

SCIENCE

Philosophy

The philosophy of the Science Department is that all students have the opportunity to gain an appreciation of the beauty and wonder of science, possess sufficient knowledge of science to engage in public discussions, are careful consumers of scientific information related to their everyday lives, and are able to continue learning about science outside of school.

Graduation Requirement for Class of 2022, 2023 and 2024

The Birmingham Board of Education approved new graduation requirements for the Class of 2022, 2023 and 2024.

The graduation requirements for the four science discipline areas, along with courses that fulfill each requirement, are listed in the table below. Please note that students can personalize their selections as their interests and future academic goals dictate.

Graduation Requirement	Course options
0.5 credit physics	0.5 credit Core Physics 1.0 credit Physics A&B * 1.0 credit AP Physics 1 A&B*
0.5 credit chemistry	0.5 credit Core Chemistry 1.0 credit Chemistry A&B* 1.0 credit Honors Chemistry A&B*
0.5 credit Earth science	0.5 credit Core Global Systems A 1.0 credit Core Global Systems A & Global Systems B 1.5 credit Advanced Placement Environmental Science A, B & C*
1.0 credit biology	1.0 credit Core Biology A&B* 1.0 credit Honors Core Biology A&B*
0.5 credit elective	0.5 credit science elective from course catalog (The B term of Chemistry, Physics, Global Systems, AP Environmental Science or AP Physics 1 courses, when taken as part of the full-year course, also meets this requirement.)

*Students must select all sections in order to fulfill the graduation requirement for this core disciplinary area

Class of 2022, 2023 and 2024 Sample Sequences

The science program offers many opportunities for students to personalize their science coursework to fit their interests and future college and career goals. The following sequences are only some of possible course clusters that satisfy the graduation requirement. Students should work with their science teachers and counselors to pick science courses that best fit their needs. Honors-level courses are available in place of Core Biology A/B, Chemistry A/B, and Physics A/B in the samples below.

	GRADE 9	GRADE 10	GRADE 11	GRADE 12
Liberal Arts Focus	<u>Core Chemistry</u> and <u>Core Physics</u>	<u>Core Biology A/B</u>	<u>Core Global Systems A</u> and Science elective	Optional courses beyond 3.0 credit graduation requirement, if desired
Health Science Focus	<u>Core Biology A/B</u>	<u>Chemistry A/B</u>	<u>Physics A/B</u> and <u>Core Global Systems A</u>	Anatomy & Physiology A/B AP Biology A/B/C
Earth/ Environmental Science Focus	<u>Core Chemistry</u> and <u>Core Physics</u> or <u>Core Biology A/B</u>	<u>Core Biology A/B</u> or <u>Chemistry A/B</u>	<u>Core Global Systems A</u> and Global Systems B or <u>AP Environmental Science A/B/C</u>	AP Environmental Science A/B/C Astronomy
Interdisciplinary Science Focus	<u>Core Chemistry</u> and <u>Core Physics</u>	<u>Core Biology A/B</u> and <u>Core Global Systems A</u>	<u>Chemistry A/B</u>	<u>AP Physics 1 A/B</u> AP Chemistry A/B/C, AP Biology A/B/C, or AP Environmental Science A/B/C
Engineering Focus	<u>Honors Chemistry A/B</u>	AP Chemistry A/B/C and <u>Core Global Systems A</u>	<u>Honors Core Biology A/B</u> and <u>AP Physics 1 A/B</u>	AP Physics C A/B/C AP Biology A/B/C
Science Department Electives:	Global Systems B Astronomy Forensic Science Anatomy & Physiology A/B	AP Biology A/B/C AP Chemistry A/B/C AP Environmental Science A/B/C AP Physics C A/B/C* AP Physics 2 A/B/C (Seaholm)	STEM Research & Design 1 (Seaholm) STEM Research & Design 2 (Seaholm) * Denotes class meets at Groves	

Underlined courses satisfy the graduation requirement.

Graduation Requirement for Class of 2021:

The science graduation requirements for students graduating in 2021 remain unchanged and are as follows:

1. **1 credit** of Biology (Biology AB or Honors Biology AB)
2. **1 credit** of Chemistry **OR** Physics (Chemistry AB, Honors Chemistry AB, Physics AB, AP Physics I AB), **OR 0.5 credit** Intro to Chemistry/Core Chemistry and **0.5 credit** Intro to Physics/Core Physics
3. **1 credit** of a science elective

While the minimum requirement for graduation is 3 credits, most universities expect students to complete 4 credits of science.

Class of 2021

Level	Grade 11	Grade 12
Honors	AP Physics I A 44002	Electives (see course descriptions for prerequisites):
	AP Physics I B 44012	
College Preparatory	Physics A 44022	AP Biology ABC 41042 41052 41053
	Physics B 44032	AP Chemistry ABC 42042 42052 42053
	STEM Physics ABC 40622 40632 40633	AP Environmental Science ABC 45042 45052 45053
	Chemistry A 42022	AP Physics 2: Algebra-Based AB 44082 44092
Essential	Chemistry B 42032	AP Physics C: Calculus-Based ABC 44062 44072 44073
	OR	Anatomy & Physiology AB 45002 45012
	Physics A 44022	Core Global Systems A 45062
	Physics B 44032	Global Systems B 45072
	Forensic Science 40052	
	Honors STEMx I Blended 40042	
	Core Physics 44142	
	Core Chemistry 45262	

Level	Grade 11	Grade 12
		Astronomy 40062 Forensic Science 40052 STEMx 1 40042BL STEMx 2 40052BL

SCIENCE COURSES

41102 Core Biology A

41112 Core Biology B

(1/2 unit of credit each)

Biology is a required laboratory- and activity-based course in which students investigate the fundamentals of biology, including ecology, energy transformations, cells, genetics, and evolution.

Grades Taught: 9, 10, 11

41162 Honors Core Biology A

41172 Honors Core Biology B

(1/2 unit of credit each)

Honors Core Biology is an accelerated two-trimester inquiry based course designed for students planning to pursue further studies in life science at the college level. Laboratory studies will represent a large portion of the curriculum. Conceptual analyses of principles of biology and chemistry will be emphasized. Major areas of study will include biochemistry, ecology, energy transformation, cellular division, genetics, molecular biology of the gene, DNA technology and evolution. Successful completion of this class will prepare students for the rigors of both Advanced Placement and collegiate level biology.

Grades Taught: 9, 10, 11

45002 Anatomy & Physiology A

45012 Anatomy & Physiology B

(1/2 unit of credit each)

The Anatomy and Physiology course is designed to prepare students for college anatomy and physiology, as well as careers in the health sciences. Students will explore the human body using a body-systems approach. Students will interact with a variety of healthcare professionals and experience real-world anatomy and physiology applications. Extensive laboratory time is spent exploring the structure and function of tissues, bones, muscles, and organs. This class will consist of classroom, online, and off-site study. All students who sign up for the class will have the opportunity to complete additional coursework in order to have their credit labeled as Honors on their transcript.

Prerequisites: Honors Core Biology or Core Biology A & B and Honors Chemistry or Chemistry A & B

Grades Taught: 11, 12

41042 AP Biology A

41052 AP Biology B

41053 AP Biology C

(½ unit of credit each)

The Advanced Placement Biology course is designed to be the equivalent of a college introductory biology course usually taken by life science majors during their first year of college. Students will learn the conceptual framework, knowledge, and analytical skills necessary to deal critically with the rapidly changing science of biology. Major areas of study will include biochemistry, energy transformation, cells, genetics, molecular genetics, biotechnology, evolution, and ecology. Students will complete a variety of laboratories, and they will be prepared to take the AP Biology Examination in May, for which they may gain college credit or placement.

Prerequisites: *Honors Core Biology or Core Biology A & B and Honors Chemistry or Chemistry A & B with grades of B or better*

Grades Taught: *11, 12*

45262 Core Chemistry

(½ unit of credit)

This is a college-preparatory, laboratory-oriented class in which students engage in investigations, problem-solving, and data-analysis tasks while learning fundamental topics in chemistry. Topics include properties of and changes in matter, atomic structure, bonding, and chemical reactions.

Prerequisites: *None*

Students who have completed Chemistry A&B are not eligible to take Core Chemistry.

Grades Taught: *9, 10, 11, 12*

42022 Chemistry A

42032 Chemistry B

(½ unit of credit each)

Chemistry is a laboratory-oriented program for students bound for college or for other post-secondary training. Topics covered include properties of matter, energy changes, stoichiometry, chemical bonding, chemical reactions, gas laws, solutions, and qualitative, quantitative and instrumental analysis. Emphasis is on laboratory skills, laboratory reporting, data analysis and general chemistry theory.

Prerequisites: *Integrated Math 1*

Grades Taught: *10, 11, 12*

42122 Honors Chemistry A

42132 Honors Chemistry B

(½ unit of credit each)

Honors Chemistry is a college-preparatory course that provides an opportunity for students to develop an in-depth understanding of the major areas of chemistry. Students will study the underlying principles and theories of chemistry while using mathematical skills during data-analysis and problem-solving activities. Students will engage in laboratory experiments designed to introduce, illustrate, and apply concepts learned in class. Topics of study include chemical change, atomic structure, bonding, chemical quantities, states of matter, gas laws, solutions, kinetics, equilibrium, acids and bases, and thermodynamics. Successful completion of this class will prepare students for the rigors of both Advanced Placement and collegiate level chemistry.

Prerequisites: *Integrated Math 1; Integrated Math 2 must be taken concurrently or previously.*

Grades Taught: *9, 10, 11, 12*

42042 AP Chemistry A

42052 AP Chemistry B

42053 AP Chemistry C

(½ unit of credit each)

Advanced Placement Chemistry is a three-term course that is sequential to Honors Chemistry. Topics previously discussed in chemistry are treated in greater depth. The course will develop theoretical concepts concurrently with laboratory investigations. Major topics will include thermodynamics, equilibrium, atomic and molecular structure, reaction kinetics, and the periodic relationships. Successful completion of this course may enable students to earn college credit through the Advanced Placement examination offered in May of each year.

Prerequisites: *Honors Chemistry or Chemistry A&B, and Integrated Math 2*

Grades Taught: *11, 12*

44142 Core Physics

(½ unit of credit)

This is a college preparatory laboratory class in which students will explore topics in physics such as kinematics, momentum, force, energy, electromagnetic radiation, and waves. Through laboratory investigations, data analysis, and problem-solving tasks, students will construct knowledge of physics in order to solve real-world problems.

Prerequisites: *None*

Students who have completed Physics A&B are not eligible for Core Physics.

Grades Taught: *9, 10, 11, 12*

44022 Physics A

44032 Physics B

(½ unit of credit each)

Physics is a two trimester, lab-based, college-preparatory course that covers the fundamental concepts of physics and how they model aspects of the physical world. Topics of study include mechanics, electricity, magnetism, waves, sound, and optics. Technological applications of physics are explored.

Prerequisites: *Integrated Math 1*

Grades Taught: *10, 11, 12*

44002 AP Physics 1 A

44012 AP Physics 1 B

(½ unit of credit each)

AP Physics 1 is a two-trimester laboratory course in which students develop many physics concepts from their own laboratory work. Students develop an understanding or awareness of the natural world and how ideas of physics are interrelated with experience, experiments, and technology. Major topics of study include mechanics, waves, sound, optics, electricity, and magnetism. Successful completion of this course may enable students to earn credit through the Advanced Placement Test offered in the spring.

Prerequisites: *Integrated Math 2; Pre-Calculus must be taken previously or concurrently.*

Grades Taught: *10, 11, 12*

44082 AP Physics 2: Algebra-Based A

44092 AP Physics 2: Algebra-Based B

(½ unit of credit each)

Advanced Placement Physics 2: Algebra-Based is a two-trimester college level course that explores topics in classical mechanics, electricity and magnetism, thermodynamics, waves and optics, atomic and nuclear physics, and fluids. Students will investigate these topics in the laboratory as they design experiments,

observe and measure real phenomena, analyze data, analyze errors, and communicate results. An emphasis is placed on using algebra and trigonometry to solve problems. Students who are interested in life science, business, law or not sure of their college major should consider taking this course as it offers a broad range of topics. Successful completion of this course may enable students to earn credit through the Advanced Placement Test offered in the spring.

Prerequisites: *AP Physics 1 or Physics; Pre-Calculus must be taken previously or concurrently.*

Grades Taught: 11, 12

44062 AP Physics C: Calculus-Based A

44072 AP Physics C: Calculus-Based B

44073 AP Physics C: Calculus-Based C

(½ unit of credit each)

Advanced Placement Physics Calculus-Based is a three-trimester college course that explores areas of physics not studied in depth in AP Physics 1 as well as many new topics while following the Advanced Placement Physics “C” outline. Major topics of study include mechanics, electricity, and magnetism with an emphasis on using calculus to analyze concepts and to problem solve. Students who are interested in pursuing university programs in engineering, physics, or chemistry should consider taking this course. Successful completion of this course may enable students to earn credit through the Advanced Placement tests offered in the spring.

Prerequisites: *AP Physics 1; Calculus must be taken previously or concurrently.*

Grades Taught: 11, 12

45062 Core Global Systems A

(½ unit of credit)

This is an interdisciplinary, laboratory-based course that will increase students’ global perspectives of the Earth’s systems. With a focus on the human impact on Earth’s geosphere, hydrosphere, and atmosphere, students will become versed in the importance of global citizenship in a changing world while developing applicable problem-solving strategies. This course is required for graduation starting with the Class of 2022.

Prerequisite: *None*

Grades Taught: 9, 10, 11, 12

45072 Global Systems B

(½ unit of credit)

Global Systems B is a college preparatory, interdisciplinary class in which students will explore topics such as early earth, plate tectonics, earthquakes, volcanoes, rock cycle, weather and climate. Through laboratory investigations, data analysis, and problem-solving tasks, students will construct knowledge of how the Earth was made and how we can predict its future. This course is an elective science course.

Prerequisite: *None*

Grades Taught: 9, 10, 11, 12

45042 AP Environmental Science A

45052 AP Environmental Science B

45053 AP Environmental Science C

(½ unit of credit each)

The AP Environmental Science course is designed to engage students with the scientific principles, concepts, and methodologies required to understand the interrelationships within the natural world. The course requires that students identify and analyze natural and human-made environmental problems, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving

or preventing them. Environmental science is interdisciplinary, embracing topics from geology, biology, environmental studies, environmental science, chemistry, and geography.

Prerequisites: *Core Biology or Honors Core Biology, Chemistry or Honors Chemistry, Integrated Math 1*

Grades Taught: 11, 12

40062 Astronomy

(½ unit of credit)

Astronomy is a one-trimester course that covers easily observed solar and lunar phenomena, as well as constellations. Students will learn how electromagnetic energy and various telescopes are used to study the sun and the evolution of stars into white dwarfs, neutron stars and black holes. Students will study the formation of our solar system and celestial objects like planets, moons, asteroids/meteoroids and comets. Moving beyond the solar system, students will compare our galaxy to others and learn about theories of the universe.

Prerequisite: *None*

Grades Taught: 11, 12

44052 Forensic Science

(½ unit of credit)

Forensic science is a one-trimester laboratory based investigative class that will cover a wide range of interdisciplinary science concepts. Students will apply biology, chemistry, and physics concepts to solve real-world forensic science questions. Students will learn how to observe, collect, analyze, and evaluate evidence found at crime scenes. The course will explore blood typing/spatter, fingerprinting, DNA gel electrophoresis, hair and fiber analysis, document analysis, toxicology, the history of forensic science, and careers in forensic science.

Prerequisites: *Honors Core Biology or Core Biology A&B, Honors Chemistry or Chemistry A&B or Core Chemistry taken previously or concurrently*

Grades taught: 11, 12

40042BL STEMx Research and Design 1

(1/2 unit of credit)

Honors STEMx Research and Design I provides opportunities for students to develop a STEM related project while embedding authentic data internships with professionals from the surrounding area. This is a blended course with numerous online activities and a combination of on campus lectures and off campus explorations. Students are introduced to the fundamental steps in scientific research methodologies, engineering design, and combining quantitative/qualitative methods of data analysis. In addition, students learn engineering skills by designing and analyzing processes and process units in order to assess product quality, measurement issues, economics, safety, and environmental/sustainability impact. This course will provide both, information on how to carry out and present various types of research, as well as knowledge of what STEM professionals must do to be successful in their work.

Prerequisites: *Honors Core Biology or Core Biology, Honors Chemistry or Chemistry, Physics must be taken previously or concurrently. Integrated Math 3 must be taken previously. Students must agree to District Policy for off campus exploration. Students must complete the STEMx R&D application. Can be taken for repeat credit.*

Grades taught: 11, 12

40052BL STEMx Research and Design 2

(1/2 unit of credit)

Honors STEMx Research and Design II will introduce students to action research, a form of self-reflective systematic inquiry by students on their own research practice. Action research is a flexible spiral process which allows action (change, improvement) and research (understanding, knowledge) to be achieved at the same time. The goals of action research are the improvement of research methodologies, a better understanding of data measurables, and an improvement in the "action" in which the research is carried out. The primary objective of the course is to prepare students to do action research in a long-term externship over the trimester.

Topics include an analysis of collaborative forms of research, ways to identify problems to investigate, the selection of appropriate research methods, collecting and analyzing data, and ways to draw conclusions from measurable research. The major assignment for the course will be the completion of a mini-research project undertaken in a professional setting outside the district in which the student is engaged with professional mentors.

- Research response groups will be formed and will meet weekly. They will identify, interpret, analyze, and synthesize research-based literature for the purpose of writing a review of the literature associated with a selected topic of interest in STEMx
- Design, implement, and measure an action research project related to the selected topic(s).

This is a blended course with numerous online activities and a combination of on campus lectures and off campus explorations.

Prerequisites: *STEMx Research and Design I. Honors Core Biology or Core Biology, Honors Chemistry or Chemistry; Physics must be taken previously or concurrently, Integrated Math 3 must be taken previously. Students must complete STEMx R&D application. Students must agree to District Policy for off campus exploration. Can be taken for repeat credit.*

Grades Taught: 11, 12

Science Transfer Policy

Level Change

A level change in science is defined as:

- Honors Bio \leftrightarrow Core Bio
- Honors Chemistry \leftrightarrow Chemistry
- AP Physics 1 \leftrightarrow Physics

Level changes may be made up to 4 weeks into the trimester with prior approval by both teachers, parents, and department head. The Science Level Change Form must be filled out and signed by all parties.

Students who transfer within the first two weeks of the trimester will be graded only on subsequent work in their new course, but be responsible for all of the content of the course in terms of future tests/quizzes and the final exam.

Students who transfer between 2 and 4 weeks into the trimester will have their grade from the previous course count as 20% of their trimester grade. The grades from their new course will count as 60% of their trimester grade. The final exam will count as 20% of their trimester grade. The student will be responsible for all of the content of the course in terms of future tests/quizzes and the final exam.

Students making a level change at the trimester mark must also fill out the Science Level Change Form.

Course Change

The following are not defined as level changes. These courses do not cover material at the same pace, depth, or sequence. These changes may only be made one week into the trimester.

Chemistry \leftrightarrow Core Chemistry

Physics \leftrightarrow Core Physics

SCIENCE FAQ

What science courses are offered for ninth-grade students?

Most students should take Core Chemistry (0.5 credits) and Core Physics (0.5 credits) or Core Biology A & B (1.0 credit). Other options include Honors Core Biology A & B (1.0 credit) and Honors Chemistry A & B (1.0 credit).

How will I know which science course to choose?

All of the classes are college preparatory. Sample sequences based on future college and career goals serve as guides for a decision. Your eighth-grade teacher will make a recommendation based on your goals and interests as well. Students electing Honors Chemistry, a sophomore-level course, must have Integrated Math 1 or higher in eighth grade.

How do Core Chemistry and Core Physics prepare me for future science classes?

Modern Biology courses cover many topics that are rooted in biochemistry. Core Chemistry provides a better foundation for students to understand those concepts. Similarly, many concepts in chemistry require students to understand motion, energy, and forces. Core Physics provides students with an understanding of those concepts prior to taking the full-year chemistry course.

If my student starts with Core Chemistry and Core Physics, are they able to take Advanced Placement science before they graduate?

Yes, students starting in Core Chemistry and Core Physics are able to take any of the Advanced Placement science courses during their high school years as long as they have the required pre-requisites completed. The science program gives your student options to personalize their science program. Please see the sample course sequences given in the course catalog. Please note that these are simply examples, many other combinations of courses exist.

What courses are required for graduation?

Students must take courses in each of the four core science disciplines, biology (1.0 credit), chemistry (0.5 credit), physics (0.5 credit), and Global Systems A (0.5 credit). In addition, students need to take an additional 0.5 credits in an elective or core area of their choosing. Please see the course catalog for a list of courses that meet these requirements.

What AP classes are offered in the Science Department?

- AP Biology is equivalent to a two-semester, introductory biology course in college. This is a three-trimester course.
- AP Chemistry is equivalent to a two-semester, introductory chemistry course in college. This is a three-trimester course.
- AP Environmental Science is equivalent to a two-semester, introductory environmental science course in college. This is a three-trimester course.
- AP Physics 1 is a first-year physics course that is not equivalent to an introductory college-level course. Students have the option of taking an AP exam at the end. This exam may be recognized for credit at the university level. This is a two-trimester course.
- AP Physics 2 Algebra-Based is a second-year physics course that addresses college-level physics concepts. This is a two-trimester course.
- AP Physics C is a second-year physics course that is equivalent to a two-semester, introductory physics course in college. This is a three-trimester course.