Slinky®

Introduction

Demonstrate spring compression and wave generation using Slinky®!

Concepts

- Longitudinal wave
- Transver wave

Materials

Slinky®

Board or other surface for an incline

Safety Precautions

Take care not to suddenly release a stretched Slinky. The spring may snap back rapidly, which may cause personal injury or damage to the Slinky. Wear safety glasses. Do not extend the Slinky more than 3 meters. Wash hands thoroughly with soap and water before leaving the laboratory. Please follow all laboratory safety guidelines.

Procedure I — Stairs

1. Place a Slinky at the top of a set of stairs. Holding the bottom of the Slinky, flip the top over toward the middle of the next step. As it uncoils, release the bottom of the Slinky. The Slinky will walk down the stairs.
2. Lean a board at an angle. Place a Slinky at the top (higher end) of the board. Holding the bottom of the Slinky, flip the top over. As it uncoils, release the bottom of the Slinky. The Slinky will walk down the board. Try changing the angle of the board. What angle, or range of angles, work best?

Procedure II — Wave Motion

1. With the aid of another person, stretch the Slinky out to a length of 3 meters.
2. To show a longitudinal wave, or pulse, pull about 30 cm of the Slinky together at one end and then release it.
   a. Describe the pulse that occurs.
   b. Does the size of the logitudinal wave change as it travels along the spring?
   c. Does a change in the tension of the spring affect the speed of the pulse?
   d. What happens to the pulse when it reaches the end of the spring?
3. To show a transverse wave, move your hand once very quickly in either side-to-side motion or in an up-and-down motion.
   a. Describe the wave that occurs.
   b. Does the size of the transverse wave change as it travels along the spring?
   c. Does a change in the tension of the spring affect the speed of the wave?
   d. What happens to the wave when it reaches the end of the spring?
4. Demonstrate interference by having both individuals holding the spring make either a pulse or a transverse wave at the same time.
   a. What happens when the waves meet?
5. Demonstrate a periodic wave by moving your hand steadily back and forth to produce a train of waves. The distance between the crest of any two neighboring waves is called the wavelength.
   a. How can you vary the wavelength?
   b. The rate at which you vibrate your hand will determine the frequency of the waves (the number of waves per unit of time). Observe how you can vary the frequency of the waves.
   c. Do you observe any relationship between the frequency and the wavelength of the waves?

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Discussion

The Slinky was invented in the early 1940s by Richard James, a marine engineer who was trying to develop a spring that would instantaneously counterbalance the wave motion that rocks a ship at sea. One day, James accidently knocked an experimental spring off a shelf and noted that it crawled, coil by coil, to a lower shelf, onto a stack of books, down to the tabletop and finally came to rest in an upright position on the floor. A quick experiment showed that the spring was particularly adept at descending stairs. It was James' wife, Betty, who realized this invention should be a toy.

A Slinky works similar to a spring that undergoes squeezing and stretching. When one end of the Slinky is placed at a lower position than the rest of the spring, it tends to fall down, stretching the spring. As the coils pile up, energy is compressing the spring. The spring will then expand slightly to release some of that energy. Since the spring is moving in somewhat of a horizontal direction, there is a tendency for the spring to topple over in the direction of motion continuing its "walk" down an inclined surface. Depending on the height of the steps, or angle of the incline, as well as the type of surface it lands on, the Slinky will either pile up at the bottom or end up laying on its side.

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The *Slinky* is available from Flinn Scientific, Inc.

Catalog No.	Description
AP1957	Slinky®

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.