AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE PHYSICS

H

Higher Tier Paper 2

Monday 16 June 2025 Morning Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator
- a protractor
- 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.
- Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- 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).
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Information
- The maximum mark for this paper is 100.
- 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.

Answer **all** questions in the spaces provided.

0 1 In a thunderstorm, lightning produces visible light waves and sound waves.

0 1 . 1 Describe the similarities and differences between visible light waves and sound waves.

[6 marks]

Do not write outside the box

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

0 1 . 2 Which equation links distance (*s*), speed (*v*) and time (*t*)?

[1 mark]

Tick (✓) **one** box.

speed = distance × time ☐

speed = $\frac{\text{distance}}{\text{time}}$ ☐

speed = $\frac{\text{time}}{\text{distance}}$ ☐

0 1 . 3 Lightning strikes the ground 13 200 m from a student.

The speed of sound in air is 330 m/s.

Calculate the time taken for the sound created by the lightning strike to reach the student.

[3 marks]

Time = _____ s

10

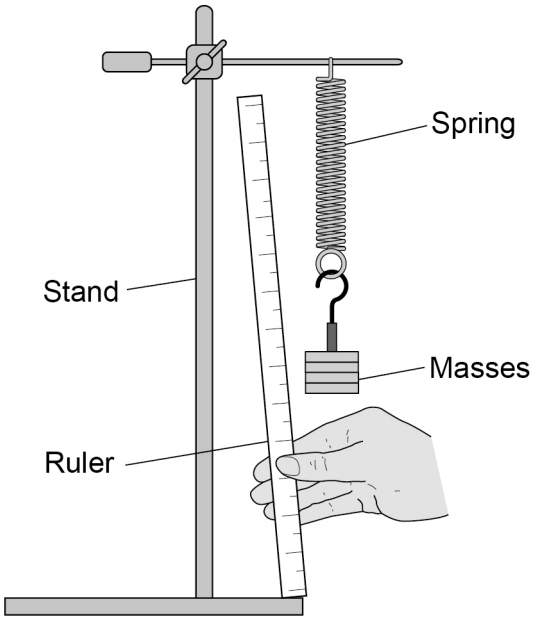
Turn over for the next question

Do not write outside the box

0 2 A student investigated how the force applied to a spring affects the length of the spring.

Figure 1 shows the apparatus used.

Figure 1



0 2 . 1 What is the independent variable in this investigation?

[1 mark]

_____

0 2 . 2 Describe **one** risk of harm in this investigation and a safety precaution to reduce the risk.

[2 marks]

Risk of harm _____

_____

Safety precaution _____

_____

Do not write outside the box

0 2 . 3 The student measured the length of the spring using the arrangement shown in **Figure 1**.

Give **two** ways the student could have changed the arrangement to improve the accuracy of the measurement.

[2 marks]

1 _____

_____

2 _____

_____

Question 2 continues on the next page

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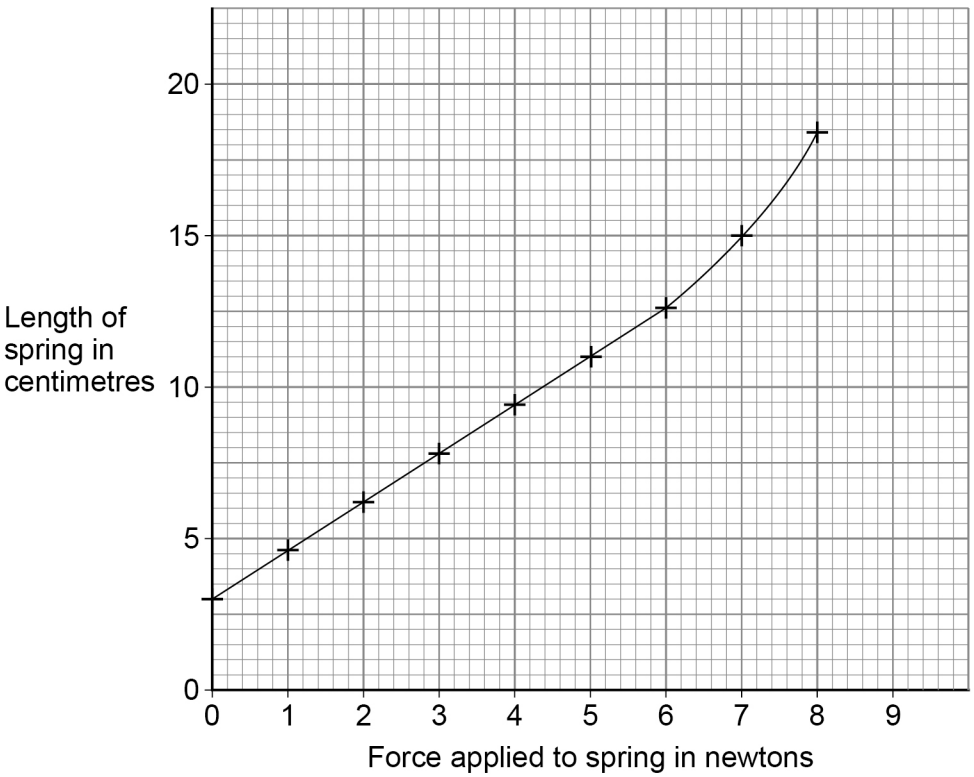
The student recorded accurate values for the length of the spring as the mass on the spring increased.

The student calculated the force applied to the spring by each mass.

Figure 2 shows the results.

Figure 2



0 2 . 4 Why does the line on the graph **not** pass through the origin?

[1 mark]

Do not write outside the box

0 2 . 5 Above 6.0 N the line on **Figure 2** curves upwards.

Explain why.

[2 marks]

Use the Physics Equations Sheet to answer questions **02.6** and **02.7**.

0 2 . 6 Which equation links extension (*e*), force (*F*) and spring constant (*k*)?

[1 mark]

Tick (✓) **one** box.

force = spring constant × extension ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

0 2 . 7 When the force on the spring is 4.0 N, the extension of the spring is 0.064 m.

Calculate the spring constant of the spring.

[3 marks]

Spring constant = _____ N/m

12

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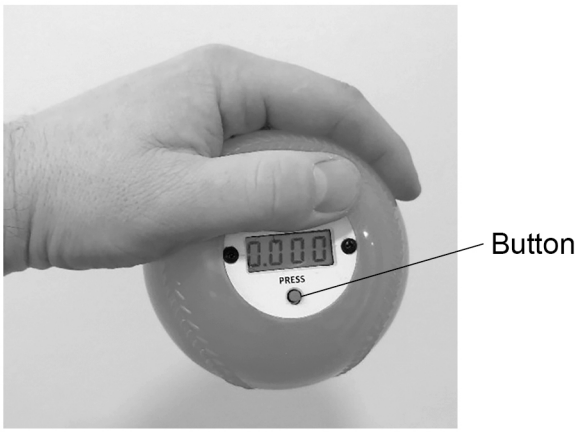
0 3 A student investigated the acceleration of a ball dropped from different heights.

Figure 3 shows a 'gravity ball' that the student used.

Figure 3



The button on the gravity ball starts the stopwatch.

When the gravity ball hits the floor, the stopwatch stops.

This is the method used.

1. Measure a vertical height above the floor.
2. Hold the gravity ball at the measured height.
3. Start the stopwatch on the gravity ball and drop the gravity ball.
4. Record the time shown on the stopwatch.
5. Repeat steps 1 to 4 using the same height.
6. Repeat steps 1 to 5 using different heights.

Do not write outside the box

0 3 . 1 The student dropped the ball from the same height five times and recorded the following results.

0.49 s 0.51 s 0.58 s 0.56 s 0.61 s

Calculate the uncertainty in these measurements of time.

[2 marks]

Uncertainty = ± _____ s

0 3 . 2 What type of error caused the variation in the measurements of time?

[1 mark]

Tick (✓) **one** box.

Random error ☐

Systematic error ☐

Zero error ☐

0 3 . 3 Suggest **one** reason for the error that caused the variation in the measurements of time.

[1 mark]

Question 3 continues on the next page

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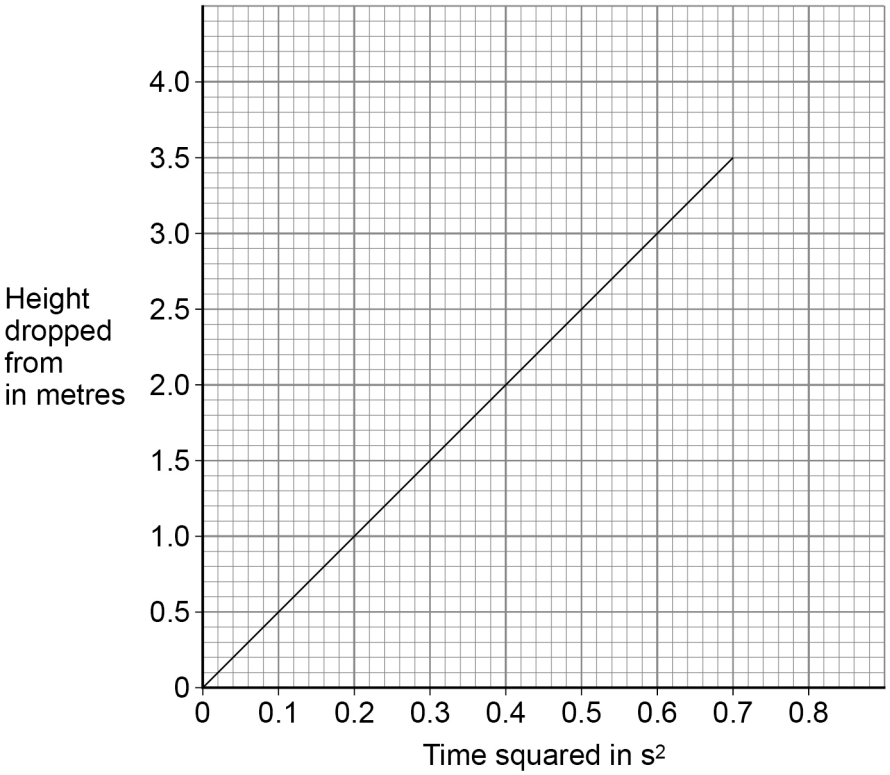
0 3 . 4 **Figure 4** shows a graph of the height the ball was dropped from against the time squared.

Figure 4



The acceleration of the ball can be calculated using the equation:

acceleration = 2 × (gradient of the graph)

Determine the acceleration of the ball.

[3 marks]

Acceleration of ball = _____ m/s²

7

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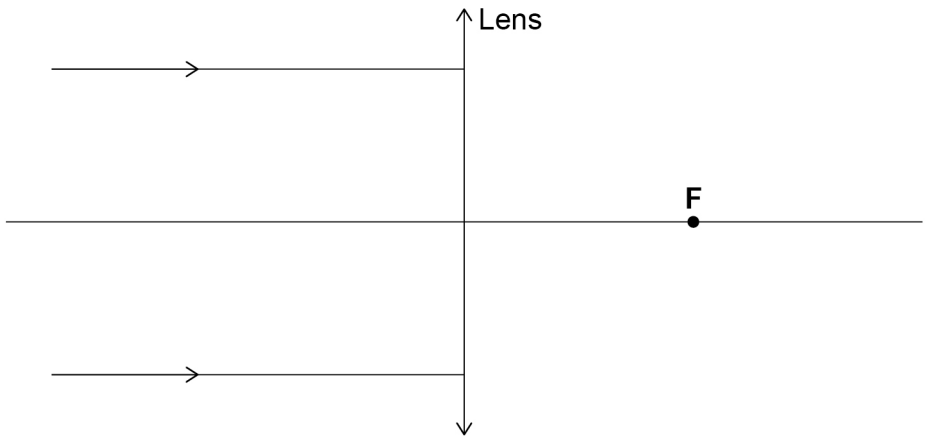
0 4 Telescopes are used to look at distant objects.

Some telescopes use lenses to form an image.

Figure 5 shows two parallel rays of light incident on a lens in a telescope.

The principal focus of the lens is labelled **F**.

Figure 5



0 4 . 1 What type of lens is shown in **Figure 5**?

[1 mark]

0 4 . 2 Complete the ray diagram in **Figure 5**.

[2 marks]

Question 4 continues on the next page

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The James Webb Space Telescope can detect electromagnetic radiation beyond the visible spectrum.

0 4 . 3 The shortest wavelength of electromagnetic radiation that can be detected by the James Webb Space Telescope is 0.60 μm.

speed of electromagnetic radiation = 3.0×10^8 m/s

Calculate the frequency of electromagnetic radiation that has a wavelength of 0.60 μm.

Use the Physics Equations Sheet.

[4 marks]

Frequency = _____ Hz

0 4 . 4 Complete the sentence.

[1 mark]

Electromagnetic radiation detected from distant galaxies is red-shifted.

This means that the electromagnetic radiation shows an increase in

_____.

Do not write outside the box

0 4 . 5 Why is the electromagnetic radiation from distant galaxies red-shifted?

[1 mark]

Tick (✓) **one** box.

All observed light from distant galaxies appears red. ☐

Distant galaxies are moving away from our galaxy. ☐

Distant galaxies are moving at the speed of light. ☐

0 4 . 6 The James Webb Space Telescope has detected electromagnetic radiation from many different galaxies.

Electromagnetic radiation from one of the galaxies detected shows the greatest red-shift ever observed.

What conclusion can be made about the distance to this galaxy?

[1 mark]

0 4 . 7 The James Webb Space Telescope is an artificial satellite that orbits the Sun at a constant speed.

Explain why the velocity of the satellite changes as it orbits the Sun.

[3 marks]

13

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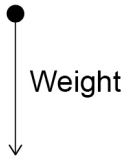
0 5 In a world record attempt, a skydiver jumped from a height of 40 km above the Earth.

0 5 . 1 **Figure 6** shows an incomplete free-body diagram for the skydiver a few seconds after the start of the jump.

Figure 6



The skydiver has not reached terminal velocity.

Complete the free-body diagram in **Figure 6**.

[2 marks]

Do not write outside the box

0 5 . 2 During the first 2.5 minutes the mean acceleration of the skydiver was 0.64 m/s^2.

The initial velocity of the skydiver was 0 m/s.

Calculate the velocity of the skydiver 2.5 minutes after the start of the jump.

Use the Physics Equations Sheet.

[4 marks]

Velocity = _____ m/s

Question 5 continues on the next page

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0 5 . 3 The skydiver accelerated until reaching terminal velocity.

Explain why the skydiver reached terminal velocity.

[4 marks]

0 5 . 4 Explain why the atmospheric pressure acting on the skydiver increased as the skydiver fell.

[2 marks]

Do not write outside the box

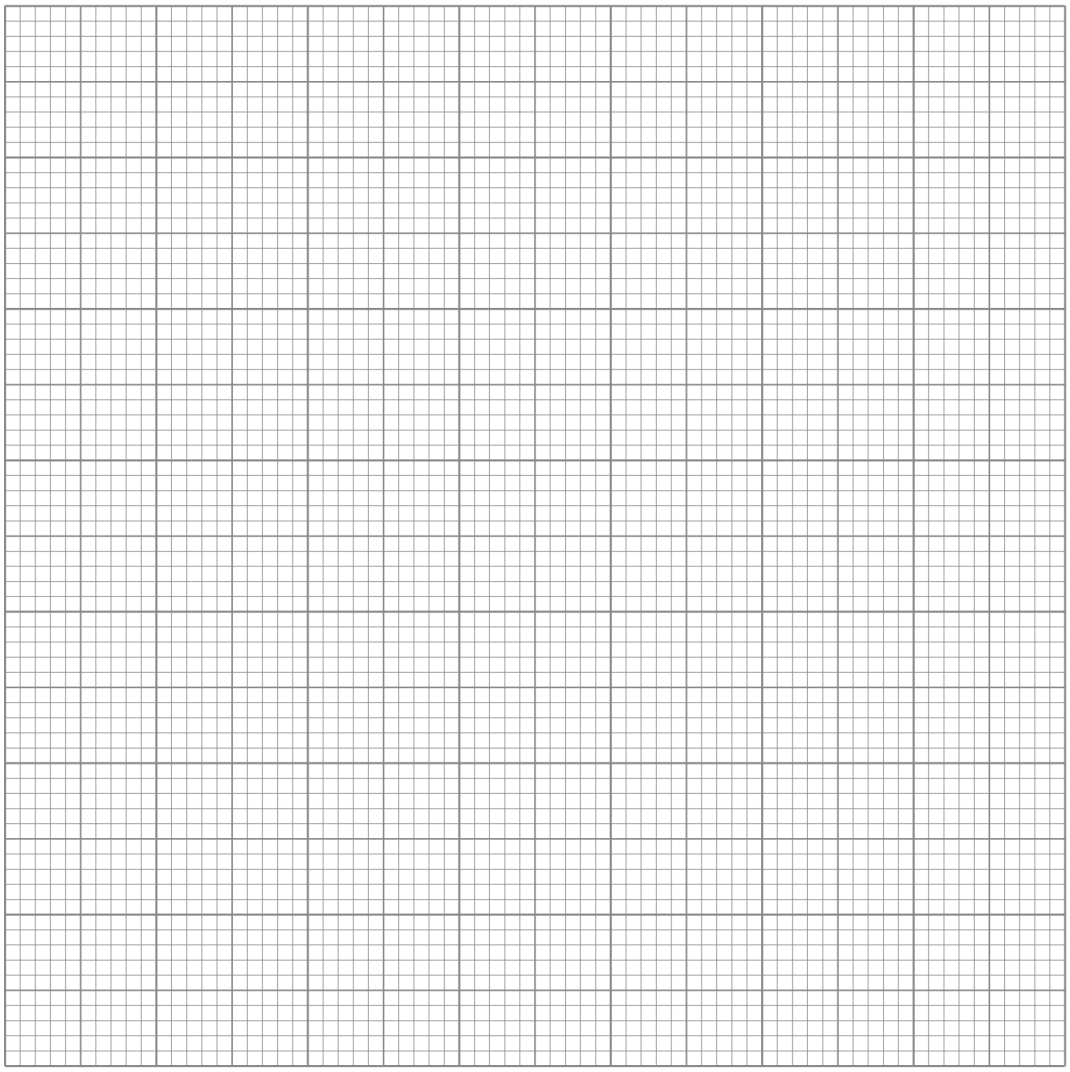
0 5 . 5 The skydiver opened his parachute.

A few seconds after opening the parachute, the resultant vertical force on the skydiver was 240 N upwards.

The wind caused a resultant horizontal force of 200 N to the left on the skydiver.

Draw a vector diagram to determine the resultant force on the skydiver.

[4 marks]



Magnitude of resultant force = _____ N

Angle to vertical of resultant force = _____ degrees

16

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0 6 A car manufacturer makes two cars, **X** and **Y**.

The cars are identical, apart from their mass.

Car **X** has a greater mass than car **Y**.

0 6 . 1 How does the maximum acceleration of car **X** compare with the maximum acceleration of car **Y**?

[1 mark]

0 6 . 2 Cars have air bags that inflate to protect the driver if the car stops very suddenly.

Explain how air bags reduce the chance of injury to the driver.

[3 marks]

Question 6 continues on the next page

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0 6 . 3 Car **X** has a mass of 1400 kg and is travelling at 18 m/s.

The driver applies the brakes.

The car has a constant deceleration and comes to a stop in a distance of 24 m.

Calculate the resultant force on the car.

Use the Physics Equations Sheet.

[5 marks]

Resultant force = _____ N

0 6 . 4 Explain why braking causes an increase in the temperature of the brakes.

[2 marks]

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0 6 . 5 The driver of a car applies the brakes so the car has a large deceleration.

Give **two** possible risks of a large deceleration.

[2 marks]

1 _____

_____

2 _____

_____

13

Turn over for the next question

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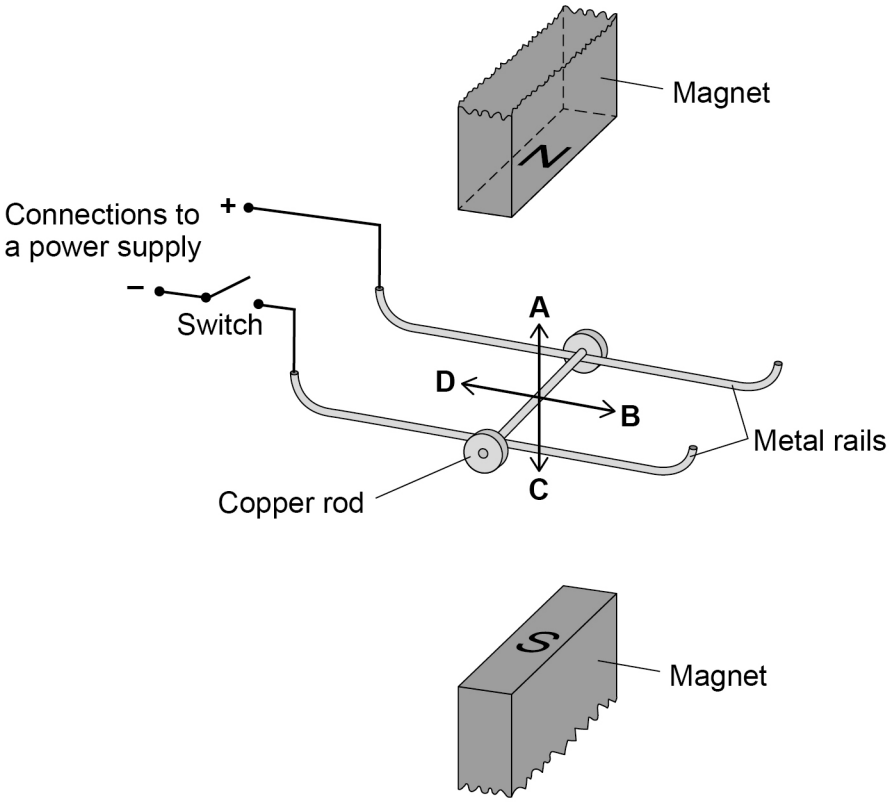
0 7 **Figure 7** shows some apparatus used to demonstrate the motor effect.

Figure 7



When the switch is closed the copper rod accelerates.

0 7 . 1 What direction is the acceleration of the copper rod?

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

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0 7 . 2 The copper rod has a mass of 5.0 g.

The length of the copper rod in the magnetic field is 0.070 m.

The magnetic flux density is 0.30 T.

Calculate the initial acceleration of the rod when the current in the rod is 2.0 A.

Use the Physics Equations Sheet.

[5 marks]

Initial acceleration = _____ m/s^2

Question 7 continues on the next page

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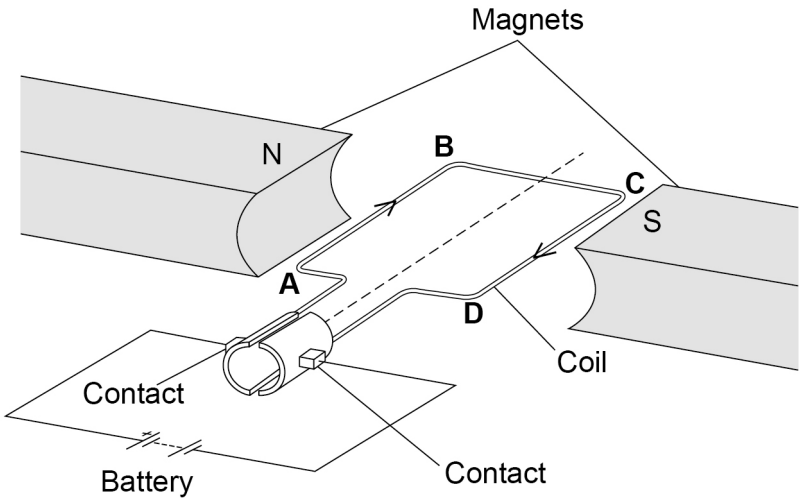
Figure 8 shows a simple motor.

There is a magnetic field between the two permanent magnets.

When there is a current in the coil, a magnetic field is produced around the coil.

Figure 8



0 7 . 3 Explain how these magnetic fields cause the coil to continuously rotate.

[4 marks]

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0 7 . 4 In **Figure 8** the coil of the motor is in a horizontal position.

Explain why the resultant moment on the coil is zero when the coil is in a vertical position.

[2 marks]

12

Turn over for the next question

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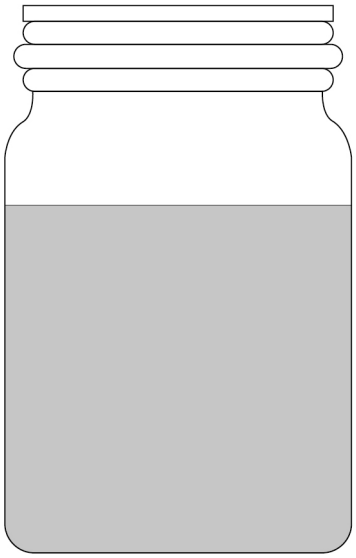
0 8 **Figure 9** shows a jar containing some liquid.

Figure 9



0 8 . 1 The pressure in the liquid causes a force on the inside walls of the jar.

What direction is the force acting on the inside walls of the jar?

[1 mark]

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0 8 . 2 The liquid in the jar has a weight of 1.50 N.

The liquid exerts a pressure of 774 N/m^2 on the base of the jar.

Calculate the area of the base of the jar.

Use the Physics Equations Sheet.

Give your answer to 3 significant figures.

[4 marks]

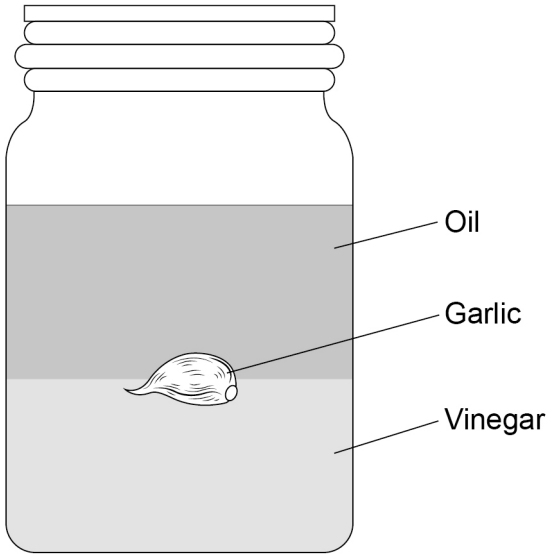
Area (3 significant figures) = _____ m^2

Question 8 continues on the next page

Do not write outside the box

0 8 . 3 **Figure 10** shows a jar containing oil, vinegar and a piece of garlic.

Figure 10



The garlic in **Figure 10** is floating at the boundary between the two liquids.

Explain why there is an upthrust on the garlic.

[4 marks]

9

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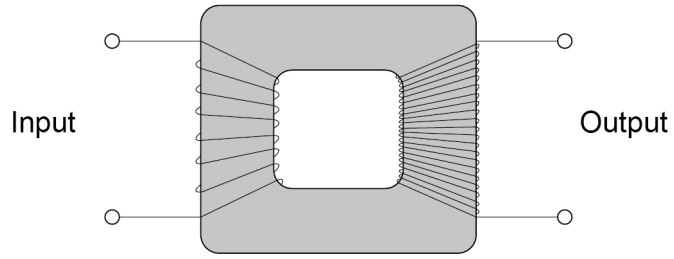
0 9 Transformers are used to change alternating potential differences.

0 9 . 1 **Figure 11** shows a transformer.

Figure 11



Why is the core of the transformer made from iron?

[1 mark]

Question 9 continues on the next page

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0 9 . 2 A transformer has 345 turns on the primary coil and 6000 turns on the secondary coil.

The potential difference across the secondary coil is 400 kV.

Calculate the potential difference across the primary coil.

Use the Physics Equations Sheet.

Give your answer in volts.

[4 marks]

Potential difference = _____ V

0 9 . 3 There is an alternating current in the primary coil of a transformer.

Explain why there is an alternating potential difference across the ends of the secondary coil of the transformer.

[3 marks]

8

END OF QUESTIONS

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