Force and extension

Investigate the relationship between force and extension of a spring.

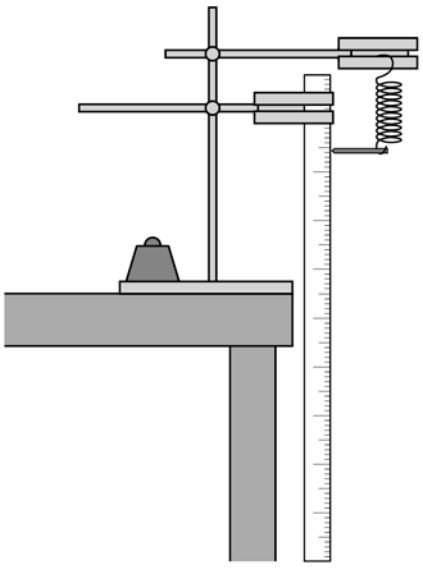
In this practical you will:

- hang different masses from a spring and measure the extension of the spring for each mass used
- convert mass into weight
- use your results to plot a graph of extension against weight.

Apparatus

- a spring
- a metre ruler
- a splint and tape to act as a pointer
- a 10 N weight stack
- a clamp stand
- two clamps and bosses
- a heavy weight or G-clamp to prevent the apparatus tipping over
- safety goggles.

Method



1. Set up your apparatus as in the diagram making sure that:
    - the ruler is vertical. The zero on the scale needs to be at the same height as the top of the spring
    - the splint is **attached securely to the bottom of the spring**. Make sure that the splint is horizontal and that it rests against the scale of the ruler.

2. Take a reading on the ruler – this is the length of the unstretched spring. Record this reading in your results table.

Weight in N	Length of spring in cm	Extension of spring in cm
0.0 (No weight stack added)		0
1.0 (weight stack added)		
2.0		

3. Carefully hook the base of the weight stack onto the bottom of the spring. This weighs 1.0 newton (1.0 N). Don't forget that the mass added will have to be converted to newtons.
4. Take a reading on the ruler – this is the length of the spring when a force of 1.0 N is applied to it.
5. Add further weights. Measure and record the length of the spring each time.
6. Calculate the extension for each weight and record it on the table.

Analysis of results

Use your results to plot a graph with:

- 'extension of spring in cm' on the y-axis.
- 'weight in N' on the x-axis.

a) State the relationship between force and extension of a wire.
b) Calculate the spring constant (force = spring constant x extension).

A force that stretches or compresses a spring does work and elastic potential energy is stored in the spring. Providing that the spring is not inelastically deformed **the work done on the spring and the elastic potential energy stored are equal.**

c) Calculate the work done in stretching your spring using the equation:

Elastic potential energy = 0.5 x spring constant x (extension)^2

d) Hang an unknown object on the spring. Measure the extension and use your graph to determine the object's weight. Check it with a newton meter.