The Spring Problem

Materials
Each group will need the following:
• One Slinky Jr.
• Clay (or play dough) to act as a weight
• A meter stick or other measuring device (butcher paper marked every 2 cm)
• A stop watch

Tasks for the team:
Holder: The person who holds the slinky in place.
Timer: The person who times the period of an oscillation.
Low Spotter: The person who spots the lowest position.
High Spotter: The person who spots the highest position.

1. Attach the clay to the end of the slinky.

2. The holder should hold the non-clay end of the slinky and extend his/her arm out so that it can be held steady for a period of time. Holding the top against a door or window jamb will make this easier. You will need to hold about $\frac{1}{4}$ of the coils from the top. Separate this section by using a ruler or other thin flat object, as shown in the picture to the right.

3. Allow the slinky to hang loose so that you get an idea of the middle position during the oscillations. Adjust the number of coils above the ruler if the spring hangs too low.

The upper spotter should raise the clay between 20 and 30 cm above the center position. The measurements will go as follows:

DROP
LOW POINT
HIGH POINT
LOW POINT
HIGH POINT -- Mark here
LOW POINT -- Mark here
HIGH POINT -- Mark again

Practice a couple of test drops to get an idea of the high and low positions. Once you have established your standards you are ready to begin the experiment.

4. Draw a line on the paper or use the floor as a reference point to measure from.
Team Task:

**Holder:** To keep your arm and hand steady to avoid any secondary motion.

**Spotters:** The high spotter is in charge of dropping the clay. Make a mark at the starting position so that each trial will start from the same point. Once the motion has started, mark the low and high points of the clay on the paper as specified previously. Use different colors or numbers for each trial.

**Timer:** Start the stop watch when the weight hits its the high marking point. Stop the watch when it reaches its next high point.

PART 1:
Run the experiment three times. Record your data on the chart below.
All heights are measured from the reference line or floor.

<table>
<thead>
<tr>
<th>TRIAL 1</th>
<th>TRIAL 2</th>
<th>TRIAL 3</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRST HIGH POINT</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>LOW POINT</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SECOND HIGH POINT</td>
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<td></td>
<td></td>
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<tr>
<td>TIME</td>
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</tbody>
</table>

PART 2:
In this part we wish to concentrate on the period of an oscillation. Measure the time it takes for the spring to make the specified number of oscillations. If you have more than one stop watch you can speed up the process. Choose a dropping height similar to the one you used in Part 1. An approximation is fine here since we are only concerned about the timing.

Start timing after one or two oscillations to minimize the effects of secondary motion.

To calculate the period, divide the time by the number of oscillations.

We will sketch a graph of the motion during our analysis. To help develop the graph, the spotters should pay close attention to the motion of the slinky and record their observations.

Complete the chart below:

<table>
<thead>
<tr>
<th>Oscillations</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Period</td>
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