



Rewarding Learning

General Certificate of Secondary Education  
2014

Centre Number

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Candidate Number

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## GCSE Physics

Unit 2

Higher Tier



[GPH22]

\*GPH22\*

MONDAY 23 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.

Write your answers in the spaces provided in this question paper.

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

Answer **all six** 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 **2(c)** and Question **5(a)**.

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- 1 (a) Mobile phones involve receiving and transmitting waves which some people think might be harmful to health. All new mobile phones in the UK must be tested and given a SAR (specific absorption rating). The SAR value is a measure of the energy absorbed by the head while a mobile phone is being used.

The table gives the SAR value, **for adults**, for three different mobile phones.

To be sold in the UK, a mobile phone must have a SAR value lower than 2.0 W/kg.

Mobile phone	SAR value in W/kg
X	0.15
Y	0.85
Z	1.85

- (i) Give **two** reasons why there might be a significant risk to very young children using mobile phone **Z**.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

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

- (ii) Other than keeping the length of the call as short as possible, what precaution might a user of a mobile phone take to minimise the risk of absorbing too much radiation?

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

Examiner Only

Marks Remark



- (b) Complete the table below to show what happens when light waves are **refracted as they travel from air into glass**.  
Choose your answer from increases, decreases or stays the same.

	increases/decreases/stays the same
Frequency	
Wavelength	
Speed	

[3]

- (c) Seismic (earthquake) waves travel through the earth to the surface. When they arrive there they cause buildings on the surface to vibrate. One type of seismic wave, called an S-wave, causes buildings on the surface to vibrate parallel to the Earth's surface.

buildings vibrate in this direction



wave direction

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- (i) Seismic waves are either longitudinal or transverse. What type of wave is a seismic S-wave?

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

- (ii) Explain the reason for your answer to part (c)(i).

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

Examiner Only	
Marks	Remark

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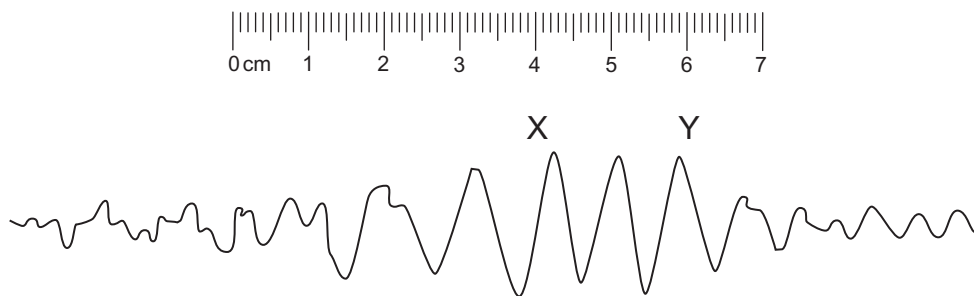


- (iii) An S-wave has a speed of 3.5 km/s in the Earth's crust and its frequency is 1.3 Hz. Calculate its wavelength. Give your answer in metres.

You are advised to show clearly how you get your answer.

Wavelength = \_\_\_\_\_ m [4]

The vibrations caused by earthquakes are detected by a seismometer. The graph produced is called a seismograph. The **full-scale** diagram below shows a seismograph.



- (iv) Using the ruler shown in the diagram measure the horizontal distance between the peaks X and Y. Each 1 cm on the scale represents a time of 0.8 s. Convert your measured distance to a time and use your answer to calculate the frequency of the seismic wave in the region XY. Remember the region XY shows two complete waves.

Frequency = \_\_\_\_\_ Hz [4]

Examiner Only

Marks	Remark





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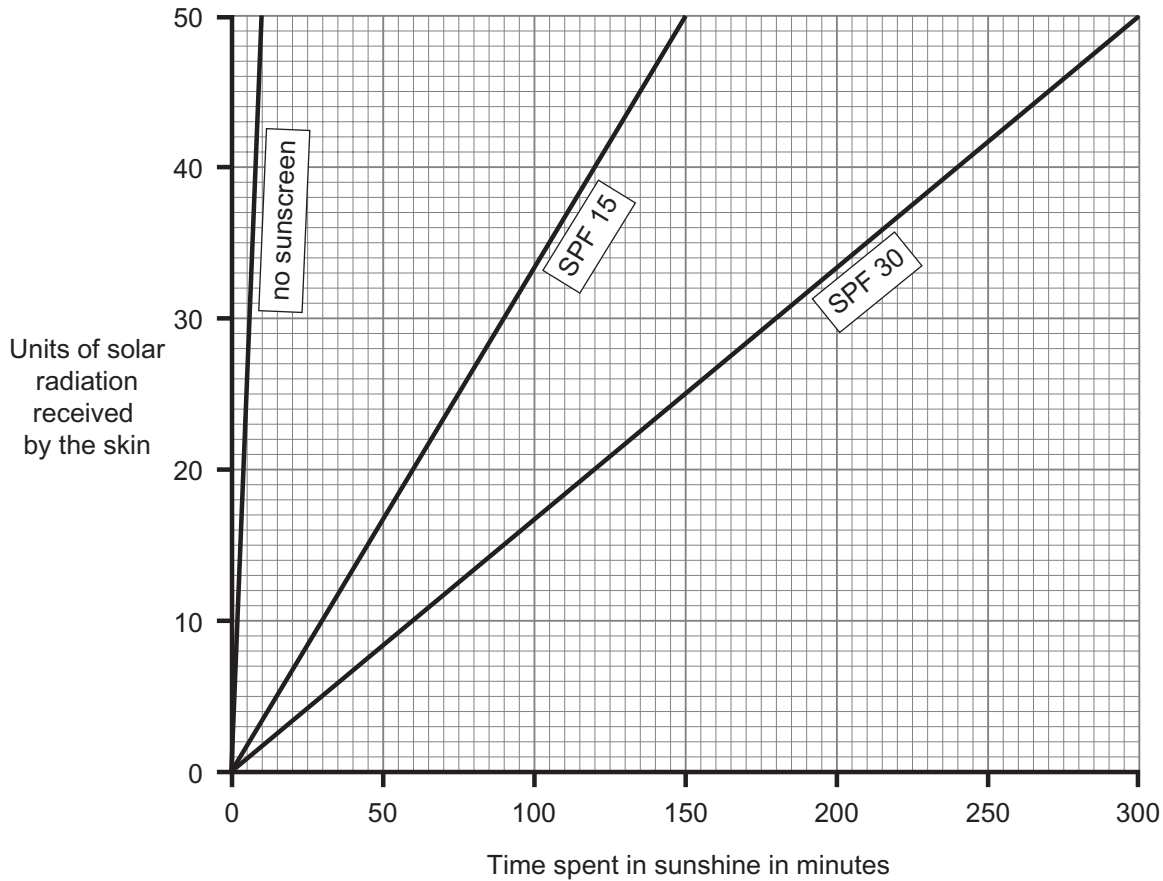
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(d) The longer you sunbathe, the more ultraviolet solar radiation your skin receives.

Sunscreen lotions absorb some of this radiation. The lotions are given a skin protection factor (SPF) number.

The graph shows how the amount of radiation received by a person's skin is related to how long they are outside on a sunny day.

**The skin gets sunburn if it receives 50 units of solar radiation.**



(i) How much longer can you stay in the sunshine if you use a lotion with SPF 30 rather than one with SPF 15 before you get sunburn?

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

Examiner Only	
Marks	Remark







For those who use sunscreen lotions, **the length of time they can stay in the sun before they get sunburn is directly proportional to the SPF factor of the sunscreen lotion used.**

- (ii) By considering the relationship between the SPF factor and the maximum time spent in the sun, calculate what minimum SPF factor is required for someone who wants to stay in the sun for 2 hours without getting sunburn.

**You are advised to show clearly how you get your answer.**

SPF = \_\_\_\_\_ [2]

Examiner Only	
Marks	Remark
Total Question 1	



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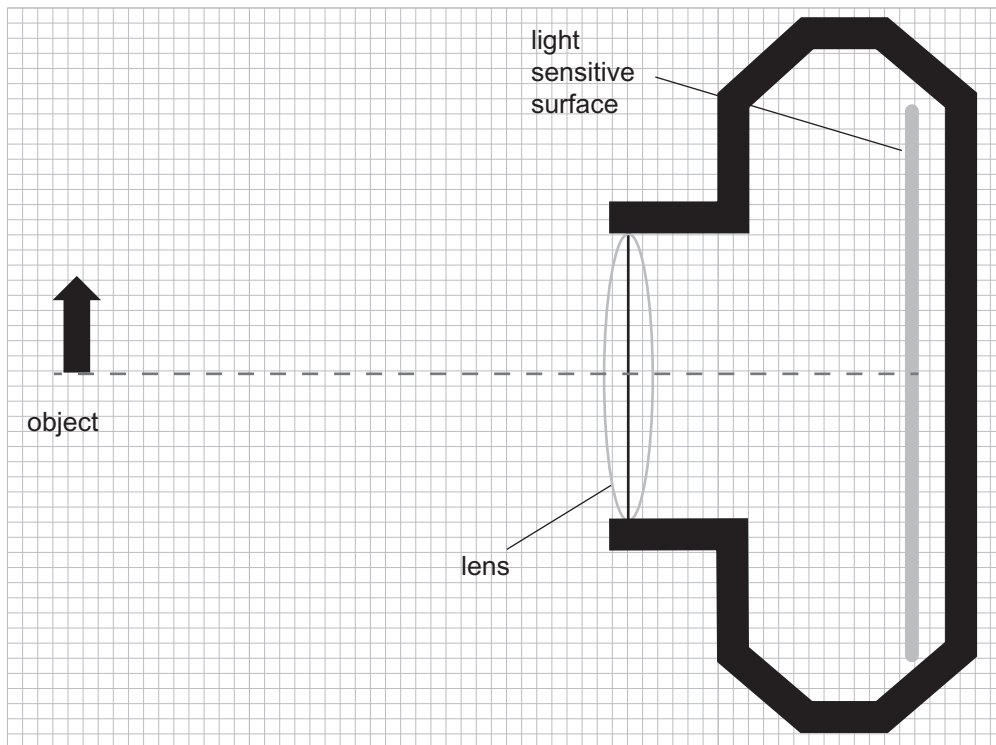


2 (a) A camera is used to take a picture of a tall object.  
The image is formed on the light sensitive surface of the camera.

(i) Give **three** properties of the image on the light sensitive surface.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_ [3]

(ii) On the **full-scale** diagram below, draw **two rays using a ruler** from the top of the object to show where the image is formed on the light sensitive surface. Remember to put arrows on your rays to show the direction in which the light is travelling and mark clearly the image.



[4]

(iii) Using a ruler, measure the focal length of the lens.  
Give your answer in mm.

Focal length = \_\_\_\_\_ mm [2]

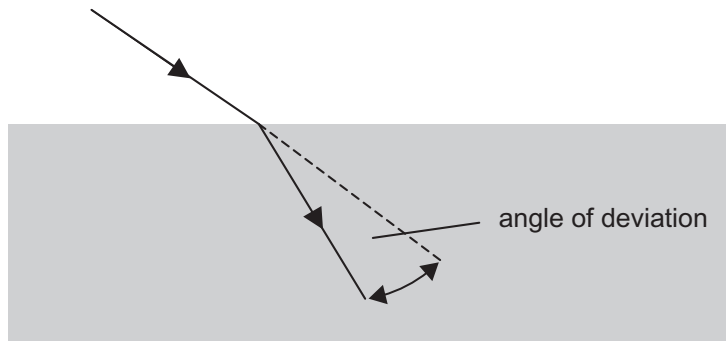
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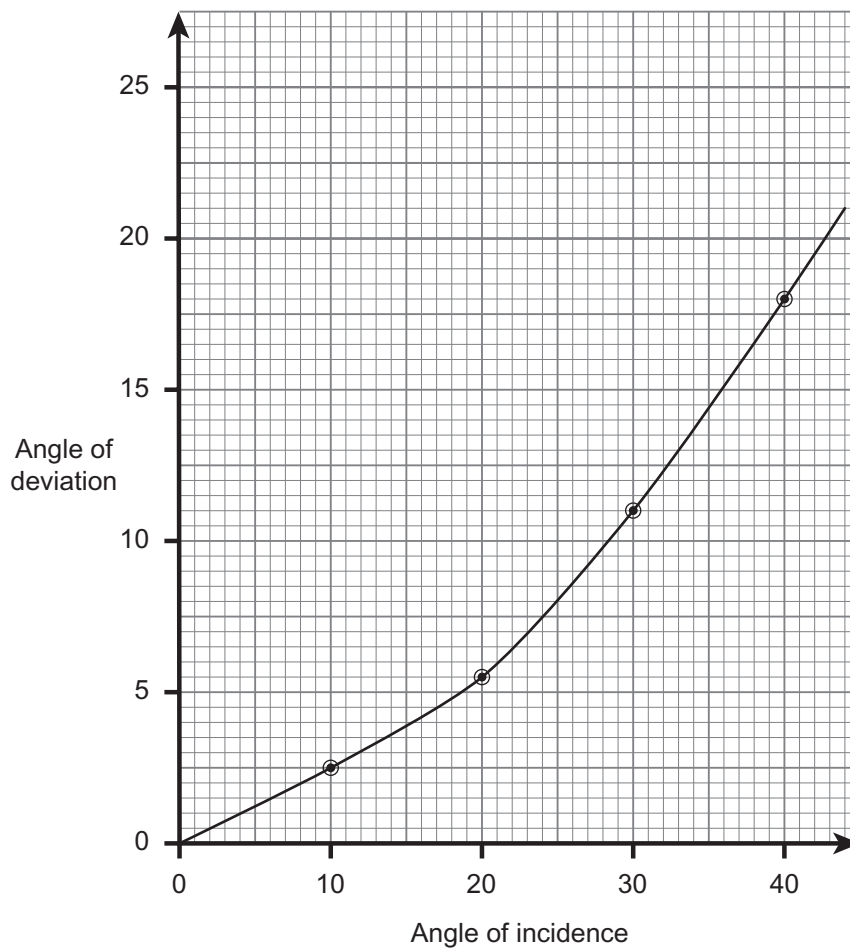
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- (b) When a ray of light is passed through a glass block it is refracted. The diagram shows a ray of light passing through a glass block. The angle of deviation is the angle between the incident ray and the refracted ray.



As part of a physics lesson Joanne used the set-up shown above to measure the angle of deviation for a range of angles of incidence. The results she obtained are plotted on the grid below.



Examiner Only

Marks Remark





(i) As shown on the grid Joanne drew a curve through the points. She then came to the conclusion that the angle of deviation was proportional to the angle of incidence. Explain why this conclusion was wrong.

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 [2]

(ii) Using values, taken from the graph, for the angles of deviation when the angle of incidence is  $20^\circ$  and  $40^\circ$  carry out two calculations that show the angle of deviation is **not** proportional to the angle of incidence. Explain how your calculations support this correct conclusion.

Explanation \_\_\_\_\_

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 [3]

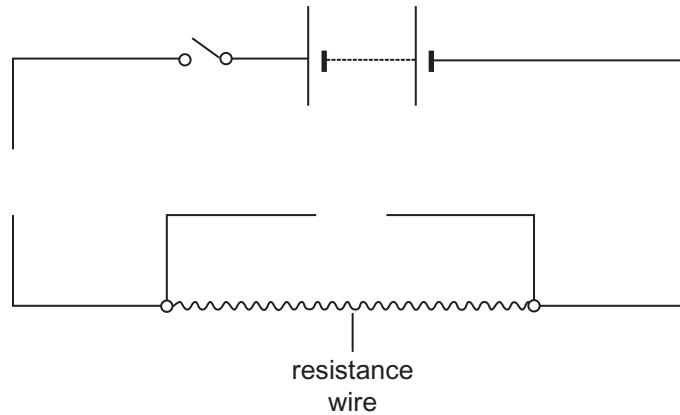
Examiner Only	
Marks	Remark







3 A pupil wishes to measure the resistance of a length of resistance wire. They are given the following incomplete circuit diagram.



- (a) To help ensure reliable results the pupil decides to take three sets of values for current and voltage for each length of wire.
  - (i) Using the correct circuit symbols complete the above circuit to show how a voltmeter, an ammeter and a variable resistor should be connected. [3]
  - (ii) During the investigation the pupil only closes the switch when taking a set of readings. One reason for doing this is to help conserve the energy of the battery but there is also another important reason. State what this other reason is and explain why this is good experimental practice. [2]

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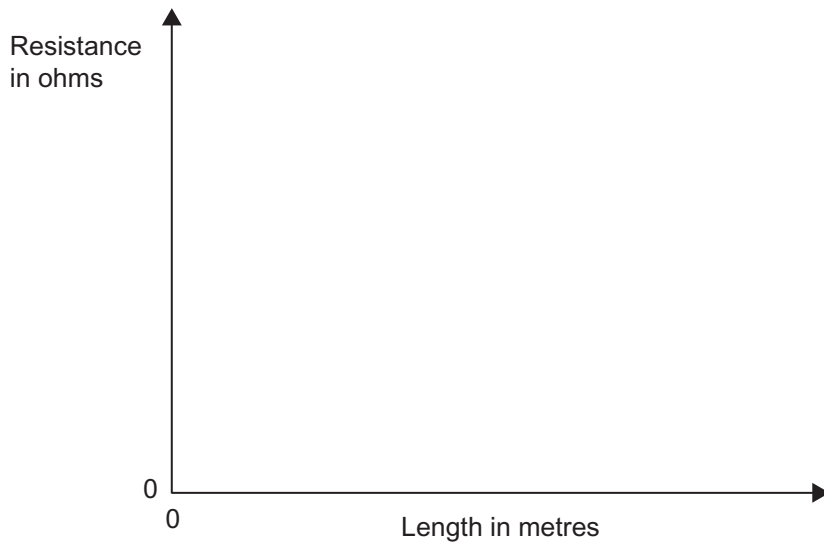
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Examiner Only	
Marks	Remark



The pupil used the circuit to measure the resistance of different lengths of wire of the same material.

(iii) On the axes below draw the graph he would expect to get when he plotted his results. [1]



(iv) An 80 cm length of this wire was found to have a resistance of  $12\ \Omega$ . Calculate the resistance of a 60 cm length of the same wire.

**You are advised to show clearly how you get your answer.**

Resistance = \_\_\_\_\_  $\Omega$  [2]

Examiner Only	
Marks	Remark







- (v) Calculate the resistance of a piece of this wire of length **120 cm** and area of cross section **half** of that of the one in part (iv).

**You are advised to show clearly how you get your answer.**

Resistance = \_\_\_\_\_  $\Omega$  [2]

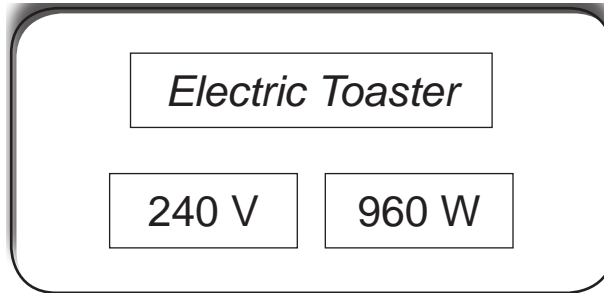
Examiner Only	
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- (b) The picture below shows an electric toaster and the label attached to it.



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- (i) Using the information from the label, as given above, calculate the current flowing in the toaster when it is in use.

**You are advised to show clearly how you get your answer.**

Current = \_\_\_\_\_ A [3]

- (ii) Calculate the resistance of the wire used in the toaster.

**You are advised to show clearly how you get your answer.**

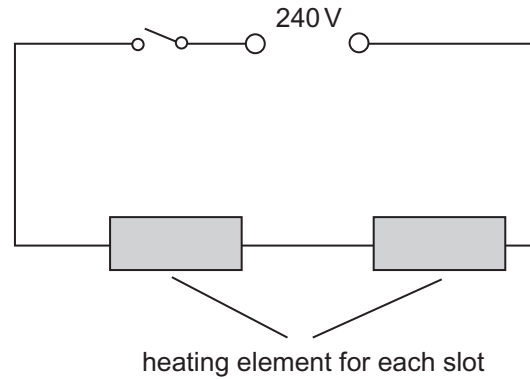
Resistance = \_\_\_\_\_  $\Omega$  [3]

Examiner Only

Marks Remark

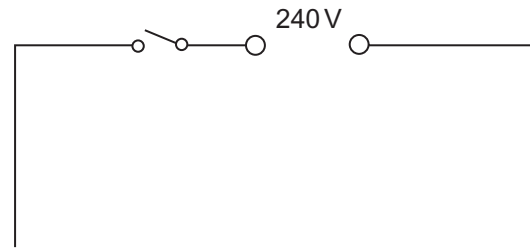


- (c) The toaster shown in the picture, which can take two slices of bread, always has both toasting slots switched on when in use. This wastes electrical energy for a lot of people who wish to make only one slice of toast. The diagram below shows the basic circuit for the toaster.



By rearranging the heating elements and adding additional switches it is possible to make a toaster to toast either one or two slices of bread as required.

Complete the diagram below to show how the circuit could be arranged.



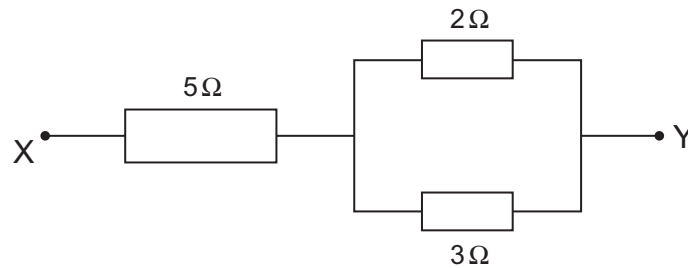
[2]

Examiner Only	
Marks	Remark



(d) Calculate the total resistance between points X and Y of the resistor network shown below.

You are advised to show clearly how you get your answer.



Total resistance = \_\_\_\_\_  $\Omega$  [2]

Examiner Only

Marks Remark

Total Question 3



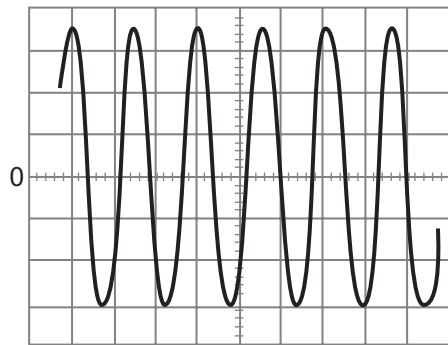


4 (a) Electrical signals can be either a.c. or d.c.  
What is meant by the abbreviations a.c. and d.c.?

(i) a.c. \_\_\_\_\_ [1]

(ii) d.c. \_\_\_\_\_ [1]

(b) An electrical signal is connected to a CRO (cathode ray oscilloscope) and a student makes a sketch of the waveform obtained, as shown below.



(i) How can you tell from the sketch that the electrical signal is a.c.?

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

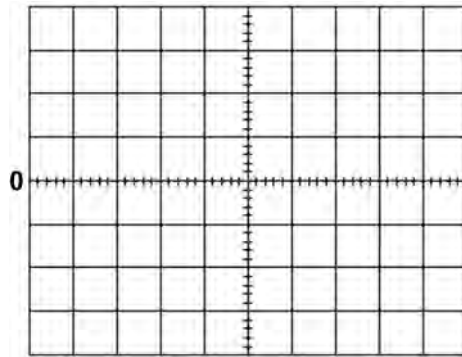
(ii) How can you tell from the sketch that the electrical signal has a constant frequency?

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

Examiner Only	
Marks	Remark



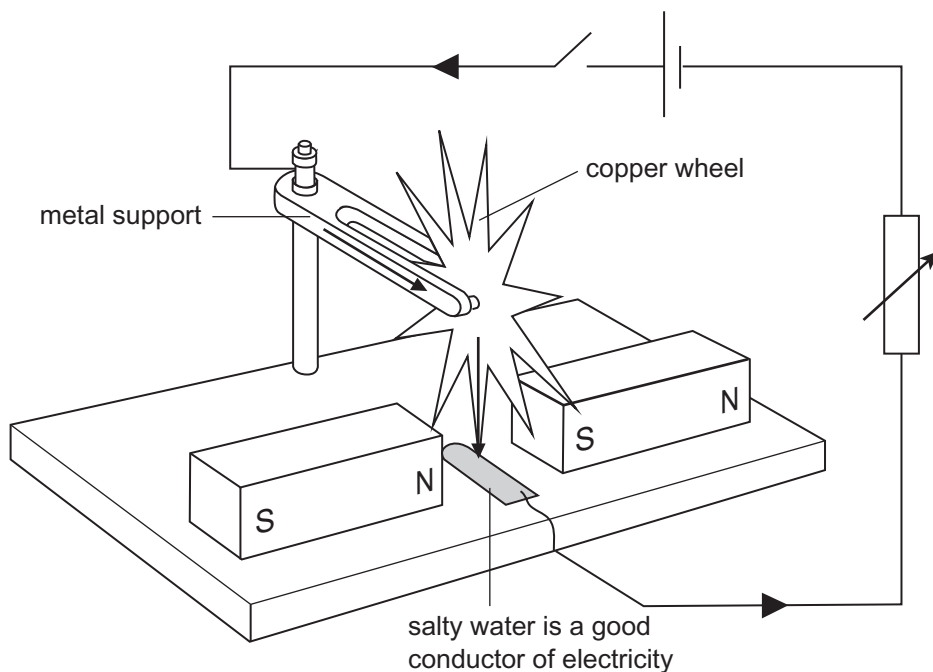
(iii) Sketch below a graph to show what the student might see on the CRO screen if the voltage was a **changing d.c.**



[2]

(c) Below is a sketch of a piece of apparatus which can be seen in some science museums. It consists of a star-shaped wheel made of copper which can rotate in the vertical plane, with one point of the wheel dipping into a pool of salty water. A wire from the salty water to the cell completes the circuit.

When the switch is closed, a current flows in the direction shown, by the arrows, through the copper wheel.



Examiner Only

Marks Remark



A magnetic field, perpendicular to the spoke dipping into the salty water, is provided by two magnets, one on either side of the wheel.

- (i) Describe and explain fully what would be observed happening to the wheel when the switch is closed.

Description: \_\_\_\_\_  
\_\_\_\_\_ [2]

Explanation: \_\_\_\_\_  
\_\_\_\_\_ [2]

When the switch is closed the variable resistor is adjusted so that the current flowing in the wheel is increased.

- (ii) What effect, if any, would this have on the wheel?  
\_\_\_\_\_ [1]

The switch is opened and both magnets are now turned round so as to reverse the direction of the magnetic field at the spoke dipping into the salty water.

- (iii) The switch is closed again. In what way, if at all, would the behaviour of the copper wheel be different from your answer to (i)?  
\_\_\_\_\_ [1]

Examiner Only

Marks	Remark

[Turn over

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(d) Transformers are used to reduce the 240 V mains voltage to run electric fences on farms in Britain.

One of the transformer coils has 480 turns, the other coil has 160 turns.

(i) What is the number of turns on the primary and secondary coils?

Number of turns on the primary coil = \_\_\_\_\_

Number of turns on the secondary coil = \_\_\_\_\_

[2]

(ii) Calculate the output voltage of the transformer.

**You are advised to show clearly how you get your answer.**

Output voltage = \_\_\_\_\_ V [6]

Examiner Only

Marks Remark

Total Question 4







**(b) (i)** The Big Bang model for the formation and evolution of the Universe involves a number of stages. These are described in the numbered statements shown below.

Place the stages in the order in which physicists believed they occurred.

Write your answers in the boxes provided.

1. neutrons and protons are formed
2. further expansion and cooling of the Universe allows hydrogen nuclei to form
3. further expansion and cooling allowing electrons to combine with neutrons and protons to form atoms of hydrogen
4. rapid expansion and cooling of the Universe

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↑  
start

[2]

**(ii)** What is cosmic microwave background radiation?

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[1]

**(iii)** What is the origin of cosmic microwave background radiation?

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[2]

Examiner Only

Marks Remark



(c) Gravity has played and continues to play an important part in the Universe.  
Describe three of the roles that gravity plays in the shaping of the Universe.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_

[3]

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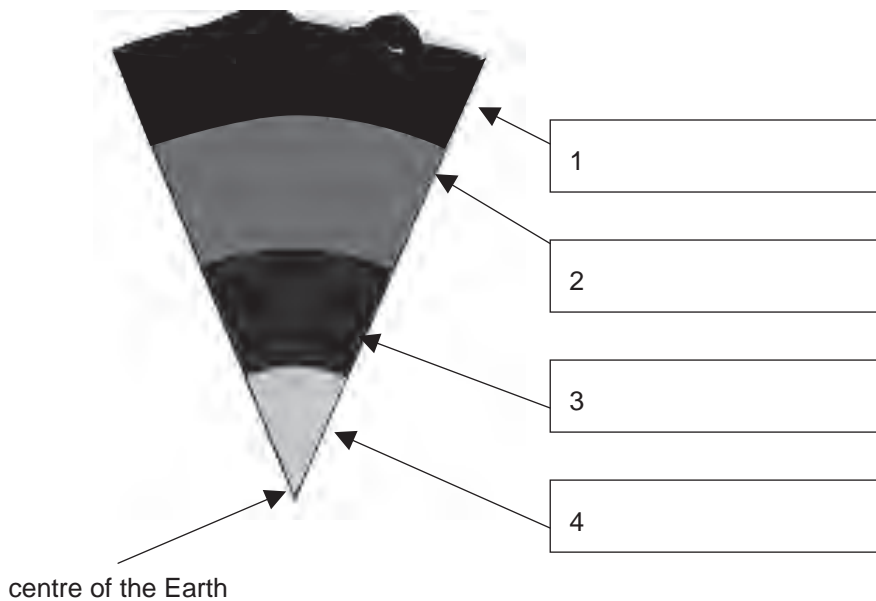


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6 (a) The Earth is divided into layers. These layers have different properties and compositions.

(i) On the diagram below label each of the layers marked by arrows. Write the name in the box provided.



Examiner Only	
Marks	Remark

[4]

(ii) Name the layer or layers which are solid.

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

(iii) Iron is one of the two main elements that are present in layer 4. Name the other element.

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

(iv) What are layer 1 and the upper part of layer 2 collectively known as?

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



(b) One cause of earthquakes is explosive volcanic eruptions. The other cause is associated with tectonic activity. Explain what tectonic activity is and how it produces earthquakes.

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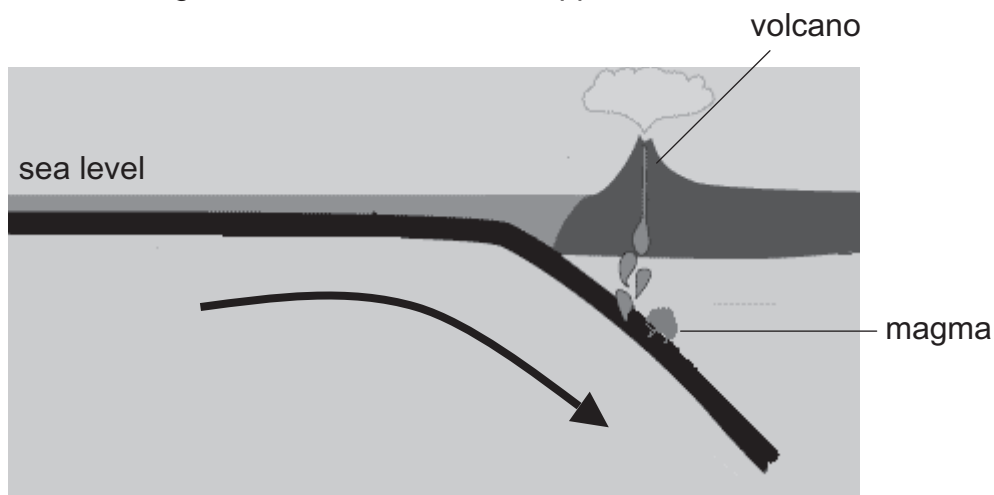
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[2]

(c) Most volcanoes are also produced as a result of tectonic activity. The diagram below shows what happens.



Adapted from: © The Why Files – University of Wisconsin - Madison

(i) Describe what is shown happening in this diagram.

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[3]

(ii) What energy is required to form magma shown in the diagram and what is the source of this energy?

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[2]

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Total Question 6	





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Question Number	Marks
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<b>Total Marks</b>	

Examiner Number

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