



# Course Syllabus

SY 2009-10

**COURSE TITLE:** Earth Science

**PREREQUISITE:** None

**DESCRIPTION:** In science, a special emphasis is placed on the research process in all grades. This includes making decisions about the generation and testing of ideas; prediction, measurement, data collection and representation; evaluation of sources of information; collaborative investigation; interpretation and communication of findings; evaluation and verification of findings and considerations relating to the social context of research. Earth Science is a study of the interrelationships between the Earth's composition, structure, processes and history, its atmosphere, meteorology, and astronomy. Various scientists and their contributions are studied. Students interpret various maps, charts, and tables. They utilize technology such as probeware and global positioning systems (GPS) to collect, organize and analyze data. Facility in using many different kinds of maps and graphics is a major outcome of learning Earth Science. Students also consider costs and benefits of using the Earth's resources in problem-solving situations.

**MAIN TOPICS:**

- Recognize the many common rock-forming minerals and how each relates to the three rock groups.
- Examine and differentiate the processes that form igneous, sedimentary, and metamorphic rocks.
- Compare and contrast the constructive, destructive, and tectonic forces that shape the Earth's features.
- Demonstrate how geological and topographic maps represent the Earth's features.
- Understand the processes of formation and the position of the Earth in our solar system while identifying the members of the solar system.
- Identify and explain the many variable components of the atmosphere and how they relate to weather. Apply these conditions to modern weather forecasting methods.
- Describe the combined chemical, biological, geological, and physical components of oceanography, and how each is interrelated to man's role in the environment and the use of Earth's resources.

**CREDIT INFO:** This course provides one of the credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

**COURSE TITLE:** Biology

**PREREQUISITE:** None

**DESCRIPTION:** In science, a special emphasis is placed on the research process in all grades. This includes making decisions about the generation and testing of ideas; prediction, measurement, data collection and representation; evaluation of sources of information; collaborative investigation; interpretation and communication of findings; evaluation and verification of findings and considerations relating to the social context of research. Students taking Biology gain detailed knowledge of living systems, especially at the biochemical level. Areas of investigation also include cellular organization, genetics, ecosystems and changes in organisms over time. The importance of science research is emphasized. Controlled experiments are performed and results are reported.

*Note: Students enrolled in life science courses participate in animal dissection. Students who decline to participate will be offered alternatives to dissection. A student's objection to participating in an animal dissection should be substantiated by a signed note from his or her parent or legal guardian.*

**MAIN TOPICS:** Demonstrate proper use of compound and stereo microscopes, SI units, and experimental design.

Formulate hypotheses for problem solving.

Identify major organic compounds through structural formula and specific tests. Recognize their significance in relationship to bonding and chemical reactions.

Determine the relationship between structure and function in major cell organelles and their relevance in the life processes of diffusion, osmosis, and mitosis.

Distinguish between photosynthesis and respiration.

Demonstrate and understand genetic principles using Punnett squares, probability, and pedigrees in the inheritance of genetic traits and disorders.

Explain the relationship of DNA to heredity and evaluate the impact of genetic engineering on society, as in Bioethics and DNA fingerprinting.

Survey the scientific evidence for evolution. Understand the current and historical theories regarding the origin of life.

Use and design a taxonomic key.

Survey the diversity of living forms and how they perform life processes with emphasis on reproduction and development of organisms.

Understand the biotic and the abiotic factors which affect ecosystems, ecological succession, and biomes.

**CREDIT INFO:** This course provides one of the credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

---

**COURSE TITLE:** Chemistry

**PREREQUISITE:** Algebra I or Algebra I, Parts 1 & 2  
Students must attain a passing score on the Algebra I SOL Test

**DESCRIPTION:** In science, a special emphasis is placed on the research process in all grades. This includes making decisions about the generation and testing of ideas; prediction, measurement, data collection and representation; evaluation of sources of information; collaborative investigation; interpretation and communication of findings; evaluation and verification of findings and considerations relating to the social context of research. Chemistry students develop an appreciation for the interaction between matter and energy. Analytical experimental investigations are conducted using the scientific method and proper safety precautions are employed. Students investigate kinetic theory, the Periodic Table, stoichiometry, redox equations, and the chemical equilibrium. Students report findings of both qualitative and quantitative data using effective communication skills, correct expression of significant figures and error, and factor labeling in problem solving.

**MAIN TOPICS:** Relate Chemistry to matter and energy by applying the scientific method to experiments showing relationships between molecules, elements, and compounds.

Identify physical and chemical changes of matter. Classify and identify matter as homogeneous, heterogeneous, substance, solution, element, compound, or mixture.

Describe Modern Atomic Theory.

Read and interpret a Periodic Table. Investigate and understand the placement of elements on the periodic table related to average atomic mass, mass number, atomic number, subatomic particles, and physical and chemical properties.

Use the Periodic Table to write, spell and symbolize chemical formulas.

Demonstrate proficiency in writing and balancing chemical equations.

Balance equations to show an understanding of chemical reactions.

Demonstrate appropriate use of significant figures.

Demonstrate an understanding of the Mole concept by using it in calculations with chemical formulas, solutions, molecular formulas, and hydrates.

Apply mass-energy relationships in chemical reactions relating to mass-mass, mass-heat, mass-volume, and volume-volume calculations.

Demonstrate an understanding of the various bonding processes and properties associated with each.

Apply the kinetic theory to describe the behavior of gases.

Recognize characteristics of solutions and ways of expressing their concentration.

Differentiate between the various acid-base theories and the properties of acids, bases, and salts.

**CREDIT INFO:** This course provides one of the credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

---

**COURSE TITLE:** Advanced Placement Chemistry

**PREREQUISITE:** Chemistry  
Students must attain a passing score on the Chemistry SOL Test

**DESCRIPTION:** In science, a special emphasis is placed on the research process in all grades. This includes making decisions about the generation and testing of ideas; prediction, measurement, data collection and representation; evaluation of sources of information; collaborative investigation; interpretation and communication of findings; evaluation and verification of findings and considerations relating to the social context of research.

The AP Chemistry program offers students the opportunity to extend their understanding of general and analytical chemistry through a fast-paced, college-level Advanced Placement program. Students are expected to take the AP chemistry examination at the conclusion of the course.

**MAIN TOPICS:** Extended analytical chemistry lab experiences, including semimicro qualitative analysis topics in:

Organic Chemistry

Biochemistry

Nuclear Chemistry

Coordination complexes

**CREDIT INFO:** This course provides one of the credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

---

**COURSE TITLE:** Conceptual Physics

**PREREQUISITE:** Algebra I or Algebra I, Parts 1 & 2  
Students must attain a passing score on the Algebra I SOL Test

**DESCRIPTION:** In science, a special emphasis is placed on the research process in all grades. This includes making decisions about the generation and testing of ideas; prediction, measurement, data collection and representation; evaluation of sources of information; collaborative investigation; interpretation and communication of findings; evaluation and verification of findings and considerations relating to the social context of research.

Students build on basic physical principles by exploring the nature and characteristics of energy and its dynamic interaction with matter. Students gain a conceptual understanding of physical systems. Students use Algebra I to understand concepts. They engage in experimentation, apply scientific reasoning, and perform data analysis and interpretation.

This course draws connections between the concepts of physics and many everyday applications. This course is not intended for students who are planning to pursue the sciences in college.

**MAIN TOPICS:**

- Mechanics
- Dynamics
- Momentum
- Work, Energy & Power
- Electricity
- Magnetism
- Waves and Optics
- Fluids
- Modern Physics

**CREDIT INFO:** This course provides one of the credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

---

<b>COURSE TITLE:</b>	Physics
<b>PREREQUISITE:</b>	Algebra II
<b>DESCRIPTION:</b>	<p>In science, a special emphasis is placed on the research process in all grades. This includes making decisions about the generation and testing of ideas; prediction, measurement, data collection and representation; evaluation of sources of information; collaborative investigation; interpretation and communication of findings; evaluation and verification of findings and considerations relating to the social context of research.</p> <p>Considered to be the most fundamental of all the sciences, Physics seeks to understand and explain the behavior of matter and energy. Students will recognize that innumerable phenomena can be explained by a surprisingly small collection of related concepts.</p> <p>Students use algebra, statistics, and trigonometry to understand concepts. They engage in experimentation, apply scientific reasoning, and perform data analysis and interpretation. Laboratory work includes graphical analysis. This is a college preparatory Physics course.</p>
<b>MAIN TOPICS:</b>	<p>Mechanics</p> <p>Dynamics</p> <p>Momentum</p> <p>Work, Energy &amp; Power</p> <p>Electricity</p> <p>Magnetism</p> <p>Waves and Optics</p> <p>Fluids</p> <p>Modern Physics</p>
<b>CREDIT INFO:</b>	This course provides one of the credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

---

**COURSE TITLE:** Advanced Placement Physics, C

**PREREQUISITE:** Physics **CO-REQUISITE:** Calculus

**DESCRIPTION:** The AP Physics program offers students the opportunity to extend their understanding of the behavior of matter and energy through a fast-paced, college-level Advanced Placement program. Emphasis is placed on mechanics and the student has the option to study additional topics. Pre-calculus and calculus skills are used to develop concepts and solve problems.

Students are required to take the AP Physics-C examination at the conclusion of the course.

**MAIN TOPICS:** Kinematics

Dynamics

Energy

Rotational Kinematics and Dynamics

**OPTIONAL TOPICS:** Electricity

Magnetism

**CREDIT INFO:** This course provides one of the credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

**COURSE TITLE:** Advanced Placement (AP) Biology

**PREREQUISITE:** Biology (Honors or Academic) & Chemistry (completed or may be taken concurrently)  
Students must attain a passing score on the Biology SOL Test

**DESCRIPTION:** In science, a special emphasis is placed on the research process in all grades. This includes making decisions about the generation and testing of ideas; prediction, measurement, data collection and representation; evaluation of sources of information; collaborative investigation; interpretation and communication of findings; evaluation and verification of findings and considerations relating to the social context of research. The AP Biology program offers students the opportunity to extend their understanding of biology and biochemistry. Some of the material studied is comparable to that in a freshman college level course and includes as many extended lab experiences as possible. The course emphasizes cellular biology, biochemical processes of cellular respiration and photosynthesis, vertebrate anatomy and physiology, advanced genetics, evolution, plant anatomy and physiology and ecology, including some field experiences. Students will take the AP Biology examination for possible college credit. Given the pace, the prescribed content, and the labs in this course, there is little opportunity for independent research, although students do gain information and skills that are related to doing research.

*Note: Students enrolled in life science courses participate in animal dissection. Students who decline to participate will be offered alternatives to dissection. A student's objection to participating in an animal dissection should be substantiated by a signed note from his or her parent or legal guardian.*

**MAIN TOPICS:**

- Review atomic structure and bonding with specific emphasis on organic compounds and chemical reactions.
- Understand the development of Cell Theory, modern techniques to studying cells (including cell membrane and organelle structure and function) and cell cycles.
- Explain ATP production and usage in respiratory and photosynthetic reactions.
- Describe the structure, functions, and abnormalities of nucleic acids and become familiar with recombinant DNA technology.
- Recognize genetic concepts through the study of Mendelian genetics, inheritance patterns, genetic defects, and genetic engineering.
- Explain the Darwinian Theory of Evolution and the modifications of the Darwinian Theory.
- Become familiar with the current classification system and recognize the applications of taxonomy as a biological tool.
- Recognize and distinguish between the major phyla of Monera, Protista, and Fungi.
- Understand the structure of higher plants and how their structure is related to their functions, adaptations, and growth patterns.
- Explore the taxonomy, anatomy, physiology, embryology, and development and behavior with the kingdom Animalia.
- Explain population growth patterns, ecosystems and community dynamics, and biochemical cycles.

**CREDIT INFO:** This course provides one of the elective credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

---

**COURSE TITLE:** Independent Science Research (ISR)

**PREREQUISITE:** Completion of 3 Lab Sciences in different disciplines (to be chosen from: Earth Science, Biology, Chemistry, Physics or AP Sciences)

**DESCRIPTION:** This elective science course is intended for seniors interested in continuing their study through an independent project in science, engineering, mathematics or computer science. Students participating in ISR should have a significant science background prior to entering the course. ISR projects are subject to considerable peer and teacher review during all phases of development.

The focus of this course is on sustained, scientific inquiry. Students are expected to take responsibility for project development, meeting timelines, collecting data, defending procedures and presenting results.

The instructor advises students on the research process, information sources and contacts. Instruction is also provided on such topics as data collection and presentation, statistical interpretation of results, protocols for research, and presentation skills.

*Note: Students enrolled in this course may participate in animal dissection. Students who decline to participate will be offered alternatives to dissection. A student's objection to participating in an animal dissection should be substantiated by a signed note from his or her parent or legal guardian.*

**CREDIT INFO:** This course provides one of the elective science credits required for the Standard or Advanced Studies Diploma.



# Course Syllabus

SY 2009-10

---

**COURSE TITLE:** Environmental Explorations

**PREREQUISITE:** Completion of 2 lab science credits (Earth Science & Biology suggested)  
Students must attain a passing score on 2 science SOL Tests (Earth Science, Biology, Chemistry)

**DESCRIPTION:** Environmental science provides opportunity to synthesize the disparate pieces of physics, chemistry, earth science and biology while developing the naturalist intelligence. Students will gain an understanding of ecological concepts including air, water, soil, biological diversity and human impacts. Inquiry skills will be developed through fieldwork, service projects, and collaborative investigation while using appropriate technology. Because of the interdisciplinary focus, students are challenged with diverse topics, rigorous reading requirements, and opportunity for written and oral presentation.

*Note: Students enrolled in this course may participate in animal dissection. Students who decline to participate will be offered alternatives to dissection. A student's objection to participating in an animal dissection should be substantiated by a signed note from his or her parent or legal guardian.*

**MAIN TOPICS:** Topics of Investigation include:

Air, atmospheric structure, pollution, weather dynamics

Biodiversity

Bioethics

Conservation

Ecology

Energy production, consumption, alternatives

Environmental economics

Land, geomorphology, soil, use and reclamation

Natural History of Loudoun

Populations, biodiversity, limiting factors

Water, watershed ecology, vernal pools, pollution

**CREDIT INFO:** 1 credit