IDH 107
Discovery: Questions, Hypotheses, and Experiments

I. IDH 107 Discovery: Questions, Hypotheses, and Experiments - 4 Semester Hours

II. Course Description

This course is an interdisciplinary study of classical problems in science, technology and mathematics. The origin of problems and the processes used in formulating possible solutions are stressed. Laboratory is required.

III. Prerequisite

Admission to the Honors Program or consent; eligibility for ENG 101 and MTH 112.

IV. Textbook

Due to the varied selection of quality college level textbooks, each college will select the textbook needed to meet the requirements of this course.

V. Course Competencies and Objectives

Competencies:

After having completed this course, the student will have learned the following basic concepts. The student will:

A. Understand the differences between science and non-science and the strengths and limitations of each method of inquiry.
B. Understand the interfaces between mathematics and science and use appropriate mathematical notations to express scientific relationships.
C. Know the relationships between matter and energy and physical, chemical, and biological organization.
D. Realize that technology is the application of basic science.
E. Understand those characteristics that distinguish living from nonliving systems.
F. Understand the properties of the basic group of elements and the principles underlying chemical reactions.
Objectives:

A. Understand the differences between science and non-science and the strengths and limitations of each method.
   1. Analyze assigned major works of the classical period and medieval periods.
   2. Analyze specific sample problems to determine if the scientific method is the appropriate method of inquiry.
   3. Discuss the responsibilities of science with respect to specific societal situations.
   4. Use examples from the assigned readings to illustrate the importance of diversity of opinion and peer review in validating the conclusions from scientific inquiry.
   5. Demonstrate an understanding of the scientific method by
      a. making critical observations
      b. formulating a testable hypothesis
      c. designing an experiment to test the hypothesis
      d. collecting, organizing and interpreting data with respect to the hypothesis
      e. using data to justify the acceptance, rejection or modification of the hypothesis

B. Understand the relationships between mathematics and science and use appropriate mathematical notations to express scientific relationships. The student will be able to:
   1. Derive mathematically (i.e. equation form) relationships between variables expressed in graphical form.
   2. Calculate the acceleration of a body from graphical data of time and distance.
   3. Calculate the acceleration of a known mass, given the applied force.
   4. Apply Newton’s three Laws to the motion of a body.
   5. Describe, mathematically, potential and kinetic energy.
   6. Apply conservation of energy to mechanical systems such as a falling object, swinging pendulum bob, and a vibrating spring, and to energy conversions in biological and chemical systems.
   7. Describe the first two Laws of Thermodynamics through equation and explain their significance to biological and chemical systems.
   8. Describe chemical reactions by balanced equation.

C. Know the relationship between matter and energy and physical, chemical, and biological organization.
   1. State and explain the first Law of Thermodynamics.
   2. State and explain the second Law of Thermodynamics.
   3. List levels of organized structure beginning with the electrons, protons, and neutrons and progressing through the cell, tissues, organs and living organisms.
4. State the energy relationship between each increasingly complex level in #3 above.

5. Use the first and second Laws of Thermodynamics to explain why living organisms require energy.

D. Realize that technology is the application of basic science.

1. Distinguish between theoretical sciences and applied sciences and give at least two specific examples of each.

2. Give at least one example from the biological, chemical, and physical sciences to illustrate that basic research is a prerequisite to technological advances.

E. Understand those characteristics that distinguish living from non-living systems.

1. Compare the chemical composition of living systems with that of non-living systems.

2. Describe the chemical characteristics (general structure, building blocks, chemical bonds) of those molecules that are regarded as “markers” of life (carbohydrates, lipids, proteins, nucleic acids).

3. State the cell theory and recognize its significance.

4. Describe the contributions of at least three early biologists to the development of the cell theory.

5. Compare a rock with a human liver cell in terms of structure and function.

6. Define the following terms as they relate to life functions at the cellular level:
   a. metabolism
   b. reproduction
   c. homeostasis

7. Describe at least one chemical process required for each of the life functions listed in #6.

F. Understand the properties of the basic groups of elements and the principles underlying chemical reactions.

1. Use the periodic chart of elements to:
   a. Give the names and symbols of selected elements on that chart
   b. Give the atomic number, atomic weight, atomic mass, proton number, neutron number, electron number and valence of the elements on the chart.
   c. Write the electronic units in atoms for each element listed on the chart
   d. Name the elements that are metals, nonmetals, and metalloids
   e. State the phase of each element when the element is at normal atmospheric pressure and temperature
   f. State the relative size of one atom in respect to another atom located in the same group or family
2. Distinguish between compound, mixture, molecule and ion.
3. Distinguish between ionic, covalent, and hydrogen bonds.
4. Describe an oxidation-reduction reaction.
5. State and apply the octet rule.
6. State and apply the general rules for naming compounds.
7. Distinguish between gram atomic weight and gram formula weight.
8. For any given compound calculate:
   a. The formula weight
   b. The percentage composition.

VI. Course Outline of Topics

VII. Evaluation and Assessment

   Evaluation of class participation
   Written exams
   Lab reports
   Oral exams and reports

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

VIII. 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.

IX. 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.

X. 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.