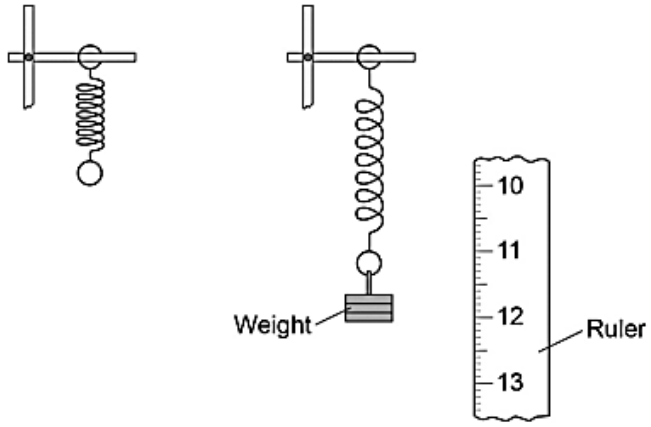
Materials GCSE AQA Higher Physics Past Papers Questions

01. A student suspended a spring from a laboratory stand and then hung a weight from the spring.

Figure 1 shows the spring before and after the weight is added.

Figure 1



1 Measure the extension of the spring shown in **Figure 1**.

[1 mark]

Extension = _____ mm

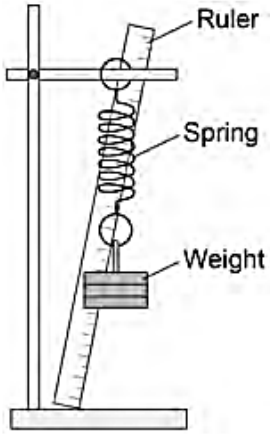
The student used the spring, a set of weights and a ruler to investigate how the extension of the spring depended on the weight hanging from the spring.

Before starting the investigation the student wrote the following prediction:

The extension of the spring will be directly proportional to the weight hanging from the spring.

Figure 2 shows how the student arranged the apparatus.

Figure 2



2 Before taking any measurements, the student adjusted the ruler to make it vertical.

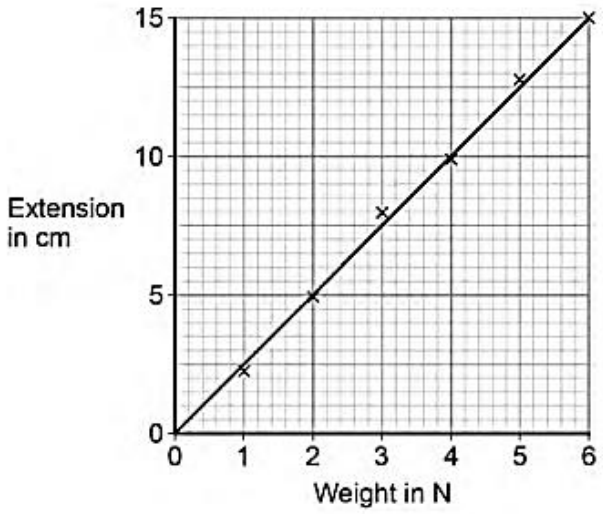
Explain why adjusting the ruler was important.

[2 marks]

The student measured the extension of the spring using a range of weights.

The student's data is shown plotted as a graph in **Figure 3**.

Figure 3



3 What range of weight did the student use?

[1 mark]

4 Why does the data plotted in **Figure 3** support the student's prediction?

[1 mark]

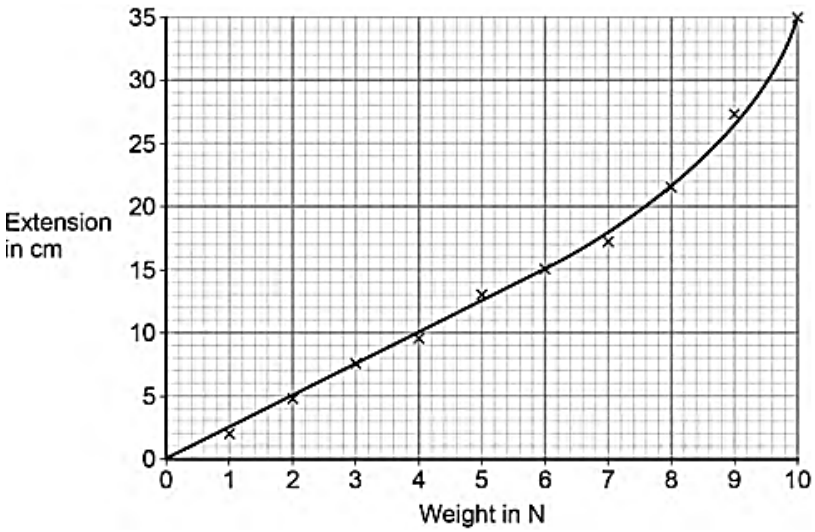
5 Describe **one** technique that you could have used to improve the accuracy of the measurements taken by the student.

[2 marks]

6 The student continued the investigation by increasing the range of weights added to the spring.

All of the data is shown plotted as a graph in **Figure 4**.

Figure 4



At the end of the investigation, all of the weights were removed from the spring.

What can you conclude from **Figure 4** about the deformation of the spring?

[2 marks]

Give the reason for your conclusion.

02.

A student carried out an investigation to determine the spring constant of a spring.

Table 1 gives the data obtained by the student.

Table 1

Force in N	Extension in cm
0	0.0
2	3.5
4	8.0
6	12.5
8	16.0
10	20.0

1 Describe a method the student could have used to obtain the data given in **Table 1**.

Your answer should include any cause of inaccuracy in the data.

Your answer may include a labelled diagram.

[6 marks]

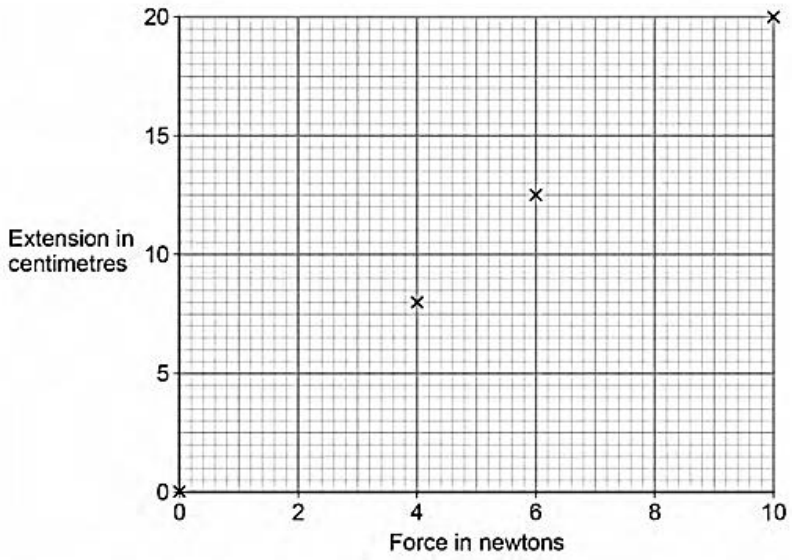
2 The student measured the extension for five different forces rather than just measuring the extension for one force.

Suggest why.

[1 mark]

Figure 2 shows some of the data obtained by the student.

Figure 2



3 Complete **Figure 2** by plotting the missing data from **Table 1.**

Draw the line of best fit.

Table 1 is repeated here to help you answer this question.

[2 marks]

Table 1

Force in N	Extension in cm
0	0.0
2	3.5
4	8.0
6	12.5
8	16.0
10	20.0

4 Write down the equation that links extension, force and spring constant.

[1 mark]

5 Calculate the spring constant of the spring that the student used.

Give your answer in newtons per metre.

[4 marks]

Spring constant = _____ N/m

6 Hooke's Law states that:
'The extension of an elastic object is directly proportional to the force applied, provided the limit of proportionality is not exceeded.'

The student concluded that over the range of force used, the spring obeyed Hooke's Law.

Explain how the data supports the student's conclusion.

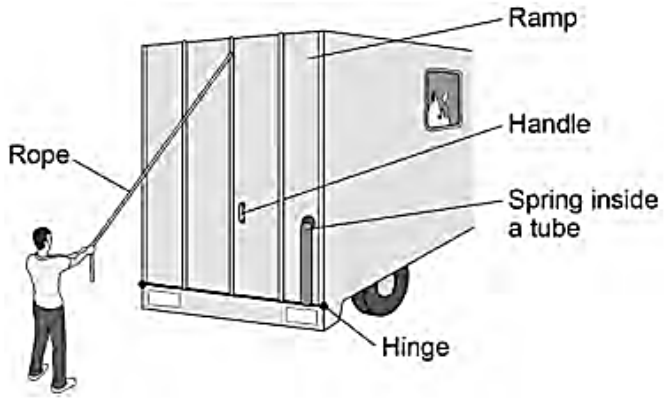
[2 marks]

16

03.

Figure 19 shows the back of a lorry. The lorry is used to carry horses.

Figure 19



The ramp is lowered by pulling on the rope or by pulling on the handle.

The hinge acts as a pivot.

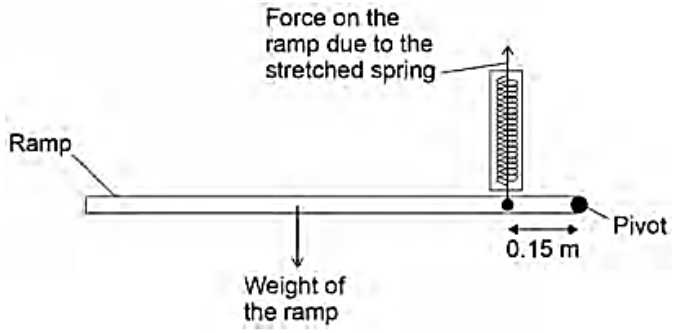
1 Explain why it is easier to lower the ramp by pulling on the rope rather than pulling on the handle.

[2 marks]

When the ramp is lowered, work is done to stretch a spring on the side of the ramp. Elastic potential energy is stored in the stretched spring.

Figure 20 shows the ramp part way down in a balanced horizontal position.

Figure 20



2 With the ramp horizontal:

the moment caused by the weight of the ramp = 924 Nm

the spring is stretched by 0.250 m

Calculate the elastic potential energy stored in the stretched spring.

Use data from **Figure 20**.

[6 marks]

Elastic potential energy = _____ J

8

04.

When the door unlocks, a force of 2.88 N is applied to the spring.

The spring extends by 1.50 cm.

Calculate the spring constant of the spring.

[4 marks]

Spring constant = _____ N/m

05. Give **two** ways the resultant force on the bolt could be increased.

[2 marks]

1 _____

_____

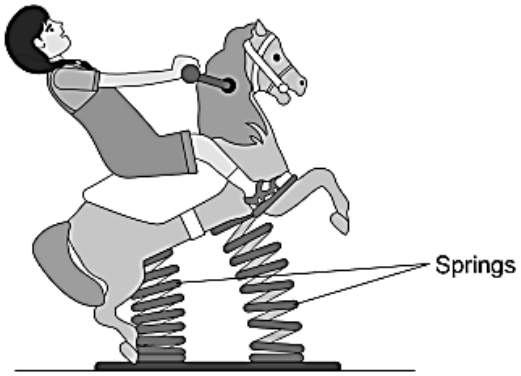
2 _____

_____

06.

Figure 3 shows a child on a playground toy.

Figure 3



1 The springs have been elastically deformed.

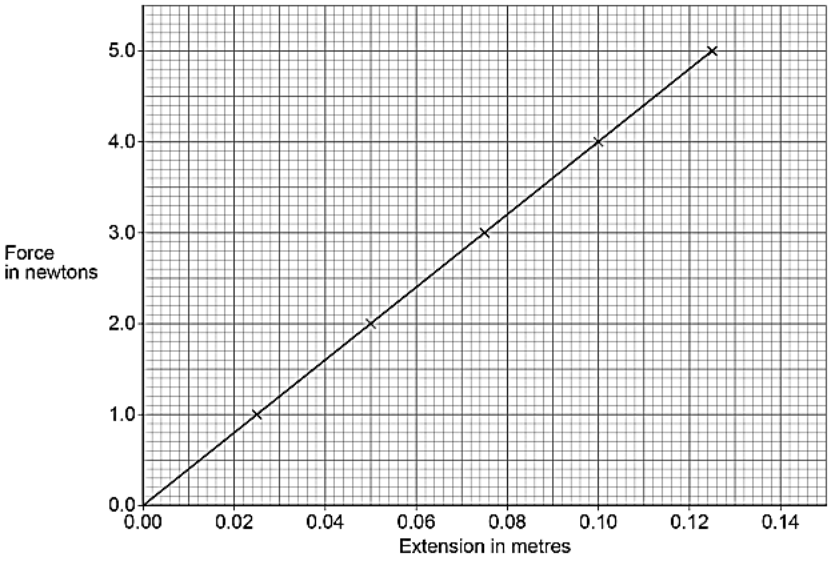
Explain what is meant by 'elastically deformed'.

[2 marks]

A student investigated the relationship between the force applied to a spring and the extension of the spring.

Figure 4 shows the results.

Figure 4



2 Describe a method the student could use to obtain the results given in **Figure 4**.

You should include a risk assessment for **one** hazard in the investigation.

Your answer may include a diagram.

[6 marks]

3 Which equation links extension (e), force (F) and spring constant (k).

[1 mark]

Tick (✓) **one** box.

force = spring constant × (extension)^2 ☐

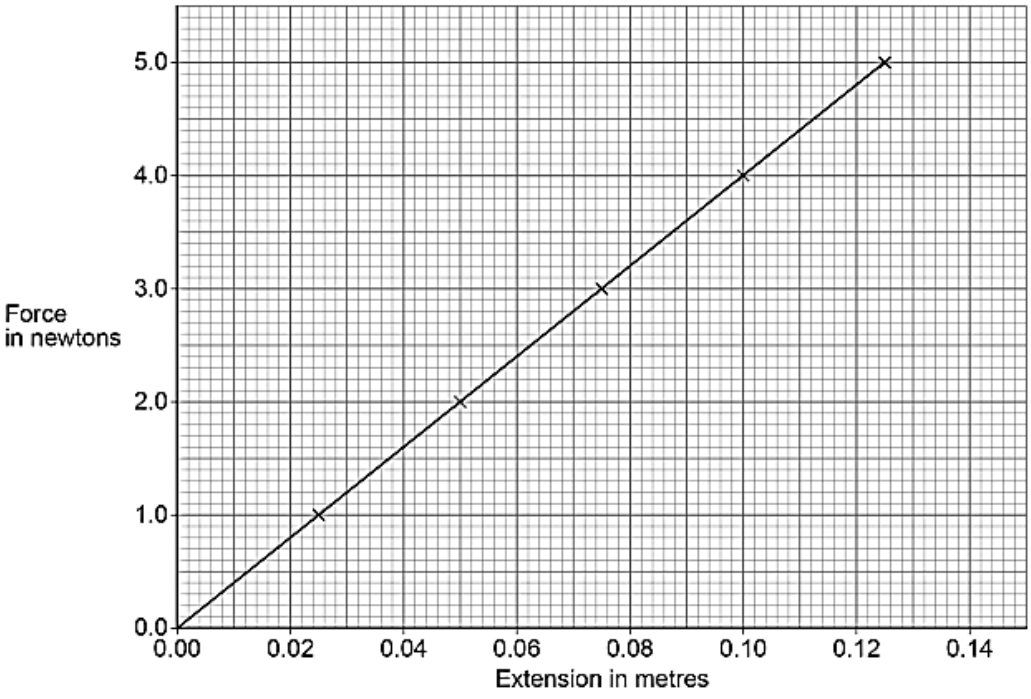
force = spring constant × extension ☐

force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

Figure 4 is repeated below.

Figure 4



4 Determine the spring constant of the spring.

Use **Figure 4**.

[3 marks]

Spring constant = _____ N/m

5 The student concluded:

'The extension of the spring is directly proportional to the force applied to the spring.'

Describe how **Figure 4** supports the student's conclusion.

[2 marks]

6 The student repeated the investigation using a different spring with a spring constant of 13 N/m.

Calculate the elastic potential energy of the spring when the extension of the spring was 20 cm.

Use the Physics Equations Sheet.

[3 marks]

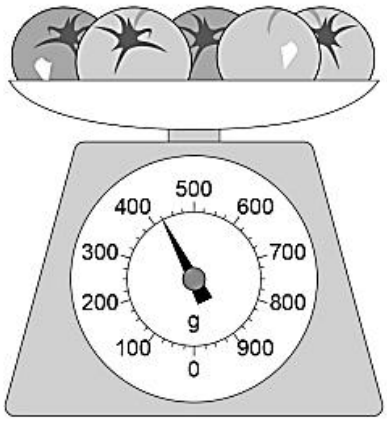
Elastic potential energy = _____ J

17

07.

Figure 9 shows a balance used to measure the mass of five tomatoes.

Figure 9



1 What is meant by 'centre of mass'?

[1 mark]

_____

_____

2 Calculate the mean weight of a tomato in **Figure 9**.

Use the Physics Equations Sheet.

gravitational field strength = 9.8 N/kg

[3 marks]

_____

_____

_____

_____

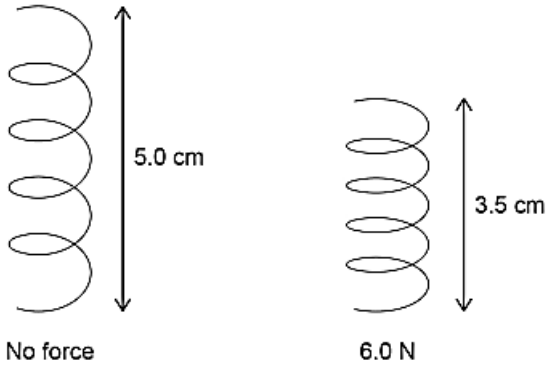
_____

Weight = _____ N

3 The balance in **Figure 9** contains a spring that compresses when the tomatoes are placed on the balance.

Figure 10 shows the spring with no force acting and with a 6.0 N force acting.

Figure 10



Determine the spring constant of the spring.

Use the Physics Equations Sheet.

[3 marks]

Spring constant = _____ N/m

4 Explain **one** property of the spring that makes it suitable for use in the balance.

[2 marks]

9