High School Physics Curriculum Pacing Guide

Energy & Momentum

Crosscutting Concepts: Energy and Matter; Systems and System Models; Cause and Effect; Scale, Proportion, and Quantity

Topics: Open and Closed Systems; Work; Power; Types of Energy; Conservation of Energy; Momentum; Impulse; Collisions

6-Week Instructional Segment

Anchoring Phenomenon	Standard	Instructional Segment	Disciplinary Core Ideas	Science and Engineering Practices	Instructional Notes
Energy is conserved with a spring or elastic pop-up toy.	**SP3a** **SP3b** **SP3c** **SP3d**	**Energy and Momentum**	From *A Framework for K-12 Science Education:* ***By the end of grade 12*** **PS2A: Forces and Motion** • Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. • In any system, total momentum is always conserved. • If a system interacts with objects outside itself, the total momentum of the system can change; any such change is balanced by changes in the momentum of objects outside the system. **PS3A: 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.	• Asking Questions • Using Mathematics and Computational Thinking • Planning and Carrying Out Investigations • Engaging in Argument from Evidence	Background: Be sure to follow all relevant safety procedures. By the end of this unit, students are using the following language in their speaking and writing • Open system • Closed

			• At the macroscopic scale, energy manifests itself in multiple ways. • At the microscopic scale, all of the different manifestations of energy can be modeled as either motions of particles or energy stored in fields. **PS3B: Conservation of Energy & 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. • Energy cannot be created or destroyed, but is transported from one place to another and transferred between systems. • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration and how kinetic energy depends on mass and speed. • The availability of energy limits what can occur in any system. • Uncontrolled systems always evolve toward more stable states--that is, toward more uniform energy distribution. • Any object or system that can degrade with no added energy is unstable. **PS3C: Relationship between Energy and Forces** • Force fields contain energy and can transmit energy across space from one object to another. • When two objects interacting through a force field change relative to position, the energy stored in the force field is changed. • Each force between between two interacting objects acts in the direction such that direction would reduce energy in the force field between objects.		system • Kinetic energy • Energy transformation • Work • power • Work-Kinetic Energy Theorem • Force • Impulse • Momentum • Collisions

This instructional segment will connect to Waves.