Spring into Action!

Remember the last time you played on a swing set? Scientists call this type of back and forth motion *simple harmonic motion*. Besides describing back and forth, or *horizontal*, movement, simple harmonic motion can also be a movement that is up and down, or *vertical*, like a bungee jumper bouncing after the jump. The time it takes for one complete cycle of these up-and-down movements is called a *period*. In this activity, we will study the up-and-down motion of a ball at the end of a Slinky® using a Go! Motion.

OBJECTIVES

In this activity, you will

- Graph vertical simple harmonic motion.
- Find how long it takes to make one complete cycle, or period.
- Find out how the period is affected by pulling the spring further down.

MATERIALS

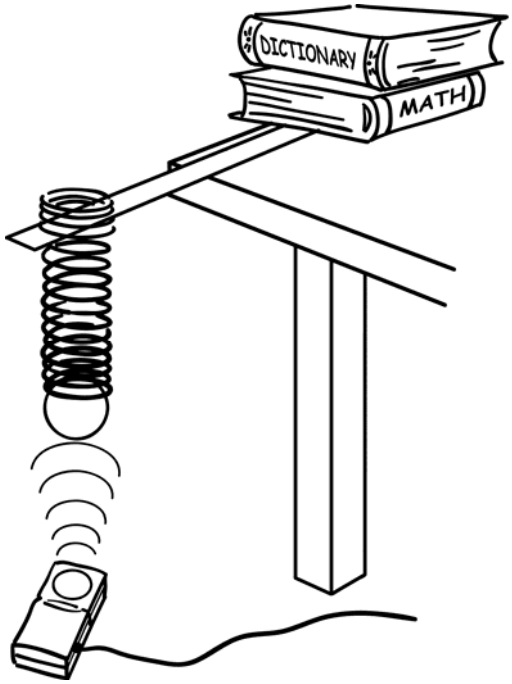
computer with Logger Lite installed
Go! Motion motion detector
meter stick with Slinky and ball attached
heavy books

KEY QUESTION

What is the relationship between the distance a spring is pulled down, or *displaced*, and its period?

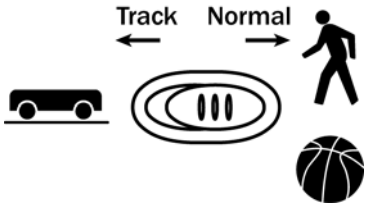
HYPOTHESIS

When a spring is displaced further, the period will be _____ (shorter, longer, or the same).



PROCEDURE

1. Do the following to set up the Go! Motion for data collection:
   a. Make sure the Go! Motion is connected to the computer.
   b. Set the switch on the Go! Motion to the Normal setting as shown here.



2. Start Logger Lite on your computer.
3. Open the file for this activity by doing the following:
   a. Click the Open button, .
   b. Open the folder called "Elementary Science."
   c. Open the file called "23 Spring into Action."
4. Assemble the equipment as shown on the previous page. Put the meter stick on a table or desk so the Slinky is hanging freely. Place the books on the meter stick to keep it on the table. Carefully place the Go! Motion so it is directly underneath the ball. Let the ball come to rest.
5. Collect data for the 10 cm displacement by following the steps below:
   a. Have one student pull the ball down about 10 cm from its resting height. Make sure you pull the ball straight down, or it will swing around when you let go.
   b. Release the ball, then click Collect in Logger Lite.
   c. When data collection is done, look at graph. The high points in the wave are called *peaks* and the low points are called *troughs*. Was the ball closer to the Go! Motion during a peak or a trough? Discuss this with your teammates and make sure you all agree.
   d. If there are sharp spikes on your graph, it probably means the ball swung out of range of the detector. If this happened, collect data again by clicking Collect.
6. Find the period of the Slinky.
   a. On your graph, highlight the first full period. You can do this by placing the mouse on one peak, clicking and holding as you drag the mouse to the next peak.
   b. Look at the time column in the data table on the screen. Find the time of the first peak and write it in the Data Table below.
   c. Find the time of the second peak and write it in the Data Table.
   d. Subtract the time of the first peak from the time of the second peak. This gives you the length of the period. Record this time in the Data Table.

Data Table				
Run	**Spring displacement**	**Time of 1st peak**	**Time of 2nd peak**	**Length of one period**
1	10 cm	s	s	s
2	20 cm	s	s	s

7. You will now repeat the data collection, but this time the displacement will be larger. Repeat Steps 5–6, pulling the ball down 20 cm instead of 10 cm.

ANALYZE YOUR DATA

1. What did you learn about the relationship between a spring's displacement and its period? Was your hypothesis correct?

2. Were the peaks and troughs larger when the displacement was 10 cm or 20 cm?

Good job!!