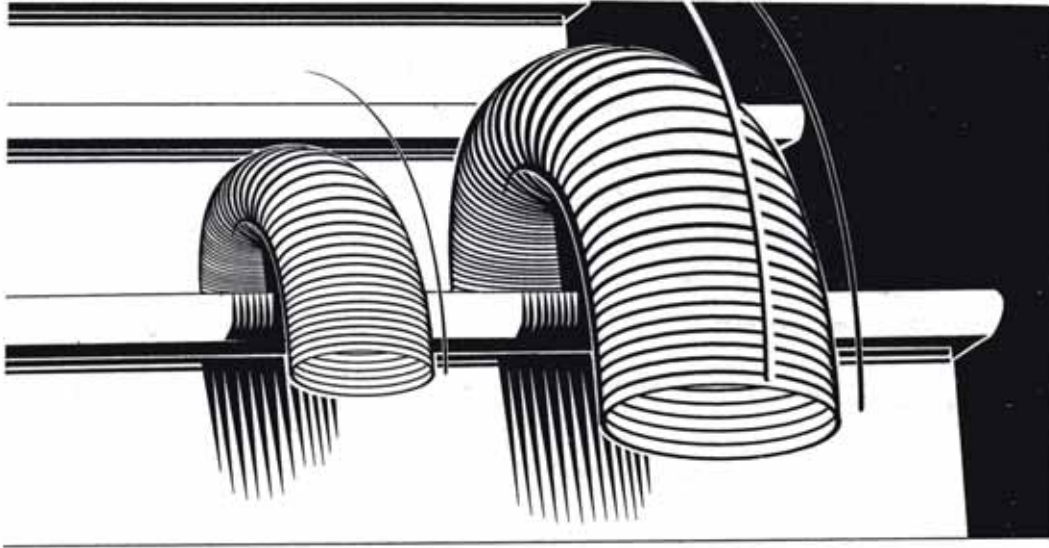


A Sample of Slinky Science



Grade Level

6-12

Materials

Two Slinkys of different sizes

Discussion

Richard James, a mechanical engineer, accidentally invented one of the world's most popular toys while trying to develop a spring to keep ship instruments steady at sea.

In 1943, an experimental steel spring fell off his desk, and "walked" down a pile of books onto the floor.

His invention had failed as an anti-vibration device for ships, so James decided to turn it into a toy and in 1941 the first Slinky® made its debut. Since 1978, Slinkys also are made of the plastic K-Resin® styrene-butadiene copolymer. More than 250 million Slinkys have been sold since 1947. That's one for every resident of the United States!

In addition to being a terrific toy, the Slinky is an excellent device for demonstrating

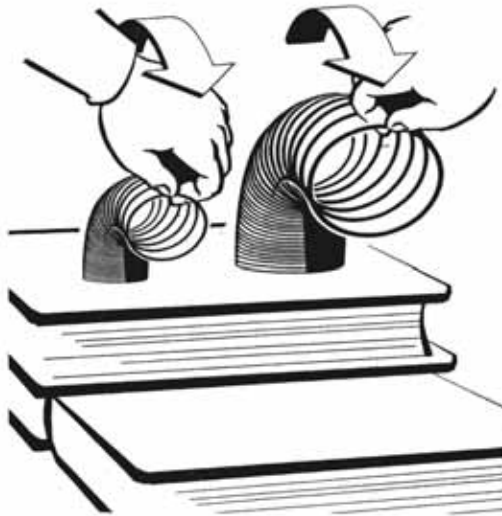
various properties of physics. Understanding how such properties work is essential to engineers who must apply the theories and principles of science and mathematics every day in solving practical technical problems such as harnessing the power of fuels that drive our cars, airplanes, trains, and ships; transforming water power into electricity; using steel and concrete to build dams, roads and bridges; etc.

The Slinky, like all objects, tends to resist change in its motion. Because of this inertia, if placed at the top of stairs it stays at rest without moving at all. At this point it has potential or stored energy. But, once it starts down the stairs and gravity affects it, the potential energy is converted to the energy of motion, or kinetic energy, and the Slinky gracefully tumbles coil by coil down the stairs.

Activity 1

In this activity, inertia, gravity, potential energy, kinetic energy, and longitudinal waves are demonstrated when the Slinky "walks" down stairs or an incline.

1. Show the class two Slinkys of different sizes and ask which Slinky they think will win a race down stairs



- or an incline. (Graduated stacks of books work well.)
- Place both Slinkys on the top stair or top of a ramp. Ask why the Slinkys remain motionless. What will it take to get them in motion? (Explain Newton's first law of motion: 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.)
 - Grip a coil of each Slinky at the top and flip it over toward the middle of the next lower step, releasing your hold (With this action, potential energy is converted to kinetic energy.) The Slinkys race downward all by themselves.
 - After the race, ask why the smaller Slinky won. (As the Slinky moves down the steps, kinetic energy is transferred from coil to coil along its length 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 tighter the tension, the faster the energy is transferred; so, energy moves faster through the smaller Slinky. Other factors, such as the length of the slinky, diameter of the coils and height of the step must be considered to completely understand why a Slinky moves as it does.)

Activity 2

This activity demonstrates how energy is transferred in a transverse wave, a wave in which the vibrations are at right angles (perpendicular) to the direction in which the energy travels

- Have two students each take one end of a Slinky and stretch it out along the floor, or between them, or stretch the Slinky between two "stands" where each end can be secured.
- Have one student move his or her end of the Slinky up and down, perpendicular to its stretched length. The other student should hold his or her end of the Slinky still. A series of transverse waves will be generated.
- Ask how this wave motion differs from the wave motion in Activity 1. (In Activity 1, the longitudinal wave, which is imperceptible because the Slinky itself is in motion, moved in the same direction in which the energy was traveling. In Activity 2, the transverse wave formed is at right angles to the direction of the wave.)

Activities provided by the engineers of Phillips Petroleum Company.

If you like what you've read here ask for the special teacher and volunteer kit developed for National Engineers Week 1998. Each kit contains additional hands-on activities, a demonstration Slinky® and a "Slinky Scientific Shindig" video. You can order one at a nominal cost for each teacher whose classroom you visit.

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