

# 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 Next Generation Science Standards. Learning experiences help students toward mastery through hands-on laboratory experiments, classroom discussions, use of authentic assessments, and implementation of 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 standardized test 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, human impact on the planet, ecology, 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 standardized test 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. Areas of study include the nature of science, cellular biology, heredity and genetics, biotechnology, biochemistry, human impact on the planet, ecology, 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 understanding why the subject is important in everyday living. Laboratory work is integrated into the weekly curriculum and focuses on lab techniques. Although study topics are explored primarily in a qualitative fashion, some quantitative elements require students to possess and apply basic math and algebra skills. Areas of study include states and properties of matter, basic atomic theory, periodic laws, chemical formulas and equations, basic chemical reactions, mole concepts, elemental stoichiometry, thermochemistry, chemical bonding, acids and bases, and nuclear chemistry.

## 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. Students study in-depth concepts at an accelerated pace and are expected to work independently. Areas of study include states and properties of matter, atomic theory, periodic laws, chemical formulas and equations, chemical reactions, mole concepts, stoichiometry, matter and its changes, thermochemistry, chemical bonding, acids and bases, reaction kinetics, equilibrium, and nuclear chemistry.

## 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; concurrent enrollment in or successful completion of Anatomy & Physiology Honors is preferred

**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; students may be required to complete a college placement exam

**Fees:** AP Environmental Science exam (paid at fall registration); dual credit course fee applies, payable to Loyola University Chicago (fee was \$195 for the 2024-25 school year)

**Dual/Articulated Credit:** 3.0 hours of dual credit (ENVS 137) through Loyola University Chicago

**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. Student eligibility for dual credit uses GPA requirements established by Loyola University. **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 provides an in-depth exploration of the mathematical relationships of physics, and is designed for students possessing strong mathematical skills. Students apply key physics concepts and mathematical equations to a variety of critical thinking scenarios, interpretation of data, observations, and information to devise solutions. Throughout the course, students enhance their critical thinking and problem solving skills by tackling real world challenges and completing significant projects that integrate scientific inquiry and engineering practices. This hands-on approach promotes deeper learning and application of physics concepts. The curriculum includes an advanced study of one- and two-dimensional kinematics, dynamics, circular motion, gravitation, work, conservation of energy, impulse, conservation of momentum, rotating systems, oscillations, and fluids. Beyond standard physics coursework, this course delves into more complex mathematical applications, pushing students to apply higher-level analytical skills. This course is equivalent to a first-semester college course in algebra-based physics, preparing students for further academic and career pathways in science, technology, engineering, and mathematics. **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 advanced course is tailored for upper-level high school students and presents a rigorous college-oriented curriculum aimed at preparing participants for higher education in physics, chemistry, engineering, and related fields in the sciences and medicine. This course is designed for highly motivated students with a strong interest in science and mathematics. An eagerness to engage in collaborative projects and take on challenges is essential for success in this dynamic learning environment. The curriculum emphasizes essential science and engineering practices, including inquiry-based learning, experimental design, data analysis, and real world problem solving. Students engage in a hands-on approach, developing critical thinking and analytical skills through mathematical modeling and laboratory investigations. Subjects covered include thermodynamics, electrostatics, electricity and magnetism, waves, optics, and atomic and nuclear physics. This course is equivalent to a second-semester college course in algebra-based physics. Students are expected to apply their knowledge through complex problem solving exercises and collaborate on experimental projects that require creativity and innovation. To enhance understanding of theoretical concepts, students conduct multiple laboratory experiments requiring additional lab time, which takes place before or after regular class hours. These labs cultivate skills in data collection, analysis, and interpretation, reinforcing principles learned in class and linking them to real world applications. **Note:** All students enrolled in this course **must** take the AP Physics II exam in the spring.

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## **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.

## **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, CRISPR-Cas9, GMOs, 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.

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## Earth & Space Science

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

**Prerequisite:** Successful completion of Biology or Biology Honors, and successful completion of, or concurrent enrollment in, Chemistry or Chemistry Honors; or consent of Division Chair

**Description:** This course engages students in an exploration of Earth and the universe through hands-on, inquiry-based learning, and emphasizes critical thinking, problem solving, and the integration of essential science skills such as data analysis, experimental design, and collaboration. Students focus on Earth sciences, studying topics like Earth's systems, climate, geology, and natural resources. Space science topics include the solar system, stars, galaxies, and the broader universe. Using national parks as the guide through time, as well as labs, hands-on activities, and guided research, students gain a deeper understanding of both the dynamic processes that shape our world and the larger cosmic phenomena, all while developing the skills needed to think like scientists.

## Field Ecology

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

**Prerequisite:** Successful completion of two science credits; or successful completion of one science credit, concurrent enrollment in another science class, and 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 field trips that are on and off campus, 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, and blood spatter all are explored.

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## 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:** This course offers a comprehensive exploration of the fundamental principles that govern the natural world, blending conceptual understanding with mathematical rigor. Students enhance their scientific and engineering skills as they delve into key concepts in physics, applying critical thinking, data collection, and data analysis to tackle real world problems. Throughout the course, students engage in engineering and design projects, allowing them to apply theoretical knowledge in practical ways. Key areas of study include motion, forces, momentum, energy, gravitation, light, sound waves, and electricity and magnetism, providing a solid foundation for future scientific inquiry and innovation.

## 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.