PHYS A112: SURVEY OF CHEMISTRY AND PHYSICS WITH LAB

Item	Value
Curriculum Committee Approval Date	10/02/2024
Top Code	190100 - Physical Sciences, General
Units	4 Total Units
Hours	108 Total Hours (Lecture Hours 54; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)
Associate Arts Local General Education (GE)	• Area 5 Physical and Biological Sciences, Scientific Inquiry, Life Science (OB)

Course Description

Formerly: NS A112, Survey of Chemistry and Physics. An investigation of the basic principles of physics and chemistry including matter, physical and chemical properties, energy, motion, light, atomic structure, bonding, solutions, and chemical reactions. The inter-dependence of chemistry and physics will be emphasized. This course is intended for non-science majors. Transfer Credit: CSU; UC.

Course Level Student Learning Outcome(s)

1. Correctly analyze natural phenomena using the concepts of physics and chemistry to make accurate predictions, quantify physical properties, and provide explanations based on scientific principles.
2. Investigate physical phenomena using appropriate equipment and methods, make valid comparisons with theoretical predictions, and communicate those results.

Course Objectives

- I Lecture Objectives
- I. 1. Describe the states of matter and associate phase changes.
- I. 2. Classify matter as elements, compounds, mixtures and describe properties of each.
- I. 3. Describe basic atomic structure including the fundamental particles and electron energy levels.
- I. 4. Explain the history and structure of the periodic table.
- I. 5. Explain and describe different ways atoms combine to form compounds.
- I. 6. Describe the motion of objects as related through the concepts of position, displacement, speed, velocity and acceleration.
- I. 7. Use Newton?s Laws to predict and explain the motion of an object.
- I. 8. Discuss the type of energy present in a system and use conservation of energy to solve problems.
- I. 9. Explain the requirements for a complete circuit in terms of a model of electric charge.
- I. 10. Describe color perception based on the wave nature of light and its interactions.
- II Laboratory Objectives
- II. 1. Understand fundamentals of taking and recording measurements including measuring length, area, volume, mass, density, significant figures, converting between units and scientific notation.
- II. 2. Identify practical applications to both the chemistry and physics lecture objectives.
- II. 3. Draw conclusions between data and results including constructing graphs and identifying relationships between variables.

Lecture Content

Measurement Fundamental Properties Fundamentals of measuring length, area, volume and mass Density of materials The Scientific Method Structure of Matter Atomic theory and basic atomic structure including the relationships between sub-atomic particles Periodic Table of Elements and periodic trends to atomic structure Characteristics of the atomic, ionic, and molecular classes of matter Phases of matter (solids, liquids, and gases) and the connections between the properties using a particle model Classification of matter--elements, substances, compounds, mixtures Basic characteristics of solutions, including acids and bases, and their relationship to the pH scale Matter and its Changes Phases of matter and associated phase changes Chemical and physical changes, and classifying chemical and physical properties of matter Basic principles of chemical bonding and chemical reactivity Energy changes during chemical reactions Motion, Forces and Energy Motion of objects as related through the concepts of position, displacement, speed, velocity, and acceleration Interpretation of distance vs. time and speed vs. time graphs The relationship between a net force and the motion of an object Explain how action and reaction forces are related to each other Basic forces in the universe including electrostatic, gravitational and magnetic Forms of energy including solar, chemical, magnetic, electric, nuclear, and thermal The relationship between net force, work, and kinetic energy Conservation of energy, and how energy is transformed from one form to another The nature of heat (thermal energy) and heat transfer (conductive, convective, radiant) and their relationship to te mperature and temperature measurement Electricity and Magnetism Electric charge and how charge is transferred from one object to another Models of electric current, voltage, resistance and their interrelationships The construction and operation of simple electrical circuits and the difference between series and parallel combinations of resistors Waves and Light Longitudinal and transverse waves Properties of sound Doppler effect and Interference Electromagnetic radiation (light), the electromagnetic spectrum and sources of light Relationship between wavelength (or frequency) and color Color perception Reflection and refraction of waves

Lab Content

Laboratory activities cover a range of topics integrated with the lecture portion of the class, with an emphasis on hands-on activities with real-world data collection and analysis. Representative experiments include investigations of: Motion graphs Newton's Second Law Newton's First Law Energy conservation Ohm's Law and circuits Reflection and refraction Diffraction and interference Standing waves Spectral lines

Acids and bases Density Chemical reactions Phase changes Crystals and amorphous solids

Method(s) of Instruction

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

Instructional Techniques

Required reading from textbook. Laboratory exercises. Written lab reports. In-class discussions and questions. Research projects and reports.

Reading Assignments

Students will read on average 2-3 hours per week from assigned texts, lab preparation manuals, handouts, and online materials as assigned.

Writing Assignments

Students will spend on average 2-3 hours per week on written assignments including lab write-ups and research projects and papers.

Out-of-class Assignments

Students will spend approximately 6 hours per week on out-of-class-assignments, including: Reading from textbook. Lab preparation from manuals. Handouts. Online materials. Lab write-ups. Research projects and papers.

Demonstration of Critical Thinking

Written reports and lab write-ups Answers to questions in class. Test and quiz answers.

Required Writing, Problem Solving, Skills Demonstration

Written reports and lab write-ups Answers to questions in class. Test and quiz answers.

Eligible Disciplines

Chemistry: Master's degree in chemistry OR bachelor's degree in chemistry or biochemistry AND master's degree in biochemistry, chemical engineering, chemical physics, physics, molecular biology, or geochemistry OR the equivalent. Master's degree required. Physical sciences: See interdisciplinary studies Master's degree required. Physics/ Astronomy: Master's degree in physics, astronomy, or astrophysics OR bachelor's degree in physics or astronomy AND master's degree in engineering, mathematics, meteorology, or geophysics OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Tillery, B.W.. Physical Science, 13 ed. McGraw-Hill Education, 2022

Manuals Resources

1. Tillery, B.W.. Lab Manual for Physical Science, McGraw-Hill Education , 02-06-2019