

# Science

## PHILOSOPHY OF THE SCIENCE DEPARTMENT

The Lemont High School Science Department believes students should develop the following characteristics:

- Problem solving skills
- Focus on scientific inquiry
- Mastery of material aligned with state standards

Courses offered within the Science Department curriculum are aligned with state standards, and help students learn through hands-on laboratory experiments, classroom discussions, authentic assessments and technology.

Based on their abilities and course level, students are expected to:

- Participate in laboratory experiments
- Work within the framework of scientific inquiry
- Take advantage of an array of courses with rigorous and differentiated curricula
- Utilize critical thought
- Develop a knowledge base that they can use as technology continues to advance

**Grading Standards:** Student grades are determined based on their performance on class work, laboratory experiments and written assessments.

## CORE COURSES - SCIENCE

### Biology

**Grades Course Open To:** 9                      **Credit:** 1.0

**Prerequisite:** Placement based on student's placement exam results

**Description:** An activity-based teacher-, student- and group-led class, this course stresses the connections between the field of biology and the real world by incorporating the science of biology and its implications on today's society. Students gain a working knowledge of the principles of scientific research and the application of simple research projects, and demonstrate the ability to recognize plants and animals and their interrelationship. In studying biological systems, students concentrate on various cross-cutting concepts, such as cause and effect, flow of energy, structure and function, and stability and change. Areas of study include the nature of science, cellular biology, heredity and genetics, biotechnology, biochemistry, classification, evolution and careers in the biological field.

### Biology Honors

**Grades Course Open To:** 9                      **Credit:** 1.0 - Honors credit

**Prerequisite:** Placement based on student's placement exam results

**Description:** This course is very rigorous in nature and includes some topics covered in a college curriculum. An activity-based teacher-, student- and group-led course, it stresses the connections between the field of biology and the real world by incorporating the science of biology and its implications on today's society. Students gain a working knowledge of the principles of scientific research and the application of simple research projects, and also demonstrate the ability to recognize plants and animals and their interrelationship. Areas of study include the nature of science, cellular biology, heredity and genetics, biotechnology, biochemistry, classification, evolution and careers in the biological field.

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## Chemistry

**Grades Course Open To:** 10-11-12      **Credit:** 1.0

**Prerequisite:** Successful completion of Integrated Math I Honors or grade of C or better in Integrated Math I

**Description:** This course integrates basic mathematical and chemical theories that traditional chemistry classes include on a “need-to-know” basis. Students are familiarized with basic chemistry concepts while also understanding why the subject is important in everyday living. Laboratory work is integrated into the curriculum on a weekly basis, and focuses on lab techniques, write-ups and data analysis; formal write-ups are introduced, but most labs are submitted in a standard format. Areas of study include water, conserving chemical resources, petroleum, food, air and climate chemistry, nuclear chemistry, and experimental design. The topics of measurement, balancing equations, writing formulas, basic stoichiometry, history and use of the periodic table, organic and biochemistry, and the gas laws are emphasized.

## Chemistry Honors

**Grades Course Open To:** 10      **Credit:** 1.0 - Honors credit

**Prerequisite:** Grade of C or better in Integrated Math I Honors or grade of B in Integrated Math I

**Description:** This advanced-level course is intended for students who are considering some type of science major in college, and prepares students for further study of chemistry, whether in AP Chemistry or in college courses. It explores basic chemical concepts and theory, and helps students develop extensive problem solving and laboratory analysis skills. Laboratory work is integrated into the curriculum on a weekly basis, and focuses on lab techniques and the presentation and statistical analysis of data; students are expected to analyze their work in formal write-ups. Students are expected to develop a deep understanding of the topics covered, which include atomic theory, electron theory, chemical bonding, formula writing, equation writing and balancing, stoichiometry, states of matter, solution chemistry, and acid base theory, as well as the history and use of the periodic table.

## ELECTIVE COURSES - SCIENCE

## AP Biology

**Grades Course Open To:** 11-12      **Credit:** 1.5 - weighted for AP

**Prerequisite:** Grade of B or better in Biology or Biology Honors and Chemistry or Chemistry Honors, or consent of Division Chair

**Fees:** AP Biology exam (paid at fall registration)

**Description:** This advanced course is designed to be the equivalent of a college introductory biology course usually taken by biology majors in their freshman year, or of a high-quality college program in introductory biology. The quality of textbook used and the kinds of labs performed are the equivalent of those done by college students. The course provides students with the conceptual framework, factual knowledge and analytical skills necessary to deal critically with the rapidly changing science of biology. Areas of study include molecules and cells, heredity, evolution, organisms and populations; students understand and apply concepts of these units to current topics in the field of study. Students must be self-motivated and have a keen interest in science. They develop analytical thinking, problem solving and critical analysis techniques, all while developing an appreciation for the beauty of nature. **Note:** All students enrolled in this course **must** take the AP Biology exam in the spring.

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## AP Chemistry

**Grades Course Open To:** 11-12      **Credit:** 1.5 - weighted for AP

**Prerequisite:** Grade of B or better in Chemistry or Chemistry Honors, or consent of Division Chair

**Fees:** AP Chemistry exam (paid at fall registration)

**Description:** This is an upper-level course designed to prepare students for college-level study in engineering, medicine or other chemistry-based careers. An emphasis is placed on theory, mathematical analysis and problem solving. The class serves as preparation for college-level chemistry classes, and is designed to enable the most aggressive high school students to gain an edge in collegiate study. Some major areas of study include thermochemistry, chemical equilibrium, acid-base theory, redox reactions, kinetics and thermodynamics, and nuclear and organic chemistry. Lab work focuses on technique, lab design and formal write-ups. Students are expected to spend additional time and energy beyond the class period to complete the course material. **Note:** All students enrolled in this course **must** take the AP Chemistry exam in the spring.

## AP Environmental Science

**Grades Course Open To:** 11-12      **Credit:** 1.0 - weighted for AP

**Prerequisite:** Grade of B or better in Biology or Biology Honors and Chemistry or Chemistry Honors, or consent of Division Chair

**Fees:** AP Environmental Science exam (paid at fall registration)

**Description:** This rigorous college-level course prepares students for collegiate study in environmental sciences, and is strongly recommended for students who plan on pursuing any college major that emphasizes environmental studies such as engineering, chemistry, ecology, forestry, environmental law, health and human services, or other environmentally or biologically based careers. The course stresses scientific principles, as well as collection and analysis of data. A large amount of time is spent outdoors working on field experiments in local streams and woodlands, with a strong emphasis placed on field techniques and analyzing data collected on field excursions. In addition to field work, students visit Argonne National Laboratory to study alternative energy, and the Lemont wastewater facility to study human waste and its impact on human health. Through field experiments, students observe environmental systems and in tandem develop and synthesize experimental designs. Additionally, they are required to maintain detailed lab journals and demonstrate the use and appropriate techniques associated with class and field experiments. Students analyze and interpret data, including mathematical, statistical and graphical evaluations. Students generate laboratory reports that draw conclusions based on data, and assess their validity and reliability. **Note:** All students enrolled in this course **must** take the AP Environmental Science exam in the spring.

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## AP Physics I

**Grades Course Open To:** 10-11-12      **Credit:** 1.0 - weighted for AP

**Prerequisite:** Grade of B or better in Biology Honors, concurrent enrollment in or successful completion of Chemistry Honors, and grade of B or better in Integrated Math II Honors, or consent of Division Chair

**Fees:** AP Physics I exam (paid at fall registration)

**Description:** This course emphasizes the mathematical relationships of physics; students enrolled must possess strong mathematical skills. Students are expected to apply concepts and equations to critical thinking situations based on data, observations or information given. Critical thinking skills are applied using the concepts of physics to solve problems and successfully complete major projects. The course covers Newtonian mechanics (including rotational dynamics and angular momentum); work, energy and power; and mechanical waves and sound. Electric circuits also are introduced. This course is very rigorous in nature and emphasizes physics concepts and their relationship to nature, with a heavier emphasis on the use of physics equations. It covers additional material and utilizes more complicated mathematics than the standard Physics course. This course is equivalent to a first-semester college course in algebra-based physics. **Note:** All students enrolled in this course **must** take the AP Physics I exam in the spring.

## AP Physics II

**Grades Course Open To:** 11-12      **Credit:** 1.5 - weighted for AP

**Prerequisite:** Grade of B or better in Integrated Math II Honors, grade of B or better in AP Physics I, and grade of B or better in Chemistry Honors, or consent of Division Chair

**Fees:** AP Physics II exam (paid at fall registration)

**Description:** This course follows an upper-level, college-oriented curriculum, and is designed to prepare students for college courses in physics and chemistry. It is highly recommended for students who plan on pursuing a degree in science, engineering or the medical field. The course emphasizes problem solving, mathematical analysis and laboratory experiments, and is intended for highly motivated students. Subjects covered include fluid mechanics; thermodynamics; electricity and magnetism; optics; and atomic and nuclear physics. This course is equivalent to a second-semester college course in algebra-based physics. Additional time outside of class is required in order to complete the course work. **Note:** All students enrolled in this course **must** take the AP Physics II exam in the spring.

## Advanced Science Research, Analysis & Application

**Grades Course Open To:** 11-12      **Credit:** 1.0 - Honors credit

**Prerequisite:** Grade of B or better in at least two Honors or Advanced Placement level science courses, or consent of Division Chair

**Description:** This course affords students the opportunity to work side-by-side with scientists to learn the finer techniques required to perform scientific research in a laboratory setting. After learning how to develop, choose and refine research topics, students conduct multiple in-depth research projects under the guidance of a scientist and present their findings using various media at the local, regional, state or national levels. Students should expect to gain the skills and master the techniques required to undertake research, evaluate critically, and communicate their findings effectively.

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## Anatomy & Physiology Honors

**Grades Course Open To:** 11-12      **Credit:** 1.0 - Honors credit

**Prerequisite:** Successful completion of Biology or Biology Honors and Chemistry or Chemistry Honors

**Description:** This course presents a thorough and detailed study of the relationship between the structure and form of the human body and the chemical and physical processes that allow it to function. Students gain a working knowledge of concepts and basic vocabulary related to anatomy and physiology. Body systems are taught through unifying themes of complementary structure and function, the interrelationships of body systems and homeostatic mechanism. Students are also introduced to pathological conditions. Students are required to participate in laboratory exercises that may include dissection.

## Big History

**Grades Course Open To:** 11-12      **Credit:** 0.5

**Prerequisite:** Successful completion of two years of science courses or consent of Division Chair

**Description:** This course presents one large story that helps explain how the world got to be the way it is and where we fit in. It is centered around certain 'threshold moments' for our universe, including: its inception, the creation of the stars, the forging of new elements, formation of the solar system and Earth, the appearance of life on Earth and of humans who could learn collectively, agriculture, and the development of the modern world.

## Biotechnology

**Grades Course Open To:** 11-12      **Credit:** 0.5

**Prerequisite:** Successful completion of Biology or Biology Honors and Chemistry or Chemistry Honors

**Description:** This course is designed for students interested in careers in the medical field and other biology fields, and illustrates the impact science has on everyday life. Concepts of biotechnology are used to teach science principles and how they affect one's daily life, including human relationships with the ecosystem and ethical issues relating to biotechnology. Students explore biotechnology issues and ethics, DNA composition, cloning, human genome project, embryology, forensic science, bacteria, viruses, twin studies, relatedness, immunology, cancer, mutations and genetic engineering. A strong knowledge of cells, including cell structure, mitosis, meiosis and DNA, is highly recommended.

## Earth & Space Science

**Grades Course Open To:** 10-11-12      **Credit:** 0.5 or 1.0

**Prerequisite:** Successful completion of Biology or Biology Honors

**Description:** This course focuses on the study of space, geologic structures and forces, the waters on our planet, and the atmospheric forces that shape our world. Students explore the Earth's spheres including the geosphere, hydrosphere, cryosphere and atmosphere, and the cycles of the Earth such as the water and carbon cycle. Students learn about scientific inquiry, geologic time, space exploration, the solar system and the universe. Students are sensitized to various environmental issues being brought to the fore by research of the universe and other areas of Earth and space structure, and function of the various cells, tissues, and integrated systems of the body.

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## Field Ecology

**Grades Course Open To:** 10-11-12      **Credit:** 1.0

**Prerequisite:** Successful completion of two science credits or consent of Division Chair

**Description:** This course places a strong emphasis on field research that uses a hands-on approach, with the primary focus on Illinois ecology. Through activities such as fish shocking, bird banding, winter tracking and informational “walk abouts,” students gather data and discuss their findings in class in order to assist in monitoring prairie, forest, lake, river, wetland and urban ecosystems; essentially, they become student scientists directly involved in the monitoring of our local ecology. The course emphasizes the importance of biodiversity in our local and global systems, and analyzes current events in order to understand the importance of the protection of the planet. Students explore global issues through a variety of methods, and develop critical thinking skills through laboratory analysis and field experiments. Because the course is designed for outdoor intensive exploration and class field trips are conducted throughout the year, students should be prepared for all types of weather conditions.

## Forensic Science

**Grades Course Open To:** 11-12      **Credit:** 0.5

**Prerequisite:** Successful completion of two science credits

**Description:** This lab-based course allows students to explore a growing field in the scientific community, and incorporates techniques and concepts learned in Biology, Physics and Chemistry. Students are challenged to problem solve with simulated crime scenes and factual case studies. Currently accepted laboratory techniques are taught and built upon throughout the course, giving students progressive insight into the scientific aspects of a crime scene. The topics of ballistics, DNA fingerprinting, crime scene evidence collection, fingerprinting, blood spatter, toxicology, entomology, glass evidence and death all are explored.

## Physics

**Grades Course Open To:** 10-11-12      **Credit:** 1.0

**Prerequisite:** Successful completion of Biology and concurrent enrollment in or successful completion of Chemistry, and concurrent enrollment in or successful completion of Integrated Math II Honors or concurrent enrollment in or grade of C or better in Integrated Math II, or consent of Division Chair

**Description:** Covering concepts in more detail than Physics Foundations, the course is taught in a rigorous conceptual format, with students learning about the rules that govern nature. Critical thinking skills are applied with the concepts of physics to solve problems and successfully complete major projects. Students apply concepts and equations to critical thinking situations based on data, observations or information given. Major areas of study include motion, forces, momentum, gravity, light, sound and electricity.

## Zoology

**Grades Course Open To:** 11-12      **Credit:** 0.5

**Prerequisite:** Successful completion of two science credits

**Description:** This course discusses the basic nature of life as it is understood today, and illustrates to students the special role all organisms play in the animal kingdom and their importance to the overall health of an ecosystem. The course addresses the basic principles of zoology and the relationships animals play within the environment. Students analyze animals’ activities, growth, reproduction, embryological development and their relationships within the biosphere. An emphasis is placed on organisms from simple coelenterates through complex mammals.