

Science

Science Curriculum Overview

When you walk into a Francis Parker science classroom, you'll find students engaged in applying scientific principles to everyday life. Whether it's designing a safe but universally thrilling roller coaster in physics, creating simulations for bonding theories in chemistry, or sampling local waterways in biology, students appreciate science as a process, rather than an accumulation of facts.

Francis Parker embraces the Physics First curriculum philosophy, which elevates Biology to a capstone course. The required core curriculum sequence is Conceptual Physics for freshmen, Chemistry for sophomores, and Biology for juniors. Rather than merely flipping the traditional order, this sequence of courses allows students to progressively build on their scientific knowledge and curiosity.

Beyond the three core courses, students have the opportunity to take semester electives and/or Advanced Placement courses in physics, biology, environmental science, and chemistry. Students can also participate in the Science Olympiad, which is a national science competition involving physics, engineering, biology, and general science.

A Francis Parker alum will have the tools to critically analyze the often- oversimplified presentation of scientific data in news, advertisements, and pop culture. Through collaborative investigations and student-centered classroom discussions, students learn how to develop good questions, how to research and analyze the world around them, and how to effectively communicate their findings to the greater community.

Science Department Course Offerings

Physics (1 credit)

What keeps airplanes in the air? How does a compass know how to point north? Would it be possible to play baseball on the moon? In this course, students address these and more questions, and, in the process, investigate the deepest principles that govern life and the universe. Physics is about discovering the fundamental laws of Nature and students in this course study not only those laws but also the process of discovery that has brought about the modern age of science. Students in Conceptual Physics conceptually explore topics including motion, forces, energy, waves, light, electricity, magnetism, and atomic physics through a combination of lecture, discussion, labs, and hands-on activities.

Chemistry (1 credit)

Chemistry is the study of matter, its structure, and transformations. In this inquiry-based course, students design and conduct experiments to answer questions about the chemical nature of their surroundings. Presented with a series of authentic problems, students work to devise methods to find solutions, collect and analyze data, and communicate the connections between the concepts and their observations in a variety of ways. Over the course of the year, these experiments, along with readings, discussions, and multimedia simulations, help students construct an understanding of the nature of the forces that hold matter together and the

changes associated with establishing or disrupting those forces. A broad range of experiments serves to familiarize students with standard laboratory procedures and methods for analyzing data, as well as providing them with an appreciation for the inherent uncertainty in measurements. Major topics include atomic structure and periodicity, chemical nomenclature and formulae, chemical reactions and equations, stoichiometry, chemical bonding, the structure and properties of matter, the role of energy in chemical and physical change, and the study of gases and solutions.

Biology (1 credit)

Biology is the study of living things. Starting with the cell and its many structures, students will gain an understanding of how things work within individual organisms and how organisms interact with other organisms within their environment. Hands-on classroom activities will enhance scientific thought development and understanding of the living things around us.

AP Physics C: Electricity and Magnetism* (1 credit)

Prerequisites: Physics; Chemistry; Precalculus or AP Calculus (can be taken concurrently with this course); permission of the instructor

This course offers a solid foundation in electricity and magnetism, in preparation for the AP examination on the subject in May. Topics include static electricity; resistors, capacitors, dielectrics, and inductors; electric circuits with resistors, capacitors, and inductors; magnetic fields; and electromagnetism, including Maxwell's equations. Lab work and lab reports form an integral component of the course. There is a great deal of math and it is calculus-based. Students need not have already taken Calculus to enroll (and in many cases will be taking Calculus concurrently with AP Physics); however, they must show strong aptitude for math and will need to spend extra time with the instructor outside class to get the tools they need as soon as possible. All students will complete a short math "primer" over the summer that will cover the basics of taking a derivative and performing an integral.

**AP Physics C: Mechanics and AP Physics C: Electricity and Magnetism are offered in alternate years.*

AP Environmental Science (1 credit)

*Prerequisites: Biology, except in exceptional cases, and permission of the instructor
Enrollment in this class is contingent upon successful completion of a summer assignment.*

The environment affects all things on earth, and all things on earth affect the environment. Through this give and take, the natural world and all its inhabitants are intimately interconnected and interdependent. AP Environmental Science will help you to understand this dynamic relationship and to predict the consequences of changes in the environment. By exploring the environment that surrounds us, each student will gain insight in many subjects, including earth science, chemistry, sociology, and biology, in this multidisciplinary course.

**AP Biology and AP Environmental Science are offered in alternate years.*

AP Chemistry (1 credit)

Prerequisites: Chemistry; permission of the instructor

Advanced Placement Chemistry is the equivalent of a full-year major's undergraduate chemistry course and is designed to follow the successful completion of introductory Chemistry. Topics include the structure of matter, kinetic theory of gases, chemical equilibria, chemical kinetics, and the basic concepts of thermodynamics. Strong emphasis is placed on chemical calculations and the mathematical formulations of principles. The course should contribute to the development of the students' abilities to think clearly and to express their ideas, orally and in writing, with clarity and logic. This rigorous course is intended for students who have demonstrated a willingness to commit considerable time to studying and completing assignments outside of the classroom.

Science Department Electives

*The following elective courses are being offered to gauge student interest; they will actually occur subject to sufficient enrollment. **Students are advised to put second and third choices for all electives.***

Vertebrate Zoology ($\frac{1}{2}$ credit)

In this course, students investigate and examine the characteristics of vertebrate organisms. Topics covered include heredity, evolution, natural selection, and taxonomy, animal behavior, environmental adaptation, domestication, and the human impact on animal life. The course covers the vertebrate classes: Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves and Mammalia. Students will learn life histories and identification techniques for members of these classes from the Louisville area.

Circuit Design and Engineering ($\frac{1}{2}$ credit)

Engineering is the beautiful union of science and creativity. In this hands-on, project-based course, students will start by learning about the concepts, components, and programming of electronics using simple, guided projects. From there we will develop more complex projects to accomplish specific tasks by combining and modifying their original project designs and codes. All these experiences will help students with their final project - designing and building their own arcade or pinball machine. No coding or circuitry experience required.

Underrepresented Groups in Physics ($\frac{1}{2}$ credit) - offered as a science and a history elective

This course offers an introduction to the historical aspects of physics, with a focus on contributions by underrepresented groups. The curriculum is based on the Underrepresentation Curriculum Project. Together, we will walk through the curriculum, thinking critically about its claims while adhering to its goals.