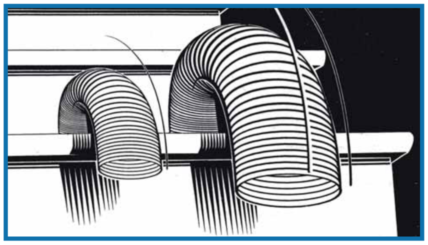
30 minutes

Grades 6–8, 9–12

Slinky Science

What can a Slinky teach you about physics?



Instructions

Watching a Slinky move down the stairs or vibrating while being stretched are ideal opportunities for teaching key science concepts. This activity goes from Newton's laws, to potential and kinetic energy, and finally into sound waves.

1. Arrange books in stair steps or bring students to the stairs or incline, along with the Slinky toys. Ask whether students think the bigger or smaller Slinky would win a race down the stairs, and why.

2. Place Slinky toys at the top of the stairs or ramp. See if anyone can cite Newton's first law of motion to explain why the Slinky toys are motionless. If nobody knows, say that a body at rest will remain at rest unless an external force acts upon it; a body in motion will remain in motion in a straight line at a steady speed unless an external force acts upon it.

3. Grip a coil of each Slinky and flip it over to land on the next lowest step from the top. Release the toys to race down the stairs or incline. Note that by releasing the Slinky toys, gravity affects them and the potential energy is converted into kinetic energy.

Materials

PER PAIR OR WHOLE CLASS:

- ☐ 2 Slinky toys of different sizes
- ☐ Stacked books, stairs, or ramp

4 See if anyone can explain why the smaller Slinky won. As the Slinky moves down the steps, kinetic energy transfers from coil to coil in a longitudinal wave. The speed of the wave depends on the tension and mass of the coil. The smaller the mass, the tighter the tension, the faster energy is transferred, the faster energy moves through the Slinky. Other factors that affect a Slinky's movement include its length, diameter of the coils, and height of the step.

5 Next, have students explore some other properties of Slinky springs. Ask two students to grasp either end of a Slinky and to stretch it out along the floor or between them.

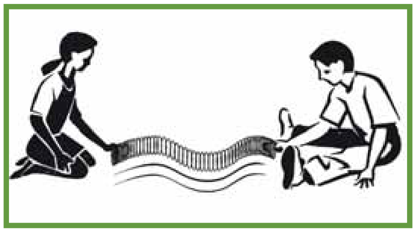
6 Have one student move an end up and down, perpendicular to its stretched length, while the other end is held still. A series of transverse waves will be generated.

7 Explain why the motion of the two waves differs: the longitudinal wave of that Slinky on the stairs was imperceptible because the Slinky was moving in the same direction as the energy was traveling. But in the stretched Slinky, the transverse wave is at right angles to the direction of the wave.

Guiding Questions ?

Does the material the Slinky is made out of matter (metal or plastic)? Why or why not?

How else can you use a Slinky to demonstrate converting potential energy into kinetic energy?



Engineering & Science Connections

- A *wave* is a disturbance that moves through a medium. A *longitudinal wave* is a wave in which the disturbance moves in the same direction as the propagation of the wave. Sound waves moving through the air are examples of longitudinal waves. When you pinch loops of the Slinky together and let go, you can create a longitudinal wave because the disturbance moves in the same direction as the wave along the length of the Slinky. A transverse wave is where the disturbance is perpendicular to the propagation of the wave, like with a ripple in a pond. You can create a transverse wave when you stretch out a Slinky and then move it up and down.
- In 1943, the mechanical engineer Richard James accidentally invented the Slinky when he was trying to develop a spring to keep ship instruments steady at sea.
- Sitting still at the top of the stairs, the Slinky demonstrates inertia: like all objects, it resists change in its motion. While not moving, the Slinky possesses potential or stored energy. Once it starts down the stairs, gravity pulls on it, and potential energy is converted to kinetic energy as the Slinky tumbles coil by coil.

This activity provided by the engineers of Phillips Petroleum Company.