Invisible Forces

Reviewed 2022

Format: Wonder Workshop
Grades: 4-8
Length: 45 minutes

General Description: To explore various invisible physical forces in order to solve a mystery.

Big Idea: The world is full of forces that we are not able to see directly, but through experiments, we can see their effects on objects around us.

Key Concepts:

- Air is full of molecules that can exert force on other objects around it.
- Sound creates vibration patterns that can travel through different substances in predictable ways.
- Electrons moving along an unbroken path create electricity used to power various items.

Colorado Academic Standards

- **MS-PS4-2** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. Waves and their Applications in Technologies for Information Transfer.
- **4-PS3-2** Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- **4-PS4-3** Generate and compare multiple solutions that use patterns to transfer information. Waves and Their Applications in Technologies for Information Transfer.

Next Generation Science Standards

- **4-PS3: A** Definitions of Energy: The faster a given object is moving, the more energy it possesses. Energy can be moved from place to place by moving objects or through sound, light or electric currents.
- **4-PS3: B** Conservation of Energy and Energy Transfer: Energy is present whenever there are moving objects, sound, light or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.
- **4-PS3:C** Relationships Between Energy and Forces: When objects collide, the contact forces transfer energy so as to change the objects' motions.
- **4-PS3:D** Energy in Chemical Processes and Everyday Life: The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.
- **MS-PS2:A** Forces and Motion: For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (a) The motion of an object is determined by the sum of the

forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (b) All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (b)