

## RHS Science Department

### **Introduction:**

Science is a human activity through which problems dealing with natural phenomena can be identified and proposed solutions can be tested. In this process, data is collected/analyzed and available knowledge is applied to explaining the results. Through this process, investigators add to the store of knowledge thereby helping people better understand their surroundings. Applications of this knowledge also may bring about changes in society and the cultural order, as well as having a direct impact on the quality of life.

The science requirement for graduation involves students in a systematic study of the earth and space, life, and physical sciences in three laboratory courses. As students study the natural phenomena that govern our world, they will have a greater understanding of the dynamic systems that interact with one another. Students will study biological systems, and the systems that govern matter. They will be expected to model real-world science and demonstrate the thinking/process skills associated with science. Students beyond the ninth grade will have an opportunity to enroll in electives that provide insights into major fields of science. Laboratory activities are included in all science courses.

Randolph's science curricula are aligned to the New Jersey Student Learning Standards in Science.

### **Course Levels:**

All Randolph High School science courses prepare students for college. In general, students at a higher level are expected to be more independent, more self-disciplined, and self-motivated. They will explore content more quickly and to a greater depth with emphasis on the analysis of data and interpretation of results. Their writing is expected to be more fluid and more sophisticated, and their thinking more rigorous and original. All science curricula will foster the development of positive attitudes toward science, better communication and thinking skills, career awareness in science, safety in science investigations, and the use of new technology in those investigations.

The required courses in Biology, Chemistry, and Physics/Environmental Science are offered at several levels to match student needs. Advanced Placement courses are offered in Biology, Chemistry, Environmental Science, and Physics. Honors and non-honors level electives are also offered.

Students are placed in appropriate levels based on teacher recommendations, classroom performance, and performance on diagnostic assessments.

### **Course Recommendation Process:**

Teacher recommendation, classroom performance, and diagnostic assessments are the primary criteria for determining appropriate course levels. When making recommendations for courses, teachers consider the following criteria:

Recommending a move to a different level: At least three of the listed indicators should be present.

#### Moving Up:

- An average of 97 or better
- An apparent ease with assignments
- An ability to grasp concepts quickly
- A capacity for thinking at a deeper level with greater insight
- An interest in the subject matter more appropriate to a higher-level student
- Success in a skills-based test (Mathematics Only)

#### Moving Down from Honors to an A-level class:

- Averaging a C- or lower
- Struggling or seeming overwhelmed by the work
- An inability to grasp concepts without additional, separate, individual explanation
- Critical thinking and writing skill levels noticeably lower than those of peers
- Lack of motivation to meet the challenges of an accelerated course

#### Moving Down from A level to a B-level class:

- Averaging a D or lower
- Struggling or seeming overwhelmed by the work
- An inability to grasp concepts without additional, separate, individual explanation
- Skill level significantly below the average

Please note that students who have an A in a class may simply be appropriately placed and are able to shine at that level. Having an A average alone does not indicate that a student should move to a more advanced level.

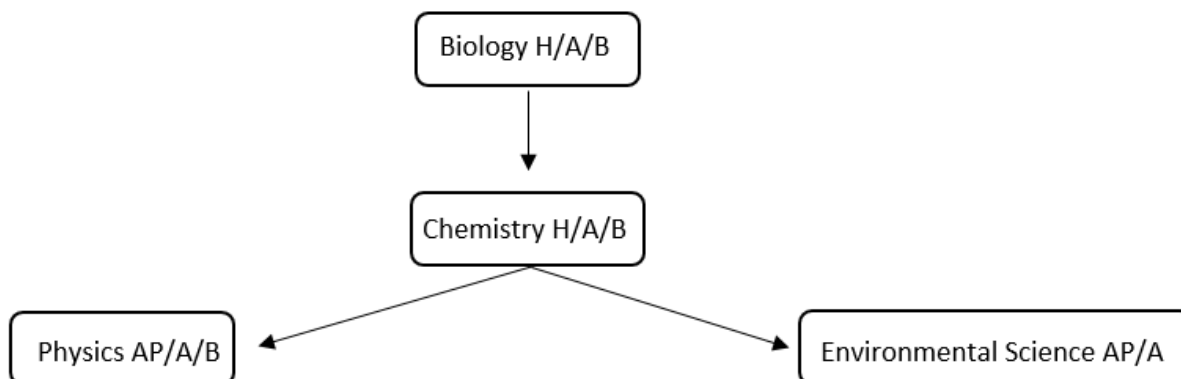
Regarding lack of motivation: If students do not submit work, it is difficult to gauge ability level. Although having difficulties completing homework assignments will naturally impact a student's grade, homework is only a portion of the average. Therefore, it stands to reason if a student is appropriately placed, he/she should be able to maintain a C+ average based on tests, submitted assignments, and participation.

#### **Summer Assignments:**

Some courses, especially the AP courses, may require a summer assignment. Any assignment will be available either from the teacher prior to leaving school in June or will be available on the school website. These assignments will be communicated to the students who are enrolled in classes with a summer requirement prior to leaving for summer break.

**Sequencing:**

Students are required to take three years of high school science. At a minimum, students will complete either courses in Biology, Chemistry, and Physics or courses in Biology, Chemistry, and Environmental Science.



Fourth Year/Doubling Up Options:		
Full Year	Semester Courses	
AP Courses	Honors/A Level	A/B Level
AP Biology	Genetics	Astronomy
AP Chemistry	Marine Biology	Forensic Science
AP Physics 1	Anatomy & Physiology	Animal Behavior
AP Physics 2	Organic & Analytical Chemistry I	Environmental Science
AP Physics C	Organic & Analytical Chemistry II	
AP Environmental Science		

Course Title (Code)	Grade Level	Length
+Biology H (SCI200)	9	Full Year
+Biology A (SCI210)	9	Full Year
+Biology B (SCI220)	9	Full Year
+Chemistry H (SCI300)	10	Full Year
+Chemistry A (SCI310)	10	Full Year
+Chemistry B (SCI320)	10	Full Year
Physics A (SCI410)	11	Full Year
Physics B (SCI420)	11	Full Year
Environmental Science (SCI800)	11, 12	Full Year
Animal Behavior (SCI955)	10, 11, 12	Semester
Forensic Science (SCI945)	10, 11, 12	Semester
Marine Biology H (SCI845)	10, 11, 12	Semester
Marine Biology A (SCI855)	10, 11, 12	Semester
Anatomy & Physiology H (SCI875)	10, 11, 12	Semester
Anatomy & Physiology A (SCI865)	10, 11, 12	Semester

Genetics H (SCI885)	10, 11, 12	Semester
Organic & Analytical Chemistry I H (SCI905)	11, 12	Semester
Organic & Analytical Chemistry II H (SCI915)	11, 12	Semester
Astronomy (SCI925)	10, 11, 12	Semester
Botany (SCI840)	11, 12	Full Year
AP Biology (SCI520)	10, 11, 12	Full Year
AP Chemistry (SCI530)	11, 12	Full Year
AP Environmental Science (SCI500)	11, 12	Full Year
AP Physics 1 (SCI420)	11, 12	Full Year
AP Physics 2 (SCI430)	12	Full Year
AP Physics C (SCI510)	12	Full Year

+ indicates required course

<b>Course Title: Biology H (SCI200), A (SCI210), B (SCI220)</b>	
<b>Level/Grade:</b> 9th	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> 8 <sup>th</sup> grade science teacher recommendation required for honors
<p><b>Course Description:</b></p> <p>This course is designed to give students a well-rounded background in key areas of biology. It introduces broad biological concepts and their application to all living systems. Fundamental concepts are discussed in varying degrees of depth depending on the level of the class. A major emphasis is placed on laboratory inquiries that allow the student to investigate various biological concepts and to develop process and analytical skills. Use of technology ranging from computers to laboratory equipment is emphasized. Major topics included are matter and energy as they travel through living systems; structure, function, and differentiation of cells; heredity and genetics from the molecular through the population level, ecosystem dynamics, and the evolution and classification of organisms. For the Honors level class reading and math skills should be excellent, students should be ready for independent self-motivated work, emphasis is placed on application and problem solving, abstract and visualization skills are important, and memorization is insufficient to be successful.</p> <p>This course is required for all Grade 9 students.</p>	

<b>Course Title: Chemistry H (SCI300), A (SCI310), B (SCI320)</b>	
<b>Level/Grade:</b> 10th	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Biology Teacher recommendation required for honors
<p><b>Course Description:</b></p> <p>This course provides students with an overview of chemistry and an understanding of the chemistry of matter. Using atomic schematization and structure as a foundation, bonding, chemical formulas, equations, periodicity and stoichiometric relationships will be explored. Gas laws and solubility factors will be employed to illustrate the interaction of pressure, concentration, temperature and reaction rates. Inquiry and process skills, laboratory techniques, and data collection and analysis are practiced and developed throughout the course.</p> <p>Chemistry and Biology may be taken concurrently with supervisor approval.</p>	

<b>Course Title: Physics A (SCI410), B (SCI420)</b>	
<b>Level/Grade:</b> 11	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Chemistry
<p><b>Course Description:</b></p> <p>This is an introductory course that will help students understand the universe through the basic laws of physics. Topics to be studied include mechanics, sound, light, electricity, circular motion, work, and energy. Emphasis will be place on problem solving, experimental laboratory work, and application of physics principles to authentic projects.</p>	

<b>Course Title: Environmental Science (SCI800)</b>	
<b>Level/Grade:</b> 11, 12	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Chemistry
<p><b>Course Description:</b></p> <p>Environmental Science is now a full year course designed to show thematic connections between a variety of science disciplines including biology, chemistry, and physics. It gives students a coherent and realistic picture of the applications of scientific concepts as they manifest in our environment. During this course, students will focus on human population growth, natural resources, and ecosystem dynamics. The aim of this course is to increase understanding of the environmental challenges of today, while continuing to cultivate scientific critical thinking skills. This course can serve as one of the three laboratory sciences required for graduation.</p>	

<b>Course Title: Animal Behavior (SCI955)</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Semester
	<b>Pre-requisites:</b> Biology
<b>Course Description:</b>	
<p>This course deals with the science of animal behavior on an individual, population, and interspecific basis. Laboratory work includes analytical experiments, field and laboratory observations, and data analysis. Students are expected to communicate their results in formal scientific papers. The major types of innate and acquired behavior will be studied with an emphasis on the evolution of adaptive behavior. Topics include taxis, reflexes, instinctive behavior, conditioned reflexes, imprinting, operant conditioning, observational learning, and reasoning in animals. Consideration will be given to social systems in animals including the concepts of sociobiology. Organisms studied will include protozoans, small invertebrates, fish, birds, and mammals.</p>	

<b>Course Title: Forensic Science</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Semester
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Biology
<b>Course Description:</b>	
<p>Forensic science is the application of multiple scientific disciplines to the investigation of criminal or civil questions of the law. In this course we will use biology, chemistry, and physics to analyze and interpret evidence within the realm of our legal system. We will begin with an introduction to scientific inquiry and the process of forensic investigation. We will then apply our knowledge of investigation to the analysis of trace evidence (hair, fiber, etc.), fingerprints, DNA, and blood. We will discuss and analyze the evidence revealed by bodies, crime scenes, and crime scene tools. Students will actively participate in labs and activities relating to the investigation of crime scenes and the analysis of evidence.</p>	

<b>Course Title: Marine Biology H (SCI845), A (SCI855)</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Semester
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Biology Teacher recommendation required for honors
<b>Course Description:</b>	
<p>This course deals with the interrelationships of living things in the marine environment. The ecological dynamics of the estuaries, oceans and bays will be investigated. Laboratory investigations will include field studies of the physical environment and interactions with the organisms of the marine world. The use of technologies such as GPS, SONAR, remote sensing, satellite imagery and chemical water analysis employed by marine scientist will be utilized. The course is designed to give students hands-on experiences to better understand the biological systems of the marine environment.</p>	

<b>Course Title: Anatomy &amp; Physiology H (SCI875), A (SCI865)</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Semester
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Biology Teacher recommendation required for honors
<b>Course Description:</b>	
<p>This course entails the study of the structure and function of the human body, commencing with a brief survey of all systems and how they interact to form the organism. The course will then focus on investigations of the cardiovascular, respiratory, nervous, skeletal, and digestive systems. The significance of histology to the understanding of the systems will also be discussed. Each unit includes anatomical, physiological, and clinical applications to the subject.</p>	

<b>Course Title: Genetics H (SCI885)</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Semester
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Biology
<b>Course Description:</b>	
<p>This hands-on, seminar course will examine a wide range of current topics in genetics as well as expand upon the genetic processes learned in students' biology course. Topics include and are not limited to personal genomics, genetic testing, bioethics, gene editing and therapy, types and benefits of biotechnology as well as review and expansion of prior knowledge learned. Students also participate in online discussions of current events on a regular basis.</p>	

<b>Course Title: Organic &amp; Analytical Chemistry I H (SCI905)</b>	
<b>Level/Grade:</b> 11, 12	<b>Length:</b> Semester
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Chemistry
<b>Course Description:</b>	
<p>Students will engage in activities that develop basic organic laboratory skills such as melting point determination, synthesis, distillation and re-crystallization. The concept-oriented course delves into diverse topics such as organic mechanisms, IUPAC nomenclature, and classification of organic families, functional groups and organic reactions. An introduction to principles of analytical chemistry will also be provided such as equilibrium and electrochemistry.</p>	

<b>Course Title: Organic &amp; Analytical Chemistry II H (SCI915)</b>	
<b>Level/Grade:</b> 11, 12	<b>Length:</b> Semester
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Organic & Analytical Chemistry I H
<b>Course Description:</b>	
<p>Students will study modern analytical laboratory techniques such as high-performance liquid chromatography, gas chromatography, and spectroscopy. Students will also test their own products and commercial grade equivalents in a laboratory setting. Advanced organic chemistry principles such as stereochemistry and chirality will be incorporated into the class. This course is recommended for students that aspire to careers in science or science related disciplines such as medicine, engineering, environmental science, marine biology, geology, or research.</p>	

<b>Course Title: Astronomy (SCI925)</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Semester
	<b>Pre-requisites:</b> Biology
<b>Course Description:</b>	
<p>This course is designed as an investigation of the world "beyond" Earth, highlighting Astronomy as a strictly observational science. Topics of study will include Moon-Earth-Sun relationships, the solar system, stars &amp; their evolution, constellations, galaxies, and the Universe. Special emphasis will be placed on the development of ideas and instrumentation in Astronomy from a historical perspective, and what the future holds.</p>	

<b>Course Title: Botany (SCI840)</b>	
<b>Level/Grade:</b> 11, 12	<b>Length:</b> Full Year
<b>Dual Enrollment with CCM</b>	<b>Pre-requisites:</b> Chemistry
<b>Course Description:</b>	
<p>This course provides an introductory study of botany including the topics of plant anatomy, growth and development, reproduction, photosynthesis and respiration, and a survey of diversity within the plant kingdom including angiosperms, gymnosperms, bryophytes and ferns. Upon successful completion of this course students will be able to: Identify the anatomical parts of plants and describe their functions; Identify the features of a plant cell and describe their functions; Explain the significance of the photosynthetic reactions; Explain the differences and ecological significance of C3, C4 and CAM pathways of photosynthesis; Compare and contrast the life cycles of seed plants versus non-seed plants; List the plant hormones and describe what influence they play in plant growth and development; List the characteristics of ten flowering plant families; Give at least five examples of plant adaptation to environmental stress.</p>	



<b>Course Title: AP Biology (SCI520)</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> 10 <sup>th</sup> Graders: Biology H; teacher recommendation 11 <sup>th</sup> and 12 <sup>th</sup> Graders: Chemistry; teacher recommendation
<b>Course Description:</b>	
<p>This Advanced Placement course is designed to be an equivalent of an introductory college course in Biology. The goal of the course is to provide students with the scientific principles, concepts, and methodologies required to understand biological systems. The course stresses scientific principles and includes a strong laboratory component. Students are expected to take the AP Exam and are encouraged to take the SAT Subject Test in biology.</p> <p><i>Students may be required to complete a summer assignment.</i></p>	

<b>Course Title: AP Chemistry (SCI530)</b>	
<b>Level/Grade:</b> 11, 12	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Chemistry; Algebra II; teacher recommendation
<b>Course Description:</b>	
<p>This Advanced Placement course is designed to be the equivalent of an introductory college course in chemistry. The course emphasizes the mathematical and theoretical aspects of inorganic chemistry. Laboratory work involves freshman college experiments in inorganic chemistry and semi- micro qualitative analysis. Students are expected to take the AP Exam and are encouraged to take the SAT Subject Test in chemistry.</p> <p><i>Students may be required to complete a summer assignment.</i></p>	

<b>Course Title: AP Environmental Science (SCI500)</b>	
<b>Level/Grade:</b> 10, 11, 12	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> 10 <sup>th</sup> Graders: Biology; teacher recommendation 11 <sup>th</sup> and 12 <sup>th</sup> Graders: Biology
<b>Course Description:</b>	
<p>This Advanced Placement course is designed to be the equivalent of an introductory college course in environmental science. The goal of the course is to provide 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 and/or preventing them. Laboratory and field investigations will be drawn from many areas of scientific study, such as biology, ecology, chemistry, physics, geology, meteorology and oceanography. This course stresses scientific principles and analysis and includes a strong laboratory and field investigation component. Students are expected to take the AP Environmental Science Test.</p>	

*Students may be required to complete a summer assignment.*

<b>Course Title: AP Physics 1 (SCI420)</b>	
<b>Level/Grade:</b> 11, 12	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> Algebra II; teacher recommendation or <b>co-requisite:</b> Algebra II H.
<b>Course Description:</b>  This course follows the curriculum set forth by the College Board and is equivalent to a first-year algebra-based college Physics course. Students will require a strong algebra background and knowledge of right triangle sine, cosine and tangent trigonometric ratios to be successful in this course. Topics include: kinematics, Newton's Laws of motion, torque, rotational motion and angular momentum, gravitation and circular motion, work, energy, power, linear momentum, oscillations, mechanical waves, sound, and an introduction to electric circuits. There will be a focus on inquiry-based laboratory activities which challenge students to design and carry out experiments targeting certain learning objectives. After the AP exam in May, an additional survey of Electricity and Magnetism will be conducted as time permits. It is highly recommended and expected for all students to take the AP Physics 1 exam in May. <i>Students may be required to complete a summer assignment.</i>	

<b>Course Title: AP Physics 2 (SCI430)</b>	
<b>Level/Grade:</b> 12	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> AP Physics 1 or Physics A with teacher recommendation
<b>Course Description:</b>  This course follows the curriculum set forth by the College Board and is equivalent to a second-year algebra-based college Physics course. Students will require a strong algebra background and knowledge of right triangle sine, cosine and tangent trigonometric ratios to be successful in this course. Topics include: Fluids, Thermodynamics, Electricity, Magnetism, Optics, and a survey of Modern Physics. There will be a focus on inquiry-based laboratory activities which challenge students to design and carry out experiments targeting certain learning objectives. After the AP exam in May, an additional survey of Modern Physics will be conducted as time permits. It is highly recommended and expected for all students to take the AP Physics 2 exam in May. <i>Students may be required to complete a summer assignment.</i>	

<b>Course Title: AP Physics C</b>	
<b>Level/Grade:</b> 12	<b>Length:</b> Full Year
<b>NCAA Approved Core Course</b>	<b>Pre-requisites:</b> AP Physics 1; Calculus co-requisite
<p><b>Course Description:</b></p> <p>The AP Physics “C” Level course includes topics in mechanics, electricity, and magnetism. Knowledge of calculus, algebra, and basic trigonometry is necessary for this course. The general areas covered are: kinematics, Newton’s laws of motion, work, energy, power, linear momentum, circular motion &amp; rotation, oscillations &amp; gravitation, electrostatics, electric circuits, magnetic fields, and electromagnetism. This course parallels college physics courses for students in physical sciences, engineering and some applied sciences. Students are expected to take the AP Exam and are encouraged to take the SAT II Subject Test in physics. Laboratory activities will incorporate application of modern computer and electronic technology. Concepts of basic physics will be reinforced and expanded through modern topical presentations in preparation for the AP Physics Test.</p> <p><i>Students may be required to complete a summer assignment.</i></p>	