

Q1.(2018)

a)

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

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]

b)

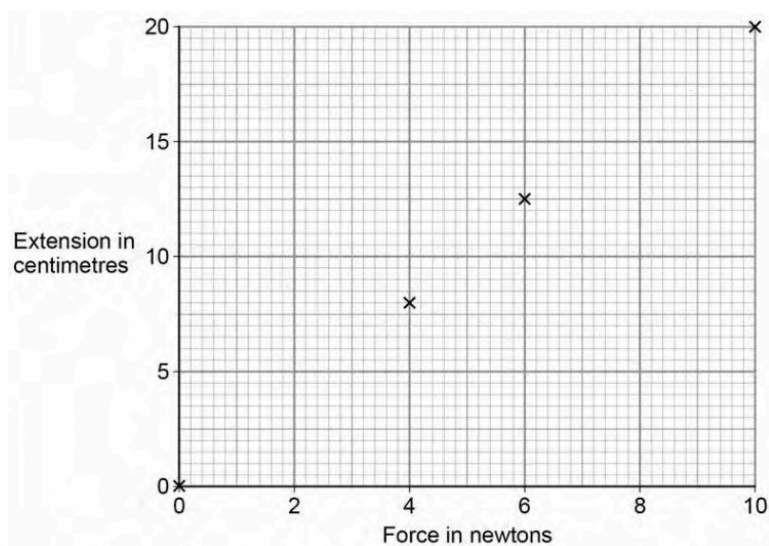
The student measured the extension for five different forces rather than just measuring the extension for one force.

Suggest why.

[1 mark]

c)

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

Figure 2

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

d)

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

[1 mark]

e)

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

Give your answer in newtons per metre.

[4 marks]

Spring constant = _____ N/m

f)

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]

Q2.(2019)

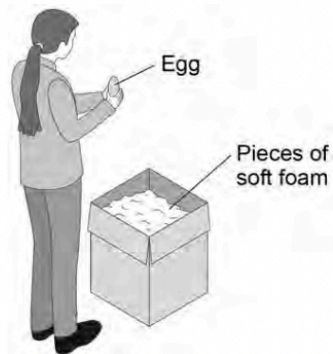
A teacher demonstrated the idea of a safety surface.

She dropped a raw egg into a box filled with pieces of soft foam.

The egg did not break.

Figure 10 shows the demonstration.

Figure 10



Explain why the egg is less likely to break when dropped onto soft foam rather than onto a concrete floor.

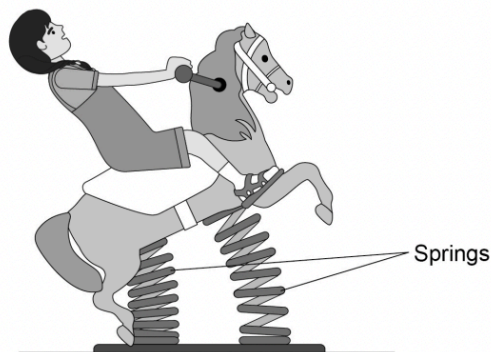
[3 marks]

Q3.(2021)

a)

Figure 3 shows a child on a playground toy.

Figure 3



The springs have been elastically deformed.

Explain what is meant by 'elastically deformed'.

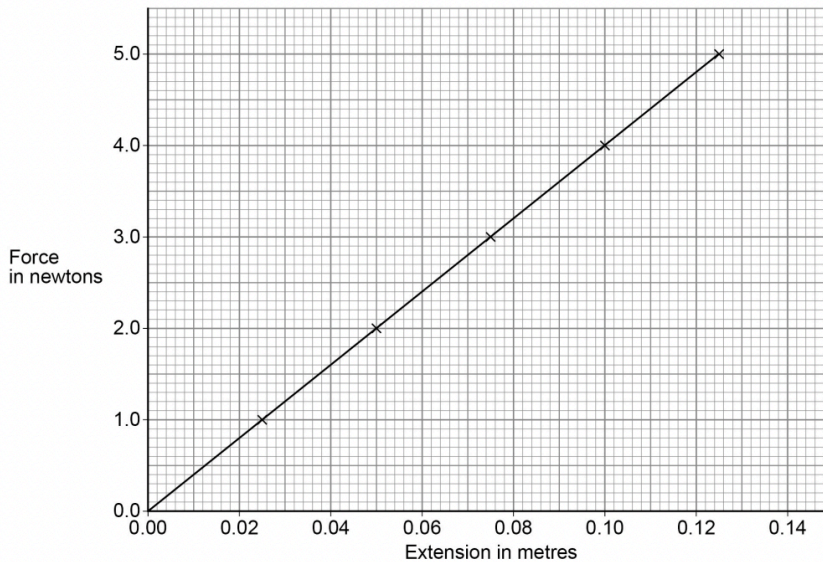
[2 marks]

b)

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



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]

c)

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

[1 mark]

Tick (✓) **one** box.

force = spring constant $\times$ (extension)²

☐

force = spring constant $\times$ extension

☐

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

☐

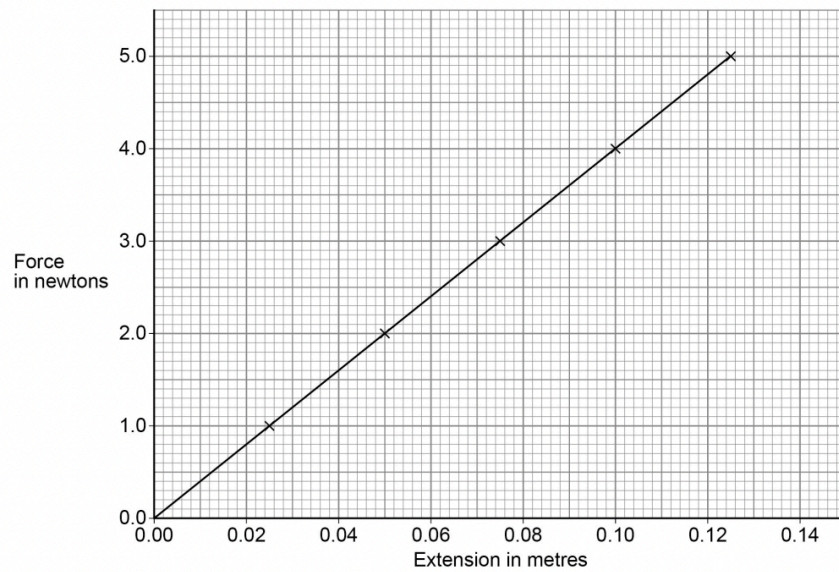
force = $\frac{\text{spring constant}}{\text{extension}}$

☐

d)

Figure 4 is repeated below.

Figure 4



Determine the spring constant of the spring.

Use Figure 4.

[3 marks]

Spring constant = _____ N/m

e)

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]

f)

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