Springs are in the Air!

A typical spring is a tightly wound coil or spiral of metal that stretches when you apply a force (a push or pull) and goes back to its original shape when you remove the force. The force with which a spring resists deformation is called its restoring force. If we stretch a spring by pulling it with our hand, we can feel the restoring force opposing our pull. Have fun exploring inclined planes, gravity, momentum, forces, and sound waves with these spring-time activities.

Slinky Snake

Springs don't have to be made of metal. Have your young scientists prepare their own springy snake to sit on their desk or hang from the ceiling.

You will need:

+ Low quality paper plates or the template provided
+ Paint or crayons
+ Scissors

What to do:

1. Have students decorate either a paper plate or the template provided.
2. Starting at the outer edge of the paper plate, begin cutting around the edge of the plate towards the centre in a spiral configuration. Leave a rounded end at the centre for the snake's head. Students can add facial features after cutting, if desired.
3. Have students pick up the snake's head and dangle it. How springy is their snake?
4. Have students try cutting snakes of different thicknesses from extra paper plates. Does the thickness of the snake's body affect its elasticity? What happens when a higher quality paper plate is used?

Slinky Drop

What happens when you stretch out a spring and let it drop? Explore this interesting phenomenon with everyone's favourite coil spring: the Slinky!

You will need:

+ Slinky
+ Some observant friends

What to do:

1. Hold a slinky vertically in both hands.
2. Stretch the slinky out so that the bottom of the slinky is dangling freely, a meter or so from the floor.
3. Have your friends watch the slinky carefully as you let go of the top. How does it fall?
4. If you have access to a video camera, record the slinky drop and play it back in slow motion or visit YouTube for some slow-motion footage of the slinky drop.
   For example: https://www.youtube.com/watch?v=wGIZKETKKdw

Note:

When the Slinky is stretched out and held in midair, it is in a state called equilibrium, in which the forces on it are balanced. When you let go of the top, the bottom stays suspended as the top begins to fall. It takes several seconds for the wave that is created to carry the information that the top has been released to the bottom of the slinky. The bottom of the slinky will only begin falling once the wave reaches it.

Slinky Walk

Take your slinky for a "STEM" walk and explore gravity, inclined planes, potential energy, angles, averages, timing and recording.

You will need:

+ Slinky
+ Protractor (optional)
+ A long plank, preferably 2 meters in length (wooden or plastic shelf, cardboard from an appliance box)
+ Books
+ Stopwatch

What to do:

1. Have students create an inclined plane using their plank and a stack of books.

2. Next have them carry out an open-ended exploration:
   a. Their first task is to determine the proper technique for holding and releasing the slinky at the top of the inclined plane so that the slinky "walks" down the plank in an end-over-end fashion.
   b. Their next task is to find the largest and smallest angle of incline for the plank that allows their slinky to walk down using an end-over-end "flipping" pattern, rather than tumbling or sliding. This will determine the parameters for their investigation.

3. Once the largest and smallest angles have been determined, have students choose 3 or 4 angles to test within the limits they determined. Depending on the age of the students the angles can be measured using a protractor, or described using words or number of books used to create it.

4. Students can then set up the plank at the first angle they will test. They should place the slinky at the top of the incline and hold it using the technique they discovered in step 1. They can use a pencil or piece of tape to mark the start line for their investigations.

5. Each group will need someone to act as a Slinky holder, a counter, a timer and a recorder. Once everyone is ready, have the Slinky holder release the slinky. The counter will observe the number of "flips" the Slinky makes from top to bottom, the timer will time how long it takes to reach the bottom of the plank and the recorder will make a note of the results. Have them repeat this step several times and calculate the average time and number of flips. They can then adjust the angle of the inclined plane and repeat the experiment for the other angles they have chosen.

6. Have students identify any patterns they observed. Depending on age, they can also graph their results and use their graph as a predictor of future Slinky behavior. For example, have your students identify an untested angle, use their graph to predict the number of flips or time required to reach the bottom, and then carry out the experiment.

Extension:

Have students choose one angle and investigate the material properties using different Slinkies (plastic versus metal; junior versus regular) and compare the results obtained.

Slinky Sound

Sound travels as a compression wave through air. Coil springs are an excellent tool for studying compression waves. Let your students use a Slinky to explore how sound is able to travel a long distance while the surrounding air molecules only travel a short distance.

You will need:

+ Slinky
+ Some tape

What to do:

1. Have two students each hold one end of the Slinky and stretch it to almost its full length.
2. Have one student hold their end of the Slinky in the palm of their hand and give a rapid push on the Slinky, immediately followed by a rapid pull. This will produce a compression pulse similar to how sound travels. Students can observe the behavior of the compression wave as it travels the length of the Slinky.

Extension:

Once students are comfortable with this technique, it can be used to study the reflection of sound waves. Have students tape one end of the Slinky to a wall. They can then send a compression pulse down the Slinky and observe what happens.