

Science

■ *Enduring understandings:*

- The relationship between structures and functions
- The nature of change and equilibrium
- The interactions between science and society
- Energy flow in systems
- The creation of models to represent abstract ideas and phenomena
- The process of scientific reasoning and evaluation of ideas

SCIENCE SEQUENCE

While the state graduation requirement in science is two units, most Clayton High School students enroll in science all four years.

9th

**Freshman
Physics**

**Honors
Freshman
Physics**

10th

Chemistry

**Honors
Chemistry**

11th

Biology

**Honors
Biology**

*** AP
Biology**

**11th grade A.P. Biology enrollment by special recommendation only*

11th-12th

JUNIOR-SENIOR COURSE OPTIONS

AP Biology (Full Year)
AP Chemistry (Full Year)
AP Physics (Full Year)
Physics (Full Year)
Honors Physics (Full Year)
Astronomy (First Semester)
Aviation Science (Full Year)
Environmental Science (One Semester)
Medical & Athletic Biology (One Semester)
Meteorology (Second Semester)
Microbiology & Biotechnology (One Semester)

SCIENCE

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notes

While the state graduation requirement in science is two units, most Clayton High School students enroll in science all four years. All courses are laboratory oriented. Extended sessions of one and one-half period duration are scheduled on alternate days for most courses. Some junior/senior elective courses meet only for a single period each day, but require attendance at field/laboratory experiences held outside of the normal school schedule. Laboratory investigations are organized to give students experiences in collecting data, in analyzing and interpreting data, and in using mathematics as a tool of science. Science courses are structured to allow students of varying abilities to have successful learning experiences. Some courses are quantitative and designed for the student of high ability in mathematics as well as in science. Other courses require less mathematics and emphasize qualitative observations. All courses give the student an appreciation for the way scientists work and arrive at generalizations about natural phenomena and to give the student the background information necessary for the understanding of scientific concepts.

Students qualified for Honors Freshman Physics score high on a test for formal reasoning, take accelerated mathematics, and exhibit exceptional attitude and aptitude in 8th grade science. All students are expected to take physics, chemistry, and biology in high school. The standard courses (Physics, Chemistry, and Biology) are designed to challenge highly motivated students and also serve students with learning difficulties. The honors courses are fast paced, require high cognitive skills, and involve extensive preparation and organizational ability. They are designed to challenge students at a high level and to prepare students for the A.P. classes. The Advanced Placement classes follow the A.P. syllabus and are designed for students who will take an A.P. exam in May. The junior and senior electives are offered to students interested in specific aspects of science, and in most cases they are scheduled for a single period (rather than the extended schedule of most science courses) in order to more easily accommodate student scheduling.

Science teachers consider the requirements for the next level before recommending students. Students not fully qualified may be enrolled in a class with the consent of the instructor. The most qualified Honors Freshman Physics students will be recommended for Honors Chemistry; however, most sophomore students will take the standard Chemistry Class. Most juniors will take Biology. Some will qualify for Honors Biology and a very few will be recommended for Advanced Placement Biology. Students taking Honors or AP Biology as juniors are encouraged to choose a second science course from the electives. Students who take Honors Chemistry as sophomores and take two science courses as juniors should take Honors or A.P. Biology and either A.P. Physics or A.P. Chemistry. Students planning to take both A.P. Physics and A.P. Chemistry are encouraged to take A.P. Physics during their junior year. During the junior and senior years, students can enroll in elective science courses that include Aviation Science, Astronomy, Environmental Science, Medical and Athletic Biology, Meteorology, Microbiology/Biotechnology, Physics, Honors Physics, A.P. Biology, A.P. Chemistry, and A.P. Physics. Astronomy, Environmental Science, Medical and Athletic Biology, Meteorology, and Microbiology/Biotechnology are one-semester courses.

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ALGEBRA/PHYSICS

9th Grade
Science Credit - 1
Full Year
Math Credit - 1

Algebra/Physics is a freshman course that emphasizes the use of the symbolic language of algebra to model physical situations. This class is team-taught by a physics instructor and a mathematics instructor. The course is scheduled back-to-back to form a block of two periods daily. Topics studied include but are not limited to the following: Motion, Newton's Laws, Energy, Waves, Electricity, Mathematical Functions, Solving Equations, Probability, and Statistics. Enrollment requires faculty recommendation.

FRESHMAN PHYSICS

9th Grade
Credit - 1
Full Year

Freshman Physics is an introductory course to the formal study of the physical sciences. Students will develop major concepts in the kinematics, dynamics, energy, electricity and magnetism, and wave motion. Students will learn to build scientific models to describe the physical world by analyzing the results of laboratory experiments. The skills of experimental design, data collection and graphical analysis will be emphasized, allowing students to express these models verbally, diagrammatically, graphically, and algebraically. Students will build a laboratory portfolio, which includes results of each of the major investigations throughout the year.

HONORS FRESHMAN PHYSICS

9th Grade
Credit - 1
Full Year

Qualifying criteria: Teacher recommendation and skill evaluation

Honors Freshman Physics is an introductory course to a formal study of the physical sciences, with emphasis on mathematical problem solving. Students will develop major concepts in the kinematics, dynamics, energy, electricity, wave motion and light. Students will learn to build scientific models to describe the physical world by analyzing the results of laboratory experiments. The skills of experimental design, data collection, and graphical analysis will be emphasized, allowing students to express these models in words, in diagrams, graphically, and algebraically. This course moves at an accelerated pace and requires excellent reasoning skills and well-developed work and study habits. Fluency in the application of algebra is essential. Students will build a laboratory portfolio, which includes results of each of the major investigations throughout the year.

CHEMISTRY

10th Grade

Credit - 1

Full Year

Prerequisite: Successful Completion of Freshman Physics

This course introduces the important concepts of chemistry in the context of important issues and concerns of science, society, and technology. Some of the issues explored are water, petroleum, nuclear chemistry, energy, food, health, and environmental chemistry. The learning process will include reading, writing, discussion, decision-making activities, risk benefit analyses, laboratory activities, and student projects. Students will frequently work together in cooperative learning activities. Advanced mathematical skills are not required.

HONORS CHEMISTRY

10th Grade

Credit - 1

Full Year

Prerequisites: Recommendation of freshman science teacher

The models and theories of chemistry are developed in this course. Considerable emphasis is placed on the student's ability to interpret data, solve problems, and use higher order thinking skills. The core topics include models for atoms, chemical reactions, kinetic molecular theory, thermochemistry, chemical bonding, rates of reactions, equilibrium, acids and bases, and electrochemistry. The course will include reading, lecture/discussion, laboratory activities, and problem solving. This course is designed for students who have demonstrated success in honors mathematics and science courses. Laboratory reports will be required, and homework assignments are given daily. Each student needs a calculator. A college level text is used.

BIOLOGY

11th - 12th Grade

Credit - 1

Full Year

Prerequisite: Successful completion of Chemistry

This course examines all aspects of life science including cellular, structural, functional, behavioral, environmental, and evolutionary history. Students will develop an appreciation of the biological issues that they will confront in the twenty-first century. Students will conduct experiments, collect and analyze data, and maintain a laboratory notebook or a portfolio to gain an understanding of the processes of science. The main objective is to present biology as a science and to see the process of science as a reliable method of gaining useful, objective knowledge. The key to this understanding lies in the meaningful investigation of real scientific problems. Homework assignments will require readings from periodicals, printed handouts, and the text Biology - The Dynamics of Life. These will support classroom lectures and discussions and help students solve problems.

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HONORS BIOLOGY

11th - 12th Grade

Credit - 1

Full Year

Prerequisites: Successful Completion of Honors Chemistry and/or teacher recommendation

Honors Biology is an experimental science course that demonstrates the importance of biology in the twentieth century. Eleven core themes are interwoven throughout the course to build a holistic understanding of the essential elements of modern biology. These themes include the following: science as inquiry, science and society, biochemistry, the cell, organ systems and homeostasis, structure and function, heredity, molecular genetics, evolution, the diversity of life, and ecology. Honors Biology is geared for students who have demonstrated solid scientific reasoning skills, exceptional work and study habits, and a record of academic excellence in previous science courses. The Textbook will be BSCS Biology.

PHYSICS

11th - 12th Grade

Credit - 1

Full Year

Prerequisites: Chemistry and Biology. Facility with Algebra and Trigonometry

This course is designed as an introduction to the study of physics. It is appropriate for students who have never studied physics. It is also intended for students who have completed Freshman Physics and would like to extend their study of physics to include a broader range of topics with slightly greater emphasis on mathematical problem solving. The fundamental concepts of physics are emphasized with topics chosen from among the following: mechanics, wave motion, light, electricity, and magnetism. The course is laboratory based as students will build physics concepts through laboratory investigations. Students will be expected to gather and interpret data, analyze experimental results, and draw conclusions. Emphasis will be placed on the graphical analysis of experimental data. Experimental results will be documented in laboratory reports and organized as a laboratory portfolio. A scientific calculator capable of performing scientific notations and trigonometric functions is required. Although this course is taught at an introductory level, it is an excellent follow-up to Freshman Physics and includes many new topics and previously encountered topics in greater depth.

HONORS PHYSICS

(pending Board of Education approval)

11th - 12th Grade

Credit - 1

Full Year

Prerequisites: Honors Freshman Physics or teacher recommendation, Chemistry, and Biology (biology enrollment may be concurrent). Excellent skills in Algebra and Trigonometry.

This course is designed as an extension of the concepts learned in Honors Freshman Physics, but is also appropriate for the strongest students from Freshman Physics. The fundamentals of physics are emphasized with topics chosen from among the following: mechanics, electricity and magnetism, wave motion, light, and modern physics. The course is laboratory based as students will build physics concepts through laboratory investigations. Students will be expected to gather data, interpret data, summarize the results, and draw conclusions. Emphasis will be placed on the graphical analysis of experimental data. Experimental results will be documented in laboratory reports and organized as a laboratory portfolio. Solving physics problems using Algebra and Trigonometry will be a significant component of the course. A scientific calculator capable of performing scientific notations and trigonometric functions is required. This course is excellent preparation for students considering the study of science or medicine in college. Successful completion of the course will prepare students for success on the SAT II in physics.

AP PHYSICS

11th - 12th Grade

Credit - 1

Full Year

Prerequisites: Honors Freshman Physics or teacher recommendation, Honors Chemistry, and Honors or AP Biology (biology enrollment may be concurrent) Excellent skills in Algebra and Trigonometry.

Advanced Placement Physics is a rigorous and fast paced study of the major topics of classical physics with an introduction to modern physics. Advanced Placement Physics builds upon and serves to extend the skills developed in Honors Freshman Physics or Physics while broadening the topic base of those courses. A major component in the development of reasoning skills will be based upon the student's involvement in the laboratory. Experiments will be performed in each topic that allow students to investigate the physical relationships underlying each topic. The laboratory portfolio prepared by each student in the prerequisite physics course will be used as a frequent reference and as the basis for extensions of previously performed experiments. The presentation of Advanced Placement Physics will be made at the university level. The topics emphasized in the course include classical mechanics, fluids, heat and thermodynamics, electricity and magnetism, waves and optics, and atomic and nuclear physics. This collection of topics follows the recommendations of the College Board for an Advanced Placement Physics B course. Students will be expected to prepare for the Advanced Placement Physics Examination in May. This course demands strong study skills and a desire to invest considerable time and effort in the study of physics.

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AP CHEMISTRY

11th - 12th Grade

Credit - 1

Full Year

Prerequisite: Honors Chemistry and Biology (Biology may be concurrent)

This course is designed to be the equivalent of the general chemistry course usually taken during the first year of college. The course is designed to provide students with sufficient depth and breadth of understanding of chemical fundamentals, competence in dealing with chemical calculations, and experience in the nature and variety of laboratory experiments equivalent to that of a typical college course. Topics such as the atomic and molecular structure of matter, kinetic theory of gases, chemical equilibrium, chemical kinetics, electrochemistry, and basic principles of thermodynamics are emphasized. A substantial portion of class time is spent on understanding and applying these concepts through chemical problem solving. Students develop the ability to think clearly and to express their ideas in writing with clarity and logic. In addition, the behavior of chemical systems is investigated in the laboratory. A bound laboratory notebook is kept, and students submit a report of each experiment. Previous or concurrent enrollment in a senior level physics course is strongly recommended. Students electing to take both AP Physics and AP Chemistry prior to graduation are encouraged to take AP Physics during the junior year, doubling up with either Honors or AP Biology in the 11th grade. Each student is expected to take the AP Exam.

AP BIOLOGY

11th - 12th Grade

Credit - 1

Full Year

Prerequisites: Freshman Physics, Chemistry, and Biology

Advanced Placement Biology is an in-depth study of living systems. All levels of biology, from the molecular to the biosphere, will be presented to ensure that the students have developed an appreciation of the relationships among these levels. Investigations that include careful observation, question posing, hypothesis formulation, and hypothesis testing under controlled conditions will ensure that the students use the scientific process. The pupils will develop higher cognitive skills by analyzing and synthesizing experimental data and discussing contemporary biological issues. Biological concepts and principles will be taught at a university level. Emphasis will be placed on biochemistry, physiology, evolution, ecology, genetics, and cytology. The students will be prepared for and expected to take the Advanced Placement Biology Examination. A few exceptional science students will be recommended to take AP Biology as a junior without first taking Biology.

AVIATION SCIENCE

11th - 12th Grade

Credit - 1

Full Year

Prerequisites: Freshman Physics, Chemistry, and Biology (Biology may be concurrent)

Aviation Science is a junior-senior level science elective. Topics covered include aviation history, aerodynamics, flight technology, airspace, air navigation, radio navigation, aircraft performance, meteorology, flight physiology, and related FAA regulations. Classroom will include discussions of readings in the text book, viewing video tapes, laboratory experiments and demonstrations, practice exercises in navigation and flight performance, and guest speakers from commercial, military, corporate, and private aviation. A series of optional weekend trips to various aviation industries and local flight schools will provide the opportunity for students to apply the classroom theory through actual flights in various types of aircraft with certified flight instructors. Students desiring flight experiences are encouraged to purchase a pilot logbook and have flying time officially recorded for future credit towards flight time requirements for a license. Students exhibiting mastery of the course content will be eligible to take the FAA ground school written examination upon completion of the course. The textbooks include Aviation Fundamentals, Aviation Fundamentals Workbook, Federal Aviation Regulations, and Private Pilot Examination Questions (Jeppesen). This course meets one period per day.

ASTRONOMY

11th - 12th Grade

Credit - 1/2

Semester - 1

Prerequisites: Freshman Physics or Honors Freshman Physics, Chemistry, and Biology (Biology may be concurrent)

This is a one-semester course for juniors and seniors. This course will capitalize on the students' inherent interest in the limitless universe that surrounds them. Based on the "Project Star" approach, a strong emphasis will be placed on making measurements and observations as students explore the following topics: gravity, light and matter, history of astronomy, solar system (inner and outer planets, development), optics and telescopes, comets and asteroids, and stars (life cycle and classification). Observations will be both individual by student, (motion of Earth, Sun, and phases of moon) and at night group outings with a telescope. This course is offered during the first semester only. It meets one period per day with additional laboratory/field experiences planned outside of the regular school schedule.

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METEOROLOGY

11th - 12th Grade

Credit - 1/2

Semester - 2

Prerequisites: Freshman Physics or Honors Freshman Physics, Chemistry, and Biology (Biology may be concurrent)

This is a one-semester course for juniors and seniors. Everyday, students see or hear a weather forecast with maps and “fronts.” This course will build a foundation in the discipline of understanding and predicting both weather (short-term) and climate (long-term). Meteorology is a discipline that probes both everyday, local events (our weather), and global and sometimes catastrophic occurrences (El Nino, hurricanes, drought). Students will learn about the following topics: cloud development and classification, air pressure, forces and wind, moisture, condensation and precipitation, energy, light, color and optics, air masses and fronts, severe weather, pollution, global climate, and climate change. This course is offered in the second semester only. It meets one period per day with additional laboratory/field experiences planned outside of the regular school schedule.

ENVIRONMENTAL SCIENCE

11th - 12th Grade

Credit - 1/2

Semester 1 or 2

Prerequisites: Freshman Physics, Chemistry, and Biology (Biology may be concurrent)

Current events will be tied in with environmental and economic principles. Appropriate audio-visual materials will be utilized. Student role-playing will be utilized to create realistic scenarios with regard to current topics. Cooperative learning and inter-disciplinary interaction will all be used along with a portfolio system of mastery learning. Topics include the following: ecology; populations; water; solid and toxic waste; pesticides; air pollution and acid rain; forest, soil, and land management; wildlife, rain forests and endangered species; recycling and conservation; energy and energy management. Students interested in preparing for the Advanced Placement Exam in Environmental Science will be given additional assignments. This course meets one period per day with additional laboratory/field experiences planned outside of the regular school schedule.

MEDICAL & ATHLETIC BIOLOGY

11th - 12th Grade

Credit - 1/2

Semester 1 or 2

Prerequisites: Chemistry and Biology (Biology may be concurrent)

This course is designed for students who want to know more about human biology. Laboratory investigations will include microbiology, dissections, and biotechnology. The experiments will be related to medical problems and athletic performances. An emphasis on anatomy and physiology will give the students a good background for health-related fields. The scientific process will be encountered during the laboratory investigations, and the students will use science skills to do a scientific research project on a problem that they select. The text for this course is Anatomy and Physiology by Tortora and Grabowski. This course meets one period per day with additional laboratory/field experiences planned outside of the regular school schedule.

MICROBIOLOGY AND BIOTECHNOLOGY

12th Grade

Credit - 1/2

Semester 1 or 2

Prerequisites: Freshman Physics, Chemistry, and Biology

The 21st century has become the age of molecular biology. You cannot turn on the news or pick up a periodical and not find articles concerning biotechnology. Cloning species nearing extinction, DNA fingerprinting to solve crimes, gene therapy to cure diseases, and genetically modified plants and animals to feed the world are but a few of the applications of biotechnology. During this course we will be examining the scientific, social, and ethical aspects of biotechnology. Our "textbook" will be articles in periodicals and features in newspapers concerning biotechnology. We will also do extensive biotechnological laboratory investigations. Our laboratory text will be DNA Science by David Micklos. We will first study bacteria and viruses and learn identification methods and sterile technique. We will then learn how to manipulate genes and move them from one organism to another. We will also clone genes and cut them with restriction enzymes. We will identify DNA fragments using electrophoresis techniques. Independent experimentation will be encouraged. This course meets one period per day. The students will also be required to meet for additional contact time (approximately one hour per week) to complete laboratory investigations, seminars, and field trips.

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