory Experiment: Cation Identification.

6 Hours

Laboratory Experiment: Calorimetry.

6 Hours

Laboratory Experiment: Spectrophotometric Iron Analysis.

6 Hours

Laboratory Experiment: Chemical Periodicity.

Valence Bond and VSEPR theories. Hybrid Orbitals and Molecular Orbital theories.

6 Hours

Laboratory Experiment: Hard Water Analysis.

3 Hours

Laboratory Experiment: Molar Mass of a Volatile Liquid.

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: An Atoms-Focused Approach, 3e, T.R. Gilbert, R.V. Kirss, S.L. Bretz, N. Foster, W.W. Norton & Company, 2020.
ISBN: ISBN 9780393674026 (hardcover), 9780393697384 (paperback), 9780393428544 (eBook)

D. Clark, G. Burce, E. Kilby. Gavilan College Chem 1A Laboratory Manual. Premium Source Publishing. Updated periodically. ISBN 9781634342766

RECOMMENDED MATERIALS:
Chemistry: The Molecular Nature of Matter, 8e., N.E. Jespersen, A. Hyslop, J. Wiley Publishing, 2021.
ISBN: 9781119741831 (eText)
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: CHEM2
CAN Sequence: CHEM SEQ A
CSU Crosswalk Course Department: CHEM
CSU Crosswalk Course Number: 110
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: CCC000071527
Sports/Physical Education Course: N
Taxonomy of Program: 190500