



Rewarding Learning

General Certificate of Secondary Education  
2013

Centre Number

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Candidate Number

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## Science: Physics

Unit P2

Higher Tier



[GPH22]

\*GPH22\*

MONDAY 24 JUNE, MORNING

### TIME

1 hour 45 minutes.

### INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

**You must answer the questions in the spaces provided. Do not write outside the box, around each page or on blank pages.**

Complete in blue or black ink only. **Do not write with a gel pen.**

Answer **all** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 115.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

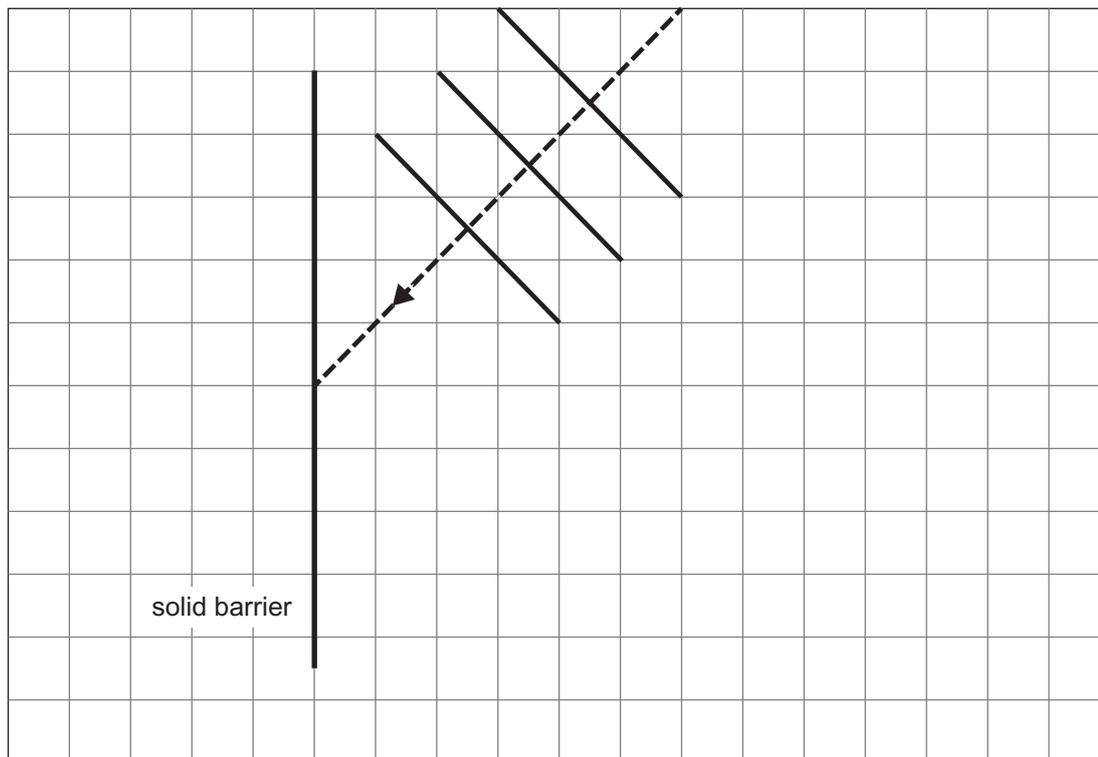
Quality of written communication will be assessed in question **4(a)**.





(b) Below is a diagram showing three wave fronts moving towards a solid barrier.

Examiner Only	
Marks	Remark



(i) Complete the diagram to show the reflection of the wave fronts at the barrier.

In your answer you should draw:

- a dotted line with an arrow on it to show the direction of the reflected wave fronts,
- 3 reflected wave fronts. [4]

(ii) Mark on the diagram the wavelength of the incident waves. [1]

(iii) In what way, if at all, do the frequency, wavelength and speed of water waves change when they are reflected? Indicate your answer by placing a tick (✓) in the appropriate boxes.

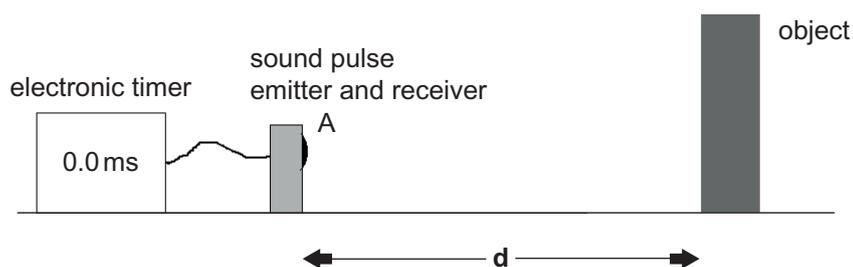
	Increases	Decreases	Unchanged
Frequency			
Speed			
Wavelength			

[3]

[Turn over



- (c) To study the reflection of sound from a solid object the apparatus below was used.



A pulse of sound was emitted by the device at A and the time taken for the sound pulse to travel **to the object and back again** (round trip time) was measured.

This was repeated for different distances  $d$ .

The results of the investigation are shown in the table below.

Distance $d$ in m	Time for the round trip in ms	Time to travel the distance $d$ in ms
0.2	1.2	
0.4	2.6	
0.6	3.4	
0.8	4.8	
1.0	6.0	

- (i) Complete the table above by calculating the time for the pulse of sound to travel the distance  $d$ . [1]
- (ii) Using the equation below and data from the table calculate the speed of sound.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$(1 \text{ ms} = 1 \text{ millisecond} = 0.001 \text{ s})$$

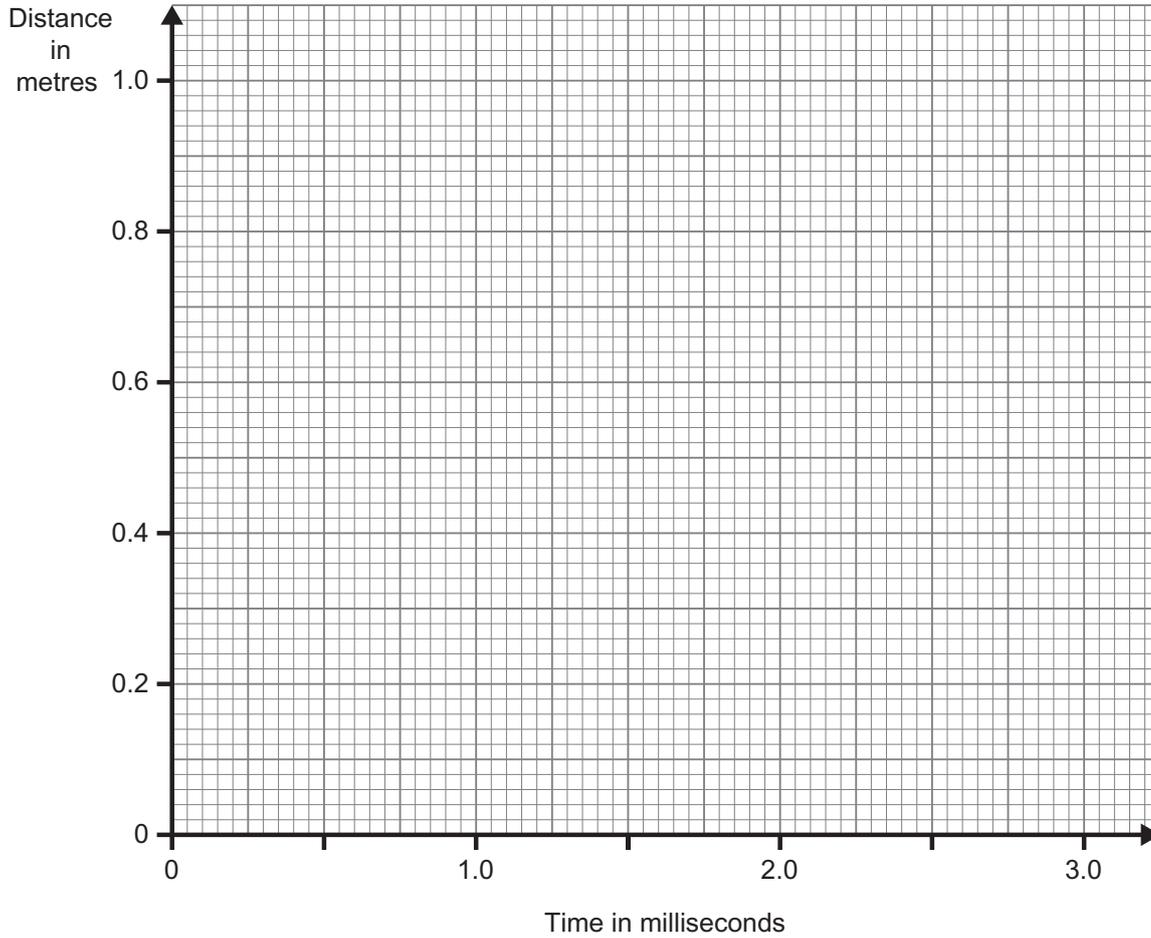
Speed of sound = \_\_\_\_\_ m/s [3]

Examiner Only

Marks Remark



- (iii) Using the grid below plot a graph of distance  $d$  (y-axis) against time to travel the distance  $d$  (x-axis). Draw a line of best fit through the points. [3]



- (iv) The sound emitter was placed at a distance from the object that gave a **round trip** time of 3.0 ms. Using the graph determine the distance  $d$ .

Distance  $d$  = \_\_\_\_\_ m [1]

Examiner Only

Marks Remark

Total Question 1

[Turn over





- (iii) David was investigating how a ray of light passed through a semicircular glass block. He drew **Diagram 1** below. However he made a number of mistakes. Using **Diagram 2** draw the correct paths of the two rays that he drew wrongly.

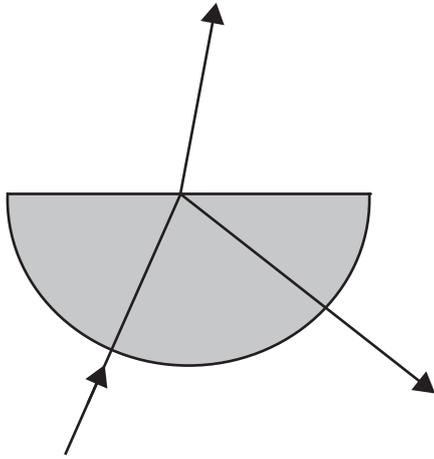


Diagram 1

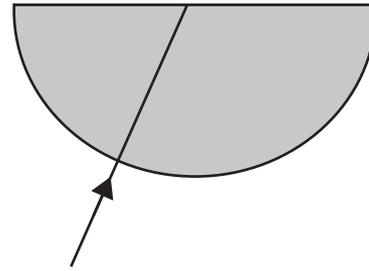


Diagram 2

[2]

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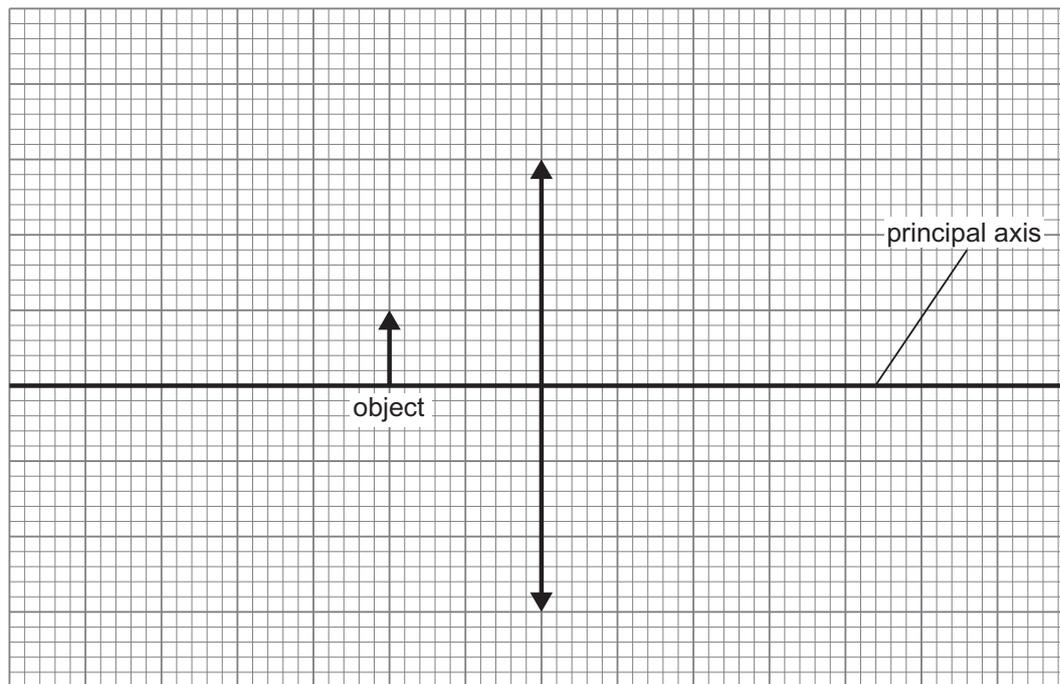
Marks	Remark

[Turn over]





- (b) The full scale diagram below shows a converging lens and an object. The lens has a focal length of 3 cm.



- (i) Mark and label with the letter **F** the position of the principal focus (focus) to the right of the lens. [1]
- (ii) The lens is being used as a magnifying glass. Using a ruler, draw **two** rays on the diagram to find the position of the image. **Label the top of the image with the letter I.** [3]
- (iii) Place arrows on the rays to show their direction. [1]
- (iv) Is this image real or virtual? Explain your answer.  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]
- (v) Mark with the letter **E** the approximate position you should place your eye to view the image. [1]

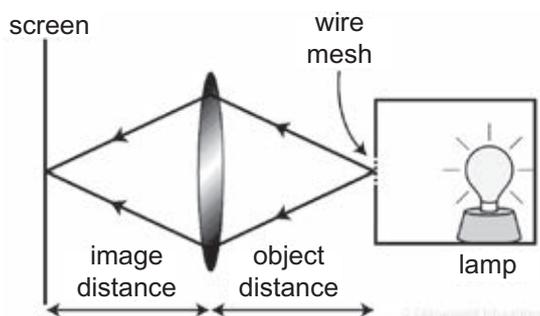
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Marks Remark

[Turn over



- (c) To investigate the properties of the image formed by a converging lens Mary set up the apparatus shown below. She placed an object at various distances from the lens. The object is a wire mesh illuminated by a lamp. For each distance she then moved the screen until a sharp image of the object was seen on the screen.



Mary measured the height of the object and then she measured the height of the image obtained at the various positions. She calculated the magnification of the image using the formula:

$$\text{Magnification} = \frac{\text{Height of image}}{\text{Height of object}}$$

The table below shows her results.

Object distance in cm	Image distance in cm	Magnification
25	100	4
30	60	2
35	46.7	1.3
40	40	1
45	36	0.8



- (i) By examining Mary's measurements deduce another method of calculating the magnification produced by the lens.  
**Support your answer by showing appropriate calculations.**

Magnification =

[2]

- (ii) What happens to the size of the image when the object is placed **further** than 40 cm from the lens?

[1]

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Marks	Remark
Total Question 2	

Total Question 2

[Turn over

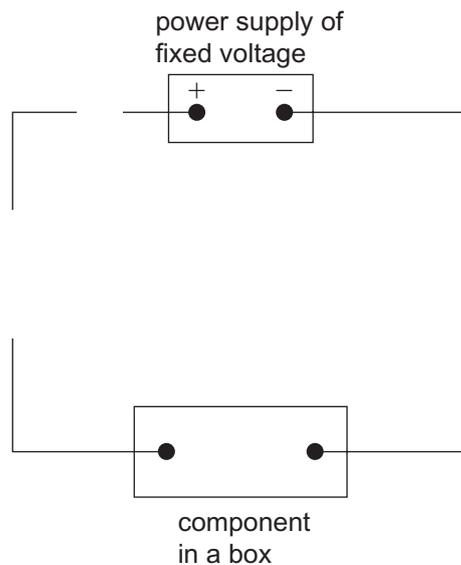
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\*28GPH2211\*

- 3 (a) Zoe was given a sealed box containing a component that conducts electricity. Two terminals attached to the box allowed her to connect it to a circuit. To find out what the component was she decided to investigate how the current passing through the component depended on the voltage across it.

- (i) Complete the circuit diagram below by inserting a switch, an ammeter, a voltmeter and a variable resistor that would allow Zoe to obtain a series of values of the voltage and the current. [4]



Examiner Only

Marks Remark







- (ii) Calculate the current flowing in the  $3\Omega$  resistor.  
You are advised to show clearly how you get your answer.

Examiner Only

Marks	Remark

Current = \_\_\_\_\_ A [2]

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[Turn over

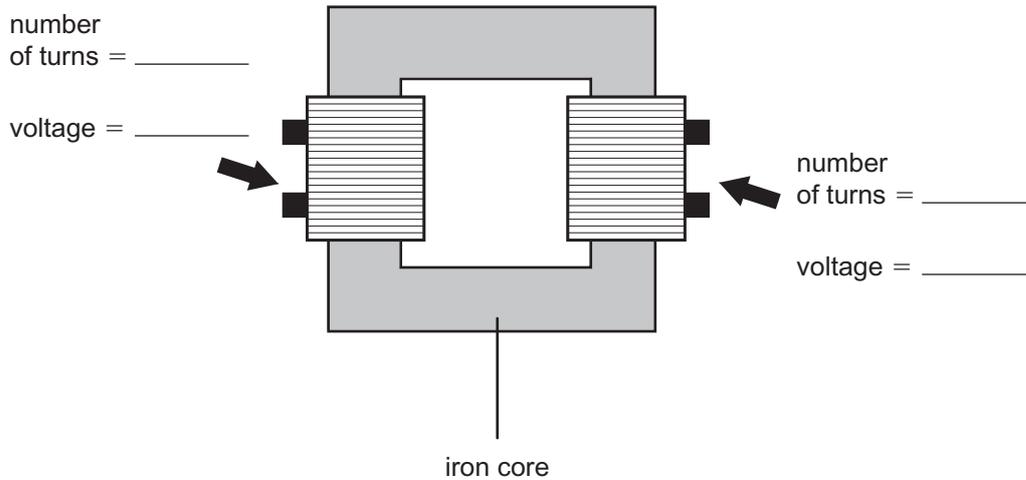


\*28GPH2215\*





- (b) A transformer has two coils, one of 100 turns and the other of 400 turns. The transformer is required to change the input voltage from 6 V to 24 V.



- (i) Label the diagram with the number of turns on each coil and indicate **clearly** to which of the coils the 6 V and the 24 V should be connected. [2]

- (ii) Complete the table below by identifying the type of voltage, alternating a.c. or direct d.c. Tick (✓) the correct box.

	a.c.	d.c.
6 V input voltage		
24 V output voltage		

[2]

- (iii) Power stations in Northern Ireland generate electricity at a voltage of 25 kV.

It is then stepped up to 115 kV before it is connected to the overhead transmission cables.

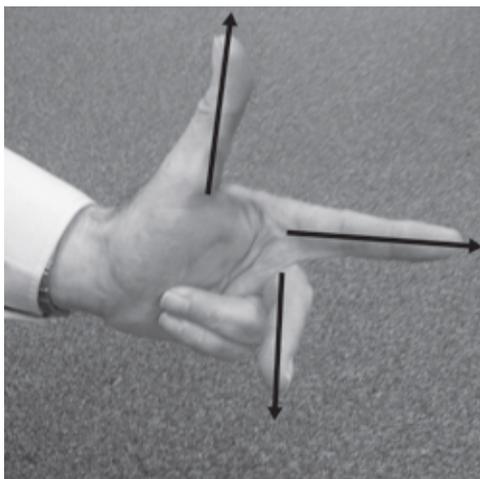
Explain fully why this is done.

\_\_\_\_\_

\_\_\_\_\_ [2]



(c) Fleming's Left Hand rule is illustrated in the diagram below.



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(i) Label each arrow with the quantity it represents. [3]

The diagram below shows a wire carrying a current. The wire is placed between the poles of a magnet.



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(ii) In what direction does the wire experience a force due to the current?

\_\_\_\_\_ [1]

(iii) Describe how the force would change, if the current used was alternating (a.c.).

\_\_\_\_\_  
 \_\_\_\_\_ [1]

Examiner Only

Marks Remark

[Turn over





5 (a) (i) What two elements are the main constituents of stars?

\_\_\_\_\_ [1]

(ii) Name the process responsible for energy production in stars.

\_\_\_\_\_ [1]

(iii) Stars continue to produce energy for a very long time.  
What two forces are in balance to maintain their stability?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(b) Describe and explain, briefly, the **nebular model** for the formation of the solar system. In your answer you should give **one** piece of evidence that supports the model.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [4]

Examiner Only	
Marks	Remark

[Turn over



(c) Read the paragraph below.

With a traditional optical telescope, the space between the stars and galaxies is completely dark. A radio telescope detects radio waves coming from space. A very sensitive radio telescope can detect a faint signal, coming from all directions, that is not associated with any star, galaxy, or other object.

Source: Wikipedia (amended).

(i) What name is given to the faint signal referred to in the passage above?

\_\_\_\_\_ [1]

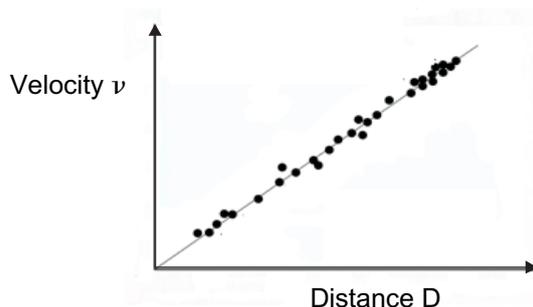
(ii) What is the explanation put forward by astronomers to explain this faint signal?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(d) (i) Galaxies are moving apart. What observation provides information for this conclusion?

\_\_\_\_\_  
\_\_\_\_\_ [1]

Each dot on the graph below represents a galaxy. The distance  $D$  from our galaxy (Milky Way) to each galaxy is plotted on the x-axis and the velocity  $v$  with which the galaxy is moving away is plotted on the y-axis.



(ii) Describe what this graph tells us about the motion of the galaxies.

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 [2]

The distance to galaxies is measured in light years.

The relationship between the velocity  $v$  and the distance  $D$  is known as Hubble's Law and is written in the form  $v = HD$ .

The velocity  $v$  is measured in km/s and the distance  $D$  in millions of light years.

$H$  is a constant known as Hubble's constant and its value is 25 km/s per million light years.

(iii) The Hercules galaxy is 670 million light years from the Milky Way. Calculate the velocity at which this galaxy is moving away from us.

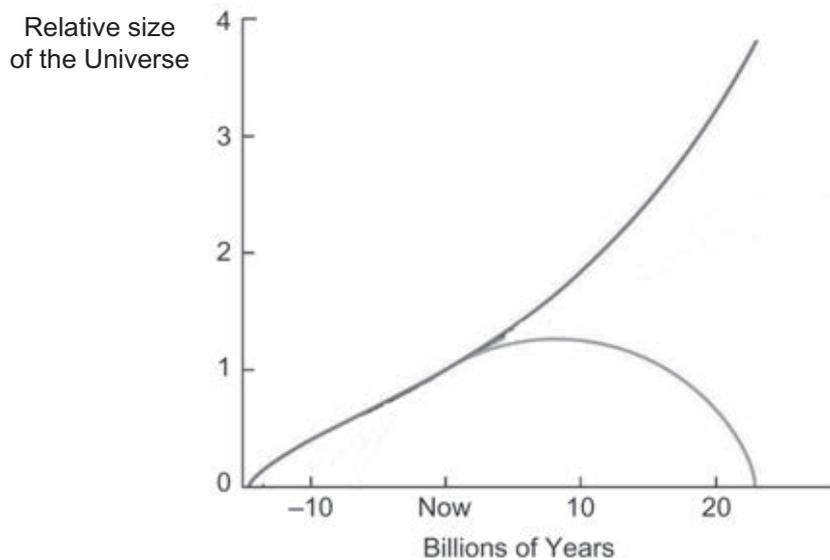
Velocity = \_\_\_\_\_ km/s [2]

Examiner Only	
Marks	Remark

[Turn over



- (e) The final fate of the Universe is not really known. The graph below shows two possible fates for the Universe, the Big Freeze and the Big Crunch.



- (i) On the graph label which curve corresponds to each of these possible fates. [2]

- (ii) Many astronomers believe that the final fate of the Universe will be the "Big Freeze".  
What is meant by the term Big Freeze?

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[2]

- (iii) What force plays an important role in the Big Crunch model and how does it bring about the Big Crunch?

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[2]

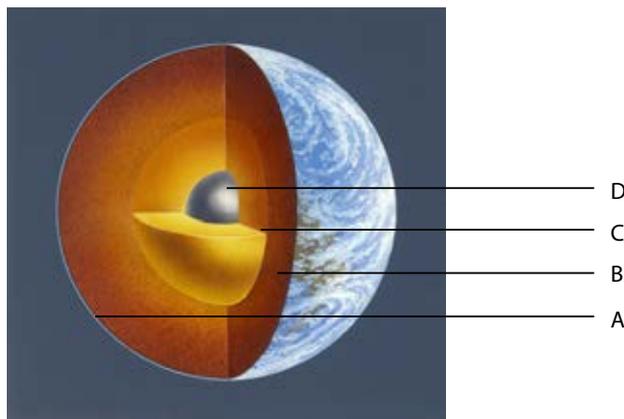
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Marks Remark

Total Question 5



- 6 (a) The Earth is made up of a number of layers. **Diagram A** below shows the main four layers.



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**Diagram A**

- (i) Complete the table below.

	Name of layer	Solid or Liquid	Composition
<b>A</b>			
<b>B</b>			
<b>C</b>	Outer core	Liquid	Nickel and Iron
<b>D</b>	Inner core		

[6]

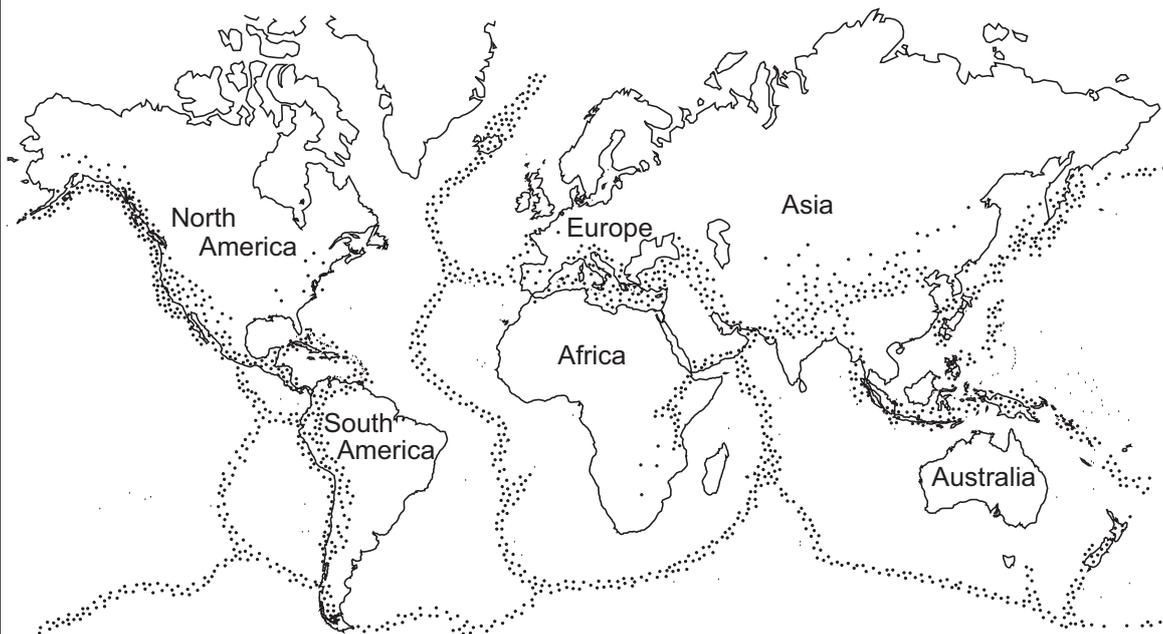
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[Turn over



**Diagram B** below is a map of the Earth. The dots show the location of Earthquakes and Volcanoes.



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**Diagram B**

(ii) What does **Diagram B** suggest about the structure of the topmost layer of the Earth?

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[1]

(iii) How does the structure of the Earth suggested by **Diagram B** explain **earthquakes**?

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[3]

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(iv) How are **volcanoes** explained by this structure of the Earth?

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[3]

(b) **Diagram 1** below shows how the continents might have looked many millions of years ago.  
**Diagram 2** below shows how they look today.



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**Diagram 1**



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**Diagram 2**

Describe the process which brought about this change.

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[2]

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Marks	Remark
Total Question 6	



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Question Number	Marks
1	
2	
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5	
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<b>Total Marks</b>	
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