CH-180 Chemistry in Our World

Catalog Description (including prerequisites)

The principles governing the systematic behavior of matter, with applications to life and living. One may not receive credit for both CH-180 and CH-181/001/081. Two lectures and three hours of laboratory. Prerequisite: MA-101 and or MA-102; completion of high school chemistry is recommended. (3)

Course Content

"Chemistry in Our World" begins with a look at the way that the Scientific Method is used to increase our understanding of the physical world. We then investigate how physical and chemical properties are used to classify and identify substances.

After we see how substances are similar and different, we begin to examine some of the ways by which chemists have explained these similarities and differences. We begin at the level of the atom, move on to the molecular level, and finally relate the molecular level to the level of our everyday experience.

On the atomic level, we investigate how we came to recognize atoms as "building blocks" from which substances are made. We see how protons, neutrons, and electrons determine the properties of an atom, and we briefly survey radioactivity and nuclear processes.

On the molecular level, we see how atoms form ionic and covalent bonds, and we relate chemical bonding to the structure and properties of molecules. The octet rule lets us predict what kinds of compounds may be formed from the various elements. We then turn our attention to chemical reactions and ways to use the Law of Conservation of Matter to understand how chemical reactions occur.

Finally, we use our understanding of atoms and molecules to explain the structure and behavior of larger samples of matter - solids, liquids, and gases of a size large enough to weigh and observe.

Nature of Course

"Chemistry in Our World" is a course that emphasizes problem solving skills. Consequently, the teaching format stresses discussion of problem-solving strategies. We keep lecturing at a minimum, and we seldom require students to memorize chemical facts. The laboratory emphasizes critical thinking, problem solving, Internet-assisted instruction, and laboratory skills.

Student Expectations

Students are expected to participate in class and laboratory, and to read approximately 250 pages of assigned readings in the textbook. Students are expected to send and receive electronic mail, and to use a Web browser to access the course's Website. There will be three exams and a final; exams make use of problem-solving and descriptive skills, with little emphasis on simple recall.

CH-181/001/081 Basic Principles of Chemistry

Catalog Description (including prerequisites)

A one semester survey of the fundamental principles and systematic behavior of matter. Three lecture hours (CH-181), one recitation hour (CH-001), two lab hours (CH-081) must be taken concurrently. One may not receive credit for both CH-181/001/081 and CH-185/005/085. Pre or corequisite: MA-101 and or MA-102. (5)

Course Content

Basic Principles of Chemistry begins with an overview of the history of the Scientific Method as a way to increase our understanding of the physical world, with special attention paid to the role that numbers and measurements play in the practice of the Scientific Method. We then take time to develop a "tool box" of problem-solving strategies and aids that are used in applications of the Scientific Method.

After we have developed our "tool box," we investigate how scientists in many parts of the world applied the Scientific Method in ways which led to our current understanding of the atom and the molecule as basic organizations of matter. We then learn how our understanding of atoms and molecules can be applied to social and technological problems, such as acid rain, production of chemicals used in manufacturing, testing of products for purity, alternate energy sources, etc.

Nature of Course

Just as a mechanic depends on the tools in a tool box to repair a car, we make use of a critical thinking "tool box" to solve problems in CH-181. We spend much of our time discussing appropriate use of each tool; lecture is used only when necessary content is introduced. Since our emphasis is on problem-solving ability, little time is spent memorizing facts that can be found in the text or a reference book. The laboratory emphasizes problem solving and laboratory skills and techniques required to obtain and interpret data and observations.

Student Expectations

Although we make much use of numbers and measurements as we formulate solutions applicable to the problems mentioned above, the degree of mathematical sophistication is quite limited: The weekly recitation period provides the student with an ongoing opportunity to develop and perfect, with the assistance of the instructor, the math skills required to thrive in CH-181. The student is expected to attend class, recitation, and laboratory, and to read approximately 150 pages in the textbook. There will be three exams and a final; exams make use of the "tool box" developed in the course, with little emphasis on simple recall.

CH-185/005/085 General Chemistry I

Catalog Description (including prerequisites)

A study of atomic structure, chemical bonding, properties of matter and chemical reactions. Initial course in general chemistry sequence. Three lecture hours (CH-185), one recitation hour (CH-005), two lab hours (CH-085) must be taken concurrently. Prerequisite: MA-101 and or MA-102. (5)

Course Content

This course is the first course in a two semester general chemistry sequence. Students meet three hours per week in lecture, one hour per week in recitation and two hours per week in laboratory for five hours credit. Intermediate Algebra (MA-095) is a prerequisite for the course.

General Chemistry I looks at the way in which measurement of physical and chemical properties of samples of matter helps us to classify matter as elements and compounds, and then to determine whether these elements and compounds are made up of atoms, molecules or ions. The early theories of the structure of the atom are discussed and used to illustrate the Scientific Method. Chemical reactions are studied and students learn how to determine the amount of products formed and the heats of reaction. The properties of gases are investigated extensively. The periodic properties of elements are related to the electronic structure of atoms. Students learn to predict whether compounds exhibit ionic or covalent bonding and then to write Lewis Structures and predict the molecular geometries of covalently bonded compounds. The properties of liquids, solids and solutions are discussed. Students are taught the factors which can affect how fast chemical reactions occur, and learn to predict the step by step mechanisms by which the reactions occur. The basic concepts and principles of chemical equilibrium are dealt with. Students learn to solve problems involving equilibrium constants.

Nature of Course

General Chemistry I emphasizes the learning of concepts and principles and the solving of problems rather than the memorizing of definitions. Weekly homework assignments are made in order to help students internalize the subject matter. Laboratory experiments are carried out each week and these illustrate the concepts and principles of chemistry and develop problem solving and laboratory skills.

Student Expectations

There are five exams given, each worth 100 points and a 200 point final exam. The laboratory experiments account for 200 points on the grade and homework is worth 100 points.

GO-150/050 Earth Science: Environmental Hazards

Catalog Description (including prerequisites)

An examination of Earth's systems, how they work, and how they relate to people, with emphasis on natural and man-made hazards to society. Two lectures, one lab per week. (3)

Course Content

This course emphasizes naturally occurring or human induced hazards such as earthquakes, volcanic eruptions, floods, and water-supply contamination. The necessary background to understand these hazards is obtained through fundamental study of earth's internal dynamics and surficial processes.

Nature of Course

1. Emphasis on Reading: Regular reading assignments are given in the textbooks and supporting materials. Laboratory exercises include written materials which must be studied.
2. Group Projects: Many of the lab projects are done by working teams. Simulations involving role-playing require group interaction. Students may participate in a debate or a poster session on environmental hazards.
3. Emphasis on Writing: A notebook of laboratory activities must be kept. Several formal written laboratory project reports are also required. Brief, informal writing is required in some other laboratories.
4. Out-of-Class Projects: All homework, including reading assignments are out-of-class work. The role-playing and debates will require out-of-class preparation. Some laboratory projects will require data collection out-of-class.
5. Teaching Format: A wide variety of formats will be used including lecture, laboratory investigations, field study, role-playing simulations, student discussion, debate, and preparation and discussion of poster presentations.

Student Expectations

There are a minimum of three unit exams (300 points) and a comprehensive final exam (150 points). Many laboratories include graded work (150 points). Participation in class is evaluated and will be a factor in final grade assignment for those students within 3% plus or minus of a grade break point. Attendance is expected at all class meetings. Punctual completion of all assignments is required.

PH-106 Physical Concepts

Catalog Description (including prerequisites)

An introduction to the concepts and principles governing the natural physical world and their relation to society. Emphasis on developing an appreciation for the role of science in our life. Does not count on a major or minor. (3)

Course Content

This course shows how we encounter physical principles in our everyday lives. It introduces concepts of matter, space, and time. Methods of measurement are discussed. Concepts of motion are explored from the Aristotelian and Galilean points of view. The concept of energy is introduced. Various forms of energy are described, and the principle of conservation of energy is formulated. Interchanges among heat and work and kinetic, potential, electromagnetic energy are illustrated with applications to our daily experiences. Wave motion is introduced in connection with sound waves and electromagnetic waves. The perception of sound and the perception of color are explained in terms of wave motion. Physical phenomena which seems at odds with our perception of events are explained. Classroom demonstrations highlight the course.

Nature of Course

1. Emphasis on Reading: In addition to reading assignments in the textbook students may be asked to locate and read relevant journal articles in the library and peruse newspapers for articles relating to topics studied in the course.
2. Emphasis on Writing: Students will be required to write a paper near the end of the course that exemplifies physical concepts learned in the course.
3. Group Projects and Out-of-Class Projects: Several of the laboratory experiments and classroom projects will be done in groups or teams. In addition, there may be simple home experiments or projects that are brought to class for presentation and discussion.
4. Teaching Format: A variety of approaches will be used in the classroom including formal lectures, group projects and discussions, demonstrations, and the use of audiovisual and computer materials. Students are expected to be actively involved in all aspects of the course.

Student Expectations

Student evaluation will be based on student participation in classroom activities and group projects, completion of laboratory exercises, satisfactory completion of homework assignments and satisfactory performance on examinations.

PH-109 Exploring the Universe

Catalog Description (including prerequisites)

An examination of the physical nature of planets, stars and galaxies, their interrelationships and evolutionary processes. Emphasis on the role of scientific inquiry in our present understanding of the Universe. (3)

Course Content

A major theme of this course is the radical change in our perception of the Universe over the ages, culminating in our present understanding of the Universe and the Earth's place in it. Accordingly, our present state of knowledge of the Cosmos is approached from an historical perspective. The student will learn how the people of ancient times interpreted the motions of the Sun, Moon and Planets, and how the contributions of Copernicus, Kepler, Galileo and Newton revolutionized our understanding of the Universe. Since this will be a first science course for many students, a great deal of emphasis will be placed on the methods astronomers use to learn about the Universe. The laws of physics are the astronomer's most important tools, and the student will develop a qualitative understanding of the law of gravity, the nature of light, and the structure of the atom. Armed with these tools, the student will learn about the physical nature of planets, stars, galaxies, and other objects which populate our Universe. Spacecraft exploration of the solar system, the life cycles of stars, the origin and eventual fate of the Universe, and the possibility of extraterrestrial life are just a few of the topics which will be addressed in the course.

Nature of Course

Classroom presentations will include formal lectures, group discussions, demonstrations, and the use of slides and videotapes. In addition to regularly scheduled laboratories, evening "stargazing" sessions will be held on many clear nights during the semester.

Students will be required to write a short paper on a topic of relevance to astronomy. Students with special capabilities may elect to do a research project instead of a term paper. Students may use a combination of cameras and telescopes to help in their observations.

Student Expectations

Course grades will be based upon 4 one-hour exams, a comprehensive final exam, 10 laboratory exercises, term paper, and several short homework assignments. A number of astronomy-related films will be available for viewing outside of class, and attendance at these films will result in extra-credit points.

PH-120 Introductory Physics I

Catalog Description (including prerequisites)

Concepts and principles of natural phenomena, including mechanics, work and energy, rotational motion, waves and thermodynamics, with emphasis on the investigative processes. Four lectures and 1 two-hour lab. Prerequisites: MA-133 and MA-134 or equivalent. (5)

Course Content

This is the first course of a two semester introductory physics sequence. The students will meet four hours per week for lecture and once a week for a two hour laboratory for five hours of credit.

Introductory Physics I is intended to provide the basic concepts, facts and methods of problem solving in physics. The lecture is based on a set of unified concepts of mechanics, waves and thermodynamics. The laboratory will help you understand the value of observation and measurement in physics. The lecture and the laboratory are one course. Topics and concepts are introduced in either the lecture or the laboratory and may be expanded in either format.

Acquiring and consolidating a knowledge of physics requires understanding rather than memorization. The laboratories will provide an opportunity to have hands-on experiences in linear and rotational mechanics, waves and sound, and thermodynamics. The lab and lecture will provide methods of thinking through problems.

Nature of Course

This course is made up of four lectures and 1 two-hour laboratory. Introductory Physics I emphasizes the understanding of the concepts through lecture and laboratories. The laboratories are of the problem solving type and not just replication. The student must pass the laboratory to pass the course. The grading scale is based on a cumulative score of lecture and laboratory points. A percentage of these points based on total points possible represent a grade.

Student Expectations

The students will show progress in meeting the course objectives by:

1. Regularly attending all lecture and laboratory sessions.
2. Actively participating in all problem solving, classroom discussions and investigative laboratories.
3. Performing and reporting on laboratory activities.
4. Demonstrating personal responsibility by completing well organized, written classroom and laboratory assignments.
5. Achieving acceptable scores on tests, quizzes, laboratory reports and laboratory practical exams.

PH-218 Physical Science: A Process Approach

Catalog Description (including prerequisites)

Major topics include atomic structure, elements and compounds, chemical reactions, mechanics and energy concepts of heat, light, sound, electricity and magnetism. Does not count for a physics major or minor. Prerequisite: BS-118. (3)

Course Content

This course is designed to acquaint students with basic concepts and principles from chemistry and physics that can be used to teach physical science in the elementary school. Eight weeks of the course are devoted to chemistry and include topics such as properties of matter, atomic structure, physical and chemical changes, chemical reactions and acids and bases. The other eight weeks of the course are devoted to physics and include topics such as mechanics, heat and temperature, wave motion and sound, electricity, magnetism, and light.

Nature of Course

The course consists of two regular one-hour class sessions and a two-hour laboratory session. Classroom presentations will combine a variety of approaches including formal lectures, group projects and discussions, demonstrations, and the use of current technology. Emphasis will be placed on hands-on activities which incorporate the inquiry/discovery mode in both the classroom and the laboratory. The applications of chemistry and physics to everyday life and to advances in technology, including the benefits to mankind, will be emphasized when possible.

The laboratory will provide an opportunity for students to make measurements, gather and analyze data, and draw conclusions based on their experimental investigations. They will be asked to locate and gather information outside the classroom and analyze this information. As a result, students will be asked to complete a project dealing with some issue related to physics or chemistry, where they must analyze alternative ideas and hypotheses and come to a conclusion.

Student Expectations

Student evaluation will be based on (1) active participation in classroom activities, group projects, and laboratory exercises (2) quality of laboratory reports and the investigative project report (3) satisfactory completion of homework assignments and (4) satisfactory performance on examinations.