SCIENCE DEPARTMENT

All Worthington Kilbourne students are required to complete 3 units of credit with at least one credit in life sciences and one credit in physical science.

The science curriculum at the high school provides students with a broad range of experiences in all areas of science. These experiences are designed to prepare the student to meet the challenges of the 21st century and the complex decisions he or she will face as society deals with the technological age. The science program has as one of its goals to provide for science literacy. To accomplish that goal, students are encouraged to consider scheduling science during all four years. Most colleges recommend a minimum of three or four years. Many selective colleges require four years of science for students interested in science-related major areas of study.
The science program provides many opportunities for those students who wish to examine science concepts more deeply. These students can opt to take Honors Physical and Earth Systems Science 9, Honors Biological and Earth Systems Science 10, Honors Chemistry, and A.P. Physics. In addition, A.P. Biology and A.P. Chemistry may be taken by students wishing an additional year of study in these areas. Usually several science courses are offered in the summer to allow students to advance through the science sequence at a faster rate. All science courses include extensive laboratory experiences.

*SUGGESTED SEQUENCE

9th	10th	11th	12th
PESS 9	BESS 10	Natural Systems Science	Chemistry
PESS 9 or Hon. PESS 9	BESS 10 or Hon. BESS 10	Chemistry/ Hon. Chemistry or Natural Systems Science	Physics or AP Physics
PESS 9	BESS 10 & Chemistry	Physics or AP Physics	AP Chemistry and/or AP Biology
PESS 9	BESS 10	Natural Systems Science	No Science

*Read individual course descriptions and prerequisites to determine other combinations.

COURSES OFFERED

Grade	Course #	Course Title	Credits
9, 10, 11, 12	4010	Physical and Earth Systems 9	1
10, 11, 12	4030	Biological and Earth Systems 10	1
9	4020	Honors Physical and Earth Systems 9	1
10, 11	4040	Honors Biological and Earth Systems 10	1
10	4035	Biological and Earth Sys. 10 + English 2	2
11, 12	4105	Natural Systems Science	1
10, 11, 12	4200	Chemistry	1
10, 11, 12	4210	Honors Chemistry	1
11, 12	4300	Physics	1
11, 12	4320	Advanced Placement Physics	1
11, 12	4110	Advanced Placement Biology	1
11, 12	4220	Advanced Placement Chemistry	1
9, 10, 11, 12		Field Ecology	1
9, 10, 11, 12		Marine Ecology	1/2

PHYSICAL AND EARTH SYSTEMS SCIENCE 9

Grades: 9,10,11,12
2 Semesters — Prerequisite: None
1Credit — Graded: Conventional

Physical science concepts include the nature of matter and energy; identifiable physical properties of substances; and properties of forces that act on objects. Ninth graders learn about forces and motions, structures and properties of atoms, how atoms react with each other to form other substances, and how molecules react with each other or other atoms. Earth and space science topics include processes that move and shape the Earth; Earth's interaction with the Solar System; and gravitational forces and the weather. Students continue to develop a deeper understanding of the processes of scientific inquiry and how these processes use evidence to support conclusions based on logical reasoning. Students investigate ways in which science and technologies combine to meet human needs and solve human problems. Ninth graders trace the historical development of scientific theories and ideas, explore scientific theories, and develop their scientific literacy to become knowledgeable citizens. This course will include many mathematical problem experiences and their constructs. These topics will be presented and studied on both a qualitative and a quantitative basis. Class activities include both individual and group laboratory experimentation, lecture, discussions, demonstrations, and problem-solving. Evaluation is based on quizzes, tests, lab reports, lab techniques, and homework, and projects.

HONORS PHYSICAL AND EARTH SYSTEMS SCIENCE 9

Grade 9
2 Semesters — Prerequisites: 8th Grade teacher recommendation
1 Credit — Concurrent with Alg. 2 Recommended
Graded: Conventional

Physical science concepts include the nature of matter and energy; identifiable properties of substances; and properties of forces that act on objects. Ninth graders learn about forces and motions, structures and properties of atoms, how atoms react with each other to form other substances, and how molecules react with each other or other atoms. Earth and space science topics include processes that move and shape the Earth; Earth's interaction with the Solar System; and gravitational forces and the weather. Students continue to develop a deeper understanding of the processes of scientific inquiry and how these processes use evidence to support conclusions based on logical reasoning. Students investigate ways in which science and technologies combine to meet human needs and solve human problems. Ninth graders trace the historical development of scientific theories and ideas, explore scientific theories, and develop their scientific literacy to become knowledgeable citizens. Honors Physical and Earth Systems includes an increased emphasis on mathematical analysis of data with opportunities for students to engage in discovery or inquiry based learning that leads to independent investigations. Students examine additional literature and scientific reviews.

The students identify topics to research and then design and implement comprehensive culminating activities that incorporate technology in their applications and presentations. Teachers utilize rubrics that include standards that reflect higher level thinking skills to assess student performance.

BIOLOGICAL AND EARTH SYSTEMS SCIENCE 10

Grades: 10,11, 12
2 Semester — Graded: Conventional
1 Credit

This course emphasizes the concepts, principles, and theories that enable people to understand the living environment. Students study life science concepts such as cells and their structure and function, the genetic and molecular bases of inheritance, biological evolution and the diversity and interdependence of life. Students explain the Earth's history using geologic evidence, identify the Earth's resources, and explore processes that shape the Earth. The flow of energy and the cycling of matter through biological and ecological systems are taught in the 10th grade. Embedded throughout his study are the basic processes of inquiry, modeling investigations, and the nature of science. Students learn to trace the historical development of scientific theories, ideas, ethical guidelines in science, the interdependence of science and technology, and the study of emerging issues.

HONORS BIOLOGICAL AND EARTH SYSTEMS SCIENCE 10

Grades: 10, 11, 12
2 Semester — Prerequisite: Science teacher
1 Credit — recommendation
Graded: Conventional

This course emphasizes the concepts, principles, and theories that enable people to understand the living environment. Students study life science concepts such as cells and their structure and function, the genetic and molecular bases of inheritance, biological evolution and the diversity and interdependence of life. Students explain the Earth's history using geologic evidence, identify the Earth's resources, and explore processes that shape the Earth. The flow of energy and the cycling of matter through biological and ecological systems are taught in the 10th grade. Embedded throughout his study are the basic processes of inquiry, modeling investigations, and the nature of science. Students learn to trace the historical development of scientific theories, ideas, ethical guidelines in science, the interdependence of science and technology, and the study of emerging issues. Honors Biological and Earth Systems includes an increased emphasis on mathematical analysis of data with opportunities for students to engage in discovery or inquiry based learning that leads to independent investigations. Students examine additional literature and scientific reviews. The students identify topics to research and then design and implement comprehensive culminating activities

that incorporate technology in their applications and presentations. Teachers utilize rubrics that include standards that reflect higher level thinking skills to assess student performance.

BESS 10 + ENGLISH 2

Grade:10
2 Semesters — Prerequisite: Teacher Recommendation
1 Credit Science and — Graded: Conventional
1 Credit English

English 2 + BESS 10 connection is a course designed to integrate both the English and science curricula. These courses cover the same required material as the non-connected classes. (Refer to the course descriptions for English 2 and Biological and Earth Systems Science 2). However, much of the English curriculum includes literature that directly relates to the science concepts being studied. This type of blocking gives more continuity to each class, thus students are more focused and tend to learn concepts more quickly and thoroughly. Because the teachers are in daily communication, they avoid assigning major projects, papers, or tests on the same day, and together identify students who may be experiencing difficulties or have special needs. The atmosphere in the connections classroom is generally more relaxed and student oriented. Time each day may be set aside for students to meet with both teachers for clarification of assignments and concerns. By meeting appropriate criteria, students will have the opportunity to participate in a culminating field trip. Evaluations will be based on labs, homework, activities, project work, quizzes and tests.

NATURAL SYSTEMS SCIENCE

Grades: 11, 12
2 Semesters — Prerequisite: Two years of High School Science,
1 Credit — (2nd year can be concurrent)
and 2 years Math credit;
Graded: Conventional

This class can fulfill the third year science requirement. Students gain an understanding of space, the natural environment and the impact of humans. Students will investigate and analyze a variety of processes that cause change to the environment. These processes include global climate change, acquisition and use of natural resources, population dynamics, development of technology, and scientific inquiry. Students will also evaluate the relationship between advances in science and technology as well as predict the associated costs, risks, and benefits.

CHEMISTRY

Grades: 10, 11, 12
2 Semesters — Prerequisite: BESS 10 or concurrent with
1 Credit — BESS 10; Algebra 2, previous or concurrent
Recommended course to be taken before Physics
Graded: Conventional

This introductory-level chemistry course is designed primarily as a general broadening course for the non-science major or as a requirement fulfillment for the person needing chemistry for a chosen field such as nursing or dentistry. It will be preparation for college chemistry at the non-major level. This course will prepare the student to interpret everyday events in terms of chemical concepts and processes. The topics of study will be generally those of any introductory high school chemistry course: basic laboratory matter, atomic structure, chemical bonding, writing and using balanced chemical equations, acid-base reactions, introductory organic chemistry, oxidation-reduction, reaction rates and chemical equilibrium, analysis of substances as to both amount and nature of contents. This course includes many mathematical problem-solving experiences and theoretical constructs, but the overall emphasis will be placed upon the qualitative aspects of chemistry as well as the role chemistry plays in everyday life. Class activities include both individual and group laboratory experimentation, lecture, discussions, demonstrations, and problem-solving sessions. Evaluation is based upon quizzes, tests, lab reports, lab techniques, and homework.

HONORS CHEMISTRY

Grades: 10,11, 12
2 Semesters — Prerequisite: BESS 10 or concurrent with
1 Credit — BESS 10, Algebra 2, previous or concurrent.
A 3.0 or higher average in all high school
math courses is recommended.
Science teacher recommendation
Graded: Conventional

This introductory-level chemistry course is designed primarily to meet the needs of the high-ability, science major student. It will serve as preparation for students intending to major in the sciences at the college level. This course will prepare the student to interpret everyday events in terms of chemical concepts and processes. The topics of study will be generally those of any introductory high school chemistry course: basic laboratory techniques and safety procedures, types and states of matter, atomic structure, chemical bonding, writing and using balanced chemical equations, acid-base reactions, introductory organic chemistry, oxidation-reduction, and analysis of substances as to both amount and nature of contents. These topics will be presented and studied on a qualitative and quantitative basis. The theoretical and mathematical aspects of the studies will be extensive. Class activities include both individual and group laboratory experimentation, lecture, discussions, demonstrations, and problem-solving sessions. Evaluation is based upon quizzes, tests, lab reports, lab techniques, and homework.

PHYSICS

Grades: 11, 12
2 Semesters — Prerequisite: Algebra 2 and two successful years
1 Credit — of high school science;
Recommended to follow Chemistry
Graded: Conventional

This introductory-level physics course is designed primarily as a general broadening course for the non-science major or as a requirement fulfillment for the student needing physics for a chosen field such as nursing or dentistry. It will be preparation for physics at the college level. This course will prepare the student to interpret everyday events in terms of physical concepts and principles. The topics of study will generally be those of any introductory high school physics course: basic laboratory techniques and safety procedures, vectors, forces, straight line motion, curved motion, energy, light, waves, sound, electricity, magnetism, and modern physics. This course will include many mathematical problem experiences and their constructs. These topics will be presented and studied on both a qualitative and a quantitative basis. Class activities include both individual and group laboratory experimentation, lecture, discussions, demonstrations, and problem-solving. Evaluation is based on quizzes, tests, lab reports, lab techniques, and homework, and projects.

ADVANCED PLACEMENT PHYSICS

Grades: 11, 12
2 Semesters — Prerequisite: FST or concurrent with
1 Credit — FST, Chemistry or Honors Chemistry
(Recommended 3.0 or above average
in high school math courses)
Math and Science teacher recommendation
Graded: Conventional, weighted

This first year physics course is primarily to meet the needs of the high-ability, science major student. It will serve as a preparation for students intending to major in the sciences at the college level. The topics of study will generally be those of any introductory high school physics course: basic laboratory techniques and safety procedures, vectors, forces, straight line motion, curved motion, energy, light, waves, sound, electricity, magnetism, and modern physics. These topics will be presented and studied on a qualitative and quantitative basis. The theoretical and mathematical aspects of the studies will be extensive. Class activities include both individual and group laboratory experimentation, lecture, discussions, demonstrations, and problem solving sessions. Evaluation is based on quizzes, tests, lab techniques, homework and projects.

ADVANCED PLACEMENT BIOLOGY

Grades: 11, 12
2 Semesters — Prerequisite: BESS 10 or Honors BESS 10 and
Chemistry or Honors Chemistry
1 Credit — Recommended: 3.0 Average and
Science Teacher Recommendation
Graded: Conventional, weighted

This course is designed to provide an in-depth study of some of the major concepts of Biology. These concepts include, but are not necessarily limited to: cellular function, biochemistry, bioenergetics, protein synthesis, genetics, evolution, population dynamics, animal biology and physiology, and plant biology and physiology. Other topics may be introduced as class interest and time permit. Teaching methods include a heavy reading load as well as lectures, discussions and laboratory experiences. Students electing this course should be highly motivated and be willing to move at a fast rate. Evaluation is based on quizzes, tests, lab reports, and homework.

ADVANCED PLACEMENT CHEMISTRY

Grades: 11,12

2 Semesters — Prerequisite: Chemistry or Honors Chemistry Credit with 3.0 Average; Physics or concurrent with Physics is recommended

Graded: Conventional, weighted

This course is designed to provide additional preparation for those students who have taken or are taking all the other available physical science courses. The use of mathematics is extensive. The serious student may wish to take the test for advanced placement college credit after completing this course. College-level texts and laboratory books are used, although not completely covered. Laboratory work is used extensively in the course and is often a cooperative venture. Individual areas of interest may be investigated. Evaluation is based upon homework, laboratory results and reports, quizzes and tests. There are frequent time requirements during the school day, outside of class time. It is recommended that students have an option period available.

FIELD ECOLOGY

Grades: 9, 10, 11, 12

Summer School Enrollment and 1 Credit (Does not replace any of the required 3 credits of science) — Prerequisite: None

Graded:Pass/Fail

Program Fee

Field Ecology offers participants an opportunity to travel in and explore unique ecosystems. This class is offered through Worthington Field Studies, Inc. and involves approximately a month-long field experience to interesting destinations in the western part of North America. Students study biology, geology and Native American cultures of the Southwestern or Rocky Mountain regions. Activities including camping, hiking, backpacking, and rafting are integral to this unique field experience. Participants are expected to highly motivated and in good physical condition.

MARINE ECOLOGY

Grade: 9, 10, 11, 12

Arranged - Spring Break
1/2 Credit
(Does not replace any of the required 3 credits of science) — Prerequisite: None

Graded: Pass/Fail

Program Fee

Marine Ecology offers participants an opportunity to travel and explore the unique ecology of the coral reef. This class is offered through Worthington Field Studies, Inc. and involves a week-long trip during Spring Break to the Caribbean or the West Indies. Students study the biology, geology and oceanography of the region. Activities include snorkeling and scuba diving. Participants are expected to be highly motivated, good swimmers and in good physical condition.