

# SCIENCE

***Indiana Education Roundtable: “Research clearly establishes that a rigorous academic curriculum is the single-most significant factor in determining a student’s success in college.”***

All Carmel High School science courses are Core 40 approved.

## **COURSES AVAILABLE TO FRESHMEN:**

Biology I

Biology I, Honors

PLTW - Principles of Biomedical Science

## **COURSES AVAILABLE TO SOPHOMORES:**

Integrated Chemistry – Physics

Earth and Space Science I

Chemistry I

Chemistry I, Honors

PLTW - Principles of Biomedical Science

PLTW - Human Body Systems

## **COURSES AVAILABLE TO JUNIORS:**

All courses listed above except Biology I, Honors Biology, and PLTW Principles of Biomedical Science

Advanced Science, Human Anatomy and Physiology

Advanced Science, Human Genetics

Advanced Science, Zoology

Advanced Science, Botany

Advanced Science, Ecology

Advanced Science, Astronomy

Advanced Science, Meteorology

Advanced Science, Materials Chemistry

Advanced Science, Physical Geology

Advanced Science, Organic and Biochemistry Chemistry

Advanced Placement/ Physics-I

Advanced Placement, Chemistry

Advanced Placement, Biology

Advanced Placement, Environmental Science

International Baccalaureate Biology HL

International Baccalaureate Biology, SL

International Baccalaureate Environmental Systems and Societies, SL

International Baccalaureate Physics SL

International Baccalaureate Physics HL

Physics

Project Lead the Way - Human Body Systems

Project Lead the Way - Medical Interventions

## **COURSES AVAILABLE TO SENIORS:**

All courses listed above except Biology I, Honors Biology, PLTW Principles of Biomedical Science and PLTW Human Body Systems

Advanced Placement, Physics-2

Advanced Placement, Physics C

International Baccalaureate Physics SL 3&4

International Baccalaureate Physics HL 3&4

Project Lead the Way - Biomedical Innovations

Advanced Science, Independent Study

## **BIOLOGICAL SCIENCES**

### **BIOLOGY I (3024)**

Classification: Regular

Prerequisite: None

Open to: 9

Course Length: Two Semesters

Credit: 2 RW

Biology I is a course based on regular laboratory investigations, including study of the characteristics of living organisms as outlined in the Indiana Academic Standards. Students enrolled in Biology I explore the functions and processes of cells, including cellular chemistry, matter and energy cycles, cellular reproduction, and the molecular basis of heredity. In addition, the topics of genetics, biological evolution, and the ecology are explored. Throughout the course, students will gain an understanding of the nature of science including the history and development of biological knowledge. This is a required Core 40 and AHD course. The Biology I Learn will be administered in the spring.

### **BIOLOGY I, Honors (3024)**

Classification: Honors

Prerequisite: Recommendation

Open to: 9

Course Length: Two Semesters

Credit: 2 PW

Honors Biology I provides an in depth study of life at different levels of organization as outlined in the Indiana Academic Standards. All content is covered with an emphasis on the nature of scientific inquiry. Topics include cellular chemistry, cell structure and function, matter and energy cycles, DNA and gene expression, cellular reproduction, genetics, biological evolution, and ecology. Peer collaboration, laboratory investigations, communication of scientific data, and student projects are major components of this course. This is a required Core 40 and AHD course. The Biology I Learn will be administered in the spring.

**ADVANCED SCIENCE, Zoology (3092)**

Classification: Regular

Prerequisite: Biology

Open to: 11-12

Course Length: One Semester

Credit: 1 RW

This Advanced Science Core 40 course will present an in-depth study of evolutionary relationships used in the classification of organisms into their representative phyla. Students will study comparative embryology, taxonomy, anatomy and physiology of the major phyla of invertebrates and vertebrates. Students will do laboratory work in dissection and histology. The purpose of a study in invertebrate and vertebrate zoology is to expose the students to an evolutionary, embryological, systematic, and physical comparison of phyla of the animal kingdom.

**ADVANCED SCIENCE, Botany (3092)**

Classification: Regular

Prerequisite: Biology I

Open to: 11-12

Course Length: One Semester

Credit: 1RW

Botany is an upper level science course that will study plant varieties, functions and environmental roles. The course will include laboratory and field work.

**ADVANCED SCIENCE, Human Anatomy and Physiology Biology (5276)**

Classification: Regular, Career-Technical

Prerequisites: Biology (Bs or better) and Chemistry (Bs or better)

Open to: 11-12

Course Length: Two Semesters

Credits: 2 FW

Human Anatomy and Physiology is the study of the structure and function of the body and how those parts relate to one another. The course begins at the molecular/cellular level and proceeds through the study of tissues and organ systems. Discussions on disease and injuries are an integral part of the course. Dissections of animal organs and a fetal pig will also be performed. This is a college level anatomy and physiology class.

**ADVANCED SCIENCE, Human Genetics (3092)**

Classification: Regular

Prerequisite: Biology

Open to: 11-12

Course Length: One Semester

Credit: 1 RW

This one-semester course in Human Genetics will include: a review of basic genetics, embryology, human traits and variations, causes and prevention of birth defects, karyotyping, pedigrees, blood groups, cloning, DNA fingerprinting, telomeres and aging, the Human Genome Project, chromosome syndromes and bioethics.

### **ADVANCED SCIENCE, Ecology (3092)**

Classification: Regular

Prerequisite: Biology

Open to: 11-12

Course Length: One Semester

Credit: 1 RW

Ecology is the study of the distribution and abundance of life and interactions between and among organisms and their environment, including the impact of human activities on the natural world. It draws on elements from biology, chemistry, physics, mathematics, and the social sciences. This course is lab and field based. Whenever possible careers related to ecology and relevant case studies will be emphasized.

### **BIOLOGY, Advanced Placement (3020)**

Classification: AP

Prerequisites: Biology and Chemistry

Open to: 11-12

Course Length: Two Semesters

Credit: 2 FW

AP Biology is a challenging course designed for students who may be interested in studying life sciences in college. Topics covered include evolution, ecology, biochemistry, cells, microbiology, animals, plants, and genetics. The AP Biology curriculum centers on four "Big Ideas": 1) The process of evolution drives the diversity and unity of life. 2) Biological systems utilize energy and molecular building blocks to grow, to reproduce and to maintain homeostasis. 3) Living systems store, retrieve, transmit and respond to information essential to life processes. 4) Biological systems interact, and these systems and their interactions possess complex properties.

### **PLTW, Principles of Biomedical Science (5218)**

Classification: PLTW

Prerequisite: None

Open to: 9-10

Course Length: Two Semesters

Credit: 2 FW

In this course, students explore concepts of biology and medicine as they take on roles of different medical professionals to solve real-world problems. Over the course of the year, students are challenged in various scenarios including investigating a crime scene to solve a mystery, diagnosing and proposing treatment to patients in a family medical practice, to tracking down and containing a medical outbreak at a local hospital, stabilizing a patient during an emergency, and collaborating with others to design solutions to local and global medical problems.

### **PLTW, Human Body Systems (5216)**

Classification: PLTW

Prerequisite: Principles of Biomedical Science

Open to: 10-11

Course Length: Two Semesters

Credit: 2 FW

Students examine the interactions of human body systems as they explore identity, power, movement, protection, and homeostasis. Exploring science in action, students build organs and tissues on a skeletal Maniken®; use data acquisition software to monitor body functions such as muscle movement, reflex and voluntary action, and respiration; and take on the roles of biomedical professionals to solve real-world medical cases.

### **PLTW, Medical Interventions (5217)**

Classification: PLTW

Prerequisites: Principles of Biomedical Science and Human Body Systems

Open to: 11-12

Course Length: Two Semesters

Credit: 2 FW

Students follow the life of a fictitious family as they investigate how to prevent, diagnose, and treat disease. Students explore how to detect and fight infection; screen and evaluate the code in human DNA; evaluate cancer treatment options; and prevail when the organs of the body begin to fail. Through real-world cases, students are exposed to a range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics.

### **PLTW, Biomedical Innovations (5219)**

Classification: PLTW

Prerequisites: Strong grades in PBS, HBS and Medical Innovations

Open to: 12

Course Length: Two Semesters

Credit: 2 FW, Dual Credit Ivy Tech

In this capstone course, students apply their knowledge and skills to answer questions and solve problems related to the biomedical sciences. Students design innovative solutions for the health challenges of the 21st century as they work through progressively challenging open-ended problems, addressing topics such as clinical medicine, physiology, biomedical engineering, and public health. Students will also spend the final quarter working on an independent project.

In addition to the regular coursework, students will be provided opportunities to shadow professionals with careers in biomedical science and health care. Because students will be expected to shadow a minimum of 20 hours, students should be motivated to explore biomedical related careers. Applicants will be responsible for arranging his/her own transportation to and from the shadowing locations. The school reserves the right to reassign participants to a study hall if they are unwilling or unable to satisfactorily represent Carmel High School in a professional setting. For students to be successful in this course, they need strong time management skills, an enthusiasm for learning, the ability to take initiative and be self directed, a positive attitude, and strong work ethic. Shadowing could be done on designated school days if the student's senior schedule allows for it.

## **PHYSICAL SCIENCES**

### **ADVANCED SCIENCE, Materials Science (3092)**

Classification: Regular

Prerequisite: Chemistry

Open to: 11,12

Course Length: One Semester

Credit: 1RW

Materials science course is a 1 semester course that will focus on solids. Students will do numerous labs for various types of solids. This class is intended for students who enjoyed Chemistry I but are not inclined to take AP Chemistry.

### **INTEGRATED CHEMISTRY PHYSICS (3108)**

Classification: Regular

Prerequisite: Algebra I

Open to: 10-12. This course is not open to students who have earned credit in Chemistry or Physics

Course Length: Two Semesters

Credits: 2 RW

Integrated Chemistry-Physics is an introductory, laboratory-based course in which students explore fundamental chemistry and physics principles. Students will examine the structure and properties of matter, chemical reactions, motion, forces, and the interactions between energy and matter. Students in need of a more conceptual introduction to either Chemistry or Physics should consider this course. ICP is not a substitute for full-year chemistry or physics, but it does satisfy Indiana Core 40 diploma requirements in the physical sciences category.

### **CHEMISTRY I (3064)**

Classification: Regular

Prerequisite: Algebra I

Open to: 10-12

Course Length: Two Semesters

Credits: 2 RW

In this course, students will study aspects of chemistry such as physical and chemical changes, matter, the arrangement of the periodic table, the mole, chemical reactions, gas laws, thermochemistry and other various topics. This course requires good problem solving skills and is a laboratory course. Students will need a scientific calculator. This course satisfies the Indiana Core 40 diploma requirement for physical science.

### **CHEMISTRY I, Honors (3064)**

Classification: Honors

Prerequisites: Biology, Algebra I, Geometry is also recommended

Open to: 10-11

Course Length: Two Semesters

Credits: 2 PW

Honors Chemistry students will be challenged to a depth of understanding and analytical problem solving skills in the following topics: matter and change, measurement, atomic structure, periodic law, chemical bonding and nomenclature, reaction types and balancing, stoichiometry, gas laws, solutions and colligative properties, acids and bases, energy and kinetics, equilibrium, redox and electrochemistry, and the basics of organic chemistry. This course satisfies the Indiana Core 40 diploma requirement for physical science.

### **ADVANCED SCIENCE, Introduction to Organic and Biochemistry (3092)**

Classification: Regular

Prerequisite: Chemistry I (L)

Open to: 11-12

Course Length: One Semester

Credit: 1 RW

Organic chemistry studies carbon compounds and their reactions to produce new and unique molecules. The course focuses on the application of chemical concepts to understanding how and why reactions occur, and ultimately how reactions can be used to create a desired product. Laboratory work and independent research are used to build essential skills and learn important applications such as aspirin synthesis and alcohol fermentation.

**CHEMISTRY, AP (3060)**

Classification: AP

Prerequisites: Algebra II with a B or better (or recommendation from Honors Chemistry teacher.) Honors Chemistry with a B or better.

Open to: 11-12

Course Length: Two Semesters

Credits: 2 FW

Chemistry, Advanced Placement (L) is a course that follows the College Board's Advanced Placement course outline. The course is intended for the students who are planning on pursuing a career in a field of science. The course emphasizes problem solving. Approximately 30-50% of class time will be devoted to laboratory activities. The course meets Indiana Core 40 and AHD requirements in the area of Physical Science. Students enrolled in the course prepare for the College Board's Chemistry Advanced Placement Examination.

**PHYSICS I (3084)**

Classification: Regular

Prerequisites: Geometry and Algebra II, strong math students can take concurrently with Algebra II

Open to: 11-12

Course Length: Two Semesters

Credit: 2 RW

Physics I is a laboratory-based course in which students will study the laws which dictate our universe. Topics include mechanics (kinematics, forces, energy and momentum), electricity, magnetism, waves (sound, light and optics), temperature and some aspects of modern physics. Regular laboratory experiments will be performed in small groups promoting collaboration among peers. Physics I will emphasize problem solving using mathematics.

**PHYSICS-I, AP (3080)**

Classification: AP

Prerequisites: Geometry and Algebra II. Recommended only for students with Bs or better.

Open to: 11-12

Course Length: Two Semesters

Credit: 2 FW

AP Physics I follows the College Board guidelines for Advanced Placement Physics I. This course is intended for the students who plan to major in science in college or for those who plan to take AP Physics II or AP Physics C the following year. It is a laboratory-based course in which students will study the laws which dictate our universe. Topics include mechanics (kinematics, forces, energy and momentum), electricity, magnetism, waves (sound, light and optics), thermodynamics, fluid mechanics and modern physics. AP Physics I will emphasize problem solving using higher levels of mathematics than required in regular Physics I and the pace of AP Physics I is faster than Physics I since more material is covered during the year. Trigonometry will be taught to the extent it is needed. This course prepares students for the Physics 1 Advanced Placement Exam.

**PHYSICS-II, AP (3080)**

Classification: AP

Prerequisites: Algebra II and Physics 1 AP

Open to: 11-12

Course Length: Two Semesters

Credit: 2 FW

AP Physics II follows the College Board guidelines for Advanced Placement Physics II. AP Physics II is an algebra-based, introductory college-level physics course that explores topics such as fluid statics and dynamics; thermodynamics with kinetic theory; PV diagrams and probability; electrostatics; electrical circuits with capacitors; magnetic fields; electromagnetism; physical and geometric optics; and quantum, atomic, and nuclear physics. Through inquiry-based learning, students will develop scientific critical thinking and reasoning skills. This course prepares students for the Physics 2 Advanced Placement Exam.

**PHYSICS C, Advanced Placement (3088)**

Classification: Advanced Placement

Prerequisite: AP Physics I or IB Physics SL, Calculus AB or BC (concurrent or already taken) or Calculus Survey with physics teacher recommendation

Open to: 12

Course Length: Two semesters

Credit: 2 FW

AP Physics C follows the College Board guidelines for Advanced Placement Physics C. This course is designed for students who plan to major in science or engineering in college. The first semester of this course covers advanced topics in Mechanics. A basic working knowledge of Calculus will be taught and applied to Physics problems and concepts. The second semester of this course covers advanced topics in Electricity and Magnetism. Students enrolled in this course prepare for the College Board's Physics C Advanced Placement Examination.

**EARTH AND SPACE SCIENCES****EARTH AND SPACE SCIENCE I (3044)**

Classification: Regular

Prerequisite: None

Open to: 10-11 (Grade 12 students should consider Astronomy, Meteorology or Physical Geology)

Course Length: Two Semesters

Credits: 2 RW

Earth Science is a laboratory science course which explores the origins and connections between the physical, chemical, and biological processes of the Earth system. This course examines Earth's materials, and changes of the surface and interior. Included is a look at the forces which cause these changes, interpreted within the context of plate tectonics. Earth Science also examines the interaction between Earth's weather and climate. Finally, a major division of Earth Science is astronomy, the study of our solar system, stars and the universe.

**ADVANCED SCIENCE, Astronomy (3092)**

Classification: Regular, Dual Credit Available

Prerequisite: Geometry

Open to: 11-12

Course Length: One Semester

Credit: 1 RW

Astronomy is the study of the physical nature of objects in the universe and methods used by scientists to understand them. Topics covered in this course are: the Solar System, stars, nebulae, galaxies and cosmology. Current and future NASA projects and research are a key aspect of the course. Students use the Carmel Planetarium as a classroom.

**ADVANCED SCIENCE, Meteorology (3092)**

Classification: Regular

Prerequisites: None

Open to: 11-12

Course Length: One Semester

Credit: 1 RW

This course will focus on the basic principles of weather. Topics include developing an understanding of physical processes responsible for daily weather changes, through laboratory and field studies. We will begin with an overview of the components making up the atmospheric environment. Weather fronts, air masses, and severe weather will be examined. Various types of technology will be used in monitoring weather patterns. Guest speakers may be used to discuss how professional services develop forecasts on a daily basis. Students enrolled in this course will research and prepare class presentations.

**ADVANCED SCIENCE, Physical Geology (3092)**

Classification: Regular

Open To: 11-12

Prerequisite: None

Course Length: One Semester

Credit: 1 RW

This course is an overview of concepts studied in physical geology. Students will study the structure and dynamics of Planet Earth and their impact on human beings. Plate tectonics and its relationship to landforms and catastrophic events, weathering and erosion, and earth resources are some topics that will be studied.

**ENVIRONMENTAL SCIENCE, AP (3012)**

Classification: Advanced Placement

Open to: 11-12

Prerequisites: B or better in Biology or Chemistry, C or better in Honors Biology or Honors Chemistry

Course Length: Two Semesters

Credit: 2 FW

AP Environmental Science integrates concepts from Biology, Earth Science, Chemistry, and Social Sciences in the study of modern environmental issues. This college-level course is designed 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 or preventing them. Through lab and field investigations, students will explore ecosystems, populations, renewable and non-renewable resources, land and water use, pollution, and global change. Curriculum is aligned to that recommended by the College Board and is designed to prepare students for the Advanced Placement Environmental Science Examination.

**INDEPENDENT RESEARCH  
SCIENCE RESEARCH, INDEPENDENT STUDY**

(3008)

Classification: Science Research

Prerequisite:

Open to: 12 and occasionally 11

Course Length: Up to Two Semesters

Credit: Up to 2 RW

Independent Study is a course reserved for seniors and occasionally juniors that have the opportunity to do research with a college or university. Independent study will require students to provide their own transportation to their research opportunity and will require students to enter their research into a science fair or research competition.

**INTERNATIONAL BACCALAUREATE DIPLOMA PROGRAMME**

**ENVIRONMENTAL SYSTEMS AND SOCIETIES (3016)**

Classification: IB

Prerequisites: Biology and Chemistry

Open to: 11-12

Course Length: Two Semesters

Credit: 2 FW

Through studying environmental systems and societies (ES&S) students will be provided with a coherent perspective of the interrelationships between environmental systems and societies; one that enables them to adopt an informed personal response to the wide range of pressing environmental issues that they will inevitably come to face. While it is not required that students take the IB Environmental Systems and Societies exam, it is expected—the focus of the class is to adequately prepare students toward this end.

**BIOLOGY, HIGH LEVEL, IB (3032)**

Classification: IB

Prerequisites: Biology and Chemistry

Open to: 11-12

Course Length: Four Semesters

Credit: 4 FW

IB Biology Higher Level focuses on six core topics: cell biology, molecular biology, genetics, ecology, evolution/biodiversity, and human physiology. It is based on the curriculum published by the International Baccalaureate Organization, which provides a practical approach to the course delivery, emphasized through the interdisciplinary group project, and a mixture of both short-term and long-term experiments and investigations. In this HL level, students are required to study the SL topics in greater depth, as well as an additional eight topics: nucleic acids, metabolism, cell respiration, photosynthesis, genetics and evolution, animal physiology, and plant biology. Optional course topics for students include neurobiology and behavior, biotechnology and bioinformatics, ecology and conservations, and human physiology. IB Biology HL is a two-year course taken over a student's junior and senior years. The junior year covers the SL topics, and the senior year covers the additional 8 topics and prepares students for the IB assessments and exam. While it is not required that students take the IB Biology HL exam, it is expected—the focus of the class is to adequately prepare students toward this end.

**BIOLOGY, STANDARD LEVEL, IB (3034)**

Classification: IB

Prerequisites: Biology and Chemistry

Open to: 11-12

Course Length: Two Semesters

Credit: 2 FW

IB Biology Standard Level focuses on six core topics: cell biology, molecular biology, genetics, ecology, evolution and biodiversity, and human physiology. It is based on the curriculum published by the 23 Indiana Department of Education High School Course Titles and Descriptions International Baccalaureate Organization, which provides a practical approach to the course delivery, emphasized through the interdisciplinary group project, and a mixture of both short-term and long-term experiments and investigations. Optional course topics include neurobiology and behavior, biotechnology and bioinformatics, ecology and conservation, and human physiology. IB Biology SL is a one year IB course. While it is not required that students take the IB Biology SL exam, it is expected—the focus of the class is to adequately prepare students toward this end.

**PHYSICS, STANDARD LEVEL IB (3098)**

Classification: IB

Prerequisites: Biology, Chemistry and Algebra 2

Open to: 11-12

Course Length: Two Semesters

Credit: 2 FW

IB Physics (SL) is a course focused on the study of Newtonian mechanics, forces, thermal physics, waves, electricity, magnetism, and nuclear physics. Students will have opportunities to learn the historical development of physics through models, laws, theories, and their applications. The course emphasizes problem solving and student-driven lab inquiry. This course intends to develop student understanding, use, and evaluation of scientific facts, concepts, methods, and techniques. IB Physics SL is a beneficial class to students pursuing a science-related field in college and/or an IB diploma. While it is not required that students take the IB Physics SL exam, it is expected—the focus of the class is to adequately prepare students toward this end. This course is a 2 year commitment.

## **PHYSICS, HIGHER LEVEL IB (3096)**

Classification: IB

Prerequisites: Biology, Chemistry and Algebra 2

Open to: 11

Course Length: Four Semesters

Credit: 4 FW

IB HL Physics is a two-year course. IB Physics HL is a course focused on the study of Newtonian mechanics, thermal physics, waves, electricity, magnetism, and nuclear physics. Students will have opportunities to learn the historical development of physics through models, laws, theories, and their applications. The course emphasizes problem solving and student-driven lab inquiry.

The level of the course is comparable to a first-year course in physics at a university, but with an emphasis on conceptual understanding. The HL Physics course is designed to give students a good preparation for the demands of university calculus-based courses in physics. IB Physics HL is ideal for students with a strong interest in fields such as engineering, physics, mathematics, or architecture. While it is not required that students take the IB Physics HL exam, it is expected—the focus of the class is to adequately prepare students toward this end.

## **APPLIED BIOLOGY**

Classification: Special Services

Prerequisites: None

Open to: 9,10,11,12

Applied Units: 2

Counts as a Science Requirement for the Certificate of Completion

Applied Biology I is a course based on the following core topics: cellular chemistry, structure and reproduction; matter cycles and energy transfer; interdependence of organisms; molecular basis of heredity; genetics and evolution. Instruction should focus on developing student understanding that scientific knowledge is gained from observation of natural phenomena and experimentation by designing and conducting investigations guided by theory and by evaluating and communicating the results of those investigations according to accepted procedures.

## **APPLIED EARTH SPACE SCIENCE**

Classification: Special Services

Prerequisites: None

Open to: 9,10,11,12

Applied Units: 2

Counts as a Science Requirement for the Certificate of Completion

Applied Earth Space Science is a course in which students develop problem solving skills and strategies while performing laboratory and field investigations of fundamental chemical, physical, and related earth and space science concepts and principles that are related to students' interests and that address everyday problems.