

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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



General Certificate of Secondary Education  
Higher Tier  
June 2011

# Physics

# PHY3H

Unit Physics P3

# H

Written Paper

Friday 27 May 2011 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

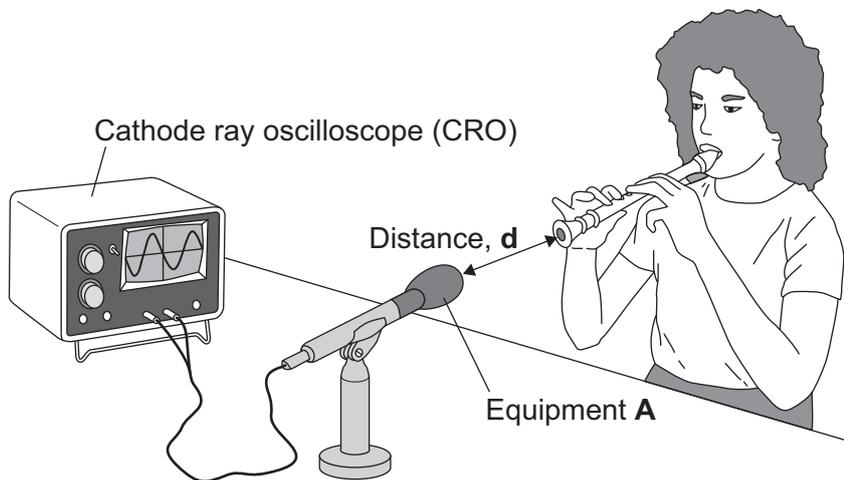
- In all calculations, show clearly how you work out your answer.



J U N 1 1 P H Y 3 H 0 1

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

- 1** A group of students investigates sound waves.  
The diagram shows part of their investigation.



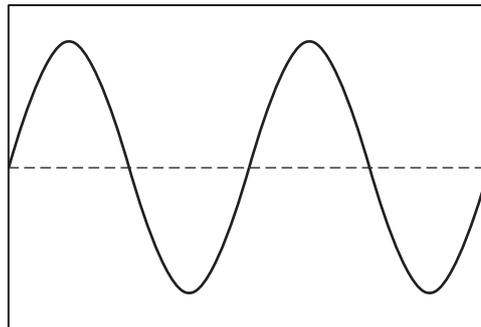
- 1 (a)** Identify the equipment labelled **A**.

.....  
(1 mark)

- 1 (b)** The student plays the same note in the same way at different distances from equipment **A**.

Another student records the amplitude of the wave shown on the cathode ray oscilloscope (CRO).

- 1 (b) (i)** Label this wave to show its amplitude.



(1 mark)

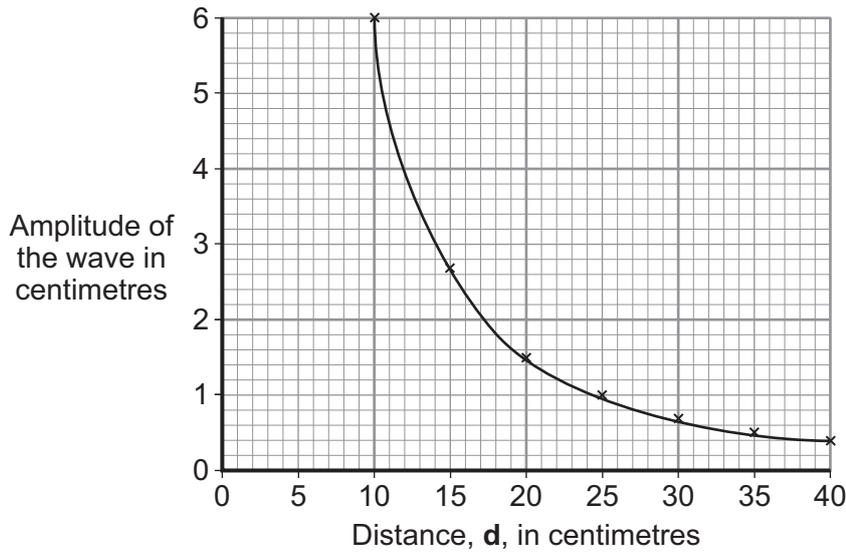
- 1 (b) (ii)** Complete the sentence.

Increasing the amplitude of a sound wave will increase the .....  
of the sound.

(1 mark)



1 (c) The graph shows the students' average results from several sets of measurements.



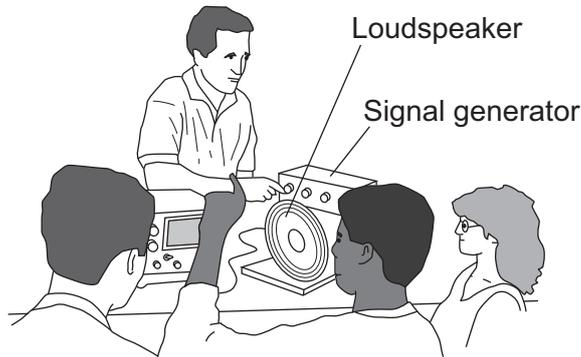
Use the graph to find the distance, *d*, in centimetres, at which the average amplitude is likely to be 2 centimetres.

Distance = ..... cm.  
(1 mark)

1 (d) Write a conclusion for this investigation.

.....  
.....  
(1 mark)

1 (e) A physics teacher uses a signal generator and a loudspeaker to demonstrate the range of hearing of a group of students.



What is the range of frequencies most humans can hear?

Most humans can hear from ..... Hz to ..... Hz.  
(2 marks)

7
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Turn over ►



2 (a) A student investigates the moment of a force.

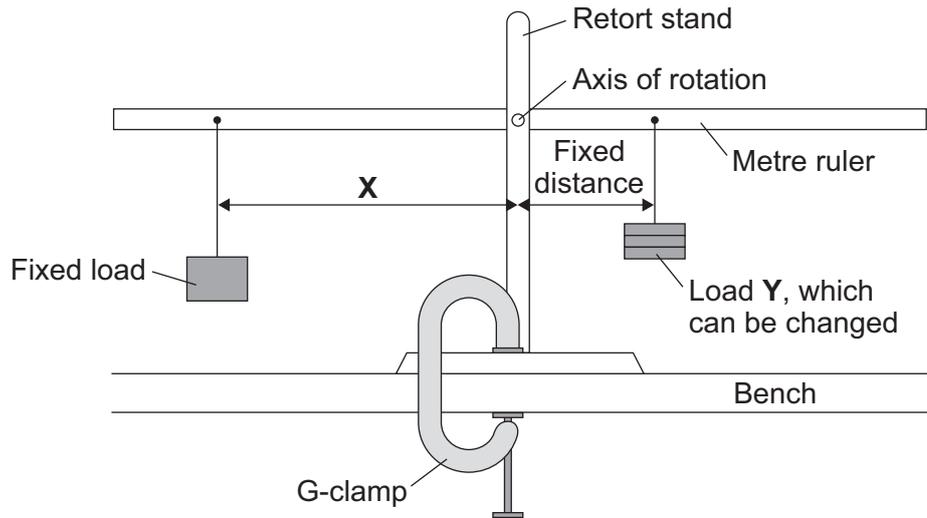
2 (a) (i) What does the word *moment* mean in this sentence?

.....

.....

(1 mark)

2 (a) (ii) The diagram shows how she sets up her apparatus.



Suggest the purpose of the G-clamp.

.....

.....

(1 mark)



- 2 (a) (iii)** A horizontal rod fits into a hole at the centre of the metre ruler. This is the axis of rotation. The student changes the load **Y** and adjusts the distance **X** until the metre ruler is horizontal. She takes six pairs of measurements which are shown in the table.

Load <b>Y</b> in newtons	Distance <b>X</b> in centimetres
1	7
2	14
3	21
4	28
5	35
6	42

Explain fully how distance **X** varies with load **Y**.

.....

.....

.....

.....

.....

(2 marks)

- 2 (a) (iv)** The weight of the ruler can be ignored in this experiment.

Which statement gives the reason why?

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

The weight of the ruler is so small it is negligible.

The centre of mass of the ruler is at the axis of rotation.

The ruler is a symmetrical object.

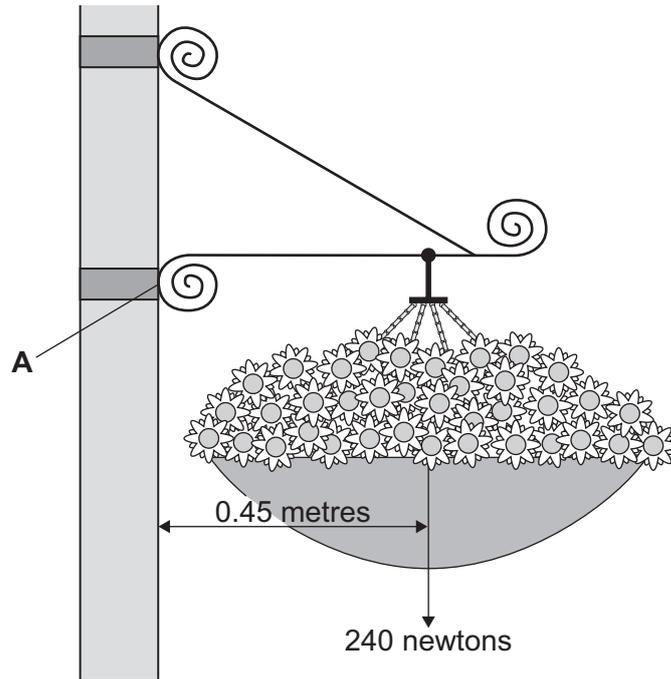
(1 mark)

**Question 2 continues on the next page**

**Turn over ►**



2 (b) In the summer, a town council fits hanging baskets to some of its lamp posts.



Use the information in the diagram and the equation in the box to calculate the moment produced by the weight of the hanging basket about an axis through point **A**.

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

Show clearly how you work out your answer **and** give the unit.

.....

.....

.....

.....

Moment = .....

(3 marks)

8



**Turn over for the next question**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Turn over ►**



- 3** Jupiter is the largest planet in the solar system. It has over sixty moons. The four largest moons were observed by Galileo using his telescope over four hundred years ago.

The table displays some of the data on these four largest moons which is now known to scientists.

Name	Distance from Jupiter in kilometres	Time to orbit Jupiter in days	Diameter in kilometres	Mass in quintillion tonnes
Callisto	1 883 000	16.9	4806	108
Europa	671 000	3.6	3130	48
Ganymede	1 070 000	7.2	5268	148
Io	422 000	1.8	3630	89

1 quintillion tonne = 1 000 000 000 000 000 000 tonnes

- 3 (a)** A centripetal force acts on each of these moons.

State clearly what provides the centripetal force.

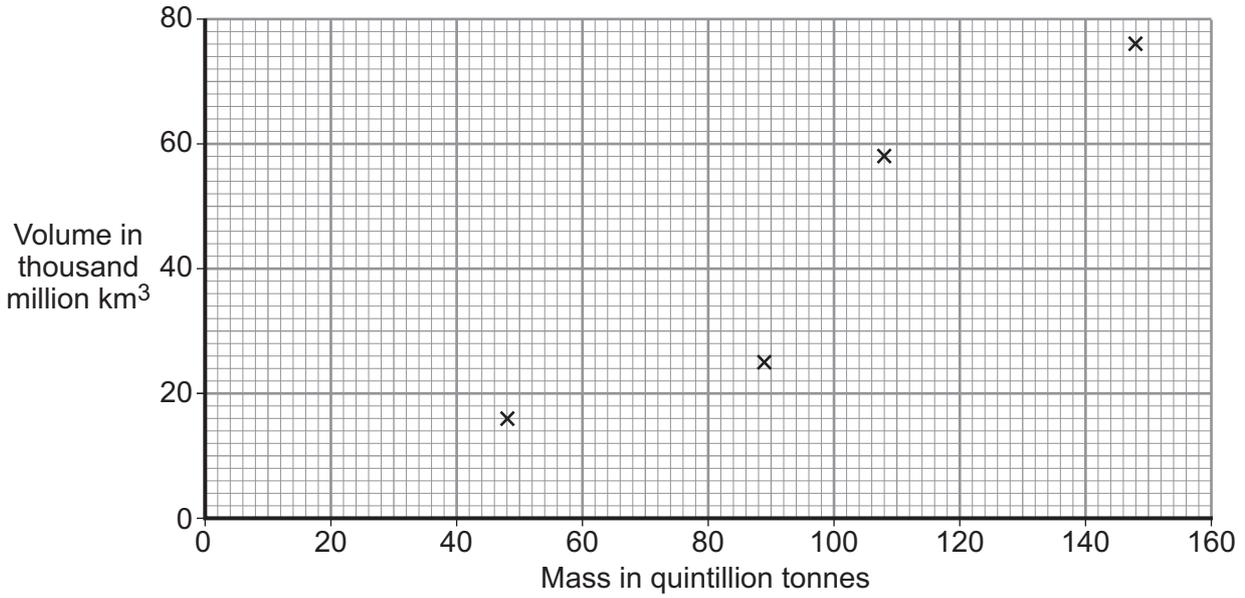
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(1 mark)



3 (b) The graph shows the volume against mass for these large moons.



Use the graph to estimate the volume of a moon with a mass of 20 quintillion tonnes.

Show clearly on the graph how you used it to get to your estimate.

Estimated volume of moon = ..... thousand million km<sup>3</sup>  
(2 marks)

3 (c) For these large moons, what is the relationship, if any, between the moon's distance from Jupiter and the time it takes for the moon to orbit Jupiter?

.....  
 .....  
 (1 mark)

3 (d) One reason why astronomers now have more data on the moons of Jupiter is that present-day astronomers have telescopes which are much more powerful than Galileo's telescope.

Give one other reason.

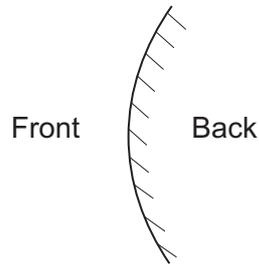
.....  
 .....  
 (1 mark)

5
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Turn over ►



- 4 (a)** Mirrors with a certain shape can be used in shops and near the stairs in buses.  
The diagram below shows a mirror with this shape.

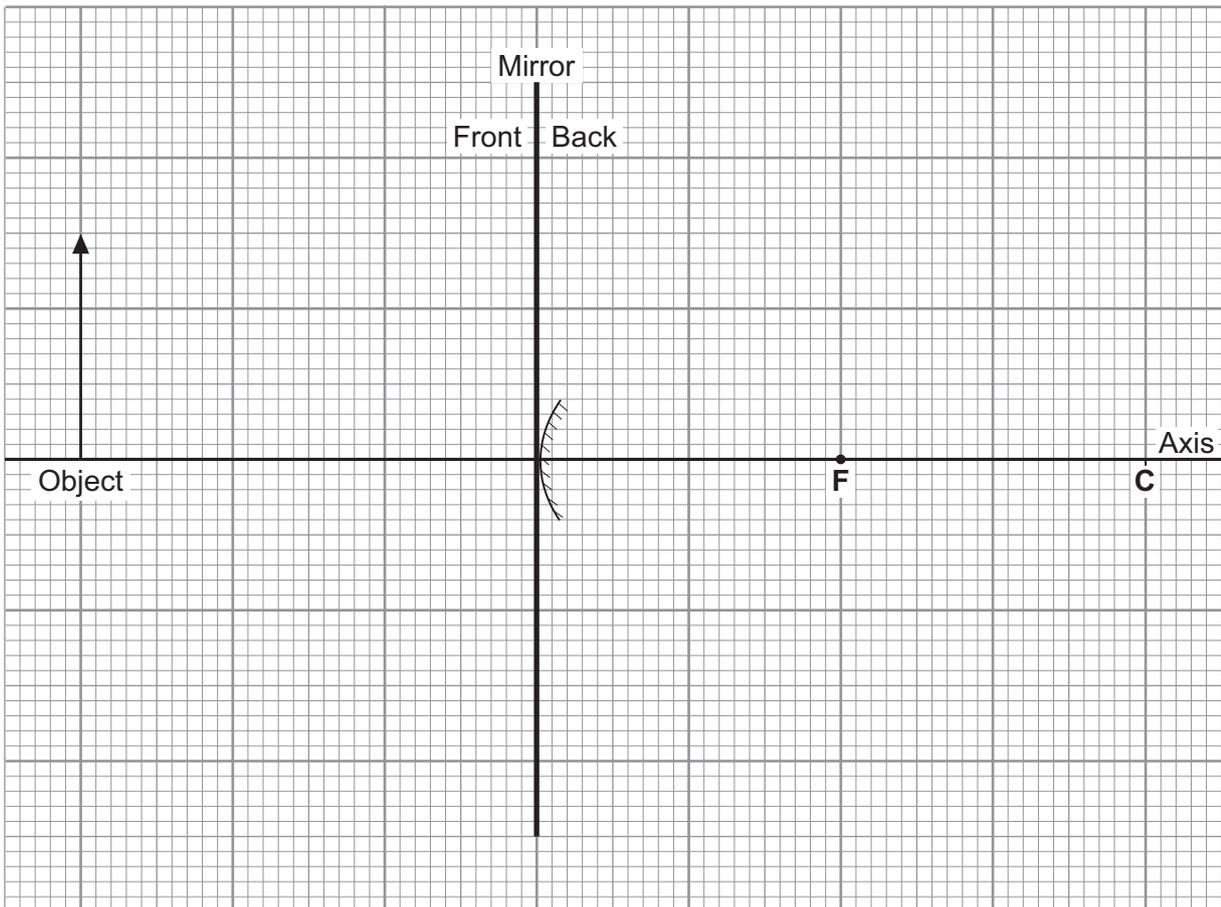


What name is given to this shape of mirror?

.....  
(1 mark)

- 4 (b)** The diagram below shows an object in front of a mirror similar to the one in part 4(a).  
The mirror is represented by a vertical line.

On the diagram below, use a ruler to draw two rays from the top of the object which show how and where the image is formed.



(4 marks)



**4 (c)** All the images formed in this type of mirror are upright.

Describe **two** other properties of these images.

1 .....

2 .....

(2 marks)

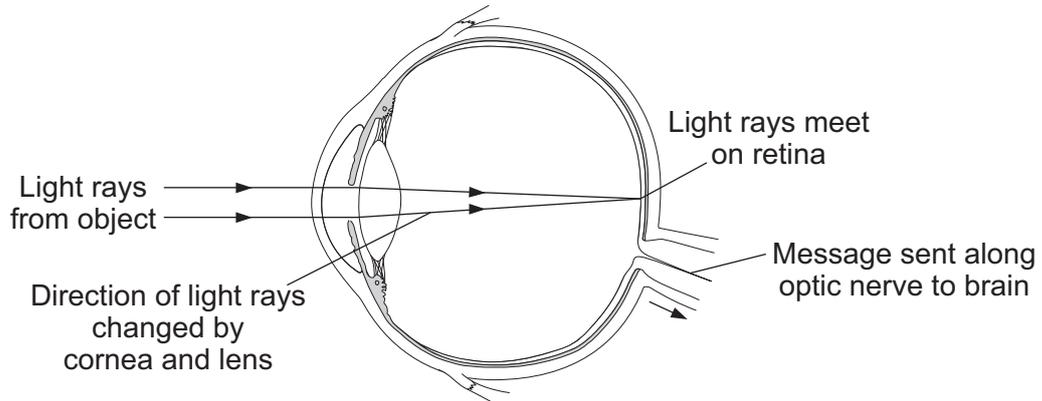
7

**Turn over for the next question**

**Turn over ►**



- 5 (a) The diagram shows the inside of the eye of a person with perfect vision.



Complete the sentence.

The process by which the cornea and lens change the direction of the light is called

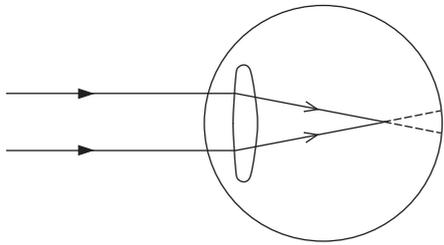
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(1 mark)

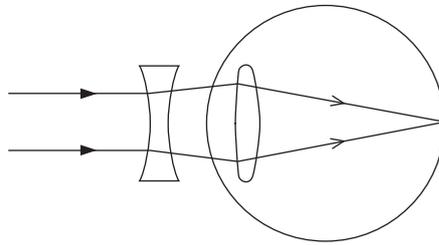


5 (b) (i) Not everyone has perfect vision. A **short-sighted** person can only clearly see objects which are close. Light from distant objects meets in front of the retina.

The diagrams show how an additional lens will correct **short-sightedness**.

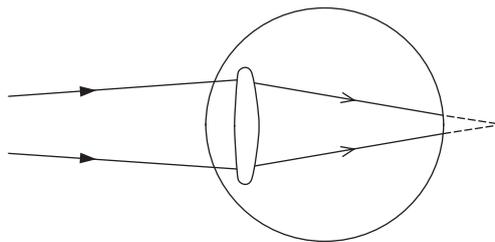


Uncorrected vision



Vision corrected with a diverging lens

The following diagram shows what happens when light from a close object enters the eye of a **long-sighted** person.



Light fails to come to focus on the retina

What type of additional lens will correct the vision of a **long-sighted** person?

.....  
(1 mark)

5 (b) (ii) The additional lens changes the direction of the light before it enters the eye.

Why does this correct the person's vision?

.....  
.....

(1 mark)

Question 5 continues on the next page

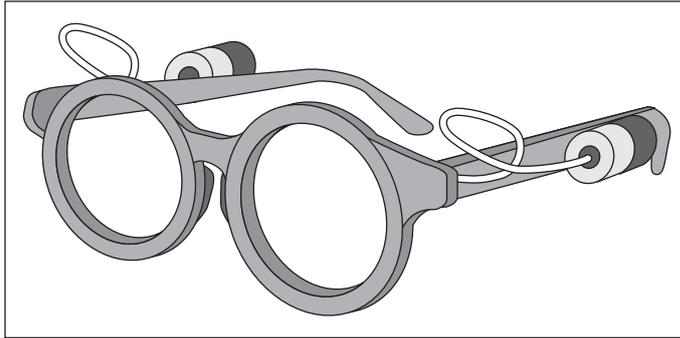
Turn over ►



5 (c) Read this passage from a magazine.

### Professor's clear vision for the future

There are billions of poor people in the world who cannot see clearly and cannot afford the cost of having their eyesight corrected. A professor has invented adjustable glasses. They are cheap and a few minutes is all it takes for you to adjust them to suit your eyes.



When the adjusting screw is turned in one direction, silicone is pushed into the flexible lens which becomes thicker in the centre. Turning the screw in the opposite direction pulls silicone out, and the lens becomes thinner at the centre than at the edge.

Explain how these glasses are adjusted for a **short-sighted** person and how this adjustment allows the person to see distant objects clearly.

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(3 marks)

6
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6 This passage is from a web page.

**Our nearest star, the Sun**

The pie chart shows the proportions of chemical elements in the Sun.

Chemical Element	Proportion
Hydrogen	75%
Helium	23%
Other elements	2%

Most of the Sun's helium has been produced from the Sun's hydrogen by the process of nuclear fusion. This process also produces vast quantities of energy. The process takes place in the core of the Sun at a temperature of about 15 million °C and has been going on for about 4.5 billion years. During this period of time, the Sun has remained stable and scientists think that it will remain stable for several billion years into the future.

6 (a) Explain why the Sun remains stable.

.....

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.....

.....

(3 marks)

6 (b) A scientific opinion is expressed on this web page.

Identify this opinion and suggest how scientists could justify it.

.....

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.....

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(2 marks)

Turn over for the next question

5

Turn over ►



**7 (a)** In the National Grid, very large step-up transformers link power stations to the transmission cables.

A transformer used for this purpose has 800 turns on its primary coil and 12 800 turns on its secondary coil. The p.d. (potential difference) across its primary coil is 25kV.

Use the equation in the box to calculate the p.d. across its secondary coil.

$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$
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Show clearly how you work out your answer **and** give the unit.

.....

.....

p.d. across secondary coil = .....  
(3 marks)

**7 (b)** The primary and secondary coils of a transformer are made of insulated wire.

Why is this insulation necessary?

.....

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(1 mark)

**7 (c)** Describe what happens when an alternating potential difference is applied across the primary coil of a transformer.

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(3 marks)

7
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**END OF QUESTIONS**

