North Polk Community Schools Pacing & Course Description Guide

Grade Level: 9-12	Content: Physical Science	Year: 2022-23

Course Description/Rationale

This course includes several physics-based topics and incorporates mathematical and engineering applications of the laws of physics. Topics include: nature of science, motion, energy, waves, electricity, and magnetism. Many of these topics require algebra skills.

Name of Unit	Time Frame	Essential Learning Target	Standard(s)
Unit 1: Nature of Science	4 weeks	*SWBAT effectively find and use a variety of resources to gather reliable information and scientific research about a science topic.* *SWBAT evaluate the reliability of the source of scientific information to determine if it is a trustworthy source of information.* *SWBAT construct a claim based on scientific research and support it with observation, evidence, and reasoning.* *SWBAT distinguish between an observation and an inference.* *SWBAT explain the difference between a scientific theory and a scientific law.* *SWBAT explain the concept of scientific bias.* *SWBAT identify common methods, products, practices, and goals of scientists.*	NGSS (Appendix H) Nature of Science Basic Understandings, Principles, & Cross-Cutting Concepts
		SWBAT evaluate how scientific knowledge is used in the engineering design process. *SWBAT contrast the work of a scientist with the work of an engineer.*	HS-ETS1-2 Engineering Design Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

		SWBAT use the engineering process to collaboratively design a structure that can withstand extreme environmental conditions.	
		SWBAT assess their engineering design solutions, including the benefits, constraints, and iterative design process.	HS-ETS1-3 Engineering Design 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 as well as possible social, cultural, and environmental impacts.
Unit 2: Forces of Motion	5 weeks	*SWBAT mathematically predict the distance an object travels and its displacement.* *SWBAT mathematically predict the speed an object travels and its velocity.* *SWBAT predict the force, mass, or acceleration of an object given data on two of the variables using Newton's 2nd Law of Motion.* *SWBAT explain net force on an object as the sum of all the forces on that object.* *SWBAT draw and explain simple free-body diagrams showing action-reaction pairs.*	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.
		SWBAT describe the momentum of each object in the system as the product of its mass and its velocity. *SWBAT apply mathematical routines to indicate that the total momentum of a system of two objects is constant if there is no net force on the system.*	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.
		SWBAT describe that the gravitational force between two objects is dependent on the mass of the objects and the distance between them.	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.
		SWBAT identify the variables and conditions that minimize the force on an object during a collision. *SWBAT form a claim based on scientific research and support it with evidence and reasoning.*	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.

		SWBAT evaluate how scientific knowledge is used in the engineering design process. *SWBAT use the engineering process to collaboratively design a device that minimizes the force on an object during a collision.*	
		SWBAT evaluate how scientific knowledge is used in the engineering design process. *SWBAT assess their engineering design solutions, including the trade-offs, benefits, constraints, iterative design process, and possible social, cultural, or environmental impacts.*	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 as well as possible social, cultural, and environmental impacts.
Unit 3: Work, Power, Energy	3 weeks	*SWBAT mathematically predict the kinetic or potential energy of an object.* *SWBAT explain that when two molecules or objects collide, total energy of the system is conserved.* *SWBAT identify the variables and conditions that cause a change in energy.*	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 component(s) and energy flows in and out of the system are known.
		SWBAT describe that as one form of energy increases, others must decrease by the same amount as energy is transferred among and between objects and particles. *SWBAT develop a model that illustrates the energy change in a closed system.*	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 positions of particles (objects).
		SWBAT use the engineering process to collaboratively design and build a device that converts one form of energy into another form of energy. *SWBAT form a claim based on scientific research and support it with evidence and reasoning.*	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.
		SWBAT evaluate how scientific knowledge is used in the engineering design process. *SWBAT assess their engineering design solutions, including the benefits, constraints, iterative design process, and possible social, cultural, or environmental impacts.*	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 as well as possible social, cultural, and environmental impacts.

Unit 4: Waves	4 weeks	*SWBAT recognize that waves transfer energy from one place to another.* *SWBAT identify types of waves and their characteristics.* *SWBAT explain that the speed of a wave depends on the type of wave and the medium through which it is passing due to the variation in wavelength.* *SWBAT identify that when traveling through empty space, all electromagnetic waves travel at the speed of light.* *SWBAT discover the relationship between the wavelength, frequency, amplitude, and energy of waves.* *SWBAT mathematically predict the wavelength, velocity, and frequency of waves when two of the quantities are known.*	HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
		SWBAT compare and contrast analog and digital transmission of data. *SWBAT evaluate the advantages and disadvantages of digital transmission and storage of data.*	HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information.
		SWBAT explain that different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. *SWBAT evaluate the reliability of a source of scientific information to determine if it is a trustworthy source of information.* *SWBAT evaluate the logic of published scientific claims and determine whether adequate evidence is given to support the claim.*	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.
		SWBAT explain how a technological device uses the principles of wave behavior and wave interactions with matter to transmit energy or information.	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.
Unit 5: Electricity & Magnetism	3 weeks	*SWBAT identify the properties of a magnet that affect its strength, including how the strength of magnetic fields vary with distance and location.* *SWBAT model the magnetic fields of a bar magnet and*	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

		those that naturally occur around Earth. *SWBAT predict the effect of a magnetic object on other objects in its vicinity, including attraction, repulsion, or no effect.* *SWBAT model electrostatic forces and electrical fields due to positive and negative charges.* *SWBAT predict the effect of a charged object on other objects in its vicinity.* *SWBAT explain the Law of Conservation of Charge.* *SWBAT describe how the amount of the charge (mass) and the distance between charges affects the electric field.* *SWBAT compare and contrast electrical and magnetic fields.*	in energy of the objects due to the interaction.
		SWBAT identify the properties of an electromagnet that affect its strength. *SWBAT create a model of an electromagnet.* *SWBAT explain the connection between electricity and magnetism.* *SWBAT use the engineering process to collaboratively design, build, and use a device that illustrates the force between objects in an electric and/or magnetic field.*	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.
		SWBAT evaluate how scientific knowledge is used in the engineering design process. *SWBAT assess their engineering design solutions, including the trade-offs, benefits, constraints, iterative design process, and possible social, cultural, or environmental impacts.*	HS-ETS1-3 Engineering Design 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 as well as possible social, cultural, and environmental impacts.