AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Physics Paper 2H

Friday 16 June 2023 Morning Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a protractor
- a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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0 1 The Sun emits a continuous spectrum of electromagnetic waves.

Figure 1 names some of the groups of waves in the electromagnetic spectrum.

Figure 1

A	**B**	Infrared	Visible light	Ultraviolet	**C**	Gamma rays

0 1 . 1 Name groups **A**, **B** and **C** in **Figure 1**.

[2 marks]

A _____

B _____

C _____

0 1 . 2 Give **one** similarity and **one** difference between the properties of ultraviolet waves and gamma rays.

[2 marks]

Similarity _____

_____

Difference _____

_____

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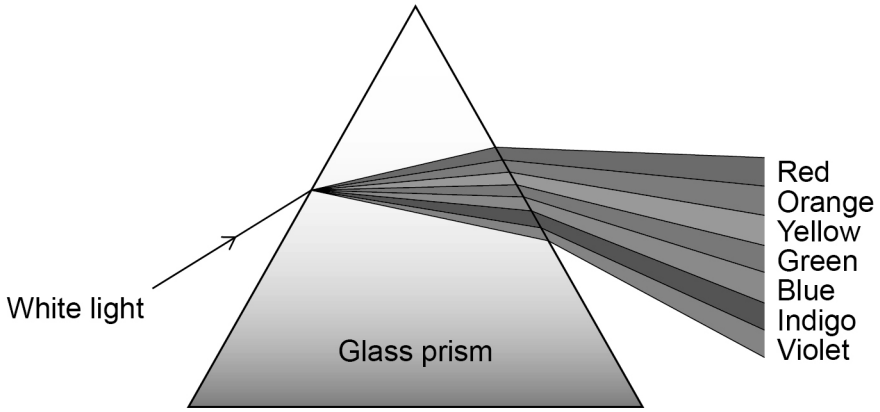
Figure 2 shows white light split into a spectrum of different colours by a glass prism.

Figure 2



0 1 . 3 Light changes direction when it enters the glass prism.

What name is given to this process?

[1 mark]

Question 1 continues on the next page

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Use the Physics Equations Sheet to answer questions **01.4** and **01.5**.

0 1 . 4 Write down the equation that links frequency (f), wavelength (λ) and wave speed (v).

[1 mark]

0 1 . 5 The wave in the middle of the spectrum has a wavelength of 5.0×10^{-7} m.

wave speed of light = 3.0×10^{8} m/s

Calculate the frequency of the wave.

[3 marks]

Frequency = _____ Hz

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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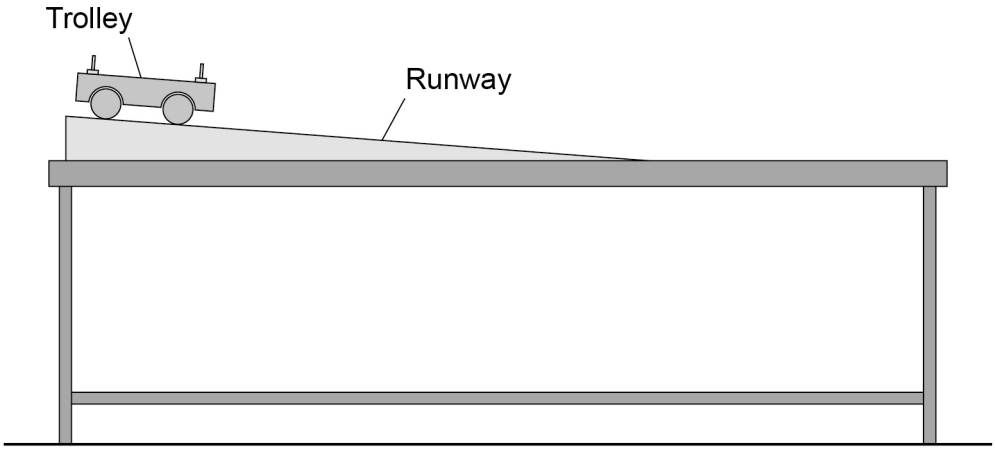
0 2 A student investigated how the acceleration of a trolley is affected by the force acting on the trolley.

Figure 3 shows some of the equipment used.

Figure 3



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0 2 . 1 Describe a method the student could use.

Your answer should include any extra equipment needed.

[6 marks]

Question 2 continues on the next page

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Table 1 shows one set of results for a similar investigation.

Table 1

Resultant force in newtons	Acceleration in m/s^2
1.2	1.6

0 2 . 2 Which of Newton's laws predicts that the acceleration of the trolley is proportional to the resultant force on the trolley?

[1 mark]

Tick (✓) **one** box.

First law ☐

Second law ☐

Third law ☐

0 2 . 3 Determine the acceleration of the trolley when the resultant force is 3.6 N.

Use **Table 1**.

[2 marks]

Acceleration = _____ m/s^2

Do not write outside the box

Use the Physics Equations Sheet to answer questions **02.4** and **02.5**.

0 2 . 4 Write down the equation that links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

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0 2 . 5 A resultant force of 0.42 N acts on a different trolley.

The acceleration of the trolley is 1.2 m/s^2.

Calculate the mass of the trolley.

[3 marks]

Mass of trolley = _____ kg

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Turn over for the next question

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0 3 A teacher used a ripple tank to demonstrate water waves.

The teacher used a lamp to project a shadow of the water waves onto a screen below the ripple tank.

0 3 . 1 **Figure 4** represents the shadow of the water waves seen on the screen.

Figure 4

1.0 mm on **Figure 4** represents 5.0 mm on the screen.

Determine an **accurate** value for the wavelength of the waves on the screen.

Give your answer in mm.

Show how you work out your answer.

[3 marks]

Wavelength = _____ mm

Do not write outside the box

The teacher adjusted the frequency of the waves produced in the ripple tank.

The teacher measured the wavelength five times.

Table 2 shows the results.

Table 2

Measurement	1	2	3	4	5	**Mean**
Wavelength in millimetres	96	99	97	**X**	97	97

0 3 . 2 Calculate value **X** in **Table 2**.

[2 marks]

X = _____ mm

0 3 . 3 The teacher states that the results are very precise.

Which of the following supports the statement made by the teacher?

[1 mark]

Tick (✓) one box.

The mean value is very close to the true value. ☐

The spread of values about the mean is very small. ☐

The values are all given to the nearest millimetre. ☐

The wavelength measurement was taken five times. ☐

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0 3 . 4 Describe the difference between longitudinal waves and transverse waves.

[2 marks]

8

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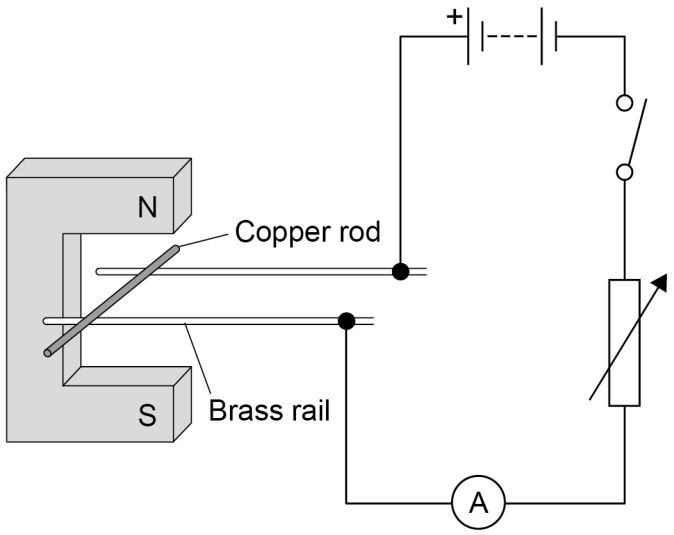
0 4 A teacher demonstrated the motor effect.

Figure 5 shows the equipment used. The equipment includes a permanent magnet.

Figure 5



0 4 . 1 The copper rod remains stationary while the switch is open.

Complete the sentence.

[1 mark]

The tendency for an object to remain stationary is

called _____ .

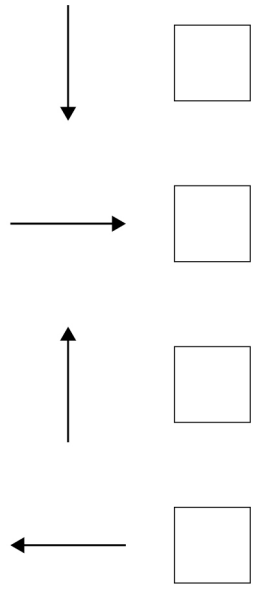
Do not write outside the box

When the switch is closed the copper rod accelerates.

0 4 . 2 In which direction will the copper rod accelerate?

[1 mark]

Tick (✓) **one** box.



0 4 . 3 Explain **one** way the teacher could increase the acceleration of the copper rod.

[2 marks]

Question 4 continues on the next page

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0 4 . 4 The magnet used in the demonstration was a permanent magnet.

Figure 6 shows an iron bar and a permanent magnet.

Figure 6

Iron bar

Permanent magnet

Describe how the permanent magnet could be used to test if the iron bar is also a permanent magnet.

[2 marks]

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0 4 . 5 **Figure 7** shows a magnetic compass used by walkers.

Figure 7

Explain how a magnetic compass provides evidence that the Earth has a magnetic field.

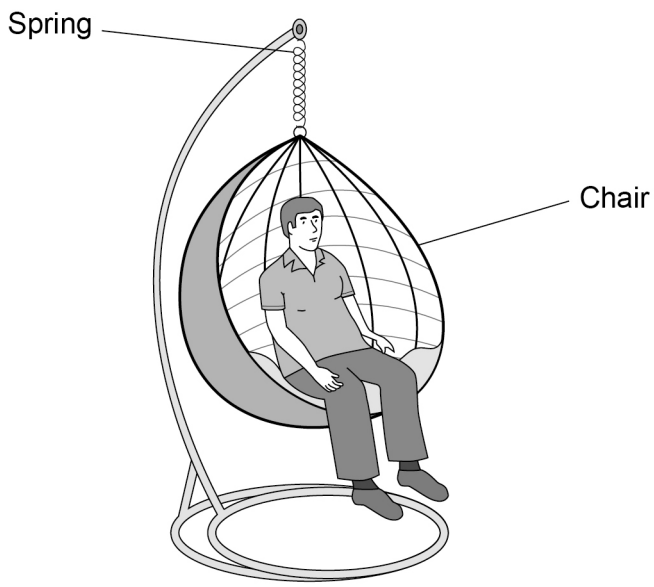
[2 marks]

8

Turn over for the next question

0 5 **Figure 8** shows a garden chair hanging from a spring.

Figure 8



0 5 . 1 Which of the following describes the relationship between the weight (W) acting on the spring and the extension (e) of the spring?

[1 mark]

Tick (✓) **one** box.

$W = e$ ☐

$W \propto e$ ☐

$W \sim e$ ☐

$W < e$ ☐

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0 5 . 2 The person in **Figure 8** has a weight of 750 N.

The person's weight causes the spring to extend by 60 mm.

Calculate the spring constant of the spring.

Use the Physics Equations Sheet.

[3 marks]

Spring constant = _____ N/m

Question 5 continues on the next page

Do not write outside the box

The manufacturer of the chair tests a new spring to see if it is suitable to hang the chair.

The spring can store a maximum of 1800 J of elastic potential energy before it becomes inelastically deformed.

0 5 . 3 Describe what is meant by 'inelastically deformed'.

[2 marks]

0 5 . 4 Calculate the maximum extension of the spring before the spring becomes inelastically deformed.

spring constant = 225 N/m

Use the Physics Equations Sheet.

[3 marks]

Maximum extension = _____ m

Do not write outside the box

0 5 . 5 Evaluate the suitability of the new spring to hang the chair.

maximum elastic potential energy = 1800 J

spring constant = 225 N/m

weight of person = 750 N

distance between the bottom of the chair and the ground = 30 cm

Include a calculation in your answer.

Use the Physics Equations Sheet.

[3 marks]

12

Turn over for the next question

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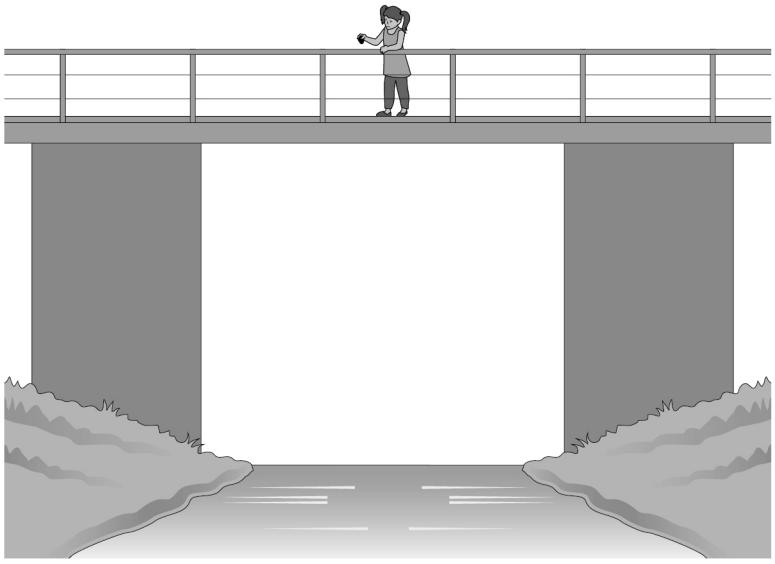
0 6 **Figure 9** shows a child dropping a stone into water.

Figure 9



0 6 . 1 When the child drops the stone it passes the child's feet with a velocity of 3.1 m/s.

The child's feet are 6.3 m above the water.

acceleration due to gravity = 9.8 m/s^2

Calculate the velocity of the stone as it hits the water.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.

[4 marks]

Velocity (2 significant figures) = _____ m/s

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0 6 . 2 Velocity is a vector.

Describe the velocity of the stone as it falls through the air.

Assume there is no air resistance.

[2 marks]

Question 6 continues on the next page

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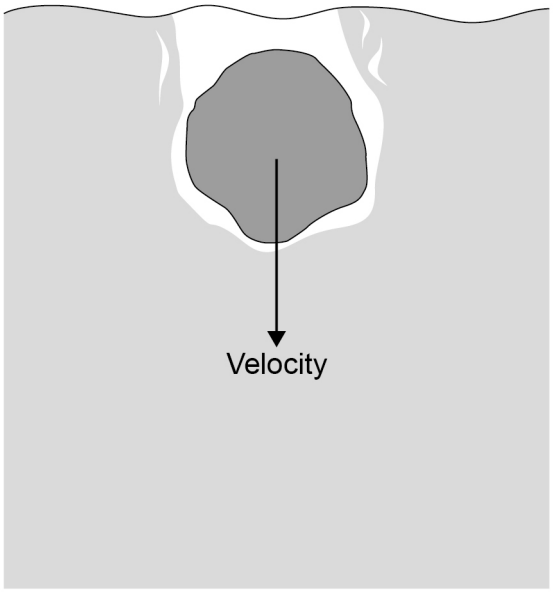
0 6 . 3 **Figure 10** shows the stone just after it has entered the water.

Figure 10



As the stone moves through the water, the stone slows to a constant velocity.

Explain why.

[4 marks]

10

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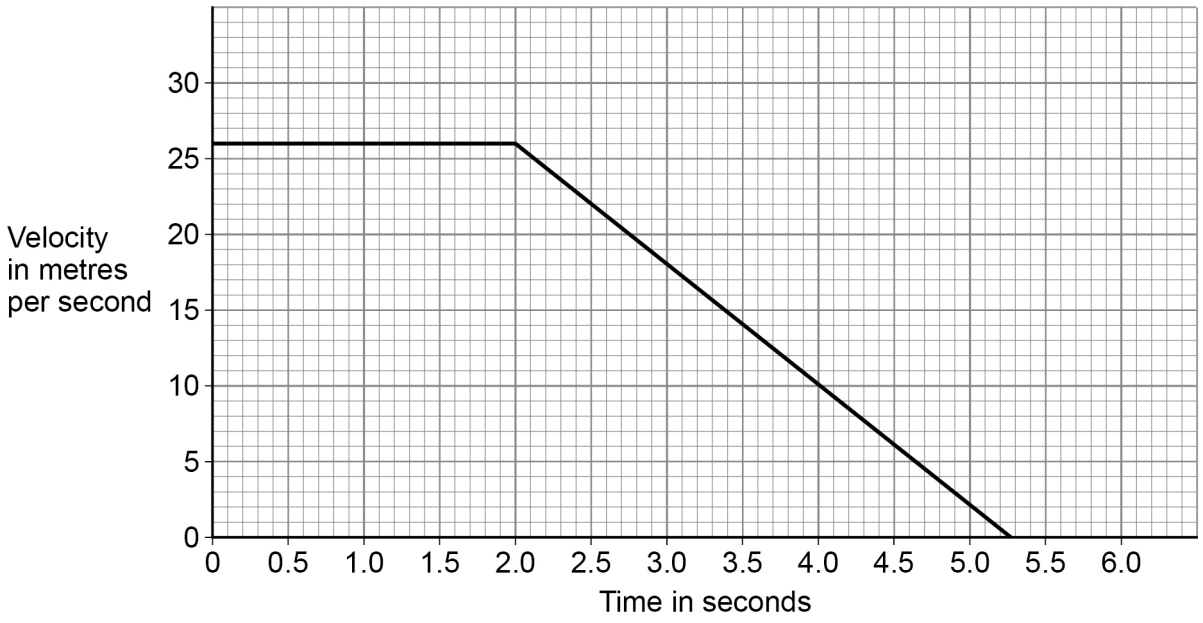
0 7 A car contains a device called a black box. The black box records the velocity and acceleration of the car.

The car was travelling at a constant velocity. The driver then reacted to a hazard.

Figure 11 shows the velocity–time graph for the car.

Figure 11



0 7 . 1 Determine the deceleration of the car.

Give the unit.

[3 marks]

Deceleration = _____ Unit _____

Do not write outside the box

0 7 . 2 The driver of the car has a reaction time of 0.75 s.

Determine the stopping distance of the car.

Use the Physics Equations Sheet.

Use **Figure 11**.

[5 marks]

Stopping distance = _____ m

0 7 . 3 If the black box records large decelerations, it identifies that the driving may be dangerous.

Explain why large decelerations may be dangerous.

[2 marks]

10

END OF QUESTIONS

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