Forces and Elasticity
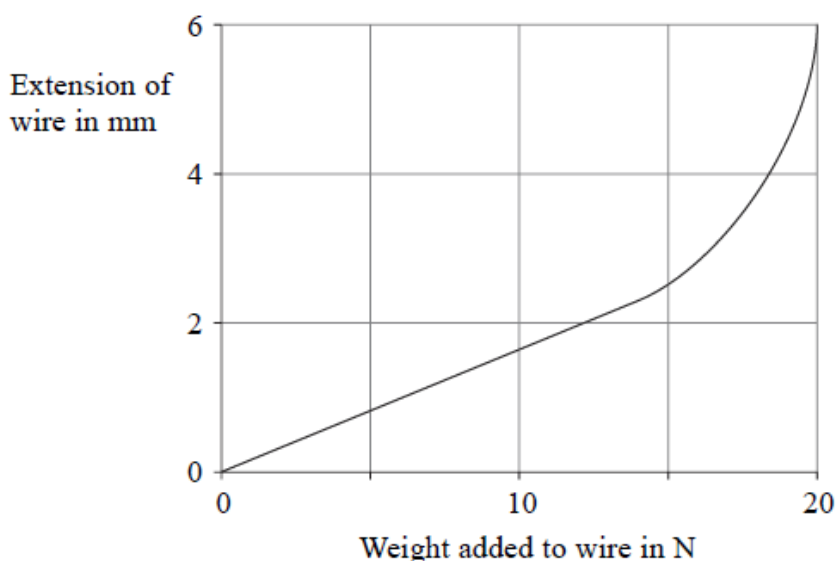

1.

(a) A student wants to use metal wire as part of a model bridge that she is building. To test if a wire is suitable she hangs a mass of 0.5 kg from it and measures its extension. Calculate the weight in newtons of the 0.5 kg mass.

....

....   Weight = ... N

(2)

(b) She continues to add masses to the end of the wire. The graph shows the results of her experiment.

(i) Indicate on the graph the region associated with Hooke's law.

(1)

(ii) Explain your answer.

....

....

(1)

(c) The student thinks the wire is too weak and decides to replace it with a thicker wire of the same material and length. She tests it in the same way as before by hanging masses from its end.
Show her possible results on the axes above.

(2)

2.

A teacher suspends an object from a clamp. She places a small screen in front of the object so that the students cannot see it. She then attaches a mass to the bottom of the object. The mass applies a force to the object and the object extends.

clamp

screen with object behind it
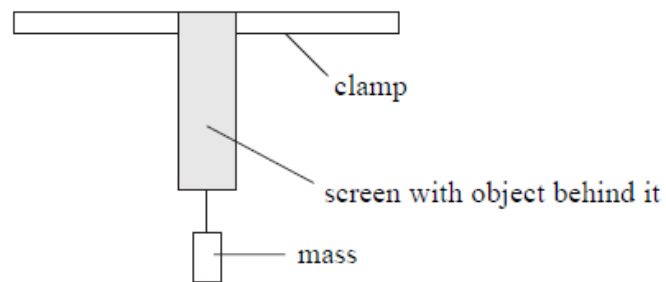
mass

(a) Different masses are attached to the bottom of the object.
The teacher measures the extension and the students calculate the value of the applied force.

The table shows the results.

Extension (cm)	0.0	1.1	1.8	2.5	3.5
Applied force (N)	0.0	3.0	5.0	7.0	9.5

Plot the points on the grid. Draw the best straight line through the plotted points.

Applied force in N
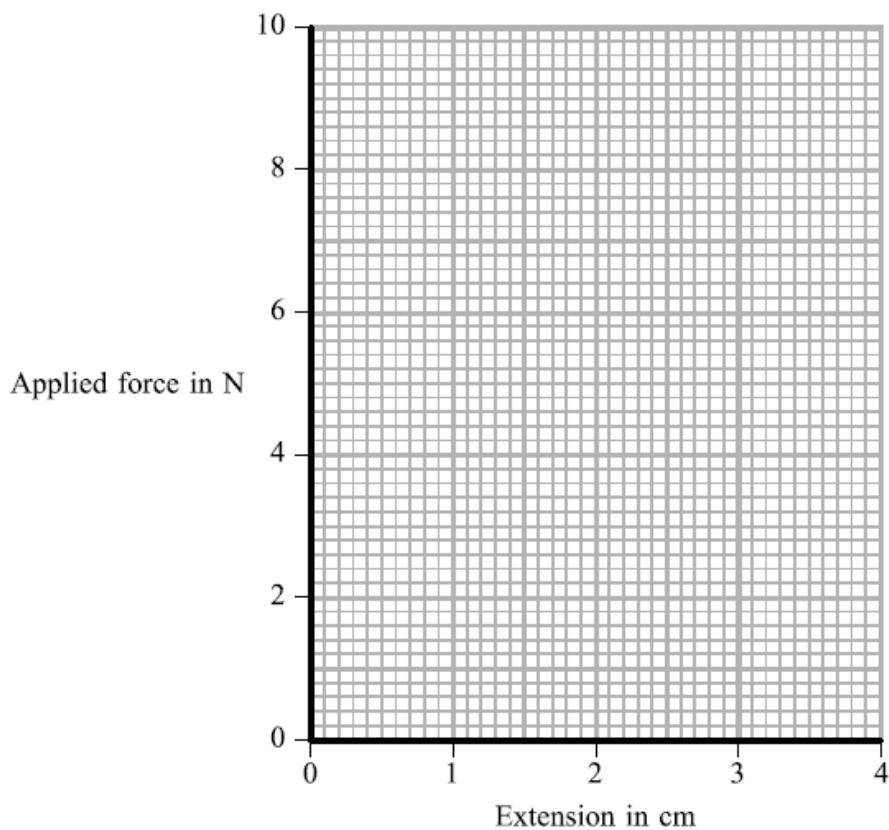
Extension in cm

(3)

(b) Use your graph to find the extension for a force of 8.0 N.

....

(1)

(c) Explain why the extension for a force of 800 N is unlikely to be one hundred times the value in (b).

....

....

(1)

(d) The teacher tells her pupils that the object is one of three things:

- a helical spring

- a metal wire

- an elastic band.

(i) Which one could it be?

....

(1)

(ii) Give two reasons for your choice.

1 ....

2 ....

(2)

(Question 3 is on the next page)

3.

Diagram 1 shows a spring with a large pin attached alongside a vertical rule. The rule is marked in cm.

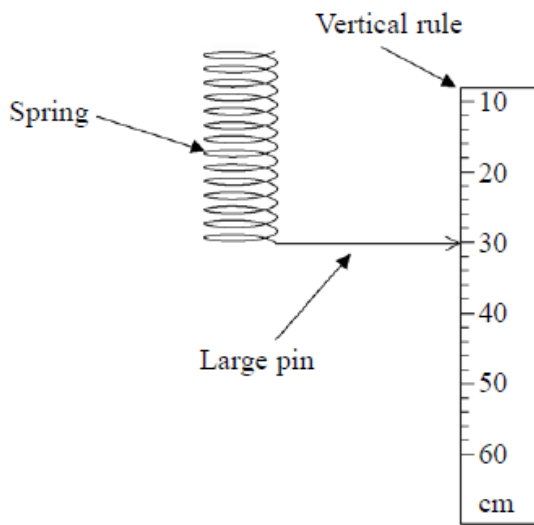Diagram 2 shows the spring with a large mass attached to it.
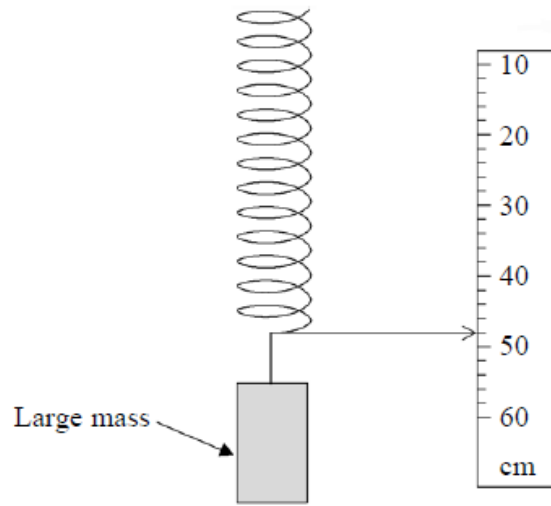

Diagram 1   Diagram 2

(i) What is the initial reading on the vertical rule (Diagram 1)?

....

(1)

(ii) What is the reading on the vertical rule when a large mass is attached to the spring (Diagram 2)?

....

(1)

(iii) What is the extension of the spring as a result of adding the large mass?

....

(1)

(iv) Describe **two** safety precautions that you would take in this experiment.

1 ....

....

2 ....

....

(2)

4.
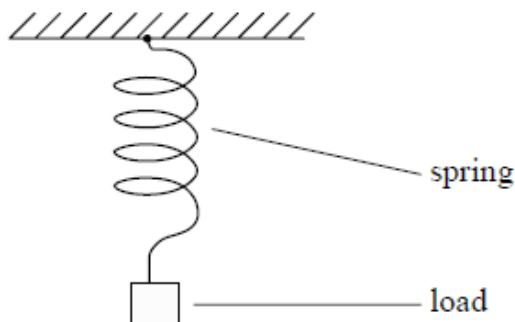
(a) Complete the sentence.

Hooke's law states that a force acting on a material produces an extension which is

.... to the force.

(1)

(b) A student attaches a load to the end of a spring.

(i) Name the type of force acting in the stretched spring.

....

(1)

(ii) The student measured the length of the spring for different loads.
The table shows her data.

Load (N)	0	1.0	2.0	3.0	4.0	5.0	6.0
Length of spring (mm)	30	70	110	150	190	250	320

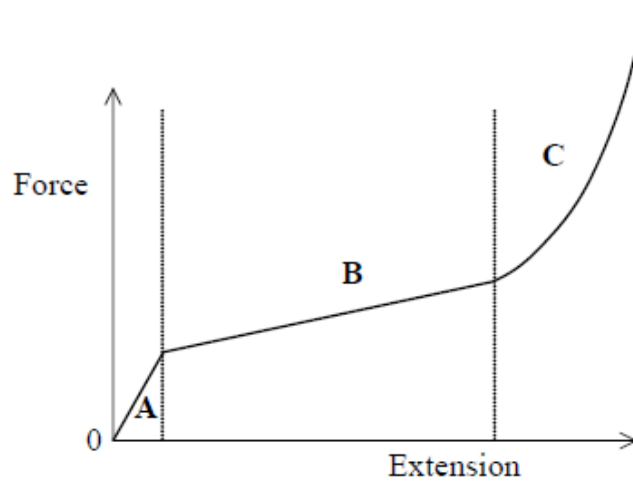1. Deduce the load in newtons that would produce a length of 130 mm.

Load = ... N

(1)

2. Estimate the maximum load in newtons at which the spring obeys Hooke's law.

Maximum load = ... N

(1)

(c) A force–extension graph for a material is shown. Three regions **A**, **B** and **C** are labelled.

(i) In which region is Hooke's law obeyed?

....
(1)

(ii) In which region is the material easiest to extend?

....
(1)

(iii) Explain your answer to (ii).

....

....

....
(1)