


PHSN 106 - ENERGY, MOTION, AND MATTER: AN INTRODUCTION TO PHYSICS AND CHEMISTRY

Units Lecture	3.00	Units Lab	0.00	Units Total	3.00
Total Hrs Lecture	49.50	Total Hrs Lab	0.00	Total Course Hrs	49.50

COURSE DESCRIPTION

This course introduces the non-scientist to the fundamental concepts of physics and chemistry. Physics topics include motion, force, work, energy, gravity, electricity, magnetism, and light. Chemistry topics include chemical and physical properties of elements and compounds, the periodic table, atomic theory and structure, chemical bonding, and nuclear structure and processes. This course also teaches students how to analyze and solve problems using critical thinking and the scientific method. UC CREDIT LIMITATION: No credit if taken after college course in Astronomy, Chemistry, Geology, or Physics.

ENROLLMENT RESTRICTIONS
PREREQUISITES

None.

COREQUISITES

None.

ADVISORIES

Eligibility for English 100 (completion of ENGL 803 or equivalent score on English placement exam)

OUTLINE OF COURSE CONTENT

The course will address the following topics:

- I. Scientific method
 - A. Process and terms
 - B. Controlled experiments
 - C. Measurements and units
 - D. Scientific reasoning
 - E. Scientific notation.

- II. Physics
 - A. Mechanics
 1. Motion: speed, velocity, and acceleration
 2. Newton's laws: force, momentum, and gravity.
 - B. Energy
 1. Types of energy
 2. Kinetic and potential energy
 3. Work
 4. First law of thermodynamics
 5. Thermal energy/heat/modes of heat transfer
 6. Entropy and second law of thermodynamics.
 - C. Electricity and magnetism
 1. Fields
 2. Ohm's law and circuits
 3. Ferromagnetism
 4. Electromagnetic induction.
 - D. Waves
 1. Types of waves
 2. Wave properties
 3. Doppler effect
 4. Behavior of waves.
 - E. Nuclear structure and processes
 1. Subatomic particles
 2. Radioactive decay
 3. Nuclear reactions.

- III. Chemistry



- A. Properties of matter
 - 1. States
 - 2. Classification: substances and mixtures.
- B. Atomic theory and structure
 - 1. Nuclear atom
 - 2. Electron shells
 - 3. Periodic Table and electronic structure.
- C. Chemical compounds and reactions
 - 1. Bonding and types of compounds
 - 2. Reactions
 - 3. Solutions: acids and bases.

PERFORMANCE OBJECTIVES

Upon successful completion of this course, students will be able to do the following:

- 1). Use the scientific method and scientific reasoning to describe how controlled experiments are designed and carried out, to identify independent and dependent variables and describe correlations between them for given data sets and/or graphs, and to solve problems and perform calculations involving equations relating to physical and chemical quantities (i.e., force, acceleration, energy, electrical forces and circuits, and waves), scientific notation, measurements, and units
- 2). Explain how energy, work, heat, etc., are transferred and transformed in both natural phenomena (sunlight heating the earth) and artificial phenomena (a hair dryer converting electrical energy to heat to dry hair)
- 3). Explain how the fundamental forces of the universe (gravity, electromagnetism, strong force, and weak force) interact with matter to create motion, the transfer and transformation of energy, the properties of chemical elements and compounds, chemical bonding, chemical reactions, nuclear reactions, etc.
- 4). Analyze a given physical or chemical system to identify and describe the forces acting on a material object and to explain how the forces affect the motion and energy of the object, based on Newton's laws of motion and universal gravitation
- 5). Analyze a given physical or chemical system to identify and describe the energy transformations, including changes in entropy, involved in various processes based on the first and second laws of thermodynamics
- 6). Analyze a given physical or chemical system to identify, describe, and explain the electrical and/or magnetic forces and energy involved in examples of electrical circuits, ferromagnetism, and electromagnetic induction
- 7). Analyze a given physical or chemical system to identify, describe, and explain how the component particles and forces of the atoms of a given element determine the properties of that element, including electronic structure and periodic properties of elements, how the atoms interact with electromagnetic radiation, types of bonding and properties of compounds the atoms will form, chemical reactions of substances containing the atoms, etc.
- 8). Analyze a given physical or chemical system to identify, describe, and explain how the component particles and forces of an atomic nucleus of a given isotope determine the types of radioactive decay and other nuclear processes it undergoes.

READING ASSIGNMENTS

Reading assignments will be consistent with, but not limited by, the following types and examples:

- 1). Read textbook sections that deal with content topics
- 2). Read articles in science periodicals and books and published on the Internet to complete individual and group research projects
- 3). Examine and analyze arguments and explanations published in both print media (newspapers, books, magazine articles, etc.) and digital media concerning topics of interest involving physical and chemical principles, and assess the validity of the conclusions expressed.

WRITING ASSIGNMENTS

Writing assignments will be consistent with, but not limited by, the following types and examples:

- 1). Construct and write cause and effect arguments and explanations, applying physical and chemical concepts to common phenomena, such as the following: explain how different types of energy are transferred and transformed in both natural and artificial phenomena
- 2). Prepare a research paper about a physical or chemical system that is of concern to contemporary society, such as concerns about nuclear reactions or radioactive decay
- 3). Write a group research paper based on a particular topic or set of related topics covered in class
- 4). Analyze arguments and explanations published in both print and digital media concerning topics of interest involving physical and chemical principles and prepare a written assessment of the conclusions expressed.



OUTSIDE-OF-CLASS ASSIGNMENTS (READING/WRITING/OTHER)

Outside-of-class assignments will be consistent with, but not limited by, the following types and examples:

- 1). Complete reading assignments to prepare for class and for individual and/or group projects
- 2). Organize, assemble, and evaluate information from a number of sources (including both print and Internet sources), and use this information to produce either a thesis paper and/or a group project
- 3). Complete calculations and other quantitative and qualitative problem-solving assignments
- 4). Complete assignments given for each chapter covered in the textbook
- 5). Prepare essays, group projects and presentations, and individual research paper
- 6). Work in a group to discuss and analyze phenomena and to solve problems involving physical and chemical principles.

STUDENT LEARNING OUTCOMES

Learning Outcome

1. Students will analyze experimental data to determine correlations between independent and dependent variables, and construct reasonable cause and effect explanations for the correlations in an experimental data set, where appropriate, based on the concepts of physics and chemistry.
2. Students will analyze a system of objects to determine the forces acting on the objects, predict the effects of these forces on the objects' motion, and explain these predictions using Newton's laws of motion and universal gravitation.
3. Students will predict the basic chemical and physical properties of an element, based on its position on the periodic table, and justify these predictions, in writing, based on the principles of atomic structure and periodic properties.

Mode of Assessment

1. Written essay problem on exam. Students will be given a table of experimental data involving at least two variables, and instructed to: 1) identify the independent and dependent variables; 2) determine whether there is a correlation between any of the independent variables and any of the dependent variables; 3) describe the correlations, if any, in words, and explain how they identified whether or not the variables are correlated; and 4) construct and write a cause and effect explanation of one or more of the correlations, as appropriate.
2. Written essay and diagram problem on exam. Students will be given a description of a physical system (objects, motion of objects, etc.) in written and/or diagram form, and instructed to identify all of the forces, including direction, acting on each object in the system. Students will also be instructed to predict and explain other properties of the system, such as changes in motion, energy, etc., as appropriate.
3. Written essay problem on exam. Students will be given a periodic table, and the name of a particular element, instructed to draw the electron shell diagram of the element. Students will also be instructed to predict one or more of its basic chemical and/or physical properties, and construct and write a cause and effect explanation of the predictions.

METHODS OF INSTRUCTION

Instructional methodologies will be consistent with, but not limited by, the following types or examples:

- 1). Lecture
- 2). Inquiry-based exercises
- 3). Group work: discussion, analysis of phenomena, presentation preparation, and completion of projects
- 4). Student presentations.

METHODS OF EVALUATION

Evaluation methodologies will be consistent with, but not limited by, the following types or examples:

- 1). Exams or tests including multiple choice, calculations, scientific reasoning, problem-solving and description, application and explanation of concepts and phenomena covered in the content outline
- 2). Projects (such as individual and/or group research papers and group presentations)
- 3). Written homework, including calculations, scientific reasoning, problem-solving and description, application and explanation of concepts and phenomena covered class
- 4). Quizzes.



REQUIRED TEXTBOOKS

Examples of typical textbooks for this course include the following:

- 1). Trefil, James, and Robert M. Hazen. *The Sciences: An Integrated Approach*. 5th ed., Wiley, 2007. ISBN: 978-0471769927
- 2). Shipman, James, Jerry D. Wilson, and Aaron Todd. *An Introduction to Physical Science*. 12th ed., Brooks Cole, 2008. ISBN: 978-0618935963
- 3). Krauskopf, Konrad, and Arthur Beiser. *The Physical Universe*. 13th ed., McGraw Hill, 2009. ISBN: 978-0073512129

OTHER REQUIRED INSTRUCTIONAL MATERIALS

- 1). Scientific calculator.

COURSE REPEATABILITY

Total Completions Allowed:

1

In Combination With: