North Polk Community Schools Pacing & Course Description Guide

Grade Level: 10-12	Content: Physics	Year: 2022-2023

Course Description/Rationale

This is a traditional high school physics course that involves the study of forces and laws of nature affecting matter. Topics include mechanics, heat, waves, magnetism and electricity. Many of these topics require strong algebra and geometry skills. Laboratory study is designed to enhance understanding of the concepts.

Name of Unit	Time Frame	Essential Learning Target	NGSS Standard(s)
Intro to Physics	1 week	13 - I can collect and organize data properly, express data graphically, and analyze relationships between variables in an investigation by using both interpretive and analytical techniques applied to the graphical representation of the data.	
Thermal Energy	3 weeks	1 - I can demonstrate understanding of conceptual, graphical, and mathematical relationships among heat, temperature, and state of matter.	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. 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). 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.
Waves 1 - Waves and Sound	2 weeks	9 - I can demonstrate understanding of conceptual and mathematical relationships of waves, including light and sound, to understand their motion and how they interact with other waves or objects.	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-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.
Waves 2 - Light and Optics	2 weeks	9 - I can demonstrate understanding of conceptual and mathematical relationships of waves, including light and sound, to understand their motion and how they interact with other waves or objects.	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-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-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.
Electrostatics & Electric Fields	1 week	10 - I can explain how electrical, gravitational, and magnetic fields existing in space and interact with other objects or systems.	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-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.
Current Electricity	2 weeks	11 - I can demonstrate understanding of conceptual and mathematical relationships of current, resistance, and voltage, and apply it to construct and interpret simple circuits.	
Electromagnetic Induction	2 weeks	12 - I can explain how electromagnetic induction produces current and describe the generation of electricity.	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-PS3-5. 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.
Semester 1 Final Project (Electricity Games)	1.5 weeks	1,9,10,11	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.
Vectors	1.5 weeks	3 - I can use vectors and free-body diagrams to describe and analyze aspects of an object's position, velocity, acceleration and forces in one and two dimensional space.	
Linear Motion	3 weeks	3 - I can use vectors and free-body diagrams to describe and analyze aspects of an object's position, velocity, acceleration and forces in one and two dimensional space, including linear, circular, and projectile motion. 4 - I can demonstrate understanding of conceptual, graphical, and mathematical relationships among position, velocity, and acceleration for the motion of a particle along a path.	
Forces	1.5 weeks	3 - I can use vectors and free-body diagrams to describe and analyze aspects of an object's position, velocity, acceleration and forces in one and two dimensional space. 6 - I can apply Newton's Three Laws of motion to conceptual and mathematical problems involving objects at rest and in motion.	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.
Impulse and Momentum	2 weeks	7 - I can use the laws of conservation of momentum and conservation of energy to analyze, explain, and calculate for systems involving elastic and inelastic collisions between two solid objects in one-dimensional motion. 8 - I can describe that momentum and impulse is a vector quantity arising from Newton's Third Law and use it to analyze, explain, and calculate for situations involving collisions.	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.
Circular Motion	2 weeks	3 - I can use vectors and free-body diagrams to describe and analyze aspects of an object's position, velocity, acceleration and forces in one and two dimensional space, including linear, circular, and projectile motion.	

Projectile Motion	2 weeks	3 - I can use vectors and free-body diagrams to describe and analyze aspects of an object's position, velocity, acceleration and forces in one and two dimensional space, including linear, circular, and projectile motion. 5 - I can use and apply gravitational force and the equations of kinematics to explain, analyze and predict the projectile motion of an object near the Earth's surface.	
Semester 2 Final Project (Model Rockets)	2 weeks	3, 4, 5, 6, 7, 8, 13	