CHEM 0002A - INTRODUCTION TO CHEMISTRY I

Catalog Description

Prerequisite: Completion of MATH A with grade of "C" or better, or placement by matriculation assessment process, or equivalent
Advisory: Eligibility for ENGL 1A; completion of CHEM A with grade of "C" or better or equivalent; completion of MATH D with grade of "C" or better or equivalent
Hours: 126 (72 lecture, 54 laboratory)
Description: Designed to meet the requirements for certain nursing, dental hygiene, physical therapy, agriculture, and forestry programs (Inorganic Chemistry). An introduction to the fundamental principles of general inorganic chemistry through related lecture and laboratory exercises. (C-ID CHEM 101) (CSU, UC-with unit limitation)

Course Student Learning Outcomes

- CSLO #1: Demonstrate proficiency in solving problems and analyzing data related to chemical stoichiometry.
- CSLO #2: Demonstrate proficiency in solving problems and analyzing data related to atomic and molecular structure.
- CSLO #3: Demonstrate proficiency in solving problems and analyzing data related to physical and chemical equilibrium.
- CSLO #4: Demonstrate proficiency in solving problems and analyzing data related to structure and properties of matter.
- CSLO #5: Demonstrate proficiency in scientific communication.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

126

Outside of Class Hours

144

Total Student Learning Hours

270

Course Objectives

Given a periodic chart, a strong and weak electrolyte chart, solubility rules, and a calculator, students will perform the following on written examination, on laboratory exercises, or in laboratory experiments:
Lecture Objectives:
1. explain the scientific method;
2. classify the properties of matter and the states of matter;
3. distinguish between the types of matter as an element, compound, mixture, pure substance, atom, molecule or formula unit;
4. distinguish between a physical change and chemical change;
5. name and use metric and SI units and their abbreviations for length, mass, volume and temperature; using the metric system, perform metric-metric and metric-English conversions;
6. analyze a problem and solve using unit conversion factors;
7. calculate numerical problems providing answers in proper scientific notation and correct number of significant figures;
8. solve problems involving density, mass, volume;
9. define energy and solve energy-related problems;
10. draw a diagram of a given atom showing protons, electrons, and neutrons;
11. determine the numbers of protons, neutrons, and electrons for given atoms and ions;
12. solve problems involving atomic number, mass number, and number of protons, electrons, and neutrons;
13. write the electron configuration for an element or ion;
14. determine the number of valence electrons for an element from its location on the periodic table;
15. predict trends in the periodic table;
16. distinguish between ionic and covalent compounds;
17. construct Lewis electron dot structure for molecules;
18. determine the shape and polarity of a molecule;
19. identify intermolecular forces in a compound;
20. write chemical formulas for given chemical names, write chemical names for given chemical formulas;
21. calculate the number of each type of atom given a chemical formula;
22. calculate the molar/formula mass of a compound;
23. calculate the percent composition of a given compound;
24. solve problems involving grams, moles, particles;
25. determine the empirical formula and/or molecular formula for a given compound from the given composition;
26. write balanced chemical equations and identify the type of chemical reaction;
27. solve stoichiometry problems involving grams, moles, particles, and volume;
28. solve stoichiometry problems involving a limiting reagent;
29. determine the percent yield of a product;
30. distinguish between exothermic and endothermic reactions and calculate the amount of energy lost or gained in a chemical reaction;
31. describe the properties of solutions;
32. determine the percent concentration and molar concentration of a solution;
33. explain colligative properties;
34. explain the concepts of a reversible reaction, equilibrium, and Le Chatelier's Principle;
35. describe properties of acids and bases;
36. compare and contrast the concept of an Arrhenius and/or Bronsted-Lowry acid and base;
37. identify conjugate acid-base pairs;
38. determine the pH from the hydrogen ion concentration or hydrogen ion concentration from pH;
39. solve titration problems to determine the concentration or volume of an acid or base;
40. explain what constitutes a buffer and how a buffer system works;
41. perform calculations for quantitative relationships between pressure, temperature, volume, and number of moles or grams;
42. solve gas stoichiometry problems;
43. perform research on a topic using library or internet resources and integrate the information into a 500 word written report to be presented to the class.
Laboratory Objectives:

1. perform laboratory experiments to reinforce the concepts, to teach basic laboratory techniques, and to prepare for more advanced laboratory work in chemistry, if applicable;
2. demonstrate proficiency in using computers for the collection, analysis, and graphical display of data;
3. develop techniques for measurement and recording data;
4. distinguish between physical and chemical properties using experimentation;
5. use appropriate equipment to measure mass and volume in order to determine density;
6. using a calorimeter, determine the specific heat of a substance;
7. atomic structure will be investigated by observing line spectra of elements;
8. use qualitative analysis to determine the composition of an ionic compound;
9. investigate different types of chemical reactions;
10. determine the empirical formula of a compound;
11. using a decomposition reaction, determine mass-mass stoichiometry and percent yield;
12. identify strong electrolytes, weak electrolytes, and nonelectrolytes in an aqueous solution; write ionic and net ionic equations;
13. investigate properties of solutions and determine the mass percent of solute in a solution;
14. investigate colligative properties through experimentation;
15. investigate reaction rates and equilibrium;
16. explore properties of acids and bases; observe the behavior of buffer solutions;
17. determine the molarity of a solution through titration;
18. determine standard molar volume and the molar mass of a metal using gas laws;
19. calculate the oxidation number of an element in a given formula;
20. given the equation for an oxidation-reduction reaction, identify the substance oxidized and the substance reduced, as well as the oxidizing agent and the reducing agent;
21. analyze oxidation-reduction equations;
22. distinguish between the different types of radioactive particles;
23. write balanced nuclear equations;
24. interpret the decay curve of a radioisotope and determine its half-life;
25. distinguish between fission and fusion;
26. exhibit cooperative and individual skills in the collection and analysis of data;
27. develop clear, cogent reporting of experimental observations, analysis and conclusions using the scientific method.

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 take quizzes and examinations utilizing a variety of objective questions like true or false and multiple choice on solving problems using relationships identified in the periodic table (lecture course objectives 10-15). Standard grading. Example Questions: 1. Group 6 elements tend to gain 2 electrons. True or False? 2. Group 7 elements tend to form ____ bond(s). a. 0 b. 1 c. 2 d. 3 e. none of the above
- Problem Solving Examinations
  - Example: Students will solve problems utilizing molar masses and stoichiometry (lecture course objectives 6, 7, 22-25, 27-29). The calculated results are graded based on work shown to demonstrate the student's problem solving process and arriving at the correct value, units and significant figures. Example Questions: 1. Solid sulfur reacts with oxygen gas to produce sulfur dioxide gas. Calculate the number of grams of the excess reactant remaining when 25.0 grams of sulfur is mixed with 125 grams of oxygen gas. Rubric grading. 2. A molecule is found to contain 64.27% by mass C, 7.191% by mass H, and 28.54% by mass O. It's molar mass is 168 g. What is the molecular formula for this molecule?
- Projects
  - Example: Students will choose a pharmaceutical drug to study and apply class information throughout the semester. 1. students will draw Lewis structures of the drug (lecture course objectives 17 and 18) and identify the various internolecular interactions possible for that molecule. Students will be graded on correct drawings and identification of intermolecular forces. 2. students will write a 500 word research paper (lecture course objectives 43) about their chosen pharmaceutical drug with a poster and oral presentation at the end of the semester. Students will be graded based on accuracy of the information, the proper use of sources, the clarity of their report, poster, and oral presentation.
- Reports
  - Example: In the course lab manual, students will collect data, calculate results and answer additional questions regarding the topics demonstrated in the lab like studying and utilizing density, the relationship between mass and volume of a substance (laboratory course objective 4) or empirical formulas (laboratory course objective 10). Students will be graded on precision of measurements and use of units and significant figures, as well as ability to convert data collected into desired results with correct units and significant figures. Example Labs and Lab Questions on Lab Reports: 1. Density Lab Report: Using the mass and initial and final volumes of water displaced by a rubber stopper, calculate the volume and density of the rubber stopper. 2. Empirical Formula of Magnesium Oxide Lab Report: Using the mass of a magnesium metal strip and then the mass of the combustion product, determine the empirical formula of the magesium oxide compound produced.
- Skill Demonstrations
  - Example: Students will utilize lab equipment to obtain precise and accurate data and results. 1.titration lab experiment (laboratory course objectives 1, 3, 17). Students will be graded on precision and accuracy of data. Example Experiment: Titration of vitamin C (ascorbic acid) where students use titrations to accurately determine the concentration of a standard sodium hydroxide titrant using weighed masses of potassium hydrogen phthalate and measured volumes of the titrant necessary to neutralize

the acid. The standardized titrant is then used to determine the amount of vitamin C in a vitamin C tablet by titrating a measured mass of vitamin C powder. 2. solution lab experiment (laboratory course objectives 1, 3, 13). Students will be graded on precision and accuracy of data. Example Experiment: measuring masses of salt solution before and after heating to determine the molarity of the original salt solution.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. Instructor organizes laboratory experiments and demonstrations that reinforce stoichiometric concepts. Instructor guides students in stoichiometric data collection and analysis and preparation of laboratory reports (lab course objectives 10, 11, and 17).
2. Instructor organizes laboratory experiments and demonstrations that reinforce gas law concepts. Instructor guides students in gas law data collection and analysis and preparation of laboratory reports.

Lecture:

1. Instructor presents information regarding limiting reactant stoichiometry and students are encouraged to ask questions. Students are then expected to work out problems in lecture or online as a worksheet related to limiting reactant stoichiometry. Example: A mixture containing 2
2. 0 g of CH2 and 10
3. g of O2 is ignited and burns according to the following equation. CH4 + 2O2 # CO2 + 2H2O How many grams of CO2 will be produced? What substances will be found in the mixture after the reaction stops? (lecture course objectives 21-29).
4. Instructor presents material covering the ideal gas law and students are encouraged to ask questions. Students are then expected to work out problems in lecture or online as a worksheet related to the ideal gas law. Example: Calculate the volume, in liters, occupied by
5. 52 moles of carbon monoxide gas at
6. 992 ate pressure and a temperature of 65°C.

Distance Learning

1. The topic of limiting reactant stoichiometry will be presented using text and/or video presentations. Students will then review example problems of limiting reactant stoichiometry and then solve problems using online homework portals and/or online worksheets on LMS. A discussion board is provided to allow students to interact and discuss problem solving strategies with each other.

Typical Out of Class Assignments Reading Assignments

1. Read the section on the Ideal Gas Law from the textbook. Be prepared to participate in class discussion and work on assigned problems relating to the ideal gas law. 2. Read the gases laboratory and be prepared to perform and answer questions on the experiment.

Writing, Problem Solving or Performance

1. Write a unit analysis strategy for solving stoichiometry problems. 2. Solve problems provided on a worksheet. For example, calculate the amount of energy required to raise the temperature of 50 grams of water by 50K.

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

Perform research on a topic using library or internet resources. Integrate the information with inorganic chemistry concepts and synthesize a 500 word written report to be presented to the class.

Required Materials

- General, Organic, and Biological Chemistry
  - Author: Stoker
  - Publisher: Cengage Learning
  - Publication Date: 2015
  - Text Edition: 7th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Lab Manual for Stoker's General, Organic, and Biological Chemistry
  - Author: Stoker
  - Publisher: Cengage Learning
  - Publication Date: 2015
  - Text Edition: 7th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Chemistry: An Introduction to General, Organic, and Biological Chemistry
  - Author: Timberlake
  - Publisher: Pearson
  - Publication Date: 2017
  - Text Edition: 13th
  - Classic Textbook?:
  - OER Link:
  - OER:

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