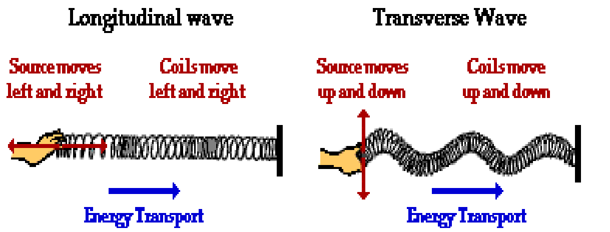
PULSES ON A COIL SPRING



The subsequent direction of motion of individual particles of a medium is the same as the direction of vibration of the source of the disturbance.

Coiled springs are excellent materials for analyzing a variety of wave behaviors. In this activity, you will examine transverse and longitudinal pulses, fixed- and free-end reflections, constructive and destructive interference, standing waves, and the behavior of waves when they reach new transmitting media.

TRANSVERSE PULSES

A. Send a transverse pulse down a stretched large coil spring. Observe the motion of the spring's coils. Draw a sketch of the pulse traveling down the spring.

Why is this pulse called a transverse pulse?

B. Observe the speed of the pulse while varying the pulse amplitude. What happens to the speed of the pulse as the amplitude changes?

C. Observe the speed of the pulse while varying the tension in the spring. What do you notice about the pulse speed with respect to changes in tension?

D. Does the stretched spring under different tensions represent the *same* or *different* transmitting media?

E. Maintain a constant tension and send continuous wave trains of varying frequencies down the spring. What happens to the wavelength as the frequency increases?

WAVE INTERFERNCE

F. Send two pulses of approximately the same amplitude from opposite ends of the spring toward each other on the same side of the spring. What do you observe?

Do the two disturbances “bounce off” each other or pass right through each other?

What do you notice when the pulses “overlap”?

Draw sketches showing the pulses, labeled “A” and “B”, before, during, and after they meet.

G. Send two pulses of approximately the same amplitude from opposite ends of the spring toward each other on opposite sides of the spring. What do you observe?

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Draw sketches showing the pulses (labeled “A” and “B”) before, during, and after they meet.

WAVE REFLECTION

H. Hold the spring firmly down in place at the far end and send a pulse down the spring. Describe and illustrate your observations of reflection from this "fixed end."

I. Attach and hold a light string on one end of the spring and send a pulse from the other end. Describe and illustrate your observations of reflection from this "free end."

WAVE BEHAVIOR AT MEDIA BOUNDARIES

J. Attach the two springs together and send a pulse from the large spring. Record your observations.

K. What happens to the wave speed when the pulse goes from the large spring to the small spring?

....from the small spring into the large spring?

L. Did you notice any reflection when the pulse reached the junction where the two springs were connected?

Did more of the wave seem to be transmitted or reflected?

Think of a common example where light waves partially reflect and partially transmit when they reach the boundary of the transmitting media.

STANDING WAVES

M. While holding one end of the large spring firmly in place, move the other end of the spring continuously back and forth to send a continuous wave train down the spring. Adjust your frequency until a standing wave with two "loops" is obtained.
Now change your frequency of vibration until more loops are formed. Since the speed of the wave remains constant (do you know why?), shaking the spring with a higher frequency does what to the wavelength?

In order to obtain standing waves with more loops when the speed of the wave is constant, what must be done to the frequency of vibration?

How could you determine the wavelength of the wave when a standing wave pattern is observed?

Draw sketches of standing waves having one, two, three, and four loops. Indicate on your sketches how the wavelength could be measured.

LONGITUDINAL PULSES

N. Stretch the large spring and send a longitudinal pulse down the spring. Observe the motion of the spring coils. Draw a sketch of the pulse traveling down the spring.

Why is this pulse called a longitudinal pulse?

Note:
Wave properties such as diffraction and refraction unfortunately cannot be observed with coiled springs.