Spark Biology: SEMESTER 1

Unit: Cells

Lesson: Introduction to Biology	● Students will understand the scope of the Biology Core Curriculum. ● Students will apply the steps of the scientific method in their own experiment.
Lesson: History of Cells	● Students will understand that all organisms are composed of one or more cells that come from preexisting cells, are made of molecules, and perform life functions.
Lesson: Structure and Function	● Students will understand that all organisms are composed of one or more cells that come from preexisting cells, are made of molecules, and perform life functions.
Lesson: Cell Transport	● Students will understand that all organisms are composed of one or more cells that come from preexisting cells, are made of molecules, and perform life functions. ● Students will investigate the structure and function of cells and cell parts.
Lab: Osmosis	● Students will understand that all organisms are composed of one or more cells that come from preexisting cells, are made of molecules, and perform life functions. ● Students will investigate the structure and function of cells and cell parts.
Lesson: Mitosis	● Students will understand that all organisms are composed of one or more cells that come from preexisting cells, are made of molecules, and perform life functions. ● Students will investigate the structure and function of cells and cell parts.

Lesson: Cell Processes and Energy	● Students will understand that all organisms are composed of one or more cells that come from preexisting cells, are made of molecules, and perform life functions. ● Students will describe the flow of energy and matter in cellular function.

Unit: Genetics

Lesson: Genetics	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will predict and interpret patterns of inheritance in sexually reproducing organisms.
Lesson: Genes	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will predict and interpret patterns of inheritance in sexually reproducing organisms.
Lab: Allele Pairing	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will predict and interpret patterns of inheritance in sexually reproducing organisms.

Lesson: Probability	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will predict and interpret patterns of inheritance in sexually reproducing organisms.
Lesson: Meiosis	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will compare sexual and asexual reproduction.
Lesson: DNA	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will explain how the structure and replication of DNA are essential to heredity and protein synthesis.
Lesson: Mutations	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will explain how the structure and replication of DNA are essential to heredity and protein synthesis.

Lesson: DNA Technological Advances	● Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction, that the basic structure of DNA is the same in all living things, and that changes in DNA may alter genetic expression. ● Students will explain how the structure and replication of DNA are essential to heredity and protein synthesis.

Unit: Evolution

Lesson: Darwin's Theory of Evolution	● Students will understand that biological diversity is a result of evolutionary processes. ● Students will cite evidence for changes in populations over time and use concepts of evolution to explain these changes.
Lesson: Effects of Evolution	● Students will understand that biological diversity is a result of evolutionary processes. ● Students will relate principles of evolution to biological diversity.
Lesson: Evidence of Evolution	● Students will understand that biological diversity is a result of evolutionary processes. ● Students will cite evidence for changes in populations over time and use concepts of evolution to explain these changes.

Spark Biology: SEMESTER 2

Unit: Classification

Lesson: Classification	● Students will understand that biological diversity is a result of evolutionary processes. ● Students will classify organisms into a hierarchy of groups based on similarities that reflect their evolutionary relationships. .

Lesson: Levels of Classification	● Students will understand that biological diversity is a result of evolutionary processes. ● Students will classify organisms into a hierarchy of groups based on similarities that reflect their evolutionary relationships.
Lesson: Kingdoms of Classification	● Students will understand that biological diversity is a result of evolutionary processes. ● Students will classify organisms into a hierarchy of groups based on similarities that reflect their evolutionary relationships.
Lesson: Dichotomous Keys	● Students will understand that biological diversity is a result of evolutionary processes. ● Students will classify organisms into a hierarchy of groups based on similarities that reflect their evolutionary relationships.

Unit: The Human Body

Lesson: Body Organization	● Students will understand the relationship between the structure and function of organs and organ systems. ● Students will describe the structure and function of organs.
Lesson: Systems of the Human Body	● Students will understand the relationship between the structure and function of organs and organ systems. ● Students will describe the structure and function of organs.

Unit: Plants

Lesson: Plant Organization	● Students will understand the relationship between structure and function of organs and organ systems. ● Students will describe the relationship between structure and function of organ systems in plants and animals.
Lesson: Leaves, Stems, and Roots	● Students will understand the relationship between structure and function of organs and organ systems. ● Students will describe the relationship between structure and function of organ systems in plants and animals.
Lesson: Plant Reproduction	● Students will understand the relationship between structure and function of organs and organ systems. ● Students will describe the relationship between structure and function of organ systems in plants and animals.
Lesson: Angiosperms	● Students will understand the relationship between structure and function of organs and organ systems. ● Students will describe the relationship between structure and function of organ systems in plants and animals.

Unit: Ecology

Lesson: Ecology	● Students will understand that living organisms interact with one another and their environment. ● Students will describe how interactions among organisms and their environment help shape ecosystems.
Lesson: Effects on Ecosystems	● Students will understand that living organisms interact with one another and their environment. ● Students will describe how interactions among organisms and their environment help shape ecosystems.
Lesson: Energy in an Ecosystem	● Students will understand that living organisms interact with one another and their environment. ● Students will summarize how energy flows through an ecosystem.
Lesson: Energy Expended Versus Energy Gained	● Students will understand that living organisms interact with one another and their environment. ● Students will summarize how energy flows through an ecosystem.
Lesson: Ecological Relationships	● Students will understand that living organisms interact with one another and their environment. ● Students will describe how interactions among organisms and their environment help shape ecosystems.
Lesson: Human Impact on the Environment	● Students will understand that living organisms interact with one another and their environment. ● Students will describe how interactions among organisms and their environment help shape ecosystems.

Spark Chemistry: SEMESTER 1

Unit: Atomic Structure

Lesson: History of Atoms	● Students will be able to state evidence supporting various atomic models. ● Students will describe weaknesses or limitations of atomic models.
Lesson: Protons, Neutrons, and Electrons	● Students will state evidence supporting various atomic models. ● Students will describe weaknesses or limitations of atomic models. ● Students will identify the location, charge, and mass of protons, neutrons, and electrons.
Lesson: Niels Bohr and Electron Energy Levels	● Students will compare the energies of different wavelengths of light. ● Students will describe why elements have different emission spectra. ● Students will identify the elements present using an emission spectrum.
Lesson: Protons, Neutrons, and Electrons in Atoms	● Students will identify an element based on the number of protons in one atom. ● Students will identify the numbers of protons and electrons in a neutral atom. ● Students will identify the numbers of protons and neutrons in a given isotope.
Lesson: Atomic Number and Atomic Mass	● Students will convert a given mass of an element to moles. ● Students will convert a given amount of an element from moles to grams.

Unit: Radioactivity

Lesson: Northern Africa	● Students will identify the location, charge, and mass of protons, neutrons, and electrons. ● Students will identify the numbers of protons and electrons in an atom.

Lesson: Half-Life	● Students will describe the meaning of the term half-life. ● Students will find the amount of a sample remaining after an integer number of half-lives.
Lesson: Carbon Dating	● Students will estimate the amount of a sample remaining after a given amount of time. ● Students will estimate the age of a radioactive sample. ● Students will use a graph to find the amount of a radioactive substance remaining.
Lesson: Types of Radioactive Decay	● Students will name the types of radioactive decay. ● Students will compare the masses of alpha, beta, and gamma particles. ● Students will identify the charges of alpha, beta, and gamma particles. ● Students will compare the penetrating power of alpha, beta, and gamma particles.
Lesson: Uses and Risks of Nuclear Decay	● Students will compare the amount of energy released in a nuclear reaction to an ordinary chemical reaction. ● Students will list ways in which radiation is used to benefit human life. ● Students will identify harmful effects of radiation.

Unit: Origin of Elements

Lesson: Origin of Elements	● Students will identify evidence that matter has a common origin. ● Students will list the most abundant elements in the universe. ● Students will describe where and how heavier elements are formed.

Lesson: Movement of Stars and Galaxies	● Students will identify evidence that matter has a common origin. ● Students will recognize that elements are the same everywhere.
Lesson: Cosmic Background Radiation	● Students will identify evidence that matter has a common origin.

Unit: The Periodic Table

Lesson: Mendeleev	● Students will describe why elements are in the same group. ● Students will identify properties of an element based on the properties of other elements in its group.
Lesson: Groups in the Periodic Table	● Students will identify patterns in reactivity in a group. ● Students will name and identify groups on the periodic table.
Lesson: Metals, Non-Metals, and Metalloids	● Students will determine whether an element is a metal, non-metal, or metalloid based on its properties. ● Students will determine whether an element is a metal, non-metal, or metalloid using a periodic table.

Unit: Electrons in Atoms

Lesson: Valence Electrons	● Students will determine the number of valence electrons in a given atom, using the periodic table.
Lesson: Ions	● Students will identify whether a given atom will gain or lose electrons when forming an ion. ● Students will determine the charge that a given atom will form.

Lesson: Ionic and Covalent Bonds	● Students will describe what happens to electrons in an ionic bond. ● Students will describe what happens to electrons in a covalent bond. ● Students will compare the strengths of different kinds of bonds.

Unit: Ionic Compounds

Lesson: Chemical Formulas	● Students will use a chemical formula to determine the number and type of atoms in a compound. ● Students will calculate the molar mass of a compound.
Lesson: Names and Formulas of Ionic Compounds	● Students will write the formula of ionic compounds, given their names. ● Students will write the name of an ionic compound, given their formula.
Lesson: Transition Metals	● Students will write the formula of ionic compounds, including transition metals. ● Students will write the name of ionic compounds, including transition metals.
Lesson: Polyatomic Ions	● Students will write the formulas of ionic compounds, including polyatomic ions. ● Students will write the names of ionic compounds, including polyatomic ions.

Unit: Covalent Compounds

Lesson: Names and Formulas of Covalent Compounds	● Students will write the formula of a covalent compound. ● Students will write the name of a covalent compound.
Lesson: Lewis Dot Structures	● Students will draw the Lewis dot structure of a simple compound.
Lesson: Molecular Geometry	● Students will describe the shape of a molecule, given a Lewis dot structure.
Lesson: Polarity	● Students will determine whether a covalent compound is polar. ● Students will determine whether a molecule will exhibit hydrogen bonding.
Lesson: Intermolecular Forces	● Students will compare the strengths of intermolecular forces. ● Students will describe the relationship between intermolecular forces and physical properties.

Spark Chemistry: SEMESTER 2

Unit: Physical and Chemical Properties

Lesson: Physical and Chemical Properties	● Students will determine whether a property is physical or chemical. ● Students will describe a sample using physical properties. ● Students will describe a sample using chemical properties.
Lesson: Properties of Elements and Compounds	● Students will compare the properties of a compound to the properties of its elements. ● Students will list evidences of a chemical reaction. ● Students will determine whether a chemical reaction has occurred.

Lesson: Comparing Ionic and Covalent Compounds	● Students will compare the physical properties of ionic, metallic, and covalent compounds. ● Students will determine whether a substance is ionic, metallic, or covalent based on its properties.

Unit 4: Chemical Reactions

Lesson: Chemical Reactions	● Students will identify reactants and products in a chemical reaction. ● Students will compare the properties of reactants to the properties of products.
Lesson: Writing Chemical Equations	● Students will write a skeletal chemical reaction, given the reactants and products.
Lesson: Balancing Chemical Equations I	● Students will describe what it means for a chemical reaction to be balanced. ● Students will decide whether a chemical reaction is balanced. ● Students will balance a chemical reaction.
Lesson: Balancing Equations II	● Students will balance a combustion reaction.
Lesson: Endothermic and Exothermic Reactions	● Students will identify energy changes in a chemical reaction. ● Students will describe a reaction as endothermic or exothermic.
Lesson: Batteries	● Students will describe energy transfer in a battery.

Unit : Stoichiometry

Lesson: Moles	● Students will convert between moles of two substances in a chemical reaction.
Lesson: Stoichiometry	● Students will convert between grams of two substances in a chemical reaction.

Unit: Reaction Rates and Equilibrium

Lesson: Collision Theory	● Students will describe reaction rate in terms of frequency and energy of collisions. ● Students will describe the role of a catalyst in a chemical reaction.
Lesson: More Factors that Affect Reaction Rate	● Students will list ways to increase reaction rate. ● Students will determine factors that affect the rate of dissolution.
Lesson: Dynamic Equilibrium	● Students will describe dynamic equilibrium. ● Students will determine whether a reaction has reached equilibrium.
Lesson: Factors That Affect Equilibrium	● Students will predict which way an equilibrium will shift when concentrations are changed. ● Students will predict which way an equilibrium will shift when temperature is changed.

Unit: Solutions

Lesson: Solutions	● Students will identify the solute and solvent in a solution.
Lesson: Modeling Solutions	● Students will model the particles in a solution. ● Students will model the particles of an ionic compound in solution.
Lesson: Concentration	● Students will describe what concentration measures. ● Students will decide which of two solutions is more concentrated.

Lesson: Molarity and Molality	● Students will find the molarity of a solution. ● Students will find the molality of a solution.

Unit: Colligative Properties

Lesson: Introduction to Colligative Properties	● Students will describe what it means for a property to be colligative.
Lesson: Major Colligative Properties	● Students will identify major colligative properties. ● Students will experimentally determine whether a property is colligative.
Lesson: Applications of Colligative Properties	● Students will identify uses of colligative properties in nature and industry.

Unit: Acids and Bases

Lesson: Introduction to Acids and Bases	● Students will determine whether a solution is acidic or basic based on its properties.
Lesson: The pH Scale	● Students will determine whether a solution is acidic or basic based on pH. ● Students will determine whether a solution is acidic or basic based on its to the power of plus end style concentration. ● Students will determine whether a solution is acidic or basic using a pH indicator.
Lesson: Titrations	● Students will find the concentration of an unknown acid or base.

Spark Conceptual Physics (2018): SEMESTER 1

Unit 1: Describing Motion

Lesson 1-1: Units and Unit Conversions	● In this lesson students will learn how to perform unit conversion calculations. ● Students will also learn how to create a graph of position vs. time. ● CCSS.MATH.CONTENT.HSN.Q.A.1; CCSS.MATH.CONTENT.HSN.Q.A.3
Lesson 1-2a: Graphing Linear Motion	● In this lesson students will learn how to plot graphical data of position vs. time. ○ Graphing Linear Motion; HS-PS2-1
Lesson 1-2b: Interpreting Motion from Slope of a Line	● Students will learn how to create a position vs. time graph to plot linear motion. ● Graphing Linear Motion; HS-PS2-1
Lesson 1-3: Changing Speed and Velocity for Linear Motion	● In this lesson students will be able to distinguish between speed and velocity, describe acceleration, and differentiate between average and instantaneous speed and velocity. ○ HS-PS2-1
Lesson 1-4: Graphing Changes in Motion	● In this lesson students will be able to graph instantaneous and average velocity, and explain the relationships between position, velocity, and acceleration on a position graph. ○ HS-PS2-1

Unit 2: Contact Forces and Motion

Lesson 2-1: Mass and Inertia	● In this lesson students will be able to identify and label the net force for simple situations and drawings. ● The student will also be able to distinguish between mass and weight, and explain the concept of inertia. ○ HS-PS2-1

Lesson 2-2: Newton's First Law	● In this lesson students will be able to describe Newton's First Law, and identify and label the net force for simple situations and drawings. ○ HS-PS2-1
Lesson 2-3: Newton's Second Law	● In this lesson students will be able to describe Newton's Second Law and develop and understanding of acceleration. ○ HS-PS2-1
Lesson 2-4: Newton's Third Law	● In this lesson students will be able to describe Newton's Third Law and be able to explain and draw forces and accelerations for simple situations ○ HS-PS2-3

Unit 3: Momentum and Conservation of Momentum

Lesson 3-1: Momentum	● Students will be able to describe momentum. ○ HS-PS2-2
Lesson 3-2: Momentum and Impulse	● Students will be able to describe impulse. ○ HS-PS2-2
Lesson 3-3: Isolated Systems and Conservation of Momentum	● Students will be able to define an isolated system in which there are no net external forces so that momentum is conserved. ○ HS-PS2-2
Lesson 3-4: Elastic and Inelastic Collisions	● Students will be able to describe how the total momentum in a system stays constant in a collision. Students will be able to distinguish between completely elastic and completely inelastic collisions. ○ HS-PS2-3; HS-PS3-2

Unit 4: Energy and Energy Transfer

Lesson 4-1: Kinetic and Potential Energy	● Students will be able to describe kinetic and potential energy and the factors that control each type of energy. ○ HS-PS3-2
Lesson 4-2: Transforming Energy	● Students will be able to describe how the total energy in a system can change from kinetic energy to potential energy and back to kinetic energy. ○ HS-PS3-1; HS-PS3-3
Lesson 4-3: Heat and Temperature	● Students will be able to explain the concepts of heat and temperature using physics concepts. ○ HS-PS3-4
Lesson 4-4: Heat Transfer	● Students will be able to describe the three basic ways to transfer heat energy. ○ HS-PS3-3; HS-PS3-4
Lesson 4-5. Conservation of Energy	● Students will be able to describe the fundamental scientific concept called Conservation of Energy. ○ HS-PS3-1; HS-PS3-2; HS-PS3-3

Spark Earth Science: SEMESTER 1

Unit: The Solar System

Lesson: Earth Science	● Students will learn about the age of the solar system. ● Students will identify scientific evidence, such as radioactive decay, for the age of Earth. ● Students will understand the scientific evidence that supports theories about the ages of the solar system and Earth.

Lesson: Big Bang Theory	● Students will be able to describe the Big Bang theory and the evidence that supports this theory. ● Students will learn about cosmic background radiation, abundance of elements, and distance/redshift relation for galaxies. ● Students will be able to describe the Nebular theory of solar system formation and the evidence supporting it.
Lesson: Stars	● Students will be able to explain the formation of stars. ● Students will learn that heavy elements found on Earth are formed in stars.
Lesson: Our Solar System	● Relate the composition of objects in the solar system to their distance from the sun. ● Compare the size of the solar system to the Milky Way galaxy. ● Compare the size and scale of objects within the solar system.

Unit: Earth

Lesson: The Revolution of Science	● Students will investigate and report how science has changed the accepted ideas regarding the nature of the universe throughout history. ● Students will provide an example of how technology has helped scientists investigate the universe.

Lesson: Life on Earth	● Students will evaluate the conditions that currently support life on Earth, such as the biosphere. ● Students will compare the conditions that support life on Earth to the conditions that exist on other planets and moons in the solar system. ● Students will learn about concepts such as the atmosphere, hydrosphere, habitable zone, geosphere, and amounts of incoming solar energy.
Lesson: The Structure of Earth	● Students will trace the lines of scientific evidence that led to the inference that Earth's lithosphere, asthenosphere, mesosphere, outer core, and inner core are separated based on physical properties. ● Students will be able to describe the basic structure of the Earth.
Lesson: Physical Properties of Earth	● Students will be able to identify that radioactive decay and heat formation are the sources of Earth's internal heat. ● Students will trace the lines of scientific evidence that led to the inference that Earth's core, mantle, and crust are separated based on composition.

Unit: Plate Tectonics

Lesson: Continental Drift Theory	● Students will be able to explain Alfred Wegener's continental drift hypothesis. ● Students will understand Wegener's evidence of his continental drift theory and why it was not accepted in his time. ● Students will learn about fossil records, ancient climates, and the geometric fit of continents. ● Students will be able to cite examples of how the geological record preserves evidence of past change..

Lesson: Theory of Plate Tectonics	● Students will establish the importance of the discovery of mid-ocean ridges, oceanic trenches, and magnetic striping of the seafloor to the development of the modern theory of plate tectonics.
Lesson: Plate Tectonic Movements	● Students will be able to model the factors that cause tectonic plates to move. These factors include gravity, density, and convection. ● Students will model tectonic plate movement and compare the results of plate movement along convergent, divergent, and transform boundaries (mountain building, volcanoes, earthquakes, mid-ocean ridges, and oceanic trenches).
Lesson: Earthquakes and Volcanoes	● Students will be able to explain how mantle plumes (hot spots) provide evidence for the rate and direction of tectonic plate motion. ● Students will organize and evaluate the evidence for the current theory of plate tectonics such as sea floor spreading, age of the seafloor, and the distribution of earthquakes and volcanoes.
Lesson: Geological Processes	● Students will design, build, and test a model that investigates local geological processes and the possible effects on human-engineered structures. ● Students will learn about geological processes such as mudslides, earthquakes, flooding, and erosion and its effects on bridges, roads, homes, and dams.

Unit: The Sun

Lesson: The Sun	● Students will be able to relate how energy from the sun drives atmospheric processes and how atmospheric currents transport matter and transfer energy. ● Students will compare and contrast the amount of energy coming from the sun that is reflected, absorbed, or scattered by the atmosphere, oceans, and landmasses.
Lesson: The Greenhouse Effect	● Students will learn about the greenhouse effect and its purpose. ● Students will construct a model that demonstrates how the greenhouse effect contributes to atmospheric energy. ● Students will explain how the presence of ozone in the stratosphere is beneficial to life, while ozone in the troposphere is considered an air pollutant.
Lesson: The Earth's Axis	● Students will conduct an investigation on how the tilt of Earth’s axis causes variations in the intensity and duration of sunlight striking Earth.
Lesson: Uneven Heating of the Earth	● Students will be able to define and describe the Coriolis effect. ● Students will be able to explain Hadley cells, trade winds, and prevailing westerlies. ● Students will explain how uneven heating of the Earth’s atmosphere at the Equator and polar regions combined with the Coriolis effect create an atmospheric circulation system, including Hadley cells, trade winds, and prevailing westerlies, that moves heat around Earth.

Unit: Weather

Lesson: Elements of Weather	● Students will identify the elements of weather and the instruments used to measure them. ● Students will be able to define and describe the use of a thermometer and rain gauge or Doppler radar for measuring temperature and precipitation. ● Students will be able to define and describe the use of satellite imaging for cloud coverage. ● Students will be able to describe how an anemometer is used to measure wind and a barometer is used to measure air pressure.
Lesson: Severe Weather	● Students will describe conditions that give rise to severe weather phenomena such as thunderstorms, tornadoes, and hurricanes. ● Students will learn about the consequences of severe weather phenomena. ● Students will be able to identify severe weather examples that have occurred in Earth's past.
Lesson: Low and High-Pressure Systems	● Students will be able to explain the difference between a low pressure system and a high pressure system. ● Students will learn about the weather associated with low-pressure and high-pressure systems.
Lesson: Air Masses and Weather Fronts	● Students will be able to define and diagram air masses and weather fronts. ● Students will learn the difference between cold, warm, occluded, and stationary boundaries between air masses. ● Students will be able to design and conduct a weather investigation, use an appropriate display of the data, and interpret the observations and data.

Unit: Climate Change

Lesson: Weather and Climate	● Students will be able to explain the differences between weather and climate. ● Students will learn about the methods used to investigate evidence for changes in climate such as ice core sampling and changes in the extent of Arctic sea ice. ● Students will understand other methods used to investigate the evidence for changes in climate such as tree rings and historical temperature changes.
Lesson: A Changing Climate	● Students will be able to explain how Earth's climate has changed over time. ● Students will be able to describe the natural causes for climate change such as solar fluctuations and plate tectonics. ● Students will learn about human-caused processes that cause Earth's climate to change.
Lesson: Carbon Cycle	● Students will learn how human activity influences the carbon cycle and may contribute to climate change. ● Students will be able to explain the differences between air pollution and climate change. ● Students will be able to explain how air pollution and climate change are related to society's use of fossil fuels.
Lesson: Consequences of Climate Change	● Students will investigate the current and potential consequences of climate change on ecosystems. ● Students will learn how climate change impacts human communities. ● Students will learn about the consequences of climate change and its relation to rising sea levels, ocean acidification, desertification, and habitat loss.

Spark Earth Science: SEMESTER 2

Unit: The Water Cycle

Lesson: The Water Cycle	● Students will identify oceans, lakes, running water, groundwater, and atmospheric moisture as the reservoirs of Earth's water cycle. ● Students will graph or chart the relative amounts of water in each.
Lesson: Water Movement	● Students will describe how the processes of evaporation, condensation, precipitation, surface runoff, ground infiltration, and transpiration contribute to the cycling of water through Earth's reservoirs.
Lesson: Water Recycling	● Students will be able to model the natural purification of water as it moves through the water cycle and compare natural purification to processes used in local sewage treatment plants.

Unit: Properties of Water

Lesson: Properties of Water	● Students will investigate the properties of water: it exists in all three states, dissolves many substances, exhibits adhesion and cohesion, and the density of solid versus liquid water.
Lesson: Biotic and Abiotic Factors	● Students will learn about and define the characteristics of ecosystems. ● Students will plan and conduct an experiment to investigate biotic and abiotic factors that affect freshwater systems.
Lesson: The Nitrogen Cycle	● Students will learn about the nitrogen cycle and its dynamics with the hydrosphere. ● Using data collected from local water systems, students will evaluate water quality and conclude how pollution can make water unavailable or unsuitable for life.

Lesson: Management of Water Resources	● Students will research and report how communities manage water resources (e.g., distribution, shortages, quality, flood control) to address social, economic, and environmental concerns.

Unit: Formation of Oceans

Lesson: Formation of Oceans	● Students will research how the oceans form through processes such as outgassing by volcanoes and ice from comets.
Lesson: Saltwater Ecosystems	● Students will investigate how salinity, temperature, and pressure at different depths and locations in oceans and lakes affect saltwater ecosystems.
Lesson: Energy Flow	● Students will model energy flow in the physical dynamics of oceans (wave action, deep ocean tides, circulation, surface currents, land and sea breezes, El Nino, and upwellings).
Lesson: Impact of Human Activities	● Students will evaluate the impact of human activities (sediment, pollution, overfishing) on ocean systems.

Unit: Processes That Shape Earth

Lesson: Processes That Shape the Earth	● Students will be able to illustrate how energy flowing and matter cycling within Earth's biosphere, geosphere, atmosphere, and hydrosphere give rise to processes that shape Earth. ● Students will design and conduct an experiment that investigates how Earth's biosphere, geosphere, atmosphere, or hydrosphere reacts to human-caused change.

Lesson: Technological Advancements of Earth Science	● Students will explain how technological advances lead to increased human knowledge (e.g., satellite imaging, deep-sea ocean probes, seismic sensors, and weather radar systems) and the ability to predict how changes affect Earth's systems.
Lesson: Informing the Public	● Students will explain how Earth's systems are dynamic and continually react to natural and human-caused changes. ● Students will research and report on how scientists study feedback loops to inform the public about Earth's interacting systems.

Unit: Natural Hazard

Lesson: Natural Hazards	● Students will identify and describe natural hazards that occur locally (e.g., wildfires, landslides, earthquakes, floods, drought) and globally (e.g., volcanoes, tsunamis, hurricanes). ● Students will evaluate and give examples of human activities that can contribute to the frequency and intensity of some natural hazards (e.g., construction that may increase erosion, human causes of wildfires, climate change).
Lesson: Human Contribution to Natural Hazards	● Students will evaluate and give examples of human activities that can contribute to the frequency and intensity of some natural hazards (e.g., construction that may increase erosion, human causes of wildfires, climate change)..
Lesson: Predicting Natural Hazards	● Students will document how scientists use technology to continually improve estimates of when and where natural hazards will occur.

Lesson: Human-Engineered Structures	● Students will investigate and report how social, economic, and environmental issues affect decisions about human-engineered structures (e.g., dams, homes, bridges, roads).

Unit: Earth's Resources

Lesson: Earth's Resources	● Students will investigate how Earth's resources (e.g., mineral resources, petroleum resources, alternative energy resources, water resources, soil and agricultural resources) are distributed across the state, the country, and the world. ● Students will research and report on how human populations depend on Earth resources for sustenance and how changing conditions over time have affected these resources (e.g., water pollution, air pollution, increases in population).
Lesson: Resource Development	● Students will predict how resource development and use alters Earth's systems (e.g., water reservoirs, alternative energy sources, wildlife preserves). ● Students will describe the role of scientists in providing data that informs the discussion on Earth resource use.
Lesson: Earth Science Literacy	● Students will learn how Earth science literacy can help the public make informed choices related to the extraction and use of natural resources.

Spark Environmental Science: SEMESTER 1

Unit: Earth Systems

Lesson: Earth Materials and Systems	• Students will be able to describe the different Earth systems (geosphere, hydrosphere, atmosphere, biosphere) and how each system requires energy to function.
Lesson: Plate Tectonics and Large-Scale System Interactions	• Students will be able to describe the internal layers of the Earth and how convection and heat transfer result in the movement of tectonic plates at the Earth's surface.
Lesson: Conservation of Energy and Energy Transfer	• Students will be able to describe the three different methods of heat transfer: conduction, convection, and radiation

Unit: Earth's Resources

Lesson: The Roles of Water in Earth's Surface	• Students will be able to describe the water cycle and how water moves through its three states of matter: solid ice, liquid water, water vapor gas.
Lesson: Weather and Climate	• Students will be able to describe the difference between weather and climate, the different layers of the atmosphere, and the fundamental role air pressure plays in producing different types of weather.
Lesson: Carbon Cycling and the Greenhouse Effect	• Students will be able to describe the carbon cycle and the greenhouse effect and why Earth is experiencing increasing temperatures.

Unit: Energy

Lesson: Types of Energy	• Students will be able to describe the different forms of energy: kinetic and potential, mechanical, chemical, electrical, nuclear, electromagnetic, thermal, and sound.

Lesson: Renewable and Nonrenewable Energy	● Students will be able to differentiate between renewable and non-renewable resources, and describe examples of both types.

Spark Environmental Science: SEMESTER 2

Unit 5: Human Activities Influence Natural Systems

Lesson 5-1: Dimensional Analysis	● Students will learn dimensional analysis techniques to quickly and efficiently convert between units of measure and to make scientific and engineering calculations. ○ CCSS.MATH.CONTENT.HSN.Q.A.1 ○ CCSS.MATH.CONTENT.HSN.Q.A.2
Lesson 5-2: Air Pollution	● In this lesson students will begin to learn how Earth's surface processes and human activities affect each other. Students learn about ways to reduce the impacts of human activities on natural systems and the environment. Through projects, students learn how to graph, interpret, and describe numerical data. Students also gain experience recording scientific data. ○ EVS-ESS3-4
Lesson 5-3: World Freshwater Crisis	● Students will continue learning how Earth's surface processes and human activities affect each other. Students learn additional ways to reduce the impacts of human activities on natural systems and the environment. Students learn about the world freshwater crisis through projects involving designing scientific experiments and calculations. ○ EVS-ESS3-1

Lesson 5-4: Numerical Models	● Students will get an introduction to numerical models. Students will use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. ○ EVS-ESS3-5; EVS-ESS3-6
Lesson 5-5: Sea Level Rise	● Students will explore additional evidence for how the occurrences of natural hazards and changes in climate have influenced human activity. Through a project, students will gain experience reading and interpreting maps. ○ EVS-ESS3-1

Unit 6: Managing Natural Resources and Sustainability of Human Populations

Lesson 6-1: The Search For Knowledge and Understanding In Science	● Students will learn about scientific studies, experiments, publishing scientific articles using the peer review process, and about sources of information -- including "fake" vs real science news. ○ EVS-LS4-6
Lesson 6-2: Natural Resources, Focus on Oil & Gas Industry	● In this lesson students will learn about extraction of natural resources with a focus on the oil and gas industry. Students will learn how petroleum (oil and gas) deposits form, how geoscientists find these deposits, how geoscientists and engineers extract the oil and gas, and about human consumption of petroleum. ○ EVS4-ETS1-3; EVS-ESS3-3

Lesson 6-3: Oil and Gas Extraction	● In this lesson students will learn how oil and gas companies extract petroleum from beneath the Earth's surface and some of the costs associated with this process. Students will also be introduced to Deepwater Horizon Oil Spill, which occurred on April 20, 2010 and is the worst marine oil spill ever in the United States. ○ EVS-ESS3-2
Lesson 6-4: Costs of the Deepwater Horizon Disaster and Oil Spill	● In this lesson students will learn about the details of British Petroleum (BP's) Deepwater Horizon Oil Spill, which occurred on April 20, 2010 and is the worst marine oil spill ever in the United States. Students will be able to identify some of the causes and effects of the spill as well as the costs involved. Students will also learn about benefits vs. costs and how to calculate a cost-benefit ratio and a net benefit. ○ EVS-ESS3-2
Lesson 6-5: Alternative Energy Solutions	● In this lesson students will learn about alternative energy solutions humans are currently using to replace fossil fuels. Students will also learn about how much fossil fuels are left and how cost drives the popularity of alternative vs. fossil fuels. ○ EVS-ESS3-3
Lesson 6-6: The Relationship Between Natural Resources and the Food We Eat	● In this lesson students will learn about the relationship between the food humans eat and the natural resources required to produce, transport, and make this food available to us. ○ EVS-LS2-7; EVS-LS4-6

Lesson 6-7: Projects	● In this lesson students will combine all informaiton learned during this unit and apply it to two different projects: Calculate the true cost of the BP Deepwater Horizon oil spill, and calculate the true cost of your favorite hamburger. ○ EVS4-ETS1-3; EVS-ESS3-2; EVS-ESS3-3; EVS-LS2-7; EVS-LS4-6

Unit 7: Interactions Within Ecosystems

Lesson 7-1: Yellowstone National Park	
Lesson 7-2: Ecosystems	● In this lesson students will learn about the different elements within different kinds of ecosystems. ○ EVS-LS2-1; EVS-LS2-2
Lesson 7-3: Carrying Capacity	● In this lesson students will learn about cause and effect within an ecosystem and what controls the size of a population. Students will also learn to describe trends in population graphs. ○ EVS-LS2-1; EVS-LS2-2
Lesson 7-4: Ecosystem Disturbances and Change	● In this lesson students will learn about disruptive events that occur within ecosystems and how ecosystems respond to both moderate and extreme changes. ○ EVS-LS2-6
Lesson 7-5: Group Behavior	● In this lesson students will learn about group or social behavior in different kinds of animals, including humans. ○ EVS-LS2-8
Lesson 7-5b: Human Teamwork	● In this lesson students will learn what separates high-performing teams from poorly-performing teams. ○ EVS-LS2-8

Lesson 7-6: Projects	● Students will combine all information learned during this unit and apply it to a project involving Yellowstone National Park. ○ EVS3-ETS1-3 ○ EVS-LS2-1; EVS-LS2-2; EVS-LS2-6; EVS-LS2-7; EVS-LS2-8

Spark Physical Science (2018): SEMESTER 1

Unit 1: Describing Motion

Lesson 1-1: Units and Unit Conversions	● In this lesson students will learn how to perform unit conversion calculations. ● Students will also learn how to create a graph of position vs. time. ○ CCSS.MATH.CONTENT.HSN.Q.A.1; CCSS.MATH.CONTENT.HSN.Q.A.3
Lesson 1-2a: Graphing Linear Motion	● In this lesson students will learn how to plot graphical data of position vs. time. ○ Graphing Linear Motion; HS-PS2-1
Lesson 1-2b: Interpreting Motion from Slope of a Line	● In this lesson students will learn how to plot graphical data of position vs. time. ○ Graphing Linear Motion; HS-PS2-1
Lesson 1-3: Changing Speed and Velocity for Linear Motion	● In this lesson students will be able to distinguish between speed and velocity, describe acceleration, and differentiate between average and instantaneous speed and velocity. ○ HS-PS2-1

Lesson 1-4: Graphing Changes in Motion	● In this lesson students will be able to graph instantaneous and average velocity, and explain the relationships between position, velocity, and acceleration on a position graph. ○ HS-PS2-1

Unit 2: Contact Forces and Motion

Lesson 2-1: Mass and Inertia	● In this lesson students will be able to identify and label the net force for simple situations and drawings. ● The student will also be able to distinguish between mass and weight, and explain the concept of inertia. ○ HS-PS2-1
Lesson 2-2: Newton's First Law	● In this lesson students will be able to describe Newton's First Law, and identify and label the net force for simple situations and drawings. ○ HS-PS2-1
Lesson 2-3: Newton's Second Law	● In this lesson students will be able to describe Newton's Second Law and develop and understanding of acceleration. ○ HS-PS2-1
Lesson 2-4: Newton's Third Law	● In this lesson students will be able to describe Newton's Third Law and be able to explain and draw forces and accelerations for simple situations ○ HS-PS2-3

Unit 3: Momentum and Conservation of Momentum

Lesson 3-1: Momentum	● Students will be able to describe momentum. ○ HS-PS2-2
Lesson 3-2: Momentum and Impulse	● Students will be able to describe impulse. ○ HS-PS2-2

Lesson 3-3: Isolated Systems and Conservation of Momentum	● Students will be able to define an isolated system in which there are no net external forces so that momentum is conserved. ○ HS-PS2-2
Lesson 3-4: Elastic and Inelastic Collisions	● Students will be able to describe how the total momentum in a system stays constant in a collision. Students will be able to distinguish between completely elastic and completely inelastic collisions. ○ HS-PS2-3; HS-PS3-2

Unit 4: Energy and Energy Transfer

Lesson 4-1: Kinetic and Potential Energy	● Students will be able to describe kinetic and potential energy and the factors that control each type of energy. ○ HS-PS3-2
Lesson 4-2: Transforming Energy	● Students will be able to describe how the total energy in a system can change from kinetic energy to potential energy and back to kinetic energy. ○ HS-PS3-1; HS-PS3-3
Lesson 4-3: Heat and Temperature	● Students will be able to explain the concepts of heat and temperature using physics concepts. ○ HS-PS3-4
Lesson 4-4: Heat Transfer	● Students will be able to describe the three basic ways to transfer heat energy. ○ HS-PS3-3; HS-PS3-4
Lesson 4-5. Conservation of Energy	● Students will be able to describe the fundamental scientific concept called Conservation of Energy. ○ HS-PS3-1; HS-PS3-2; HS-PS3-3

Spark Physics (CP): SEMESTER 1

Unit 1: Introduction to Physics

Lesson 1-1: Introduction to Physics	● Students will be able to describe what the study of physics includes. ○ 1.1.1 ● Students will be able to describe the various branches of physics. ○ 1.1.2 ● Students will be able to describe the scientific method. ○ 1.1.3
Lesson 1-2: Measurements in Experiments	● Students will be able to list basic SI units and the quantities they describe. ○ 1.2.1 ● Students will be able to convert measurements into scientific notation. ○ 1.2.2 ● Students will be able to distinguish between accuracy and precision. ○ 1.2.3 ● Students will be able to use significant figures in measurements and calculations. ○ 1.2.4
Lesson 1-3: The Language of Physics	● Students will be able to define key terms used in physics to include laws, hypothesis, theories. ○ 1.3.1 ● Students will be able to describe why math skills are important in the study and applications of physics. ○ 1.3.2 ● Students will be able to describe how data may be effectively displayed. ○ 1.3.3 ● Students will be able to describe how equations are used to represent physical events. ○ 1.3.4

Unit 2: One Dimension Kinematics

Lesson 2-1: One Dimension Kinematics (Motion)	● Students will be able to define position, displacement, and distance traveled in one dimension. ○ 2.1.1 ● Students will be able to explain what the mathematical relation between position and displacement in one dimension. ○ 2.1.2 ● Students will be able to calculate displacement and distance traveled when given initial position, path of travel, and final position in one dimension. ○ 2.1.3
Lesson 2-2: Vectors, Scalars, and Coordinate Systems	● Students will define and distinguish between scalar and vector quantities. ○ 2.2.1 ● Students will assign a coordinate system for a scenario involving one-dimensional motion. ○ 2.2.3
Lesson 2-3: Time, Velocity, Speed, and Acceleration	● Students will be able to define the concept of time. ○ 2.3.1 ● Students will be able to calculate speed and velocities. ○ 2.3.2 ● Students will be able to calculate acceleration. ○ 2.3.3
Lesson 2-4: Free Fall	● Students will calculate position and time of flight in a one dimensional free fall problem. ○ 2-4-1 ● Students will perform mathematical calculations for one dimensional problem from data collected during an experiment to estimate the acceleration of gravity for earth. ○ 2-4-2

Unit 3: 2D Kinematics

Lesson 3-1: Introduction to 2D Kinematics	● 3.1.1 – Students will be able to represent the motion of an object in two dimensions using a vector. ● 3.1.2 – Students will be able to work problems in two dimensions using both vector algebra and graphical methods. ● 3.1.1 – Students will be able to identify and explain the properties of a projectile, such as acceleration due to gravity, range, maximum height, and trajectory. ● 3.1.4 – Students will be able to determine the location and velocity of a projectile at different points in its trajectory.

Unit 4: Dynamics (Force-Newton Laws)

Lesson 4-1: Dynamics	● 4.1.1 – Students will be able to define what the study of dynamics entails. ● 4.1.2 – Students will be able to define and illustrate the concepts of inertia, mass, and force. ● 4.1.3 – Students will be able to describe the Laws of Newton. ● 4.1.4 – Students will be able to describe how these laws can be applied by engineers and scientists to solve problems.

Unit 5: Applications of Newton's Law

Lesson 5-1: Friction	● 5.1.1 – Students will be able to define friction and describe where friction occurs. ● 5.1.2 – Students will be able to calculate friction and the coefficient of friction when given the needed parameters. ● 5.1.3 – Newton's laws apply to the force of friction.
Lesson 5-2: Drag	● 5.2.1 Students will be able to describe what drag is and specify the units of drag. ● 5.2.2 Students will be able to discuss how drag is calculated.

Lesson 5-3: Stress and Strain	● 5.3.1 – Students will be able to define what stress and strain are. ● 5.3.2 – Students will be able to describe Hooke's Law and when it is applicable. ● 5.3.3 – Students will be able to perform calculations to determine changes in length in materials resulting from stress and strain.

Unit 6: Circular Motion

Lesson 6-1: Introduction to Circular Motion	● 6.1.1 – Students will be able to define and describe what circular motion is. ● 6.1.2 – Students will be able to define, describe, and calculate angular velocity. ● 6.1.3 – Students will be able to define, describe and calculate centrifugal acceleration and Force.
Lesson 6-2: Newton's Law of Universal Gravity and Kepler's Laws	● 6.2.1 – Students will be able to perform calculations to calculate gravitational forces between two masses using Newtons' Law of Universal Gravitation" ● 6.2.2 – Students will be able to explain Keplar's Laws and perform calculations about orbits.

Unit 7: Work and Energy

Lesson 7-1: Introduction to Work and Energy	● 7.1.1 – Students will be able to define work and specific the correct units for work. ● 7.1.2. –Students will be define and calculate the kinetic energy for a given mass. ● 7.1.3 – Students will be able to solve problems using the work-energy theorem.

Lesson 7-2: Potential Energy and Conservation of Energy	● 7.2.1 – Students will be able to calculate potential energy. ● 7.2.2 – Students will be able to describe the difference in conservative and non conservative forces. ● 7.2.3 – Students will be able to solve problems for conservation of energy that contain conservative and/or non conservative forces.

Unit 8: Momentum

Lesson 8-1: Introduction to Momentum and Impulse	● 8.1.1 – Students will be able to define momentum and be able to calculate linear momentum. ● 8.1.2 – Students will be able to define impulse and be able to calculate an impulse.
Lesson 8-2: Conservation of Momentum	● 8.2.1 – Students will be able to describe how conservation of momentum can be used to calculate unknown parameters in a elastic and perfectly inelastic collisions. ● 8.2.2 – Students will be able to solve conservation of momentum problems in two dimensions.

Unit 9: Statics (Torque)

Lesson 9-1: Introduction to Statics	● 9.1.1 – Students will be able to define torque and depict torque on force diagrams. ● 9.1.2 – Students will discuss the conditions of equilibrium with torques are present.
Lesson 9-2: Statics Applications	● 9.2.1 – Students will describe how statics can be applied to design simple machines. ● 9.2.2 – Students will describe how statics can be applied to study of the human body.

Unit 10: Rotation (Angular Momentum)

Lesson 10-1: Introduction to Rotational Motion and Angular Momentum	● 10.1.1 – Students will be able to describe uniform and non uniform circular motion. ● 10.1.2 – Students will be able to calculate angular acceleration. ● 10.1.3 – Students will be able to calculate linear/tangential acceleration. ● 10.1.4 – Students will be able to describe and perform calculations with the rotational kinematic equations. ● 10.1.5 – Students will be able to describe and calculate moments of inertia. ● 10.1.6 – Students will be able to discuss and perform calculation rotational kinetic energy and use this value in the work-energy theorem.
Lesson 10-2: Conservation of Angular Momentum	● 10.2.1 – Students will be able to describe what conservation of angular momentum is and compare this with the conservation of linear momentum. ● 10.2.2. – Students will be able to calculate physical parameters using the conservation of angular momentum.

Unit 11: Fluid (Statics)

Lesson 11-1: Introduction Fluid Dynamics	● 11.1.1 – Students will be able to define what a fluid is and what the study of fluid dynamics includes. ● 11.1.2 – Students will be able to calculate pressures and densities of fluids.

Lesson 11-2: Applications of Fluid Dynamics	● 11.2.1 – Students will apply Pascal's Principle to work pressure problems in fluids. ● 11.2.2 – Students will define gauge and absolute pressures. ● 11.2.3 – Students will apply Archimede's principle. ● 11.2.4 – Students will describe the forces associated with cohesion and surface tension found within liquids.

Spark Physics (CP): SEMESTER 2

Unit 2-1: Kinetic Theory

Lesson 2-1-1: Temperature and Thermal Expansion	● 2.1.1 – Students will define temperature in terms of energy. ● 2.1.2 – Students will convert from one temperature to another unit. ● 2.1.3 – Students will describe what absolute zero is. ● 2.1.4 – Students will calculate thermal expansion given temperature and any needed equation constants for the material of concern.
Lesson 2-1-2: Kinetic Molecular Theory, Ideal Gas Law, and Phase Change	● 2.2.1 – Students describe the kinetic molecular theory and its assumptions. ● 2.2.2 – Students perform calculations with the ideal gas law. ● 2.2.3 –Students describe what phases are and how they can be graphically displayed to include the triple point.

Unit 2-2: Heat Transfer

Lesson 2-2-1: Heat and Heat Transfer	● 2.2.1 – Students will define what heat is and how heat transfer from hot to cold objects. ● 2.2.2 – Students will define heat capacity and use this parameter to calculate heat absorbed or given off. ● 2.2.3 – Students will describe how heat is absorbed or given off during a phase change.
Lesson 2-2-2: Heat Transfer Methods	● 2.2.2.1 – Students will be able to describe the three methods of heat transfer (conduction, convection, radiation). ● 2.2.2.1 – Students will be able to calculate heat transfer when given estimation equations.

Unit 2-3: Thermodynamics

Lesson 2-3-1: Laws of Thermodynamics	● 2.2.2.1 – Students will be able to describe the three methods of heat transfer (conduction, convection, radiation) ● 2.2.2.1 – Students will be able to calculate heat transfer when given estimation equations.
Lesson 2-3-2: Entropy	● 2.2.2.1 – Students will be able to describe the three methods of heat transfer{conduction, convection, radiation) ● 2.2.2.1 – Students will be able to calculate heat transfer when given estimation equations.
Lesson 2-3-3: Applications of Thermodynamics	● 2.3.3.1 – Students will be able to apply the principles of thermodynamics to real world applications. ● 2.3.3.2 – Students will be able to explain how a heat pump works.

Unit 2-4: Waves Oscillatory Motion

Lesson 2-4-1: Waves Oscillatory Motion	● 2.4.1 – Students will be able to describe what oscillatory motion is. ● 2.4.2 – Students will be able to define and calculate wave frequency, period and wave length. ● 2.4.3 – Students will be able to model a simple pendulum. ● 2.4.4 – Students will be able to describe constructive and destructive wave interactions. ● 2.4.5 – Students will be able to explain what causes wave harmonics. ● 2.4.6 – Students will be able to describe what a standing wave is. ● 2.4.7 – Students will be able to model wave nodes and antinodes.

Unit 2-5: Electric Charge and Field

Lesson 2-5-1: Static Electricity	● 2-5-1-1 – Students will describe what static electricity is. ● 2-5-1-2 – Students will be able to define conductors and insulators. ● 2-5-2-3 – Students will calculate voltages using Coulomb's Law. ● 2-5-2-4 – Students will be able to apply the principle of conservation of charge to work problems.
Lesson 2-5-2: Electric Fields and Applications	● 2-5-2-1 – Students will describe what electric fields are. ● 2-5-2-2 – Students will describe what practical applications are based on our understanding of electric fields. ● 2-5-2-3 – Students will calculate field strengths when given charges and distances of separation and angles between lines connecting one charge point to multiple charge points.

Unit 2-6: Electric Potential

Lesson 2-6-1: Electric Potential	● 2-5-2-1 – Students will be able to describe what electric fields are. ● 2-5-2-2 – Students will be able to describe what practical applications are based on our understanding of electric fields. ● 2-5-2-3 – Students will be able to calculate field strengths when given charges and distances of separation and angles between lines connecting one charge point to multiple charge points.
Lesson 2-6-2: Capacitor	● 2.6.2.1 – Students will be able to describe how a capacitor works. ● 2.6.2.2 – Students will be able to describe how a capacitor is used in electrical devices. ● 2.6.2.3 – Students will be able to calculate capacitance for capacitors in parallel and series.

Unit 2-7: Electric Current (Resistance and Ohms Law)

Lesson 2-7-1: Electric Current	● 2.7.1 – Students will be able to define electric current. ● 2.7.2 – Students will be able to define resistance. ● 2.7.3 – Students will be able to calculate current, resistance and voltage using Ohm's Law. ● 2.7.4 – Students will be able to calculate electric power. ● 2.7.5 – Students will be able to describe the differences in alternating and direct currents.

Unit 2-8: Magnetism

Lesson 2-8-1: Magnetism	● 2.8.1.1 – Students will be able to describe what magnetism is and what causes it. ● 2.8.1.2 – Students will describe what the strength of a magnetic field is. ● 2.8.1.3 – Students will calculate the magnetic field strength by calculating the force on a moving charge in a magnetic field.

Lesson 2-8-2: Applications of Magnetism	● 2.8.2.1 – Students will be able to calculate the torque on a current loop. ● 2.8.2.2 – Students will be able to explain how an electric motor works. ● 2.8.2.3 – Students will be able to explain how magnetic fields can be produced by electric currents. ● 2.8.2.4 – Students will be able to calculate magnetic forces between two parallel conductors when current flows through the conductor.

Unit 2-9: Quantum Physics

Lesson 2-9-1: Quantum Physics	● 2.9.1 – Students will be able to describe why quantum physics should be employed instead of Newtonian Physics. ● 2.9.2 – Students will be able to define a photon and describe the particle and wave nature of light. ● 2.9.3 – Students will be able to calculate photon energies. ● 2.9.4 – Students will be able to explain how experimental results support the validity of quantum physics.
Lesson 2-9-2: Quantum Rules	● 2.9.1 – Students will be able to model an atom. ● 2.9.2 – Students will be able to describe the Bohr model. ● 2.9.3 – Students will be able to describe the wave nature of matter. ● 2.9.4 – Students will be able to describe the quantum rules for quantum numbers for orbitals in an atom. ● 2.9.5 – Students will be able to explain the Pauli Exclusion Principle.

Unit 2-10: Nuclear Physics

Lesson 2-10-1: Nuclear Physics	● 2.9.1 – Students will be able to model a atom. ● 2.9.2 – Students will be able to describe the Bohr model. ● 2.9.3 – Students will be able to describe the wave nature of matter. ● 2.9.4 – Students will be able to describe the quantum rules for quantum numbers for orbitals in an atom. ● 2.9.5 – Students will be able to explain the Pauli Exclusion Principle.

Unit 2-11: Frontiers of Physics

Lesson 2-11-1: Einstein's Postulates and Simultaneity and Time Dilation	● 2.11.1.1 – Students will be able to state what the theory of special relativity postulates. ● 2.11.1.2 – Students will be able to apply the special theory of relativity to calculate time and distance dilations.
Lesson 2-11-2: Frontiers of Physics Summary	● 2.11.2.1 – Students will be able to define what cosmology is. ● 2.11.2.2 – Students will be able to describe what general relativity tells us about the universe. ● 2.11.2.3 – Students will be able to list two emerging studies in cosmology such as dark matter and string theory.