

SCIENCE

BIOLOGICAL AND PHYSICAL SCIENCES COURSE SEQUENCES

The most common course sequences are...

If *Intro to Functions* was successfully mastered in grade 8

(H) Honors/ (AP) Advanced Placement Level

Grade 9	Quantitative Physical Science
Grade 10	Chemistry I H, Chemistry A, plus/or Biology I H, Biology A
Grade 11	Chemistry II AP plus/or Biology I H, Biology II AP, Biology II A, or Physics I H, Physics A
Grade 12	Physics I H, Physics II AP, Biology II AP, Cell Physiology & Microbiology H, Vertebrate Anatomy H/A, Human Anatomy H/A, Forensics H/A
Grades 9 – 12	Research In Science H

If *Intro to Functions* was NOT successfully mastered in grade 8

(A)Advanced Level

Grade 9	(CPS) Conceptual Physical Science A/ICR
Grade 10	Chemistry A or Biology I A/ICR
Grade 11	Biology I A/ICR (if Chemistry A was taken in grade 10), Chemistry A (if Biology I A was taken in grade 10); * plus an additional elective
Grade 12	Physics IA, plus *Biology II A, Cell Physiology & Microbiology H, Environmental Studies A, Vertebrate Anatomy H/A, Human Anatomy H/A, Forensics H/A, or Planetary Exploration A
Grades 9 – 12	Research In Science A

(R) Regular Level

Grade 11	Biology IA (if Chemistry R was taken in grade 10), Chemistry R (if Biology I R was taken in grade 10); * plus an additional elective
Grade 12	Physics IR, plus *Environmental Studies R, Vertebrate Anatomy A/R, Forensics A/R
Grades 9 – 12	Research In Science R

Other

Grade 9	Physical Science Concepts
Grade 10	Biology Environmental Concepts
Grade 11	Chemistry/Environmental Science Concepts

RESEARCH IN SCIENCE: H/A/R: 9, 10, 11, 12

1-5 credits

The ability to conduct scientific research is crucial to the future success of our students. Research in Science (RIS) is a single or multi-year (preferred) course designed to engage students in scientific research in one of the disciplines of science, such as, Biology, Chemistry, Physics, Technology, Astronomy, Geology, Medicine, Engineering, Computer Science, or Mathematics. The course is the foundation for the department's efforts to motivate students to engage in scientific research in their area of interest and to apply knowledge in a practical and real situation. Students begin with a topic search, review the scientific literature in academic journals, conduct their experimental research project, document their research and enter a science fair, exhibit or contest. This class will be offered as an additional period either before or after school, including Internet communication between the student and the instructor and involves both class meetings and some individual one-on-one work.

CORE COURSES

QUANTITATIVE PHYSICAL SCIENCE H: 9

6 credits

PREPARATION: Successful completion of Intro to Functions 8th grade

This is a rigorous first-year science program designed for the student whose interest and aptitude lie in the field of mathematics, science, or engineering. Using various scientific instruments and computer technology, students conduct their own experiments, constantly making calculations and quantitative analyses. In this process, the QPS student develops important mathematical skills and basic principles of physics (force and motion) and chemistry. This course will adequately prepare the student for more advanced science courses such as Chemistry and Physics. QPS is a preparation for Chemistry Honors.

CONCEPTUAL PHYSICAL SCIENCE (CPS) A/ICR: 9

6 credits

Conceptual Physical Science (CPS) is designed for college-bound students who may, or may not, be planning for a career in science. Fundamental to CPS is a study of the principles, theories, and laws that are central to all of the disciplines of Physical Science. This approach emphasizes the critical relationship between mathematics and science, and utilizes the computer as a tool to advance scientific understanding. The major topics of the course include geological and atmospheric cycles of the Earth, energy and resources, chemical and physical systems, and understanding the Earth and its place within the universe. Students who successfully complete this course will be well prepared to continue their high school education in the physical sciences.

PHYSICAL SCIENCE CONCEPTS

5 credits

PREPARATION: Completion of 8th grade science course

In this course, students will solidify their understanding of physical science concepts at a level and in a context appropriate for high school students. The students will be (re)introduced to physical science concepts in a real world context. Use of the scientific method in problem solving, chemical and physical properties, and the study of motion are some of the major topics they will learn. Through the use of hands-on activities, internet exploration and graphing calculators, students will gain an understanding of these science

concepts as they develop skills that will prepare them for future science courses. The teacher will develop instructional and assessment strategies that will best help each student meet the goals of the curriculum. This course is only available to students with IEPs.

BIOLOGY

BIOLOGY 1 H: 10, 11, 12

6 credits

PREPARATION: Successful completion of QPS-H or CHEMISTRY (may be concurrent)

Biology 1H is designed for the academically advanced, college-bound student. It focuses on major life categories through a hands-on, minds-on inquiry approach in order to develop scientific attitudes and interests. It provides a greater understanding of biology at the molecular level. More advanced topics such as biochemistry, enzyme chemistry, genetics, molecular biology (chemistry of DNA including DNA extraction, PCR amplification, and electrophoresis) and bioenergetics will be studied in addition to the core biology topics. Students are expected to have a fundamental background in chemistry as well as a serious work ethic to meet the challenge and rigor of an honors program. Students planning to take AP Biology or contemplating a career in science or related disciplines are encouraged to take this course. At the conclusion of this course, students will be required to take and pass for graduation an end of course competency assessment.

BIOLOGY 1 A/ICR: 10, 11, 12

6 credits

PREPARATION: Successful completion of 9th grade A level science

Biology 1 A is designed for the academically advanced, college-bound student. With an emphasis on inquiry, theory development and the application of biological principles, it provides knowledge important for both everyday life and further scientific development. It focuses on major life categories and processes, presented in such a way as to further develop scientific attitudes and interests. Major emphasis is placed on areas from the New Jersey Core Curriculum Content Standards such as cell biology, genetics, ecology, evolution and human health and disease. The double lab period and four recitation sessions are student-activity oriented. At the conclusion of this course, students will be required to take and pass for graduation an end of course competency assessment.

BIOLOGY 1 R/ICR: 11, 12

6 credits

PREPARATION: Successful completion of 9th grade R level science

Biology 1 R is a survey course for the college-bound student. The content is aligned to the New Jersey Core Curriculum Content Standards and its purpose is to provide the student with a general knowledge of basic biological principles including: the cell, evolution, genetics, ecology and human health and disease. Emphasis is placed on making the student a literate citizen in a scientific society. The methods used include: individualized learning skills, group learning skills and laboratory skills. This is an approach which has less emphasis on chemistry and mathematics, but still requires the application of both. The double lab period and four recitation sessions are student-activity oriented. At the conclusion of this course, students will be required to take and pass for graduation an end of course competency assessment.

BIOLOGY 2 AP: 12**6 credits****PREPARATION: Successful completion of Biology 1 A or H, and Chemistry 1 A or H**

Biology 2 AP is a first-year college-level course for students of high academic ability who may plan to major in biology or prepare for one of the health related fields (medicine, dentistry, and nursing). Topic areas include cellular and molecular biology, organismal reproduction, development, growth and nutrition, ecology, heredity, genetic engineering, evolution, organismal biology (structure and function), systematics, and behavior. Students taking this course should be prepared to put forth the time and effort required for a college science course. A great deal of reading will be required. There is a summer reading requirement. Students may be eligible for college credit from Camden County College. See your school counselor for more information.

BIOLOGY CONCEPTS: 10**5 credits**

Biology Concepts 10 is a hands-on, minds-on Biology course designed to meet high school graduation requirements for special education students. Its purpose is to provide the student with a general knowledge of basic biological principles including: the cell, evolution, the human body, plant and animal life, genetics, and ecology. Emphasis is placed on making the student a literate citizen in a scientific society. The methods used include: individualized learning skills, group learning skills and laboratory skills. Through the use of hands-on activities, internet exploration and graphing calculators, students will gain an understanding of these science concepts as they develop skills that will prepare them for future science courses. The teacher will develop instructional and assessment strategies that will best help each student meet the goals of the curriculum. This course is only available to students with IEPs.

CHEMISTRY

CHEMISTRY 1 H: 10, 11, 12**6 credits****PREPARATION: Successful completion of QPS-H and Geometry H/A, Biology (may be concurrent)**

Chemistry H is an honors-level introductory chemistry course designed for those students who have displayed exceptional interest and aptitude in their previous science studies. This course is recommended for those students who intend to major in science and technical fields at the college level. The student should display a high degree of mathematical competency and superior problem-solving abilities. The design of Chemistry H will permit the student to study a larger number of concepts in greater depth than is possible in the A level course. This course will incorporate units on atomic and molecular structure, the periodic table, stoichiometry, thermodynamics, chemical kinetics, equilibrium, acid-base theory, and electrochemistry. This course will prepare students to take the SAT II Chemistry test and the Chemistry 2AP course.

CHEMISTRY 1 A: 10, 11, 12**6 credits****PREPARATION: Successful completion of Enriched Algebra A and QPSH or CPSA**

Chemistry 1A is a full-year, six-credit, higher level chemistry course designed for those students having considerable interest and aptitude in science studies. It will adequately provide the chemistry background for those students intending to take science courses at the

university level. Basic chemical principles and theories are developed in both qualitative and quantitative schemes that require memorization and a high level of mathematical and problem solving ability on the part of the students.

APPLIED CHEMISTRY R/ICR: 11-12

6 credits

PREPARATION: Successful completion of Algebra 1R and CPSR

Applied Chemistry presents an alternative approach to the study of chemistry designed specifically for non-science majors who have an interest in science but are not necessarily math-science oriented. Its purposes are to help students (1) realize the important role that chemistry will play in their personal and professional lives, (2) use principles of chemistry to think more intelligently about current issues they will encounter that involve science and technology, and (3) develop a lifelong awareness of the potential and limitations of science and technology. It is a chemistry action course that brings to its students hands-on investigations focused on real world chemistry that they should know and will enjoy. Topics such as the environment, heat and energy, and scientific measurement are used to investigate real world problems. The students use basic chemistry concepts to accomplish open-ended labs, use research to investigate and problem solve, write lab reports, and use math concepts to meet the science education standards and at the same time let students enjoy learning chemistry.

CHEMISTRY 2 AP: 11, 12

6 credits

PREPARATION: Successful completion of Algebra 2A, Chemistry 1A or 1H

Chemistry 2 AP is a college-level course, using first-year college texts and laboratory experiments. It is designed to give the science major a more extensive chemical background than is possible from Chemistry 1A or 1H alone. The course content will draw upon the student's knowledge of first year chemistry. In addition, new concepts will be covered such as acid-base and solution equilibrium, thermo chemistry, electrochemistry, oxidation-reduction and organic chemistry. Chemistry 2 AP is designed such that a student who is interested in science as a career may receive advanced placement at the college level upon successful performance on the Advanced Placement Examination, and the instructor's recommendation. Because of the subject matter included in the course, it is expected that the student will exhibit a proficiency level higher than that required for Chemistry 1A and 1H.

CHEMISTRY/ENVIRONMENTAL SCIENCE CONCEPTS: 11, 12

5 credits

PREPARATION: Successful completion of Biology Concepts and Algebra 1

Science Concepts 11 presents an alternative approach to the study of Chemistry and Environmental Science specifically for special education students. This course is designed to fulfill the third year science requirement for graduation. Its purposes are to help students realize the important role that chemistry will play in their personal and professional lives; use principles of chemistry to think more intelligently about current issues they will encounter that involve science and technology; and develop a lifelong awareness of the potential and limitations of science and technology. It addresses the interrelationships between the living and non-living components of an ecosystem as well as the social, economic, political and ethical issues associated with our major environmental concerns. It is a course that brings to its students hands-on investigations focused on real world issues and concerns that they should know and will enjoy. Topics such as the environment, heat and energy, and scientific measurement are used to investigate real world problems. The students use basic chemistry concepts to accomplish open-ended labs, use research to

investigate and problem solve, write lab reports, and use math concepts to meet the science education standards and enjoy learning science. This course is available only to students with IEPs.

PHYSICS

PHYSICS 1 H: 11, 12

6 credits

PREPARATION: Grade 11 – Taking Pre-Calculus currently; Grade 12 – Taking Calculus A or H currently

Physics 1 H is designed for students who have displayed exceptional interest and aptitude in their previous science courses. The course will best fit the needs of students who plan to go college with a major in science, engineering or medicine. Topics covered will include Kinematics, Newton's Laws of Motion, Energy, Momentum, Conservation Laws, Rotation, Oscillations, Gravitation, Electrostatics, Current Electricity, Magnetostatics, Electromagnetic Induction, Wave Motion, Sound, Geometric Optics, Physical Optics, and introductory modern physics.

PHYSICS 1 A: 11, 12

6 credits

PREPARATION: Successful completion of Algebra 1A, Geometry 1A, Algebra 2; Current enrollment in Pre-Calculus or Calculus desirable

Physics 1A is a level 1 accelerated college preparatory course directed at students who are intent on specializing in the sciences or engineering at the college level. The core of the program consists of kinematics, vectors, Newton's Laws of Motion, universal gravitation, oscillatory motion, the laws of conservation of energy and momentum, geometrical and physical optics, scientific models, Coulomb's Law, and simple circuits. The course attempts to develop critical thinking to enable the student to reach a true understanding of science, rather than accumulate a mass of facts; as well, it strives to acquaint the student with the power and limitations of science.

APPLIED PHYSICS R: 11, 12

6 credits

The Applied Physics R incorporates the Active Physics approach and organizes physics content from the National Science Education Standards into six thematic units of: communications, home, predictions, medicine, sports and transportation. Applied Physics students take a hands-on approach to problem solving, working in small groups to foster teamwork.

PHYSICS 2 AP-C: 11, 12

6 credits

PREPARATION: Successful completion of Physics 1 H or 1 A; taking Calculus H or A currently

Physics 2 AP-C is a college level course, which strives to enhance the scientific maturity of the student through a vigorous emphasis on the fundamentals of physics. The core of the program consists of mechanics, electricity, and magnetism, and parallels the Advanced Placement C Level curriculum. Other topics to be covered at the option of the instructor, and as time permits, shall include waves, thermodynamics, special relativity, and quantum theory.

COMMON CORE ELECTIVES

BIOLOGY 2 A: 11, 12

6 credits

PREPARATION: Successful completion of Biology 1 A, Biology 1 R

Biology 2 A is a full year course that builds on existing content knowledge from Biology 1. New content is also introduced that is not included in a first-year biology curriculum. Topics include evolution, microbiology, applied genetics, botany, zoology, biotechnology and molecular genetics, and bioethics. Students are expected to conduct independent laboratory research for many of the topics throughout the year. The course is designed to sharpen laboratory skills and to expose students to new content, laboratory techniques and equipment.

CELL PHYSIOLOGY AND MICROBIOLOGY H: 11, 12

6 credits

PREPARATION: Successful completion of Biology 1A or 1H and Chemistry 1A or 1H

This course builds upon key concepts introduced in both biology and chemistry. Emphasis is given to the molecular nature of cells, the role of enzymes in metabolism, cell structure function and genetic engineering. In addition, this course also includes an in-depth study of microorganisms including viruses, bacteria, protists and fungi. Particular emphasis is given to bacteria, their identification, cultivation, control and the role they play in infectious disease. This course is laboratory oriented and will be of value to students who are science oriented and plan a possible career in a medical field or biological research.

ENVIRONMENTAL STUDIES A/R/ICR: 11, 12

6 credits

PREPARATION: Successful completion of Biology 1H, A or R

Environmental Science is the study of how humans affect their environment. It addresses the interrelationships between the living and non-living components of an ecosystem as well as the social, economic, political and ethical issues associated with our major environmental concerns. Some topics of study will include principles of ecology, population dynamics, energy, major environmental concerns, toxicology, risk management, wildlife conservation, economics and politics of the environment, and the New Jersey Pinelands. This course is both laboratory and field-oriented. Environmental Studies is designed to provide students with information to help them make reasonable decisions regarding their actions on the environment. This course is co-taught and is available to students with IEPs.

FORENSIC SCIENCE H/A/R: 11-12

6 credits

PREPARATION: Successful completion of Biology 1 & Chemistry

This course is a standards-based introduction to the topics of Criminology within the field of forensic science. Forensic Science is the application of science to those criminal and civil laws that are enforced by agencies in the criminal justice system. It applies the knowledge and technology of science for the definition and enforcement of such laws. Students will be required to apply principles and techniques from the areas of chemistry, physics, biology, and geology to analyze the many different types of physical evidence that may be recovered during a criminal investigation. Students are required to prepare formal criminal investigation reports and give oral reports on their findings. They will also be required to participate in mock courtroom trials where they must present their scientific evidence in a clear and informed manner to a “jury” and/or “judge”. Topics covered include: History of Forensics, The Crime Lab, Glass, Fingerprinting, Hairs, Fibers, Paint, Document Examination, Blood, Blood Splatter Analysis, DNA Analysis, Drugs & Alcohol, Footprints, and Forensic Anthropology. The course culminates with students investigating an actual

crime scene, applying the techniques and skills acquired throughout the course.

PLANETARY EXPLORATION A: 11-12

6 credits

This program will address the following essential questions: What physical and chemical systems do the planets of our solar system have? How do the solar system and galaxies evolve? What is the origin of universe? By exploring these essential questions, students will apply the fundamental concepts of earth science, biology, chemistry, physics and technology. In their investigation of the earth, our solar system, Milky Way galaxies and the universe, they will examine real time view of various images of planets through the Internet and get connected with the various government agencies, such as JPL, NASA, NOAA. This program is a technology-rich, integrated program designed to meet the needs of students who are non-science majors. Its purpose is to help students (1) realize the important role that science will play in their personal and professional lives, (2) use principles of science to think more intelligently about the universe they live in and about the current issues of science and technology, and (3) develop a lifelong awareness of the potential and limitations of science and technology.

VERTEBRATE ANATOMY AND PHYSIOLOGY H/A/R: 11, 12

6 credits

PREPARATION: Successful completion of Biology 1H or A

This course is designed for students interested in careers in the health field and concentrates on vertebrate anatomy and physiology. It uses dissection of fish, amphibians, reptiles, birds and mammals. It shows the interrelationship between these vertebrates using an evolutionary approach. Comparison is made to the human structures, especially with mammals using cat dissection. Clinical application of content material is accomplished in the form of case studies and computer simulation. The student will become proficient in dissection and the use of the microscope in order to identify human cells and tissues. Note: Dissection is large portion of the curriculum, and students enrolled in this course must be willing to be active participants in the dissections.

HUMAN ANATOMY AND PHYSIOLOGY H/A: 11/12

6 credits

This course is an in-depth study of human anatomy and physiology and is designed for students interested in pursuing a career in medicine, nursing, physical therapy or other health-care fields. In this laboratory-oriented course involving the detailed study of the structure and function of human body systems, students will have the opportunity to explore organ physiology as well as its intricate structure. In addition, students will relate the physiology they study to the real-world case studies. Unique components of the honors level course such as student participation in the study of human dissection at the cadaver lab of the University of Medicine and Dentistry of New Jersey are sought. Also, the "Shadow a Medical Student" program is intended for all interested students, allowing them to gain insight into the medical school experience.