

ST. JOHNSBURY ACADEMY | Course Bulletin

All courses at St. Johnsbury Academy are semester-long courses with credit being awarded at the end of each semester. Prerequisites are listed for all courses with such requirements.

SCIENCE

In science courses, students participate in a course of study that will enable them to:

- Master the processes of scientific investigation, and to design, and safely conduct, evaluate, and communicate about such investigations.
- Acquire Essential Knowledge about the content of science in the fields of Physical Science, Life Science, and Earth and Space Science.
- Be scientifically Literate, able to read and analyze scientific information.
- Engage in the Authentic Practice of science. They will know and understand relationships among science, technology, and human activity and how they affect the world, and understand that science involves a particular way of knowing, and understand common connections among scientific disciplines.
- Understand the History of Science.

Basic courses emphasize practical applications to everyday life. Standard and accelerated courses are designed to prepare students for college-level science courses, including Advanced Placement courses. Accelerated courses emphasize the use of mathematical analysis and explore the topics at a more rapid pace, in a more rigorous manner. Permission to take an accelerated course is normally predicated on maintaining a grade of at least 85 in the previous accelerated course, or at least 90 in the previous standard course.

Core Courses

Three core science courses are required for graduation. For students graduating in 2018, 2019, or 2020, the sequence is Biology, Chemistry, and Physics. Beginning with the class of 2021, the sequence will be Biology: Living and Chemical Systems; Physics: Systems of Matter, Motion, and Energy; and Science Research Methods and Environmental Systems. Note that college preparatory chemistry topics will be integrated in the first two courses. With written departmental permission, a student may replace one of these courses with the

corresponding Advanced Placement course, though it is normally recommended that students take AP courses as their second course in the subject of interest. All students should plan to complete their three core courses before the end of their junior year. Because there are certain math prerequisites for some of these core courses, students should carefully plan their math sequence as well.

Biology: Living and Chemical Systems (Basic)

1 CREDIT (4321)

Prerequisite: At least concurrent enrollment in Algebraic Foundations I

This laboratory course investigates living organisms and their relationships with the non-living world. Topics include the anatomy and physiology of organisms, evolution, genetics, and cellular function. Learn to explain the interactions of life by drawing on fundamental concepts in chemistry. Emphasis is placed on developing strong science inquiry skills. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use abstract reasoning extensively.

Biology: Living and Chemical Systems (Standard)

1 CREDIT (4322)

Prerequisite: At least concurrent enrollment in Algebraic Foundations I

This laboratory course investigates living organisms and their relationships with the non-living world. Topics include the anatomy and physiology of organisms, evolution, genetics, and cellular function. Learn to explain the interactions of life by drawing on fundamental concepts in chemistry. Emphasis is placed on developing strong science inquiry skills. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use abstract reasoning extensively.

Biology: Living and Chemical Systems (Accelerated)

1 CREDIT (4323)

Prerequisite: At least concurrent enrollment in Algebraic Foundations I

This laboratory course investigates living organisms and their relationships with the

non-living world. Topics include the anatomy and physiology of organisms, evolution, genetics, and cellular function. Learn to explain the interactions of life by drawing on fundamental concepts in chemistry. Emphasis is placed on developing strong science inquiry skills. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use abstract reasoning extensively.

Chemistry (Basic)

1 CREDIT (4332)

Prerequisites: Biology and Algebraic Foundations II or Algebra I (Standard)

This laboratory course involves students in the study of matter and its changes. Topics include the relationships between matter and energy, atomic structure, chemical bonding and reaction types, stoichiometry, the gas laws, solutions, and chemical equilibrium. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use algebraic reasoning extensively.

Chemistry (Standard)

1 CREDIT (4333)

Prerequisite: Biology and Algebra I (Standard)

This laboratory course involves students in the study of matter and its changes. Topics include the relationships between matter and energy, atomic structure, chemical bonding and reaction types, stoichiometry, the gas laws, solutions, and chemical equilibrium. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use algebraic reasoning extensively.

Chemistry (Accelerated)

1 CREDIT (4335)

Prerequisites: Biology (Accelerated) grade >85 or (Standard) grade >90 and at least concurrent enrollment in Algebra II (Accelerated) and department recommendation

This laboratory course involves students in the study of matter and its changes. Topics include the relationships between matter and energy, atomic structure, chemical bonding and reaction types, stoichiometry, the gas laws, solutions, and chemical equilibrium. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use algebraic reasoning extensively.

Physics (Basic)

1 CREDIT (4351)

Prerequisites: Chemistry (Basic) and at least concurrent enrollment in Integrated Math (Standard)

Physics investigates the interactions between mass and energy, with an emphasis on forces, motion, conservation laws, electromagnetism, waves, and nuclear and atomic physics. Laboratory experiences emphasize the development of physical intuitions related to the concepts and principles of physics. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use algebraic reasoning extensively.

Physics (Standard)

1 CREDIT (4353)

Prerequisites: Chemistry and Geometry (Standard or Accelerated)

Physics investigates the interactions between mass and energy, with an emphasis on forces, motion, conservation laws, electromagnetism, waves, and nuclear and atomic physics. Laboratory experiences emphasize the development of physical intuitions related to the concepts and principles of physics. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use algebraic reasoning extensively.

Physics (Accelerated)

1 CREDIT (4355)

Prerequisites: Chemistry (Accelerated) grade >85 or (Standard) grade >90 and at least concurrent enrollment in Trigonometry (Standard or Accelerated), and department recommendation

Physics investigates the interactions between mass and energy, with an emphasis on forces, motion, conservation laws, electromagnetism, waves, and nuclear and atomic physics. Laboratory experiences emphasize the development of physical intuitions related to the concepts and principles of physics. The accelerated level of this course is intended for those students who have a strong background and interest in mathematics, and will use algebraic reasoning extensively.

Elective Courses

The following courses are intended for students who wish to explore particular scientific topics in more depth than the core courses. Elective courses—with the exception of Advanced Placement courses – cannot

be used as a substitute for the core courses as a graduation requirement. An AP course can replace a core course in the same area of study (for example, AP Biology for Biology) with written departmental permission, though normally this is not recommended.

AP Biology

1 ½ CREDITS (4378/4379)

Prerequisites: Biology and Chemistry (Accelerated) grade >85 or (Standard) grade >90; with department recommendation

This university-level biology course covers the same topics as the core biology courses, at a level appropriate for successfully taking the Advanced Placement Biology examination. Students must take this course both semesters, with the class meeting every other day in the second semester.

AP Chemistry

1 ½ CREDITS (4388/4389)

Prerequisites: Chemistry (Accelerated) grade >85 or (Standard) grade >90 with department recommendation

This university-level chemistry course covers the same topics as the core chemistry courses, at a level appropriate for successfully taking the College Board Advanced Placement Chemistry examination. Students must take this course both semesters, with the class meeting every other day in the second semester.

AP Physics 1 (4348)

AP Physics 2 (4349)

2 CREDITS

Prerequisites: Physics (Accelerated) grade >85 or (Standard) grade >90, with department recommendation; Trigonometry. Students may take this sequence as a first physics course with department approval.

This college-level, trigonometry-based physics course builds on the core physics courses at a level appropriate for successfully taking the College Board Advanced Placement Physics 1 and Physics 2 examinations. It is equivalent to the first year (two semesters) of college physics taken by students majoring in the life sciences and pre-medicine. Topics studied include Newtonian mechanics, oscillations, fluid dynamics, thermodynamics, optics, electromagnetism, electric circuits, and modern physics. Significant laboratory practical work is included. Students must take both semesters of the course.

AP Physics C: Mechanics (4399)

AP Physics C: Electricity & Magnetism (4397)

2 CREDITS

Prerequisites: Physics (Accelerated) grade >85 or (Standard) grade >90 and at least concurrent enrollment in Applied Calculus (Accelerated) or AP Calculus; with department recommendation. Students may take this sequence as a first physics course with department approval.

This college-level, calculus-based physics course builds on the core physics courses at a level appropriate for successfully taking the College Board Advanced Placement Physics C examinations in Mechanics and Electricity & Magnetism. It is equivalent to the first year of college physics taken by students majoring in physics and the engineering disciplines. Topics include Newtonian mechanics, rotational dynamics, oscillations, electrostatics, electromagnetism, and circuits. Significant laboratory practical work is included. Students must take both semesters of the course.

AP Environmental Science

1 ½ CREDITS (4367/4369)

Prerequisites: Biology, Chemistry and Physics (Accelerated) grade >85 or (Standard) grade >90 and Algebra II (Accelerated); with department recommendation

AP Environmental Science is an interdisciplinary, rigorous college-level science course that provides students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving or preventing them. Students must take this course both semesters, with the class meeting every other day in the second semester.

Genetics (Accelerated)

1 CREDIT (4940)

Prerequisites: Biology and Chemistry (Accelerated) grade >85 or (Standard) grade >90

During the first half of the course, students will investigate laboratory techniques and tools used in genetics. Model organisms will include *Drosophila melanogaster*, *Brassica rapa*, and *C. elegans* for study of inheritance patterns beyond those learned in earlier courses. During the second part of the course, students will use polymerase chain reaction technology and on-line libraries of sequenced genomes to conduct experiments that can identify the presence of genes in organisms. Students' outcomes will include an enhanced

exposure to and understanding of how the field of genetics influences their lives and environments, from genetically-modified foods and medicines, to selective breeding programs of domestic animals, and other relevant applications. Treatment will be given to ethical and legal considerations as well.

Anatomy and Physiology (Standard)

1 CREDIT (4373)

Prerequisites: Biology and Chemistry

Anatomy and Physiology (Accelerated)

1 CREDIT (4375)

Prerequisites: Biology and Chemistry

Students interested in studying human biology in greater depth should consider this course. It is appropriate for students considering advanced study in fields such as medicine, medical technology, dental technology, and nursing, exercise sciences, and physical therapy.

Environmental Science (Accelerated)

1 CREDIT (4385)

Prerequisites: Biology, Chemistry, Physics, and Algebra II (Accelerated)

This comprehensive, inclusive science course investigates the complex interactions that link humans and the environment, and will place a heavy emphasis on a strong foundation in biology, chemistry, and physics. Students will investigate environmental problems of local concern and propose solutions to problems created by human impact on natural systems.

Astronomy (Standard)

1 CREDIT (4393)

Prerequisites: Chemistry and Physics

This introductory course emphasizes observational aspects of astronomy. Students will learn about our place in the universe, always addressing the issue of “How do we know what we know?” Topics include the relationship between the earth and the sky, short term and long term cycles in the celestial sphere, the exploration of the solar

system, light, telescopes, and stellar evolution cycles. Practical work will be done using portable telescopes on campus and using the Northern Skies Observatory (NSO), located in Peacham, Vermont. Students will make use of the robotic capabilities of the NSO to make their own research grade observations and measurements. Professional imaging processing software will be used extensively.

Forensics (Standard)

1 CREDIT (4930)

Prerequisites: Biology with department recommendation

This introductory course will expose students to “real life” applications of the life and physical sciences to criminal investigation. Students will use techniques of biological and chemical tools to analyze evidence found at crime scenes, including the use of DNA analysis. Students will interact with law enforcement officials, crime scene technicians, and court officials to explore career opportunities in forensics. Mock trials will play an important role in this laboratory-based course.

This course is intended for students, primarily sophomores, who find science and mathematics challenging, and who would like an intermediate course to prepare for taking chemistry. Students who are interested in the topic and have completed chemistry, especially at the accelerated level, should take Biotechnical Engineering, which has a forensics unit, instead of this course. Forensics does not qualify as a core course.

Biomedical and Health Sciences Certificate Program

The Biomedical and Health Sciences Certificate Program consists of a combination of guidance, coursework, clinical experience, mentoring, and independent research to provide students with a pre-university experience in allied health. Students who satisfactorily complete all of the requirements

will earn a St. Johnsbury Academy Certification in Biomedical and Health Sciences, as well as develop advantageous mentoring relationships with regional health care providers.

Students wishing to pursue the certificate should complete their core science courses (Biology: Living and Chemical Systems, Chemistry, and Physics) and meet with the program advisor as early in their high school career as possible. See Sample Course Selections beginning on page 35 of the Course Bulletin.

Students must also take part in an approved internship as part of a clinical or patient care experience (either during or outside of the school day), and complete a related Senior Capstone project mentored by the program advisor.

Studies and Management Program

2 SCIENCE CREDITS, 1 SOCIAL STUDIES CREDIT, AND 1 ENGLISH CREDIT

Available Fall Semester Only

Prerequisites: Two core science courses, Geometry

The Environmental Studies and Management Program is an interdisciplinary immersion semester for juniors and seniors interested in concentrated study within the environmental field. This off-campus, place-based program uses outdoor, field-based projects on a network of local properties to teach fundamental concepts and technical skills while contributing to the collection of long-term ecological data. Students will complete their third core science requirement as part of the experience, and earn additional credits for Accelerated coursework in natural resource management, ecological research and monitoring, and upper level humanities. This intensive experience provides a solid foundation for pursuing further education and careers in environmental engineering, natural resources management, field research, and related disciplines.

ST. JOHNSBURY ACADEMY

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