

Science Course Descriptions

PSI Physics

Prerequisites: Taking Algebra I concurrently

This course represents the first year in a comprehensive two-year sequence of Algebra/Trigonometry based physics. This first course is comprised of Mechanics, which is studied for the first 40% of the year; Electricity and Magnetism, which is studied for the next 40%; and, finally, Simple Harmonic Motion, Waves, Light and the Bohr model of the Hydrogen atom for the last 20%.

The order of the topics has been geared to use and reinforce the mathematics that the students are studying. For this reason, this first year course is geared towards reinforcing skills in algebra and requires no trigonometry. This is accomplished by restricting the first year course to problems that can be simplified to one-dimensional form. While vectors are introduced, they are only added and subtracted in one dimension at a time. This allows students to do about 90% of the Physics AP 1 topics. Connections are also developed between the analysis of motion and graphical analysis, collision problems and the solving of systems of equations, etc.

6 Credits, Full Year Course with a Lab.

AP Physics 1

Prerequisites: PSI Physics, Geometry, teacher recommendation*

AP Physics 1 is an algebra-based, introductory college-level physics course that explores topics such as Newtonian mechanics (including rotational motion); work, energy, and power; mechanical waves and sound; and introductory, simple circuits. Through inquiry-based learning, students will develop scientific critical thinking and reasoning skills. The course is based on six Big Ideas, which encompass core scientific principles, theories, and processes that cut across traditional boundaries and provide a broad way of thinking about the physical world.

This course requires that 25 percent of the instructional time will be spent in hands-on laboratory work, with an emphasis on inquiry-based investigations that provide students with opportunities to apply the science practices.

Students should have completed geometry and be concurrently taking Algebra II or an equivalent course. Although the Physics 1 course includes basic use of trigonometric functions, this understanding can be gained either in the concurrent math course or in the AP Physics 1 course itself.

7 Credits, Full Year Course with a Lab.

*Teacher recommendations are strongly encouraged for honors and AP courses since a teacher has evaluated required skills/maturity and will have assessed likelihood of success.

PSI Chemistry

Prerequisites: Physics, Algebra I

PSI Physics and Algebra are pre-requisites to this course; the work done in PSI Physics is applied and expanded upon to explain macroscopic phenomenon through an understanding of the microscopic. The course is both quantitative and qualitative in nature, so mathematics will often be applied to the solving of problems. Topics include the Atom and Period Table of Elements, Bonding, Chemical Reactions, States of Matter, Intermolecular Forces, Thermodynamics, Acids and Bases, Redox Reactions, Organic Chemistry and more.

Throughout the year, students will be involved in problem-solving activities on an individual, small group and large group basis. Through this process the ability to read and understand problems, break them down into their component parts and then create and present solutions will be developed.

Students who have successfully completed this course will be well prepared for PSI Biology. In fact, the last two chapters of this course apply the principles of chemistry to biology. In the biology course, a similar approach of developing a microscopic understanding in order to explain macroscopic phenomena plays a key role.

6 Credits, Full Year Course with a Lab.

PSI Chemistry – Honors

Prerequisite: Physics-Honors, Algebra I, teacher recommendation*

This course represents the first year in a comprehensive two-year sequence of chemistry; students who elect to go on to the second year course, AP Chemistry, will be prepared to take the AP Exam at the end of that course. The honors course will follow the same curriculum as the general chemistry course, however, the pace may be accelerated to allow for enrichment and more in-depth discovery of topics.

6 Credits, Full Year Course with a Lab.

*Teacher recommendations are strongly encouraged for honors and AP courses since a teacher has evaluated required skills/maturity and will have assessed likelihood of success.

AP Chemistry

Prerequisite: Chemistry Honors, Geometry, Teacher Recommendation*

This AP Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first year of college. For most students, the course enables them to undertake, as a freshman, second year work in the chemistry sequence at their institution or to register in courses in other fields where general chemistry is a prerequisite. This course is structured around the six big ideas articulated in the AP Chemistry curriculum framework provided by the College Board. A special emphasis will be placed on the seven science practices, which capture important aspects of the work that scientists engage in, with learning objectives that combine content with inquiry and reasoning skills.

The labs completed require following or developing processes and procedures, taking observations, and data manipulation. Students communicate and collaborate in lab groups; however, each student maintains their own lab notebook and is assessed on each laboratory experience. A minimum of 25% of student contact time will be spent doing hands-on laboratory activities.

7 Credits, Full Year Course with a Lab.

*Teacher recommendations are strongly encouraged since a teacher has evaluated required skills/maturity and will have assessed likelihood of success.

Organic Chemistry/Introduction to Biochemistry

Prerequisites: Chemistry, Biology (concurrently), Teacher Recommendation*

This upper level science elective gives students a glimpse into two specific areas of chemistry typically studied by chemical researchers, chemical engineers, and professionals in the medical field.

The first half of the year will be a survey of the basic organic compounds and the most common organic reactions, with examples of biological and industrial processes involving organic chemistry. Students will learn how to name organic compounds, to draw and understand their structures in two and three dimensions, and to learn how chemical structure and chemical reactivity (reactions) are interrelated.

The second half of the year students will gain an understanding of the basic chemistry and overall structure of the most important biological macromolecules. This course will include the study of enzyme catalysis; cellular architecture; intermediary metabolism; and special processes such as photosynthesis, biological oxidation and energy production. Students will explore the various ways that biological systems react to their environment.

2.5 Credits each, ½ year for each course.

PSI Biology

Prerequisites: Chemistry or Environmental Science

The aim of this course is to help students build an understanding of modern biology on the foundation of their prior learning in physics and chemistry. Students will learn about the origin of life and the process of evolution through natural selection. They will then progress to learn about molecular biology, cellular biology and processes, genetics, ecology, and biotechnology. This course also serves as a strong foundation for Anatomy and Physiology, Marine Science and Genetic Engineering.

A key goal of the course is to give students an integrated insight into the modern scientific view of the world. The separation of the sciences into the discrete disciplines of physics, chemistry and biology is becoming less useful; our world is simply not divided up in that way. By the conclusion of this course students should have a perspective on the world, and how it works, which will empower them to follow their interests in any direction after high school, either on to college/university or their career.

6 Credits, Full Year Course with a Lab.

PSI Biology – Honors

Prerequisites: Honors Chemistry, Teacher Recommendation*

This is the first course in a two-year biology sequence. All the course topics are either taken directly from AP Biology, or are designed to prepare students to understand AP Biology topics. The second course in the sequence, AP Biology, expands on some of those topics, and adds others, so that students are prepared to take the AP Biology examination at the end of that second year course.

6 Credits, Full Year Course with a Lab.

*Teacher recommendations are strongly encouraged since a teacher has evaluated required skills/maturity and will have assessed likelihood of success.

AP Biology

Prerequisites: Honors Biology, Teacher Recommendation*

The curriculum for the Advanced Placement Biology course is the equivalent of a college level biology course that is usually taken by biology majors during their first year of college. Students obtain weighted credit by successfully completing the AP Biology exam at the end of the course. This biology course differs from the typical freshman high school biology class in that the text is a college level text, the types and depth of topics covered, the laboratory work done by the students, and most importantly, the amount of time and effort that is required by the students.

The main focus of this course is to help foster a better awareness of biology as an understanding of concepts, that science is a process and not just a memorization of facts. This will be achieved through personal experience gained from scientific inquiry, recognition of unifying themes that are inherent in the major topics of biology, and the practical application.

of biological knowledge and critical thinking to social and environmental concerns. Topics that will be covered include the chemistry of life, cells, cells use of energy, heredity, molecular genetics, evolution, the diversity of organisms, the structure and function of both plants and animals, and ecology.

7 Credits, Full Year Course with a Lab.

*Teacher recommendations are strongly encouraged since a teacher has evaluated required skills/maturity and will have assessed likelihood of success.

Anatomy and Physiology

Prerequisites: Biology, Chemistry, Teacher Recommendation*

This course is a systematic study of the shape and structure of the organs of the human body and the functioning of those organ systems. It includes: cytology, histology, morphology, genetics, immunology, and pathology. Human anatomy and physiology is offered to meet the needs of our students who want an advanced level science course. It also serves to prepare students interested in entering medicine, nursing, dentistry, and other related health occupations.

6 Credits: Full Year Course with a Lab.

*Teacher recommendations are strongly encouraged since a teacher has evaluated required skills/maturity and will have assessed likelihood of success.

Forensic Science

Prerequisites: Chemistry, Biology (Concurrently)

Forensic Science is the application of scientific techniques and technology to the investigation of a crime and the presentation of evidence in a court of law. This elective science class provides students with an introduction to the topics of criminology within the field of forensic science. Study includes the applications of concepts from the areas of biology, chemistry, physics and geology to analyze and investigate evidence that may be discovered in a criminal investigation.

Classroom activities include experiments, projects, case studies and the incorporation of technology. It emphasizes inquiry-based learning, process skills, and higher-order thinking skills. In addition, it will present an introduction to the possible career paths in the forensic sciences. As in all science courses, it will develop critical thinking skills and help students to become fluent in the scientific method. Because experimentation is the basis of science, laboratory investigations are an integral part of this course. Investigative, hands-on lab activities that address the high school inquiry standards are central to the understanding of the topics of this course. Students will be introduced to the laboratory techniques of criminal investigators, and learn what methods they use in the criminal investigation process. Unlike other Forensic science is not just about one field of study; rather, it's a truly holistic science, in that it combines many fields with the crucial addition of legal standards and rules of evidence. The class is going to be focused on hands-on activities that follow procedures used in the current criminal study field.

5 Credits: Full Year Course.

Genetic Engineering

Prerequisites: Chemistry, Biology

This is a full year lab course intended for students entering 11th and 12 grades. The course is designed for students that are interested in recombinant DNA technology and its applications to the field of medical science, livestock and agriculture. The students will explore how DNA works and how DNA can be manipulated for a variety of purposes. Topics include: DNA, RNA, protein synthesis, human heredity and traits, mutations, genetic disorders and pattern of inheritance, recombinant DNA technology, gene therapy, transgenic organisms, genetic engineering and stem cells, positive and negative impacts of genetic engineering, and ELSI/ethical, legal and social implications of genetic engineering. The lab section of in this course includes analyzing experimental data, DNA extraction, restriction enzyme digest, gel electrophoresis, DNA fingerprinting, PCR, bacterial transformation, cloning, case-studies, project/research assignments, group presentations, web quests and recombinant DNA problem sets and tutorials.

5 Credits: Full Year Course.

Environmental Science

Prerequisites: None

The goal of this course is to provide students with the scientific principles, concepts, and methodologies to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, and to evaluate the risks associated with these problems and examine alternative solutions for resolving and/or preventing them. This course has no prerequisite, however, students will benefit from the knowledge of some biological and chemical processes.

6 Credits – Full Year Course with a Lab.

AP Environmental Science

Prerequisites: Chemistry, Biology, Teacher Recommendation*

The goal of this course is to provide students with the scientific principles, concepts, and methodologies to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, and to evaluate the risks associated with these problems and examine alternative solutions for resolving and/or preventing them. There is an extensive field work component to this course as to best understand the environment, one must be in the environment. Upon completion of coursework, students will be prepared for and expected to take the AP Environmental Science Exam.

7 Credits: Full Year Course with a Lab/Study Hall

*Teacher recommendations are strongly encouraged since a teacher has evaluated required skills/maturity and will have assessed likelihood of success.

Space Science

Prerequisites: None

This course is designed to give students a deeper understanding of astronomy, the solar system, and the universe beyond, as well as, the human innovations that helped humans explore space. Students will be able to increase their awareness of the scope and scale of our universe by gaining an understanding of the explorations and discoveries of astronomers and scientists from antiquity to the present.

5 Credits: Full Year Course.

Marine Science

Prerequisites: Biology

Marine Science is an advanced level laboratory course that is designed to introduce the student to the study of marine environments. This is accomplished through the application of theory introduced within the traditional classroom laboratory to field experiences utilizing the marine ecosystem available at the Perth Amboy waterfront. Theory is introduced to foster critical thinking and enable the student to apply authentic scientific research to support or refute conjecture.

6 Credits: Full Year Course with a Lab.

Principles of Engineering

Prerequisites: Physics (B or higher), acceptance into the STEM Academy through the application process

This is the first course of the Engineering Track of the STEM Academy. Principles Of Engineering (POE) is a high school-level survey course of engineering. The course exposes students to some of the major concepts that they will encounter in a postsecondary engineering course of study. Students have an opportunity to investigate engineering and high tech careers. POE gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Used in combination with a teaming approach, APPB learning challenges students to continually hone their interpersonal skills, creative abilities, and problem solving skills based upon engineering concepts. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

To be successful in POE, students should have been successful in Algebra I and Algebra-based Physics. Students will employ engineering and scientific concepts in the solution of engineering design problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students will also learn how to document their work and communicate their solutions to their peers and members of the professional community.

5 Credits: Full Year Course.

Robotics

Prerequisites: Physics, Algebra I

This course will ask and solve questions that interest engineers, such as: How do you design complex objects in a limited time with limited resources? How do you formulate questions about complex technical issues in a structured fashion so that you are able to solve them? Some limited programming will be included as students learn how equipment is controlled with logical instructions. The building and controlling of VEX robotic systems will be intertwined with theory.

5 Credits: Full Year Course.

Dynamics of Healthcare

Prerequisites: Acceptance into the STEM Academy through the application process

This is the first course in the Biomedical track of the STEM Academy. Students explore community health while improving fundamental research skills, applying statistical analysis and enhancing oral and visual presentation techniques. In this course students will utilize research skills to learn about components of the health care field of employment and human disease. Topics will include ethics, professional behavior, decision making, problem solving, time management, infection control, safety on the job, health careers, stress, time management skills, the history of health care, communication, an examination of health problems, disease classification, symptoms, and terminology associated with disease and wellness. Each student develops his/her own independent science research project with a foundation in community health and learns how to structure, organize, publish, and communicate findings during a more formal presentation.

5 Credits: Full Year Course.

Essentials of Information Technology

Prerequisites: Acceptance into the STEM Academy through the application process

This is the first course in the Computer Systems Technology Track of the STEM Academy. Students will be introduced to networking personal computers. Topics include, network terminology and protocols, configuring, maintenance, management, and security of a network, and troubleshooting elements of the basic network infrastructure. Students will also be introduced to local-area networks, wide-area networks, OSI model, cabling, router programming, Ethernet, IP addressing, and network standards. Students will be prepared to seek CompTIA A+ certification.

7 Credits: Full Year Course.