

# LaSalle-Peru Township High School District 120



## Science Curriculum

Adopted by the Board of Education, August 15, 2018

## Table of Contents

|   |    |
|---|----|
| Acknowledgements.....                     | 3  |
| Introduction.....                         | 4  |
| District Mission.....                     | 6  |
| Subject Area Mission.....                 | 7  |
| Course Purposes.....                      | 8  |
| Curriculum at a Glance .....              | 10 |
| Biology.....                              | 30 |
| Biology Honors.....                       | 34 |
| Chemistry.....                            | 39 |
| Chemistry Honors .....                    | 44 |
| Chemistry of Living Systems.....          | 51 |
| Earth Science .....                       | 54 |
| Forensic Science Honors.....              | 61 |
| Human Anatomy and Physiology Honors ..... | 73 |
| Physical Science.....                     | 80 |
| Physics .....                             | 84 |
| Physics Honors.....                       | 90 |
| AP Biology.....                           | 97 |
| AP Chemistry.....                         | 98 |

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## Introduction

The purpose of the LaSalle-Peru Township High School District's Science Curriculum is to provide coherent, rigorous instruction that results in students being able to acquire and apply scientific knowledge to unique situations as well as have the ability to think and reason scientifically. The curriculum includes specific outcomes and components for these outcomes which further clarify the skills necessary to achieve each outcome. Each outcome also describes the depth of knowledge and level of rigor required for students to demonstrate their conceptual understanding of the outlined curriculum.

The *Outcomes and Components* are **grade-level/course specific**. These have been carefully aligned to the New Illinois Learning Standards for Science (Next Generation Science Standards), and teachers are expected to align their instruction to the identified outcomes for each course. Outcomes express the essential learning that all students in the grade level/course must know or be able to do in the content area. They make connections among separate concepts or skills described in the components. Outcomes require high cognitive levels and direct assessment. Components state simple and complex concepts or skills that students must know or do in order to perform each outcome. All outcomes and components are to be included within the course of instruction for the year. Assessments will be written at the outcome level.

The study of science assists students in making informed decisions concerning issues ranging from healthcare to energy policy that affect themselves, their families, and their communities. In addition, it also assists students to be equipped with the skills necessary for all careers – within and beyond STEM fields. Students will also have the right foundation to tackle long-term and difficult issues facing our and future generations.

Each outcome has been assigned a code number consisting of symbols for content area, grade level or course, and outcome number. In the example shown below, SCI stands for Science (content area) – B stands for Biology (course) – 1 symbolizes that it is the first outcome in this course.

Example:

**Outcome SCI.B.1:**

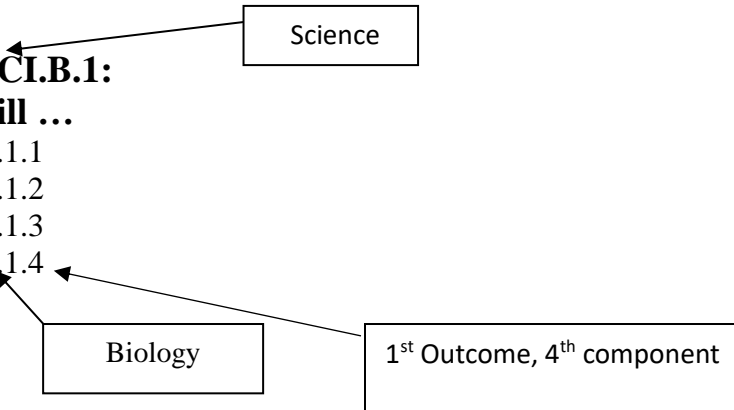
**Students will ...**

SCI.B.1.1

SCI.B.1.2

SCI.B.1.3

SCI.B.1.4



At the end of each outcome, the code number in parentheses indicates the Illinois Learning Standards for Science (Next Generation Science Standards) to which it aligns and includes the category, domain, and standard number. The following is a link to the complete Illinois Learning Standards for Science – <http://isbe.state.il.us/nils/science/default.htm>

There are many steps to the curriculum implementation process. The draft curriculum will be implemented during the 2016-17 school year. During that time, teachers will provide feedback to validate the draft curriculum. Based on teacher feedback, the SAC will then make revisions as deemed necessary and finalize the curriculum. During the 2017-18 school year, the SAC will select aligned resources and develop common outcome assessments. The following year, 2018-19, teachers will administer the assessments and provide feedback to validate them. The SAC will make revisions and finalize the assessments. The curriculum and assessments will be fully implemented for several years before the curriculum development process begins again in 2021-22.

*We Are*



## **District Mission Statement**

The Mission of LaSalle-Peru Township High School is to educate all students to the highest standards in a safe and challenging environment while developing within each of them:

- The ability to think critically, solve problems, and communicate effectively.
- Pride and respect in themselves, school, and community.
- An inspiration to become life-long learners who meet the challenges of an ever-changing and diverse world.

## **Vision Statement**

Learn... Grow... Lead... Excellence is our Standard.

## **Beliefs**

We believe that...

- Every person should strive for excellence.
- Every person is unique and worthy of respect.
- LPHS is the core of the community.
- Students need a safe school.
- Today's learners must be educated to meet tomorrow's challenges.

## **Science Subject Area Mission**

Students completing the Science curriculum at LPHS utilize literacy skills to think critically and apply inquiry to formulate solutions relating science and technology to societal and environmental challenges. In order to be college and career ready, as well as life-long learners, students will:

- Ask questions and define problems;
- Develop and use models;
- Plan and carry out investigations;
- Analyze and interpret data;
- Use mathematics and computational thinking;
- Construct explanations and design solutions;
- Evaluate conflicting viewpoints based on evidence; and
- Obtain, evaluate, and communicate information effectively.

## **Course Purposes**

### **Biology:**

Students will examine organisms to determine their characteristic structures, functions, and interdependence using scientific knowledge and methods. They will generate solutions to real-world problems through critical thinking and effective communication.

### **Biology Honors:**

Students will examine organisms to determine their characteristic structures, functions, and interdependence using scientific knowledge and methods. Students will create solutions to real-world problems through critical thinking and effective communication. Students will develop dissection skills using preserved animals.

### **Chemistry:**

Students will examine the states of matter, predict how gases behave under various conditions, classify types of chemical bonds, and investigate how chemical reactions occur. Students will identify and explain the significance of atomic structure and its relation to the periodic table.

### **Chemistry Honors:**

Students will investigate the mole in order to predict the relationships among reactants and products in a chemical reaction. Students will examine the states of matter, predict how gases behave under various conditions, describe how intermolecular forces affect the properties of matter, classify types of chemical bonds, and investigate how chemical reactions occur. Students will identify and explain the significance of atomic structure and its relation to the periodic table.

### **Chemistry of Living Systems:**

Students will utilize laboratory skills to examine and classify organic functional groups and their chemical reactions.



**Earth Science:**

Students will analyze earth systems to predict natural phenomena such as weather, earthquakes, and volcanic eruptions. Students will compare and contrast space systems to discuss the formulation of our solar system. Students will investigate and examine Earth's natural resources to assess human sustainability.

**Forensic Science Honors:**

Students will utilize the proper investigative techniques of collection, preservation, analysis, and interpretation of physical evidence to determine solutions and principles related to solving simulated crimes.

**Human Anatomy and Physiology Honors:**

Students will analyze conditions of body systems caused by disease to formulate medical diagnoses in hypothetical situations. Students will determine the relationships between form and function of the human body through dissection, model examination, and microscope viewing. Students will also conduct independent research to investigate careers available in the anatomy and physiology field.

**Physical Science:**

Students will solve problems related to motion, energy, and matter using appropriate tools, operations, methods, and measurements, and they will analyze and interpret data in order to predict and explain natural phenomena.

**Physics:**

Students will solve problems involving motion, energy and matter using appropriate tools, methods, measurements, and complex mathematical formulas to analyze and interpret data related to predicting and explaining natural phenomena.

**Physics Honors:**

Students will solve problems involving motion, energy and matter using appropriate tools, methods, measurements, and complex mathematical formulas to analyze and interpret data related to predicting and explaining natural phenomena with an emphasis on solving complex mathematical equations.

# Curriculum at a Glance

## Biology

### Course Purpose:

Students will examine organisms to determine their characteristic structures, functions, and interdependence using scientific knowledge and methods. They will generate solutions to real-world problems through critical thinking and effective communication.

- SCI.B.1** Students will utilize the scientific method and knowledge of the characteristics of living things to solve real world problems. (HS-LS1-3, HS-LS2-7, HS-ETS1-2, HS-ETS1-3)
- SCI.B.2** Students will utilize hierarchical organization to classify organisms into different groups. (HS-LS1-2, HS-LS2-1)
- SCI.B.3** Students will investigate how the distribution and abundance of organisms and populations in ecosystems are limited by the availability of resources and the ability of the ecosystem to recycle materials. (HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS2-8, HS-LS4-6, HS-ETS1-4, HS-ESS3-1, HS-ESS3-3, HS-ESS3-4, HS-ETS1-1)
- SCI.B.4** Students will relate the principles of chemistry to living things. (HS-LS1-6, HS-LS2-4)
- SCI.B.5** Students will utilize the cell theory to discuss how cells maintain their structures and functions through homeostasis. (HS-LS1-3)
- SCI.B.6** Students will demonstrate the cycling of matter and the transfer of energy to the cells of all living things. (HS-LS1-5, HS-LS1-1, HS-LS2-3, HS-LS2-5, HS-LS1-7)
- SCI.B.7** Students will correlate the structures and functions of mitosis and meiosis to the roles they play in cellular reproduction, gamete formation, and genetic variation. (HS-LS1-4, HS-LS3-2)
- SCI.B.8** Students will relate the role of Mendel's laws of heredity as it helped pave the way for other scientists to discover the function and structure of DNA. (HS-LS3-1, HS-LS3-3)
- SCI.B.9** Students will construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life. (HS-LS1-1)

- SCI.B.10**      **Students will support the claims that changes in environmental conditions may result in three things: 1) Increase in the number of individuals of some species, 2) the emergence of new species over time, and 3) the extinction of other species by relating those changes to the theory of evolution. (HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-ESS1-5, HS-ESS1-6, HS-ESS2-7)**
- SCI.B.11**      **Students will evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. (HS-LS2-8)**
- SCI.B.12**      **Students will examine ancient Earth materials and apply the theory of plate tectonics to construct an account of the Earth's formation, early history, and life on Earth. (HS-ESS1-5, HS-ESS1-6, HS-ESS2-1, HS-ESS2-2, HS-ESS2-7)**

## **Biology Honors**

### **Course Purpose:**

Students will examine organisms to determine their characteristic structures, functions, and interdependence using scientific knowledge and methods. Students will create solutions to real-world problems through critical thinking and effective communication. Students will develop dissection skills using preserved animals.

- SCI.BH.1** Students will utilize the scientific method and knowledge of the characteristics of living things to solve real world problems. (HS-LS1-3, HS-LS2-7, HS-ETS1-2, ETS1-3)
- SCI.BH.2** Students will utilize hierarchical organization to classify organisms into different groups. (HS-LS1-2, HS-LS2-1)
- SCI.BH.3** Students will investigate how the distribution and abundance of organisms and populations in ecosystems are limited by the availability of resources and the ability of the ecosystem to recycle materials. (HS-LS2-2, HS-LS2-6, HS-LS2-8, HS-LS4-6, HS-ETS1-4, HS-ESS3-1, HS-ESS3-3, HS-ESS3-4, HS-ETS1-1)
- SCI.BH.4** Students will relate the principles of chemistry to living things. (HS-LS1-6, HS-LS2-4)
- SCI.BH.5** Students will utilize the cell theory to discuss how cells maintain their structures and functions through homeostasis. (HS-LS1-3)
- SCI.BH.6** Students will demonstrate the cycling of matter and the transfer of energy to the cells of all living things. (HS-LS1-5, HS-LS1-1, HS-LS2-3, HS-LS2-5, HS-LS1-7)
- SCI.BH.7** Students will correlate the structures and functions of mitosis and meiosis to the roles they play in cellular reproduction, gamete formation, and genetic variation. (HS-LS1-4, HS-LS3-2)
- SCI.BH.8** Students will relate the role of Mendel's laws of heredity as it helped pave the way for other scientists to discover the function and structure of DNA. (HS-LS3-1, HS-LS3-3)
- SCI.BH.9** Students will construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life. (HS-LS1-1)

- SCI.BH.10** Students will support the claims that changes in environmental conditions may result in three things: 1) increase in the number of individuals of some species 2) the emergence of new species over time, and 3) the extinction of other species by relating those changes to the theory of evolution. (HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-ESS1-5, HS-ESS1-6, HS-ESS2-7)
- SCI.BH.11** Students will evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. (HS-LS2-8)
- SCI.BH.12** Students will examine ancient Earth materials and apply the theory of plate tectonics construct an account of Earth's formation, early history, and life on Earth. (HS-ESS1-5, HS-ESS1-6, HS-ESS2-1, HS-ESS2-2, HS-ESS2-7)
- SCI.BH.13** Students will develop dissection skills using preserved animals. (HS-LS1-2)

## Chemistry

### Course Purpose:

Students will examine the states of matter, predict how gases behave under various conditions, classify types of chemical bonds, and investigate how chemical reactions occur. Students will identify and explain the significance of atomic structure and its relation to the periodic table.

- SCI.CHEM.1**      **Students will classify matter, distinguish between physical and chemical properties/changes, and list the steps for the scientific method. (HS-PS1-3, HS-PS1-4, HS-ESS3-2)**
- SCI.CHEM.2**      **Students will apply standards of measurement and convert units of measurement using factor label method (dimensional analysis). Students will analyze data using percent error. Students will identify direct and inverse proportions. (HS-PS1-3, HS-ESS3-5, HS-PS2-6)**
- SCI.CHEM.3**      **Students will identify and determine the number of subatomic particles for a given isotope and use Dalton's Atomic Theory to explain the Law of Conservation of Mass. (HS-PS1-1, HS-PS1-7, HS-ESS2-6, HS-PS1-8, HS-ESS2-6)**
- SCI.CHEM.4**      **Students will explain the relationship among speed, wavelength, frequency, and energy of electromagnetic radiation. Students will define and identify the four quantum numbers and write the electron configuration for the atoms of any element. (HS-PS4-1, HS-PS1-2, HS-PS4-3, HS-PS4-4)**
- SCI.CHEM.5**      **Students will analyze the trends in the periodic table to better understand properties of chemical families. (HS-PS1-1, HS-PS1-2)**
- SCI.CHEM.6**      **Students will explain why most atoms form chemical bonds, classify the three types of chemical bonds, and describe the properties associated with different types of chemical bonds. (HS-PS1-1)**
- SCI.CHEM.7**      **Students will write chemical names and chemical formulas for ionic and molecular compounds. Students will determine percent composition of the elements in a compound.**
- SCI.CHEM.8**      **Students will identify five types of chemical reactions, write and balance chemical equations, and identify factors that affect chemical reactions. (HS-PS1-2, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-ESS2-4)**

- SCI.CHEM.9** Students will describe the motion of particles and the properties of the three states of matter according to kinetic molecular theory. Students will describe the properties of water and how the properties are determined by the structure of water. (HS-PS3-1, HS-PS3-4, HS-ESS2-5)
- SCI.CHEM.10** Students will define pressure and use Boyle's law, Charles' law, Gay-Lussac's law, and the combined gas law to calculate changes in pressure, volume, and temperature of a gas. Students will use Dalton's law of Partial Pressure to calculate the total pressure of a mixture of gases. (HS-ESS3-6)
- SCI.CHEM.11** Students will state the law of combining volumes, Avogadro's law, and define standard molar volume. Students will state and use the ideal gas law to calculate pressure, volume, temperature, or amount of gas when the other three variables are known. Students will describe effusion and diffusion and calculate rates of effusion using Graham's law of Effusion.
- SCI.CHEM.12** Students will compare properties of solutions, suspensions, and colloids and distinguish between electrolytes and nonelectrolytes. Students will describe factors involved in making a solution and the types of solutions. Students will determine the concentration of a solution using percent by mass and percent by volume and define molarity and molality. Students will describe freezing point depression and boiling point elevation. (HS-PS1-3, HS-PS1-7)

## **Chemistry Honors:**

### **Course Purpose:**

Students will investigate the mole in order to predict the relationships among reactants and products in a chemical reaction. Students will examine the states of matter, predict how gases behave under various conditions, describe how intermolecular forces affect the properties of matter, classify types of chemical bonds, and investigate how chemical reactions occur. Students will identify and explain the significance of atomic structure and its relation to the periodic table.

- SCI.CHEMH.1**      **Students will classify matter, distinguish between physical and chemical properties/changes, and list the steps for the scientific method. (HS-PS1-3, HS-PS1-4, HS-ESS3-2)**
- SCI.CHEMH.2**      **Students will apply standards of measurement and convert units of measurement using factor label method. Students will analyze data using significant figures, accuracy, precision, and percent error. Students will distinguish direct and inverse proportions. (HS-PS1-3, HS-PS2-6, HS-ESS3-5)**
- SCI.CHEMH.3**      **Students will identify and determine the number of subatomic particles for a given isotope, solve different types of mole problems, and use Dalton's Atomic Theory to explain the Law of Conservation of Mass. (HS-PS1-1, HS-PS1-7, HS-PS1-8, HS-ESS2-6)**
- SCI.CHEMH.4**      **Students will explain and calculate the relationship among speed, wavelength, frequency, and energy of electromagnetic radiation. Students will define the four quantum numbers and describe their significance. Students will write the electron configuration for the atoms of any element. (HS-PS4-1, HS-PS1-2, HS-PS4-3, HS-PS4-4)**
- SCI.CHEMH.5**      **Students will analyze the trends in the periodic table to better understand properties of chemical families. (HS-PS1-1, HS-PS1-2)**
- SCI.CHEMH.6**      **Students will explain why most atoms form chemical bonds, classify the three types of chemical bonds, and describe the properties associated with different types of chemical bonds. (HS-PS1-1)**
- SCI.CHEMH.7**      **Students will write chemical names and chemical formulas for ionic and molecular compounds. Students will determine the oxidation number of the atoms in a given compound. Students will convert grams to moles or moles to grams of a given compound, determine percent composition of the elements in a compound, and given the percent composition of a compound determine the simplest formula.**



- SCI.CHEMH.8** Students will identify five types of chemical reactions, write and balance chemical equations, predict production of simple reactions, and identify factors that affect chemical reactions. (HS-PS1-2, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-ESS2-4)
- SCI.CHEMH.9** Students will solve different types of stoichiometry problems, determine the limiting reactant, and calculate percent yield. (HS-PS1-7)
- SCI.CHEMH.10** Students will describe the motion of particles and the properties of the three states of matter according to kinetic molecular theory. Students will explain relationships between equilibrium and changes of state. Students will describe the properties of water and how the properties are determined by the structure of water. (HS-PS3-1, HS-PS3-4, HS-ESS2-5)
- SCI.CHEMH.11** Students will define pressure and use Boyle's law, Charles' law, Gay-Lussac's law, and the combined gas law to calculate changes in pressure, volume, and temperature of a gas. Students will use Dalton's law of Partial Pressure to calculate the total pressure of a mixture of gases. (HS-ESS3-6)
- SCI.CHEMH.12** Students will state the law of combining volumes, Avogadro's law, and define standard molar volume. Students will state and use the ideal gas law to calculate pressure, volume, temperature, or amount of gas when the other three variables are known. Students will describe effusion and diffusion and calculate rates of effusion using Graham's law of Effusion.
- SCI.CHEMH.13** Students will compare properties of solutions, suspensions, and colloids and distinguish between electrolytes and nonelectrolytes. Students will describe factors involved in making a solution and the types of solutions. Students will determine the concentration of a solution using percent by mass, percent by volume, molarity, and molality. Students will calculate freezing point depression and boiling point elevation. (HS-PS1-3, HS-PS1-7)

## **Chemistry of Living Systems**

### **Course Purpose:**

Students will utilize laboratory skills to examine and classify organic functional groups and their chemical reactions.

- SCI.CLS.1** Students will identify acids and bases and describe their properties. Students will write neutralization reactions and describe reactions of acids with carbonates and bicarbonates.
- SCI.CLS.2** Students will calculate and describe how to dilute a solution. Students will use acid-base titration to determine the molarity of an unknown solution. Students will use the pH scale to classify a substance as an acid or a base and use the ion product of water to calculate hydronium ion or hydroxide ion concentration.
- SCI.CLS.3** Students will describe how to determine if a substance has been oxidized or reduced. Students will identify oxidizing and reducing agents.
- SCI.CLS.4** Students will identify, define, give physical and chemical properties, name, and draw structural formulas for alkanes, alkenes, alkynes, and aromatic hydrocarbons.
- SCI.CLS.5** Students will identify, define, give physical and chemical properties, name, and draw structural formulas for alcohols, phenols, and ethers.
- SCI.CLS.6** Students will identify, define, give physical and chemical properties, name, and draw structural formulas for aldehydes and ketones.
- SCI.CLS.7** Students will identify, define, give physical and chemical properties, name, and draw structural formulas for carboxylic acids, esters, and amides.
- SCI.CLS.8** Students will identify, define, give physical and chemical properties, name, and draw structural formulas for amines.
- SCI.CLS.9** Students will identify different types of isomers and describe structural formulas associated with each type of isomer.

## **Earth Science**

### **Course Purpose:**

Students will analyze earth systems to predict natural phenomena such as weather, earthquakes, and volcanic eruptions. Students will compare and contrast space systems to discuss the formulation of our solar system. Students will investigate and examine Earth's natural resources to assess human sustainability.

- SCI.ES.1** Students will determine how the Sun, Earth, and the Moon form a dynamic system that influences all life on Earth. (HS-ESS1-4)
- SCI.ES.2** Students will use the laws of motion and gravitation to describe the orbits and the characteristics of the planets and other objects in the solar system. (HS-ESS1-4, HS-ESS1-6)
- SCI.ES.3** Students will determine the relationship between the life cycle of a star and its mass, luminosity, magnitude, temperature, and composition. (HS-ESS1-1, HS-ESS1-3)
- SCI.ES.4** Students will identify and describe how observations of galaxy expansion, cosmic background radiation, and the Big Bang Theory are related to the estimated age of the universe. (HS-ESS1-2)
- SCI.ES.5** Students will describe how weathering and erosion are instrumental in changing the Earth's surface. (HS-ESS2-2, HS-ESS2-5)
- SCI.ES.6** Students will investigate changes of the Earth's surface due to mass movements caused by gravity, winds and glaciers. (HS-ETS1-3)
- SCI.ES.7** Students will investigate how surface water moves weathered materials, and how it produces weathering and shapes the surface of Earth. (HS-ETS1-3, HS-ESS2-5)
- SCI.ES.8** Students will investigate formation and movements of groundwater. (HS-ESS2-5)
- SCI.ES.9** The students will investigate how the composition, structure, and properties of Earth's atmosphere form the basis of Earth's weather and climate. (HS-ESS2-4, HS-ESS3-5)
- SCI.ES.10** Students will observe, analyze and predict weather patterns. (HS-ESS2-2)
- SCI.ES.11** Students will analyze the exchange of thermal energy in the atmosphere to explain that it sometimes occurs with great violence that varies in form, size and duration. (HS-ESS2-2)

- SCIE.S. 12** Students will investigate the different climates on Earth and how they are influenced by natural factors as well as human activities. (HS-ESS2-4, HS-ESS3-5)
- SCIE.S.13** Students will evaluate how and why geologic activity occurs at tectonic plate boundaries. (HS-ESS1-5, HS-ESS2-1)
- SCIE.S.14** Students will evaluate how the use of natural resources can impact Earth's land, air and water. (HS-ESS3-2, HS-ESS3-3, HS-ESS3-4)
- SCIE.S.15** Students will evaluate how oceans effect mankind and the environment. (HS-ESS3-4, HS-ESS3-6)
- SCIE.S.16** Students will explain the causes and probability of earthquakes occurring in different locations on the Earth. (HS-ESS2-3)

## **Forensic Science Honors**

### **Course Purpose:**

Students will utilize the proper investigative techniques of collection, preservation, analysis, and interpretation of Physical evidence to determine solutions and principles related to solving simulated crimes.

- SCI.FSCH.1**            **Students will describe the importance of forensic science; identify its major disciplines and contributors; and compare, contrast and analyze the changing role of forensic science. Students will explain how specific case studies relate to the material in the unit. (HS-ETS1-1)**
- SCI.FSCH.2**            **Students will explain the proper procedure to process and package physical evidence from a crime scene and interpret the role of forensic science to the scientific fields of pathology, anthropology and entomology. Students will explain how specific case studies relate to the material in the unit.**
- SCI.FSCH.3**            **Students will examine the role that physical evidence plays in crime scene reconstruction and understand the difference between individual and class evidence. Students will explain how specific case studies relate to the material in the unit.**
- SCI.FSCH.4**            **Students will examine the basic principles of chemistry to determine its role in the analysis of glass and soil evidence. Students will explain how specific case studies relate to the material in the unit. (HS-PS1-1, HS-PS4-1, HS-PS4-3)**
- SCI.FSCH.5**            **Students will explain the role of the forensic toxicologist in the analysis of drug evidence and describe the commonly used laboratory tests used to identify a drug. Students will explain how specific case studies relate to the material in the unit.**
- SCI.FSCH.6**            **Students will explain the role of the forensic toxicologist in the analysis of alcohol; the role of a police officer in applying field sobriety tests to determine blood alcohol concentration (BAC); and the legal rulings associated with alcohol impairment. Students will explain how specific case studies relate to the material in the unit.**
- SCI.FSCH.7**            **Students will explain the importance of different types of microscopes and their capabilities in the crime laboratory. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.8** Students will explain the role of a forensic serologist and describe the forensic applications of different body fluids. Students will explain how specific case studies relate to the material in the unit.
- SCI.FSCH.9** Students will describe the importance of nuclear and mitochondrial DNA to criminal investigations and the types of tests utilized to determine DNA from different body fluids and cells. Students will explain how specific case studies relate to the material in the unit. (HS-LS3-1)
- SCI.FSCH.10** Students will describe and explain the importance of the forensic analysis of hair and fiber evidence. Students will explain how specific case studies relate to the material in the unit.
- SCI.FSCH.11** Students will apply the principles of chemistry to the forensic application of metal and paint evidence. Students will explain how specific case studies relate to the material in the unit. (HS-PS1-8)
- SCI.FSCH.12** Students will explain the chemistry of a fire to determine the forensic application in an arson. Students will explain how specific case studies relate to the material in the unit.
- SCI.FSCH.13** Students will explain the basic principles of fingerprint classification and apply it to fingerprint evidence. Students will explain how specific case studies relate to the material in the unit.
- SCI.FSCH.14** Students will describe the importance of document examination in criminal investigations. Students will explain how specific case studies relate to the material in the unit.
- SCI.FSCH.15** Students will describe the importance of firearms, tools marks and other types of impressions in criminal investigations. Students will explain how specific case studies relate to the material in the unit.

## **Human Anatomy and Physiology Honors**

### **Course Purpose:**

Students will analyze conditions of body systems caused by disease to formulate medical diagnoses in hypothetical situations. Students will determine the relationships between form and function of the human body through dissection, model examination, and microscope viewing. Students will also conduct independent research to investigate careers available in the anatomy and Physiology field.

- SCI.HAPH.1**        **Students will use anatomical terms to describe body sections, body regions, and relative positions. Students will discuss negative and positive feedback mechanisms in homeostatic regulation. Students will identify each organ system and its components.**
- SCI.HAPH.2**        **Students will relate the principles of chemistry to the human body.**
- SCI.HAPH.3**        **Students will relate cell structure and function to the formation of and roles of tissues in the body.**
- SCI.HAPH.4**        **Students will examine the body's four major tissue types and describe their roles in body structure and function.**
- SCI.HAPH.5**        **Students will recognize components and discuss the functions of the skeletal system in relation to other body systems.**
- SCI.HAPH.6**        **Students will identify the components of and discuss the functional relationships between the muscular system and other body systems.**
- SCI.HAPH.7**        **Students will identify the components of and divisions of the nervous system and discuss the interrelationships between the nervous system and other body systems.**
- SCI.HAPH.8**        **Students will identify the components of and discuss the functional relationships between the sense organs and the other body systems.**
- SCI.HAPH.9**        **Students will identify structures and discuss the interrelationships between the endocrine system and other body systems.**
- SCI.HAPH.10**       **Students will be able to identify structures of and discuss the functional relationships between the cardiovascular system and other body systems.**

- SCI.HAPH.11**      **Students will identify components and functions of the lymphatic system and discuss the functional relationships between the lymphatic system and other body systems.**
- SCI.HAPH.12**      **Students will identify structures of and discuss the interrelationships between the respiratory system and other body systems.**
- SCI.HAPH.13**      **Students will identify the components of and discuss the functional relationships between the digestive system and other body systems.**
- SCI.HAPH.14**      **Students will identify the structures of the urinary system and will discuss the functional relationships between the urinary system and other body systems.**
- SCI.HAPH.15**      **Students will identify the components of and discuss the functional relationships between the male and female reproductive systems and the other body systems.**



## Physical Science

### Course Purpose:

Students will solve problems related to motion, energy, and matter using appropriate tools, operations, methods, and measurements, and they will analyze and interpret data in order to predict and explain natural phenomena.

- SCI.PS.1** Students will conduct a controlled experiment, make all appropriate measurements, and effectively communicate the results.
- SCI.PS.2** Students will analyze the motion of objects in order to calculate speed, velocity, and linear acceleration and describe their relationships. (HS-PS2-1, HS-PS2-4)
- SCI.PS.3** Students will demonstrate how Newton's Laws of motion connect the change in an object's motion with the forces acting on it. (HS-PS2-1, HS-PS2-2, HS-PS3-2)
- SCI.PS.4** Students will distinguish between kinetic and potential energy and demonstrate how energy changes from one form to another and is conserved. (HS-PS1-8, HS-PS3-1)
- SCI.PS.5** Students will explain how work, energy, and power are related. Using the six types of simple machines, students will investigate the relationship between work, energy, and power. (HS-PS3-1, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3)
- SCI.PS.6** Students will explain how thermal energy moves within a system. (HS-PS1-4, HS-PS3-1, HS-PS3-4)
- SCI.PS.7** Students will explain how matter can be classified by what it is made of and by its physical and chemical properties. (HS-PS1-1, HS-PS1-2, HS-PS1-5, HS-PS1-8)
- SCI.PS.8** Students will explain how the physical properties of matter can be described by the motion of its particles.
- SCI.PS.9** Students will show how properties of elements are determined by the composition of an atom. (HS-PS1-2, HS-PS1-8)
- SCI.PS.10** Students will predict and explain the type of bonds that will form between various elements. (HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS2-6)
- SCI.PS.11** Students will identify and explain the changes that chemicals undergo during a chemical reaction. (HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS2-6)

## **Physics:**

### **Course Purpose:**

Students will solve problems involving motion, energy and matter using appropriate tools, methods, measurements, and complex mathematical formulas to analyze and interpret data related to predicting and explaining natural phenomena

- SCI.PHY.1** Students will examine branches of physics, the scientific method, and models in physics. Students will identify and use tools for working with measurements and data. (PS2-1)
- SCI.PHY.2** Students will analyze one-dimensional motion in terms of displacement, time, speed, and velocity. Students will distinguish between accelerated and non-accelerated motion. (PS2-1, PS2-2)
- SCI.PHY.3** Students will use vectors to analyze two-dimensional motion and to solve problems in which objects are projected into the air. (PS2-1, PS2-2)
- SCI.PHY.4** Students will analyze interactions by identifying the forces involved. Students will predict and explain many types of motion. (PS2-1, PS2-2, PS2-3, PS2-4, ESS1-1)
- SCI.PHY.5** Students will analyze momentum to compare and describe collisions between two or more objects. Students will consider the mass and velocity of one or more objects and the conservation of momentum and energy. (PS2-2, PS3-1, PS3-2, PS3-3)
- SCI.PHY.6** Students will investigate work and types of energy that are relevant to mechanics. Students will investigate and explain kinetic energy associated with motion and potential energy related to an object's position. (PS3-1, PS3-2, PS3-3, ESS1-1, ESS1-2)
- SCI.PHY.7** Students will analyze simple harmonic motion to explain relationships between vibrations and waves. (PS4-1, PS4-2, PS4-3, PS4-5)
- SCI.PHY.8** Students will identify and explain properties of light and other forms of electromagnetic radiation. (PS4-1, PS4-3, PS4-4, PS4-5, ESS1-1, ESS1-2)
- SCI.PHY.9** Students will examine the basic properties of electric charge and the force produced by point charges. Students will interpret electric field lines. (PS2-5, PS3-2, PS3-3)
- SCI.PHY.10** Students will investigate properties of electric potential and electrical energy. Students will also explain how capacitance, resistance, and current work in electrical circuits. (PS2-4, PS3-1, PS3-2, PS3-5, PS3-6)

**SCI.PHY.11 Student will explore the basic properties of series and parallel circuits. Students will construct schematic diagrams of series and parallel circuits. (PS2-5, PS2-6 PS3-3)**

**SCI.PHY.12 Students will explain how current carrying wires act as magnets. Students will examine how magnetic fields exert a force on charged particles. (PS2-5, PS3-2, PS3-5, ESS2-3)**

**SCI.PHY.13 Students will identify and describe the types of simple machines, describe circular motion, and the forces associated with it including gravity. (PS2-3, PS3-3, EES1-4)**

## **Physics Honors:**

### **Course Purpose:**

Students will solve problems involving motion, energy and matter using appropriate tools, methods, measurements, and complex mathematical formulas to analyze and interpret data related to predicting and explaining natural phenomena with an emphasis on solving complex mathematical equations.

- SCI.PHYH.1**        **Students will examine branches of physics, the scientific method, and models in physics, identify and use tools for working with measurements and data, and perform order of magnitude calculations. (PS2-1)**
- SCI.PHYH.2**        **Students will analyze one-dimensional motion in terms of displacement, time, speed, and velocity. Students will distinguish between accelerated and non-accelerated motion. (PS2-1, PS2-2)**
- SCI.PHYH.3**        **Students will use vectors to analyze two-dimensional motion and to solve problems in which objects are projected into the air. (HS-PS2-1, HS-PS2-2)**
- SCI.PHYH.4**        **Students will analyze interactions by identifying the forces involved. Students will predict and explain many types of motion. (PS2-1, PS2-2, PS2-3, PS2-4, ESS1-1)**
- SCI.PHYH.5**        **Students will analyze momentum to compare and describe collisions between two or more objects. Students will consider the mass and velocity of one or more objects and the conservation of momentum and energy. (PS2-2, PS3-1, PS3-2, PS3-3)**
- SCI.PHYH.6**        **Students will investigate work and types of energy that are relevant to mechanics. Students will investigate and explain kinetic energy associated with motion and potential energy related to an object's position. (PS3-1, PS3-2, PS3-3, ESS1-1, ESS1-2)**
- SCI.PHYH.7**        **Students will analyze simple harmonic motion to explain relationships between vibrations and waves. (PS4-1, PS4-2, PS4-3, PS4-5)**
- SCI.PHYH.8**        **Students will identify and explain properties of light and other forms of electromagnetic radiation. (PS4-1, PS4-3, PS4-4, PS4-5, ESS1-1, ESS1-2)**
- SCI.PHYH.9**        **Students will examine the basic properties of electric charge and calculate force produced by point charges. Students will interpret electric field lines. (PS2-5, PS3-2, PS3-3)**

- SCI.PHYH.10**      **Students will investigate properties of electric potential and electrical energy. Students will also explain how capacitance, resistance, and current work in an electrical circuit. (PS2-4, PS3-1, PS3-2, PS3-5, PS3-6)**
- SCI.PHYH.11**      **Student will explore the basic properties of series and parallel circuits. Students will construct schematic diagrams of series and parallel circuits. (PS2-5, PS2-6 PS3-3)**
- SCI.PHYH.12**      **Students will explain how current carrying wires act as magnets. Students will examine how magnetic fields exert a force on charged particles. (PS2-5, PS3-2, PS3-5, ESS2-3)**
- SCI.PHYH.13**      **Students will identify and describe the types of simple machines and calculate the mechanical advantage of each. Students will describe circular motion, and the forces associated with it including gravity. (PS2-3, PS3-3, EES1-4)**

## Biology

**SCI.B.1 Students will utilize the scientific method and knowledge of the characteristics of living things to solve real world problems. (HS-LS1-3, HS-LS2-7, HS-ETS1-2, HS-ETS1-3)**

- SCI.B.1.1 Define biology and discuss the importance of biology in everyday life.
- SCI.B.1.2 List and relate the seven properties of life to an organism.
- SCI.B.1.3 Justify whether an object is living or non-living.
- SCI.B.1.4 Differentiate the steps of scientific investigations including the following: control group, experimental group, independent variables, dependent variables, hypothesis, and predictions.
- SCI.B.1.5 Design an experiment to solve a real-world problem.

**SCI.B.2 Students will utilize hierarchical organization to classify organisms into different groups. (HS-LS1-2, HS-LS2-1)**

- SCI.B.2.1 Develop a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- SCI.B.2.2 Demonstrate how biological classifications are based on relationships between organisms.
- SCI.B.2.3 Construct a model using traits to classify organisms.

**SCI.B.3 Students will investigate how the distribution and abundance of organisms and populations in ecosystems are limited by the availability of resources and the ability of the ecosystem to recycle materials. (HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS2-8, HS-LS4-6, HS-ETS1-4, HS-ESS3-1, HS-ESS3-3, HS-ESS3-4, HS-ETS1-1)**

- SCI.B.3.1 Discuss factors affecting biodiversity and populations in ecosystems.
- SCI.B.3.2 Explain the role of group behavior on individual and species' changes to survive and reproduce.
- SCI.B.3.3 Evaluate the evidence that complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions to determine how changing conditions may result in a new ecosystem.
- SCI.B.3.4 Use mathematical representation to support explanations of factors that affect the carrying capacity of populations at different scales.
- SCI.B.3.5 Design and evaluate a solution for reducing the impacts of human activities on the environment and biodiversity.

**SCI.B.4 Students will relate the principles of chemistry to living things. (HS-LS1-6, HS-LS2-4)**

- SCI.B.4.1 Compare and contrast the structures and functions of different types of biomolecules.
- SCI.B.4.2 Diagram the flow of energy and the cycling of matter of living things.
- SCI.B.4.3 Analyze enzymes to determine their effect on chemical reactions.
- SCI.B.4.4 Construct a model based on evidence that C, H, and O from sugar may combine with other elements to form large carbon-based molecules.

**SCI.B.5 Students will utilize the cell theory to discuss how cells maintain their structures and functions through homeostasis. (HS-LS1-3)**

- SCI.B.5.1 Relate the importance of the cell theory to cell organization.
- SCI.B.5.2 Determine the similarities and differences of the structures and functions of plant and animal cells utilizing scientific tools.
- SCI.B.5.3 Explain how cell functions are regulated.
- SCI.B.5.4 Predict the movement of substances in and out of cells.
- SCI.B.5.5 Plan and conduct an experiment to provide evidence that feedback mechanisms maintain homeostasis.

**SCI.B.6 Students will demonstrate the cycling of matter and the transfer of energy to the cells of all living things. (HS-LS1-5, HS-LS1-1, HS-LS2-3, HS-LS2-5, HS-LS1-7)**

- SCI.B.6.1 Describe the flow of energy and the cycling of matter in the ecosystem.
- SCI.B.6.2 Use a model to demonstrate how photosynthesis transforms light energy into stored chemical energy.
- SCI.B.6.3 Illustrate the chemical process of cellular respiration through the breakdown of food to produce new compounds resulting in a net transfer of energy.
- SCI.B.6.4 Compare and contrast the efficiency of aerobic and anaerobic respiration.
- SCI.B.6.5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon in the environment.

**SCI.B.7 Students will correlate the structures and functions of mitosis and meiosis to the roles they play in cellular reproduction, gamete formation, and genetic variation. (HS-LS1-4, HS-LS3-2)**

- SCI.B.7.1 Review and describe the major events of the cell cycle and how the cell cycle is controlled in eukaryotic cells.
- SCI.B.7.2 Demonstrate and model the major events of mitosis as they relate to cell reproduction.
- SCI.B.7.3 Demonstrate and model the major events of meiosis as they relate to sexual reproduction and gamete formation.
- SCI.B.7.4 Describe inheritable genetic variations resulting from crossing over, independent assortment, and random fertilization.
- SCI.B.7.5 Evaluate the genetic and evolutionary advantages and disadvantages of asexual and sexual reproduction.

**SCI.B.8 Students will relate the role of Mendel’s laws of heredity as it helped pave the way for other scientists to discover the function and structure of DNA. (HS-LS3-1, HS-LS3-3)**

- SCI.B.8.1 Summarize Gregor Mendel’s experiments using the garden pea as it relates to heredity.
- SCI.B.8.2 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- SCI.B.8.3 Ask questions to clarify relationships about the role of DNA in coding the instructions for traits passed from parents to offspring.
- SCI.B.8.4 Propose and defend a claim based on evidence that factors such as environmental mutations and replication errors can influence patterns of heredity.
- SCI.B.8.5 Examine the works of other scientists as they relate to identifying the genetic material.
- SCI.B.8.6 Construct a model of DNA using various materials.

**SCI.B.9 Students will construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life. (HS-LS1-1)**

- SCI.B.9.1 Compare and contrast the structure of RNA with that of DNA.
- SCI.B.9.2 Summarize and outline the processes of protein synthesis.
- SCI.B.9.3 Compare and contrast gene regulation in prokaryotic and eukaryotic organisms.
- SCI.B.9.4 Evaluate mutations to construct an explanation of the altered genetic material.



**SCI.B.10**      **Students will support the claims that changes in environmental conditions may result in three things: 1) increase in the number of individuals of some species, 2) the emergence of new species over time, and 3) the extinction of other species by relating those changes to the theory of evolution. (HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-ESS1-5, HS-ESS1-6, HS-ESS2-7)**

- SCI.B.10.1      Summarize Darwin’s theory of evolution by natural selection.
- SCI.B.10.2      Contrast the different theories of the rate of evolution.
- SCI.B.10.3      Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
- SCI.B.10.4      Construct an explanation based on evidence for how four factors: 1) the potential for a species to increase in number, 2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, 3) competition for limited resources, and 4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
- SCI.B.10.5      Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
- SCI.B.10.6      Construct a model based on evidence for how natural selection leads to adaptation of populations.
- SCI.B.10.7      Apply the theory of plate tectonics and ancient Earth materials to construct an account of Earth’s formation and early history.

**SCI.B.11**      **Students will evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce. (HS-LS2-8)**

- SCI.B.11.1      Identify internal changes and external stimuli that affect an organism’s behavior.
- SCI.B.11.2      Describe how natural selection shapes behavior.
- SCI.B.11.3      Relate how sexual selection can influence evolution and the chances for survival.
- SCI.B.11.4      Model how behavior is influenced by both heredity and learning.

**SCI.B.12**      **Students will examine ancient Earth materials and apply the theory of plate tectonics to construct an account of the Earth’s formation, early history, and life on Earth. (HS-ESS1-5, HS-ESS1-6, HS-ESS2-1, HS-ESS2-2, HS-ESS2-7)**

- SCI.B.12.1      Construct an account of the formation of the Earth.
- SCI.B.12.2      Apply plate tectonics and continental movement to describe the early history of the Earth.
- SCI.B.12.3      Relate the evolution of life on Earth to changes of the Earth’s systems.

## Biology Honors

**SCI.BH.1 Students will utilize the scientific method and knowledge of the characteristics of living things to solve real world problems. (HS-LS1-3, HS-LS2-7, HS-ETS1-2, ETS1-3)**

- SCI.BH.1.1 Define biology and discuss the importance of biology in everyday life.
- SCI.BH.1.2 List and relate the seven properties of life to an organism.
- SCI.BH.1.3 Justify whether an object is living or non-living.
- SCI.BH.1.4 Differentiate the steps of scientific investigations including the following: control group, experimental group, independent variables, dependent variables, hypothesis, and predictions.
- SCI.BH.1.5 Design an experiment to solve a real-world problem.

**SCI.BH.2 Students will utilize hierarchical organization to classify organisms into different groups. (HS-LS1-2, HS-LS2-1)**

- SCI.BH.2.1 Develop a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- SCI.BH.2.2 Illustrate how biological classifications are based on relationships between organisms.
- SCI.BH.2.3 Construct a model using traits to classify organisms.

**SCI.BH.3 Students will investigate how the distribution and abundance of organisms and populations in ecosystems are limited by the availability of resources and the ability of the ecosystem to recycle materials. (HS-LS2-2, HS-LS2-6, HS-LS2-8, HS-LS4-6, HS-ETS1-4, HS-ESS3-1, HS-ESS3-3, HS-ESS3-4, HS-ETS1-1)**

- SCI.BH.3.1 Discuss factors affecting biodiversity and populations in ecosystems.
- SCI.BH.3.2 Explain the role of group behavior on individual and species' changes to survive and reproduce.
- SCI.BH.3.3 Evaluate the evidence that complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions to determine how changing conditions may result in a new ecosystem.
- SCI.BH.3.4 Use mathematical representation to support explanations of factors that affect the carrying capacity of populations at different scales.
- SCI.BH.3.5 Design and evaluate a solution for reducing the impacts of human activities on the environment and biodiversity.

**SCI.BH.4 Students will relate the principles of chemistry to living things. (HS-LS1-6, HS-LS2-4)**

- SCI.BH.4.1 Compare and contrast the structures and functions of different types of biomolecules.
- SCI.BH.4.2 Diagram the flow of energy and the cycling of matter of living things.
- SCI.BH.4.3 Analyze enzymes and their effect on chemical reactions to visually represent the changes.
- SCI.BH.4.4 Construct a model based on evidence that C, H, and O from sugar may combine with other elements to form large carbon-based molecules.

**SCI.BH.5 Students will utilize the cell theory to discuss how cells maintain their structures and functions through homeostasis. (HS-LS1-3)**

- SCI.BH.5.1 Relate the importance of the cell theory to cell organization.
- SCI.BH.5.2 Determine the similarities and differences of the structures and functions of plant and animal cells utilizing scientific tools.
- SCI.BH.5.3 Explain how cell functions are regulated.
- SCI.BH.5.4 Utilize mathematical computation to determine why cells must be relatively small.
- SCI.BH.5.5 Predict the movement of substances in and out of cells.
- SCI.BH.5.6 Plan and conduct an experiment to provide evidence that feedback mechanisms maintain homeostasis.

**SCI.BH.6 Students will demonstrate the cycling of matter and the transfer of energy to the cells of all living things. (HS-LS1-5, HS-LS1-1, HS-LS2-3, HS-LS2-5, HS-LS1-7)**

- SCI.BH.6.1 Discuss the flow of energy and the cycling of matter in the ecosystem.
- SCI.BH.6.2 Use a model to demonstrate how photosynthesis transforms light energy into stored chemical energy.
- SCI.BH.6.3 Demonstrate the chemical process of cellular respiration through the breakdown of food to produce new compounds resulting in a net transfer of energy.
- SCI.BH.6.4 Compare and contrast the efficiency of aerobic and anaerobic respiration.
- SCI.BH.6.5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon in the environment.

**SCI.BH.7 Students will correlate the structures and functions of mitosis and meiosis to the roles they play in cellular reproduction, gamete formation, and genetic variation. (HS-LS1-4, HS-LS3-2)**

- SCI.BH.7.1 Review and describe the major events of the cell cycle and how the cell cycle is controlled in eukaryotic cells and use mathematical models to determine the ratio of cells in each phase.
- SCI.BH.7.2 Demonstrate and model the major events of mitosis as they relate to cell reproduction.
- SCI.BH.7.3 Demonstrate and model the major events of meiosis as they relate to sexual reproduction and gamete formation.
- SCI.BH.7.4 Describe inheritable genetic variations resulting from crossing over, independent assortment, and random fertilization.
- SCI.BH.7.5 Evaluate the genetic and evolutionary advantages and disadvantages of asexual and sexual reproduction.

**SCI.BH.8 Students will relate the role of Mendel's laws of heredity as it helped pave the way for other scientists to discover the function and structure of DNA. (HS-LS3-1, HS-LS3-3)**

- SCI.BH.8.1 Summarize Gregor Mendel's experiments using the garden pea as it relates to heredity.
- SCI.BH.8.2 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- SCI.BH.8.3 Ask questions to clarify relationships about the role of DNA in coding the instructions for traits passed from parents to offspring.
- SCI.BH.8.4 Propose and defend a claim based on evidence that factors such as environmental mutations and replication errors can influence patterns of heredity.
- SCI.BH.8.5 Examine the works of other scientists as they relate to identifying the genetic material.
- SCI.BH.8.6 Construct and describe a model of DNA using various materials.

**SCI.BH.9 Students will construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life. (HS-LS1-1)**

- SCI.BH.9.1 Compare and contrast the structure of RNA with that of DNA.
- SCI.BH.9.2 Summarize and outline the processes of protein synthesis.
- SCI.BH.9.3 Simulate the processes of DNA replication and protein synthesis.
- SCI.BH.9.4 Discuss genetic engineering and other technologies being used to improve society.
- SCI.BH.9.5 Compare and contrast gene regulation in prokaryotic and eukaryotic organisms.
- SCI.BH.9.6 Evaluate mutations to construct an explanation of the altered genetic material.

**SCI.BH.10 Students will support the claims that changes in environmental conditions may result in three things: 1) increase in the number of individuals of some species 2) the emergence of new species over time, and 3) the extinction of other species by relating those changes to the theory of evolution. (HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-ESS1-5, HS-ESS1-6, HS-ESS2-7)**

SCI.BH.10.1 Summarize Darwin’s theory of evolution by natural selection.

SCI.BH.10.2 Contrast the different theories of the rate of evolution.

SCI.BH.10.3 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

SCI.BH.10.4 Construct an explanation based on evidence for how four factors: 1) the potential for a species to increase in number, 2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, 3) competition for limited resources, and 4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

SCI.BH.10.5 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

SCI.BH.10.6 Construct a model based on evidence for how natural selection leads to adaptation of populations.

SCI.BH.10.7 Apply the theory of plate tectonics and ancient Earth materials to construct an account of Earth’s formation and early history.

**SCI.BH.11 Students will evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce. (HS-LS2-8)**

SCI.BH.11.1 Identify internal changes and external stimuli that affect an organism’s behavior.

SCI.BH.11.2 Describe how natural selection shapes behavior.

SCI.BH.11.3 Relate how sexual selection can influence evolution and the chances for survival.

SCI.BH.11.4 Model how behavior is influenced by both heredity and learning.

**SCI.BH.12 Students will examine ancient Earth materials and apply the theory of plate tectonics construct an account of Earth’s formation, early history, and life on Earth. (HS-ESS1-5, HS-ESS1-6, HS-ESS2-1, HS-ESS2-2, HS-ESS2-7)**

SCI.BH.12.1 Construct an account of the formation of the Earth.

SCI.BH.12.2 Apply plate tectonics and continental movement to describe the early history of the Earth.

SCI.BH.12.3 Relate the evolution of life on Earth to changes of the Earth’s systems.

**SCI.BH.13 Students will develop dissection skills using preserved animals. (HS-LS1-2)**

- SCI.BH.13.1 Identify the body systems and determine the functions of the major organs within each system.
- SCI.BH.13.2 Identify organs in each of the body's major organ systems through dissection of preserved animals.
- SCI.BH.13.3 Distinguish radial symmetry from bilateral symmetry.
- SCI.BH.13.4 Summarize the importance of a body cavity.
- SCI.BH.13.5 Discuss the characteristics of mammals.
- SCI.BH.13.6 Relate the characteristics of mammals to one animal

## Chemistry

**SCI.CHEM.1**      **Students will classify matter, distinguish between physical and chemical properties/changes, and list the steps for the scientific method. (HS-PS1-3, HS-PS1-4, HS-ESS3-2)**

- SCI.CHEM.1.1      Classify elements, compounds, and mixtures.
- SCI.CHEM.1.2      List the steps for the scientific method.
- SCI.CHEM.1.3      Distinguish between physical and chemical properties.
- SCI.CHEM.1.4      Distinguish between physical and chemical changes.
- SCI.CHEM.1.5      Differentiate between basic research, applied research, and technological developments.

**SCI.CHEM.2**      **Students will apply standards of measurement and convert units of measurement using factor label method (dimensional analysis). Students will analyze data using percent error. Students will identify direct and inverse proportions. (HS-PS1-3, HS-ESS3-5, HS-PS2-6)**

- SCI.CHEM.2.1      Name International System (SI) of units for length, mass, time, volume, and density.
- SCI.CHEM.2.2      Solve density problems.
- SCI.CHEM.2.3      Convert SI units using factor label method.
- SCI.CHEM.2.4      Calculate percent error.
- SCI.CHEM.2.5      Identify inverse and direct proportions.

**SCI.CHEM.3**      **Students will identify and determine the number of subatomic particles for a given isotope and use Dalton's Atomic Theory to explain the Law of Conservation of Mass. (HS-PS1-1, HS-PS1-7, HS-ESS2-6, HS-PS1-8, HS-ESS2-6)**

- SCI.CHEM.3.1      Identify atomic number and average atomic mass.
- SCI.CHEM.3.2      Determine the number of protons, neutrons, electrons, and mass number for a given isotope and calculate the average atomic mass.
- SCI.CHEM.3.3      Define mole, Avogadro's number, and molar mass.
- SCI.CHEM.3.4      Use Dalton's Atomic Theory to explain the Law of Conservation of Mass.
- SCI.CHEM.3.5      Differentiate between fission and fusion.

**SCI.CHEM.4**      **Students will explain the relationship among speed, wavelength, frequency, and energy of electromagnetic radiation. Students will define and identify the four quantum numbers and write the electron configuration for the atoms of any element. (HS-PS4-1, HS-PS1-2, HS-PS4-3, HS-PS4-4)**

- SCI.CHEM.4.1      Define wavelength, frequency, and speed of light.
- SCI.CHEM.4.2      Describe the relationship of the energy of electromagnetic radiation to wavelength and frequency.
- SCI.CHEM.4.3      Describe the excited state and ground state of an atom.
- SCI.CHEM.4.4      Identify and construct models of the atom (Dalton, Thomson, Rutherford, Bohr, and the Quantum model).
- SCI.CHEM.4.5      Define and identify the four quantum numbers.
- SCI.CHEM.4.6      Write electron configurations, including orbital and electron dot notation.

**SCI.CHEM.5**      **Students will analyze the trends in the periodic table to better understand properties of chemical families. (HS-PS1-1, HS-PS1-2)**

- SCI.CHEM.5.1      Identify parts of the periodic table including metals, nonmetals, metalloids, blocks, alkali metals, alkaline-earth metals, halogens, transition metals, lanthanides, actinides, noble gases, and rare-earth elements.
- SCI.CHEM.5.2      Identify trends in the periodic table in terms of electronegativity, electron affinity, atomic radius, ionic radius, and ionization energy.
- SCI.CHEM.5.3      Define valence electrons and identify the amount of valence electrons for a given group.
- SCI.CHEM.5.4      State what type of ion is formed for a given group.



**SCI.CHEM.6**      **Students will explain why most atoms form chemical bonds, classify the three types of chemical bonds, and describe the properties associated with different types of chemical bonds. (HS-PS1-1)**

- SCI.CHEM.6.1      Define ionic bond, polar covalent bond, nonpolar covalent bond, and metallic bond and identify the type of chemical bond in a given chemical compound.
- SCI.CHEM.6.2      Explain how covalent bonds form and how it is related to the octet rule.
- SCI.CHEM.6.3      Define molecule, molecular compound, bond energy, and bond length.
- SCI.CHEM.6.4      Draw the Lewis structure for a given molecule or polyatomic ion.
- SCI.CHEM.6.5      Define ionic compound, formula unit, and lattice energy.
- SCI.CHEM.6.6      Describe the electron sea model of metallic bonding and explain why metals conduct electricity, are malleable and ductile.
- SCI.CHEM.6.7      Predict the shape of molecules using Valence Shell Electron Pair Repulsion (VSEPR) theory.

**SCI.CHEM.7**      **Students will write chemical names and chemical formulas for ionic and molecular compounds. Students will determine percent composition of the elements in a compound.**

- SCI.CHEM.7.1      Memorize element names and symbols.
- SCI.CHEM.7.2      Write a chemical name given a chemical formula.
- SCI.CHEM.7.3      Write a chemical formula given a chemical name.
- SCI.CHEM.7.4      Determine percent composition of the elements in a compound.

**SCI.CHEM.8**      **Students will identify five types of chemical reactions, write and balance chemical equations, and identify factors that affect chemical reactions. (HS-PS1-2, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-ESS2-4)**

- SCI.CHEM.8.1      Balance a formula equation by inspection.
- SCI.CHEM.8.2      Write a formula equation given a word equation or write a word equation given a formula equation.
- SCI.CHEM.8.3      Identify and classify a chemical reaction as synthesis, decomposition, single displacement, double displacement, or combustion.

**SCI.CHEM.9**            **Students will describe the motion of particles and the properties of the three states of matter according to kinetic molecular theory. Students will describe the properties of water and how the properties are determined by the structure of water. Students will identify factors that affect chemical reactions. (HS-PS3-1, HS-PS3-4, HS-ESS2-5)**

- SCI.CHEM.9.1            List the five assumptions of kinetic molecular theory.
- SCI.CHEM.9.2            Describe characteristic properties of the three states of matter using kinetic molecular theory.
- SCI.CHEM.9.3            Describe the structure of a water molecule.
- SCI.CHEM.9.4            Discuss how hydrogen bonding determines the physical properties of water.
- SCI.CHEM.9.5            Identify the variables of the equation  $Q = mc\Delta t$ .
- SCI.CHEM.9.6            Conduct an investigation of  $Q = mc\Delta t$ .
- SCI.CHEM.9.7            Describe the process of erosion.
- SCI.CHEM.9.8            Identify factors that affect rates of reaction.
- SCI.CHEM.9.9            Identify a change in conditions that will produce increased amounts of products at equilibrium.

**SCI.CHEM.10**            **Students will define pressure and use Boyle’s law, Charles’ law, Gay-Lussac’s law, and the combined gas law to calculate changes in pressure, volume, and temperature of a gas. Students will use Dalton’s law of Partial Pressure to calculate the total pressure of a mixture of gases. (HS-ESS3-6)**

- SCI.CHEM.10.1            Define pressure, give units of pressure, and describe how pressure is measured.
- SCI.CHEM.10.2            State conditions at Standard Temperature and Pressure (STP).
- SCI.CHEM.10.3            Use Dalton’s law of Partial Pressure to calculate the total pressure of a mixture of gases.
- SCI.CHEM.10.4            Describe Boyle’s law and use Boyle’s law to calculate volume-pressure changes of a gas at constant temperature.
- SCI.CHEM.10.5            Describe Charles’ law and use Charles’ law to calculate volume-temperature changes of a gas at constant pressure.
- SCI.CHEM.10.6            Describe Gay-Lussac’s law and use Gay-Lussac’s law to calculate pressure-temperature changes of a gas at constant volume.
- SCI.CHEM.10.7            Use the combined gas law to calculate volume-temperature-pressure changes of a gas.

**SCI.CHEM.11**      **Students will state the law of combining volumes, Avogadro’s law, and define standard molar volume. Students will state and use the ideal gas law to calculate pressure, volume, temperature, or amount of gas when the other three variables are known. Students will describe effusion and diffusion and calculate rates of effusion using Graham’s law of Effusion.**

- SCI.CHEM.11.1      State the law of combining volumes and Avogadro’s law.
- SCI.CHEM.11.2      Define standard molar volume of a gas.
- SCI.CHEM.11.3      Use the ideal gas law to calculate pressure, volume, temperature, or amount of gas when the other three variables are known.
- SCI.CHEM.11.4      Use variations of the ideal gas law to solve for molar mass or density.
- SCI.CHEM.11.5      Define and describe effusion and diffusion.
- SCI.CHEM.11.6      Solve problems using Graham’s law.

**SCI.CHEM.12**      **Students will compare properties of solutions, suspensions, and colloids and distinguish between electrolytes and nonelectrolytes. Students will describe factors involved in making a solution and the types of solutions. Students will determine the concentration of a solution using percent by mass and percent by volume and define molarity and molality. Students will describe freezing point depression and boiling point elevation. (HS-PS1-3, HS-PS1-7)**

- SCI.CHEM.12.1      Define solute and solvent and describe the different types of solutions.
- SCI.CHEM.12.2      Compare the properties of solutions, suspensions, and colloids.
- SCI.CHEM.12.3      Distinguish between electrolytes and nonelectrolytes.
- SCI.CHEM.12.4      List the three factors that affect the rate of dissolution.
- SCI.CHEM.12.5      Distinguish between saturated, unsaturated, and supersaturated solutions.
- SCI.CHEM.12.6      Explain the general rule of solubility of “like dissolves like.”
- SCI.CHEM.12.7      Compare the effects of temperature and pressure on solubility and describe the energy changes associated with forming a solution.
- SCI.CHEM.12.8      Determine the concentration of a solution using percent by mass and percent by volume.
- SCI.CHEM.12.9      Define molarity and molality.
- SCI.CHEM.12.10     Describe freezing point depression and boiling point elevation.

## Chemistry Honors

**SCI.CHEMH.1**      **Students will classify matter, distinguish between physical and chemical properties/changes, and list the steps for the scientific method. (HS-PS1-3, HS-PS1-4, HS-ESS3-2)**

- SCI.CHEMH.1.1      Classify elements, compounds, and mixtures.
- SCI.CHEMH.1.2      List the steps for the scientific method.
- SCI.CHEMH.1.3      Distinguish between physical and chemical properties.
- SCI.CHEMH.1.4      Distinguish between physical and chemical changes.
- SCI.CHEMH.1.5      Differentiate between basic research, applied research, and technological developments.

**SCI.CHEMH.2**      **Students will apply standards of measurement and convert units of measurement using factor label method. Students will analyze data using significant figures, accuracy, precision, and percent error. Students will distinguish direct and inverse proportions. (HS-PS1-3, HS-PS2-6, HS-ESS3-5)**

- SCI.CHEMH.2.1      Name International System (SI) of units for length, mass, time, volume, and density.
- SCI.CHEMH.2.2      Solve density problems.
- SCI.CHEMH.2.3      Convert SI units using factor label method.
- SCI.CHEMH.2.4      Interpret the number of significant figures in a measurement and apply the correct number of significant figures to the result of a calculation.
- SCI.CHEMH.2.5      Analyze data to determine accuracy and precision.
- SCI.CHEMH.2.6      Calculate percent error.
- SCI.CHEMH.2.7      Distinguish between inverse and direct proportions.

**SCI.CHEMH.3**      **Students will identify and determine the number of subatomic particles for a given isotope, solve different types of mole problems, and use Dalton’s Atomic Theory to explain the Law of Conservation of Mass. (HS-PS1-1, HS-PS1-7, HS-PS1-8, HS-ESS2-6)**

- SCI.CHEMH.3.1      Identify atomic number and average atomic mass.
- SCI.CHEMH.3.2      Determine the number of protons, neutrons, electrons, and mass number for a given isotope.
- SCI.CHEMH.3.3      Define mole, Avogadro’s number, and molar mass.
- SCI.CHEMH.3.4      Solve problems involving mass in grams, amount in moles, and number of atoms of an element.
- SCI.CHEMH.3.5      Use Dalton’s Atomic Theory to explain the Law of Conservation of Mass.
- SCI.CHEMH.3.6      Differentiate between fission and fusion.

**SCI.CHEMH.4**      **Students will explain and calculate the relationship among speed, wavelength, frequency, and energy of electromagnetic radiation. Students will define the four quantum numbers and describe their significance. Students will write the electron configuration for the atoms of any element. (HS-PS4-1, HS-PS1-2, HS-PS4-3, HS-PS4-4)**

- SCI.CHEMH.4.1      Define wavelength, frequency, and speed of light.
- SCI.CHEMH.4.2      Calculate wavelength or frequency using  $c = \lambda\nu$ .
- SCI.CHEMH.4.3      Calculate the energy of a quantum using  $E = h\nu$ .
- SCI.CHEMH.4.4      Describe the excited state and ground state of an atom.
- SCI.CHEMH.4.5      Examine the idea that electromagnetic radiation can be described by a wave model or wave particle model.
- SCI.CHEMH.4.6      Differentiate the models of the atom (Dalton, Thomson, Rutherford, Bohr, and the Quantum model).
- SCI.CHEMH.4.7      Define and identify the four quantum numbers.
- SCI.CHEMH.4.8      Write electron configurations, including orbital notation, electron configuration notation, and electron dot notation.

**SCI.CHEMH.5**      **Students will analyze the trends in the periodic table to better understand properties of chemical families. (HS-PS1-1, HS-PS1-2)**

- SCI.CHEMH.5.1      Identify parts of the periodic table including metals, nonmetals, metalloids, blocks, alkali metals, alkaline-earth metals, halogens, transition metals, lanthanides, actinides, noble gases, and rare-earth elements.
- SCI.CHEMH.5.2      Analyze trends in the periodic table to predict electronegativity, electron affinity, atomic radius, ionic radius, and ionization energy.
- SCI.CHEMH.5.3      Define valence electrons and determine the amount of valence electrons for a given group.
- SCI.CHEMH.5.4      Determine whether a given element will lose or gain electrons based on the octet rule and identify what type of ion will be formed.

**SCI.CHEMH.6**      **Students will explain why most atoms form chemical bonds, classify the three types of chemical bonds, and describe the properties associated with different types of chemical bonds. (HS-PS1-1)**

- SCI.CHEMH.6.1      Define ionic bond, covalent bond, and metallic bond and identify the type of chemical bond in a given chemical compound or element.
- SCI.CHEMH.6.2      Explain how chemical bonds form and how it is related to the octet rule.
- SCI.CHEMH.6.3      Define molecule, molecular compound, bond energy, and bond length.
- SCI.CHEMH.6.4      Define ionic compound, formula unit, and lattice energy.
- SCI.CHEMH.6.5      Distinguish between properties of ionic and molecular compounds.
- SCI.CHEMH.6.6      Explain the electron sea model of metallic bonding and the resulting properties of metals (conduct electricity, are malleable, and ductile).
- SCI.CHEMH.6.7      Draw the Lewis structure for a given molecule or polyatomic ion and determine whether polar or nonpolar.
- SCI.CHEMH.6.8      Predict the shape of molecules using Valence Shell Electron Pair repulsion (VSEPR) theory and determine whether it is polar or nonpolar.
- SCI.CHEMH.6.9      Identify dipole-dipole forces, hydrogen bonding, induced dipoles, and London dispersion forces and describe how these intermolecular forces impact properties such as boiling and melting points.

**SCI.CHEMH.7**      **Students will write chemical names and chemical formulas for ionic and molecular compounds. Students will determine the oxidation number of the atoms in a given compound. Students will convert grams to moles or moles to grams of a given compound, determine percent composition of the elements in a compound, and given the percent composition of a compound determine the simplest formula.**

- SCI.CHEMH.7.1      Memorize element names and symbols.
- SCI.CHEMH.7.2      Write a chemical name given a chemical formula.
- SCI.CHEMH.7.3      Write a chemical formula given a chemical name.
- SCI.CHEMH.7.4      Determine the oxidation number of each atom in a given compound.
- SCI.CHEMH.7.5      Solve mole/mass conversion problems for compounds.
- SCI.CHEMH.7.6      Determine percent composition of the elements in a compound.
- SCI.CHEMH.7.7      Determine simplest formula from percent composition.

**SCI.CHEMH.8**      **Students will identify five types of chemical reactions, write and balance chemical equations, predict production of simple reactions. (HS-PS1-2, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-ESS2-4)**

- SCI.CHEMH.8.1      Balance a formula equation by inspection.
- SCI.CHEMH.8.2      Write a formula equation given a word equation or write a word equation given a formula equation.
- SCI.CHEMH.8.3      Predict products of simple reactions given the reactants.
- SCI.CHEMH.8.4      Identify and classify a chemical reaction as synthesis, decomposition, single displacement, double displacement, or combustion.

**SCI.CHEMH.9**      **Students will solve different types of stoichiometry problems, determine the limiting reactant, and calculate percent yield. (HS-PS1-7)**

- SCI.CHEMH.9.1      Define stoichiometry and write mole ratios given a chemical equation.
- SCI.CHEMH.9.2      Calculate mole-mole, mole-mass, mass-mole, and mass-mass problems using a given chemical equation.
- SCI.CHEMH.9.3      Determine which reactant is the limiting reactant.
- SCI.CHEMH.9.4      Determine the theoretical yield of a product using the limiting reactant.
- SCI.CHEMH.9.5      Calculate the percent yield.

**SCI.CHEMH.10**      **Students will describe the motion of particles and the properties of the three states of matter according to kinetic molecular theory. Students will explain relationships between equilibrium and changes of state and identify factors that affect chemical reactions. Students will describe the properties of water and how the properties are determined by the structure of water. (HS-PS3-1, HS-PS3-4, HS-ESS2-5)**

- SCI.CHEMH.10.1      List the five assumptions of kinetic molecular theory.
- SCI.CHEMH.10.2      Describe characteristic properties of the three states of matter using kinetic molecular theory (volume, shape, density).
- SCI.CHEMH.10.3      Interpret phase diagrams and explain the relationship between equilibrium and changes of state.
- SCI.CHEMH.10.4      Explain what is meant by equilibrium vapor pressure.
- SCI.CHEMH.10.5      Describe the structure of a water molecule.
- SCI.CHEMH.10.6      Discuss how hydrogen bonding determines the physical properties of water.
- SCI.CHEMH.10.7      Identify the variables of the equation  $Q = mc\Delta t$ .
- SCI.CHEMH.10.8      Conduct an investigation of  $Q = mc\Delta t$ .
- SCI.CHEMH.10.9      Describe the process of erosion.
- SCI.CHEMH.10.10      Identify factors that affect rates of reaction.
- SCI.CHEMH.10.11      Identify a change in conditions that will produce increased amounts of products at equilibrium.

**SCI.CHEMH.11**      **Students will define pressure and use Boyle's law, Charles' law, Gay-Lussac's law, and the combined gas law to calculate changes in pressure, volume, and temperature of a gas. Students will use Dalton's law of Partial Pressure to calculate the total pressure of a mixture of gases. (HS-ESS3-6)**

- SCI.CHEMH.11.1      Define pressure, give units of pressure, and describe how pressure is measured.
- SCI.CHEMH.11.2      State conditions at Standard Temperature and Pressure (STP).



- SCI.CHEMH.11.3 Use Dalton's law of Partial Pressure to calculate the total pressure of a mixture of gases and the partial pressure of a gas collected by water displacement.
- SCI.CHEMH.11.4 Make predictions about how changing volume, pressure, and/or temperature effects other variables and identify the corresponding gas law.
- SCI.CHEMH.11.5 Use Boyle's law to calculate volume-pressure changes of a gas at constant temperature.
- SCI.CHEMH.11.6 Use Charles' law to calculate volume-temperature changes of a gas at constant pressure.
- SCI.CHEMH.11.7 Use Gay-Lussac's law to calculate pressure-temperature changes of a gas at constant volume.
- SCI.CHEMH.11.8 Use the combined gas law to calculate volume-temperature-pressure changes of a gas.

**SCI.CHEMH.12 Students will state the law of combining volumes, Avogadro's law, and define standard molar volume. Students will state and use the ideal gas law to calculate pressure, volume, temperature, or amount of gas when the other three variables are known. Students will describe effusion and diffusion and calculate rates of effusion using Graham's law of Effusion.**

- SCI.CHEMH.12.1 Define standard molar volume of a gas and use it to calculate gas volumes and masses.
- SCI.CHEMH.12.2 Use the ideal gas law to calculate pressure, volume, temperature, or amount of gas when the other three variables are known.
- SCI.CHEMH.12.3 Use variations of the ideal gas law to solve for molar mass or density.
- SCI.CHEMH.12.4 Define and describe effusion and diffusion.
- SCI.CHEMH.12.5 Solve problems using Graham's law.

**SCI.CHEMH.13 Students will compare properties of solutions, suspensions, and colloids and distinguish between electrolytes and nonelectrolytes. Students will describe factors involved in making a solution and the types of solutions. Students will determine the concentration of a solution using percent by mass, percent by volume, molarity, and molality. Students will calculate freezing point depression and boiling point elevation. (HS-PS1-3, HS-PS1-7)**

- SCI.CHEMH.13.1 Define solute and solvent and describe the different types of solutions.
- SCI.CHEMH.13.2 Compare the properties of solutions, suspensions, and colloids.
- SCI.CHEMH.13.3 Distinguish between electrolytes and nonelectrolytes.
- SCI.CHEMH.13.4 List the three factors (stirring, heat, surface area) that affect the rate of dissolution.
- SCI.CHEMH.13.5 Distinguish between saturated, unsaturated, and supersaturated solutions.
- SCI.CHEMH.13.6 Explain the general rule of solubility of “like dissolves like.”
- SCI.CHEMH.13.7 Compare the effects of temperature and pressure on solubility and describe the energy changes associated with forming a solution.
- SCI.CHEMH.13.8 Determine the concentration of a solution using percent by mass, percent by volume, molarity, and molality.
- SCI.CHEMH.13.9 Calculate freezing point depression and boiling point elevation.

## Chemistry of Living Systems

**SCI.CLS.1 Students will identify acids and bases and describe their properties. Students will write neutralization reactions and describe reactions of acids with carbonates and bicarbonates.**

- SCI.CLS.1.1 Describe properties of acids.
- SCI.CLS.1.2 Describe properties of bases.
- SCI.CLS.1.3 Identify the ions associated with an acid and the ions associated with a base.
- SCI.CLS.1.4 Name some common acids and bases.
- SCI.CLS.1.5 Write a neutralization reaction and identify the salt.
- SCI.CLS.1.6 Write an ionic equation and net ionic equation for a neutralization reaction.
- SCI.CLS.1.7 Describe the reactions of acids with carbonates and bicarbonates.

**SCI.CLS.2 Students will calculate and describe how to dilute a solution. Students will use acid-base titration to determine the molarity of an unknown solution. Students will use the pH scale to classify a substance as an acid or a base and use the ion product of water to calculate hydronium ion or hydroxide ion concentration.**

- SCI.CLS.2.1 Use the formula  $M_1V_1 = M_2V_2$  to dilute a solution.
- SCI.CLS.2.2 Use data from an acid-base titration to determine the volume of unknown solution needed or the molarity of the unknown solution used.
- SCI.CLS.2.3 Use the pH scale to classify a substance as an acid or a base.
- SCI.CLS.2.4 Use the ion product of water to calculate the hydronium ion or hydroxide ion concentration.

**SCI.CLS.3 Students will describe how to determine if a substance has been oxidized or reduced. Students will identify oxidizing and reducing agents.**

- SCI.CLS.3.1 Describe the chemical and physical properties of oxygen and hydrogen.
- SCI.CLS.3.2 Define oxidation and reduction.
- SCI.CLS.3.3 Assign oxidation numbers to all atoms in an oxidation-reduction reaction and determine what substance has been oxidized and what substance has been reduced.
- SCI.CLS.3.4 Identify common oxidizing agents and reducing agents.

**SCI.CLS.4 Students will identify, define, give physical and chemical properties, name, and draw structural formulas for alkanes, alkenes, alkynes, and aromatic hydrocarbons.**

- SCI.CLS.4.1 Identify and define alkanes, alkenes, alkynes, and aromatic hydrocarbons and list physical and chemical properties of each.
- SCI.CLS.4.2 Name using IUPAC nomenclature and draw structural formulas for alkanes, alkenes, alkynes, and aromatic hydrocarbons.
- SCI.CLS.4.3 Define and identify isomers.
- SCI.CLS.4.4 Define, name, and draw structural formulas for alkyl groups.
- SCI.CLS.4.5 Define monomers and describe addition polymerization.

**SCI.CLS.5 Students will identify, define, give physical and chemical properties, name, and draw structural formulas for alcohols, phenols, and ethers.**

- SCI.CLS.5.1 Identify and define alcohols, phenols, and ethers and list physical and chemical properties of each.
- SCI.CLS.5.2 Name using IUPAC nomenclature and draw structural formulas for alcohols, phenols, and ethers.
- SCI.CLS.5.3 Define functional groups and identify organic functional groups.
- SCI.CLS.5.4 Describe the reaction for the preparation of alcohols by the hydration of alkenes.

**SCI.CLS.6 Students will identify, define, give physical and chemical properties, name, and draw structural formulas for aldehydes and ketones.**

- SCI.CLS.6.1 Identify and define aldehydes and ketones and list physical and chemical properties of each.
- SCI.CLS.6.2 Name using IUPAC nomenclature and draw structural formulas for aldehydes and ketones.
- SCI.CLS.6.3 Describe the reaction for the preparation of aldehydes and ketones by the oxidation of primary and secondary alcohols.

**SCI.CLS.7 Students will identify, define, give physical and chemical properties, name, and draw structural formulas for carboxylic acids, esters, and amides.**

- SCI.CLS.7.1 Identify and define carboxylic acids, esters, and amides and list physical and chemical properties of each.
- SCI.CLS.7.2 Name using IUPAC nomenclature and draw structural formulas for carboxylic acids, esters, and amides.
- SCI.CLS.7.3 Describe the reaction for the preparation of carboxylic acids by the oxidation of aldehydes and/or primary alcohols.
- SCI.CLS.7.4 Describe the esterification of a carboxylic acid to prepare an ester.
- SCI.CLS.7.5 Describe the synthesis of amides by the addition of ammonia to a carboxylic acid.

**SCI.CLS.8 Students will identify, define, give physical and chemical properties, name, and draw structural formulas for amines.**

- SCI.CLS.8.1 Identify and define amines and list physical and chemical properties of amines.
- SCI.CLS.8.2 Name using IUPAC nomenclature and draw structural formulas for amines.
- SCI.CLS.8.3 Describe heterocyclic amines.

**SCI.CLS.9 Students will identify different types of isomers and describe structural formulas associated with each type of isomer.**

- SCI.CLS.9.1 Define structural isomers, positional isomers, functional group isomers, and stereoisomers.
- SCI.CLS.9.2 Compare and contrast polarized light and non-polarized light.
- SCI.CLS.9.3 Identify chiral molecules.
- SCI.CLS.9.4 Differentiate between cis and trans isomers.

## Earth Science

### **SCI.ES.1 Students will determine how the Sun, Earth, and the Moon form a dynamic system that influences all life on Earth. (HS-ESS1-4)**

- SCI.ES.1.1 Define electromagnetic radiation.
- SCI.ES.1.2 Explain how telescopes work.
- SCI.ES.1.3 Describe how space exploration helps scientists learn about the universe.
- SCI.ES.1.4 Recognize lunar properties and structures.
- SCI.ES.1.5 Identify features of the Moon.
- SCI.ES.1.6 Explain the theory of how the Moon formed.
- SCI.ES.1.7 Identify the relative positions and motions of the Sun, Earth, and Moon.
- SCI.ES.1.8 Identify the phases of the Moon.
- SCI.ES.1.9 Distinguish between solstices and equinoxes.
- SCI.ES.1.10 Explain eclipses of the Sun and Moon.

### **SCI.ES.2 Students will use the laws of motion and gravitation to describe the orbits and the characteristics of the planets and other objects in the solar system. (HS-ESS1-4, HS-ESS1-6)**

- SCI.ES.2.1 Explain how the solar system formed.
- SCI.ES.2.2 Describe early concepts of the structure of the solar system.
- SCI.ES.2.3 Describe how our current knowledge of the solar system developed.
- SCI.ES.2.4 Relate gravity to the motions of the objects in the solar system.
- SCI.ES.2.5 Compare and contrast the characteristics of the inner planets and outer planets.
- SCI.ES.2.6 Survey some of the probes used to explore the solar system.
- SCI.ES.2.7 Identify and explain the formation of the major moons and rings.
- SCI.ES.2.8 Compare the composition of the gas giant planets to the composition of the Sun.
- SCI.ES.2.9 Distinguish between planets and dwarf planets.
- SCI.ES.2.10 Describe meteoroids, meteors, and meteorites.
- SCI.ES.2.11 Determine the structure and behavior of comets.

**SCI.ES.3 Students will determine the relationship between the life cycle of a star and its mass, luminosity, magnitude, temperature, and composition. (HS-ESS1-1, HS-ESS1-3)**

- SCI.ES.3.1 Describe the layers and features of the Sun.
- SCI.ES.3.2 Explain the process of energy production in the Sun.
- SCI.ES.3.3 Define the three types of spectra.
- SCI.ES.3.4 Determine how distances between stars are measured.
- SCI.ES.3.5 Distinguish between magnitude (brightness) and luminosity.
- SCI.ES.3.6 Identify the properties and composition used to classify stars.
- SCI.ES.3.7 Determine the effect of mass on a star's evolution.
- SCI.ES.3.8 Identify the features of massive and regular star life cycles.
- SCI.ES.3.9 Explain how the universe is affected by the life cycles of stars.

**SCI.ES.4 Students will identify and describe how observations of galaxy expansion, cosmic background radiation, and the Big Bang Theory are related to the estimated age of the universe. (HS-ESS1-2)**

- SCI.ES.4.1 Determine the size and shape of our galaxy.
- SCI.ES.4.2 Distinguish the different kinds of variable stars.
- SCI.ES.4.3 Identify the different kinds of stars in a galaxy and their locations.
- SCI.ES.4.4 Describe how astronomers classify galaxies.
- SCI.ES.4.5 Identify how galaxies are organized into clusters and superclusters.
- SCI.ES.4.6 Describe the expansion of the universe – the Big Bang Theory.

**SCI.ES.5 Students will describe how weathering and erosion are instrumental in changing the Earth's surface. (HS-ESS2-2, HS-ESS2-5)**

- SCI.ES.5.1 Distinguish between mechanical and chemical weathering.
- SCI.ES.5.2 Describe and identify the different factors that affect the rate of mechanical and chemical weathering.
- SCI.ES.5.3 Describe the relationship of gravity to all agents of erosion.
- SCI.ES.5.4 Contrast the features left from different types of erosion.
- SCI.ES.5.5 Analyze the impact of living and nonliving things to determine their effect on the processes of weathering and erosion.
- SCI.ES.5.6 Describe how soil forms and how soil horizons within the soil profiles develop.
- SCI.ES.5.7 Differentiate among the factors of soil formation.

**SCI.ES.6 Students will investigate changes of the Earth’s surface due to mass movements caused by gravity, winds and glaciers. (HS-ETS1-3)**

- SCI.ES.6.1 Analyze the relationship between gravity and mass movements.
- SCI.ES.6.2 Identify factors that affect mass movements.
- SCI.ES.6.3 Distinguish between the types of mass movements.
- SCI.ES.6.4 Relate how mass movements affect people.
- SCI.ES.6.5 Describe conditions that contribute to the likelihood that an area will experience wind erosion.
- SCI.ES.6.6 Identify wind-formed landscape features.
- SCI.ES.6.7 Describe how dunes form and migrate.
- SCI.ES.6.8 Explain how glaciers form.
- SCI.ES.6.9 Compare and contrast the conditions that produce valley glaciers with those that produce continental glaciers.
- SCI.ES.6.10 Describe glacial features and how glaciers modify landscapes.

**SCI.ES.7 Students will investigate how surface water moves weathered materials, and how it produces weathering and shapes the surface of Earth. (HS-ETS1-3, HS-ESS2-5)**

- SCI.ES.7.1 Describe how surface water can move weathered materials.
- SCI.ES.7.2 Explain how a stream carries its load.
- SCI.ES.7.3 Describe how a floodplain develops.
- SCI.ES.7.4 Describe some of the physical features of stream development.
- SCI.ES.7.5 Describe the relationship between meanders and stream flow.
- SCI.ES.7.6 Explain the process of rejuvenation in the stream development.
- SCI.ES.7.7 Explain the formation of freshwater lakes and wetlands.
- SCI.ES.7.8 Describe the process of eutrophication.
- SCI.ES.7.9 Explain the effects of human activity on lake development.

**SCI.ES.8 Students will investigate formation and movements of groundwater. (HS-ESS2-5)**

- SCI.ES.8.1 Describe how groundwater storage and underground movement relate to the water cycle.
- SCI.ES.8.2 Illustrate an aquifer and an aquiclude.
- SCI.ES.8.3 Identify the characteristics of aquifers which create springs.
- SCI.ES.8.4 Explain how groundwater dissolves and deposits rocks and minerals.
- SCI.ES.8.5 Illustrate how caves form and describe how the features of karst topography shape the landscape.
- SCI.ES.8.6 Explain how groundwater is withdrawn from aquifers by wells.
- SCI.ES.8.7 Describe the major problems that threaten groundwater supplies.



**SCI.ES.9     The students will investigate how the composition, structure, and properties of Earth’s atmosphere form the basis of Earth’s weather and climate. (HS-ESS2-4, HS-ESS3-5)**

- SCI.ES.9.1            Describe the gas and particle composition of the atmosphere.
- SCI.ES.9.2            Compare and contrast the five layers of the atmosphere.
- SCI.ES.9.3            Identify three ways energy is transferred in the atmosphere.
- SCI.ES.9.4            Identify three properties affected by changes in altitude.
- SCI.ES.9.5            Explain the difference between stable and unstable air.
- SCI.ES.9.6            Identify the types of clouds and determine location in the atmosphere (low, middle, high, and vertical).
- SCI.ES.9.7            Explain how precipitation forms.

**SCI.ES.10    Students will observe, analyze and predict weather patterns. (HS-ESS2-2)**

- SCI.ES.10.1           Compare and contrast weather and climate.
- SCI.ES.10.2           Analyze how imbalances in the heating of Earth’s surface create weather.
- SCI.ES.10.3           Describe how air masses form.
- SCI.ES.10.4           Identify five types of air masses.
- SCI.ES.10.5           Compare and contrast the three major wind systems.
- SCI.ES.10.6           Identify four types of weather fronts.
- SCI.ES.10.7           Distinguish high- and low-pressure systems.
- SCI.ES.10.8           State the importance of accurate weather data.
- SCI.ES.10.9           Identify the instruments used to collect weather data from Earth’s surface.
- SCI.ES.10.10          Compare the strengths and weaknesses of weather radar and weather satellites.
- SCI.ES.10.11          Analyze a basic surface weather chart.
- SCI.ES.10.12          Describe problems with long-term forecasts.

**SCI.ES.11 Students will analyze the exchange of thermal energy in the atmosphere to explain that it sometimes occurs with great violence that varies in form, size and duration. (HS-ESS2-2)**

- SCI.ES.11.1 Identify and describe the processes that form thunderstorms and determine its duration.
- SCI.ES.11.2 Explain why some thunderstorms are more severe than others.
- SCI.ES.11.3 Distinguish the dangers of severe weather, including lightning, hail, and high winds.
- SCI.ES.11.4 Describe how tornadoes form.
- SCI.ES.11.5 Identify and describe the conditions required for tropical cyclones to form and the life cycle of a tropical cyclone.
- SCI.ES.11.6 Identify the dangers of hurricanes.
- SCI.ES.11.7 Describe recurring weather patterns and the problems they create.
- SCI.ES.11.8 Analyze atmospheric events to explain what causes recurring weather patterns.

**SCI.ES. 12 Students will investigate the different climates on Earth and how they are influenced by natural factors as well as human activities. (HS-ESS2-4, HS-ESS3-5)**

- SCI.ES.12.1 Recognize limits associated with the use of normals.
- SCI.ES.12.2 Explain why climates vary.
- SCI.ES.12.3 Compare and contrast temperatures in different regions on Earth.
- SCI.ES.12.4 Describe the criteria used to classify climates.
- SCI.ES.12.5 Compare and contrast different climates.
- SCI.ES.12.6 Explain and give examples of microclimates.
- SCI.ES.12.7 Distinguish between long-term and short-term climatic changes.
- SCI.ES.12.8 Identify natural causes of climate change and explain why climatic changes occur.
- SCI.ES.12.9 Explain the greenhouse effect.
- SCI.ES.12.10 Describe global warming.
- SCI.ES.12.11 Analyze data to determine if humans impact climate.

**SCI.ES.13 Students will evaluate how and why geologic activity occurs at tectonic plate boundaries. (HS-ESS1-5, HS-ESS2-1)**

- SCI.ES.13.1 Summarize the evidence that led to the discovery of seafloor spreading.
- SCI.ES.13.2 Explain the significance of magnetic patterns on the seafloor and the process that formed them.
- SCI.ES.13.3 Describe how Earth's tectonic plates results in creating geologic features.
- SCI.ES.13.4 Identify the three types of plate boundaries and the features associated with each.
- SCI.ES.13.5 Describe the processes associated with subduction zones.
- SCI.ES.13.6 Summarize how convection in the asthenosphere is related to the movements of tectonic plates.
- SCI.ES.13.7 Compare and contrast the processes of ridge push and slab pull.

**SCI.ES.14 Students will evaluate how the use of natural resources can impact Earth's land, air and water. (HS-ESS3-2, HS-ESS3-3, HS-ESS3-4)**

- SCI.ES.14.1 Summarize the typical pattern of population growth of organisms.
- SCI.ES.14.2 Describe what happens to populations when they reach carrying capacity.
- SCI.ES.14.3 Identify environmental factors that affect population growth.
- SCI.ES.14.4 Describe the environmental impact of mineral extraction.
- SCI.ES.14.5 Discuss the environmental problems created by agriculture and forestry, and list possible solutions.
- SCI.ES.14.6 Explain how urban development affects soil and water.
- SCI.ES.14.7 Identify ways to conserve water.
- SCI.ES.14.8 Summarize the types and sources of water pollution.
- SCI.ES.14.9 Describe some methods of controlling water pollution.
- SCI.ES.14.10 Relate the greenhouse effect to global warming.
- SCI.ES.14.11 Sequence the reactions that occur as CFCs cause ozone depletion.
- SCI.ES.14.12 Identify the causes and effects of acid precipitation.

**SCI.ES.15 Students will evaluate how oceans effect mankind and the environment.  
(HS-ESS3-4, HS-ESS3-6)**

- SCI.ES.15.1 Identify and interpret methods used by scientists to study Earth's oceans.
- SCI.ES.15.2 Discuss the evidence that supports scientists' understanding of the origin and composition of the oceans.
- SCI.ES.15.3 Describe the distribution of water at Earth's surface.
- SCI.ES.15.4 Identify the chemical and physical properties of seawater.
- SCI.ES.15.5 Illustrate ocean layering.
- SCI.ES.15.6 Describe the formation of deep water masses and determine how they affect ocean currents.
- SCI.ES.15.7 Describe the physical properties of waves.
- SCI.ES.15.8 Explain how tides form.
- SCI.ES.15.9 Compare and contrast various ocean currents.

**SCI.ES.16 Students will explain the causes and probability of earthquakes occurring in different locations on the Earth. (HS-ESS2-3)**

- SCI.ES.16.1 Define stress and strain as they apply to rocks.
- SCI.ES.16.2 Distinguish among the three types of movement of faults.
- SCI.ES.16.3 Contrast the three types of seismic waves.
- SCI.ES.16.4 Explain how seismic waves have been used to determine the structure and composition of Earth's interior.
- SCI.ES.16.5 Compare and contrast earthquake magnitude and intensity and the scales used to measure each.
- SCI.ES.16.6 Explain why data from at least three seismic stations are needed to locate an earthquake's epicenter.
- SCI.ES.16.7 Describe Earth's seismic belts.
- SCI.ES.16.8 Discuss factors that affect the amount of damage caused by an earthquake.
- SCI.ES.16.9 Explain some of the factors considered in earthquake-probability studies.
- SCI.ES.16.10 Identify how different types of structures are affected by earthquakes.

## Forensic Science Honors

**SCI.FSCH.1**      **Students will describe the importance of forensic science; identify its major disciplines and contributors; and compare, contrast and analyze the changing role of forensic science. Students will explain how specific case studies relate to the material in the unit. (HS-ETS1-1)**

- SCI.FSCH.1.1      Define forensic science and list the major disciplines.
- SCI.FSCH.1.2      Identify major contributors to the development of forensic science.
- SCI.FSCH.1.3      Explain the rapid growth of forensic laboratories over the past forty years.
- SCI.FSCH.1.4      Explain the major court cases and their importance on the admissibility of scientific evidence in the courtroom.
- SCI.FSCH.1.5      List and describe the services of a full-service crime laboratory and compare that to those of specialized crime laboratories.
- SCI.FSCH.1.6      Compare the roles and responsibilities of an expert witness to that of a lay witness.
- SCI.FSCH.1.7      Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.1.8      Investigate the importance of trace evidence and body measurements as they relate to crime scene investigation.
- SCI.FSCH.1.9      List the five major crime labs in the United States.
- SCI.FSCH.1.10     List and describe the three functions of a forensic scientist.

**SCI.FSCH.2**

**Students will explain the proper procedure to process and package physical evidence from a crime scene and interpret the role of forensic science to the scientific fields of pathology, anthropology and entomology. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.2.1 Define physical evidence.
- SCI.FSCH.2.2 Discuss the role of the Initial Responding Officer and other specialists at a crime scene.
- SCI.FSCH.2.3 Explain the proper steps, in order, to record and process evidence at a crime scene using the Adapt Procedure and identify the four types of search patterns.
- SCI.FSCH.2.4 Explain the importance of following Chain of Custody (COC) and understand the consequences if COC is broken.
- SCI.FSCH.2.5 Describe the proper techniques for packaging common types of physical evidence and predict the changes that could occur if it is not properly packaged, especially in a suspicious fire.
- SCI.FSCH.2.6 Describe two types of evidence that the Postal Service recommends not be sent in the mail.
- SCI.FSCH.2.7 Describe the roles and contributions of a forensic pathologist, entomologist and anthropologist to a homicide investigation.
- SCI.FSCH.2.8 List the five manners of death.
- SCI.FSCH.2.9 Describe the importance of insects at a crime scene and what environmental factors can influence their development.
- SCI.FSCH.2.10 List the two causes of death and explain under what circumstances an autopsy is required.
- SCI.FSCH.2.11 Calculate the time of death from several cases studies.
- SCI.FSCH.2.12 Identify the stages of decomposition.
- SCI.FSCH.2.13 Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.2.14 Investigate the importance of documenting a crime scene by doing a crime scene project: crime story, rough sketch, finished sketch, and a 3-dimensional model.
- SCI.FSCH.2.15 Investigate the importance of photography as it relates to crime scene investigation.

**SCI.FSCH.3**

**Students will examine the role that physical evidence plays in crime scene reconstruction and understand the difference between individual and class evidence. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.3.1 Explain the difference between identification and comparison of physical evidence.
- SCI.FSCH.3.2 Define and contrast between class and individual evidence.
- SCI.FSCH.3.3 Define and contrast between the following major classifications of physical evidence – physical vs non-physical, real vs demonstrative, and known vs unknown.
- SCI.FSCH.3.4 Describe the value of class evidence as it relates to criminal investigations.
- SCI.FSCH.3.5 Hypothesize the purpose that physical evidence plays in crime scene reconstruction.
- SCI.FSCH.3.6 Describe the following types of physical evidence – transient, pattern, conditional, transfer, and associative.
- SCI.FSCH.3.7 Explain the importance of the relevance rule in collecting physical evidence.
- SCI.FSCH.3.8 Describe the role probability plays on physical evidence.
- SCI.FSCH.3.9 Explain the role the jury plays in court.
- SCI.FSCH.3.10 Define and contrast the two methods for examination of physical evidence in the crime lab.
- SCI.FSCH.3.11 Explain the function of national databases that are available to forensic scientists.
- SCI.FSCH.3.12 Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.3.13 Investigate the importance of class and individual characteristics as it relates to crime scene investigation.
- SCI.FSCH.3.14 Investigate the importance of physical evidence as it relates to crime scene investigation.

**SCI.FSCH.4**

**Students will examine the basic principles of chemistry to determine its role in the analysis of glass and soil evidence. Students will explain how specific case studies relate to the material in the unit. (HS-PS1-1, HS-PS4-1, HS-PS4-3)**

- SCI.FSCH.4.1 Define and distinguish between physical and chemical properties of matter, and between elements and compounds.
- SCI.FSCH.4.2 Explain the basic units of the metric system and describe the role of the metric system in the crime laboratory.
- SCI.FSCH.4.3 Contrast between solids, liquids and gases.
- SCI.FSCH.4.4 State the principles behind the behavior of light and how it applies to forensic science.
- SCI.FSCH.4.5 Describe the electromagnetic spectrum and explain how it can be used to identify different types of physical evidence.
- SCI.FSCH.4.6 Describe the proper procedure for the collection and preservation of glass and soil evidence.
- SCI.FSCH.4.7 List and explain the forensic methods comparing glass and soil evidence using the properties of density and refractive index.
- SCI.FSCH.4.8 Examine fractures in glass to determine the direction of impact of a projectile.
- SCI.FSCH.4.9 Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.4.10 Investigate the importance of sand and soil evidence as they relate to crime scene investigation.



**SCI.FSCH.5**

**Students will explain the role of the forensic toxicologist in the analysis of drug evidence and describe the commonly used laboratory tests used to identify a drug. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.5.1 Compare and contrast psychological and physical dependence.
- SCI.FSCH.5.2 Name and classify the types of commonly abused drugs.
- SCI.FSCH.5.3 Describe and explain how the forensic toxicologist utilizes a variety of laboratory tests to perform routine drug analysis; color spot tests, microscopic analysis, chromatography, and spectrophotometry.
- SCI.FSCH.5.4 Discuss the importance of drug control laws.
- SCI.FSCH.5.5 Discuss the role of the Controlled Substance Act to the apprehension and conviction of a criminal in possession of a controlled substance.
- SCI.FSCH.5.6 Describe the proper procedure for the collection and preservation of drug evidence.
- SCI.FSCH.5.7 Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.5.8 Investigate the importance the analysis of drug evidence as it relates to crime scene investigation.
- SCI.FSCH.5.9 Investigate the importance of chromatography as it relates to crime scene investigation.

**SCI.FSCH.6**

**Students will explain the role of the forensic toxicologist in the analysis of alcohol; the role of a police officer in applying field sobriety tests to determine blood alcohol concentration (BAC); and the legal rulings associated with alcohol impairment. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.6.1 Explain the process of alcohol absorption and elimination in the body.
- SCI.FSCH.6.2 Describe the significance of field sobriety tests to determine alcohol impairment and the concept of breath testing devices (infrared and fuel cell devices).
- SCI.FSCH.6.3 Compare and contrast laboratory procedures for measuring concentration of alcohol in the blood.
- SCI.FSCH.6.4 Describe the proper procedure collection and preservation of blood evidence for alcohol analysis.
- SCI.FSCH.6.5 Explain the importance of implied consent laws, the 4<sup>th</sup> Amendment and the *Schmerber v CA* case to forensic science and the incarceration of a criminal.
- SCI.FSCH.6.6 Describe the forensic techniques that are utilized in the crime laboratory to isolate and identify alcohol, drugs and poisons.
- SCI.FSCH.6.7 Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.6.8 Investigate the importance of alcohol and the role of a forensic toxicologist as they relate to crime scene investigation.

**SCI.FSCH.7                    Students will explain the importance of different types of microscopes and their capabilities in the crime laboratory. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.7.1                List and describe the functions of the different parts of a microscope.
- SCI.FSCH.7.2                Define the following terms: magnification, field of view, working distance and depth of focus and describe their importance to different microscopes.
- SCI.FSCH.7.3                Compare and contrast between the capabilities of the different microscopes: magnifying glass, light compound, comparison microscope, stereoscopic, polarizing, microspectrophotometer and scanning electron.
- SCI.FSCH.7.4                Hypothesize about the forensic applications of the different microscopes.
- SCI.FSCH.7.5                Explain the function of a forensic microscopist and a forensic palynologist.
- SCI.FSCH.7.6                Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.7.7                Investigate the importance of using a microscope in a forensic laboratory as it relates to crime scene investigation.

**SCI.FSCH.8                    Students will explain the role of a forensic serologist and describe the forensic applications of different body fluids. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.8.1                    List the ABO antigens and antibodies of the 4 blood groups; A, B, AB, O.
- SCI.FSCH.8.2                    Describe how whole blood is typed.
- SCI.FSCH.8.3                    Describe the forensic tests utilized to characterize a stain found at a crime scene as blood.
- SCI.FSCH.8.4                    Examine blood stain evidence to interpret and reconstruct events that produced the bleeding.
- SCI.FSCH.8.5                    Describe how antigen-antibody interactions can be used to determine species and drug identification.
- SCI.FSCH.8.6                    Explain how Punnett squares are used to determine genotypes and phenotypes of offspring to apply it in paternity suits.
- SCI.FSCH.8.7                    Explain the proper procedure for collection and preservation of biological fluids.
- SCI.FSCH.8.8                    Identify the necessary steps to address universal precautions concerning biological fluids.
- SCI.FSCH.8.9                    Describe the laboratory tests used to characterize seminal stains.
- SCI.FSCH.8.10                    Describe the proper collection and preservation of rape evidence.
- SCI.FSCH.8.11                    Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.8.12                    Investigate the importance of blood typing as it relates to crime scene investigation.

**SCI.FSCH.9**

**Students will describe the importance of nuclear and mitochondrial DNA to criminal investigations and the types of tests utilized to determine DNA from different body fluids and cells. Students will explain how specific case studies relate to the material in the unit. (HS-LS3-1)**

- SCI.FSCH.9.1 Name and describe the parts of a nucleotide and base-pairing rules on DNA.
- SCI.FSCH.9.2 Contrast DNA strands that code for proteins with strands that contain repeating base sequences.
- SCI.FSCH.9.3 Explain polymerase chain reaction (PCR) technology and its application to DNA typing.
- SCI.FSCH.9.4 Compare and contrast restriction fragment length polymorphism (RFLP) to short tandem repeats (STRs).
- SCI.FSCH.9.5 Describe the difference between nuclear and mitochondrial DNA.
- SCI.FSCH.9.6 Describe the proper procedure for the collection and preservation of DNA evidence.
- SCI.FSCH.9.7 Explain the importance of the Combined DNA Index System (CODIS) database in criminal investigations.
- SCI.FSCH.9.8 Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.9.9 Investigate the importance of nuclear DNA as it relates to crime scene investigation.

**SCI.FSCH.10**            **Students will describe and explain the importance of the forensic analysis of hair and fiber evidence. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.10.1            Describe the main parts of the hair that are analyzed in criminal investigations: the cuticle, cortex and medulla.
- SCI.FSCH.10.2            List the 3 phases for hair growth and describe its importance to physical evidence.
- SCI.FSCH.10.3            Distinguish between human and other animal hair.
- SCI.FSCH.10.4            Describe the features of hair for microscopic comparison.
- SCI.FSCH.10.5            Describe the differences between natural and manufactured fibers.
- SCI.FSCH.10.6            Describe the proper procedure for the collection and preservation of hair and fiber evidence.
- SCI.FSCH.10.7            Explain the properties of fibers that are useful for forensic comparison.
- SCI.FSCH.10.8            Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.10.9            Investigate the importance of hair evidence as it relates to crime scene investigation.
- SCI.FSCH.10.10           Investigate the importance of fiber evidence as it relates to crime scene investigation.

**SCI.FSCH.11**            **Students will apply the principles of chemistry to the forensic application of metal and paint evidence. Students will explain how specific case studies relate to the material in the unit. (HS-PS1-8)**

- SCI.FSCH.11.1            Define and distinguish between protons, neutrons and electrons.
- SCI.FSCH.11.2            Define and distinguish between atomic number and atomic mass.
- SCI.FSCH.11.3            Explain the concept of an isotope and how certain elements can become radioactive.
- SCI.FSCH.11.4            Describe the proper procedure for the collection and preservation of trace evidence.
- SCI.FSCH.11.5            Describe the laboratory tests used in the analysis of paint evidence.
- SCI.FSCH.11.6            Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.11.7            Investigate the importance of paint evidence as it relates to crime scene investigation.

**SCI.FSCH.12            Students will explain the chemistry of a fire to determine the forensic application in an arson. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.12.1            List the conditions that are necessary for combustion.
- SCI.FSCH.12.2            Explain the three mechanisms for heat transfer.
- SCI.FSCH.12.3            Recognize the tell-tale signs of an accelerant-initiated fire.
- SCI.FSCH.12.4            Describe the proper procedure for the collection and preservation of fire evidence.
- SCI.FSCH.12.5            Describe laboratory procedures used to detect and identify hydrocarbon residues.
- SCI.FSCH.12.6            Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.12.7            Investigate the importance of arson evidence as it relates to crime scene investigation.

**SCI.FSCH.13            Students will explain the basic principles of fingerprint classification and apply it to fingerprint evidence. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.13.1            Describe the common ridge characteristics of a fingerprint.
- SCI.FSCH.13.2            List the scientists credited with fingerprint classification and their contributions.
- SCI.FSCH.13.3            List the three major fingerprint patterns and their subclasses.
- SCI.FSCH.13.4            Distinguish between visible, plastic, and latent prints found at a crime scene.
- SCI.FSCH.13.5            Explain the techniques for lifting and developing latent fingerprints at a crime scene using the ACE-V method.
- SCI.FSCH.13.6            Describe the proper procedure for collection and preservation of fingerprint evidence.
- SCI.FSCH.13.7            Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.13.8            Investigate the importance of the many different ways of lifting fingerprints as it relates to crime scene investigation.
- SCI.FSCH.13.9            Investigate the importance of fingerprint classification as it relates to crime scene investigation.

**SCI.FSCH.14**            **Students will describe the importance of document examination in criminal investigations. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.14.1            Define questioned document.
- SCI.FSCH.14.2            Describe the common individual characteristics that are associated with handwriting.
- SCI.FSCH.14.3            Describe the guidelines for collecting known writings to compare to questioned documents.
- SCI.FSCH.14.4            Describe the class and individual characteristics of printers and copiers.
- SCI.FSCH.14.5            Describe the proper procedure for the collection and preservation of document evidence.
- SCI.FSCH.14.6            Explain the techniques document examiners utilize to uncover alterations, erasures, obliterations, and variations in inks.
- SCI.FSCH.14.7            Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.14.8            Investigate the importance of chromatography and ink characterization as they relate to crime scene investigation.

**SCI.FSCH.15**            **Students will describe the importance of firearms, tools marks and other types of impressions in criminal investigations. Students will explain how specific case studies relate to the material in the unit.**

- SCI.FSCH.15.1            Describe techniques for rifling a barrel.
- SCI.FSCH.15.2            Explain the class and individual characteristics of bullets and cartridge cases.
- SCI.FSCH.15.3            Explain the procedure to determine how far a weapon was fired from a target.
- SCI.FSCH.15.4            Explain the laboratory tests utilized to determine whether an individual has fired a weapon (gunshot residue - GSR).
- SCI.FSCH.15.5            Describe the proper procedure for the collection and preservation of ballistic evidence.
- SCI.FSCH.15.6            Explain the forensic significance of class and individual characteristics to compare tool marks, footwear and tire impressions.
- SCI.FSCH.15.7            Explain the importance of evidence used in special cases and how that evidence was used in court to convict someone.
- SCI.FSCH.15.8            Investigate the importance of gunshot residue as it relates to crime scene investigation.



## **Human Anatomy and Physiology Honors**

**SCI.HAPH.1**      **Students will use anatomical terms to describe body sections, body regions, and relative positions. Students will discuss negative and positive feedback mechanisms in homeostatic regulation. Students will identify each organ system and its components.**

- SCI.HAPH.1.1      Determine the basic functions and major levels of organization in living organisms.
- SCI.HAPH.1.2      Identify the organ systems of the human body and the major components of each system.
- SCI.HAPH.1.3      Give an example of and discuss how negative and positive feedback is involved in homeostatic regulation.
- SCI.HAPH.1.4      Use anatomical terms to distinguish body sections, body regions, and relative positions utilizing laboratory experience.
- SCI.HAPH.1.5      Divide the body into major cavities listing the organs and their subdivisions.
- SCI.HAPH.1.6      Determine that there are various specialties and opportunities within anatomy and physiology.

**SCI.HAPH.2**      **Students will relate the principles of chemistry to the human body.**

- SCI.HAPH.2.1      Describe the important role of enzymes in metabolism. Identify the structure and function of carbohydrates, lipids, proteins, nucleic acids, and high-energy compounds.
- SCI.HAPH.2.2      Describe the pH scale and discuss the role of buffers in body fluids.
- SCI.HAPH.2.3      Explain the physiological roles of inorganic compounds in the body.

**SCI.HAPH.3**      **Students will relate cell structure and function to the formation of and roles of tissues in the body.**

- SCI.HAPH.3.1      Review various mechanisms that cells use to transport substances across the cell membrane.
- SCI.HAPH.3.2      Review the structure and functions of the organelles within a typical cell.
- SCI.HAPH.3.3      Summarize the process of protein synthesis.
- SCI.HAPH.3.4      Describe the process of mitosis and explain its significance to the body.
- SCI.HAPH.3.5      Explain cell differentiation and discuss its importance in the body.

**SCI.HAPH.4**            **Students will examine the body’s four major tissue types and describe their roles in body structure and function.**

- SCI.HAPH.4.1            Recognize the body’s four major tissues utilizing microscopes and technology.
- SCI.HAPH.4.2            Describe the relationship between form and function for each type of epithelial tissue.
- SCI.HAPH.4.3            Compare the structures and functions of the various types of connective tissue.
- SCI.HAPH.4.4            Describe the three types of muscle tissue and the special structural features of each.
- SCI.HAPH.4.5            Identify the basic structure and role of neural tissue.
- SCI.HAPH.4.6            Explain how tissues respond in a coordinated manner to maintain homeostasis.
- SCI.HAPH.4.7            Describe how aging affects the tissues of the body.

**SCI.HAPH.5**            **Students will recognize components and discuss the functions of the skeletal system in relation to other body systems.**

- SCI.HAPH.5.1            Identify the structures of the skeletal system through laboratory experience.
- SCI.HAPH.5.2            Explain bone growth and development and factors affecting them.
- SCI.HAPH.5.3            Compare and contrast the components and functions of the axial and appendicular skeletons.
- SCI.HAPH.5.4            Relate the re-modeling and repair of the skeleton to homeostatic mechanisms responsible for regulating mineral deposition and turnover.
- SCI.HAPH.5.5            Distinguish among different types of joints and link structural features to joint formations and functions.
- SCI.HAPH.5.6            Justify the functional relationships between the skeletal system and other body systems.
- SCI.HAPH.5.7            Diagnose conditions and diseases affecting the skeletal system.

**SCI.HAPH.6            Students will identify the components of and discuss the functional relationships between the muscular system and other body systems.**

- SCI.HAPH.6.1            Identify the structures of the muscular system through laboratory experience.
- SCI.HAPH.6.2            Differentiate between the three types of muscle tissue and will compare and contrast their functions.
- SCI.HAPH.6.3            Relate the structural components of a sarcomere to the key steps involved in the contraction of a skeletal muscle fiber.
- SCI.HAPH.6.4            Describe mechanisms by which muscles obtain and use energy to power contractions.
- SCI.HAPH.6.5            Relate the types of muscle fibers to muscular performance and distinguish between aerobic and anaerobic endurance and explain their implications for muscular performance.
- SCI.HAPH.6.6            Describe the effects of aging on muscle tissue.
- SCI.HAPH.6.7            Explain functional relationships between the muscular system and other body systems.
- SCI.HAPH.6.8            Diagnose conditions and/or diseases affecting the muscular system.

**SCI.HAPH.7            Students will identify the components of and divisions of the nervous system and discuss the interrelationships between the nervous system and other body systems.**

- SCI.HAPH.7.1            Outline the divisions of the nervous system and describe their general functions.
- SCI.HAPH.7.2            Distinguish between neurons and neuroglia on the basis of structure and function.
- SCI.HAPH.7.3            Order the events that generate action potentials in the membranes of nerve cells.
- SCI.HAPH.7.4            Explain the mechanisms of nerve impulse transmission at the synapse.
- SCI.HAPH.7.5            Describe and identify the components that protect the central nervous system.
- SCI.HAPH.7.6            Describe the components of the nervous system through laboratory experience and discuss their functions.
- SCI.HAPH.7.7            Draw and discuss the components of a reflex arc.
- SCI.HAPH.7.8            Summarize the effects of aging on the nervous system.
- SCI.HAPH.7.9            Justify interrelationships between the nervous system and other body systems.
- SCI.HAPH.7.10            Diagnose conditions and/or diseases affecting the nervous system

**SCI.HAPH.8                    Students will identify the components of and discuss the functional relationships between the sense organs and the other body systems.**

- SCI.HAPH.8.1            Distinguish between the general senses and the special senses and provide examples of each.
- SCI.HAPH.8.2            Identify the components of and functions of the skin utilizing laboratory experience.
- SCI.HAPH.8.3            Identify the receptors and outline the processes involved in the sense of smell utilizing laboratory experience.
- SCI.HAPH.8.4            Identify the receptors and order the processes involved in the sense of taste utilizing laboratory experience.
- SCI.HAPH.8.5            Identify the parts of the eye and discuss the functions of those parts utilizing laboratory experience.
- SCI.HAPH.8.6            Outline how we see objects and distinguish colors.
- SCI.HAPH.8.7            Describe the receptors and processes involved in the sense of equilibrium utilizing laboratory experience.
- SCI.HAPH.8.8            Identify the components of the ear, describe their roles, and show the order in the process of hearing, utilizing laboratory experience.
- SCI.HAPH.8.9            Describe how the skin responds to injury and repairs itself.
- SCI.HAPH.8.10           Summarize the effects of aging on smell, taste, vision, hearing, equilibrium, and skin repair.
- SCI.HAPH.8.11           Diagnose conditions and/or diseases affecting the sense organs.

**SCI.HAPH.9                   Students will identify structures and discuss the interrelationships between the endocrine system and other body systems.**

- SCI.HAPH.9.1            Compare and contrast similarities and differences between the endocrine and nervous systems.
- SCI.HAPH.9.2            Identify the structures of the endocrine system utilizing laboratory experience.
- SCI.HAPH.9.3            Compare the major chemical classes of hormones.
- SCI.HAPH.9.4            Explain the general mechanisms of hormonal control.
- SCI.HAPH.9.5            Explain how endocrine organs are controlled.
- SCI.HAPH.9.6            Describe the location, hormones released from, and functions of the following endocrine glands and tissues: pituitary gland, thyroid gland, parathyroid gland, adrenal glands, pancreas, kidneys, heart, thymus, testes, ovaries, and adipose.
- SCI.HAPH.9.7            Identify the functional relationships between the endocrine system and other body systems.
- SCI.HAPH.9.8            Diagnose conditions and/or diseases affecting the endocrine system.

**SCI.HAPH.10**      **Students will be able to identify structures of and discuss the functional relationships between the cardiovascular system and other body systems.**

- SCI.HAPH.10.1      Describe the components and functions of the blood (plasma and formed elements [RBC, WBC & platelets] utilizing laboratory experience.
- SCI.HAPH.10.2      Explain the factors that determine a person's blood type and why blood types are important.
- SCI.HAPH.10.3      Describe the location, components, and functions of the heart through laboratory experience.
- SCI.HAPH.10.4      Trace the flow of blood through the heart and identify major blood vessels, chambers, and valves utilizing laboratory experience.
- SCI.HAPH.10.5      Describe the components and trace the path of the conducting systems of the heart.
- SCI.HAPH.10.6      Distinguish among the types of blood vessels on the basis of their structure and function.
- SCI.HAPH.10.7      Describe the factors that influence blood pressure and mechanisms that regulate blood pressure.
- SCI.HAPH.10.8      Explain the structural and functional interactions between the cardiovascular system and other body systems.
- SCI.HAPH.10.9      Diagnose conditions and/or diseases affecting the cardiovascular system.

**SCI.HAPH.11**      **Students will identify components and functions of the lymphatic system and discuss the functional relationships between the lymphatic system and other body systems.**

- SCI.HAPH.11.1      List and describe nonspecific defenses and explain how each functions.
- SCI.HAPH.11.2      Define specific resistance and identify the forms and properties of immunity.
- SCI.HAPH.11.3      Distinguish between cell-mediated immunity and antibody-mediated (humoral) immunity.
- SCI.HAPH.11.4      Relate allergic reactions and autoimmune disorders to immune mechanisms.
- SCI.HAPH.11.5      Identify structures of the lymphatic system through laboratory experience.
- SCI.HAPH.11.6      Explain the structural and functional interactions between the lymphatic systems and other body systems.
- SCI.HAPH.11.7      Diagnose conditions and/or diseases affecting the lymphatic system.

**SCI.HAPH.12            Students will identify structures of and discuss the interrelationships between the respiratory system and other body systems.**

- SCI.HAPH.12.1        Explain how the delicate respiratory exchange surfaces are protected from pathogens, debris and other hazards.
- SCI.HAPH.12.2        Identify the structural specializations of the tissues and organs of the respiratory system.
- SCI.HAPH.12.3        Describe the physical principles governing the movement of air into the lungs and diffusion of gases into and out of the blood.
- SCI.HAPH.12.4        Identify the structures of the respiratory system through laboratory experience.
- SCI.HAPH.12.5        Describe the actions of respiratory muscles on respiratory movements and volumes.
- SCI.HAPH.12.6        Identify the major factors that influence the rate of respiration.
- SCI.HAPH.12.7        Explain the interrelationships between the respiratory system and other body systems.
- SCI.HAPH.12.8        Diagnose conditions and/or diseases affecting the respiratory system.

**SCI.HAPH.13            Students will identify the components of and discuss the functional relationships between the digestive system and other body systems.**

- SCI.HAPH.13.1        Identify the structures of the digestive system through laboratory experience.
- SCI.HAPH.13.2        Describe the histology of each digestive tract segment in relation to its function.
- SCI.HAPH.13.3        Distinguish between mechanical and chemical digestion.
- SCI.HAPH.13.4        Describe the structures and functions of accessory structures (pancreas, liver, and gall bladder) and explain how their activities are regulated.
- SCI.HAPH.13.5        Describe the digestion and absorption of carbohydrates, lipids, and proteins.
- SCI.HAPH.13.6        Identify the functions of vitamins, minerals, and other important nutrients.
- SCI.HAPH.13.7        Describe changes in the digestive system that occur with age.
- SCI.HAPH.13.8        Explain the interrelationships between the digestive system and other body systems.
- SCI.HAPH.13.9        Diagnose conditions and/or diseases affecting the digestive system.

**SCI.HAPH.14**      **Students will identify the structures of the urinary system and will discuss the functional relationships between the urinary system and other body systems.**

- SCI.HAPH.14.1      Identify the components of the urinary system through laboratory experience.
- SCI.HAPH.14.2      Describe the structural features of the kidney.
- SCI.HAPH.14.3      Trace the path of blood flow through the kidney.
- SCI.HAPH.14.4      Describe the structure of the nephron and the processes involved in urine formation.
- SCI.HAPH.14.5      Describe the components and functions of the ureters, urinary bladder, and urethra.
- SCI.HAPH.14.6      Order the process of urination and explain how it is controlled.
- SCI.HAPH.14.7      Describe the effects of aging on the urinary system.
- SCI.HAPH.14.8      Explain the interrelationships between the urinary system and other body systems.
- SCI.HAPH.14.9      Diagnose conditions and/or diseases affecting the urinary system.

**SCI.HA.15**      **Students will identify the components of and discuss the functional relationships between the male and female reproductive systems and the other body systems.**

- SCI.HAPH.15.1      Describe the components of the male and female reproductive systems through laboratory experience.
- SCI.HAPH.15.2      Distinguish between the processes of spermatogenesis and oogenesis.
- SCI.HAPH.15.3      Describe the roles the male reproductive tract and accessory glands play in the maturation and transport of spermatozoa.
- SCI.HAPH.15.4      Describe the roles the female reproductive tract and accessory glands play in the maturation of ova.
- SCI.HAPH.15.5      Outline the physiological processes involved in the ovarian and menstrual cycles.
- SCI.HAPH.15.6      Describe changes in the reproductive systems that occur with aging.
- SCI.HAPH.15.7      Explain the interrelationships between the male and female reproductive systems and other body systems.
- SCI.HAPH.15.8      Diagnose conditions and/or diseases affecting the reproductive system.

## Physical Science

**SCI.PS.1 Students will conduct a controlled experiment, make all appropriate measurements, and effectively communicate the results.**

- SCI.PS.1.1 Identify the steps scientists use to solve problems.
- SCI.PS.1.2 Distinguish between an independent and dependent variable.
- SCI.PS.1.3 Identify a control in an experiment.
- SCI.PS.1.4 Write a testable hypothesis.
- SCI.PS.1.5 Select and construct an appropriate graph based on scientific data.
- SCI.PS.1.6 Demonstrate appropriate use of measurement tools for length, volume, temperature, and mass.
- SCI.PS.1.7 Conduct a controlled experiment and identify its components.

**SCI.PS.2 Students will analyze the motion of objects in order to calculate speed, velocity, and linear acceleration and describe their relationships. (HS-PS2-1, HS-PS2-4)**

- SCI.PS.2.1 Distinguish between distance and displacement.
- SCI.PS.2.2 Interpret motion graphs.
- SCI.PS.2.3 Explain the difference between speed and velocity.
- SCI.PS.2.4 Calculate the acceleration of an object.
- SCI.PS.2.5 Explain how acceleration, time, and velocity are related.
- SCI.PS.2.6 Use the formula for speed to calculate speed, distance, or time for an object in motion.
- SCI.PS.2.7 Identify balanced forces and unbalanced forces and determine the net force.
- SCI.PS.2.8 Define inertia and describe how it relates to Newton's First Law of Motion.



**SCI.PS.3 Students will demonstrate how Newton’s Laws of motion connect the change in an object’s motion with the forces acting on it. (HS-PS2-1, HS-PS2-2, HS-PS3-2)**

- SCI.PS.3.1 Define Newton’s Second Law of Motion.
- SCI.PS.3.2 Calculate force, mass, or acceleration using Newton’s Second Law of Motion.
- SCI.PS.3.3 Compare and contrast different types of friction.
- SCI.PS.3.4 Describe gravitational force using Newton’s Law of Universal Gravitation.
- SCI.PS.3.5 Distinguish between mass and weight.
- SCI.PS.3.6 Explain why objects that are thrown will demonstrate projectile motion.
- SCI.PS.3.7 Describe centripetal acceleration.
- SCI.PS.3.8 Define and apply Newton’s Third Law of Motion.
- SCI.PS.3.9 Explain how momentum is conserved.
- SCI.PS.3.10 Define momentum and use the formula for momentum to calculate momentum, mass, or velocity of an object in motion.

**SCI.PS.4 Students will distinguish between kinetic and potential energy and demonstrate how energy changes from one form to another and is conserved. (HS-PS1-8, HS-PS3-1)**

- SCI.PS.4.1 Calculate the kinetic and potential energy of a given system.
- SCI.PS.4.2 Explain mechanical energy.
- SCI.PS.4.3 Identify and describe different forms of potential energy.
- SCI.PS.4.4 Describe how energy can be transformed from one form to another.
- SCI.PS.4.5 Discuss the law of conservation of energy.

**SCI.PS.5 Students will explain how work, energy, and power are related. Using the six types of simple machines, students will investigate the relationship between work, energy, and power. (HS-PS3-1, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3)**

- SCI.PS.5.1 Describe how work and energy are related.
- SCI.PS.5.2 Define and calculate work.
- SCI.PS.5.3 Define and calculate power.
- SCI.PS.5.4 Define and calculate percent efficiency and ideal mechanical advantages of simple machines.
- SCI.PS.5.5 Describe how simple machines make work easier.
- SCI.PS.5.6 Explain how work, energy, and power are related.
- SCI.PS.5.7 Identify the six types of simple machines.
- SCI.PS.5.8 Construct simple machines to investigate mechanical advantage.

**SCI.PS.6 Students will explain how thermal energy moves within a system. (HS-PS1-4, HS-PS3-1, HS-PS3-4)**

- SCI.PS.6.1 Define temperature and thermal energy.
- SCI.PS.6.2 Explain how thermal energy and heat are related.
- SCI.PS.6.3 Calculate the change in thermal energy;  $Q = m\Delta T C$ .
- SCI.PS.6.4 Compare and contrast the transfer of thermal energy by conduction, convection, and radiation.
- SCI.PS.6.5 Discuss the effects of insulators and conductors on thermal energy transfer.
- SCI.PS.6.6 Describe the first and second laws of thermodynamics.
- SCI.PS.6.7 Explain how a refrigerator transfers thermal energy from a cool to a warm temperature.

**SCI.PS.7 Students will explain how matter can be classified by what it is made of and by its physical and chemical properties. (HS-PS1-1, HS-PS1-2, HS-PS1-5, HS-PS1-8)**

- SCI.PS.7.1 Classify matter as an element, compound, or mixture.
- SCI.PS.7.2 Compare and contrast solutions, colloids, and suspensions.
- SCI.PS.7.3 Distinguish between physical and chemical properties.
- SCI.PS.7.4 Distinguish between physical and chemical changes.
- SCI.PS.7.5 Describe how the law of conservation of mass applies to chemical or physical changes.

**SCI.PS.8 Students will explain how the physical properties of matter can be described by the motion of its particles.**

- SCI.PS.8.1 Explain the kinetic theory of matter.
- SCI.PS.8.2 Describe particle movement in the three states of matter.
- SCI.PS.8.3 Explain particle behavior at melting and boiling points.
- SCI.PS.8.4 Determine properties of fluids as Archimedes Principle, Pascal's Principle, or Bernoulli's Principle.
- SCI.PS.8.5 Explain how a gas exerts pressure on its container.
- SCI.PS.8.6 Identify the relationship that exists between pressure, temperature, or volume of a gas.
- SCI.PS.8.7 Calculate the pressure or volume of a gas using Boyle's Law.
- SCI.PS.8.8 Calculate the temperature or volume of a gas using Charles' Law.

**SCI.PS.9 Students will show how properties of elements are determined by the composition of an atom. (HS-PS1-2, HS-PS1-8)**

- SCI.PS.9.1 Define atomic number.
- SCI.PS.9.2 Identify the particles in an atom, their location, and characteristics.
- SCI.PS.9.3 Identify models of the atom (Dalton, Thomson, Rutherford, Bohr, and the electron cloud models).
- SCI.PS.9.4 Explain how electrons are arranged in an atom.
- SCI.PS.9.5 For a given isotope, determine the number of protons, neutrons, electrons, and mass number.
- SCI.PS.9.6 Calculate the average atomic mass of an element.
- SCI.PS.9.7 Use the Periodic table to obtain information about an element's properties and structure.

**SCI.PS.10 Students will predict and explain the type of bonds that will form between various elements. (HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS2-6)**

- SCI.PS.10.1 Identify the names and symbols of the most common elements.
- SCI.PS.10.2 Given a chemically bonded element, explain how it differs from the individual elements that make it up.
- SCI.PS.10.3 Define chemical bond.
- SCI.PS.10.4 Propose the type of chemical bond, ionic or covalent, that will form given the element's location on the periodic table.
- SCI.PS.10.5 Determine the name of a compound given the chemical formula.
- SCI.PS.10.6 Determine the chemical formula of a compound given the name of the compound.
- SCI.PS.10.7 Distinguish between polar and nonpolar bonds.

**SCI.PS.11 Students will identify and explain the changes that chemicals undergo during a chemical reaction. (HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS2-6)**

- SCI.PS.11.1 Identify the parts of a chemical reaction and symbols used in chemical reactions.
- SCI.PS.11.2 Describe how a chemical reaction satisfies the law of conservation of mass.
- SCI.PS.11.3 Balance chemical equations and identify coefficients.
- SCI.PS.11.4 Identify the five types of chemical reactions (synthesis, decomposition, single displacement, double displacement, combustion).
- SCI.PS.11.5 Identify exergonic, endergonic, exothermic, and endothermic reactions.
- SCI.PS.11.6 Describe the effects of catalysts and inhibitors on the speed of chemical reactions.

## Physics

### **SCI.PHY.1 Students will examine branches of physics, the scientific method, and models in physics. Students will identify and use tools for working with measurements and data. (PS2-1)**

|              |  |
|--------------|--|
| SCI.PHY.1.1  | Identify the activities and fields that involve the major areas within physics.    |
| SCI.PHY.1.2  | List Describe the processes of the scientific method.                              |
| SCI.PHY.1.3  | Describe and use models and diagrams in physics.                                   |
| SCI.PHY.1.4  | Identify and use basic SI units and quantities.                                    |
| SCI.PHY.1.5  | Convert measurements into scientific notation.                                     |
| SCI.PHY.1.6  | Use significant figures in measurements and calculations.                          |
| SCI.PHY.1.7  | Distinguish between accuracy and precision.  |
| SCI.PHY.1.8  | Interpret data in tables and graphs and identify equations that summarize data.    |
| SCI.PHY.1.9  | Distinguish between conversions for abbreviating units and quantities.             |
| SCI.PHY.1.10 | Use dimensional analysis (factor label method) to check the validity of equations. |

### **SCI.PHY.2 Students will analyze one-dimensional motion in terms of displacement, time, speed, and velocity. Students will distinguish between accelerated and non-accelerated motion. (PS2-1, PS2-2)**

|             |   |
|-------------|---|
| SCI.PHY.2.1 | Describe motion in terms of frame of reference, displacement, time, speed, and velocity.                      |
| SCI.PHY.2.2 | Calculate the displacement of an object traveling at a known velocity for a specific time interval.           |
| SCI.PHY.2.3 | Construct and interpret graphs of position versus time.   |
| SCI.PHY.2.4 | Describe motion in terms of changing velocities.  |
| SCI.PHY.2.5 | Compare graphical representation of accelerated and nonaccelerated motions.                                   |
| SCI.PHY.2.6 | Apply kinematic equations to calculate distance, time, or velocity under conditions of constant acceleration. |
| SCI.PHY.2.7 | Relate the motion of freely falling objects to motion with constant acceleration.                             |
| SCI.PHY.2.8 | Compare and contrast the motion of different objects in free fall.  |

**SCI.PHY.3 Students will use vectors to analyze two-dimensional motion and to solve problems in which objects are projected into the air. (PS2-1, PS2-2)**

- SCI.PHY.3.1 Distinguish between a scalar and vector.
- SCI.PHY.3.2 Add and subtract vectors by using graphical methods.
- SCI.PHY.3.3 Multiply and divide vectors by scalars.
- SCI.PHY.3.4 Identify appropriate coordinate systems for solving problems with vectors.
- SCI.PHY.3.5 Apply the Pythagorean Theorem and tangent function to calculate the magnitude and direction of a resultant vector.
- SCI.PHY.3.6 Resolve vectors into components using the sine and cosine functions.
- SCI.PHY.3.7 Add vectors that are not perpendicular.
- SCI.PHY.3.8 Identify examples of projectile motion and describe the path of a projectile as a parabola.
- SCI.PHY.3.9 Describe situations in terms of frame of reference.
- SCI.PHY.3.10 Solve problems involving relative velocity.
- SCI.PHY.3.11 Construct and evaluate in terms of altitude, velocity, and time a device (i.e. rocket) that shows projectile motion.

**SCI.PHY.4 Students will analyze interactions by identifying the forces involved. Students will predict and explain many types of motion. (PS2-1, PS2-2, PS2-3, PS2-4, ESS1-1)**

- SCI.PHY.4.1 Describe how force affects the motion of an object.
- SCI.PHY.4.2 Interpret and construct free-body diagrams.
- SCI.PHY.4.3 Describe an object's acceleration in terms of its mass and the net force acting on it.
- SCI.PHY.4.4 Predict and calculate the direction and magnitude of the acceleration caused by a known net force.
- SCI.PHY.4.5 Identify action reaction pairs.
- SCI.PHY.4.6 Explain the difference between weight and mass.
- SCI.PHY.4.7 Calculate frictional force using coefficients of friction.
- SCI.PHY.4.8 Describe air resistance as a form of friction.

**SCI.PHY.5 Students will analyze momentum to compare and describe collisions between two or more objects. Students will consider the mass and velocity of one or more objects and the conservation of momentum and energy. (PS2-2, PS3-1, PS3-2, PS3-3)**

- SCI.PHY.5.1 Compare the momentum of objects with different masses and velocities.
- SCI.PHY.5.2 Identify examples of change in motion of an object in terms of force and time.
- SCI.PHY.5.3 Describe the interactions between two objects in terms of the change in momentum of each object.
- SCI.PHY.5.4 Compare the total momentum of two objects before and after they interact.
- SCI.PHY.5.5 State the law of conservation of momentum.
- SCI.PHY.5.6 Predict the final velocities of objects after collisions, given the initial velocities.
- SCI.PHY.5.7 Identify different types of collisions.
- SCI.PHY.5.8 Compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions.
- SCI.PHY.5.9 Design, build, and revise a device that will allow an object (i.e. egg) to be dropped from the window without breaking.

**SCI.PHY.6 Students will investigate work and types of energy that are relevant to mechanics. Students will investigate and explain kinetic energy associated with motion and potential energy related to an object's position. (PS3-1, PS3-2, PS3-3, ESS1-1, ESS1-2)**

- SCI.PHY.6.1 Compare and contrast scientific and ordinary definitions of work in relationship to force and displacement.
- SCI.PHY.6.2 Identify where and when work is being performed.
- SCI.PHY.6.3 Calculate the net work done when many forces are applied to an object.
- SCI.PHY.6.4 Identify and classify different types of energy.
- SCI.PHY.6.5 Distinguish between and calculate kinetic and potential energy of an object.
- SCI.PHY.6.6 Explain the work-kinetic energy theorem to solve problems.
- SCI.PHY.6.7 Solve problems using conservation of mechanical energy.
- SCI.PHY.6.8 Explain the concept of energy, time, and power.
- SCI.PHY.6.9 Calculate power.
- SCI.PHY.6.10 Explain the effects of machines on work and power.
- SCI.PHY.6.11 Design, construct, and revise a device powered by a specific source of energy (i.e. mouse trap) to demonstrate energy transfer.

**SCI.PHY.7 Students will analyze simple harmonic motion to explain relationships between vibrations and waves. (PS4-1, PS4-2, PS4-3, PS4-5, ESS1-1, ESS1-2, ESS1-3, ESS2-3)**

- SCI.PHY.7.1 Identify the conditions of simple harmonic motion.
- SCI.PHY.7.2 Explain how force, velocity, and acceleration change as an object vibrates with simple harmonic motion.
- SCI.PHY.7.3 Identify amplitude, period, and frequency and explain the relationship between them.
- SCI.PHY.7.4 Calculate amplitude, period, and frequency of an object vibrating with simple harmonic motion.
- SCI.PHY.7.5 Distinguish between various properties of waves.
- SCI.PHY.7.6 Compare and contrast transverse and longitudinal waves.
- SCI.PHY.7.7 Identify constructive and destructive interference.
- SCI.PHY.7.8 Describe when a reflected wave will be inverted.

**SCI.PHY.8 Students will identify and explain properties of light and other forms of electromagnetic radiation. (PS4-1, PS4-3, PS4-4, PS4-5, ESS1-1, ESS1-2)**

- SCI.PHY.8.1 Identify the components of the electromagnetic spectrum.
- SCI.PHY.8.2 Calculate the frequency and wavelength of electromagnetic radiation.
- SCI.PHY.8.3 Identify that light has a finite speed.
- SCI.PHY.8.4 Apply the law of reflection for flat mirrors.
- SCI.PHY.8.5 Describe distances and focal length using the mirror equation for concave and convex mirrors.
- SCI.PHY.8.6 Draw ray diagrams to find the image distance and magnification of concave and convex mirrors.
- SCI.PHY.8.7 Distinguish between real and virtual images.
- SCI.PHY.8.8 Identify how pigments affect the color of reflected light.
- SCI.PHY.8.9 Explain how linear polarization is formed and detected.
- SCI.PHY.8.10 Explain how energy reaches the Earth from the sun.

**SCI.PHY.9 Students will examine the basic properties of electric charge and the force produced by point charges. Students will interpret electric field lines. (PS2-5, PS3-2, PS3-3)**

- SCI.PHY.9.1 Examine the basic properties of electric charge.
- SCI.PHY.9.2 Differentiate between conductors and insulators.
- SCI.PHY.9.3 Distinguish between charging by contact, charging by induction, and charging by polarization.
- SCI.PHY.9.4 Describe electric force using Coulomb's law.
- SCI.PHY.9.5 Compare electric force with gravitational force.
- SCI.PHY.9.6 Describe electric field strength.
- SCI.PHY.9.7 Draw and interpret electric field lines.
- SCI.PHY.9.8 Identify the four properties associated with a conductor in electrostatic equilibrium.

**SCI.PHY.10 Students will investigate properties of electric potential and electrical energy. Students will also explain how capacitance, resistance, and current work in electrical circuits. (PS2-4, PS3-1, PS3-2, PS3-5, PS3-6)**

- SCI.PHY.10.1 Distinguish between electrical potential energy, electric potential, and potential difference.
- SCI.PHY.10.2 Solve problems involving electric energy and potential difference.
- SCI.PHY.10.3 Describe the energy conversions that occur in a battery.
- SCI.PHY.10.4 Relate capacitance to the storage of electrical potential energy in the form of separated charges.
- SCI.PHY.10.5 Describe the capacitance of various devices and the energy stored in a capacitor.
- SCI.PHY.10.6 Describe basic properties of electric current, and solve problems relating current, charge, and time.
- SCI.PHY.10.7 Calculate resistance, current, and potential difference.
- SCI.PHY.10.8 Differentiate between direct and alternating current.
- SCI.PHY.10.9 Relate electric power to the rate it is converted to other forms of energy.
- SCI.PHY.10.10 Compare and evaluate the electric power and cost of running electrical appliances.



**SCI.PHY.11 Student will explore the basic properties of series and parallel circuits. Students will construct schematic diagrams of series and parallel circuits. (PS2-5, PS2-6 PS3-3)**

- SCI.PHY.11.1 Interpret and construct circuit diagrams.
- SCI.PHY.11.2 Distinguish between open and closed circuits.
- SCI.PHY.11.3 Calculate potential difference across the circuit load relative to the battery's terminals.
- SCI.PHY.11.4 Calculate the resistance, current, and potential difference across each resistor in a series and a parallel circuit.
- SCI.PHY.11.5 Construct simple series and parallel circuits following schematic diagrams and using basic components.

**SCI.PHY.12 Students will explain how current carrying wires act as magnets. Students will examine how magnetic fields exert a force on charged particles. (PS2-5, PS3-2, PS3-5, ESS2-3)**

- SCI.PHY.12.1 Predict in a given situation if magnets will attract or repel each other.
- SCI.PHY.12.2 Draw and describe a magnetic field around a permanent magnet.
- SCI.PHY.12.3 Describe the orientation of the Earth's magnetic field.
- SCI.PHY.12.4 Describe the magnetic fields produced in a current – in a straight conductor and a solenoid.
- SCI.PHY.12.5 Use the right-hand rule to determine the direction of the magnetic field in a current-carrying wire.

**SCI.PHY.13 Students will identify and describe the types of simple machines, describe circular motion, and the forces associated with it including gravity. (PS2-3, PS3-3, EES1-4)**

- SCI.PHY.13.1 Solve problems involving centripetal acceleration and centripetal force.
- SCI.PHY.13.2 Discuss the relationship between inertia and the apparent outward force in circular motion.
- SCI.PHY.13.3 Explain how Newton's law of universal gravitation accounts for various phenomena, including planetary orbits, falling objects, and the tides.
- SCI.PHY.13.4 Apply Newton's law of universal gravitation to solve problems.
- SCI.PHY.13.5 Describe Kepler's laws of planetary motion.
- SCI.PHY.13.6 Describe problems involving orbital speed and period.
- SCI.PHY.13.7 Distinguish between torque and force.
- SCI.PHY.13.8 Describe the magnitude of forces on an object.
- SCI.PHY.13.9 Identify six types of simple machines and where they are used.
- SCI.PHY.13.10 Match formulas to calculate mechanical advantage of each type of simple machine.

## PHYSICS HONORS

**SCI.PHYH.1**      **Students will examine branches of physics, the scientific method, and models in physics, identify and use tools for working with measurements and data, and perform order of magnitude calculations. (PS2-1)**

- SCI.PHYH.1.1      Identify the activities and fields that involve the major areas within physics.
- SCI.PHYH.1.2      List the processes of the scientific method.
- SCI.PHYH.1.3      Describe the role of models and diagrams in physics.
- SCI.PHYH.1.4      Identify and use basic SI units and quantities.
- SCI.PHYH.1.5      Express measurements in scientific notation.
- SCI.PHYH.1.6      Use significant figures in measurements and calculations.
- SCI.PHYH.1.7      Distinguish between accuracy and precision.
- SCI.PHYH.1.8      Interpret data in tables and graphs and identify equations that summarize data.
- SCI.PHYH.1.9      Distinguish between conventions for abbreviating units and quantities.
- SCI.PHYH.1.10     Use dimensional analysis to check the validity of equations.

**SCI.PHYH.2**      **Students will analyze one-dimensional motion in terms of displacement, time, speed, and velocity. Students will distinguish between accelerated and non-accelerated motion. (PS2-1, PS2-2)**

- SCI.PHYH.2.1      Define frame of reference.
- SCI.PHYH.2.2      Compare and contrast displacement, speed, and velocity.
- SCI.PHYH.2.3      Calculate the displacement of an object traveling at a known velocity for a specific time interval.
- SCI.PHYH.2.4      Construct and interpret graphs of position versus time.
- SCI.PHYH.2.5      Describe motion in terms of changing velocities.
- SCI.PHYH.2.6      Compare graphical representation of accelerated and nonaccelerated motions.
- SCI.PHYH.2.7      Apply kinematic equations to calculate distance, time, or velocity under conditions of constant acceleration.
- SCI.PHYH.2.8      Calculate displacement, velocity, and time at various points in the motion of a freely falling object.
- SCI.PHYH.2.9      Describe the motion of objects in free fall.

**SCI.PHYH.3**            **Students will use vectors to analyze two-dimensional motion and to solve problems in which objects are projected into the air. (HS-PS2-1, HS-PS2-2)**

- SCI.PHYH.3.1            Distinguish between a scalar and vector.
- SCI.PHYH.3.2            Add vectors by using graphical methods.
- SCI.PHYH.3.3            Multiply vectors by scalars.
- SCI.PHYH.3.4            Apply the Pythagorean theorem and tangent function to calculate the magnitude and direction of a resultant vector.
- SCI.PHYH.3.5            Resolve vectors into components using the sine and cosine functions.
- SCI.PHYH.3.6            Add vectors that are not perpendicular.
- SCI.PHYH.3.7            Construct a device (i.e. rocket) that shows projectile motion and analyze its flight in terms of altitude, range, and velocity.
- SCI.PHYH.3.8            Identify examples of projectile motion and describe the path of a projectile as a parabola.
- SCI.PHYH.3.9            Apply kinematic equations to solve problems involving projectile motion.
- SCI.PHYH.3.10           Describe situations in terms of frame of reference.

**SCI.PHYH.4**            **Students will analyze interactions by identifying the forces involved. Students will predict and explain many types of motion. (PS2-1, PS2-2, PS2-3, PS2-4, ESS1-1)**

- SCI.PHYH.4.1            Describe how force affects the motion of an object.
- SCI.PHYH.4.2            Explain the relationship between the motion of an object and the net external force acting on the object.
- SCI.PHYH.4.3            Explain the difference between weight and mass.
- SCI.PHYH.4.4            Interpret and construct free-body diagrams.
- SCI.PHYH.4.5            Calculate frictional force using coefficients of friction.
- SCI.PHYH.4.6            Calculate force of gravity, normal force, applied force, or frictional force for an object in motion.
- SCI.PHYH.4.7            Calculate the direction and magnitude of a net force.
- SCI.PHYH.4.8            Calculate an object's acceleration in terms of its mass and the net force acting on it.
- SCI.PHYH.4.9            Identify action reaction pairs.

**SCI.PHYH.5**      **Students will analyze momentum to compare and describe collisions between two or more objects. Students will consider the mass and velocity of one or more objects and the conservation of momentum and energy. (PS2-2, PS3-1, PS3-2, PS3-3)**

- SCI.PHYH.5.1      Compare and calculate the momentum of objects with different masses and velocities.
- SCI.PHYH.5.2      Define impulse.
- SCI.PHYH.5.3      Use the impulse-momentum theorem to calculate force, time interval, or change in momentum.
- SCI.PHYH.5.4      Describe changes in momentum in terms of force and time.
- SCI.PHYH.5.5      State the law of conservation of momentum.
- SCI.PHYH.5.6      Calculate the final velocity, initial velocity, or mass of an object using the formula for conservation of momentum.
- SCI.PHYH.5.7      Differentiate between perfectly inelastic collisions and elastic collisions.
- SCI.PHYH.5.8      Calculate the changes in kinetic energy during perfectly inelastic collisions.
- SCI.PHYH.5.9      Compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions.
- SCI.PHYH.5.10      Calculate the final velocity, initial velocity, or mass of an object in a perfectly inelastic or elastic collision.
- SCI.PHYH.5.11      Design, build, and revise a device that will allow an object (i.e. egg) to be dropped from the window without breaking.
- SCI.PHYH.5.12      Calculate conservation of momentum in perfectly inelastic collisions and elastic collisions.

**SCI.PHYH.6**      **Students will investigate work and types of energy that are relevant to mechanics. Students will investigate and explain kinetic energy associated with motion and potential energy related to an object's position. (PS3-1, PS3-2, PS3-3, ESS1-1, ESS1-2)**

- SCI.PHYH.6.1      Compare and contrast scientific and ordinary definitions of work in relationship to force and displacement.
- SCI.PHYH.6.2      Identify two conditions that need to exist for work to be accomplished.
- SCI.PHYH.6.3      Calculate the net work done when more than one force is applied to an object.
- SCI.PHYH.6.4      Distinguish between and calculate kinetic energy, gravitational potential energy, and elastic potential energy of an object.
- SCI.PHYH.6.5      Apply the work-kinetic energy theorem to solve problems.
- SCI.PHYH.6.6      Solve problems using conservation of mechanical energy.
- SCI.PHYH.6.7      Calculate power.
- SCI.PHYH.6.8      Design, construct, and revise a device powered by a specific source of energy to demonstrate energy transfer.

**SCI.PHYH.7**            **Students will analyze simple harmonic motion to explain relationships between vibrations and waves. (PS4-1, PS4-2, PS4-3, PS4-5)**

- SCI.PHYH.7.1            Define resting position, equilibrium position, forced vibration, damping, and restoring force.
- SCI.PHYH.7.2            Describe simple harmonic motion.
- SCI.PHYH.7.3            Describe the two dominant forces acting on a pendulum bob.
- SCI.PHYH.7.4            Calculate the spring force using Hooke's Law.
- SCI.PHYH.7.5            Identify amplitude, period, and frequency and explain the relationship between them.
- SCI.PHYH.7.6            Calculate the period and frequency of a simple pendulum.
- SCI.PHYH.7.7            Calculate the period and frequency of a mass-spring system.
- SCI.PHYH.7.8            Define medium, mechanical wave, pulse wave, periodic wave, and sine wave.
- SCI.PHYH.7.9            Identify and distinguish between transverse and longitudinal waves.
- SCI.PHYH.7.10           Label the parts of a transverse or longitudinal wave.
- SCI.PHYH.7.11           Calculate the speed of a wave.

**SCI.PHYH.8**            **Students will identify and explain properties of light and other forms of electromagnetic radiation. (PS4-1, PS4-3, PS4-4, PS4-5, ESS1-1, ESS1-2)**

- SCI.PHYH.8.1            Identify the components of the electromagnetic spectrum.
- SCI.PHYH.8.2            Calculate the frequency and wavelength of electromagnetic radiation.
- SCI.PHYH.8.3            Identify that light has a finite speed.
- SCI.PHYH.8.4            Apply the law of reflection for flat mirrors.
- SCI.PHYH.8.5            Calculate distances and focal length using the mirror equation for concave and convex mirrors.
- SCI.PHYH.8.6            Draw ray diagrams to find the image distance and magnification of concave and convex mirrors.
- SCI.PHYH.8.7            Distinguish between real and virtual images.
- SCI.PHYH.8.8            Identify how pigments affect the color of reflected light
- SCI.PHYH.8.9            Explain how linear polarization is formed and detected.
- SCI.PHYH.8.10           Explain how energy reaches the Earth from the sun.

**SCI.PHYH.9**                    **Students will examine the basic properties of electric charge and calculate force produced by point charges. Students will interpret electric field lines. (PS2-5, PS3-2, PS3-3)**

- SCI.PHYH.9.1            Examine the basic properties of electric charge.
- SCI.PHYH.9.2            Differentiate between conductors and insulators.
- SCI.PHYH.9.3            Distinguish between charging by contact, charging by induction, and charging by polarization.
- SCI.PHYH.9.4            Calculate electric force using Coulomb's law.
- SCI.PHYH.9.5            Compare electric force with gravitational force.
- SCI.PHYH.9.6            Calculate electric field strength.
- SCI.PHYH.9.7            Draw and interpret electric field lines.
- SCI.PHYH.9.8            Identify the four properties associated with a conductor in electrostatic equilibrium.

**SCI.PHYH.10**                **Students will investigate properties of electric potential and electrical energy. Students will also explain how capacitance, resistance, and current work in an electrical circuit. (PS2-4, PS3-1, PS3-2, PS3-5, PS3-6)**

- SCI.PHYH.10.1           Distinguish between electrical potential energy, electric potential, and potential difference.
- SCI.PHYH.10.2           Solve problems involving electric energy and potential difference.
- SCI.PHYH.10.3           Describe the energy conversions that occur in a battery.
- SCI.PHYH.10.4           Relate capacitance to the storage of electrical potential energy in the form of separated charges.
- SCI.PHYH.10.5           Calculate the capacitance of various devices and the energy stored in a capacitor.
- SCI.PHYH.10.6           Describe basic properties of electric current, and solve problems relating current, charge, and time.
- SCI.PHYH.10.7           Calculate resistance, current, and potential difference.
- SCI.PHYH.10.8           Differentiate between direct and alternating current.
- SCI.PHYH.10.9           Relate electric power to the rate it is converted to other forms of energy.
- SCI.PHYH.10.10          Calculate and evaluate the electric power and cost of running electrical appliances.

**SCI.PHYH.11      Student will explore the basic properties of series and parallel circuits. Students will construct schematic diagrams of series and parallel circuits. (PS2-5, PS2-6 PS3-3)**

- SCI.PHYH.11.1      Interpret and construct circuit diagrams.
- SCI.PHYH.11.2      Distinguish between open and closed circuits.
- SCI.PHYH.11.3      Calculate potential difference across the circuit load relative to the battery's terminals.
- SCI.PHYH.11.4      Calculate the resistance, current, and potential difference across each resistor in a series and a parallel circuit.
- SCI.PHYH.11.5      Construct simple series and parallel circuits following schematic diagrams and using basic components.
- SCI.PHYH.11.6      Calculate the equivalent resistance, current, and potential difference for a complex circuit involving both a series and a parallel portion.

**SCI.PHYH.12      Students will explain how current carrying wires act as magnets. Students will examine how magnetic fields exert a force on charged particles. (PS2-5, PS3-2, PS3-5, ESS2-3)**

- SCI.PHYH.12.1      Predict in a given situation if magnets will attract or repel each other.
- SCI.PHYH.12.2      Draw and describe a magnetic field around a permanent magnet.
- SCI.PHYH.12.3      Describe the orientation of the Earth's magnetic field.
- SCI.PHYH.12.4      Describe the magnetic fields produced in a current - in a straight conductor and a solenoid.
- SCI.PHYH.12.5      Use the right-hand rule to determine the direction of the magnetic field in a current-carrying wire.

**SCI.PHYH.13**      **Students will identify and describe the types of simple machines and calculate the mechanical advantage of each. Students will describe circular motion, and the forces associated with it including gravity. (PS2-3, PS3-3, EES1-4)**

- SCI.PHYH.13.1      Solve problems involving centripetal acceleration and centripetal force.
- SCI.PHYH.13.2      Discuss the relationship between inertia and the apparent outward force in circular motion.
- SCI.PHYH.13.3      Explain how Newton's law of universal gravitation accounts for various phenomena, including planetary orbits, falling objects, and the tides.
- SCI.PHYH.13.4      Apply Newton's law of universal gravitation to solve problems.
- SCI.PHYH.13.5      Describe Kepler's laws of planetary motion.
- SCI.PHYH.13.6      Solve problems involving orbital speed and period.
- SCI.PHYH.13.7      Distinguish between torque and force.
- SCI.PHYH.13.8      Calculate the magnitude of torque on an object.
- SCI.PHYH.13.9      Identify six types of simple machines and where they are used.
- SCI.PHYH.13.10     Calculate mechanical advantage of simple machines.



## **Advanced Placement Biology**

The AP Biology curriculum follows the topics outlined in the course description as set forth by the AP College Board.

## **Advanced Placement Chemistry**

The AP Chemistry curriculum follows the topics outlined in the course description as set forth by the AP College Board.