Surname

Other Names

Candidate Signature

AQA

General Certificate of Secondary Education
Foundation Tier
January 2013

Physics

Unit Physics P3

PHY3F

F

Wednesday 30 January 2013   9.00 am to 9.45 am

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.

PHY3F

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

1   The diagram shows part of the lifecycle of a very large star.

Use words or phrases from the box to complete the sentences contained in the diagram.

black hole	red supergiant	supernova	white dwarf

(3 marks)
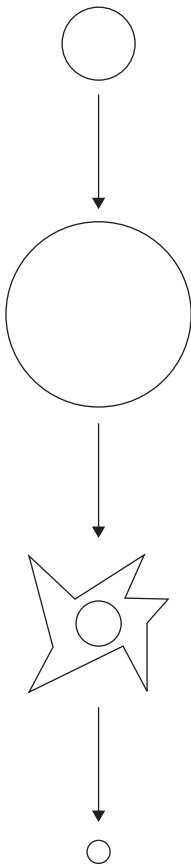
The star is stable.

The star expands forming

a ....

The star collapses, the outer layers explode

as a ....

The centre collapses further and further until

it finally forms a ....

3

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

0 3

2 (a) The table gives information about the frequencies in the hearing ranges of six different mammals.

Name of mammal	Frequencies in hearing range
Bat	20 Hz ⟶ 160 kHz
Dog	20 Hz ⟶ 30 kHz
Dolphin	40 Hz ⟶ 110 kHz
Elephant	5 Hz ⟶ 10 kHz
Human	20 Hz ⟶ 20 kHz
Tiger	30 Hz ⟶ 50 kHz

2 (a) (i) Which mammal in the table can hear the highest frequency?

....

(1 mark)

2 (a) (ii) Give **one** example of a frequency which an elephant can hear but which a tiger **cannot** hear.
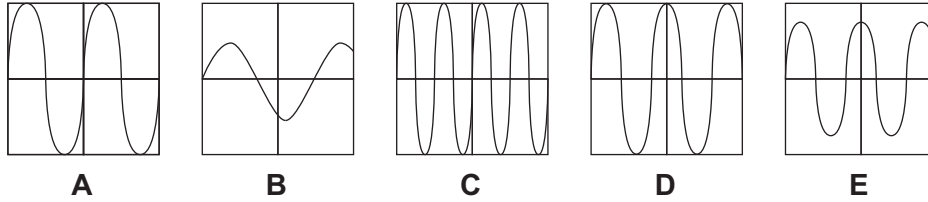
Include the unit in your answer.

Frequency ....

(1 mark)

2 (b) A sound wave can be represented as a trace on the screen of an oscilloscope.

The diagrams show five traces, **A**, **B**, **C**, **D** and **E**, on the oscilloscope. All the traces are drawn to the same scale.

| A | B | C | D | E |

2 (b) (i) Which **three** diagrams show traces with the same amplitude?

Diagrams .... , ... and ....

(1 mark)

2 (b) (ii) Which **two** diagrams show traces with the same frequency?

Diagrams .... and ....

(1 mark)

2 (c) There is no air in space.

Astronauts in space cannot hear sounds from outside their spacesuits.

Explain this.

....

....

....

....
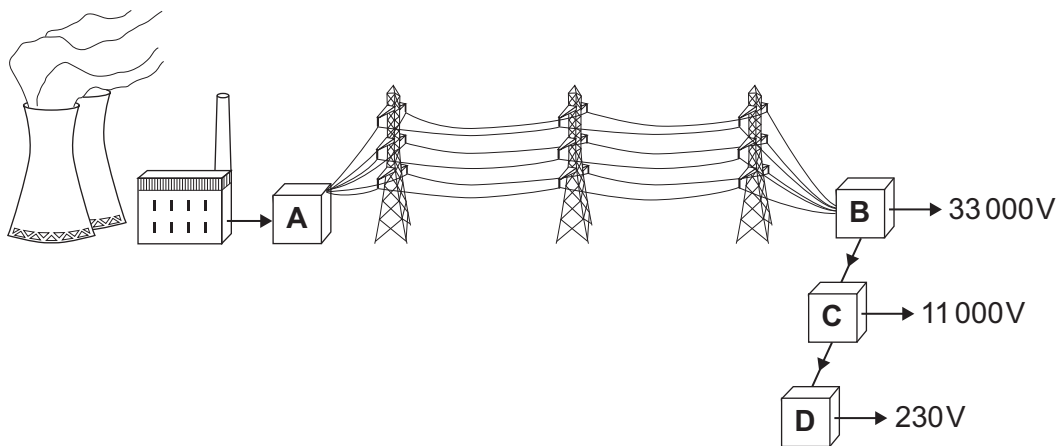
(2 marks)

6

Turn over ▶

3 Electricity is generated in power stations. It is then sent to all parts of the country through a network of cables.

3 (a) Complete the following sentence by using **one** of the words in the box.

Grid	Power	Supply

The network is called the National ....

(1 mark)

3 (b) In the diagram, **A**, **B**, **C** and **D** are transformers.

3 (b) (i) Which transformer, **A**, **B**, **C** or **D**, is a step-up transformer?

Transformer ....

(1 mark)

3 (b) (ii) Which transformer, **A**, **B**, **C**, or **D**, will supply homes, offices and shops?

Transformer ....

(1 mark)

3 (c) Complete the following sentence by drawing a ring around the correct line in the box.

In a step-up transformer, the potential difference (p.d.) across the

primary coil is

less than
the same as
more than

the p.d. across the secondary coil.

(1 mark)

4

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

4 The hammer throw is an athletic event.

The athlete throws a heavy metal ball attached by a wire to a handle.
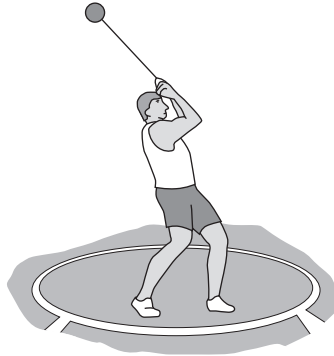
4 (a) The hammer thrower swings the hammer round in a circle before letting go.

He swings the hammer slowly at first and then faster.

Complete the following sentence by drawing a ring around the correct word or line in the box.

As the speed of the swing increases, the centripetal force on the

hammer

decreases.
does not change.
increases.

(1 mark)

4 (b) The diagram shows an overhead view of a hammer thrower swinging the hammer anticlockwise in a circle.
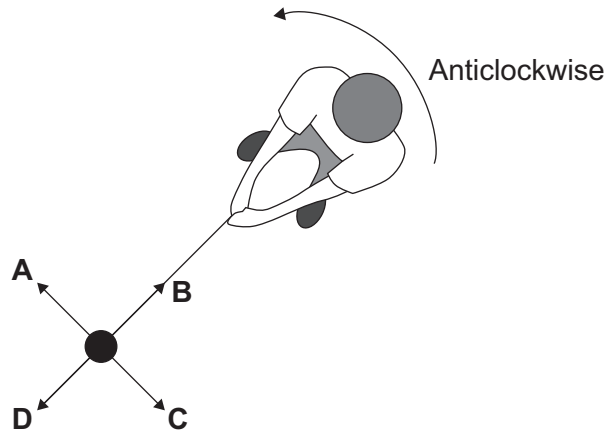
4 (b) (i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the hammer?

(1 mark)

4 (b) (ii) Complete the following sentence by drawing a ring around the correct line in the box.

The centripetal force is provided by the

air resistance.

gravitational force.

tension in the wire.

(1 mark)

4 (b) (iii) At the instant shown in the diagram above, the athlete lets go of the handle.

In which direction, **A**, **B**, **C** or **D**, does the hammer move?

(1 mark)

4

Turn over ▶

5 The diagram, which is not to scale, shows two satellites, **L** and **M**, orbiting the Earth.

Equator
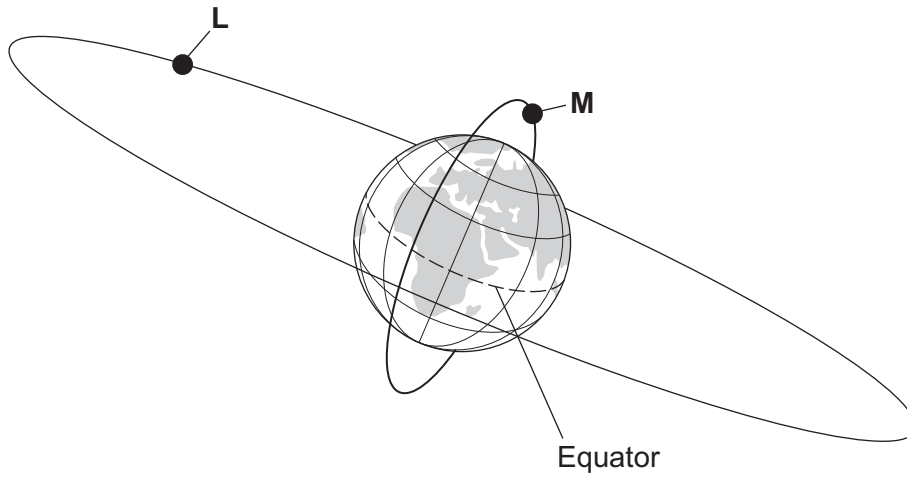
5 (a) Complete the following table.

Each letter, **L** or **M**, may be used once, more than once, or not at all.

Statement about the satellite	Letter for the satellite
It is used as a monitoring satellite.	
It is a geostationary satellite.	
It takes 24 hours to complete its orbit.	

(2 marks)

5 (b) Complete the following sentence.

To stay in its present orbit around the Earth, each satellite must move at

a particular ....

(1 mark)

5 (c) Thousands of satellites are now in orbit around the Earth. A student used the internet to collect information about some of them.

Name of satellite	Average distance from the centre of the Earth in kilometres	Speed in kilometres per second	Time taken to orbit the Earth
The Moon	391 400	1.01	28 days
GEO	42 200	3.07	1 day
Navstar	26 600	3.87	12 hours
Lageos	12 300	5.70	3.8 hours
HST	7 000	7.56	97 mins
ISS	6 700	7.68	92 mins

5 (c) (i) The Moon takes a longer time than any of the other satellites to orbit the Earth.

Give **one** other way in which the Moon is different from the other satellites in the table.

....

....

(1 mark)

5 (c) (ii) What conclusion on the relationship between the *average distance* and *speed* can the student come to on the basis of this data?

....

....

(1 mark)

5

Turn over ▶

6 A student has made a simple electric motor. The diagram shows the electric motor.
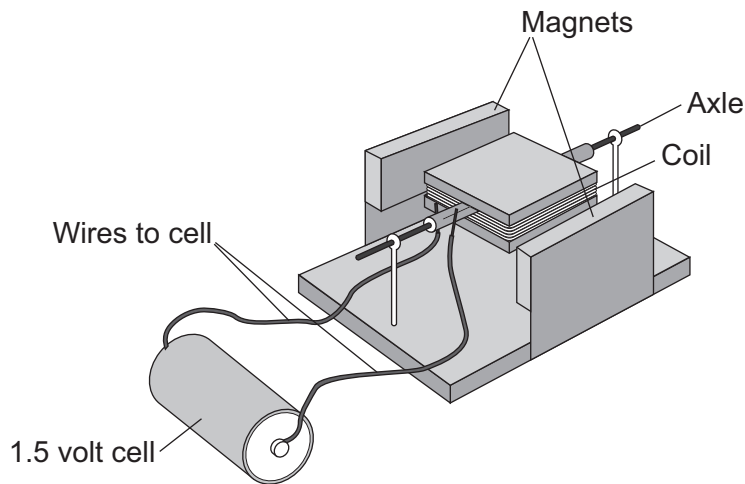
6 (a) Complete the following sentence by drawing a ring around the correct line in the box.

Once the coil is spinning, one side of the coil is pushed by

| the cell |
| the coil |
| a force |

and the other

side is pulled, so the coil continues to spin.

(1 mark)

6 (b) Suggest **two** changes to the electric motor, each one of which would make the coil spin faster.

1 ....

....

2 ....

....

(2 marks)

6 (c) Suggest **two** changes to the electric motor, each one of which would make the coil spin in the opposite direction.

1 ....

....

2 ....

....

(2 marks)

5

7 The diagram shows a gardener using a steel bar to lift a tree stump out of the ground.
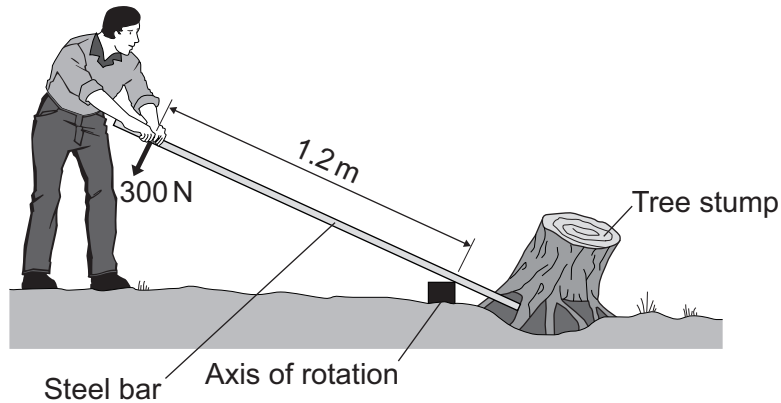
When the gardener pushes with a force of 300 N, the tree stump just begins to move.

7 (a) Use the equation in the box to calculate the moment produced by the 300 N force.

moment = force ×	perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer.

....

....

Moment = ... newton metres

(2 marks)

7 (b) Using a longer steel bar would have made it easier for the gardener to lift the tree stump out of the ground.

Explain why.

....

....

....

....

(2 marks)

Turn over ▶

4

8 (a) Explain what ultrasound is.

....

....

....

....

(2 marks)

8 (b) Ultrasound is used for pre-natal scanning. This is much safer than using X-rays. However, doctors were only sure ultrasound was safe after experiments on mice.

Do you think the ultrasound experiments on mice were justified?

Explain your answer.

....

....

....

....

(2 marks)

8 (c) Explain what scientists should do if they find evidence that ultrasound may be harmful to human health.

....

....

....
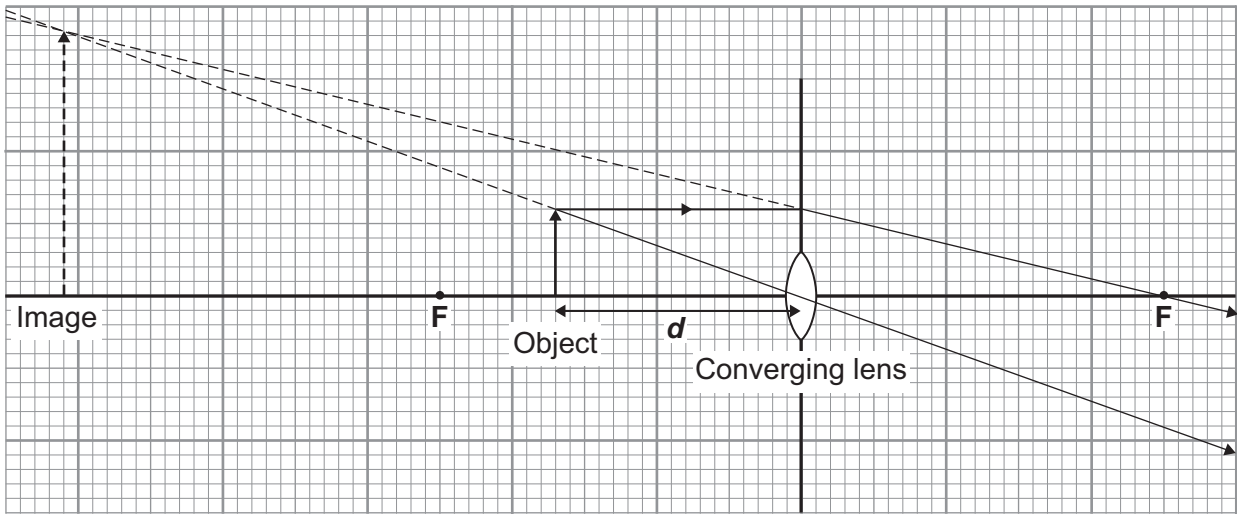
(2 marks)

6

9 A student investigates how the magnification of an object changes at different distances from a converging lens.

The diagram shows an object at distance *d* from a converging lens.

9 (a) (i) The height of the object and the height of its image are drawn to scale.

Use the equation in the box to calculate the magnification produced by the lens shown in the diagram.

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

Show clearly how you work out your answer.

....

....

....

Magnification = ...

(2 marks)

9 (a) (ii) The points **F** are at equal distances on either side of the centre of the lens.

State the name of these points.

....

(1 mark)

9 (a) (iii) Explain how you can tell, **from the diagram**, that the image is virtual.

....

....

(1 mark)

Question 9 continues on the next page

Turn over ▶

9 (b) The student now uses a different converging lens. He places the object between the lens and the point **F** on the left.

The table shows the set of results that he gets for the distance *d* and for the magnification produced.

Distance *d* measured in cm	Magnification
5	1.2
10	1.5
15	2.0
20	3.0
25	6.0

His friend looks at the table and observes that when the distance doubles from 10 cm to 20 cm, the magnification doubles from 1.5 to 3.0.

His friend's conclusion is that:

> The magnification is directly proportional to the distance of the object from the lens.

His friend's observation is correct.
His friend's conclusion is wrong.

9 (b) (i) Explain using data from the table why his friend's conclusion is wrong.

....

....

....

....

(2 marks)

9 (b) (ii) Write a correct conclusion.

....

....

(1 mark)

9 (b) (iii) The maximum range of measurements for *d* is from the centre of the lens to **F** on the left.

The student **cannot** make a correct conclusion outside this range.

Explain why.

....

....

(1 mark)

8

END OF QUESTIONS

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1 8

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