SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Physics	**Length of Course:** Full Year
Grade Level(s): 10 - 12	**Periods Per Cycle:** 6
Units of Credit: 1	**Length of Period:** 40 Minutes
Classification: Core or Elective	**Total Instructional Time:** 120 Hours

Course Description

The course will teach the principles of physics and problem solving without the strong mathematical component in the current Physics Honors course. The course will include inquiry-based lab experiences and challenges where the students will learn the concepts through doing instead of mathematical relationships and quantitative reasoning.

Instructional Strategies, Learning Practices, Activities, and Experiences

Bell Ringers	Teacher Demonstration	Practice AP Exams and Essays
Class Discussion	Detailed Laboratory Experiments	Formal Assessments
Flexible Groups	Inquiry Laboratory Experiments	Guided Practice
APL Strategies	Textbook Reading	Online Tutorials/Resources
Posted Objectives and Agenda	Homework	Critical Thinking
Building Projects	Research	

Assessments

Quiz	Exam	Problem Sets
Lab Analysis	Qualitative From Observation	Class Discussion
In-Class Problems	Building Projects	

Materials/Resources

Textbook	Vernier Lab Equipment	Gizmo – Lab Simulations
Calculator	iPad	Phet – Lab Simulations
Lab Equipment	Additional Text Resources	

Adopted: 2/21/90
Revised: 9/3/91, 6/17/98, 11/15/01, 8/20/07, 5/22/23
https://springgroveareascho.sharepoint.com/sites/PrivateSGASD/Shared Documents/AASG/NEWCURR/SCIENCE/2023/HS Science Elective Courses/Physics/Physics_Overview.doc

Forces	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Projects: Bridge/Tower Rocket Balloon Lift Build an Overlook without Supports	1. The student will be able to understand and apply the basic forces. 2. The student will be able to demonstrate the use of force to illustrate equilibrium. 3. The student will explain the effects of net force on a bode or structure. 4. The student will apply the concepts of density and lift to illustrate how a balloon lifts. 5. The student will utilize center of gravity and center of pressure to design and fly a rocket. **HS-PS2-1 - Forces and Interactions** - 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. **Science and Engineering Practices** Asking questions, for science, and defining problems (for engineering) Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations, for science, and designing solutions, for engineering Engaging in argument from evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Patterns Systems and system models Structure and function Stability and change

Energy	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Projects: Mousetrap Car Mentos Powered Car Balloon Powered lift Rube Goldberg Unknown Resistance	1. The student will be able to evaluate different types of energy in selecting parts and designing the Rube Goldberg device. 2. The student will transfer energy from a mousetrap to power a car the farthest. 3. The student will apply pressure for propulsion. 4. The student will investigate the principles of resistance in electrical circuits to determine unknown resistance. **HS-PS3-1 – Energy** - 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 – Energy** - 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 – Energy** - Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. **Science and Engineering Practices** Asking questions, for science, and defining problems (for engineering) Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations, for science, and designing solutions, for engineering Engaging in argument from evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Patterns Systems and system models Structure and function Stability and change

Momentum	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Projects: Pringles Chip Challenge Egg Drop Seatbelt Test Scrambler	1. The student will be able to model an airbag to protect a dropped egg. 2. The student will investigate and test various packaging to protect a pringles chip during shipping. 3. The student will model a seatbelt to protect occupants (eggs) in a propelled car down a ramp. 4. The student will use a falling mass to propel a car with an exposed egg in the front into a wall and stop with. **HS-PS2-2 – Forces and Interactions -** 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 - Forces and interactions** - Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. **Science and Engineering Practices** Asking questions, for science, and defining problems (for engineering) Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations, for science, and designing solutions, for engineering Engaging in argument from evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Patterns Systems and system models Structure and function Stability and change

Waves, Light, and Sound	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Projects: Images Mirrors and Lenses Hidden Message	1. The student will be able to explain how wave theory is supported by the observations of interference and diffraction. 2. The student will be able to use double slit and single slit equations to calculate problems. 3. The student will be able to explain the visible spectrum in terms of wavelength, color, etc. 4. The student will be able to explain dispersion through a prism. 5. The student will be able to explain why thin-film interference occurs. 6. The student will be able to explain what polarization is and how it occurs. 7. The student will be able to determine the location and type of image formed by mirrors and lenses. **HS-PS4-1 – Waves and their Applications -** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. **HS-PS4-3 – Waves and their Applications -** 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. **Science and Engineering Practices** Asking questions, for science, and defining problems (for engineering) Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations, for science, and designing solutions, for engineering Engaging in argument from evidence Obtaining, evaluating, and communicating information **HS-PS4-1 – Waves and their Applications** - Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. **HS-PS4-3 – Waves and their Applications** - 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. **Crosscutting Concepts** Patterns Systems and system models Structure and function Stability and change

Velocity and Acceleration	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Projects: Slow Bike Race CO_2 Powered Dragster Balloon Powered Car Hot Air Balloon Nothing but Net	1. The student will be able to compare and contrast constant velocity, average velocity and instantaneous velocity. 2. The student will be able to solve speed and acceleration problems. 3. The student will be able to describe constant speed graphs and construct graphs for accelerated motion. 4. The student will be able to determine relative speed. 5. The student will be able to use slopes and areas of velocity and acceleration graphs to find motion related quantities. 6. The student will be able to determine the acceleration due to gravity. **HS-PS2-1 - Forces and Interactions -** 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. **Science and Engineering Practices** Asking questions, for science, and defining problems (for engineering) Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations, for science, and designing solutions, for engineering Engaging in argument from evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Patterns Systems and system models Structure and function Stability and change