Surname	
Other Names	
Candidate Signature	

AQA

General Certificate of Secondary Education
Higher Tier
June 2012

Physics

PHY3H

Unit Physics P3

H

Written Paper

Wednesday 30 May 2012   1.30 pm to 2.15 pm

For this paper you must have:
● a ruler.
You may use a calculator.

Time allowed
● 45 minutes

Instructions
● Use black ink or black ball-point pen.
● Fill in the boxes at the top of this page.
● Answer **all** questions.
● You must answer the 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.

Information
● The marks for questions are shown in brackets.
● The maximum mark for this paper is 45.
● You are expected to use a calculator where appropriate.
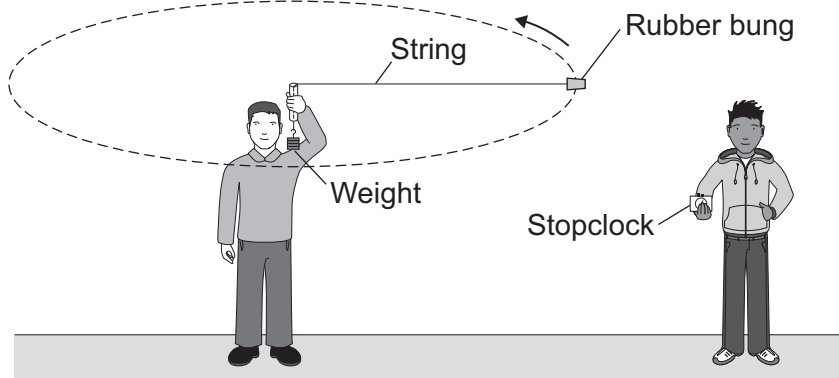● You are reminded of the need for good English and clear presentation in your answers.

Advice
● In all calculations, show clearly how you work out your answer.

PHY3H

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

1 The diagram shows the apparatus used by two students to find out how the centripetal force acting on an object affects the speed of the object.

1 (a) (i) In which direction does the centripetal force act on the rubber bung?

....
(1 mark)

1 (a) (ii) In this investigation, what provides the centripetal force?

....

....
(1 mark)

1 (b) One student swung the rubber bung around in a circle at constant speed. The second student timed how long it took the rubber bung to complete 10 rotations. The students then calculated the speed of the rubber bung, using the radius of the circle and the time to complete one rotation. The students repeated this for several different values of centripetal force.

1 (b) (i) During the investigation, the radius of the circle and the mass of the rubber bung were not changed.

Explain why.

....

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....

....
(2 marks)

1 (b) (ii) One of the variables in this investigation was the time taken by the rubber bung to complete 10 rotations.

Which **two** words can be used to describe this variable?

Draw a ring around each of your **two** answers.

    continuous   **control**   **dependent**   **independent**
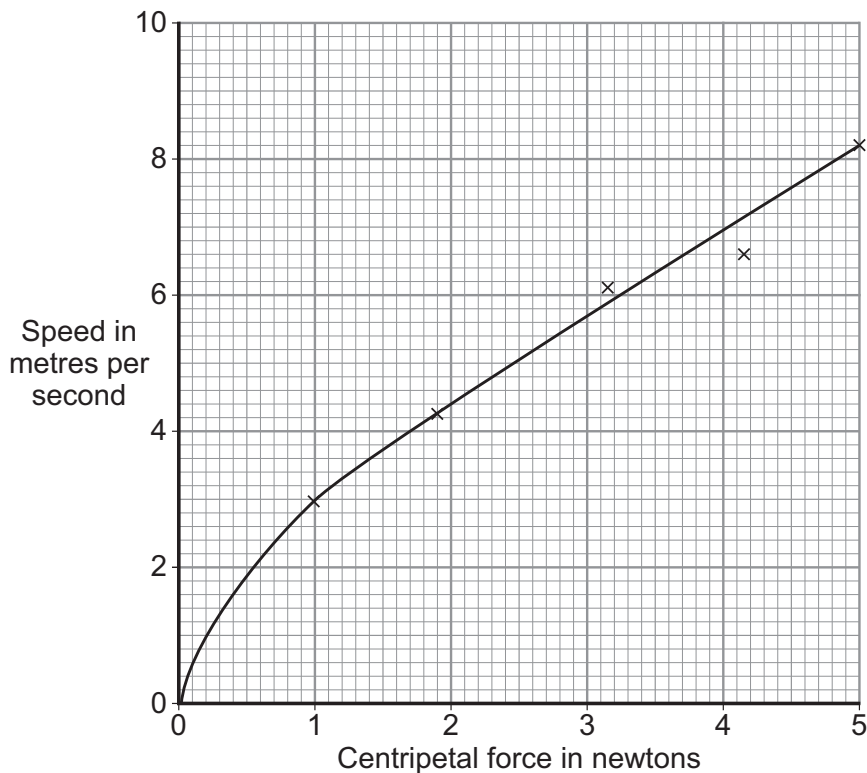
(1 mark)

1 (b) (iii) The students timed 10 rotations of the rubber bung, rather than just one rotation.

Suggest why.

....

....

(1 mark)

1 (c) The graph shows the students' data.

There is a relationship between the speed of an object moving in a circle and the centripetal force acting on the object.

What conclusion about this relationship can the students make from their data?

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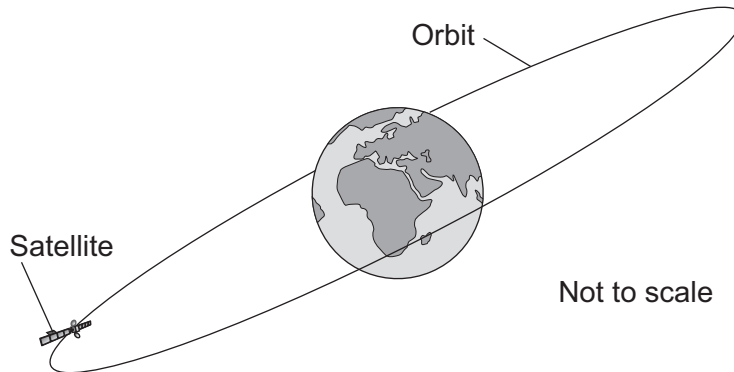
(1 mark)

Question 1 continues on the next page

Turn over ▶

1 (d) The diagram shows a satellite in a circular orbit above the Earth.
The satellite is part of the global positioning system (GPS).
The satellite orbits the Earth **twice** every 24 hours.

Orbit

Satellite

Not to scale

1 (d) (i) What provides the centripetal force needed to keep the satellite in its orbit around the Earth?

....

(1 mark)

1 (d) (ii) Is this satellite in a geostationary orbit?

Draw a ring around your answer. **Yes** **No**

Give a reason for your answer.

....

....

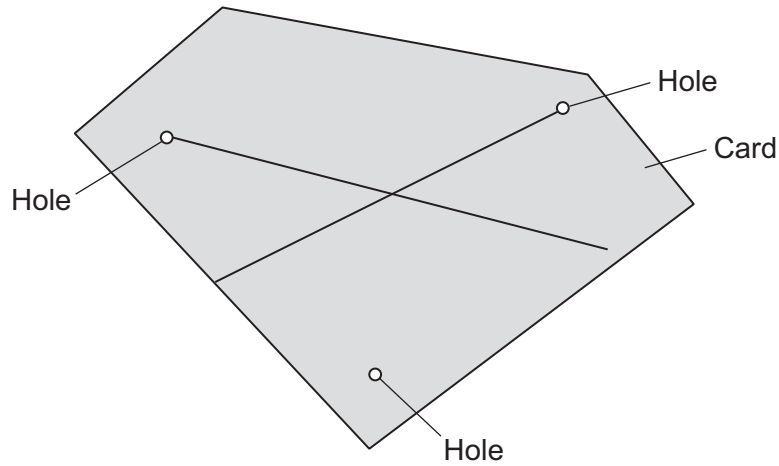*(1 mark)*

9

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Turn over ▶

0 5

2 A student was asked to find the centre of mass of a thin sheet of card. The diagram shows the result of the student's experiment. The student drew two lines onto the card. The centre of mass is where the two lines cross.

Hole

Card

Hole

Hole

2 (a) Describe how the student found the correct positions to draw the **two** lines. You may include a labelled diagram in your answer.

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(3 marks)

2 (b) Explain how the student can check that the position found for the centre of mass is accurate.

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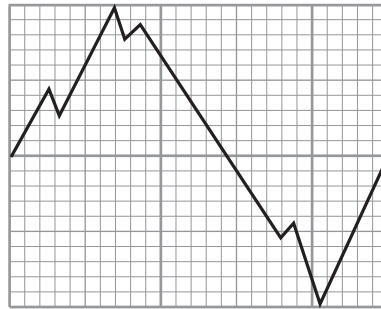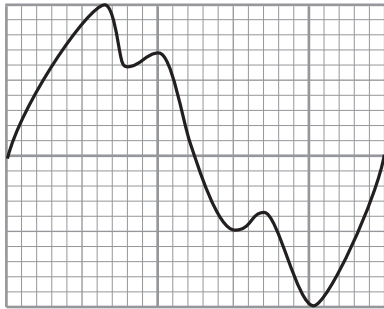
(2 marks)

5

Turn over for the next question

Turn over ▶

3 (a) The diagrams show the waveform for a musical note played on two different instruments. The notes have the same pitch.

3 (a) (i) Apart from pitch, in what other way are the two notes the same?

....

(1 mark)

3 (a) (ii) In what way are the two notes different?

....

(1 mark)

3 (b) Listening to loud music can damage hearing.

3 (b) (i) What property of a sound wave determines the loudness of the sound?

....

(1 mark)

3 (b) (ii) The music played at an indoor concert may sound louder than the same music played equally loudly at an outdoor concert.

Suggest why.

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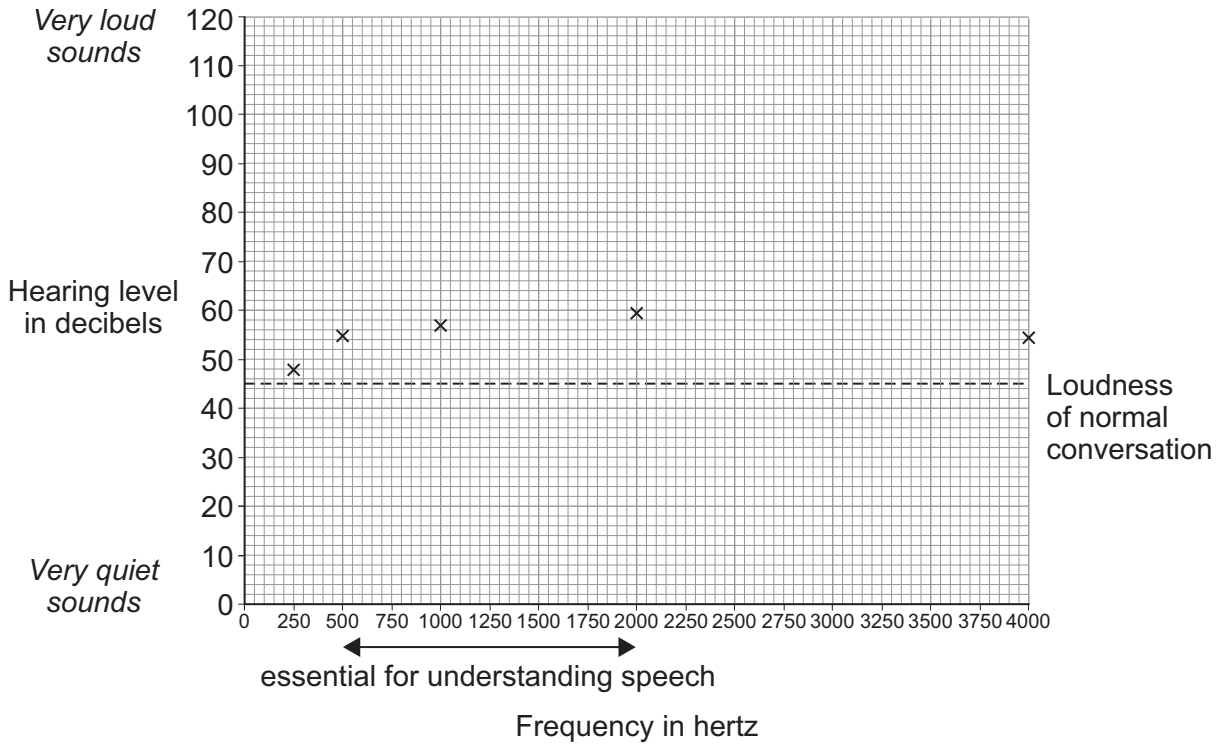
(1 mark)

3 (c) An audiogram displays the quietest sounds that a person can hear at particular frequencies.

The diagram shows an audiogram for a person with damaged hearing. Also shown on the audiogram are the frequencies that are needed for understanding speech.

3 (c) (i) Without a hearing aid, this person can hear people only when they talk loudly.

Explain why.

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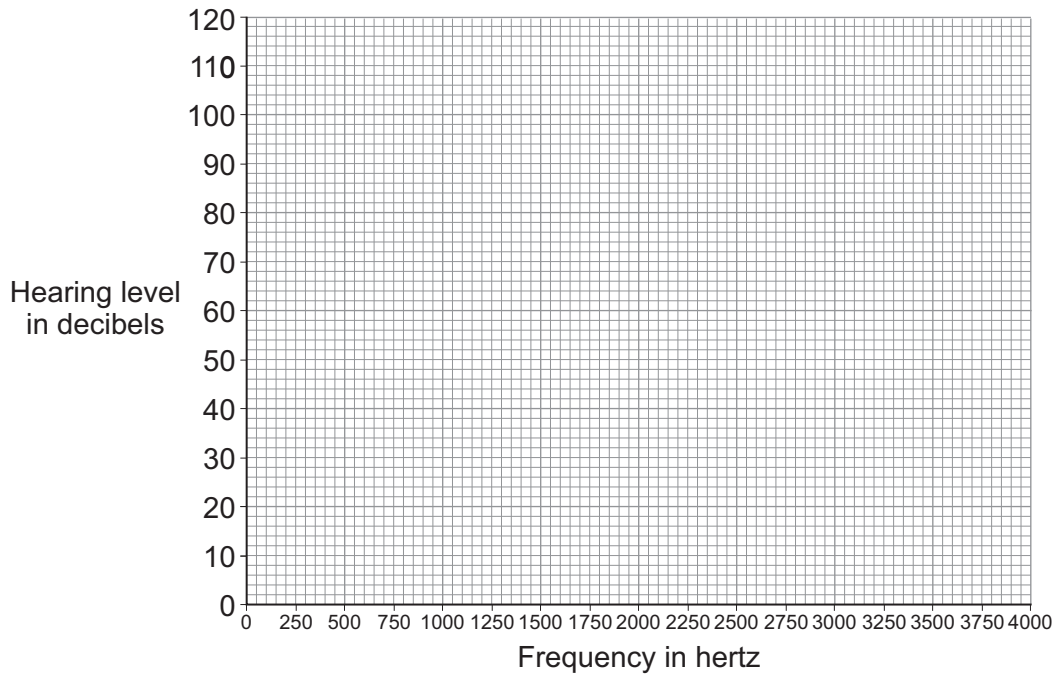
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Question 3 continues on the next page
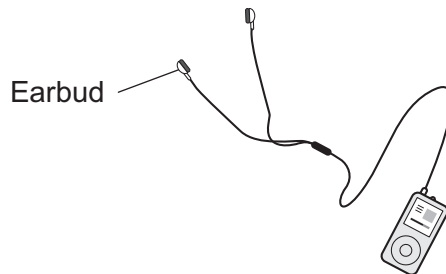
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3 (c) (ii) Someone with normal hearing can hear all frequencies at sound levels below 20 decibels. By drawing crosses (x) on the grid below, complete an audiogram for a person with normal hearing.

Hearing level in decibels (y-axis, 0 to 120)

Frequency in hertz (x-axis, 0 to 4000)

(1 mark)

3 (c) (iii) Research has shown that many teenagers are now showing signs of damaged hearing. Although the evidence is not conclusive, there is a strong suggestion that listening to loud music through earbuds is partly to blame.

Earbud

It is important that teenagers understand the possible risk of listening to loud music through earbuds.

Suggest why.

....

....

....

(1 mark)

8

Turn over for the next question

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Turn over ▶

4 (a) Different shaped lenses are used to correct different types of eye defect.

The diagram shows the type of lens used to correct a defect called short-sight.

What name is given to a lens with this shape?

....
(1 mark)

4 (b) The diagram below shows the positions of an object and a lens. The lens is represented by a vertical line. Someone looking through the lens can see an image of the object.

4 (b) (i) On the diagram, use a ruler to draw two rays from the top of the object, to show how and where the image is formed. Use an arrow to represent the image. The arrow should be drawn to the correct size and at the correct position.

Object

F
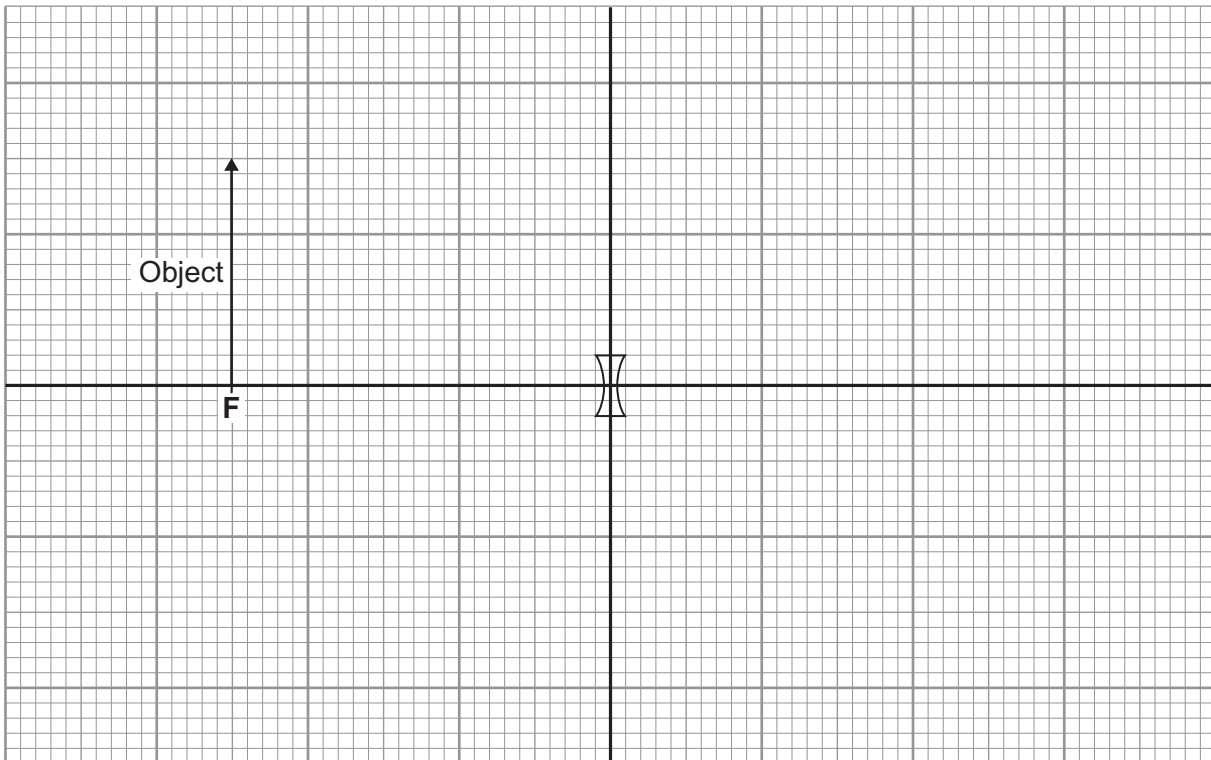
(3 marks)

4 (b) (ii) Use the equation in the box to calculate the magnification produced by the lens.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

....

....

Magnification = ...

(2 marks)

4 (b) (iii) This type of lens always produces a virtual image.

How can you tell from the completed ray diagram that this image is virtual?

....

....

(1 mark)

7

Turn over for the next question

Turn over ▶

5   The diagram shows a transformer.

Iron core

Primary
input

Secondary
output
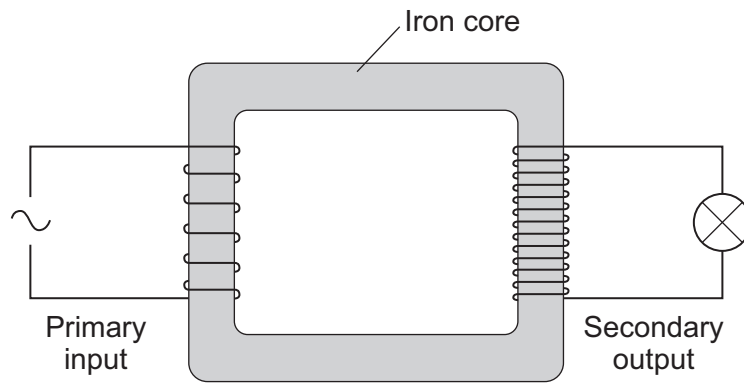
5 (a) (i)   Is the transformer in the diagram being used as a step-up transformer or as a step-down transformer?

Put a tick (✓) in the box next to your answer.

a step-up transformer   ☐

a step-down transformer   ☐

Give a reason for your answer.

....

....

(1 mark)

5 (a) (ii)   Why is the core made of iron?

....

....

(1 mark)

5 (b) The power supply to a laptop computer contains a transformer designed to change the 230 V mains input to a 15 V output. The transformer has 920 turns on its primary coil.

Use the equation in the box to calculate the number of turns on the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

....

....

....

Number of turns on the secondary coil = ...

(2 marks)

4
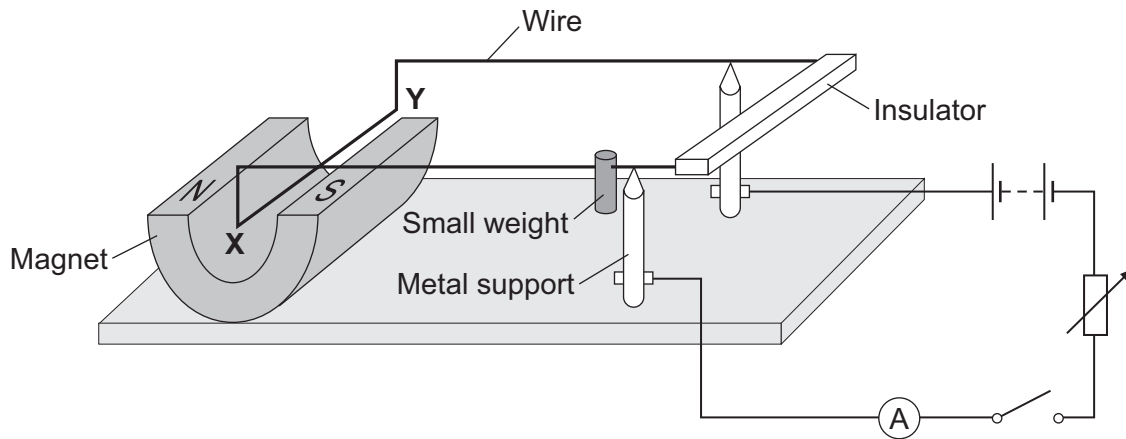
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6 (a)   The diagram shows a device called a current balance.

6 (a) (i)   When the switch is closed, the part of the wire labelled **XY** moves upwards.

Explain why.

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....

....

....

(2 marks)

6 (a) (ii)   What is the name of the effect that causes the wire **XY** to move?

....

(1 mark)

6 (a) (iii)   An alternating current (a.c.) is a current which reverses direction. How many times the current reverses direction in one second depends on the frequency of the alternating supply.

Describe the effect on the wire **XY** if the battery is replaced by an a.c. supply having a frequency of 5 hertz.

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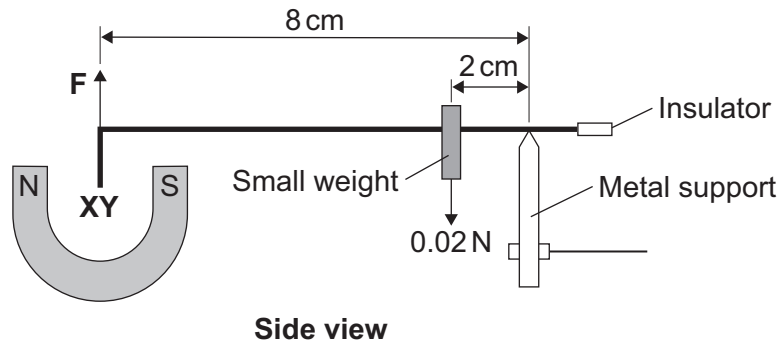
(2 marks)

6 (b) The diagram shows how a small weight can be used to make the wire **XY** balance horizontally.

Side view

Use the data in the diagram and the equation in the box to calculate the force, **F**, acting on the wire **XY**.

moment	=	force	$\times$	perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer.

....

....

....

....

Force = ... N

(3 marks)

8
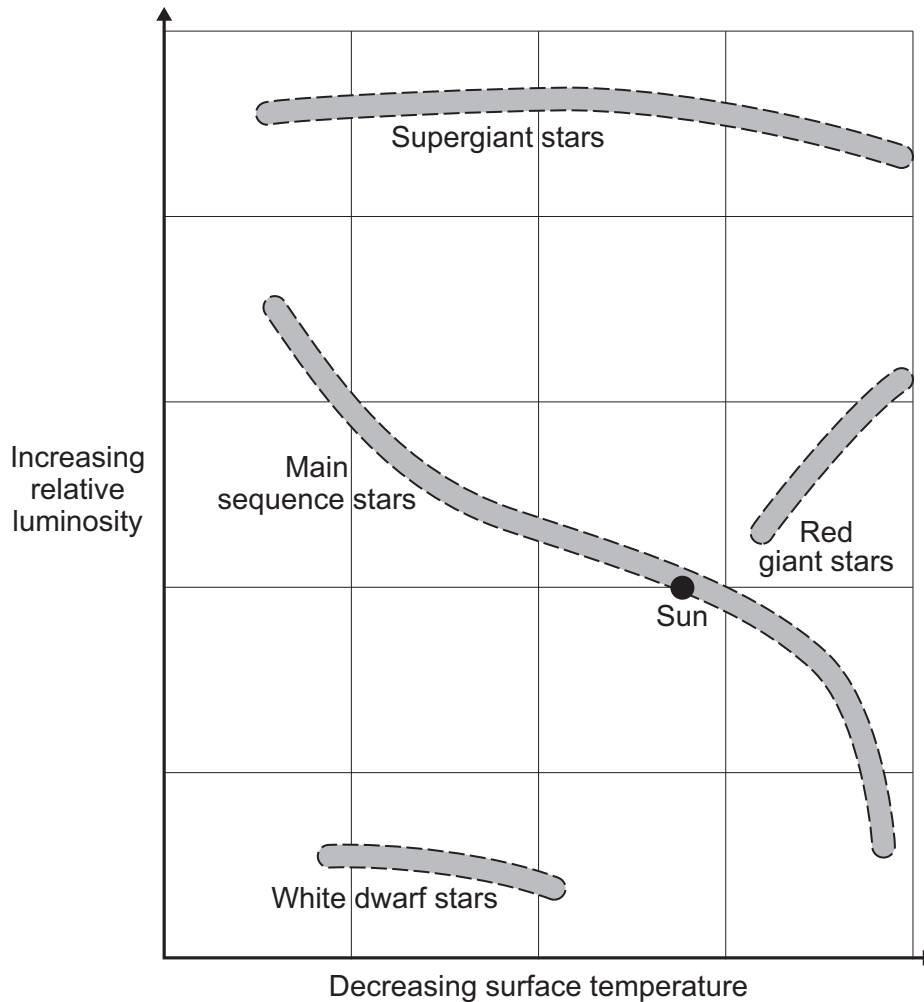
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7 The diagram, drawn below, places stars in one of four groups.
Where a star is placed on the diagram is determined by the surface temperature and relative luminosity of the star.
A star with a relative luminosity of 1, emits the same amount of energy every second as the Sun.

7 (a) The Sun will spend most of its life cycle as a main sequence star. This is the stable period of the Sun's life cycle.

What happens to cause the stable period in the life cycle of a star to end?

....

....
(1 mark)

7 (b) Use the information in the diagram to describe what will happen to the Sun after the stable period ends.

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(3 marks)

4

END OF QUESTIONS

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