Science

Science Curriculum Overview

When you walk into a St. Francis 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.

St. Francis 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 St. Francis 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: Mechanics *(1 credit)*
Prerequisites: Physics and Chemistry; Precalculus or AP Calculus must be taken concurrently with or prior to this course; permission of the department required.

*Note: Students who have not *completed* Calculus before taking Mechanics will have a summer reading assignment. In addition, they will need to spend considerable extra time with the instructor at the beginning of the year in order to learn the math they need.*

This course provides a foundation in kinematics (the study of motion) and dynamics (the study of force), the two branches of mechanics. Topics include one-dimensional motion; projectile motion; Newton's laws; work, energy, and power; linear momentum; circular and rotational motions; gravitation; and simple harmonic motion (oscillations). The course makes extensive use of calculus; however, interested students taking Precal may enroll with permission from the instructor.

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

AP Biology *(1 credit)*
Prerequisites: Biology, except in exceptional cases, and permission of the instructor
Enrollment in this class is contingent upon the successful completion of a summer reading and writing assignment.

Advanced Placement Biology is a challenging course that covers both classical and modern concepts of biology. The ongoing knowledge explosion in biology makes these goals even more challenging. However, the primary emphasis is on developing an understanding of biological concepts. Essential to this conceptual understanding are: a grasp of science as a process rather than an accumulation of facts; personal experience in scientific inquiry, recognition of unifying themes that integrate the major themes of biology; and application of biological knowledge and critical thinking to environmental and social concerns. Students who complete this course are sufficiently prepared to take the AP Exam in May.

**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.***

Anatomy and Physiology I *(½ credit)*
This semester-long course covers both the structure and function of the integumentary, skeletal, muscular, nervous, and endocrine systems. Students will engage in laboratory and in-class activities that will reinforce concepts and principles presented in class.

Circuitry and Robotics I *(½ credit)*
What are robots? What steps are necessary to design and program robots to accomplish specific functions? In this project-based course, we will explore essential concepts in circuitry with a focus on switches and logic circuits. Those concepts will be applied towards the design, programming, and building of robotic machines. Students should enroll with a willingness to challenge themselves, improve their design and analysis skills, and apply their creativity towards solving problems.

Astronomy - The Solar System *(½ or 1 credit)*
This course offers an introduction to the solar system, our "cosmic town." We'll survey the objects that orbit our sun, with their respective satellites, and examine what we know and how we know it. If the interest is there, we will continue the class for a second semester, examining questions such as: Where are we in the universe? How did the universe form, and when? What is a black hole? a quasar? a pulsar? a supernova? This course uses basic principles from physics, chemistry, and biology, with virtually no math.