PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



EXAM QUESTION PACK

TOPIC 15: FORCES AND MATTER (PAPER 2)

SCORE	PERCENTAGE
/105	%

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Q1.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

A student measures the length of a spring when it is horizontal and when it is vertical, as shown in Figures 9a and 9b.

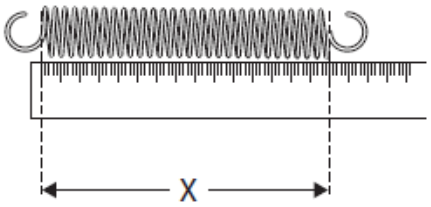


Figure 9a

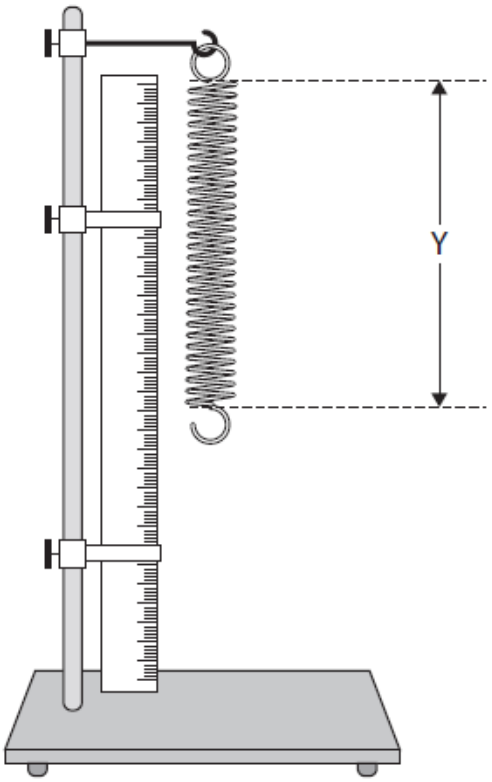


Figure 9b

The length, Y, of the vertical spring in Figure 9b is greater than the length, X, of the spring in Figure 9a.

(i) Give a reason why the length of the spring in Figure 9b is greater than the length of the spring in Figure 9a.

(1)

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(ii) The student adds some weights to the end of the spring, as shown in Figure 10b.

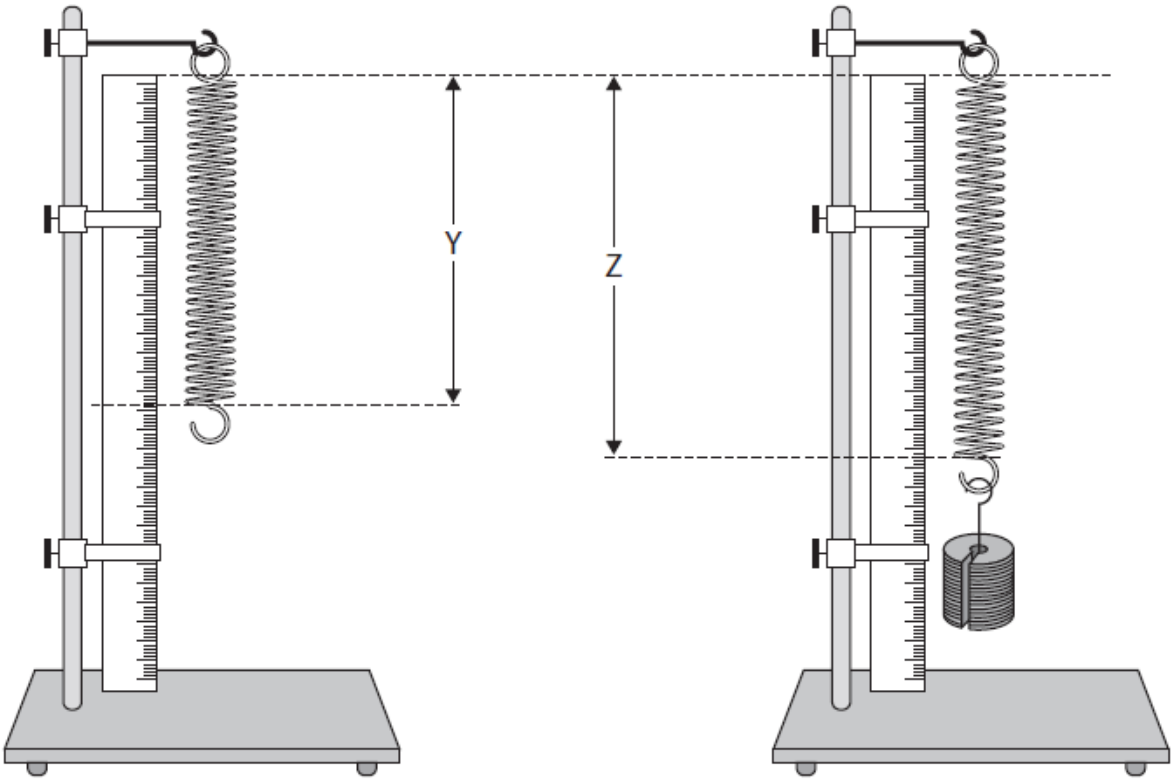


Figure 10a **Figure 10b**

(Source: https://www.shalom-education.com/courses/ks3-physics/lessons/motion-and-forces/topic/deformation-and-hookes-law/)

The extension of the spring due to these added weights is equal to

(1)

- ☒ **A** Z − Y
- ☒ **B** Z + Y
- ☒ **C** Z
- ☒ **D** Y

(Total for question = 2 marks)

(**QU05a 1SC0/2PH, June 2025**)

Q2.

Figure 7 shows what happens when weights are added to the end of a wooden strip.

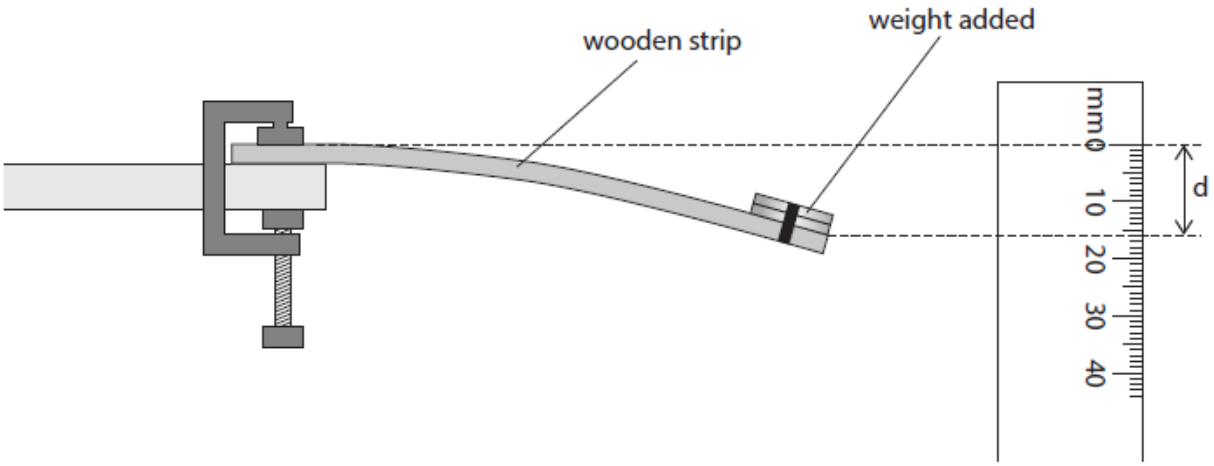


Figure 7

(Source: https://www.schoolphysics.co.uk/age16-19/Mechanics/Simple%20harmonic%20motion/text/Vibrating_cantilever/index.html)

The end of the strip of wood moves down by a distance, d, as shown in Figure 7.

(i) Describe how a student could investigate how the distance, d, depends on the weight added to the wooden strip.

(4)

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(ii) A student conducts a second experiment with the same equipment where they decide to keep the size of the weight constant.

State another variable, other than the weights added, that would affect the distance, d.

(1)

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(Total for question = 5 marks)

Q3.

Figure 9 shows a spring standing on a table.

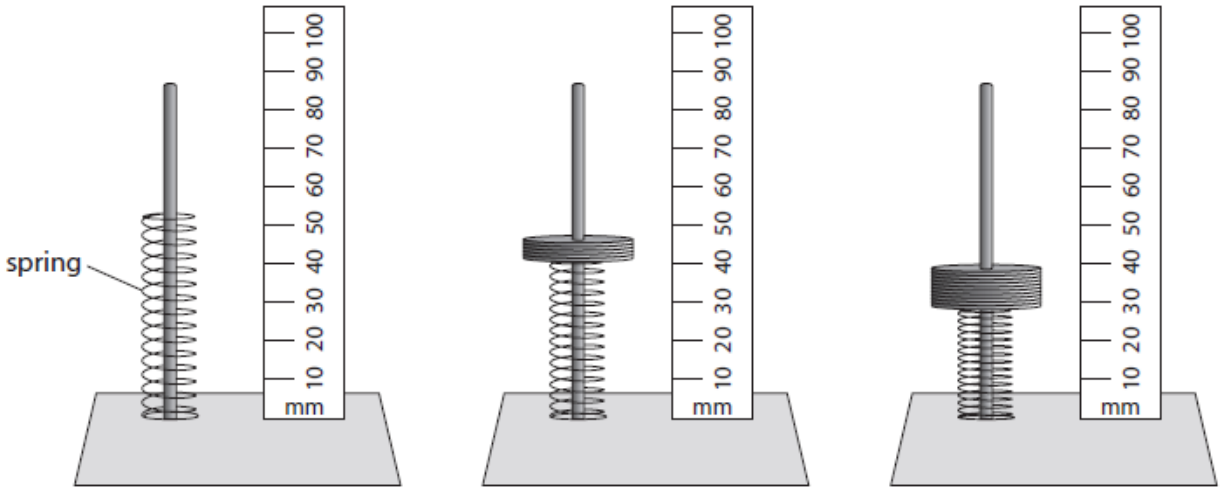


Figure 9a **Figure 9b** **Figure 9c**

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)

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

(2)

1 .....

.....

2 .....

.....

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

(1)

.....

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(Total for question = 6 marks)

(**Q04a 1SC0/2PH, Nov 2020**)

Q4.

A student sets up the apparatus shown in Figure 9.

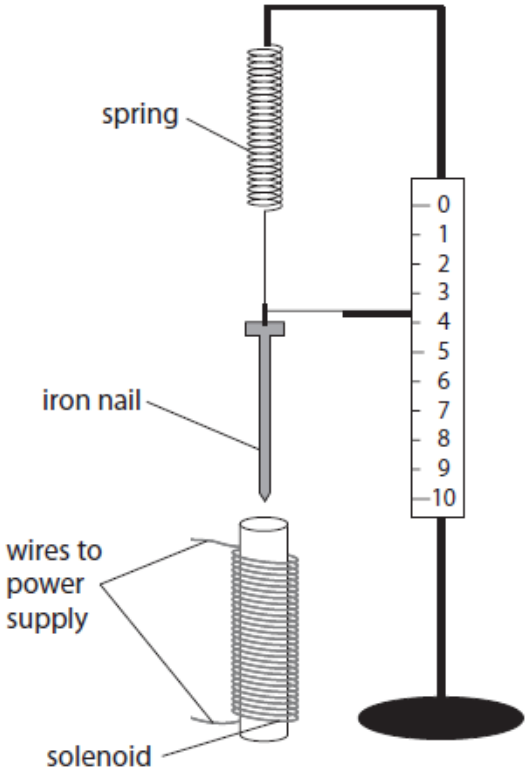


Figure 9

(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)

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(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)

energy transferred = ... J

(Total for question = 6 marks)

(**Q09 1SC0/2PH, June 2018**)

Q5.

The extension of the spring in Figure 10b is now determined for different weights added to the spring up to a maximum of 6 N.

Figure 11 shows a graph of the results.

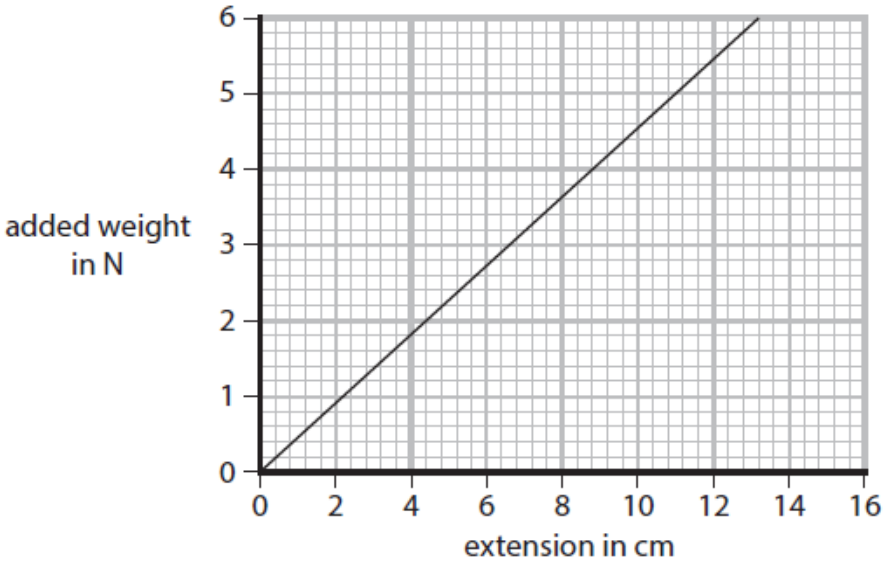


Figure 11

(i) The increase in potential energy stored in the spring is equal to the area under the graph in Figure 11.

Calculate the increase in potential energy stored in the spring when the spring is extended from 0 cm to 8 cm.

Give your answer in joules (J).

(3)

energy = ... J

(ii) Calculate the spring constant of the spring using data from the graph in Figure 11.

State the unit.

(2)

spring constant = ... unit
.....

(iii) The box in Figure 12 represents a weight added to the end of the spring.



Figure 12

Draw **two** vectors on Figure 12 to complete a free body force diagram of a 5 N weight in equilibrium.

(2)

(Total for question = 7 marks)

(**QU05b 1SC0/2PH, June 2025**)

Q6.

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)

extension of spring = ... m

(Total for question = 3 marks)

(**Q04c 1SC0/2PH, Nov 2020**)

Q7.

Figure 6 shows part of the inside of a pen.

The pen contains a spring that can be compressed.

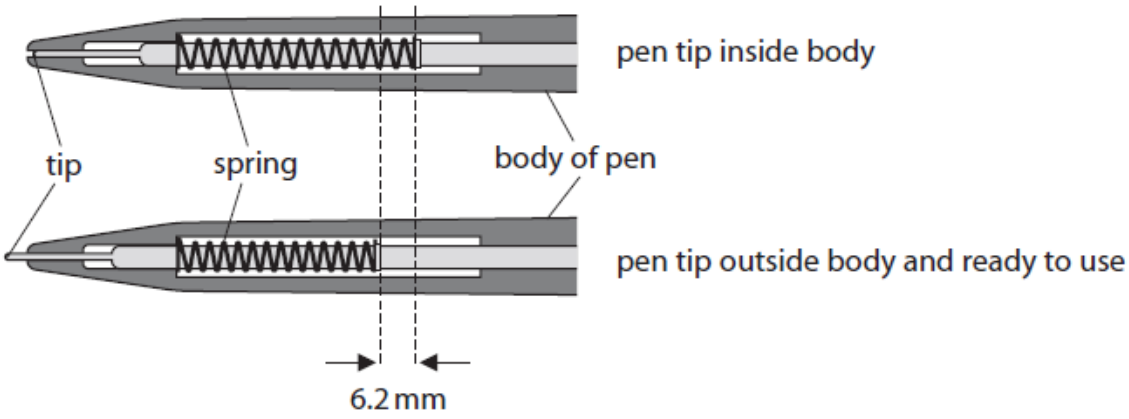


Figure 6

The spring constant of the spring is 260 N/m.

(i) Calculate the force needed to compress the spring by the amount shown in Figure 6.

Give your answer to an appropriate number of significant figures.

(3)

force = ... N

(ii) A student removes the spring from the pen and investigates the compression of the spring.

Figure 7 shows the equipment and the procedure that the student uses.

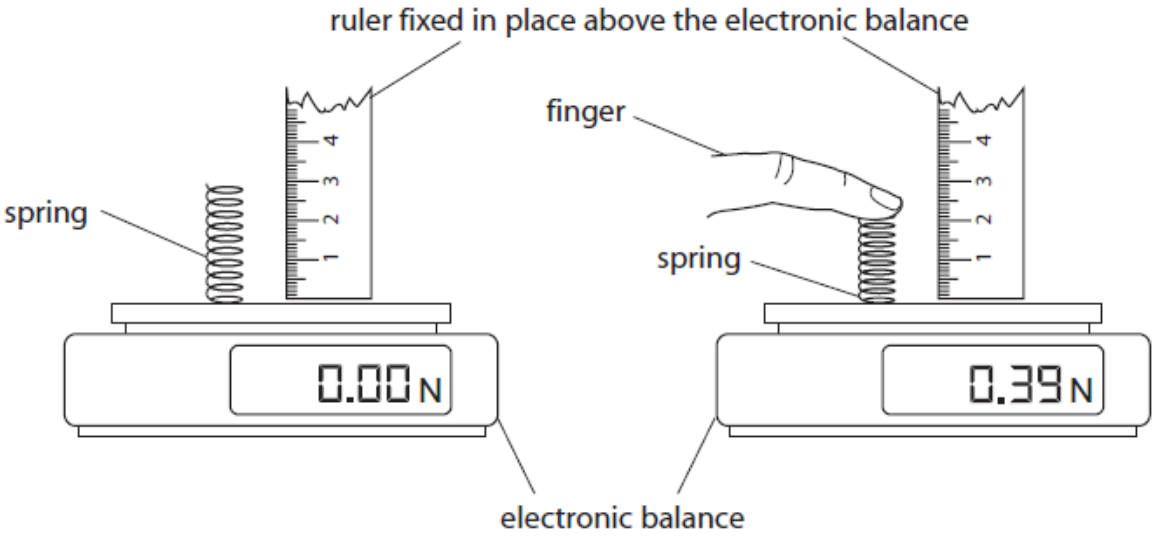


Figure 7

The student presses down on the spring to change its length.

The electronic balance measures the force applied to the spring.

Describe how the student can determine the change in length of the spring. You may add to Figure 7 to help your answer.

(3)

(iii) The student finds it difficult to make an accurate measurement of the change in length of the spring using the equipment as shown.

Describe **one** way that the student could improve the procedure.

(2)

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.....

(Total for question = 8 marks)

(**QU04a 1SC0/2PH, June 2023**)

Q8.

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)

spring constant k = ... N/m

(Total for question = 3 marks)

(**Q04b 1SC0/2PH, Nov 2020**)

Q9.

A weight of 4.0 N is used to extend a spring.
The extension of the spring is 0.06 m.

(i) Calculate the spring constant, k, of the spring.

Use the equation

$$F = k \times x$$

(3)

spring constant = ... N/m

State what measurements should be made to determine the extension of the spring produced by the 4.0 N weight.

(2)

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(Total for question = 5 marks)

(**Q03b 1SC0/2PF, June 2019**)

Q10.

(i) Figure 8 shows a spring stretched by some weights.

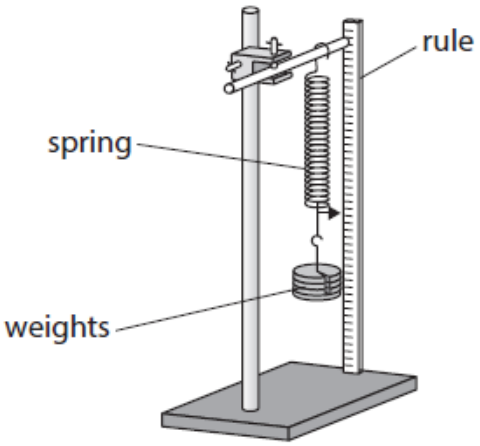


Figure 8

The extension of the spring is 6.2 cm when a weight of 2 N is added.

Calculate the spring constant, *k*, of the spring.

Use the equation

$$k = \frac{F}{x}$$

(2)

spring constant, *k* = ... N/m

(ii) Work is done when a spring is stretched.

A different spring has a spring constant of 25 N/m.

The spring is stretched by 0.06 m.

Calculate the energy transferred by stretching the spring.

Use the equation

$$E = \frac{1}{2} \times k \times x^2$$

(2)

energy transferred = ... J

(Total for question = 4 marks)

(**QU04c 1SC0/2PF, June 2025**)

Q11.

Figure 7 shows an athlete using a fitness device.

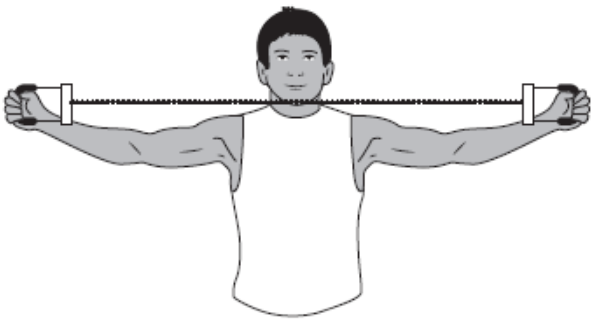


Figure 7

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)

useful power output of the athlete = ... W

(ii) Calculate the extension of the spring.

Use an equation selected from the list of equations from the relevant equation sheet.

(3)

extension of the spring = ... m

(Total for question = 5 marks)

(**Q05a 1SC0/2PH, June 2019**)

Q12.

Another spring has a spring constant of 250 N/m.

Calculate the work done in stretching the spring by 0.30 m.

State the unit.

Use the equation

$$E = \frac{1}{2} \times k \times x^2$$

(3)

work done in stretching the spring = ... unit .....

(Total for question = 3 marks)

(**Q03c 1SC0/2PF, June 2019**)

Q13.

Figure 3 shows a toy used to launch a ball.

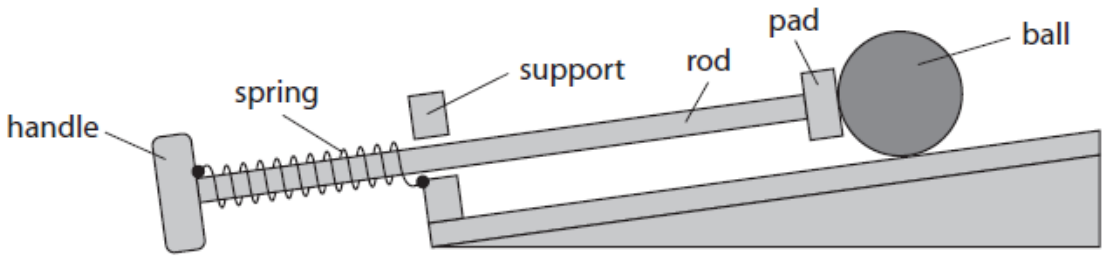


Figure 3

One end of the spring is fixed to the handle.

The other end of the spring is fixed to the support.

The child pulls the handle until the pad is against the support as shown in Figure 5.

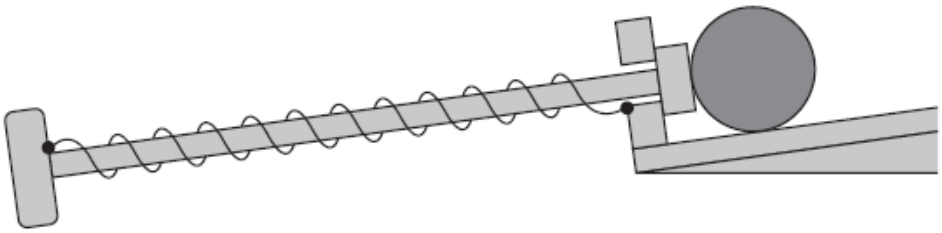


Figure 5

(i) The extension of the spring is 0.09 m.

The spring constant (k) is 20 N/m.

Calculate the work done in extending the spring by 0.09 m.

Use the equation

$$\text{work done} = \tfrac{1}{2} \times k \times (\text{extension})^2$$

(2)

work done = ... J

(ii) The child lets go of the handle.

The ball starts to move.

The spring returns to its original length.

Describe the energy transfer that takes place when the ball starts to move.

(2)

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(iii) The child can only stretch the spring until the pad is pressing against the support.

Explain how the design of the toy prevents the spring from becoming damaged.

(2)

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(Total for question = 6 marks)

(**Q02b 1SC0/2PF, Nov 2020**)

Q14.

Figure 4 shows a 10 N weight hanging from a spring.

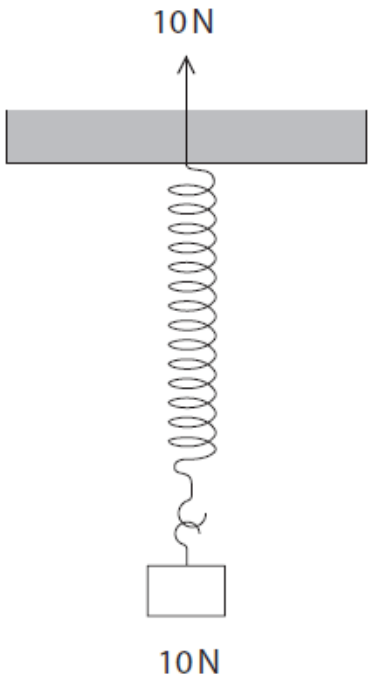


Figure 4

One of the forces acting to stretch the spring is shown in Figure 4.

Complete Figure 4 by adding an arrow to show the other force acting to stretch the spring.

(Total for question = 2 marks)

(**Q03a 1SC0/2PF, June 2019**)

Q15.

A student investigates the stretching of a long piece of rubber.

Figure 8 shows the apparatus to be used.

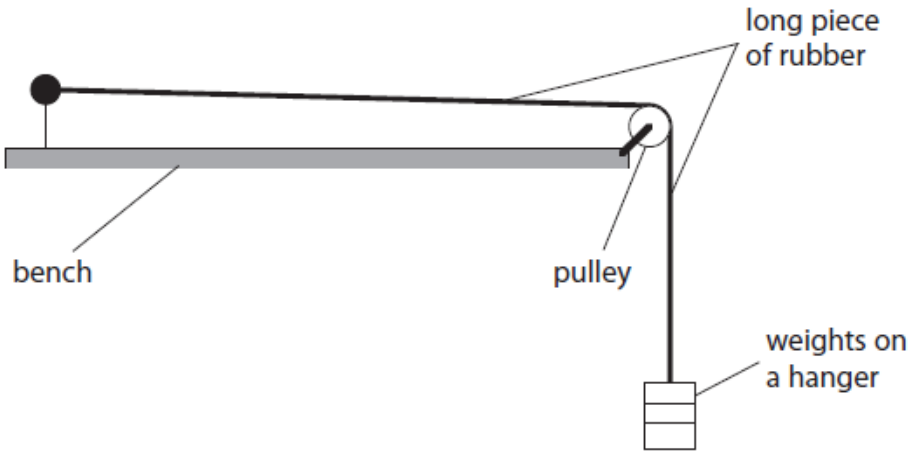


Figure 8

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)

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(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.

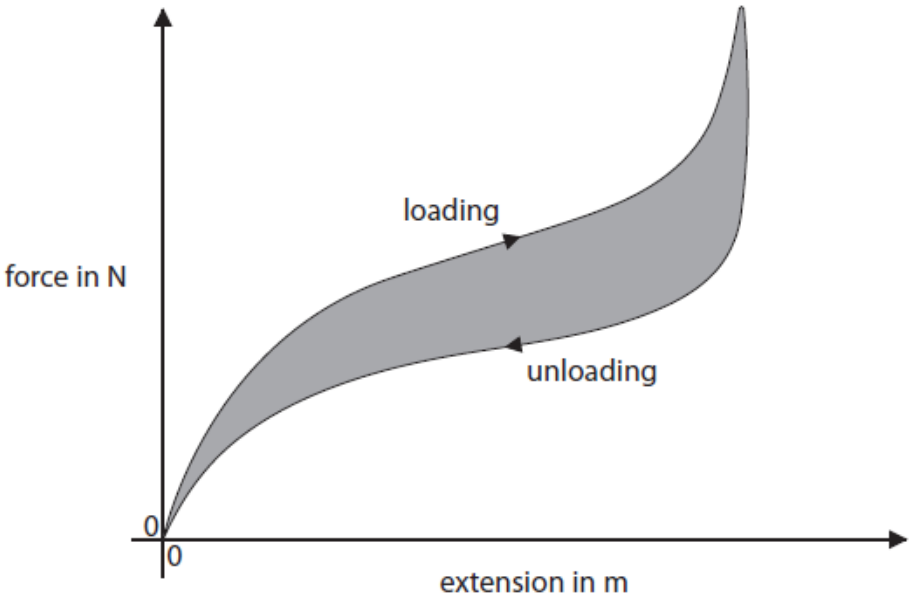


Figure 9

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)

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(Total for question = 4 marks)

(**Q05b 1SC0/2PH, June 2019**)

Q16.

A student investigates the stretching of a spring with the equipment shown in Figure 22.

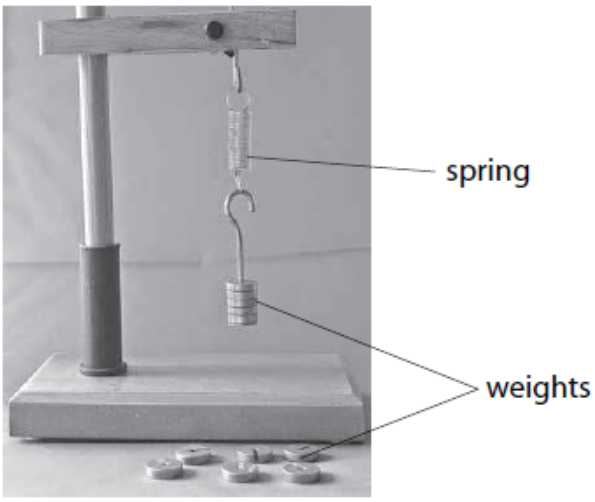


Figure 22

The student extends the investigation by finding information about the stretching of wires.

The student finds the graph shown in Figure 24 for the stretching of a wire.

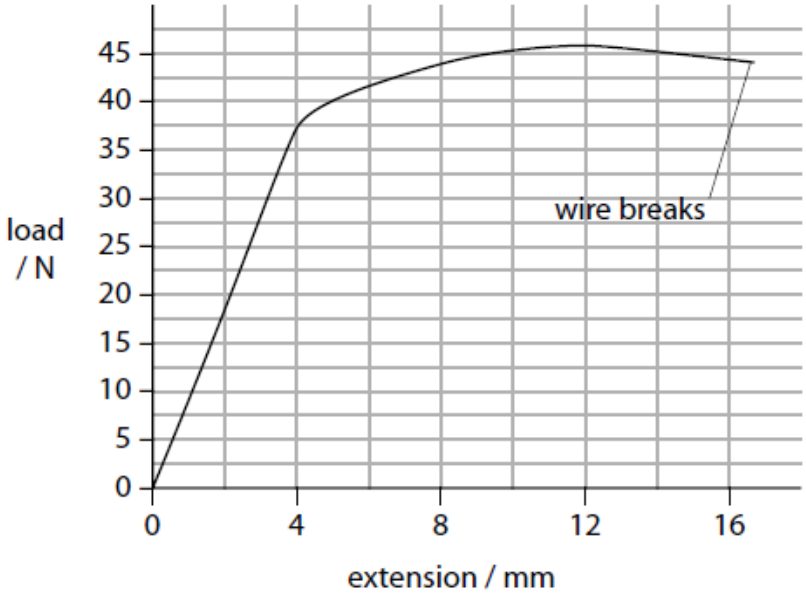


Figure 24

Describe the non-linear stretching of the wire shown in Figure 24.

(3)

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(Total for question = 3 marks)

(**Q06c 1SC0/2PF, SAM 2016**)

Q17.

The student measures the extension of the spring as he adds different loads (loading).

He then measures the extension of the spring as he takes the loads off (unloading).

He then repeats the investigation using a rubber band instead of the spring.

The tables in Figure 4 show his results.

spring		
load in N	extension in mm	extension in mm
	loading	unloading
0	0	0
1	20	20
2	40	40
3	60	60

rubber band		
load in N	extension in mm	extension in mm
	loading	unloading
0	0	0
1	14	25
2	33	42
3	60	60

Figure 4

State **two** similarities and **two** differences between the results for the spring and the results for the rubber band.

(4)

Similarity 1

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.....

Similarity 2

.....

.....

Difference 1

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.....

Difference 2

.....

.....

(Total for question = 4 marks)

(Q02b 1SC0/2PF/S2, SAM)

Q18.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 3 shows a toy used to launch a ball.

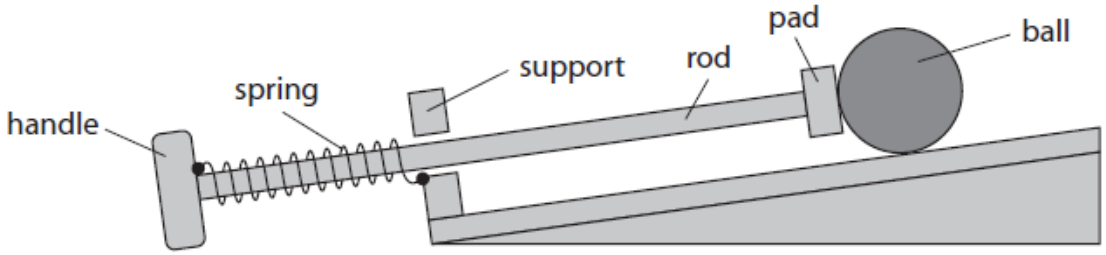


Figure 3

One end of the spring is fixed to the handle.

The other end of the spring is fixed to the support.

A child pulls the handle, stretching the spring.

Figure 4 shows the toy with the spring stretched.

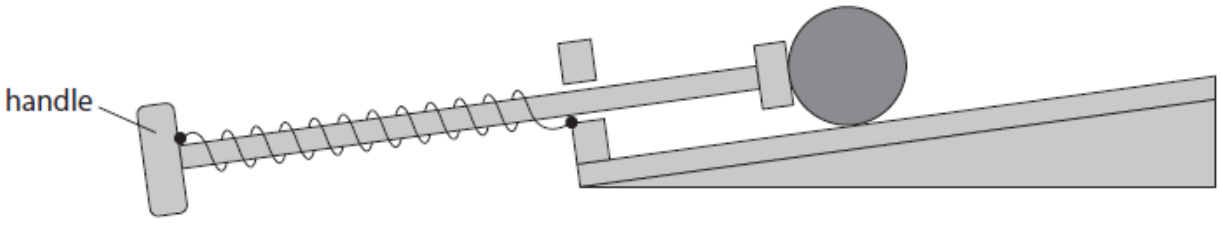


Figure 4

(i) Which of these shows the forces acting on the handle when the child keeps the spring

stretched?

Ignore the force due to gravity.

(1)



☒ A ☒ B ☒ C ☒ D

(ii) In Figure 4, the extension of the spring is 0.070 m.

The spring constant (k) is 20 N/m.

Calculate the force used to extend the spring.

Use the equation

$$\text{force} = k \times \text{extension}$$

(2)

force = ... N

(Total for question = 3 marks)

(**Q02a 1SC0/2PF, Nov 2020**)

Q19.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 8 shows a different spring hanging from a hook fixed to the ceiling.

A block hangs from the other end of the spring.

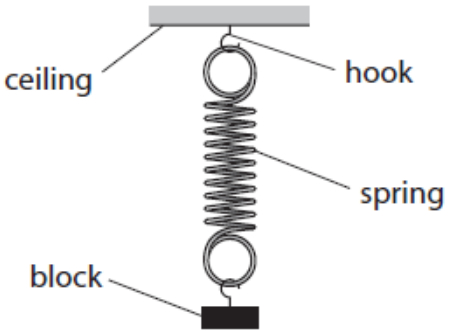


Figure 8

The weight of the spring is 1 N.
The weight of the block is 5 N.

The force exerted on the top of the spring by the hook is

(1)

☒ **A** 4 N down

☒ **B** 4 N up

☒ **C** 6 N down

☒ **D** 6 N up

(Total for question = 1 mark)

(**QU04b 1SC0/2PH, June 2023**)

Q20.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Bending or stretching objects can cause distortions.

Which of these small distortions can be described as **inelastic**?

(1)

☒ **A** stretching a rubber band

☒ **B** squashing a piece of modelling clay

☒ **C** compressing a steel spring

☒ **D** bending a plastic ruler

(Total for question = 1 mark)

(**QU04a 1SC0/2PF, June 2025**)

Q21.

A student uses a digital calliper to measure the length of a spring, as shown in Figure 20.

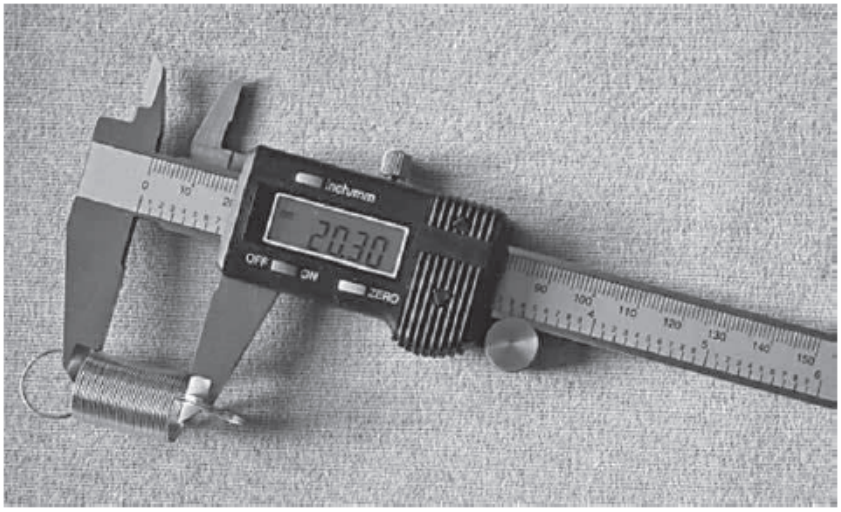


Figure 20

The spring is bendy and difficult to measure.

The student takes the six readings shown in Figure 21.

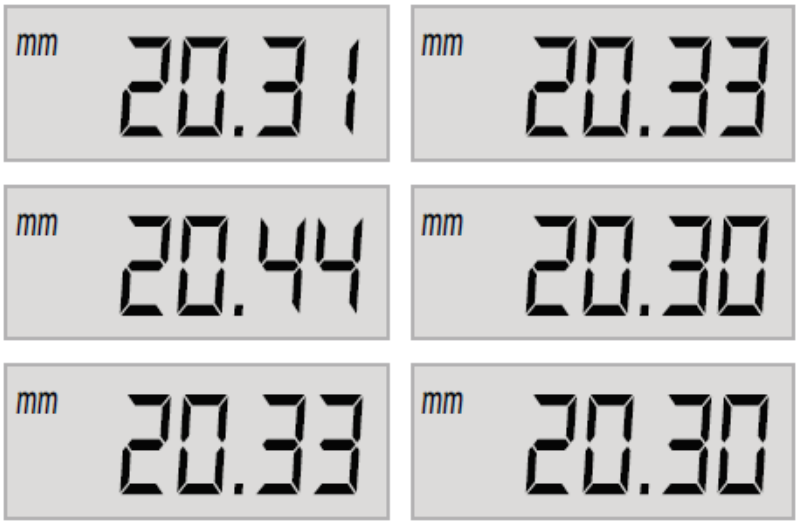


Figure 21

(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 22.

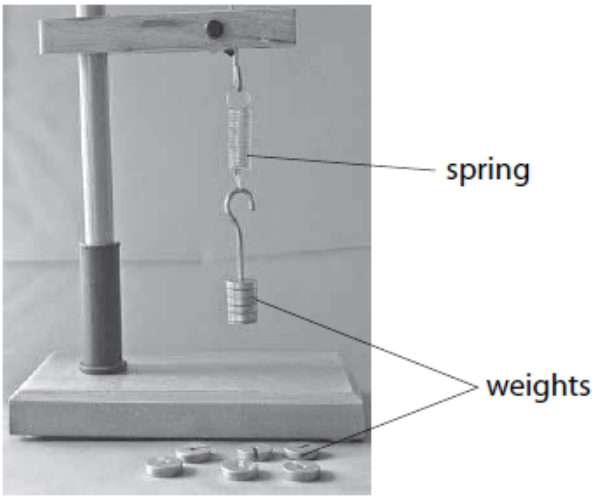


Figure 22

The student investigates the extension of the spring using six different weights.

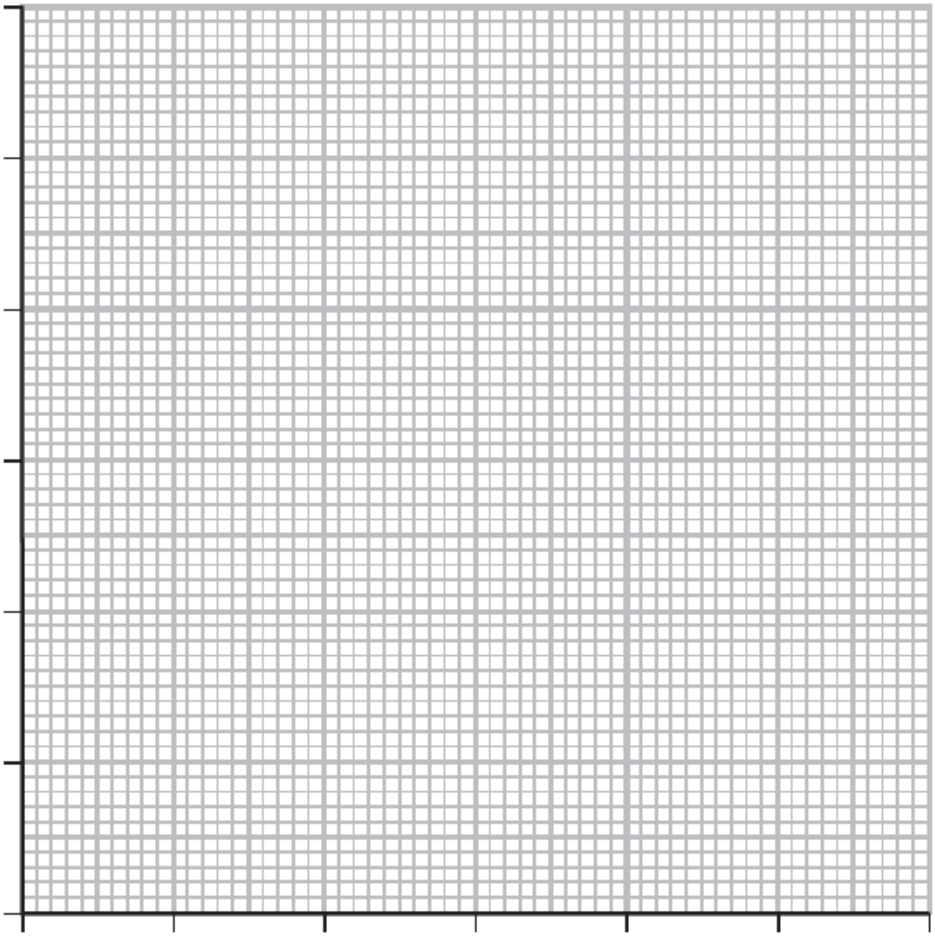
The results are shown in Figure 23.

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 23

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

(3)



(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)

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(Total for question = 8 marks)

(**Q06ab 1SC0/2PF, SAM 2016**)

Q22.

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

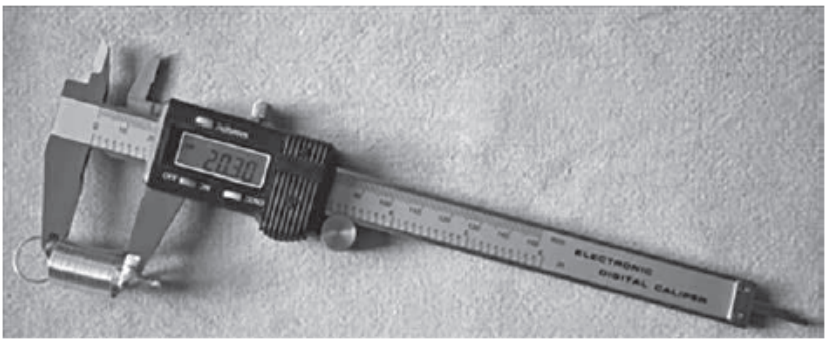


Figure 10

The spring is bendy and difficult to measure.

The student takes the six readings shown in Figure 11.

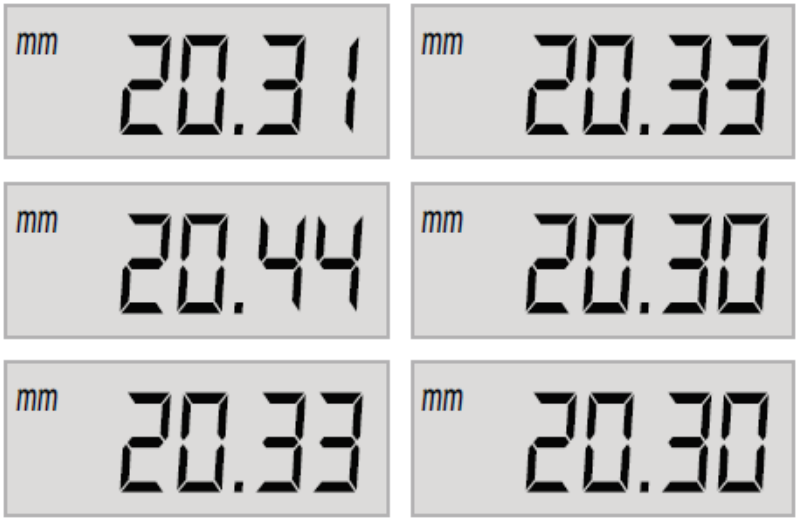


Figure 11

(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.

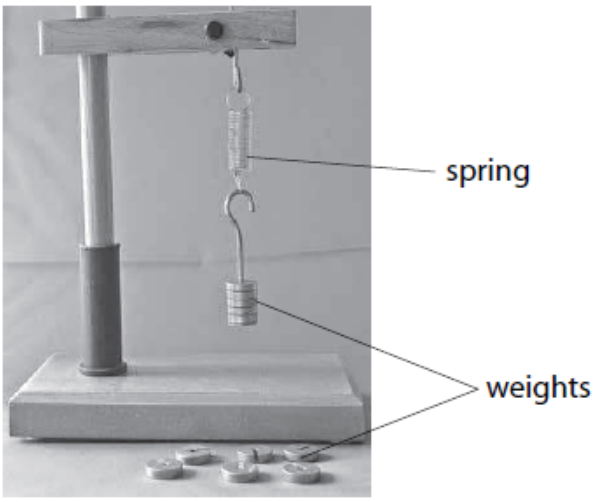


Figure 12

The student investigates the extension of the spring using six different weights.

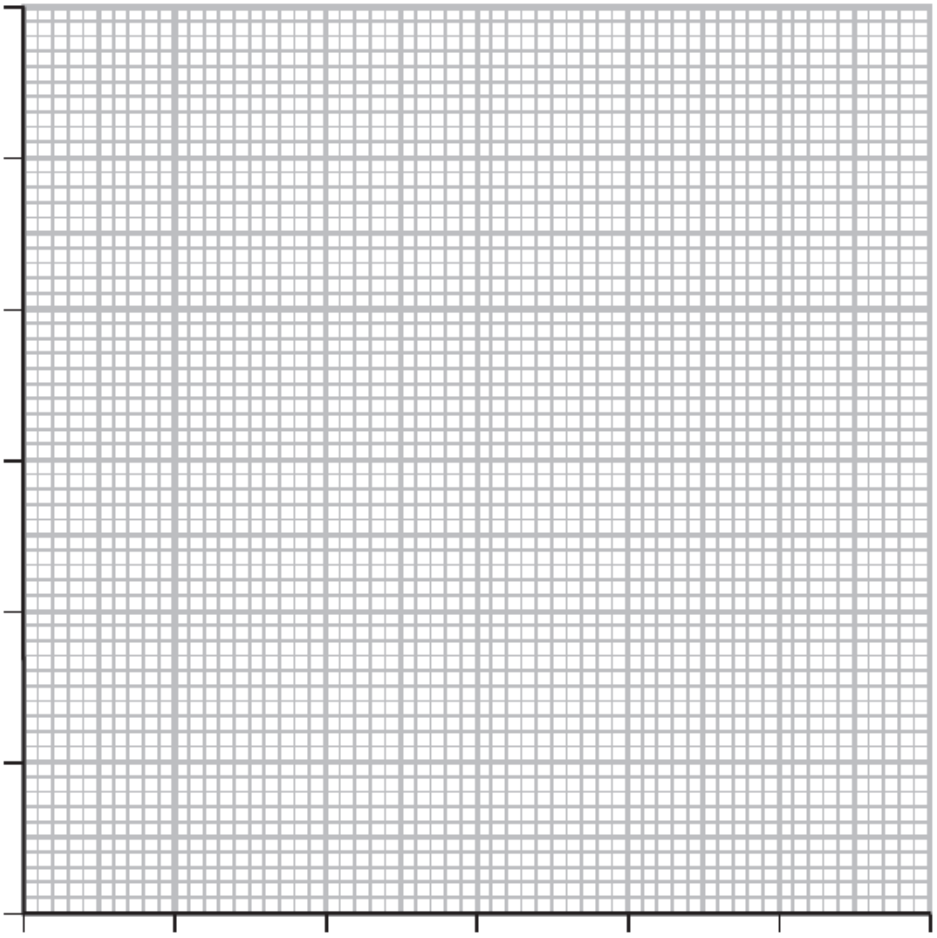
The results are shown in Figure 13.

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)



(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)

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(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.

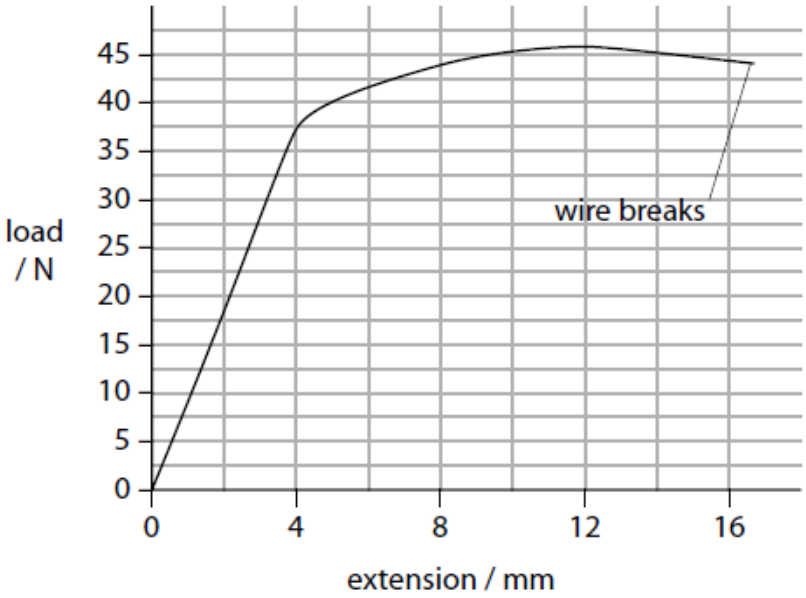


Figure 14

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

(3)

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(Total for question = 11 marks)

(**Q05 1SC0/2PH, SAM 2016**)

Q23.

A student uses the apparatus shown in Figure 3 to investigate the extension of a spring.

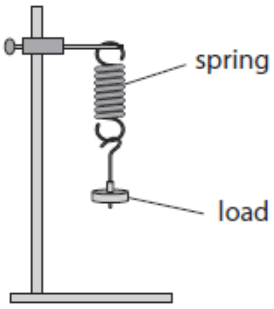


Figure 3

(i) Describe how the student could measure the extension of the spring when a load is added.

(3)

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.....

.....

(ii) The extension of the spring for a load of 1.5 N is 30 mm.

Calculate the spring constant for the spring.

Use the equation

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

(2)

spring constant = ... N/mm

(Total for question = 5 marks)

(**Q02a 1SC0/2PF/S2, SAM**)