

## Title: Investigating force and extension with a spring.

### *Investigate the relationship between force and extension for a spring*

There are different ways to investigate the relationship between force and extension for a spring. In this required practical activity, it is important to:

- make and record length accurately
- measure and observe the effect of force on the extension of springs
- collect the data required to plot a force-extension graph

**OBJECTIVE:** To investigate Hooke's Law (The relation between force and stretch for a spring).

### **Aim of the experiment:**

**Hooke's law** states that the extension of a spring is directly proportional to the force applied, provided that the elastic limit is not exceeded.

**The aim** of the experiment is to investigate the relationship between a force and the extension of a spring, and see if the spring obeys **Hooke's law**.

For the online investigation use the link

[https://phet.colorado.edu/sims/html/hookes-law/latest/hookes-law\\_en.html](https://phet.colorado.edu/sims/html/hookes-law/latest/hookes-law_en.html)

### **Focus Questions**

1. When you attach a weight to a spring, what happens? Which force is responsible for this?
2. Is the extension produced related to the force? How?
3. If load on a spring is doubled will the extension double as well?
4. If we stretch a spring beyond its elastic limit, then remove the force, will the spring go back to its original length?
5. What happened when two springs are joined in series and parallel arrangements.
6. Think about applications of springs, in systems from door catches to vehicle suspensions.

## Hooke's Law Investigation

### Method

1. Put all the ticks in the right tab (applied force, spring force, displacement, equilibrium position, values). Keep the spring constant 200 N/m
2. Set the applied force on 20 N, take the readings of displacement.
3. Set applied force on 40 N, take the readings of displacement.
4. Take all the readings up to 100 N
5. Fill the table below.

### Results

Force (N)	Displacement (m)
0 (unloaded)	
20	
40	
60	
80	
100	

### Analysis

1. Plot a line graph with force on the vertical (y) axis, and extension on the horizontal (x) axis. Draw a suitable line or curve of best fit.
2. Calculate the gradient of the line. What this line is representing?
3. Did you get a straight line when you plotted the graph? If you do, what relationship is there between force and extension? Is Hooke's Law for the spring obeyed?
4. What happens if too large a load is attached? Does a spring always 'spring' back to its original shape? What do we call the point beyond which the spring is deformed?
5. What happened when two springs are joined in series and parallel arrangements. Is the extension produced greater or less when two springs are used? Why? Is there a difference between joining springs horizontally and vertically?

## Hooke's Law Investigation

### Conclusion/ Evaluation

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