Q1.

Figure 9 shows a spring standing on a table.

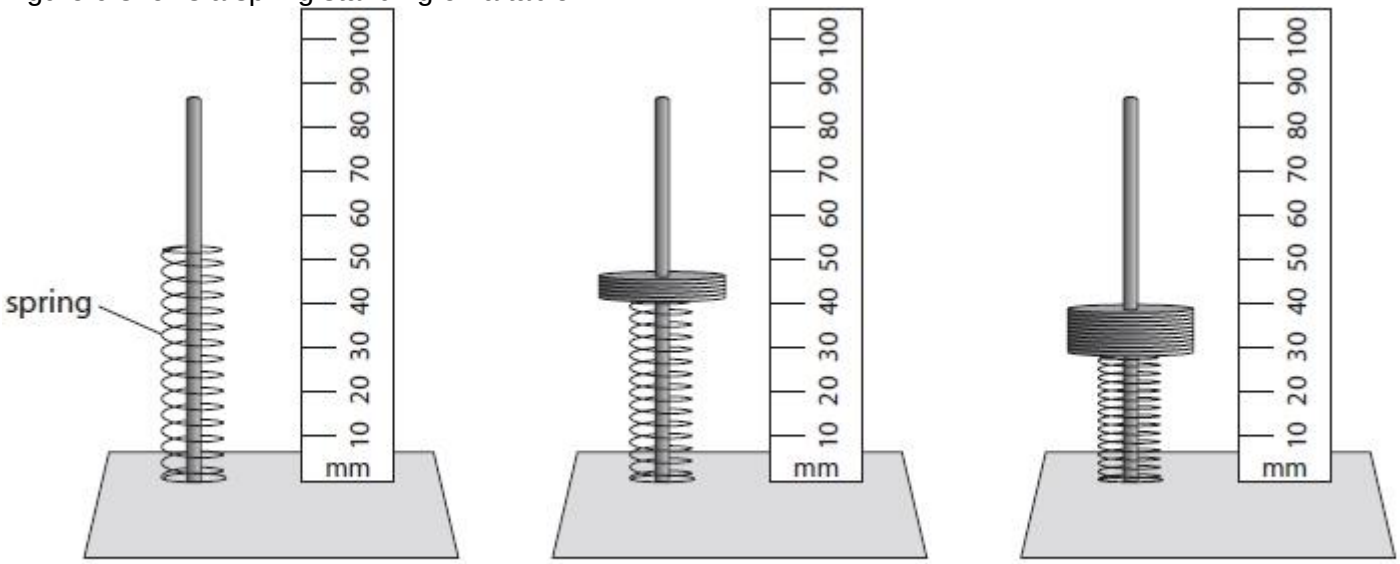


Figure 9a **Figure 9b** **Figure 9c**

Weights are added to the spring as shown in Figures 9b and 9c.

(i) Estimate the original length of the spring as shown in Figure 9a.

(1)

original length = ... mm

(ii) Describe how the reduction in the length of the spring when weights are added can be determined.

(2)

(iii) State **two** ways that the experimental procedure could be improved.

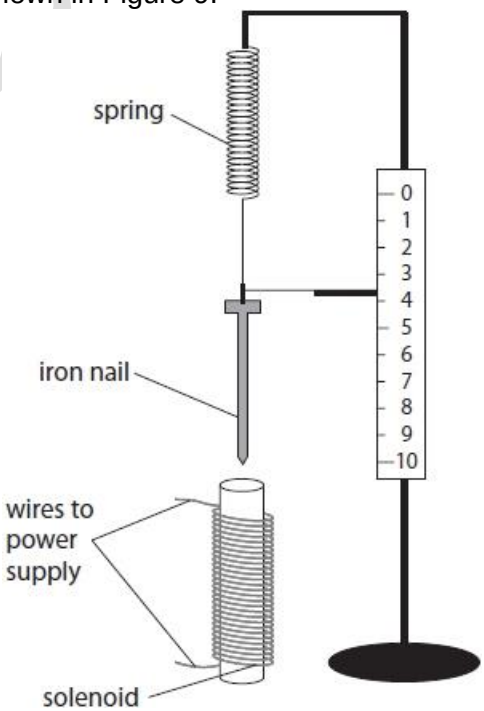
(2)

(iv) Give **one** reason why the reduction in length eventually reaches a limit as more weights are added.

(1)

Q2.

A student sets up the apparatus shown in Figure 9.



Forces & Matter

(i) When the current in the solenoid is switched on, the solenoid attracts the iron nail.
Describe how the student could use this apparatus to investigate how the size of the current in the solenoid affects the force of attraction between the solenoid and the iron nail.

(4)

(ii) The spring constant of a different spring is 24 N/m.
The spring is extended from its unstretched length by 12 cm.
Calculate the energy transferred in extending the spring by 12 cm.
Use an equation selected from the list of equations at the end of this paper.

(2)

Q3.

Another spring is extended.
The work done to extend the spring is 0.14 J.
The spring constant of the spring is 175 N/m.
Calculate the extension of the spring.
Use an equation selected from the list of equations at the end of this paper.

(3)

Q4.

A different spring is extended.
A force of 0.50 N gives an extension of 13 mm.
Calculate the spring constant *k* in N/m.

(3)

Q5.

Figure 7 shows an athlete using a fitness device.

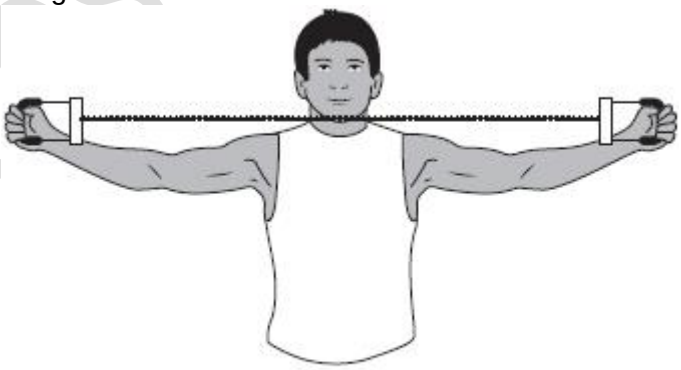


Figure 7

The athlete stretches the spring in the device by pulling the handles apart.
The spring constant of the spring is 140 N/m.
The athlete does 45 J of work to extend the spring.
The athlete takes 0.6 s to expand the spring.
(i) Calculate the useful power output of the athlete when stretching the spring.

(2)

Forces & Matter (H)

(ii) Calculate the extension of the spring.
Use an equation selected from the list of equations from the relevant equation sheet.

(3)

Q6.

A student investigates the stretching of a long piece of rubber.
Figure 8 shows the apparatus to be used.

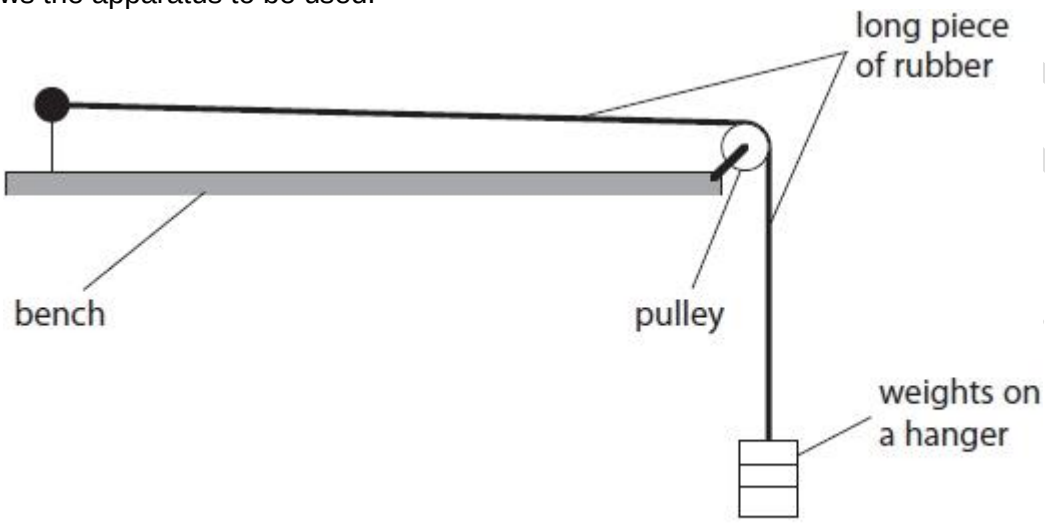


Figure 8

The student puts just enough weight on the weight hanger to make the piece of rubber just tight.
The student wants to plot a graph to show how the extension of the piece of rubber varies with the force used to stretch it.
The student adds a known weight to the weight hanger.
(i) Describe how the student could measure the extension of the rubber when he adds another weight to the weight hanger.

(2)

(ii) The student obtains a series of values of force and extension while loading the piece of rubber and then unloading it.
Figure 9 shows the graph of the student's values.

Forces & M

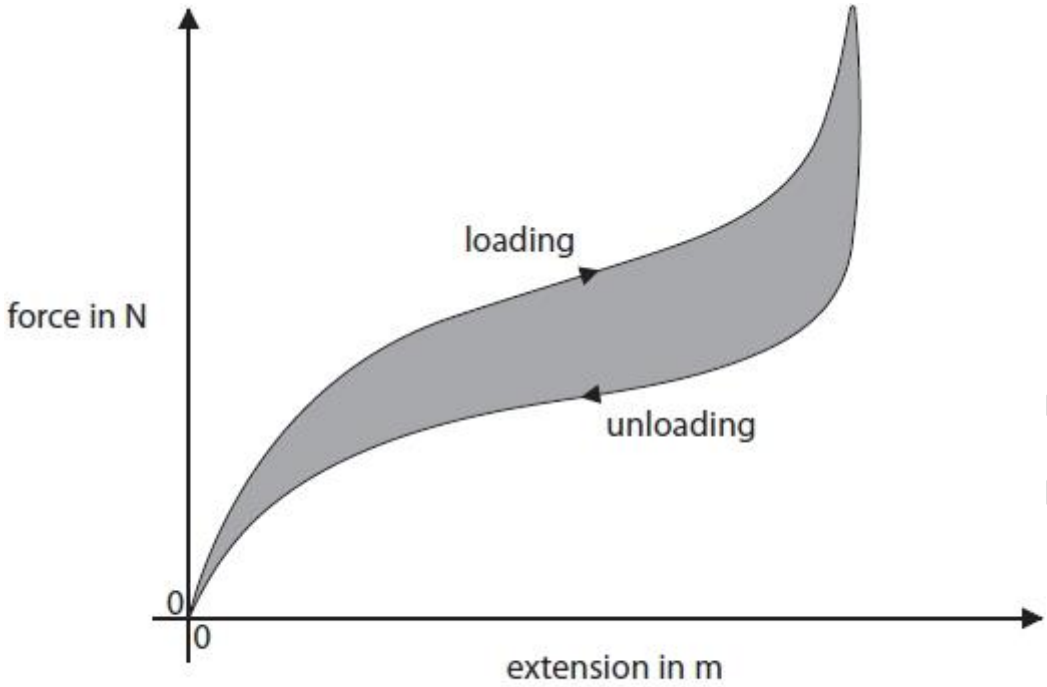


Figure 9

Explain how the shape of this graph shows that the distortion of the piece of rubber being stretched is different from the distortion of a spring being stretched.

(2)

Q7.

A student uses a digital calliper to measure the length of a spring, as shown in Figure 10.

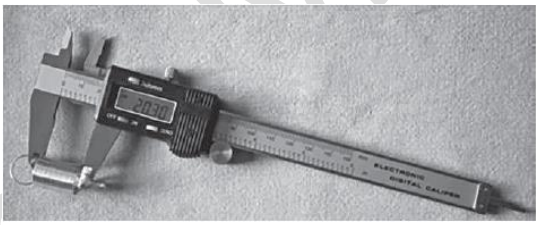


Figure 10

The spring is bendy and difficult to measure.
The student takes the six readings shown in Figure 11.

Figure 11

(a) Calculate the average length of the spring.

(2)

average length = ... mm

(b) The student investigates the stretching of a spring with the equipment shown in Figure 12.

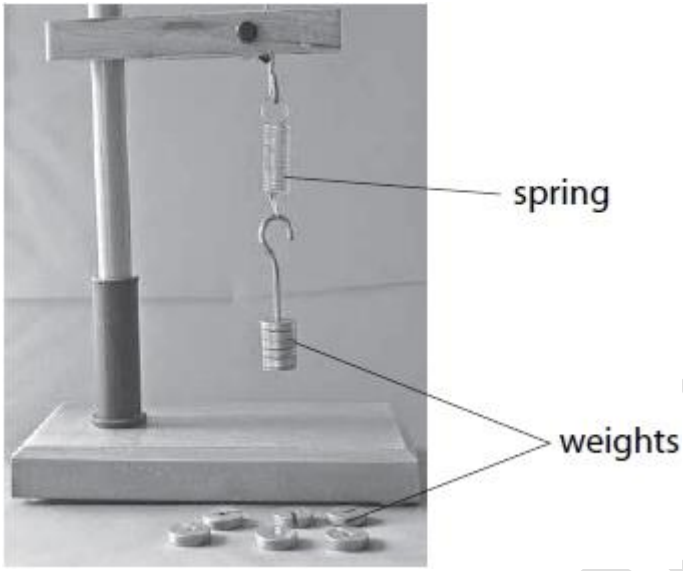


Figure 12

The student investigates the extension of the spring using six different weights.
The results are shown in Figure 13.

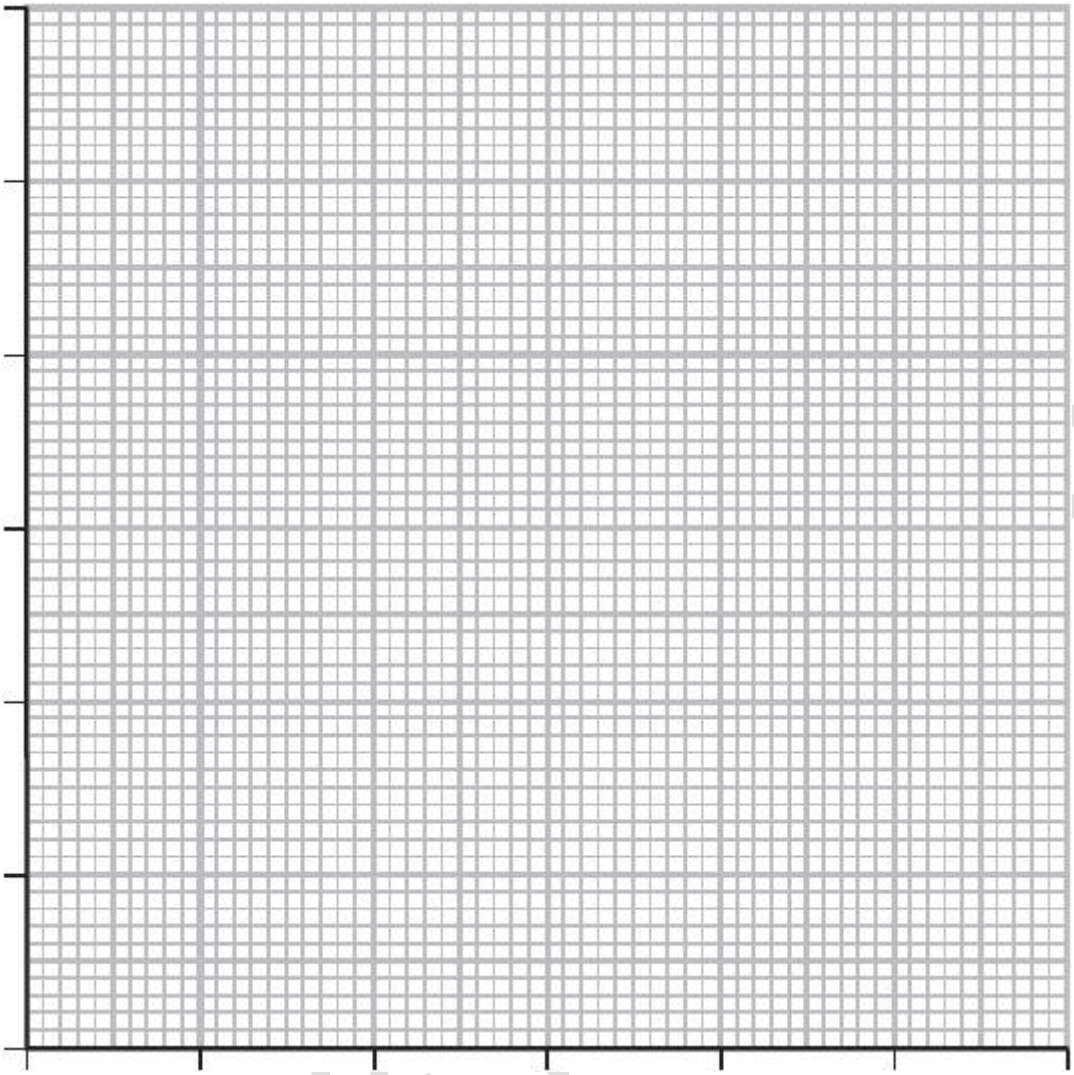
weight (N)	extension (mm)
0.20	4.0
0.40	8.0
0.60	12.0
0.80	16.0
1.00	20.0
1.20	24.0

Figure 13

(i) Draw a graph for the readings, using the grid shown.

(3)

Forces (H)



(ii) The student writes this conclusion:
'*The extension of the spring is directly proportional to the weight stretching the spring.*'
Comment on the student's conclusion.

(3)

(c) The student extends the investigation by finding information about the stretching of wires.
The student finds the graph shown in Figure 14 for the stretching of a wire.

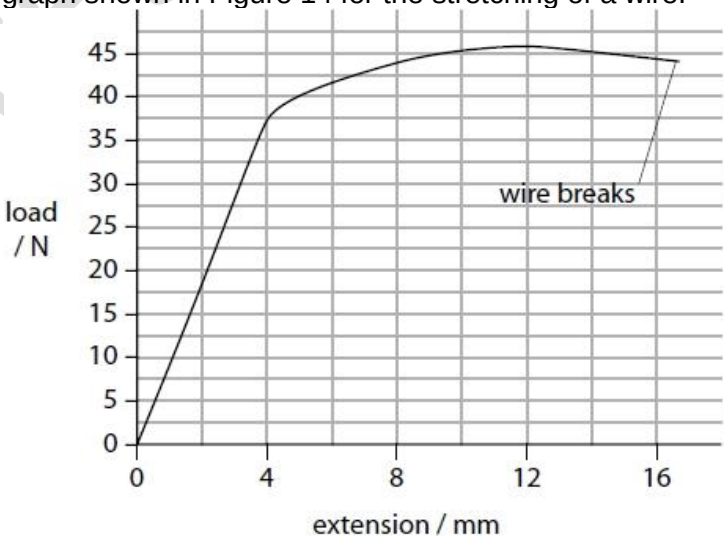


Figure 14

Describe the non-linear stretching of the wire shown in Figure 14.

(3)