Science

Science Curriculum Overview

When you walk into a St. Francis science classroom, you'll find students engaged in applying science principles to everyday life. Whether it's designing a safe but universally thrilling roller-coaster in physics, synthesizing the "bounciest" bouncy ball 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.

Students then have the opportunity to take semester electives and/or Advanced Placement courses in physics, biology, environmental science, and chemistry. Students can also participate in Science Olympiad, which is a national science competition where students can compete in 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 Introductory Physics conceptually explores 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 in teams to devise methods to find solutions, proceed to the lab where they collect and analyze data and communicate the results of their investigations in written lab reports. Over the course of the year, these experiments, along with supplemental readings from the text, help students construct an understanding of the nature of the forces that hold matter together and the energy

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 Chemistry *(1 credit)*
Prerequisites: Chemistry; permission of the instructor
Enrollment in this class is contingent upon successful completion of a summer research assignment.
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.

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.
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.
*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.*

AP Biology *(1 credit)*
Prerequisites: Biology, except in exceptional cases, and permission of the instructor
AP Biology and AP Environmental Science are offered in alternate years.
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. *This course has a summer assignment.*

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 *(1/2 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.

Design and Engineering I *(1/2 credit)*
This hands-on, project-based course will provide students an introduction into the process of engineering design: assessing needs, creating plans, budgeting, fabrication, and implementation. Students will learn “old-school” techniques - including sketching and drafting, model-making, and woodworking - before moving to modern computer-aided design and fabrication using 3-D printing and laser-cutting. Emphasis will be placed on collaboration, problem-solving, and creativity.

Astronomy - The Solar System *(1/2 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 how we know what we know about them. We'll also address questions like, Where are we in the Milky Way? the universe? How did our solar system form, and when? Are there other solar systems like ours? While we will discuss basic physics principles and equations, math will be kept to a minimum.