Alabama
Department of
Postsecondary Education

Representing Alabama's Public Two-Year College System

Jefferson State Community College

PHS 112
Physical Science II

I.   **PHS 112 Physical Science - 4 Semester Hours**
Core Area III, ASCI TSCI (Lec 3 hrs, Lab 2 hrs)

II.   **Course Description**

This course provides the non-technical student with an introduction to the basic principle of chemistry and physics.

III.   **Prerequisite**

As required by program.

IV.   **Textbook**

Conceptual Physical Science, Hewitt, Suchocki, Hewitt 4th Ed. Addison Wesley,2003.
Conceptual Physical Science Laboratory Manuel, Hewitt, Suchocki, Hewitt, 3rd Ed. Addison Wesley, 2004.

V.   **Course Objectives**

The student will:

A. Gain an understanding of basic physics and chemistry.
B. Appreciate the applications of physics and chemistry to the real world.
C. Develop basic laboratory skills.
D. To show the student how different areas of the sciences are
    related to each other
E. To familiarize the student with the involvement of
    historical events in the development of the sciences
F. To emphasize the use of the scientific method

VI. **Course Outline of Topics**
A. Measuring and motion – kinematics, free fall, circular, projectile, forces
B. Heat, work, energy, and machines
C. Electricity and magnetism
D. Optics – mirrors and lenses

E. Atoms, elements, compounds, states of matter
F. Chemical reactions – acids, base, salts, organic

Suggested Labs:

A. Measurement, lab technique – density
B. Graphing, Hooke's Law
C. Motion, determination of g
D. Phase change in water
E. Simple machines
F. Pendulum
G. EMF – cells in series, parallel
H. OHMS law
I. Resistors in series and parallel
J. Geometric optics
K. Chemical properties and changes
L. Acid – base reactions

VII. **COURSE CONTENT**
    A. Mechanics
        1. How motion is described: speed, velocity, and acceleration
        2. The acceleration of gravity
        3. Newton's laws of motion
        4. Mass and weight
        5. Vectors
        6. Circular motion
        7. The law of universal gravitation
        8. The scientific method
        9. Energy and momentum
    B. Fluids and waves
        1. Pressure and density
        2. Archimedes' principle
        3. Wave motion
    C. Heat and kinetic theory of matter
        1. Temperature scales including absolute temperature
        2. The gas laws
        3. Heat and molecular energy
        4. Changes of state
        5. The first and second law of thermodynamics
    D. Light
        1. Electromagnetic waves
        2. Determination of the speed of light
        3. Reflection, refraction, interference, and diffraction
        4. Color
    E. Electricity and Magnetism
        1. Electric charge
        2. Fields and force
        3. The electron
        4. Electric current
        5. Magnetism
        6. Magnetic fields and electric current
        7. Electromagnetic induction

F.   Basic chemistry
     1. Elements and compounds
     2. Atoms and molecules
     3. Chemical calculation
G.   The atomic nucleus
     1. The nucleus
     2. Nuclear energy
     3. Radioactivity
     4. Quantum theory of light
     5. The hydrogen atom
    *6. Quantum theory of the atom
     7. Lasers
H.   Chemistry
     1. The periodic table
     2. Atomic structure and the periodic law
     3. Chemical bonds
     4. Valence
    *5. Chemical energy
    *6. Reaction rates
    *7. Oxidation and reduction
     8. Introduction to organic chemistry

VIII. GENERAL COURSE COMPETENCIES

The student will acquire understanding of the basic terms and methodologies used in the physical science.

A.   The student will acquire understanding of the basic concept of motion.
B.   The student will acquire understanding of the basic concept of forces.
C.   The student will acquire understanding of the wave motion (both sound and light).
D.   The student will acquire understanding of electricity and magnetism.
E.   The student will acquire understanding of quantum mechanics and the atom.
F.   The student will acquire understanding of the atom as related to the periodic table.
G.   The student will demonstrate understanding of hierarchy of chemical structure.
H.   The student will demonstrate understanding of chemical reactions.
I.   The student will demonstrate understanding of complex molecules.
J.   The student will develop skills in reasoning logically and reporting results concisely from data obtained.

IX.   COURSE OBJECTIVES STATED IN PERFORMANCE TERMS

A.   The student will acquire understanding of the basic terms and methodologies used in the physical sciences. The student will:

1. State and be able to give the appropriate units of measure of the fundamental properties of nature.
2. Distinguish between percentage error and percentage   difference.
3. Express any number in powers of 10 notation and use the metric prefixes mega, kilo, centi, milli, and micro.
4. Explain the process called the scientific method.

B.   The student will acquire understanding of the basic concept of motion. The student will:
1. Differentiate between scalars and vectors and give an example of each.
2. Differentiate between average velocity and instantaneous velocity.

3. Define the term acceleration, and give an example referring to throwing a ball upward.
4. Compute the speed of a falling object given the time and initial speed.
5. Explain why two bullets, the first dropped and the second simultaneously fired horizontally, will hit the ground at the same time (if friction can be ignored).

C. The student will acquire understanding of the basic concept of forces.
   The student will:
   1. Define the term's force, inertia, and mass.
   2. State Newton's second law of motion in words and with an equation.
   3. Explain why any object will fall at the same rate regardless of weight.
   4. State and give an example of Newton's third law of motion.

D. The student will acquire understanding of wave motion (both sound and light).
   The student will:
   1. Define the five properties of waves.
   2. List in order of increasing frequency the various types of electromagnetic waves.
   3. Give the speed of light and the speed of sound.
   4. Explain what causes sound waves.
   5. State the two basic laws of reflection.
   6. Draw diagrams illustrating the principles of refraction and reflection.
   7. Use diagrams to describe the images seen in concave and convex mirrors for various positions of the object with respect to the focal point.
   8. Use diagrams to describe the images seen in concave and convex lenses for various positions of the object with respect to the focal point.

E. The student will acquire and understanding of electricity and magnetism.
   The student will:
   1. Give the mks system of units of electric charge, electric current, voltage, resistance, energy and power.
   2. State the basic force law for (a) electric charges and (b) magnetic poles.
   3. Explain briefly why some materials are conductors and some are insulators.
   4. State Ohm's law in equation form.
   5. Draw diagrams of a series circuit and a parallel circuit, and explain why some appliances are wired in parallel rather than series.
   6. Sketch the magnetic field around the earth.
   7. Briefly give an atomic description of what causes iron to be magnetic.
   8. Explain how one magnetizes a piece of iron.

F. The student will acquire understanding of quantum mechanics and the atom.
   The student will:
   1. Explain what is meant by the dual nature of light.
   2. Describe quantitatively the Bohr model of the atom.
   3. State how radiation from atoms occurs.
   4. Describe the spectrum and tell how one is produced.
   5. Discuss what distinguishes whether spectral lines are in the visible, ultraviolet, infrared, microwave or other parts of the spectrum.
   6. State and explain de Broglies' hypothesis concerning matter waves and give an example calculation.
   7. Explain the meaning of the wave function in Schrodingers equation.
   8. Explain Heisenberg's uncertainty principle.

G. The student will acquire understanding of the atom as related to the periodic table.
   The student will:
   1. List the four quantum numbers generated by the wave equation for the hydrogen atom, state their meaning, and give their possible values.

2. Draw the ground-state energy-level diagrams for a given element.
3. Write the electron configuration for any atom listed in the periodic table.
4. Name the symbol for each element given in the periodic table and specify the element's atomic number, atomic weight, atomic mass, proton number and valence.
5. Name the elements in any family or group of elements.
6. Name the elements in any period.
7. State the phase of each element when the element is at normal atmospheric pressure and temperature.
8. Name the elements that are metals, nonmetals, or metalloids.

H. The student will demonstrate understanding of hierarchy of chemical structure. The student will:
1. Define, explain and give an example of the important terms in the following list: (a) compound,   (b) mixture, (c) molecule and (d) ion.
2. State the two basic assumptions made to explain compound formation.
3. Describe ionic bonding, state the properties of ionic compounds, and give a few examples, of ionic compounds.
4. Describe covalent bonding, state the properties of covalent compounds, and give a few examples of covalent compounds.
5. Distinguish between and oxidation and a reduction process and give examples of each.
6. Distinguish between polar and nonpolar molecules and give examples of each.
7. State the general rules for naming compounds.
8. State and use the octet rule to predict compound formation.

I. The student will demonstrate understanding of chemical reactions. The student will:

1. Describe the various types of matter and give examples of each.
2. Distinguish between chemical and physical properties of matter.
3. Distinguish between gram atomic-weight and gram formula-weight.
4. Distinguish the principle characteristics of solutions.
5. Calculate the formula weight of a compound.
6. Calculate the percentage composition of a compound.
7. Describe a chemical reaction and distinguish between the reactants and products.
8. Explain chemical equilibrium and give an example.
9. Explain how temperature affects the rate of a chemical reaction.
10. Define and give an example of (a) an acid, (b) a base, (c) a salt.
11. Explain neutralization.
12. Explain and be able to calculate pH.

J. The student will demonstrate understanding of complex molecules. The student will:
1. State and explain the general formula for carbohydrates.
2. Describe the chemical structure of proteins.
3. Describe the general structure of the DNA and the RNA molecules.
4. Explain the function of DNA and RNA in cell reproduction and the genetic code.

K. The student will develop skills in scientific logic, reasoning, data collecting, and reporting. The student will:
1. Construct a graph on the appropriate scales including units, clearly indicating data points and drawing the best fit curve.
2. Demonstrate the technique for presenting and analyzing data by the submission of well written laboratory reports.

X. CLASS ACTIVITIES

A.Lecture
B.Discussion
C.Experimentation
D.Demonstration
E.Recitation
F.Written examinations

XI.   **Evaluation and Assessment**

Grades will be given based upon A = 90 – 100%, B = 80 – 89%, C = 70 – 79%, D = 60 – 69%, and F = below 60%.

XII.   **Attendance**

Students are expected to attend all classes for which they are registered. Students who are unable to attend class regularly, regardless of the reason or circumstance, should withdraw from that class before poor attendance interferes with the student's ability to achieve the objectives required in the course. Withdrawal from class can affect eligibility for federal financial aid.

XIII.   **Statement on Discrimination/Harassment**

The College and the Alabama State Board of Education are committed to providing both employment and educational environments free of harassment or discrimination related to an individual's race, color, gender, religion, national origin, age, or disability. Such harassment is a violation of State Board of Education policy. Any practice or behavior that constitutes harassment or discrimination will not be tolerated.

IXV.   **Americans with Disabilities**

The Rehabilitation Act of 1973 (Section 504) and the Americans with Disabilities Act of 1990 state that qualified students with disabilities who meet the essential functions and academic requirements are entitled to reasonable accommodations. It is the student's responsibility to provide appropriate disability documentation to the College. The ADA Accommodations office is located in FSC 300 (205-856-7731).