CHEM A180: GENERAL CHEMISTRY A

Item	Value
Curriculum Committee Approval Date	03/20/2024
Top Code	190500 - Chemistry, General
Units	5 Total Units
Hours	162 Total Hours (Lecture Hours 54; Lab Hours 108)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	Yes
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S)
Associate Arts Local General Education (GE)	• OC Physical/Biological Sci - AA (OB)
Associate Science Local General Education (GE)	• OCC Physical/Biological Sci-AS (OSB)
California General Education Transfer Curriculum (Cal-GETC)	• Cal-GETC 5A Physical Science (5A) • Cal-GETC 5C Laboratory Activity (5C)
Intersegmental General Education Transfer Curriculum (IGETC)	• IGETC 5A Physical Science (5A) • IGETC 5C Laboratory Activity (5C)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B1 Physical Science (B1) • CSU B3 Laboratory Activity (B3)

Course Description

This course studies gases, solutions, reactions, bonding theories, acid-base, and redox theory. PREREQUISITE: Successful completion of a course at the level of intermediate algebra or Appropriate OCC math placement, and CHEM A130. Transfer Credit: CSU; UC. C-ID: CHEM 110.**C-ID:** CHEM 110.

Course Level Student Learning Outcome(s)

1. Use unit equations and algebraic methods to solve computational problems in the areas of unit conversion, stoichiometry, gas laws, thermochemistry, and solution concentrations.
2. Apply the principles of electron configurations, Lewis structural theory, VSEPR theory, molecular orbital theory, and valence bond theory to predict the structure, bonding, three-dimensional shape, and molecular polarity of simple inorganic and organic species from the chemical formula.
3. Use the atomic theory and kinetic molecular theory to explain the gas laws and the properties of ideal and non-ideal gases.
4. Write and balance total ionic and net ionic equations for chemical reactions, including predicting the products of ionic reactions and writing the correct ionic formulas.
5. Apply safe and proper laboratory techniques to make accurate, reproducible measurements of masses and volumes, and accurate, reproducible experimental observations.

Course Objectives

- 1. Describe the meaning and common usage of terms important in general chemistry.
- 2. Explain observations which are new to them in terms of the principles of chemistry.
- 3. Use the important systems of chemical nomenclature to name compounds new to them; or given the name, write the formula.
- 4. Predict and write correct balanced chemical equations and properly interpret chemical equations.
- 5. Draw Lewis structures of molecules and ions which are new to them; and draw sketches of orbital representations.
- 6. Analyze and solve unfamiliar chemistry problems in an organized and logical manner.
- 7. Correctly use laboratory equipment in a safe manner with good results.
- 8. Quantitatively evaluate precision and accuracy of experimental results.

Lecture Content

Lecture Topics (not necessarily covered in this order). Measurements, rounding calculated answers, precision, and accuracy Fundamental definitions leading to the concept of the mole and molar mass Interpretation of a chemical formula and finding the empirical formula Oxidation numbers Various methods of nomenclature of compounds and ions Stoichiometry Kinetic Molecular Theory Gas law calculations including Van der Waals equation of state solved for volume to introduce students to successive approximations Definitions of oxidation and reduction (optional: Introduction to galvanic cells) Half equations, redox equations, and balancing Molarity, definition and calculations Titration calculations Optional: The concept of the equivalent for acid base and redox reactions and normality Precipitation reactions, prediction using solubility generalizations and the writing of net ionic equations for precipitation reactions Brønsted theory of acids and bases Acid base reactions, prediction of acid base reactions, monoprotic, diprotic, and triprotic acid base reactions, involving excess acid or base and strong and weak acids and bases The principle of Le Chatelier applied to saturated solutions and to acid base reactions. The dissolving of an insoluble compound by an acid base reaction. Thermochemistry: The first law of thermodynamics, the system and the surroundings, heat, work, change in internal energy, Hesss law, enthalpy, and standard enthalpy of formation (Thermochemistry is included in this course about half the time, but is always included in the second semester, Chemistry 185.) Quantum theory and experimental facts leading to the development of quantum theory: the wave and particle natures of light, photoelectric effect ; photons (Einstein), elemental spectra, black body radiation (Planck), wavelength of the electron (de Broglie), electron diffraction, and the uncertainty principle. Bohr model of hydrogen atom and hydrogen like ions, orbits, quantum number, electron transitions. Schrödinger equation (and mention of the existence of other equations such as Diracs and Heisenbergs), orbitals, wave functions, quantum numbers, electronic configuration of the elements as determined from the periodic table (Pauli exclusion principle and Hunds rule), ionization energies, paramagnetism and diamagnetism. Periodic table and the model of the atom, periodic trends of: atomic radius, ionic radius, first ionization energy, electronegativity, melting point, boiling point, (electron affinity some semesters). Predicting redox reactions using a redox table or a list of strong oxidizers and strong reducers together with a list of weaker oxidizers and reducers. The number of valence electrons, covalent bonds, Lewis symbols, bond order, bond length, writing Lewis structures of polyatomic molecules and ions with the correct geometry as predicted by VSEPR Theory. Writing Lewis structures for resonance hybrids. Bond energies, calculating the change in enthalpy from bond energies (Sometimes this is covered only in Chemistry 185.) Valence bond theory, writing electron configurations for simple molecules and ions. Molecular orbital theory, writing electron configurations for simple molecules and ions. Complex ions, predicting reactions involving the formation of complex ions in excess concentrated liligand and reactions of complex ions. States of Matter Solutions

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- Lab (04)
- DE Live Online Lab (04S)

Instructional Techniques

Lecture, demonstration, problem assignments, discussion, and laboratory experiments

Reading Assignments

Assigned reading from the course textbook and other appropriate sources - approximately 2-3 hours per week.

Writing Assignments

Experiments and exams will include some questions requiring the writing of sentence explanations and/or descriptions. Students will be expected to analyze questions and create answers to them. Some answers will be in the language of mathematics and other will, as stated above, be in English. Some questions will require the use of principles to synthesize an answer which was not taught. Approximately 2-3 hours per week.

Out-of-class Assignments

Homework problem sets - approximately 2-3 hours per week.

Demonstration of Critical Thinking

Skill demonstrations of laboratory procedures; a timed final exam and at least three prior timed exams involving written explanations and descriptions, and problem solving

Required Writing, Problem Solving, Skills Demonstration

Experiments and exams will include some questions requiring the writing of sentence explanations and/or descriptions. Students will be expected to analyze questions and create answers to them. Some answers will be in the language of mathematics and other will, as stated above, be in English. Some questions will require the use of principles to synthesize an answer which was not taught.

Eligible Disciplines

Chemistry: Masters degree in chemistry OR bachelors degree in chemistry or biochemistry AND masters degree in biochemistry, chemical engineering, chemical physics, physics, molecular biology, or geochemistry OR the equivalent. Masters degree required.

Textbooks Resources

1. Required Petrucci, R.H., Herring, F.G., Madura, J.D., Bissonnette, C. General Chemistry: Principles and Modern Applications, 10th ed. Toronto: Pearson Canada, 2011 2. Required Ashbaugh S., Bazell, A., Ezell, M., Gonzales, S., Johnson, S., Roundy, W., and Wylie, J.. General Chemistry Notes, 9th ed. Pearson, 2009 Rationale: .

Other Resources

1. Course notes including homework assignments and laboratory information. 2. Non-programmable calculator. 3. Safety glasses.