AQA Style

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier   Physics Paper 2

Time allowed: 1 hour 15 minutes

Materials

• A ruler

• A pen and pencil

• A calculator

Instructions and Information

• Answer all the questions using a black pen.

• Answer the questions in the space available and cross out any work you do not want to be marked.

• In any calculations make sure you show your working out.

• The marks for each question are shown in brackets.

• The maximum mark for the paper is 70.

• You must make your work as neat as possible and use good English in your answers.

• You should make sure you leave time to check your answers.

Question	Mark
1	
2	
3	
4	
5	
6	
7	
Total	

Name _____

Date _____

BEYOND SCIENCE

0 1   A student investigated the behaviour of springs using the method below.

1. Suspend a spring from a clamp stand.
2. Measure the length of the spring.
3. Apply a force to the spring by attaching a 100g mass hanger to the spring.
4. Measure the extension of the spring.
5. Add a 100g mass to the mass hanger and measure the new extension of the spring.
6. Repeat step 5 another three times.

Figure 1 shows the equipment used in the investigation.

Figure 1
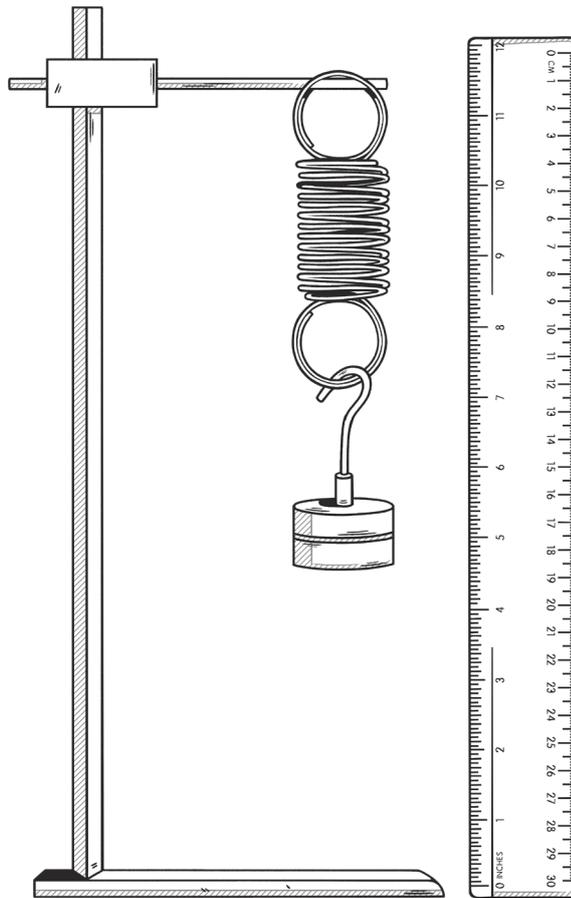
0 1 . 1   Write down the independent variable in this investigation.

[1 mark]

_____

0 1 . 2   Give **one** control variable in this investigation.

[1 mark]

_____

0 1 . 3   Each 100g mass provided 1N of force on the spring.

A second student's results are shown in **Table 1**.

Table 1

Force (N)	Extension (cm)			Mean Extension (cm)
	Repeat 1	**Repeat 2**	**Repeat 3**	
1	2.1	2.1	2.2	2.1
2	4.0	4.1	4.0	4.0
3	6.0	12.0	6.0	8.0
4	8.1	7.9	8.0	8.0
5	10.0	10.2	10.2	

Calculate the mean extension at 5N.

Write your answer to an appropriate number of significant figures.

[2 marks]

_____

_____

_____

_____

mean extension = _____ cm

0 1 . 4   One of the results in **Table 1** was anomalous.

Suggest how the anomalous result may have occurred.

[1 mark]

_____

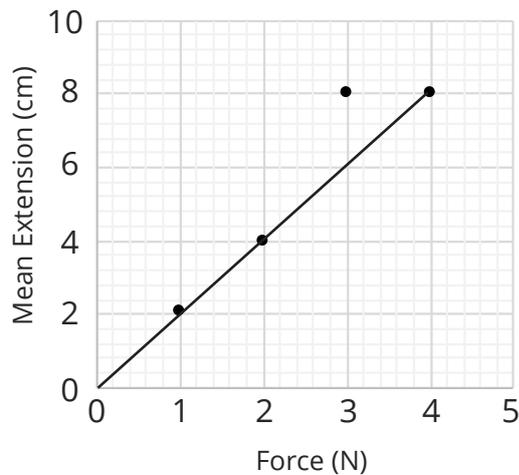_____

_____

_____

0 1 . 5 The student plotted a graph of their results and drew a line of best fit. The graph is shown in **Figure 2**.

Figure 2

Complete the sentence to describe the relationship between the extension of the spring and the force applied.

[1 mark]

The extension of the spring is _____ to the force applied.

0 1 . 6 Write down the equation that links extension, force and spring constant.

[1 mark]

_____

0 1 . 7 Calculate the spring constant of the spring used by the student.

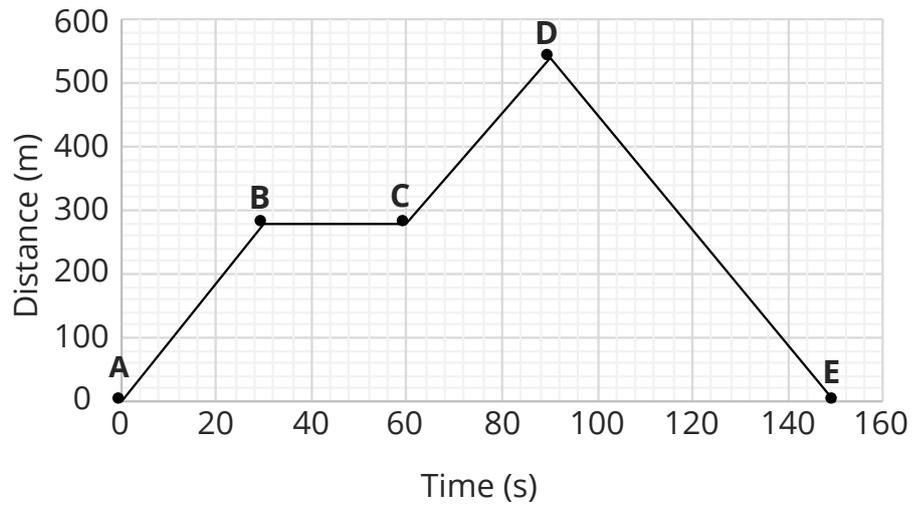Use a force of 2N and an extension of 0.04m.

[3 marks]

_____

_____

_____

_____

spring constant = _____ N/m

10

BEYOND
SCIENCE

0 2   **Figure 3** shows a distance-time graph for the journey made by a car.

Figure 3

0 2 . **1**   Describe what **Figure 3** shows about the motion of the car between points **A** and **E**.

You should refer to data from **Figure 3** in your answer.

[4 marks]

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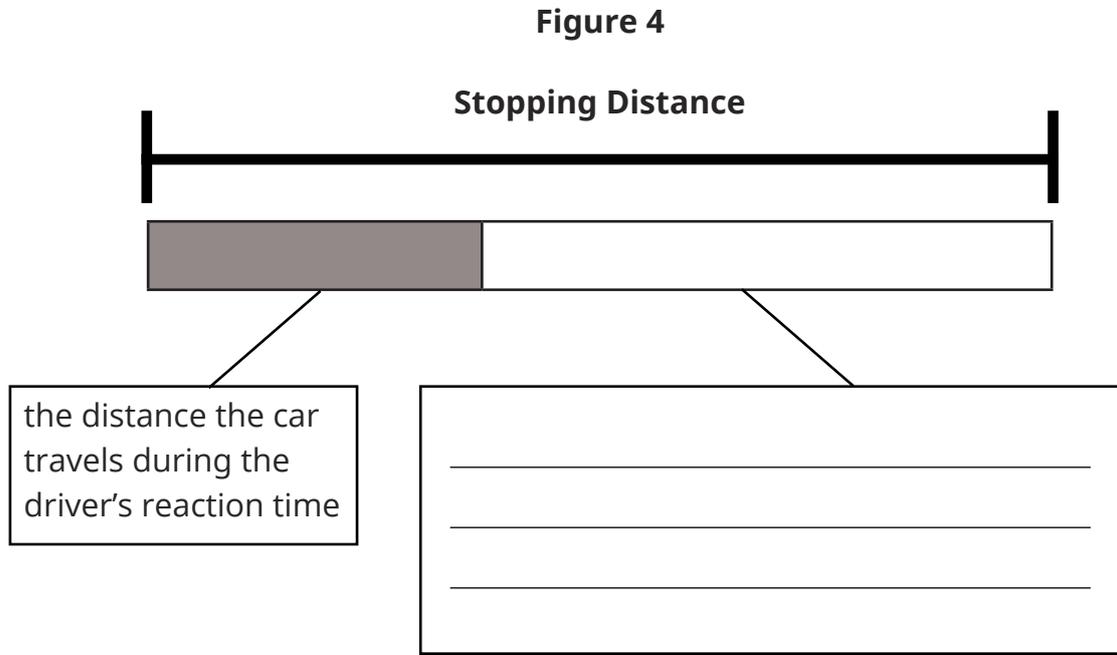
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BEYOND
SCIENCE

0 2 . 2   A car is travelling at constant speed. When the driver applies the brakes, the car slows down and stops.

Figure 4 shows the two different sections that make up the total stopping distance of the car.

Figure 4

Stopping Distance

the distance the car travels during the driver's reaction time

_____

_____

_____

Complete **Figure 4** by labelling the second part of the stopping distance.

[1 mark]

0 2 . 3   Give **two** factors that could affect the distance the car travels during the driver's reaction time.

[2 marks]

1. _____

_____

2. _____

_____

BEYOND
SCIENCE

0 2 . 4   When the driver applies the brakes, the car decelerates.

Write down the equation that links acceleration, change in velocity and time taken.

[1 mark]

_____

0 2 . 5   Before the driver applies the brakes, the car is travelling at a speed of 17m/s. It takes 3.4s for the car to come to a complete stop.

Calculate the deceleration of the car between the driver first applying the brakes and the car coming to a complete stop.

Give the unit.

[2 marks]

_____

_____

_____

_____

_____

deceleration = _____ unit _____

0 2 . 6   Describe what happens to the brakes when they are used to stop the car.

[1 mark]

_____

_____

11

BEYOND
SCIENCE

0 3   Some students want to find out how the number of coils affects the strength of an electromagnet. **Figure 5** shows some equipment that could be used in this investigation.

Figure 5

nail   insulated copper wire   paper clips   power supply

0 3 . 1   Describe a method you could use to investigate how the number of coils affects the strength of an electromagnet.

You should include:

- how you would make an electromagnet from the equipment;
- how you would use the equipment to carry out the investigation;
- how you would make sure your results are valid.

[6 marks]

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BEYOND
SCIENCE

0 3 . 2 **Figure 6** shows a single coil of wire in a magnetic field.

Figure 6
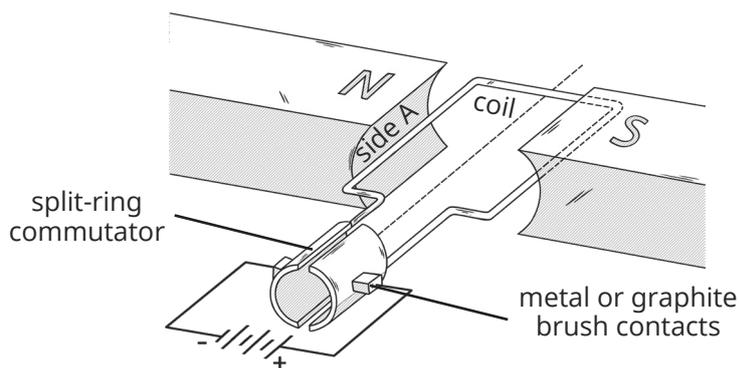
When a current passes through the wire, the coil spins.

Give the name of this effect.

[1 mark]

_____

0 3 . 3 Give the direction in which **side A** of the coil moves when a current flows.

[1 mark]

_____

0 3 . 4 Suggest **two** changes to the system that would make the coil spin in the opposite direction.

[2 marks]

1. _____

_____

2. _____

_____

0 3 . 5 Suggest **two** changes to the system that would make the coil spin at a greater speed.

[2 marks]

1. _____

_____

2. _____

_____

12

0 4   Some students want to investigate the properties of different waves.

Student 1 drops a rock into a pond.

Student 2 stands at the opposite side of a pond, 5m away, with a stopwatch.

The students and the pond are shown in **Figure 7**.

Figure 7
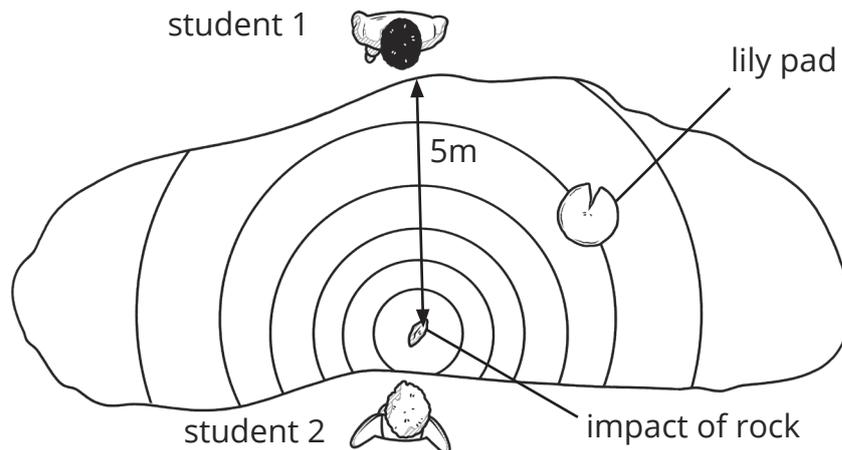
When the rock hits the water, it makes a sound and causes ripples on the surface of the water.

0 4 . 1   Student 2 observes the rock hitting the water.

Describe how the students could determine the speed of sound.

[2 marks]

_____

_____

_____

_____

0 4 . 2   Sound is transmitted by a longitudinal wave.

The ripples caused by the rock are transverse waves.

Describe the difference between transverse and longitudinal waves.

[2 marks]

_____

_____

_____

_____

0 4 . 3   The ripples cause a lily pad on the pond to move up and down.

The students conclude that it is the wave, not the water itself, that travels out from the impact site.

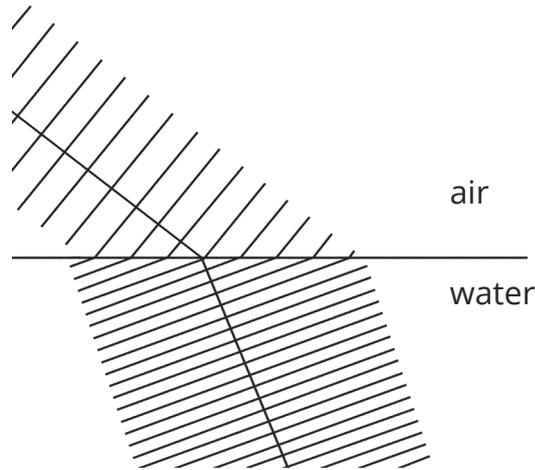Explain whether the students' conclusion is correct.

[3 marks]

_____

_____

_____

_____

_____

_____

0 4 . 4   Light waves travel from the air into the pond water. **Figure 8** shows how light is refracted as it passes from the air to the water.

Figure 8

Explain why the wave front appears different in the water compared to the air.
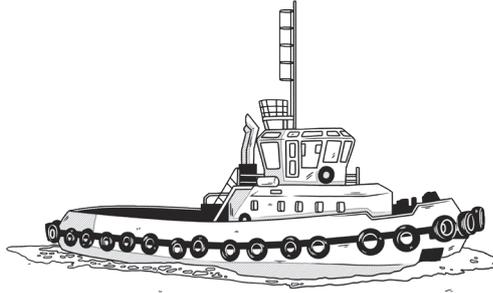
[3 marks]

_____

_____

_____

_____

_____

_____

10

0 5 **Figure 9** shows a tugboat moving at a constant speed.

Figure 9

The weight of the tugboat is 24 000N.

The thrust force caused by the propeller is 15 000N.

0 5 . 1 Describe the other forces acting on the tugboat when it is moving at a constant speed.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

BEYOND SCIENCE

0 5 . 2   The tugboat slows down as it approaches a ship.

Draw and label a free body diagram to show the forces acting on the tugboat as it slows down.
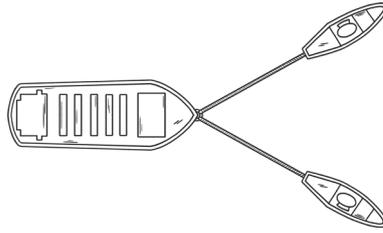
[3 marks]

0 5 . 3 **Figure 10** shows two tugboats pulling a ship into the harbour.

Figure 10

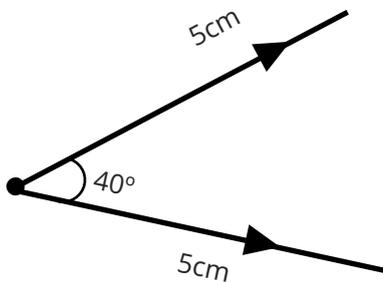Each tugboat exerts a force of 100 000N.

The angle between the two forces is 40°.

Complete the vector diagram in **Figure 11** to determine the resultant force exerted by the two tugboats.

1cm = 20 000N

[2 marks]

Figure 11

resultant force = _____ N

9

0 6   **Figure 12** shows the waves that form the electromagnetic spectrum.

Figure 12

gamma rays	x-rays	A	visible light	infrared	B	radio waves

Two electromagnetic waves are missing from **Figure 12**. Their positions are labelled **A** and **B**.

0 6 . 1   Give the name of the type of electromagnetic wave at position **A**.

[1 mark]

_____

0 6 . 2   Give the name of the type of electromagnetic wave at position **B**.

[1 mark]

_____

0 6 . 3   Complete the sentences.

[2 marks]

The type of electromagnetic wave with the longest wavelength is

_____.

The type of electromagnetic wave with the highest frequency is

_____ .

0 6 . 4   X-ray therapy is used to destroy cancerous tumours. X-rays used for medical imaging carry less energy than those used in x-ray therapy.

Explain why low-energy x-rays are suitable for medical imaging.

[3 marks]

_____

_____

_____

_____

_____

_____

BEYOND SCIENCE

0 6 . 5   Electromagnetic waves travel at a speed of 300 000 000m/s.

A radio station transmits waves with a wavelength of 20 metres.

Calculate the frequency of the waves.

Give the unit.

[3 marks]

_____

_____

_____

_____

frequency = _____ unit _____

0 6 . 6   The radio waves are absorbed by an aerial.

Describe how this produces signals in the electrical circuit of the radio.

[2 marks]

_____

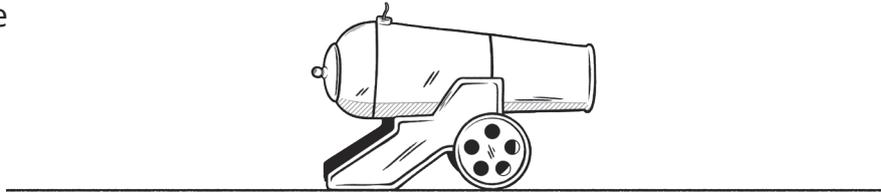_____

_____

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12

0 7   **Figure 13** shows a cannon before and after it is fired.

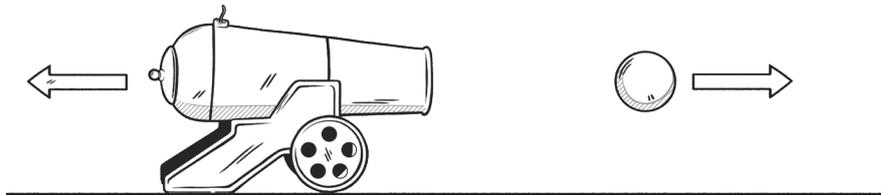Before it is fired, the cannon is stationary.

When the cannonball is fired, the cannon moves backwards.

Figure 13

before

After

The arrows show the direction of movement of the cannon and the cannonball.

0 7 . 1   Explain why the cannon moves backwards.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

0 7 . 2   The mass of the cannon is 1500kg. The mass of the cannonball is 10kg.

The cannonball moves forward at a velocity of 67.5m/s.

Calculate the velocity at which the cannon moves backwards.

[3 marks]

_____

_____

_____

_____

velocity = _____m/s

6

BEYOND
SCIENCE