ScienceCube

Measuring Force Using a Spring

---

1. **Measure the magnitude of force using a spring.**
2. **Measure the length of the spring according to the magnitude of the force and explain the relationship.**

Fundamental Concept

1. Magnitude of Force

The force required to stretch a spring slightly is different from the force required to stretch it a lot. Also, holding several books requires more force than holding just one book. The degree to which it is harder or easier to pull the spring, or the feeling of heaviness or lightness when lifting objects, is referred to as the magnitude of force..

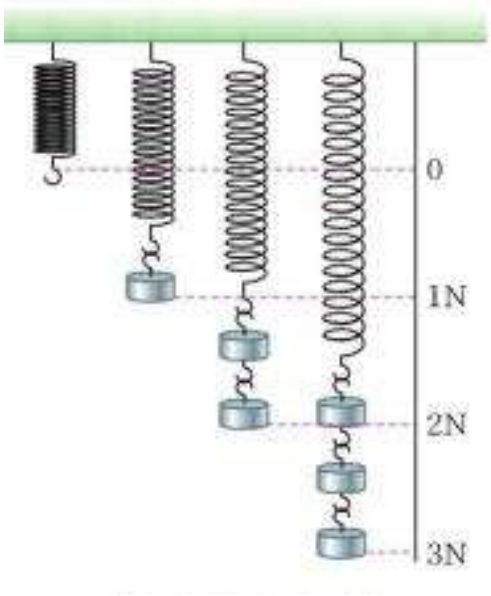
(a) (b)

When the magnitudes of the forces are different

2. Measuring the Magnitude of Force

The magnitude of force can be measured by the degree of change in shape or motion of an object..

- Measuring force using a spring scale: The magnitude of the force acting on the spring is proportional to the length it stretches, which is used to measure the force.
- Measuring force using a spring: The length the spring stretches is proportional to the applied force. Therefore, by measuring the length the spring stretches, the magnitude of the force can be determined.



Deformation of the spring

Experiment

Materials Needed

Interface, Science# program, Force sensor, Two springs, Stand, Two clamp stands, Ruler, Pieces of paper (2cm x 1cm), Several weights (50g x 3), Cellophane tape

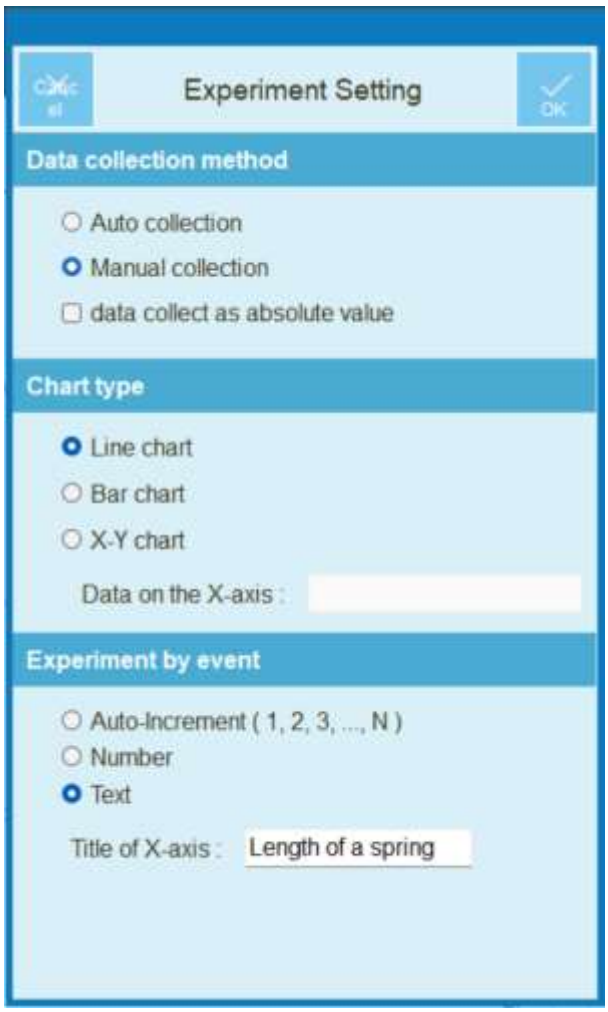
Preparing the Experimental Setup

1. Attach the ruler securely to the stand using a clamp stand so that the 0 mark is at the top.
2. Pull and release the spring 2-3 times with your hand. (For new springs, pull strongly a couple of times to ensure they are not overcompressed.)
   ※ Before the experiment, identify and set aside suitable springs that do not exceed the ruler's scale range when weights are added or when pulled by the force sensor.
3. Secure pieces of paper to the ends of both springs using cellophane tape..

4. Attach another clamp stand to the stand and secure the springs so that they are in front of the ruler's scale. Adjust the height so that the paper pieces attached to the springs align precisely with the ruler's scale.
5. Note the initial scale reading of the paper piece when no weight is attached to the spring.
6. Add 50g weights to the spring one by one, measure the stretched length of the spring each time, and record the measurements in a table..

Interface Setup

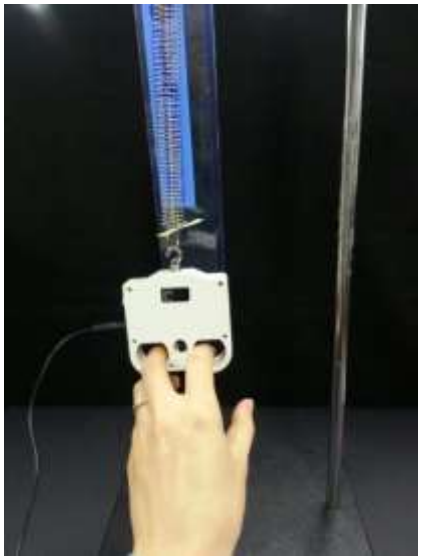
1. Run Science#.
2. Connect the force sensor to the interface.
3. Press the button to set up the experimental environment as shown below or press the button for automatic setup.



4. Switch the spring and attach the force sensor to the spring hook, then press the button to set the zero point..

Data Collection

1. Press the button - press the button to record the length of the spring as 0cm on the x-axis when no force is applied.
2. Measure the length of the spring at 0.5N force intervals while pulling with the force sensor, and record each measurement on the x-axis.



3. Press the button to end the experiment..

Data Analysis

Recording Data

1. Describe the changes observed in the spring when weights are added.

2. Record the length of the spring according to the weight of the weights in the table below.

Weight of	50	100	150

Weights (g)			
Stretched Length of Spring (cm)			

3. Show the changes in the length of the spring according to the magnitude of the force in a graph and table..

Applied Force (N)	0.5	1	1.5
Stretched Length of Spring (cm)			

Data Application

1. Explain the relationship between the force (weight) applied to the spring and the stretched length.

2. Explain the property of the spring that is used for measuring the force..

Extended Activity

1. Predict the length the spring will stretch if the force increases to 50N.. .


Report
(For Teachers)
Report
(For Students)