



Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

Centre Number \_\_\_\_\_

Candidate Number \_\_\_\_\_

Candidate Signature \_\_\_\_\_

I declare this is my own work.

**GCSE**

**COMBINED SCIENCE: TRILOGY**

**H**

Higher Tier

Physics Paper 2H

**8464/P/2H**

Friday 14 June 2024

Afternoon

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



J U N 2 4 8 4 6 4 P 2 H 0 1

## **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.**
- **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.**



## **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.**

**DO NOT TURN OVER UNTIL TOLD TO DO SO**

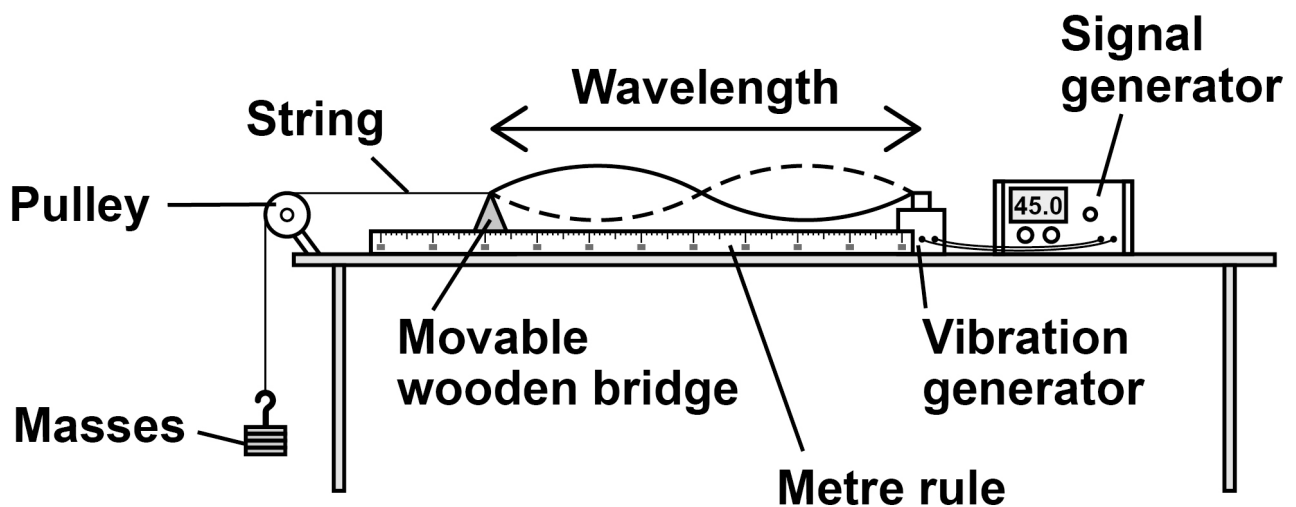


01

A teacher demonstrated how the frequency of a wave on a string affects the wavelength of the wave.

FIGURE 1 shows the equipment used.

FIGURE 1



The frequency of the signal generator is adjusted so that the wave shown in FIGURE 1 is seen.

At this frequency the string vibrates between the two positions shown in FIGURE 1.





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Use the Physics Equations Sheet to answer questions 01.2 and 01.3.

01.2

Which equation links frequency ( $f$ ), wavelength ( $\lambda$ ) and wave speed ( $v$ )? [1 mark]

Tick (✓) ONE box.

$$f = \lambda \times v$$

$$\lambda = f \times v$$

$$v = f \times \lambda$$



0	1	.	3
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The wave on the string has a frequency of 45.0 Hz.

The wave speed is 35.1 m/s.

Calculate the wavelength of the wave. [3 marks]

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Wavelength = \_\_\_\_\_ m

[Turn over]

8



0 2

**FIGURE 2** shows an Olympic gymnast performing a floor routine.

**FIGURE 2**



**The floor contains springs.**

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



0	2	.	1
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**When a spring is compressed, the elastic potential energy of the spring increases.**

**Explain why compressing the springs in the floor helps the gymnast to jump higher.**

**Use ideas about energy in your answer. [2 marks]**

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**[Turn over]**



0	2	.	2
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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]

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Elastic potential energy = \_\_\_\_\_

Unit \_\_\_\_\_



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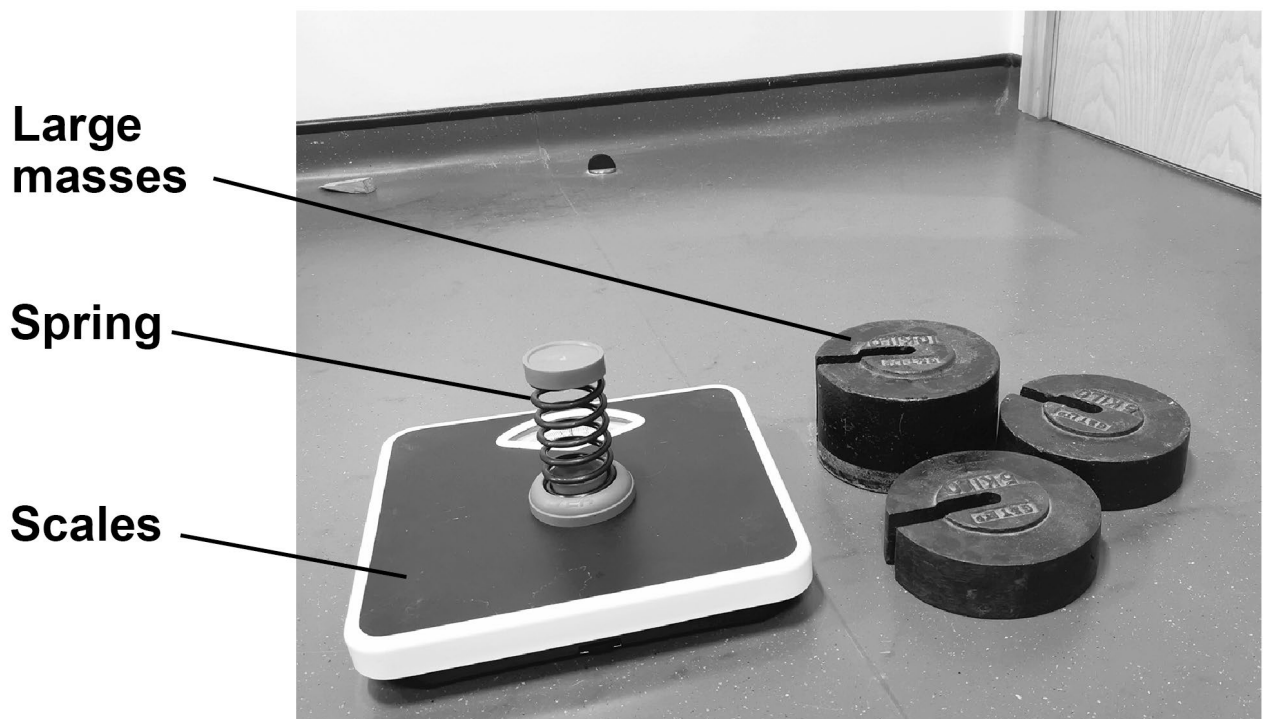
A student investigated a spring with a different spring constant.

When masses are placed on the spring it compresses.

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

FIGURE 3 shows some of the equipment used.

FIGURE 3



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**Describe how the compression of the spring could be determined. [2 marks]**

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**[Turn over]**



0	2	.	4
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**Explain why the investigation should be done on the laboratory floor rather than on a table. [2 marks]**

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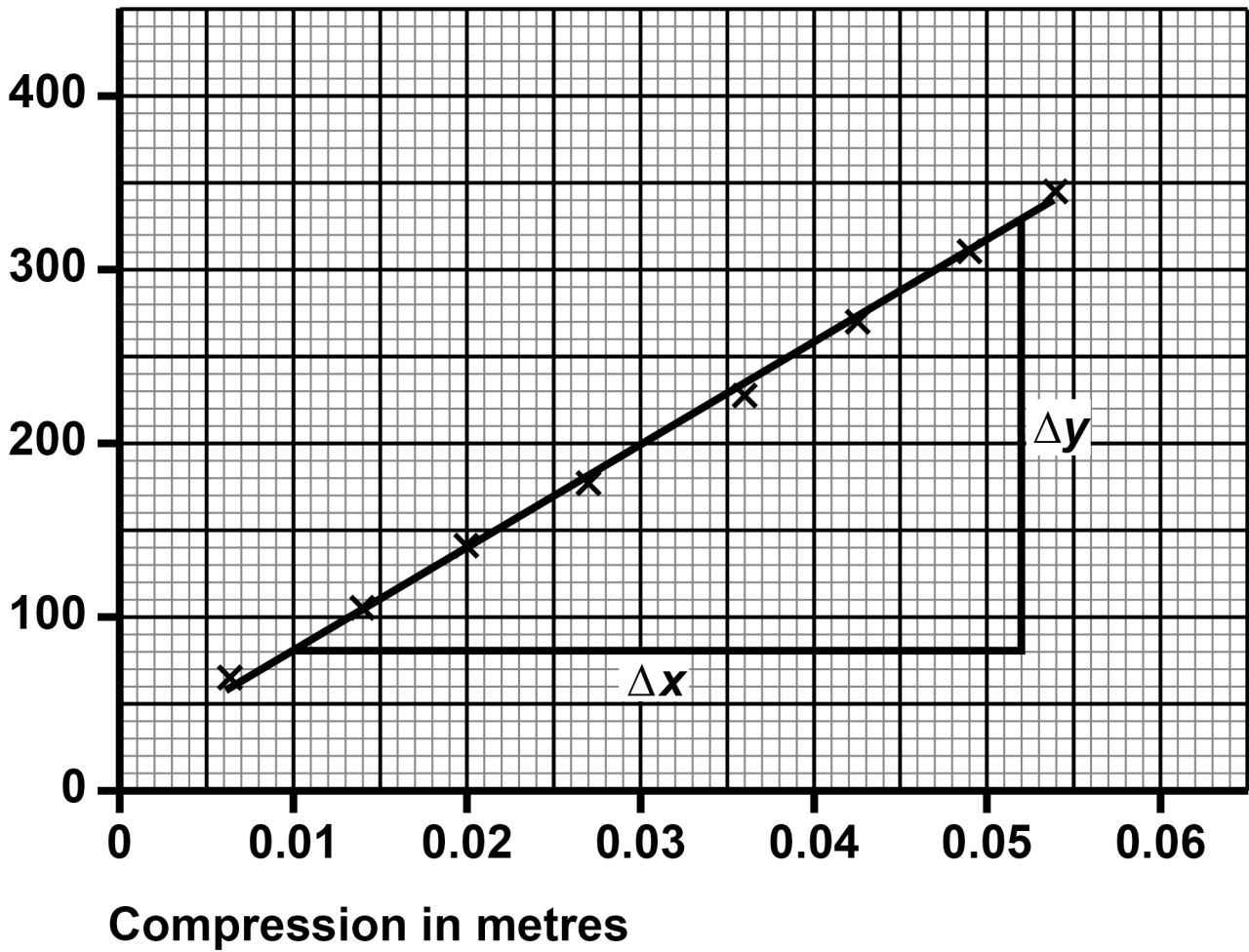
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FIGURE 4 shows the results.

FIGURE 4

Force in  
newtons



The spring constant is the gradient of the line of best fit shown on FIGURE 4.

0 2 . 5

Determine the value  $\Delta y$  on FIGURE 4. [1 mark]

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$\Delta y =$  \_\_\_\_\_ N

0 2 . 6

Determine the value  $\Delta x$  on FIGURE 4. [1 mark]

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$\Delta x =$  \_\_\_\_\_ m

[Turn over]



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**02.7**

Determine the spring constant of the spring.

Use your answers to Question 02.5 and Question 02.6.

Give your answer to 3 significant figures. [2 marks]

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Spring constant (3 significant figures) =

\_\_\_\_\_ N/m

[Turn over]

14



0	3
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**Electromagnetic waves are grouped according to their wavelength and frequency.**

**Electromagnetic waves are transverse waves and can travel through a vacuum.**

0	3	.	1
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**Give one OTHER property that is the same for all types of electromagnetic wave. [1 mark]**

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0	3	.	2
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**What is meant by 'transverse wave'? [1 mark]**

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0	3	.	3
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**Which group of electromagnetic waves is used for satellite communications? [1 mark]**

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0	3	.	4
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**Visible light is the only group of electromagnetic waves that the human eye can detect.**

**Which colour of visible light has the shortest wavelength? [1 mark]**

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**[Turn over]**



**03.5**

**The three highest frequency groups of electromagnetic waves are hazardous.**

**Describe a risk linked to each group of high frequency electromagnetic wave. [2 marks]**

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**[Turn over]**



**FIGURE 5** shows a person using a mobile phone to allow a laptop to access the Internet.

**FIGURE 5**



**Mobile phone**

**Laptop**

**The electromagnetic waves emitted by the mobile phone send information to the laptop.**

0	3	.	6
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The electromagnetic waves emitted by the mobile phone have a period of  $4.0 \times 10^{-10}$  s.

Calculate the frequency of the waves.

Use the Physics Equations Sheet.

Give your answer in standard form. [3 marks]

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Frequency (in standard form) = \_\_\_\_\_ Hz

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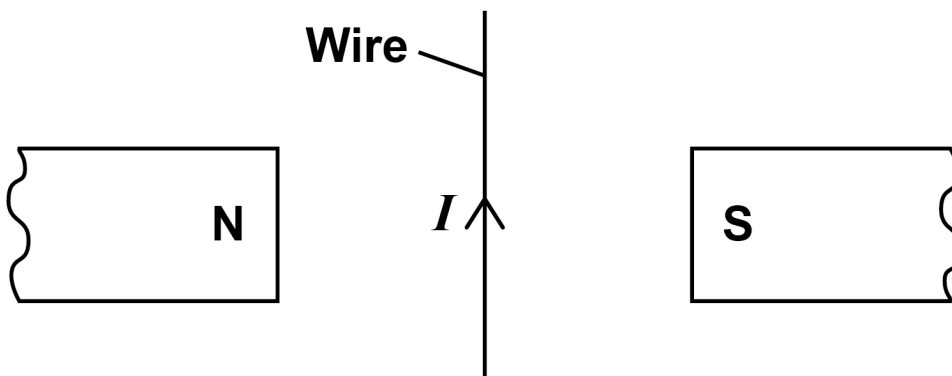


04

FIGURE 6 shows two magnets and a wire.

There is a current in the wire.

FIGURE 6



0	4	.	1
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**A force acts on the wire in FIGURE 6.**

**What is the direction of the force on the wire? [1 mark]**

**Tick (✓) ONE box.**

**Into the page**

**Out of the page**

**To the left**

**To the right**

**[Turn over]**



**04.2**

The length of the wire in the magnetic field between the magnets is 80 mm.

The current in the wire is 4.6 A.

The force on the wire is 0.092 N.

Calculate the magnetic flux density between the magnets.

Use the Physics Equations Sheet.

Give the unit. [4 marks]

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**Magnetic flux density =** \_\_\_\_\_

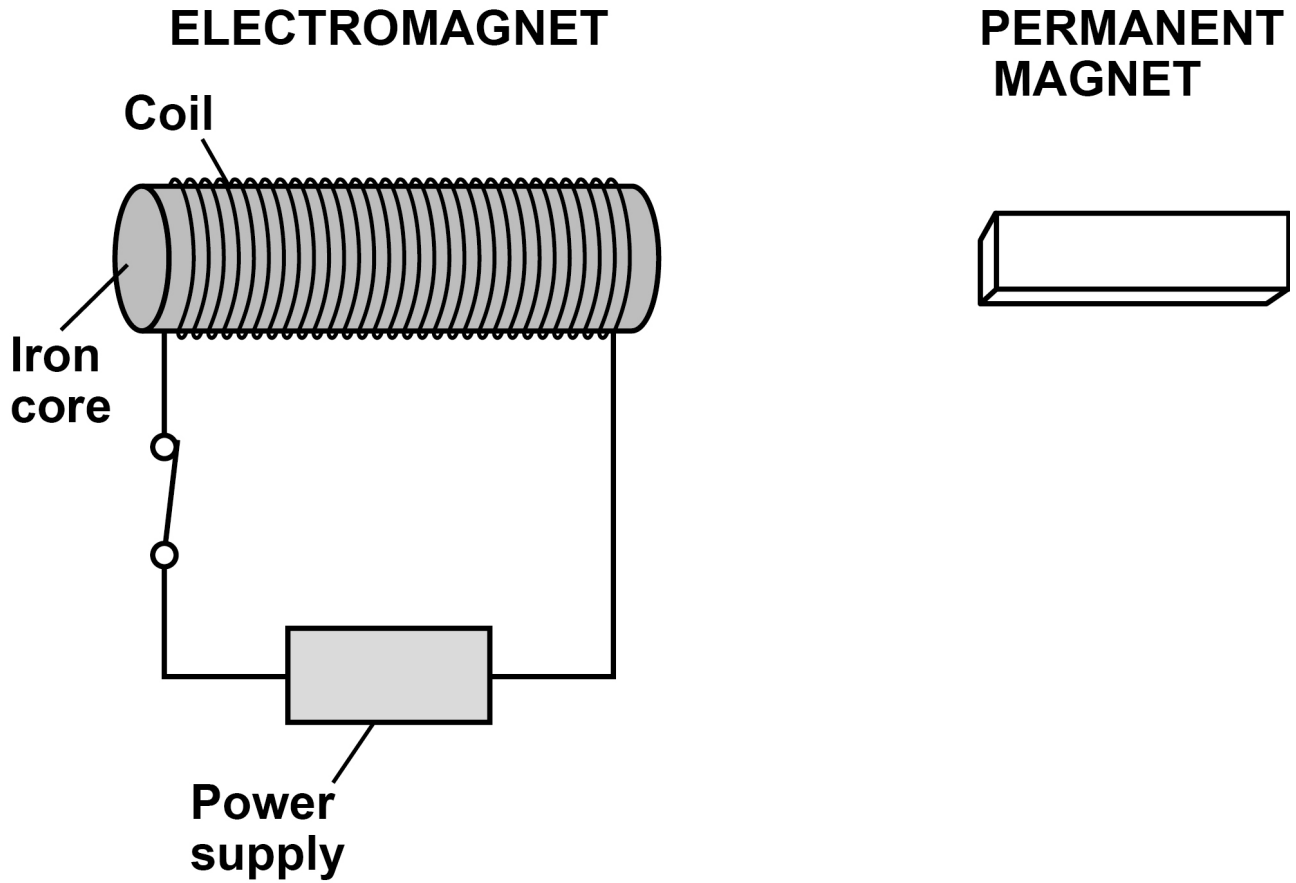
**Unit** \_\_\_\_\_

**[Turn over]**



**FIGURE 7** shows an electromagnet close to a permanent magnet.

**FIGURE 7**



**0 4 . 3**

**The electromagnet exerts a force on the permanent magnet.**

**The permanent magnet exerts an equal and opposite force on the electromagnet.**

**Which law is this an example of? [1 mark]**

**Tick (✓) ONE box.**

**Newton's first law**

**Newton's second law**

**Newton's third law**

**[Turn over]**



0	4	.	4
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**Give TWO changes to the electromagnet that would increase the force exerted on the permanent magnet.  
[2 marks]**

1

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2

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0	4	.	5
---	---	---	---

**Give TWO changes to the electromagnet that would reverse the direction of the force exerted on the permanent magnet. [2 marks]**

1

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2

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**[Turn over]**

10



0	5
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**A safety test was carried out to determine how the speed of a car affects the stopping distance of the car.**

0	5	.	1
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**At the start of the test the car was moving slowly.**

**Then the car accelerated at  $5.8 \text{ m/s}^2$  for 2.5 s.**

**The final velocity of the car was 20 m/s.**

**Calculate the initial velocity of the car.**

**Use the Physics Equations Sheet. [4 marks]**

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Initial velocity = \_\_\_\_\_ m/s

0 5 . 2

The reaction time of the driver was measured.

How can the reaction time of the driver be used to calculate the thinking distance? [1 mark]

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[Turn over]



The car was driven at a constant speed. The driver applied the maximum braking force, and the braking distance was measured.

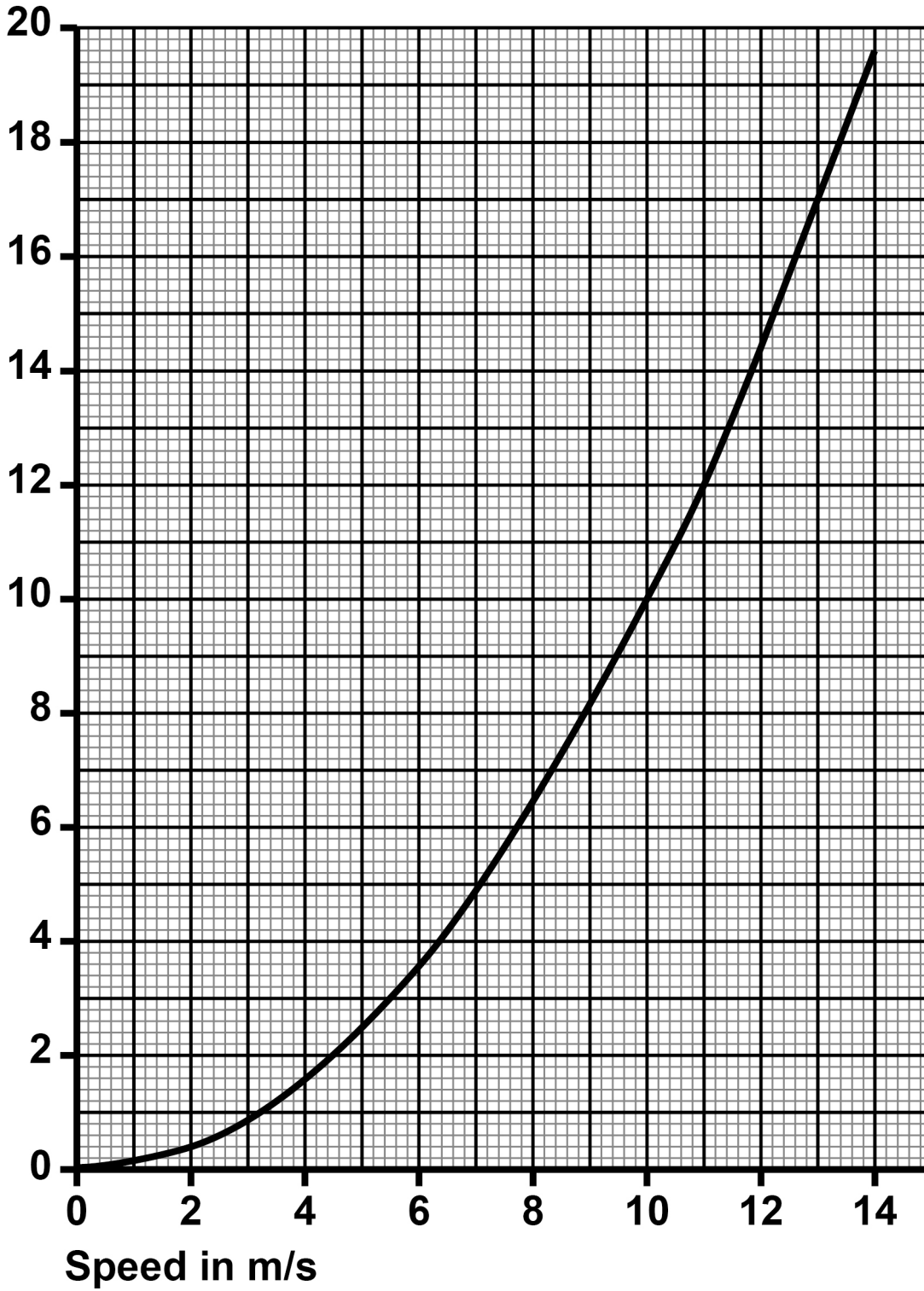
The test was repeated at different speeds.

FIGURE 8, on the opposite page, shows the results.



FIGURE 8

Braking  
distance  
in m



[Turn over]



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05.3

Which of the following gives the relationship between the speed and the braking distance? [1 mark]

Tick (✓) ONE box.

braking distance  $\propto \frac{1}{\text{speed}}$

braking distance  $\propto \text{speed}$

braking distance  $\propto \text{speed}^2$

[Turn over]



0	5	.	4
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**During one test the brakes were applied with a force of 6250 N.**

**The deceleration of the car was  $5.0 \text{ m/s}^2$ .**

**The braking distance of the car was 14.4 m.**

**Determine the momentum of the car before the brakes were applied.**

**Use the Physics Equations Sheet.**

**Use FIGURE 8, on page 39. [6 marks]**

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Momentum = \_\_\_\_\_ kg m/s

[Turn over]

12



0	6
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Rockets have been developed so that people who are not trained astronauts can pay to travel to space.

**FIGURE 9** shows the passenger module and the propulsion module of a rocket.

The propulsion module burns a large volume of fuel.

**FIGURE 9**

Passenger  
module

Propulsion  
module



0	6	.	1
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The rocket was initially stationary on the ground.

Then the rocket accelerated upwards until it reached a height of 40 km.

The constant acceleration of the rocket was  $6.48 \text{ m/s}^2$ .

Calculate the velocity of the rocket at a height of 40 km.

Use the Physics Equations Sheet. [4 marks]

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[Turn over]



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**Velocity = \_\_\_\_\_ m/s**







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**[Turn over]**

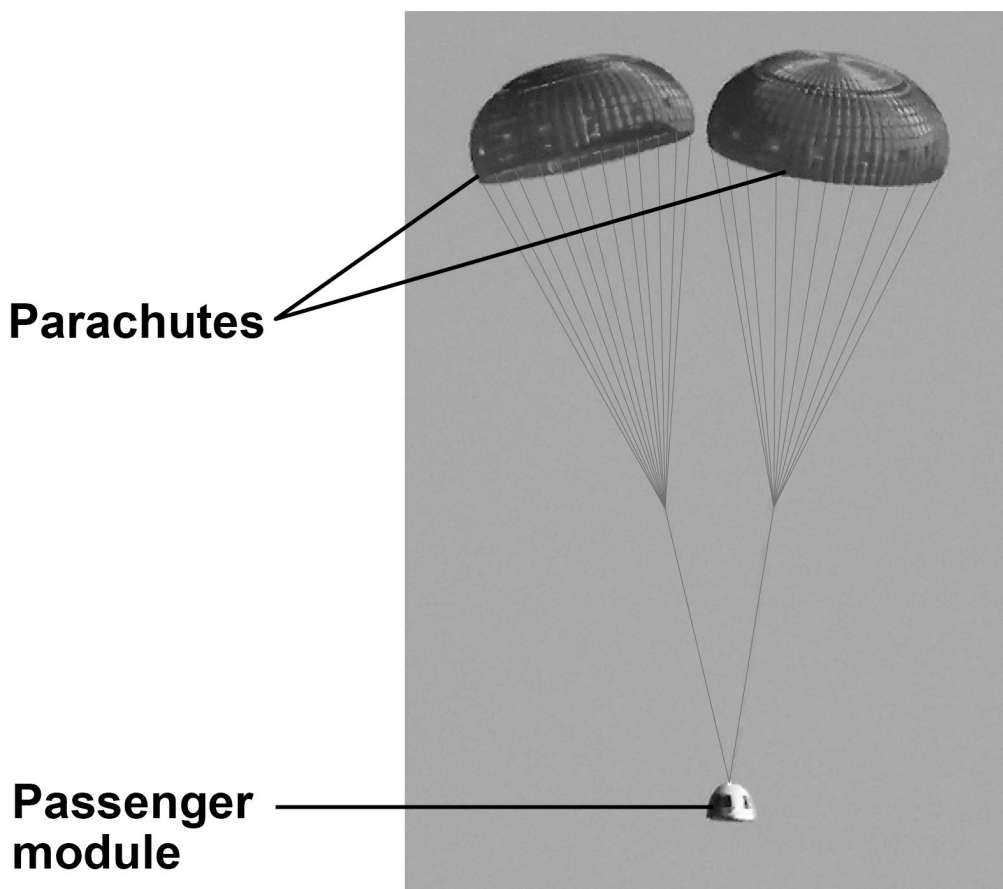


**06.4**

At a height of 60 km the two modules of the rocket separated and the passenger module fell back to Earth.

FIGURE 10 shows the passenger module falling towards the Earth's surface.

FIGURE 10









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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
<b>TOTAL</b>	

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