

# SCIENCE PROGRAM

The Science Program offers courses designed to acquaint students with the means of inquiry used by scientists, to acquire knowledge that comprises the essential structure of each of the sciences, and to develop a respect for and an enduring curiosity about the natural world and the mysteries of the universe. Courses are available in earth science, biology, chemistry, and physics. In all of the courses laboratory work is stressed rather than a lecture-reading method. Emphasis is placed on the recognition of fundamental principles through direct experience.

The sequence chart that follows the listing of courses depicts the normal progression from one course to another within each ability level. It is noted, however, that some students take courses in an order different from that depicted, based on consultation with the department chairperson. After each year students will be reevaluated to make certain they are placed in the correct level course based on their most recent performance. Course selections should reflect a student's ability, interests, and future educational and career plans. The levels have been designed so that each course will consider essential content but will vary in terms of rigor and breadth and depth of coverage. Students are reminded that two years of science are required for graduation from Concord-Carlisle High School.

## COURSES OFFERED BY THE SCIENCE DEPARTMENT

Earth Science (Full Year) Introductory Biology (Full Year) Advanced Placement Biology (Full Year) Human Anatomy & Physiology (Full Year) Meteorology (Half Year) Forensic Science (Half Year)	Introductory Chemistry (Full Year) Advanced Placement Chemistry (Full Year) Introductory Physics (Full Year) Advanced Placement Physics (Full Year) Advanced Placement Physics with Calculus (Full Year)
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## SCIENCE PROGRAM SEQUENCE CHART

→ Potential path students can take. Alternative paths can be created with teacher permission.

GRADE	COLLEGE PREP	ENRICHED	HONORS
9	Earth Science (CP)		Introductory Biology (H) Earth Science (H)
10	Introductory Biology (CP) Earth Science (CP)	Introductory Chemistry (E)	Introductory Biology (H) Introductory Chemistry (H) Earth Science (H)
11	Introductory Chemistry (CP)	Introductory Chemistry (E) Introductory Physics (E)	Introductory Chemistry (H) Introductory Physics (H) AP Biology (H) AP Chemistry (H)
12	Introductory Physics (CP) Introductory Physics (CPB)	Introduction Physics (E) Human Anatomy & Physiology (E) Forensic Science (E) Meteorology (E)	Introductory Physics (H) AP Biology (H) AP Chemistry (H) AP Physics B (H) AP Physics with Calc. (H)

The Science Department's goal is to place all students in the proper level course that allows them to be placed in a challenging and enjoyable learning environment. At the end of each year the department reevaluates all students to determine if they should continue to move vertically down the sequence chart, or if a horizontal move across the sequence chart is warranted. The potential paths diagramed above are designed to show that each year students in CP and Enriched level courses are moved to Enriched and Honors courses when their performance merits such a move. Additionally, students in Honors and Enriched classes are moved to Enriched and CP level courses when, through a variety of assessment tools, the department determines that their current path is no longer appropriate.

It is possible for students to elect the Advanced Placement chemistry or biology course in the junior year in addition to Physics I. Students may elect two advanced science courses in senior year as well. The ability of a student to schedule more than one science course in the honors sequence in one year is dependent both on the ability level of the student and the ability of the schedule to accommodate this.

**EARTH SCIENCE (CP)**

**FULL YEAR – 5.00 CREDITS**

**COURSE #511**

**Primarily for students in grades 9 and 10**

**Prerequisites: None**

**Description:** The objective of this course is to give students an appreciation of the world around them. This course is an introduction to earth science for students who usually grasp basic concepts on their own. The topics to be covered include physical and historical geology, meteorology, astronomy and oceanography. Students will use their text as their primary source of information. Class time will be devoted to detailed study through lectures, discussion, audio-visual presentations, demonstrations and laboratory investigations and will reinforce concepts discussed in the text. Field trips to the Town Forest will be taken during class to investigate glacial features, field mapping, compass work and leaf identification. Students will be required to read the text and complete associated homework assignments on a regular basis. These assignments will serve as a starting point for classroom discussion. Group discussion will be encouraged in order to stimulate abstract thinking and to relate the student's own experience and knowledge on the topic. Projects will be given to students on a quarterly basis. These topics include a research paper, the Leaf Project, and the creations of earth related web pages, radio broadcasts and videos.

This course has as a primary learning concern the following Student Learning Expectation 3 and also supports to a lesser extent the following Student Learning Outcomes: 1, 7

**Evaluation:** Evaluation will be based on homework, class participation, laboratory work and reports, special projects, tests, and the semester examination.

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**EARTH SCIENCE (H)**

**FULL YEAR – 5.00 CREDITS**

**COURSE #513**

**Primarily for students in grades 9 and 10**

**Prerequisites: Concurrent enrollment in Honors or CP1 Math; demonstration of a strong reading comprehension and independent learning; recommendation of previous teacher.**

**Description:** The objective of this course is to give students an appreciation of the world around them. This course is designed for students who are capable of reading a high level, challenging science text and independently comprehending difficult material. The topics to be covered include physical and historical geology, meteorology, ecology, astronomy and oceanography. The topics will be covered in depth and expanded far beyond the classroom. Class time will be devoted to detailed study through lectures, discussions, audio-visual presentations, demonstrations and laboratory investigations. Laboratory assignments will ask students to create meaningful hypotheses, independently design and conduct controlled investigations, collect data, draw and present insightful conclusions and finally identify possible errors found in the experiments. Field trips to the Town Forest will be taken during class to investigate glacial features, field mapping, compass work and leaf identification. Students will use their text as one of their resources but will also be expected to read related articles found in recent scientific journals. Students will be required to read the text and complete associated homework assignment on a regular basis. These assignments will serve as a string point for classroom discussion. Projects will be given to students on a quarterly basis. These topics include a research paper, the Leaf Project, and the creation of earth science related web pages, radio broadcasts and videos.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 1, 7

**Evaluation:** Evaluation will be based on homework, class participation, special projects, tests, laboratory work and reports, and the semester examinations.

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**METEOROLOGY (E)****HALF YEAR – 2.50 CREDITS****COURSE #516****Only for students in grades 11 and 12****Prerequisite: Completion of two years of H, CPI or II level math or its equivalent and/or teacher recommendation**

**Description:** This fast paced course will explore everyday weather phenomena, winter storms, hurricanes, severe weather, climate, and global warming. Class time will be devoted to lectures and presentation, analysis of School WeatherNet data, and hands on activities. This will be supported by textbook and Internet resources. Students will gain an understanding of the daily weather, and how variables such as temperature, dew point, wind speed, and air pressure contribute to meteorological events. They will gain an appreciation of local and global weather as well as climate concerns. Students will be able to interpret sounding graphs, weather maps, and models. They will critically review television, newspaper, and on-line forecast and learn how to generate their own weather forecasts that may be presented on the morning announcements, WIQH-FM, and CCTV.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 1, 7

**Evaluation:** Evaluation will be based on homework, class participation, laboratory work and reports, special projects, tests, and the semester examination.

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**INTRODUCTION TO BIOLOGY (CP)****FULL YEAR – 5.00 CREDITS****COURSE #521****Primarily for students in grade 10****Prerequisite: Teacher recommendation**

**Description:** This introduction to biology course is for students who can usually grasp basic concepts on their own so that class time can be devoted to oral review of more difficult concepts and to provide open time for discussion and questions. This course will address topics dealing with the nature of life and continuity of life. Other major areas such as microbiology, botany zoology, human biology and ecology will be covered using a survey approach. Students will use the text as their prime source of information. Students will be required to answer chapter questions and class time will be used to discuss the difficult questions. Group discussion will be encouraged in order to stimulate abstract thinking and to relate students' own experience and knowledge of other fields to this subject matter. Laboratory work will be done during class time or during scheduled laboratory hours. Students will be assigned some outside readings and reports on various topics of interest.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on homework, class participation, laboratory work and reports, and tests, and semester examinations.

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**INTRODUCTORY BIOLOGY (H)****FULL YEAR – 5.00 CREDITS****COURSE #523****Primarily for Students in Grades 9 and 10****Prerequisites: Concurrent enrollment in honors or CPI math and/or recommendation of previous teacher.**

**Description:** This honors program is an overview of topics in the biological sciences with an expansion upon selected areas. The primary topics will include evolution, ecology, biochemistry, cellular biology, and diversity of life. It is intended for students who are capable of reading and understanding the text on their own so that more class time can be devoted to in-depth study. Because of the math prerequisite, the instructor will assume that students will be able to solve quantitative problems independently. Students will conduct laboratory research and investigate additional selected topics through library research projects throughout the year.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on homework assignments, class participation, laboratory reports, projects, quizzes, tests, and semester examinations.

**ADVANCED PLACEMENT BIOLOGY (H)****FULL YEAR – 5.00 CREDITS****COURSE #525****Primarily for students in grade 11 and 12****Prerequisites: A minimum grade of B+ in Introductory Biology (H) , a minimum grade of B in Introductory Chemistry (H) and/or teacher recommendation.**

**Description:** This course is designed to be the equivalent of a college introductory biology course usually taken by biology majors during their first year. It aims to provide students with the conceptual framework, factual knowledge, and analytical skills necessary to deal with the rapidly changing science of biology. Topics include biochemistry, cellular biology, heredity, molecular genetics, evolution, diversity of organisms, and ecology. It is expected that students use the college level text for learning much of the course content. Other sources for learning are class lectures, laboratory experiments and independent research.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on laboratory and periodical reports, independent research projects, tests, and semester exams.

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**HUMAN ANATOMY AND PHYSIOLOGY (E)****FULL YEAR – 5.00 CREDITS****COURSE #526****Primarily for students in grades 11 and 12****Prerequisites: Above average achievement in Honors Biology and Honors/Enriched Chemistry, or teacher recommendation.**

**Description:** The topics addressed include body systems, comparative anatomy, cell physiology, histology and pathology. Students will be expected to do independent laboratory work, research work, outside reading and to submit reports on various topics of interest. Students may also be expected to do a long-term independent project.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on homework, laboratory activities, class participation, quizzes, tests, and semester examinations.

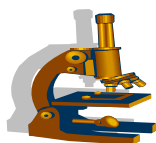
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**INTRODUCTORY CHEMISTRY (CP)****FULL YEAR – 5.00 CREDITS****COURSE #531****Primarily for students in grade 11****Prerequisites: Successful completion of two years of CIII math courses or equivalent, and completion of the departmental math evaluation.**

**Description:** This college preparatory course in introductory chemistry will include most of the topics contained within the Enriched Chemistry offering. However, greater emphasis will be placed on the qualitative treatment of this material. Problem solving will include appropriate math review by the teacher.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 7

**Evaluation:** Evaluation will be based on homework, laboratory reports and techniques, class participation, quizzes, tests, and semester examinations.



**INTRODUCTORY CHEMISTRY (E)****FULL YEAR – 5.00 CREDITS****COURSE #532****Primarily for students in grades 10 and 11****Prerequisites: Concurrent enrollment in CPI or II level math and/or teacher recommendation, and completion of the departmental math evaluation.**

**Description:** This course will involve quantitative and descriptive work in the following areas; stoichiometry, atomic theory, equilibrium, solubility products, hydrolysis, acid/base theory, thermodynamics, colligative properties, rates, gaseous behavior, chemical bonding, and electrochemistry.

This course will examine both the macroscopic and particulate world of chemistry; however, the focus will be on the atomic level. The laboratory investigations will enhance the student's comprehension of the topics. They will be required to make direct observations and collect raw data that can be manipulated to further understand the world around them. Students will gain an appreciation of how chemistry impacts our daily lives.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 7

**Evaluation:** Evaluation will be based on homework assignments, class participation, laboratory reports, projects, quizzes, tests, and semester examinations.

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**INTRODUCTORY CHEMISTRY (H)****FULL YEAR – 5.00 CREDITS****COURSE #533****Primarily for students in grades 10 and 11****Prerequisites: Exemplary performance in Honors Biology or Honors Earth Science. Students planning to take this course must demonstrate proficiency in mathematical concepts and computational skills by having success in Honors Geometry and Honors Algebra 2 or receiving high grades in CPI Geometry and CPI Algebra 2, and completion of the departmental math evaluation.**

**Description:** This honors course will include a more intensive and in-depth study of the topics listed in Introductory Chemistry (E) The program assumes that students are adept at the math that is involved. For this reason, the instructor will assume that students will be able to solve quantitative problems independently.

The laboratory investigations are primarily student driven, as the students are often required to develop their own procedures. They are asked to determine the best way to collect meaningful data to achieve a particular goal. The formal laboratory reports are intense assessments and are modeled after scientific journal articles.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on homework assignments, class participation, laboratory reports, projects, quizzes, tests, and semester examinations.

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**ADVANCED PLACEMENT CHEMISTRY (H)****FULL YEAR – 5.00 CREDITS****COURSE #535****Primarily for students in grades 11 and 12****Prerequisites: A minimum grade of B+ Introductory Chemistry (H) and/or teacher recommendation.**

**Description:** The topics in this college level course include atomic theory, chemical bonding, structures and properties, chemical dynamics, equilibrium, electrochemistry, descriptive chemistry, states of matter, reaction types, and kinetics.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on homework assignments, class participation, laboratory reports, quizzes, tests, and semester examinations.

**FORENSIC SCIENCE (E)****HALF YEAR – 2.50 CREDITS****COURSE #536****Only for students in grades 11 and 12****Prerequisites: Successful completion of Biology and Chemistry**

**Description:** Forensic science is designed for motivated, college bound students interested in the application of science to criminal investigations. During the semester class, all areas of scientific endeavors will be explored to determine evidential value of a crime scene. Topics covered include: the crime scene, physical evidence, physical properties, organic analysis, inorganic analysis, the microscope, hairs, fibers, and paint, drugs, forensic toxicology, forensic aspects of arson and explosion investigations, forensic serology, DNA, fingerprints, firearms, toolmarks and other impressions, and document examination. Juniors and seniors who have successfully completed biology and chemistry classes are eligible for this class.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on homework assignments, class participation, laboratory reports, projects, quizzes, tests, and semester examinations.

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**INTRODUCTORY CHEMISTRY (CPB) (Chem in the Community) FULL YEAR – 5.00 CREDITS COURSE #537****Primarily for students in grade 11****Prerequisites: Successful completion of two years of CPIII math courses or equivalent, and completion of the departmental math evaluation.**

**Description:** This is college preparatory course in introductory chemistry in which topics are organized around societal issues involving chemistry. Emphasis will be placed on the qualitative treatment of the material, and any problem solving will include appropriate math review by the teacher. This course also features activities in which students apply their chemistry knowledge in decision-making situations.

This course's primary learning concern follows Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 7

**Evaluation:** Evaluation will be based on homework, laboratory reports and techniques, class participation, quizzes, tests, and semester examinations.

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**INTRODUCTORY PHYSICS (CP)****FULL YEAR – 5.00 CREDITS****COURSE #541****Primarily for students in grade 12****Prerequisites: Completion of two years of CPIII or CPII math or its equivalent, and completion of the departmental math evaluation.**

**Description:** This course is designed to give students an introduction to some of the basic physical principles that govern the universe. Topics are approached by examining how everyday objects work and the physics behind them. Examples of some of these objects include seesaws, bumper cars and light bulbs. It is a hands-on class with many activities, laboratory investigations and projects. Topics that will be addressed in this course include one and two- dimensional motion, Newton's laws of motion, energy, rotational motion, momentum and light. This course assumes a basic understanding of algebra; additional math skills may be taught in the classroom.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on laboratory reports, class participation, homework, tests, projects and semester examinations.

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**INTRODUCTORY PHYSICS (E)**  
**Primarily for students in grades 11 and 12**

**FULL YEAR – 5.00 CREDITS**

**COURSE #542**

**Prerequisites:** Completion of two years of CPI or II level math or its equivalent and/or teacher recommendation and completion of the departmental math evaluation.

**Description:** This course is designed to give students an introduction to some of the basic physical principles that govern the universe with an emphasis on connection to daily life. It is a hands-on, laboratory driven course that involves individual and collaborative laboratory work. Students will perform laboratory investigations in response to stated research goals; students are expected to collect appropriate data and draw meaningful conclusions from the data. Students will be required to document their research in a laboratory notebook modeled after the laboratory reports they would submit in college-level science courses. Other instructional practices include lecture, group discussion, demonstration, and problem solving. The topics addressed in this course include one and two-dimensional motion, Newton's laws, work and energy, momentum, gravitation, waves, sound and light, and electricity. This course assumes that students are skilled in solving algebraic equations; additional math skills may be taught in the classroom.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based primarily on laboratory reports, class participation, homework, tests, and semester examinations.

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**INTRODUCTORY PHYSICS (H)**  
**Primarily for students in grade 11 and 12**

**FULL YEAR – 5.00 CREDITS**

**COURSE #543**

**Prerequisites:** Exemplary achievement in science accompanied by a consistent demonstration of sound study skills/habits. Strong proficiency in algebraic concepts and skills. For example, completion of and concurrent enrollment in Honors or CPI Math with an A-average and completion of the departmental math evaluation.

**Description:** This course is designed to give students an introduction to some of the basic physical principles that govern the universe with an emphasis on connection to daily life. It is a laboratory driven course that involves extensive individual and collaborative laboratory work. Students will design investigative procedures in response to stated research goals, collect appropriate data, and draw meaningful conclusions from the data. Students will be required to document their research in a laboratory notebook and prepare formal laboratory reports modeled directly after scientific journal articles. Other instructional practices include lecture, group discussion, demonstration, and problem solving. The topics addressed in this honors course include one and two-dimensional motion, Newton's laws of motion, work and energy, momentum, circular motion and gravitation, periodic motion, geometrical and physical optics, and electricity. This honors course assumes that students will be able to solve quantitative problems independently; background math skills will not be taught in the classroom.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based primarily on laboratory reports, class participation, homework, test, and semester examinations.

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**AP PHYSICS WITH CALCULUS (H)**  
**Primarily for students in grade 12**

**FULL YEAR – 5.00 CREDITS**

**COURSE #544**

**Prerequisites: Exemplary achievement in honors science accompanied by a consistent demonstration of sound study skills/habits along with teacher’s recommendation.**

**Co-requisite:** Students must be enrolled in Calculus.

**Description:** AP Physics ‘C’ is designed for students who are taking physics for the first time. The course covers the areas of mechanics and wave phenomena. The course stresses both the mathematical and the practical applications of the topics being studied. A significant amount of class time is spent doing laboratory investigations. The topics addressed in this honors course include one and two-dimensional motion, Newton’s laws of motion, work and energy, momentum, circular motion and gravitation, rotational dynamics, periodic motion, geometrical and physical optics. Analysis of these topics will use calculus where appropriate. This honors course assumes that students will be able to solve quantitative problems independently; background math skills will not be taught in the classroom. Students taking this course will be well prepared for the Advanced Placement Physics C Mechanics examination

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on class participation, homework, laboratory reports, tests, and semester examinations.

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**AP PHYSICS B (H)**  
**Primarily for students in grade 12**

**FULL YEAR – 5.00 CREDITS**

**COURSE #545**

**Prerequisites: Teacher’s recommendation is required along with a minimum grade of B+ in Introductory Physics (H). Students should have already taken or be taking CPI, or Honors Trigonometry and Analysis and completion of the departmental math evaluation.**

**Description:** The topics addressed in this honors course include heat, kinetic theory, thermodynamics, fluid statics, fluid dynamics, electrostatics, direct current circuitry, magnetism, atomic and nuclear physics, waves and sound, and special relativity. Students will be required to integrate first year physics concepts into their study of the advanced topics listed above. Those who successfully complete this course will be prepared to take the non-calculus based Advanced Placement Examination (AP) Physics “B” in May.

This course has as a primary learning concern the following Student Learning Expectation: 3

This course also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on class participation, homework, laboratory reports, quizzes, tests, and semester examinations.

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**INTRODUCTORY PHYSICS (CPB)**  
**Primarily for students in grade 12**

**FULL YEAR – 5.00 CREDITS**

**COURSE #546**

**Prerequisites: Completion of two years of CPIII or CPII math or its equivalent, and completion of the departmental math evaluation.**

**Description:** This course is designed to give students an introduction to some of the basic physical principles that govern the universe. This will be accomplished by looking at the physics behind everyday phenomena, devices and objects, which may include bridges, towers, boats, windmills, electric circuits and robots. The students will then implement what they have learned through the design and construction of several of the objects studied.

This course has as a primary learning concern the following Student Learning Expectation: 3 and also supports to a lesser extent the following Student Learning Outcomes: 2, 7

**Evaluation:** Evaluation will be based on class work, projects, student journals, class participation, homework and quizzes.