

Q1. (2018)

0 5

Figure 6 shows a man using a resistance band when exercising.

The resistance band behaves elastically.

Figure 6



a)

0 5 . 1

What happens to the store of elastic potential energy of the resistance band when the band is stretched?

[1 mark]

b)

0 5 . 2

Explain what happens to the resistance band as it is released.

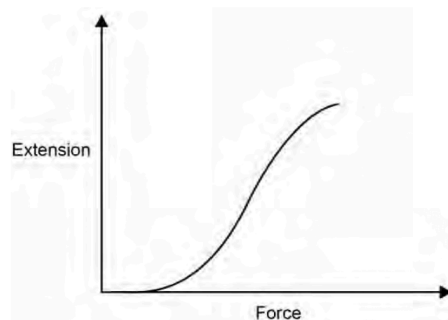
[2 marks]

c)

0 5 . 3

Figure 7 shows how the extension of the resistance band changes as the force applied changes.

Figure 7



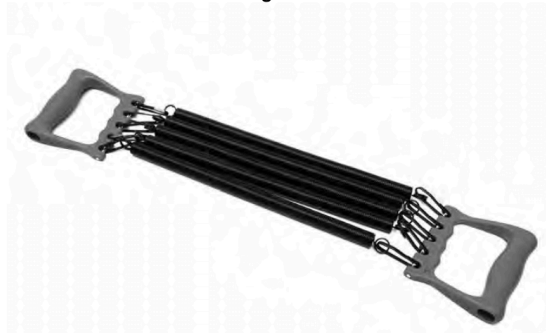
Describe the trend shown in the graph.

[2 marks]

Q2. (2018)

Figure 8 shows a chest expander.

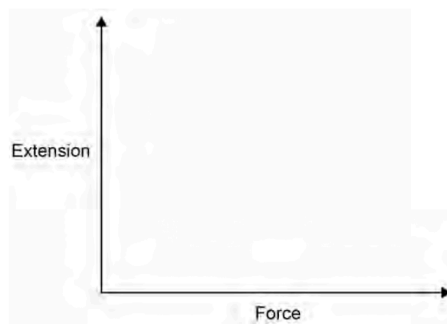
Figure 8



0 5 . 4 Sketch a graph on Figure 9 to show how the extension of a spring in the chest expander changes as the force applied changes.

[2 marks]

Figure 9



Q3. (2018)

When a force is applied to a spring, the spring extends by 7.5 cm

0 5 . 5 Write down the equation that links extension, force and spring constant.

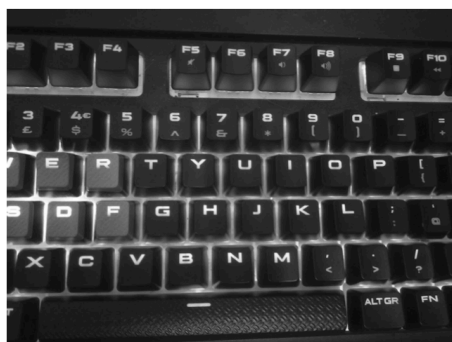
[1 mark]

Q4. (2020)

0 2 Figure 3 shows a computer keyboard.

There is a spring under each key.

Figure 3



a)

0 2 . 1 Why do the keys have springs under them?

[1 mark]

Tick (✓) **one** box.

Springs make the keys easier to press.

☐

Springs make the keys lighter.

☐

Springs push the keys back to their original position.

☐

b)

0 2 . 2 Why does every spring used in the keyboard have the same spring constant?

[1 mark]

Tick (✓) **one** box.

So that more than one key can be pressed at the same time.

☐

So that the same force is needed to press each key.

☐

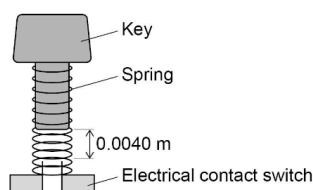
So that the springs are all the same length.

☐

c)

Figure 4 shows one of the keys and its spring.

Figure 4



0 2 . 3 What happens to the length of the spring when the key is pressed?

[1 mark]

d)

0 2 . 6 The spring in **Figure 4** has a spring constant of 200 N/m

Calculate the force on the spring when the key moves a distance of 0.0040 m

Use the equation:

$$\text{force} = \text{spring constant} \times \text{compression}$$

[2 marks]

e)

0 2 . 7 Suggest **two** ways the spring in the key in **Figure 4** could be changed so that the switch can be closed more quickly.

[2 marks]

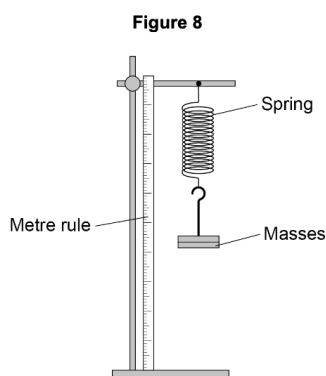
1 _____

2 _____

Q5. (2021)

0 6

Figure 8 shows a stretched spring.
The spring is elastically deformed.



a)

0 6 . 1

What is meant by 'elastically deformed'?

[1 mark]

Tick (✓) **one** box.

As the force on the spring increases the length of the spring increases.

☐

Only a very small force is needed to stretch the spring.

☐

The force on the spring causes it to change shape.

☐

The spring will return to its original length when the force is removed.

☐

b)

0 6 . 2

Describe a method to determine the extension of the spring.

[2 marks]

c)

0 6 . 3

The extension of the spring is 80 mm.

spring constant = 40 N/m

Calculate the elastic potential energy of the spring.

Use the Physics Equations Sheet.

[3 marks]

d)

0 6 . 4

Write down the equation which links extension (e), force (F) and spring constant (k).

[1 mark]

e)

0 6 . 5

A force of 300 N acts on a different spring.

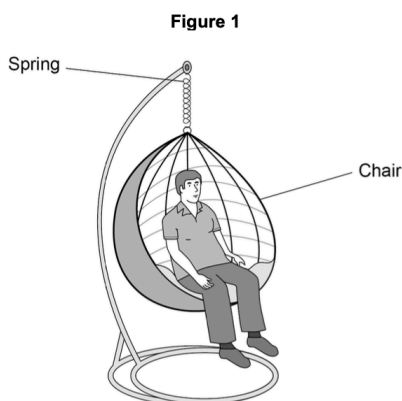
The force causes the spring to extend by 0.40 m.

Calculate the spring constant of the spring.

[3 marks]

0 1

Figure 1 shows a garden chair hanging from a spring.



The weight of the person causes the spring to extend.

a)

0 1 . 1

Why does the weight of the person cause the spring to extend?

[1 mark]

Tick (✓) **one** box.

Weight acts downwards

☐

Weight acts in all directions

☐

Weight acts upwards

☐

b)

The weight of the person causes an extension in the spring of 0.070 m.

The spring constant of the spring is 12 000 N/m.

0 1 . 3

Calculate the weight of the person.

Use the equation:

$$\text{weight} = \text{spring constant} \times \text{extension}$$

[2 marks]

c)

0 1 . 4

Calculate the elastic potential energy stored in the extended spring.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

[2 marks]

d)

0 1 . 5

If there is more than one person on the chair, the spring could become inelastically deformed.

What is meant by 'inelastically deformed'?

[1 mark]

Tick (✓) **one** box.

The spring extends more when two or more forces act on it.

☐

The spring will not go back to its original length when the force is removed.

☐

The spring extends so that it is twice as long as its original length.

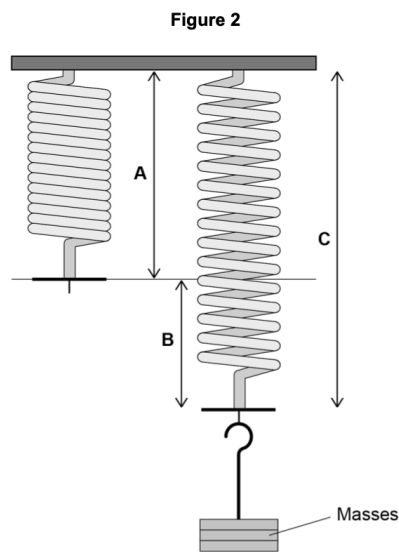
☐

e)

The manufacturer of the chair investigated the extension of a new spring.

0 1 . 6 **Figure 2** shows slotted masses hanging from the spring.

The weight of the masses extends the spring.



Which length in **Figure 2** represents the extension of the spring?

[1 mark]

Tick (✓) **one** box.

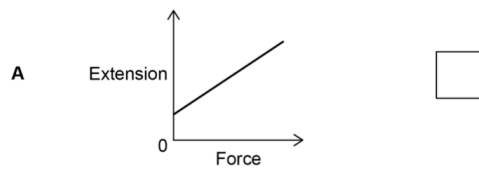
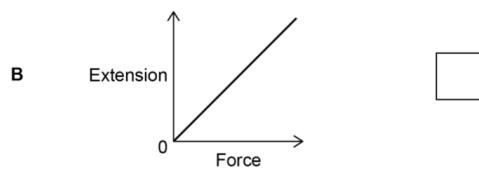
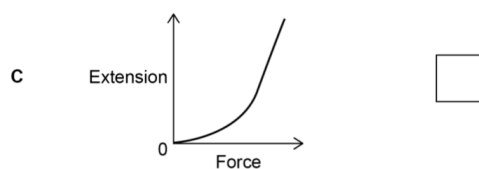
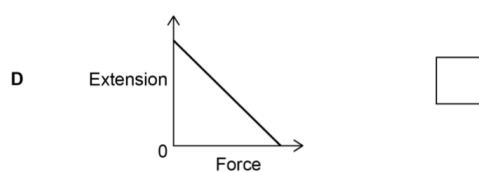
A ☐ **B** ☐ **C** ☐

f)

0 1 . 7 Which graph shows that the extension of the spring is directly proportional to the force applied to the spring?

[1 mark]

Tick (✓) **one** box.



g)

0 1 . 8 Table 1 shows the results of the manufacturer's investigation.

Table 1

Force in newtons	Extension in metres
100	0.008
200	0.016

Suggest **two** improvements to the investigation.

[2 marks]

1 _____

2 _____

Q7. (2024)

0 7 Figure 12 shows an Olympic gymnast performing a floor routine.

Figure 12



The floor contains springs.

When the gymnast lands on the floor, a force compresses the springs in the floor.

0 7 . 2 When the gymnast lands on the floor, one of the springs compresses by 1.2 cm.

spring constant = 8500 N/m

Calculate the elastic potential energy stored in the spring.

Use the Physics Equations Sheet.

Give the unit.

[4 marks]

Q8. (2024)

A student investigated a spring with a different spring constant.

When masses are placed on the spring it compresses.

The student measured the compression of the spring for different masses.

Figure 13 shows some of the equipment used.

Figure 13



a)

0 7 . 3 Describe how the compression of the spring could be determined.

[2 marks]

b)

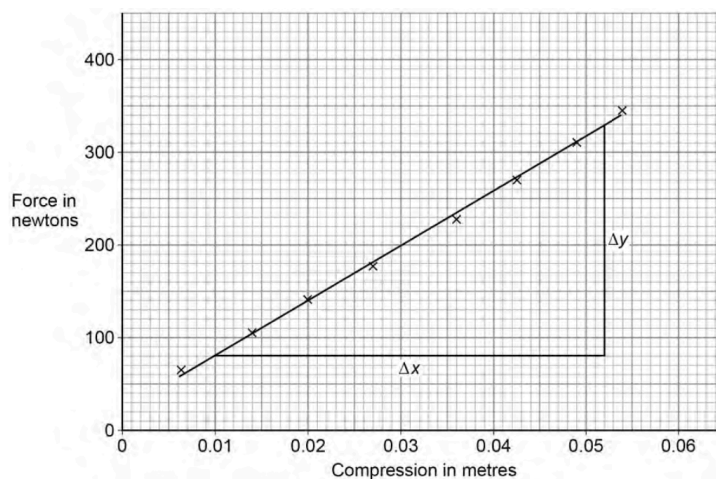
0 7 . 4 Explain why the investigation should be done on the laboratory floor rather than on a table.

[2 marks]

c)

Figure 14 shows the results.

Figure 14



The spring constant is the gradient of the line of best fit shown on Figure 14.

0 7 . 5 Determine the value Δy on Figure 14.

[1 mark]

$\Delta y =$ _____ N

d)

07.6 Determine the value Δx on **Figure 14**.

[1 mark]

$\Delta x =$ _____ m

e)

07.7 Determine the spring constant of the spring.

Use your answers to Question **07.5** and Question **07.6**.

Give your answer to 3 significant figures.

[2 marks]