ScienceCube

Hooke's Law

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1. **Explain Hooke's Law and elastic force.**
2. **Calculate the extension of a spring according to the number of weights and explain the relationship.**

Fundamental Concept

1. Elasticity and Elastic Force

(1) Elasticity: The property of an object that allows it to return to its original shape after being deformed by an external force.

(2) Elastic Object: An object that has elasticity

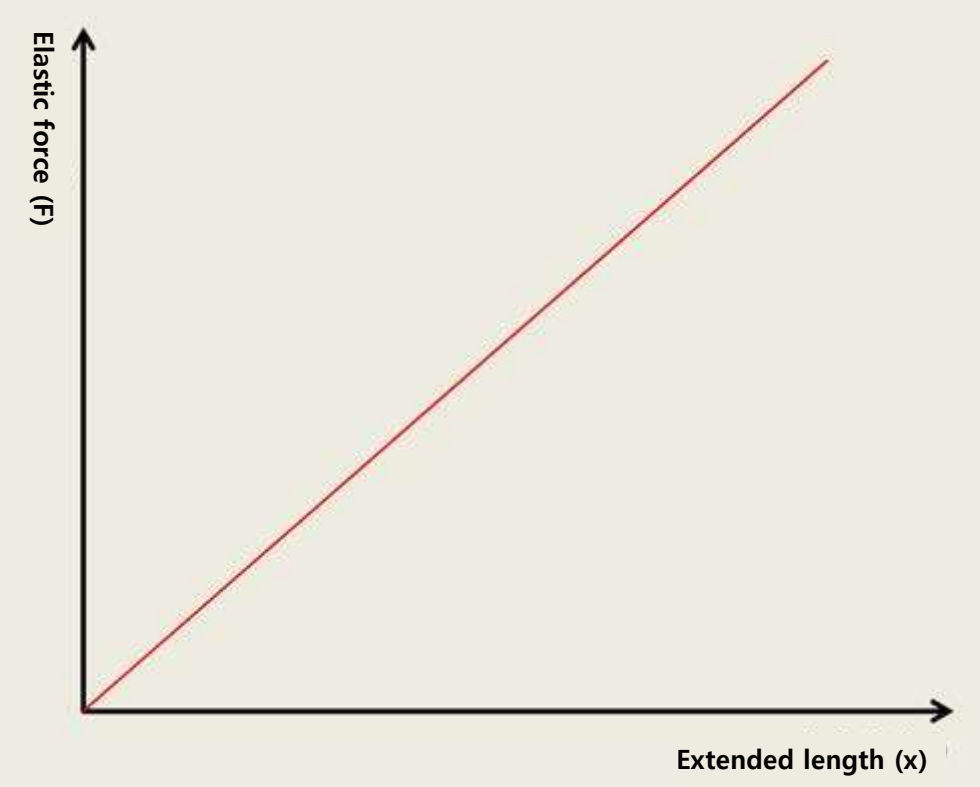
ex) rubber bands, springs, tires.

(3) Elastic Force: The force that tries to return an object to its original shape, proportional to the deformation length (x).

2. Hooke's Law

The elastic force (F) acting on an object like a spring is proportional to the length (x) the spring is stretched or compressed..

$F=-kx$ (where k is the spring constant or elastic coefficient.)



<Elastic Force according to Spring Extension>

Experiment

Materials Needed

Science# program, Force sensor, Spring, Toothpick, Glue gun, Red pen, Cellophane tape, 100g weights (3), 30cm ruler

Preparation of the Apparatus

1. Connect the force sensor to the stand.
2. Color one end of the toothpick with the red pen as shown in the picture below.

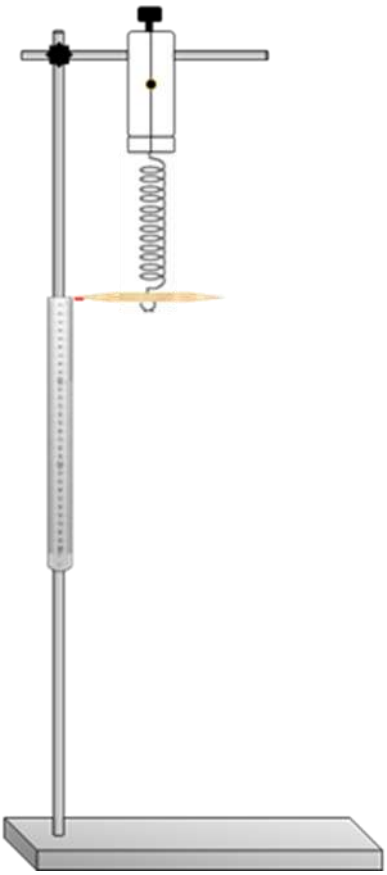
3. Attach the toothpick to the end of the spring using the glue gun.

4. Connect the spring with the attached toothpick to the force sensor.

   Tip) Pre-stretch the spring several times to ensure it stretches easily according to the weight of the weights..

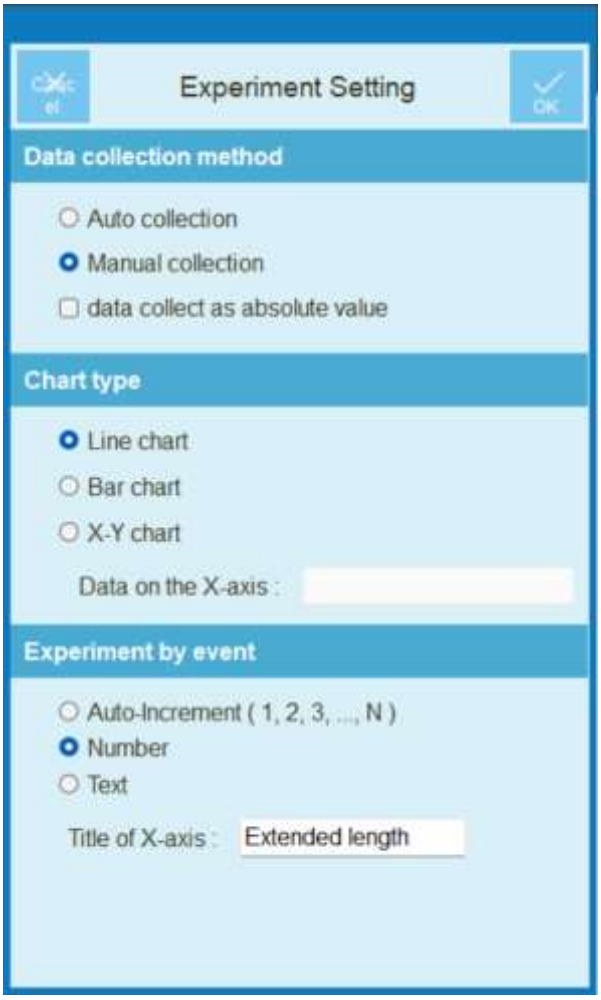
5. Set up the ruler on the stand with the red end of the toothpick at the 0cm mark, and fix it with tape.

   Tip) Copy the ruler, cut out the copy, and attach it to the stand for easier setup.



Interface Setting

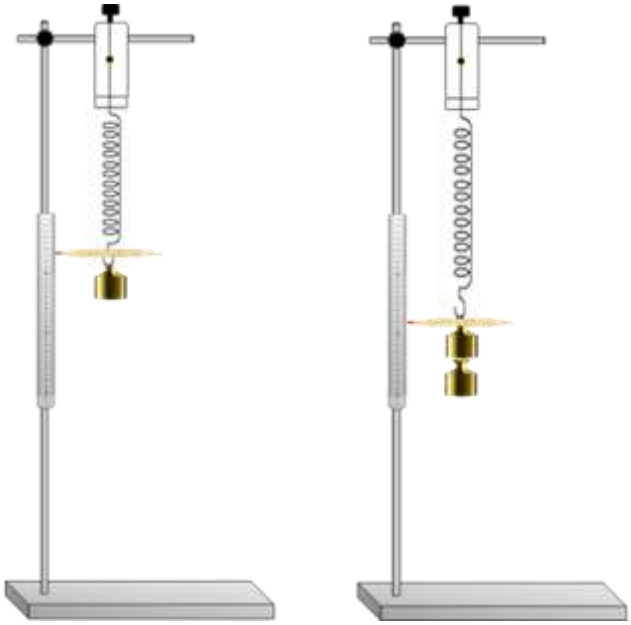
1.  Run Science#.
2. Connect the force sensor.
3.  Click the button to zero the force at 0N. This should be done with only the spring and toothpick attached.
4.  Click the button to set up the experiment environment as shown below, or click the button for auto setup. 



[Automatic Setup]

Data Collection

1. Click the button to start collecting data.
2. Hang one weight on the spring and click the button.
3. Measure the extension of the spring by reading the mark on the ruler pointed to by the red end of the toothpick.
4. Enter the extension length of the spring (in cm) in the input field.
5. Repeat the above process by increasing the number of weights to 2 and 3.



Data Analysis

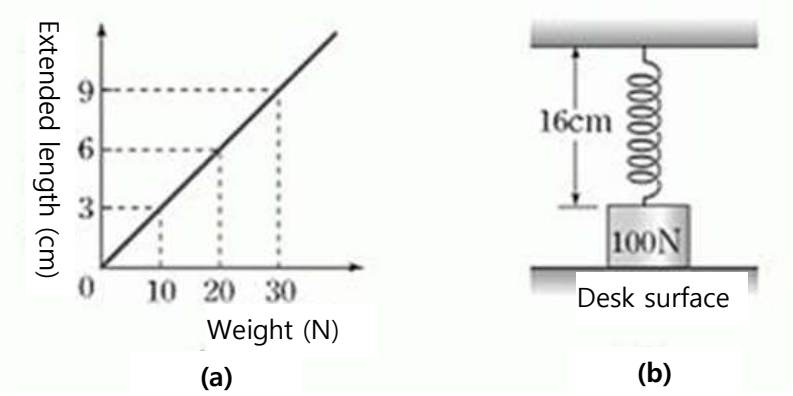
Recording Data

1. Draw a graph showing the relationship between the force magnitude and the extension length of the spring.

2. Record the force magnitude and extension length according to the number of weights in the table below.

Application of Data and Extension Activities

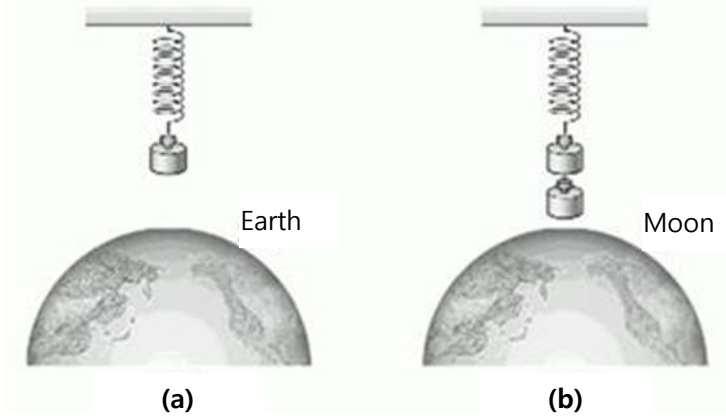
1. In the diagram (a), a graph is drawn by measuring the extension length of a spring with a length of 10cm by varying the weight. When a 100N object is hung on this spring as shown in diagram (b), the spring's length becomes 16cm and touches the desk surface. Write down the force exerted on the desk surface.



2. When a weight of 5N is hung on a spring with a length of 30cm, the spring extends to 40cm. Using the following formula, write down the spring constant (k) of this spring.

$$F = -kx$$

3. On Earth, when a weight is hung on a spring, the spring extends by 12cm. If this spring is taken to the moon and the same type of weight is hung on it as shown in diagram (b), how much would the spring extend? Write it down.


Earth
Moon
(a)
(b)


Report
(For Teachers)
Report
(For Students)