FAIRFIELD PUBLIC SCHOOLS

Course Information

Grade(s):	11 /12
Discipline/Course:	Science / Physics
Course Title:	Physics
Prerequisite(s):	Successful completion of or concurrently enrolled in 10th grade Chemistry, Environmental Chemistry, or AP Chemistry and Algebra 1.
Course Description: *Program of Studies*	**Physics** is a year-long, laboratory-based, college preparatory course that integrates Physics, Engineering, and Earth Science concepts and meets the expectations of the Next Generation Science Standards. Students will be asked to use evidence, evaluate claims, and develop models to interpret the seen and unseen and design solutions to real world problems. Each unit begins with a phenomena or design challenge to develop understandings of core science ideas. Topics include: Forces and Motion, Momentum and Energy Conservation; Energy and Forces in the Geosphere; Gravity, Orbits & Planetary Formation; Waves and Information Transfer Technologies; and Stars and the Origin of the Universe
Course Essential Questions:	How can we explain and predict interactions between objects and within systems of objects? How do observations of patterns in systems at all scales provide evidence towards the composition of planets, stars, and the universe?
Course Enduring Understandings:	The total momentum of a system of objects is conserved when there is no net force on the system. Energy is understood as a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system, and the total change of energy in any system is always equal to the total energy transferred into or out of the system.

	The energy associated with the configuration of particles can be thought of as stored in fields. Stars are fueled by nuclear fusion which emits electromagnetic radiation and causes the formation of many elements. Wave properties and the interactions of electromagnetic radiation with matter can transfer information across long distances as well as store information. Engineering and technology play a large role in obtaining and analyzing the data that support the theories of the formation of the solar system and universe.
Duration:	Full year/1.0 credit
Course Materials/ Resources:	There is no textbook associated with this course. Student and teacher materials will be compiled using a variety of primary scientific resources including but not limited to: NASA, National Oceanic and Atmospheric Administration, (NOAA), United States Geologic Society (USGS), American Association for the Advancement of Science (AAAS)
FPS Course Academic Expectation(s):	Synthesizing and Evaluating Creating and Constructing

Unit Number and Title:	Unit 1: Designing Flying Machines: Newton's Laws of Motion and Momentum
Duration:	Approximately 6 weeks
Resource(s):	N/A
Unit Overview:	Students will examine a variety of flying machines to determine how their structure matches their function. They will evaluate this through a lens of kinematics & forces, and then use their observations to design & construct their own flying machine using the engineering design process.
Learning Goals	
Standard(s):	**Scientific and Engineering Practices: (Highlighted Practices are Priority)** Asking Questions, Engaging in Argument from Evidence, **Construction Explanations & Designing Solutions**, **Developing & Using Models**, Obtaining, Evaluating & Communicating Information, **Analyzing & Interpreting Data**, **Using Mathematics and Computational Thinking, Planning and Carrying Out Investigations** **Disciplinary Core Ideas:** **HS.ETS1.A: Defining and Delimiting Engineering Problems** Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) **HS.ETS1.B: Developing Possible Solutions** When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3) **HS.PS2.A: Forces and Motion** Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1)

	Crosscutting Concepts: Cause and Effect, Systems and System Models, Scale, Proportion, and Quantity, Structure and Function
Essential Question(s):	How do flying machines take off?
Enduring Understanding(s):	To change the motion of an object, the object must experience unbalanced forces. The resulting motion will be dependent upon the magnitude and direction of the forces as well as the mass of the object. The engineering design process requires defining and prioritizing criteria and constraints surrounding the intended purpose of the solution. This process is iterative, requiring testing of prototypes, documentation and analysis of results, and redesign until criteria and constraints are satisfactorily met.
Learning Goal(s): *Students will be able to use their learning to:*	**During this unit, students will meet the following NGSS Performance Expectations:** **HS-PS2-1:** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. **During this unit, students will be working towards the following NGSS Performance Expectations:** **HS-ETS1-3:** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics *In addition to the learning goals above, Honors students will be able to use their learning to:* ● Explore additional topics ● Engage in greater quantitative analysis including projectile motion in two dimensions, which involves applying trigonometry, including decomposing vectors, to solve problems

Unit Number and Title:	Unit 2: Rocket Design: Energy, Momentum, and Conservation
Duration:	Approximately 6 weeks
Resource(s):	N/A
Unit Overview:	Students will build on their engineering design skills and their understanding of forces and motion as they investigate the role of momentum and energy in rocket launches and landings. Students will create computational models then utilize the engineering process to build rockets with payloads that must land safely.
Learning Goals	
Standard(s):	**Scientific and Engineering Practices: (Highlighted Practices are Priority)** Asking Questions, **Planning and Carrying Out Investigations**, Engaging in Argument from Evidence, **Construction Explanations & Designing Solutions**, **Developing & Using Models**, Obtaining, Evaluating & Communicating Information, Analyzing & Interpreting Data **Disciplinary Core Ideas:** **HS.PS2.A: Forces and Motion** Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. (HS-PS2-2) If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS-PS2-2),(HS-PS2-3) **HS.PS3.D Energy in Chemical Processes and Everyday Life** Alth energy cannot be destroyed, it can be converted to less useful forms- for example, to thermal energy in the surrounding environment. (HS-PS3-3), (HS-PS3-4)

	ESS3.A Natural Resources All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2) **PS3.B Conservation of Energy and Energy Transfer** Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1) The availability of energy limits what can occur in any system. (HS-PS3-1) Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4) **PS3.A Definitions of Energy** Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2) **Crosscutting Concepts: Patterns; Energy & Matter; Systems & System Models; Scale, Proportion, and Quantity**
Essential Question(s):	How do we launch someone into space and bring them back safely? How do we create computational models? How do we utilize the engineering design process to create a model to test a complex system?
Enduring Understanding(s):	Momentum is conserved during collisions and interactions between objects.

	Energy cannot be created nor destroyed, it only moves between one place and another place, between objects and/or fields, or between systems. Mathematical models can be utilized to evaluate design solutions.
Learning Goal(s): *Students will be able to use their learning to:*	**During this unit, students will meet the following NGSS Performance Expectations:** HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (Energy and Matter) HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other components and energy flows in and out of the system are known. **During this unit, students will be working towards the following NGSS Performance Expectations:** HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects). HS-ESS3-3: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on csst-benefit ratios. *In addition to the learning goals above, Honors students will be able to use their learning to:* ● Evaluate two dimensional systems with multi-step calculations, which involves applying trigonometry, including decomposing vectors, to solve problems

Unit Number and Title:	Unit 3: The Solar System: Gravity, Orbits, and Planetary Formation
Duration:	Approximately 6 weeks
Resource(s):	N/A
Unit Overview:	Planets have a specific place in the solar system, but why? Newton's Laws of Gravitation explain Kepler's observations of planetary motion, and now are cited to describe the formation of planets. This unit will require students to analyze astronomical data to construct explanations regarding the origins of the inner planets.
Learning Goals	
Standard(s):	**Scientific and Engineering Practices: (Highlighted Practices are Priority)** Asking Questions, Engaging in Argument from Evidence, **Construction Explanations & Designing Solutions**, **Developing & Using Models**, Obtaining, Evaluating & Communicating Information, Analyzing & Interpreting Data, **Using Mathematics and Computational Thinking** **Disciplinary Core Ideas:** **PS2.B: Types of Interactions** Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2- 4),(HS-PS2-5) **PS3.C Relationship Between Energy and Forces** When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5)

	ESS1.B: Earth and the Solar System Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (HS-ESS1-4) **ESS1.C: The History of Planet Earth** Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history . (HS-ESS1-6) **Crosscutting Concepts:** Patterns; Stability and Change; and Scale, Proportion, and Quantity
Essential Question(s):	Why are planets found around stars?
Enduring Understanding(s):	Newton's law of universal gravitation provides the mathematical model to describe and predict the effects of gravitational fields between distant objects. Gravitational forces can explain the formation of planetary bodies and their resulting orbital motion.
Learning Goal(s): *Students will be able to use their learning to:*	**During this unit, students will be working towards the following NGSS Performance Expectations:** HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

	In addition to the learning goals above, Honors students will be able to use their learning to: ● Explore additional topics related to planetary formation ● Solve related problems involving complex work functions, including air resistance ● Apply Kepler's Laws and articulate mathematically and verbally how they confirm Newton's Law of Universal Gravitation

Unit Number and Title:	Unit 4: The Inner Planets: Waves and Plate Tectonics
Duration:	Approximately 6 weeks
Resource(s):	N/A
Unit Overview:	In this unit, students will investigate the geologic processes of the inner planets over their lifespans. As planets age, their internal energy dissipates. Each planet's energy dissipates at different rates, leading to some planets that still maintain tectonic activity as evidenced by their changing surface and seismic activity. Other planets who have lost too much energy will have a static surface. Students will investigate the role of waves in collecting this data.
Learning Goals	
Standard(s):	**Scientific and Engineering Practices: (Highlighted Practices are Priority)** Asking Questions, **Engaging in Argument from Evidence**, Construction Explanations & Designing Solutions, **Developing & Using Models**, **Obtaining, Evaluating & Communicating Information,** Analyzing & Interpreting Data, Using Mathematics and Computational Thinking **Disciplinary Core Ideas:** **HS.ESS1.C: The History of Planet Earth** Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. (HS-ESS1-5) **HS.ESS2.A: Earth Materials and Systems** Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetics field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from the Earth's interior and the gravitational movement of denser materials

	towards the interior. (HS-ESS2-3) **HS.ESS2.B: Plate Tectonics and Large-Scale System Interactions** Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. (HS-ESS1-5, HS-ESS2-1) Radioactive decay of unstable isotopes continually generates new energy within Earth's Crust and mantle, providing the primary source of the heat that drives mantle convection. Plate Tectonics Can be viewed as the surface expression of mantle convection. (HS-ESS2-3) Plate movements are responsible for most continental and ocean-floor features and for the distribution of rocks and minerals within Earth's crust. (HS-ESS2-1) **HS.PS3.B: Conservation of Energy and Energy Transfer** Uncontrolled systems always evolve toward more stable states - that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4) **HS.PS4.A: Wave Properties** The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1) Geologists use seismic waves to probe structures deep in the planet. **Crosscutting Concepts:** Cause and Effect, Energy and Matter, Systems and System Models, Stability and Change,

Essential Question(s):	Why are some planets still active while others are inert?
Enduring Understanding(s):	Planetary surfaces are sculpted by plate tectonics, which are driven by thermal convection occurring under a planet's surface layer. Some planets are more tectonically active than others. The interior of planetary bodies can be modeled utilizing data from seismic activity. Mechanical waves are energy transmitted through a medium. The speed of a wave is dependent on what medium it travels through, while its wavelength and frequency are inversely proportional.
Learning Goal(s): *Students will be able to use their learning to:*	**During this unit, students will meet the following NGSS Performance Expectations:** HS-PS4-1: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. HS-ESS2-3: Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. HS-ESS2-1: Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. HS-ESS1-5: Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. **During this unit, students will be working towards the following NGSS Performance Expectations:** HS-PS3-4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). HS-PS3-5: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

	In addition to the learning goals above, Honors students will be able to use their learning to: ● Explore additional topics related to the following: historical scientific discoveries and current scientific models of Earth's internal structure; the formation of Earth's magnetic field; the absence or presence of magnetic fields around the inner planets ● Apply the mathematical relation between energy density dissipation and surface area in this context.

Unit Number and Title:	Unit 5: Where is the best place to look for life around other stars? Energy from Stars
Duration:	Approximately 6 weeks
Resource(s):	N/A
Unit Overview:	In this unit, students will investigate how the activity of our sun can impact life on Earth. Students will learn about the sun's lifespan and the processes that drive these changes. Focus will be on stars' emission of electromagnetic radiation during nuclear fusion and how that radiation interacts with our planet.
Learning Goals	
Standard(s):	**Scientific and Engineering Practices: (Highlighted Practices are Priority)** Asking Questions, **Engaging in Argument from Evidence**, Construction Explanations & Designing Solutions, Developing & Using Models, **Obtaining, Evaluating & Communicating Information**, **Analyzing & Interpreting Data**, Using Mathematics and Computational Thinking **Disciplinary Core Ideas:** HS.ESS1.A The Universe and Its Stars: The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. HS.PS3.A Definitions of Energy: Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. At

	a macroscopic scale, energy manifests itself in multiple ways, such as motion, sound, light, and thermal energy. "Electrical Energy" may mean energy stored in a battery or energy transmitted by electric currents. HS.PS3.B Conservation of Energy and Energy Transfer: Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. HS.PS2.B Types of Interactions: Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. HS.PS1.C Nuclear Processes: Nuclear processes, including fission, fusion, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. HS.PS4.B Electromagnetic Radiation: When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. HS.PS3.D Energy in Chemical Processes and Everyday Life: Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches the Earth as radiation. **Crosscutting Concepts:** Energy and Matter, Systems and System Models, Stability and Change, Scale, Proportion, and Quantity

Essential Question(s):	Where is the best place to look for life around stars?
Enduring Understanding(s):	Stars have life cycles that vary depending on the type of star. Stars are fueled by nuclear fusion which emits electromagnetic radiation and causes the formation of many elements. Stars have internal processes that lead to instability and emission of bursts of electromagnetic radiation in the form of solar storms and solar flares. Electromagnetic radiation can be modeled as a wave or a particle and does not require a medium to travel. Electromagnetic radiation can interact with the planet's magnetic field, causing Auroras.
Learning Goal(s): *Students will be able to use their learning to:*	**During this unit, students will meet the following NGSS Performance Expectations:** HS-ESS1-3: Communicates scientific ideas about the way stars, over their life cycle, produce elements. HS-ESS1-1: Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation. HS-PS2-5: Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). HS-PS4-4: Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and

	the energy released during the processes of fission, fusion, and radioactive decay. *In addition to the learning goals above, Honors students will be able to use their learning to:* ● Explore additional topics related to the following: Stellar formation (atomic and subatomic processes) and evolution, Neutron Stars, Supernovae, and Black Holes ● Apply the mathematical relation between energy density dissipation and surface area in this context.

Unit Number and Title:	Unit 6: Exploring The Universe: Technology
Duration:	Approximately 6 weeks
Resource(s):	N/A
Unit Overview:	Space, the final frontier. "Space is big. Really big. You just won't believe how vastly hugely mind-bogglingly big it is." -Douglas Adams In this unit, students will interpret the giganticness of the vacuum of space that really cannot be understood by the human brain. Then we'll learn about how scientists figure out the chemicals and behaviors that make up stars and planets that are super duper far. Students will be able to understand how telescopes and analytical tools are utilized to create our image of the universe. ● The Big Bang ● EM-Light ● Data Transmission Technology
Learning Goals	
Standard(s):	**Scientific and Engineering Practices: (Highlighted Practices are Priority)** Asking Questions, Engaging in Argument from Evidence, Construction Explanations & Designing Solutions, **Developing & Using Models**, **Obtaining, Evaluating & Communicating Information**, **Analyzing & Interpreting Data**, Using Mathematics and Computational Thinking **Disciplinary Core Ideas:** **PS3.A: Definitions of Energy** These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases

	the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2) **PS4.A: Wave Properties** Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. (HS-PS4-3) Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-2),(HSPS4-5) **PS4.B: Electromagnetic Radiation** Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2) Photoelectric materials emit electrons when they absorb light of a high-enough frequency. (HS-PS4-5) Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. (HS-PS4-3) **PS4.C: Information Technologies and Instrumentation** Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4- 5)

	ESS1.A The Universe and Its Stars The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gasses, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2) **Crosscutting Concepts:** Energy and Matter, Systems and System Models, Cause and Effect, and Patterns
Essential Question(s):	How do we know what we know about the Universe? How would we know if there is other life in the Universe?
Enduring Understanding(s):	Scientists gather and analyze astronomical data in order to explain the formation of the universe and make predictions about the future of the universe. The properties of atoms within stars and exoplanets can create identifiable markers called spectra that allow their composition to be determined using modern technology. Advances in digital technologies over the past century have enabled more detailed and sophisticated data to be collected and then processed with increasing speed.
Learning Goal(s): *Students will be able to use their learning to:*	**During this unit, students will meet the following NGSS Performance Expectations:** HS-ESS1-2. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information. HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. HS-PS4-5. Communicate technical information about how some technological devices use the

	principles of wave behavior and wave interactions with matter to transmit and capture information and energy.* **During this unit, students will be working towards the following NGSS Performance Expectations:** HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. *In addition to the learning goals above, Honors students will be able to use their learning to:* ● Apply the special theory of relativity ● Explore alternative interpretations of spacetime, including block vs. growing block universe views