Springs

Name & Set

1 In an experiment to stretch a spring the following results were obtained

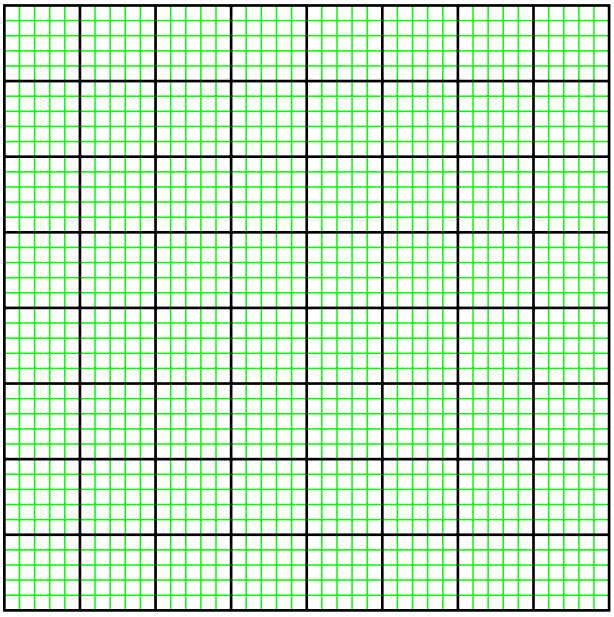
Load (N)	0	1	2	3	4	5	6	7
Length of spring (mm)	50	58	70	74	82	90	102	125
Extension (mm)								

(a) What is the length of the spring **before** it is stretched?

_____ [1]

(b) Complete the table. [2]

(c) Plot a graph of load (x-axis) against extension (y-axis) [4]



(d) One of the results is wrong. What should it be? _____ [1]

(e) Mark the point on the graph at which the spring reaches the *elastic limit*. [1]

(f) What load would give an extension of 30mm?_____ [1]

(g) What would the spring length for a load of 4.5 N? _____ [1]

2 (a) Some types of Newton balance contain a spring. Why is a spring good for measuring forces?

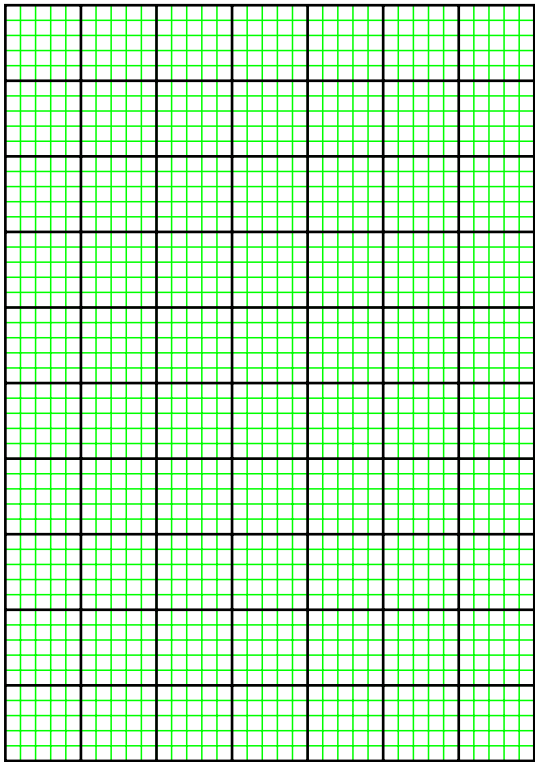
_____

_____ [2]

(b) John wanted to find out how much a spring would stretch when different masses were hung on it. His results are shown below.

mass/g	10	20	30	40	50	60	70
length of spring/cm	9	10	11	12	13	14	19

Plot a graph for these results on the grid below. [4]



(ii) What is the length the unstretched spring? _____ [1]

(c) If the spring is overloaded it will be over-stretched. Has the spring in John's experiment been over-stretched? Explain your answer.

_____

_____ [2]

(d) John examined two Newton balances. One was designed to measure up to 10 N and the other up to 50 N. Which one would contain the stiffer spring and why?

_____

_____

_____ [2]

3 In an experiment involving stretching a coiled spring a pupil makes a spring by winding a length of wire several times around a pencil. The pupil then hangs weights in stages from the spring. These stages, *A* to *F*, are shown in figure 1 below.

The ruler is ten centimetres long and weights are added to the spring in steps of 1 N. Take readings from the ruler to the *left* of each diagram of the spring.

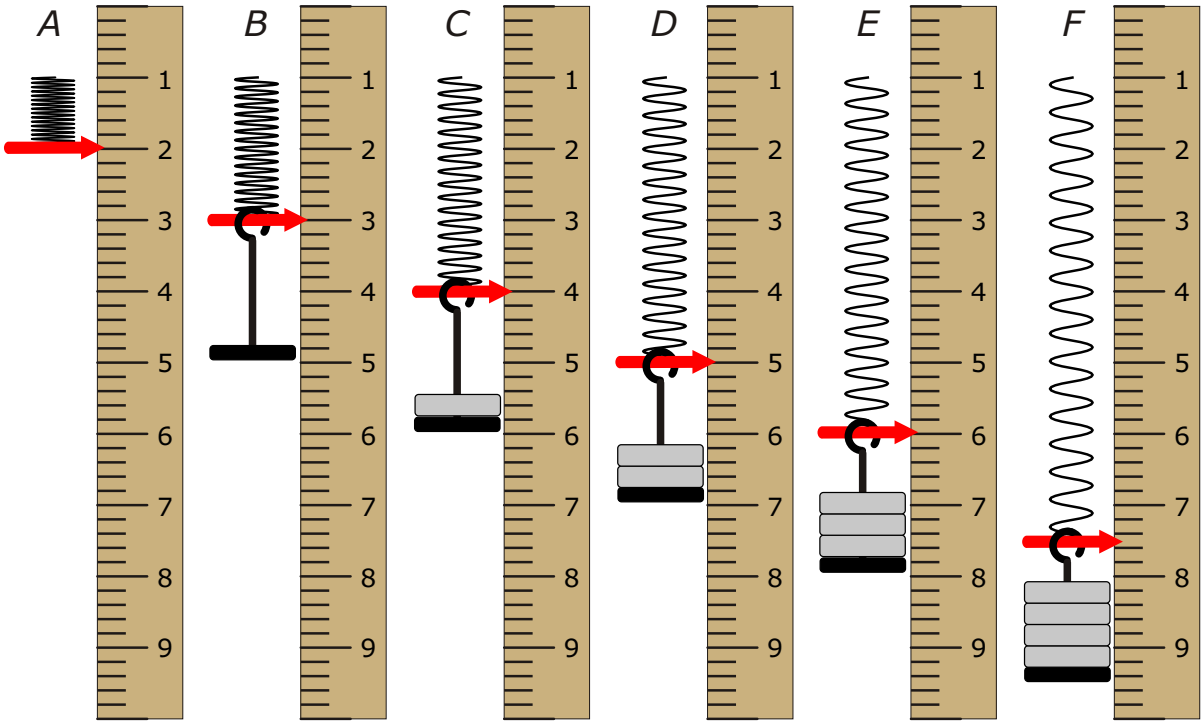


Fig 1

(a) Using the scale printed on the rulers take readings from these diagrams (to the nearest millimetre) and fill the table below. [7]

Quantity	Unit	Readings					
Weight of Load							
Length of spring							
Extension							

(b) Use the grid on the next page to plot a graph of load against extension of spring. [4]

Use the graph to answer the following questions:

(c) What does your graph show about the relationship between load and extension up to a load of 4 N?

_____

_____ [2]

(d) What is the name of this relationship? _____ [1]

(c) What is the extension of the spring when a load of 3.5 N is hung from it? _____ [1]

(e) What is the weight of an object that causes the spring to extend 3 cm? _____ [1]

(f) What happens to the spring when a weight of more than 4 N is hung from it?

_____

_____ [2]

(g) What would happen to the spring if you took the weights off after having added 3N?

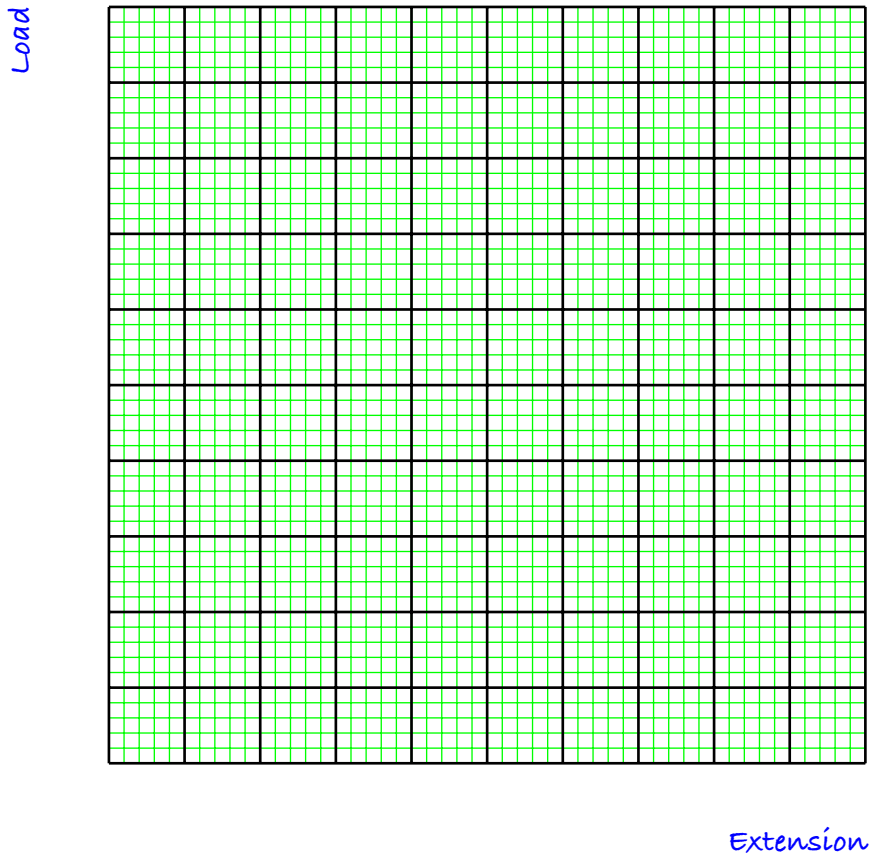
_____

_____ [2]

(h) What would happen to the spring if you took the weights off after having added 5N?

_____

_____ [2]



(i) The experiment is repeated using a spring made the same wire and having the same number of turns as the one above, but with a larger diameter. Draw a line on your graph to show the results you would expect it to give. Label this line clearly. [1]

(k) Draw and label clearly another line to show the graph you would expect to obtain if the experiment was carried out with a spring having the same diameter, but with twice as many coils. [2]

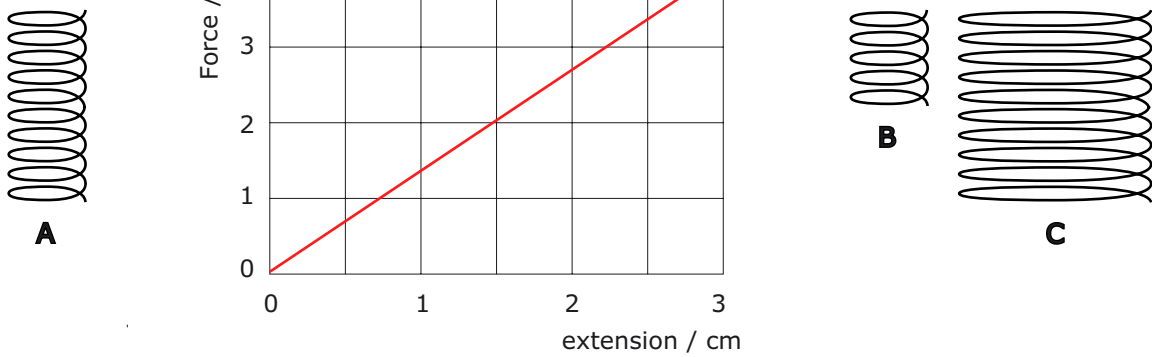
(l) How, if at all, would the results of this experiment on springs differ if you were to perform it on the Moon? Explain your answer.

_____

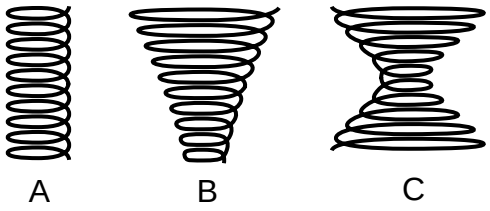
_____

_____ [3]

4 A force/extension graph for spring A is shown below. Make an enlarged copy of the graph in your book and on it plot the force-extension graph you would expect to get for spring B (same diameter, material and wire thickness as A, but half as long), and for spring C (same length, material and wire thickness as A, but twice the diameter). Label each graph with the letter of the spring.



3 Predict how each of these springs will change shape when each is squeezed in turn by the same force.



Spring A _____

_____

_____ [1]

Spring B _____

_____

_____ [1]

Spring C _____

_____

_____ [1]

4 Explain what is meant by the following words when applied to stretching or squashing objects.

Give an example in each case.

Elastic

_____

_____

_____

_____ [3]

Plastic

_____

_____

_____

_____ [3]

Elastic limit

_____

_____

_____

_____ [3]