

Science

PHILOSOPHY OF THE SCIENCE DEPARTMENT

The Lemont High School Science Department believes that 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 curriculum are aligned with state standards, and help students learn through laboratory experiments, discussion, authentic assessments and technology.

Based on 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 classwork, laboratory experiments and written assessments.

Note: College-bound students who are interested in science and technological fields are encouraged to enroll in Biology Honors as freshmen and concurrently in Physics and Chemistry as sophomores, in order to take advantage of the department's numerous electives in their final two years. Based on MAP scores, other freshmen typically are enrolled in Integrated Science as freshmen, and are encouraged to enroll in Physics as sophomores and Chemistry as juniors.

CORE COURSES - SCIENCE

Integrated Science

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

Prerequisite: Placement based on MAP score

Description: This lab-based course introduces students to basic scientific concepts, incorporating the areas of chemistry, meteorology, astronomy, environmental science, life science and geology. Students carry out experiments related to the curriculum in an effort to develop their laboratory skills, improve their ability to analyze data, and further their understanding of scientific inquiry, all while applying these skills to real-world examples. Through the integration of the varied areas of science, students draw the connection between physical and life sciences to study the overlying theme of life. The skills learned in Integrated Science are vital for students' success in upper-level science courses that they will enroll in later in their academic careers.

Science

Biology Honors

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

Prerequisite: Placement based on MAP score

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 not only the science of biology, but also 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.

Physics Foundations

Grades Course Open To: 10 **Credit:** 1.0

Prerequisite: Successful completion of Integrated Science and either Pre-Algebra or Algebra I, and result of Physics placement test; or consent of Division Chair

Description: This course introduces students to the physical laws of science, stressing a basic understanding of the concepts of physics. These concepts are presented simply and logically, with ideas developed to a more complex level through laboratory work and activities. The course uses hands-on conceptual experiences, rather than emphasizing the mathematical relationships of physics. Concepts are related to everyday life and their importance to all students. The course presents a practical study of the relationship between matter and energy, with a major emphasis placed on the areas of motion, forces, momentum, gravity, energy, light, sound and electricity. Physics equations are used as a guide to reinforce the concepts of physics, rather than being the main emphasis of the course. **Note:** This course is not accepted by the NCAA Clearinghouse.

Physics

Grades Course Open To: 10 **Credit:** 1.0

Prerequisite: Successful completion of Integrated Science or Biology Honors, grade of C or better in Algebra I or Algebra I AB, and result of Physics placement test; 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. Mathematical equations are applied in a limited format as they relate to the subject matter; students apply these new concepts to solve for new and interesting situations. 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.

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Physics Honors

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

Prerequisite: Grade of B or better in Algebra II or Accelerated Algebra II Honors, successful completion of Biology Honors, and result of Physics placement test; or consent of Division Chair

Description: 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 Physics course, and is a precursor to AP Physics B. The course emphasizes the mathematical relationships of physics, meaning students enrolled in the course must possess strong mathematical skills. Students are expected to use and apply concepts and equations to critical thinking situations based on data, observations or information given. Critical thinking skills are applied with the concepts of physics to solve problems and successfully complete major projects. Major areas of study include motion, forces, momentum, gravity, light, sound, electricity, heat, temperature, kinetic theory and stellar evolution. Students are suggested to enroll in this course concurrently with Chemistry Honors.

ELECTIVE COURSES - SCIENCE

AP Biology

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

Prerequisite: Successful completion of Integrated Science 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.

AP Chemistry

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

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AP Environmental Science

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

Prerequisite: Successful completion of Biology Honors; or grade of B or better in Integrated Science, and successful completion of Physics Honors or grade of B or better in Physics; 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, or other environmentally or biologically based careers. The course stresses scientific principles, as well as collection and analysis of data. Environmental issues are evaluated from scientific, sociological and political perspectives. Topics of study include climate change, aquatic, soil, forest and prairie ecosystems, and major concepts related to biological diversity. A large amount of time is spent outdoors working on field experiments, with a strong emphasis placed on field techniques and analyzing data collected on field excursions. 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.

AP Physics B

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

Prerequisite: Grade of B or better in Accelerated Algebra II Honors, grade of B or better in Physics Honors, and grade of B or better in Chemistry Honors; or consent of Division Chair

Fees: AP Physics B 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. Additional time outside of class is required in order to complete the course work. The course follows the AP Physics B curriculum, which includes mechanics, Newton's Laws, electricity, waves and magnetism. **Note:** All students enrolled in this course **must** take the AP Physics B exam in the spring.

Anatomy & Physiology Honors

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

Prerequisite: Successful completion of Integrated Science or Biology Honors, and successful completion of 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.

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Astronomy

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

Prerequisite: Successful completion of Integrated Science or Biology Honors; and successful completion of, or concurrent enrollment in, Physics Foundations, Physics, or Physics Honors

Description: This course, which focuses on the study of the universe around us, is designed for college-bound students who wish to take a science elective without the use of advanced mathematics. The course illustrates how the universe works, and covers topics related to the history of astronomy, forces of nature, the space program, the solar system, and the birth and evolution of stars. Demonstrations, group interaction, lectures and audio-visual materials all are utilized to help students gain a better understanding of the subject matter.

Biology

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

Prerequisite: Successful completion of Integrated Science and Physics; or consent of Division Chair

Description: This course further engages students in the study of many aspects of biology. Included among the topics covered are the interdependence of organisms, energy flow, the cell, heredity, the effect over time of species on ecosystems, and the relationships between structure and function.

Biotechnology

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

Prerequisite: Successful completion of Integrated Science or Biology Honors; successful completion of Chemistry Foundations, Chemistry or Chemistry Honors; and successful completion of Physics Foundations, Physics or Physics 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. Additionally, students create their own Web page to post projects and essays on the Internet. A strong knowledge of cells, including cell structure, mitosis, meiosis and DNA, is highly recommended.

Chemistry Foundations

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

Prerequisite: Successful completion of Integrated Science, and Physics Foundations or Physics

Description: This is a non-traditional, introductory course intended for students who are either not planning on attending college in the future, or who do not have a strong background in math or science. Students apply basic chemistry concepts to everyday situations and learn the importance of chemistry in their own lives. Laboratory work is integrated into the curriculum on a weekly basis, and focuses on lab techniques, connecting labs to class work and reporting lab results in a standard format. Areas of study include water, conserving chemical resources, petroleum, food, air and climate 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. **Note:** This course is not accepted by the NCAA Clearinghouse.

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Chemistry

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

Prerequisite: Successful completion of Accelerated Algebra II Honors, grade of C or better in Algebra II, or grade of A in Algebra II AB; and successful completion of Physics Honors, grade of C or better in Physics, or grade of A in Physics Foundations

Description: Covering concepts in more detail than Chemistry Foundations, this course is designed for college-bound students who are not expecting to major in a science field in college, and 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: 10-11 **Credit:** 1.0 - Honors credit

Prerequisite: Grade of A in Algebra II or Algebra II AB, grade of C or better in Accelerated Algebra II Honors, or grade of A in Algebra I or Algebra I AB (for sophomores); and grade of A in Physics, grade of C or better in Physics Honors, or grade of A in Integrated Science or grade of C or better in Biology Honors (for sophomores)

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.

Field Botany

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

Prerequisite: Successful completion of Integrated Science or Biology Honors

Description: This course presents the basic concepts of plant and insect biology, helping students to recognize and identify common flowering plants and insects in the local region. Students take part in a number of field trips, including ones in which they study local plant species, insect species, and their relationship in the ecosystem. Students compare and contrast basic types of vegetative and reproductive anatomy - including leaves, stems, roots, flowers and fruits - as well as various mechanisms of pollination. The areas of coevolution and pollination, botany economics, horticulture, phylogenetic trees, vegetation analysis and invasive species also are addressed. The course includes a strong field laboratory component and includes traditional lab studies.

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Field Ecology

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

Prerequisite: Successful completion of two science credits, including Integrated Science or Biology Honors

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 Integrated Science or Biology Honors; successful completion of, or concurrent enrollment in, Chemistry Foundations, Chemistry or Chemistry Honors; and successful completion of Physics Foundations, Physics or Physics Honors

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.

Geology

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

Prerequisite: Successful completion of Integrated Science or Biology Honors

Description: This introductory course is designed to be hands-on and lab-oriented, and provides students with working knowledge of the concepts and basic vocabulary related to geology and Earth science. Students take part in a number of field trips, including ones to local areas that show land formation processes and allow for the search for fossils; topographic maps and GPS devices are utilized on these trips. Areas of study include plate tectonics in relation to earthquakes, volcanoes and land formations; as well as other forces, such as weathering, glaciations, winds, waves and currents, that shape the Earth’s physical features. The history of the Earth also is explored, with topics including fossils, minerals and rock formation types. Students also construct towers that are subjected to the forces of an earthquake.

Invertebrate Zoology

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

Prerequisite: Successful completion of Integrated Science or Biology Honors

Description: This course provides students with an opportunity to learn more about invertebrates, the special role they play in the environment, and the importance of these organisms to the biosphere. Students are introduced to the morphology, physiology, taxonomy and behavior of a variety of invertebrate organisms. Invertebrates (animals lacking a backbone) do not constitute a uniform group, but comprise all of the approximately 30 different phyla of the animal kingdom. The distribution, systematics, relationships and ecology of these organisms is studied in detail, with an emphasis on unity amid diversity, evolution and ecology.

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Meteorology

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

Prerequisite: Successful completion of Integrated Science or Biology Honors, and successful completion of, or concurrent enrollment in, Physics Foundations or Physics

Description: This course introduces students to meteorological events, such as tornadoes, lightning and hurricanes, in order to provide them with a working knowledge of the concepts and basic vocabulary related to the subject. The class covers major weather events, as well as the technology used to forecast these events. Students are introduced to concepts and techniques used by meteorologists to predict weather, as well as the major concepts of meteorology and climate changes. Areas of study include the Earth's atmosphere, isotherms, water cycle, acid rain, storms, ozone, clouds, and tools used by meteorologists. Students participate in class projects that lead up to them forecasting the weather themselves.

Science Competitions

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

Prerequisite: Successful completion of two science credits, including Integrated Science or Biology Honors; and consent of Division Chair

Description: Intended for students who demonstrate superior academic performance, this course provides students with the opportunity to pursue in-depth study of their field of choice through various academic challenges and/or competitions. Students are engaged in a variety of science endeavors, and are expected to participate in organized competition(s). This course may be repeated for credit. **Note:** This course is not accepted by the NCAA Clearinghouse.

Zoology

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

Prerequisite: Successful completion of Integrated Science or Biology Honors

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.