Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014

GCSE: Physics

Unit 2

Foundation Tier

[GPH21]

GPH21

MONDAY 23 JUNE, MORNING

TIME

1 hour 30 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 90.
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 **5(c)**.

Examiner Only	
Marks	Remark

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) All organisations use the same test to measure a SAR value.
Why is using the same test important?

_____ [1]

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

1. _____

_____

2. _____

_____ [2]

(iii) 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]

(b) Water waves and light waves can be refracted and reflected.

Examiner Only	
Marks	Remark

(i) Complete the table below to show what happens when light waves are **reflected by a plane mirror**.
Choose your answer from increases, decreases or stays the same.

	increases/decreases/stays the same
Frequency	
Wavelength	
Speed	

[3]

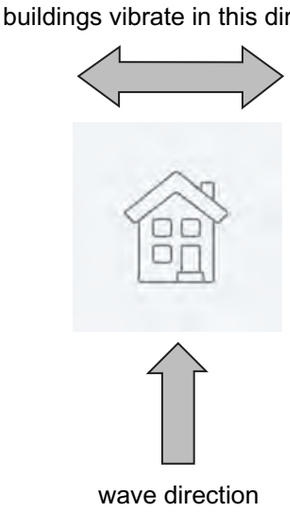
(ii) Complete the table below to show what happens when light waves are **refracted as they travel from air into glass**.
Choose your answer from increases, decreases or stays the same.

	increases/decreases/stays the same
Frequency	
Wavelength	
Speed	

[3]

Examiner Only	
Marks	Remark

(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.



(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]

(iii) This particular S-wave has a wavelength of 2700 m and its frequency is 1.3 Hz. Calculate its speed.

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

Speed = _____ m/s [4]

Examiner Only	
Marks	Remark

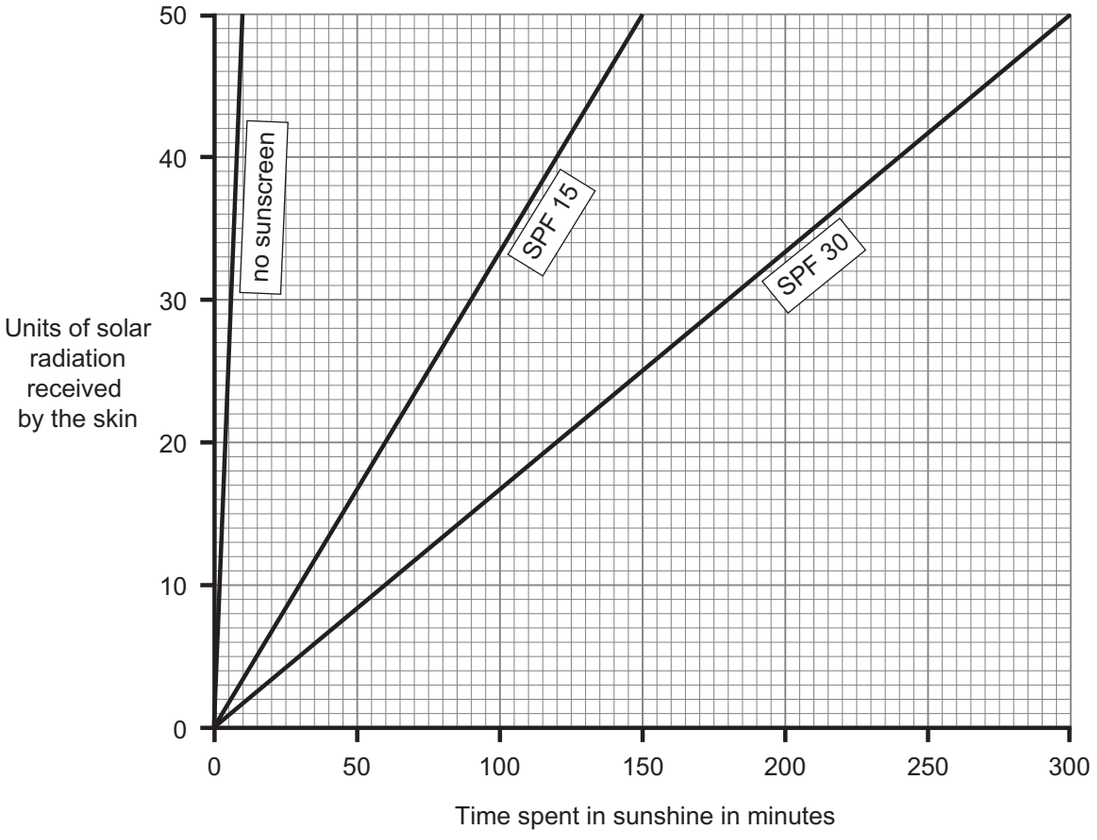
(d) The longer you sunbathe, the more solar radiation your skin receives.

Examiner Only	
Marks	Remark

(i) Which part of the electromagnetic spectrum causes sunburn?

_____ [1]

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.



(ii) If no sunscreen is applied, how long can you stay in the sun before you get sunburn?

_____ minutes [1]

(iii) 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
Total Question 1	

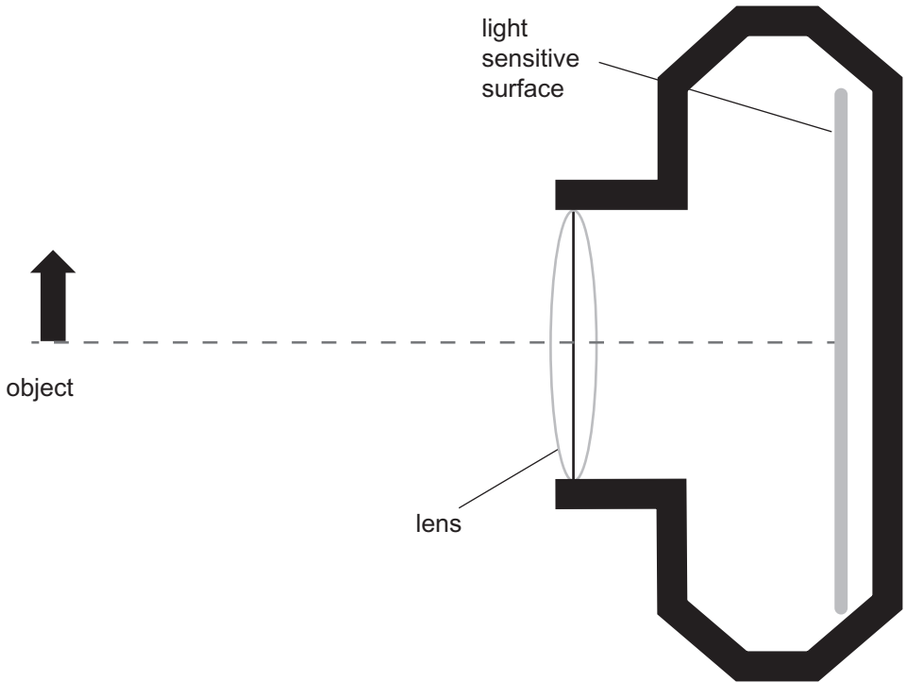
Examiner Only	
Marks	Remark

2 **(a)** **(i)** What is meant by the focal length of a converging lens?

_____

_____ [1]

(ii) A converging lens is used in a camera as shown below. On the diagram draw **two rays <u>using a ruler</u>** 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.



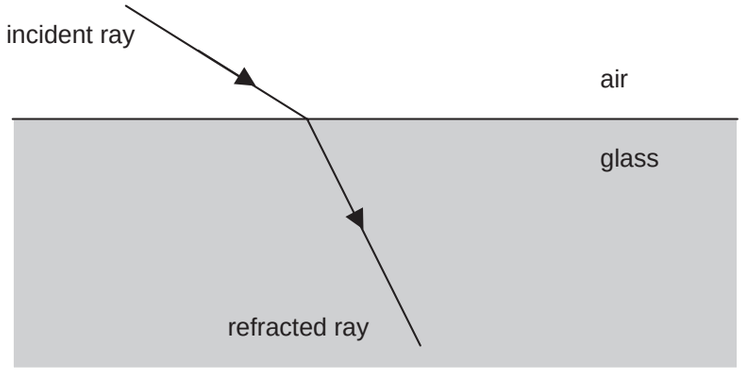
[4]

(iii) The image in the camera is real.
What is meant by a real image?

_____

_____ [1]

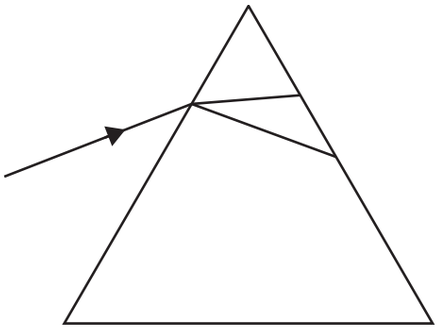
(b) When a ray of light is passed through a glass block it is refracted. The diagram below shows a ray of light incident on a glass block. The refracted ray is also shown.



(i) On the diagram mark clearly with the letter i the angle of incidence. [1]

(ii) On the diagram mark clearly with the letter r the angle of refraction. [1]

(iii) The diagram shows the dispersion of white light by a glass prism. Complete the diagram to show the path of red and violet rays as they leave the prism.
Label each ray with its colour.

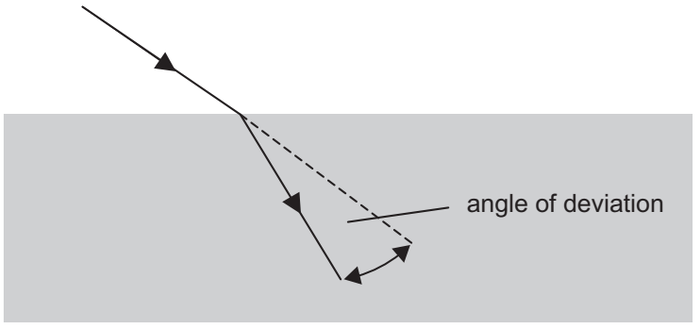


[1]

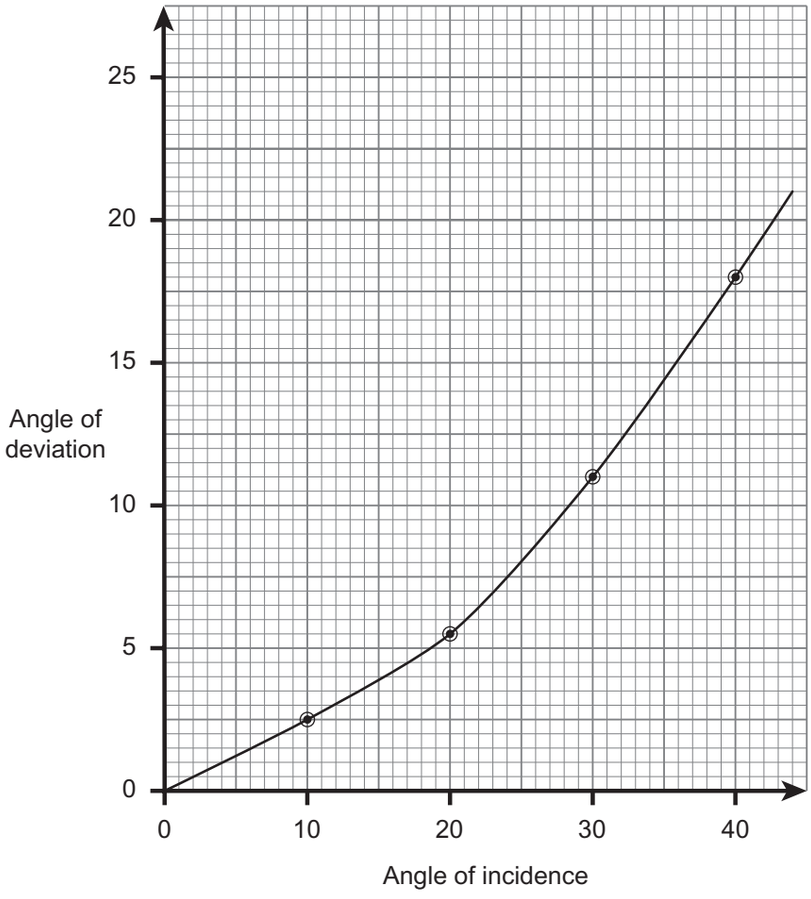
Examiner Only	
Marks	Remark

(c) 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.

Examiner Only	
Marks	Remark



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.



(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.

_____

_____

_____ [2]

(ii) Using values, taken from the graph, for the angles of deviation when the angle of incidence is 20° and 40° 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 _____

_____

_____ [3]

(iii) The diagram below shows a glass block.
On the diagram show the path taken by a ray of light through the glass block for which the angle of incidence is **zero**.

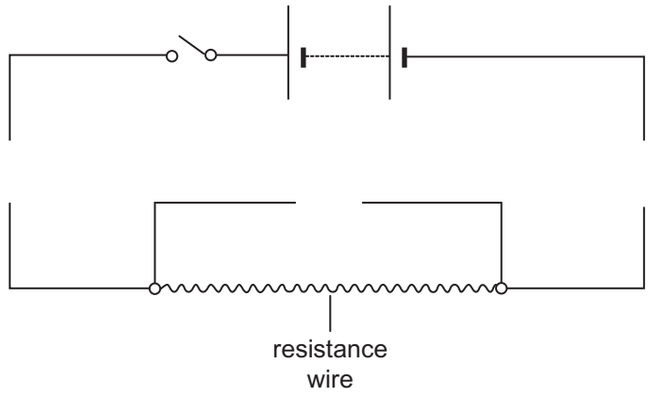
[1]

Examiner Only	
Marks	Remark
Total Question 2	

[Turn over

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

Examiner Only	
Marks	Remark



(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.

_____

_____

_____

_____

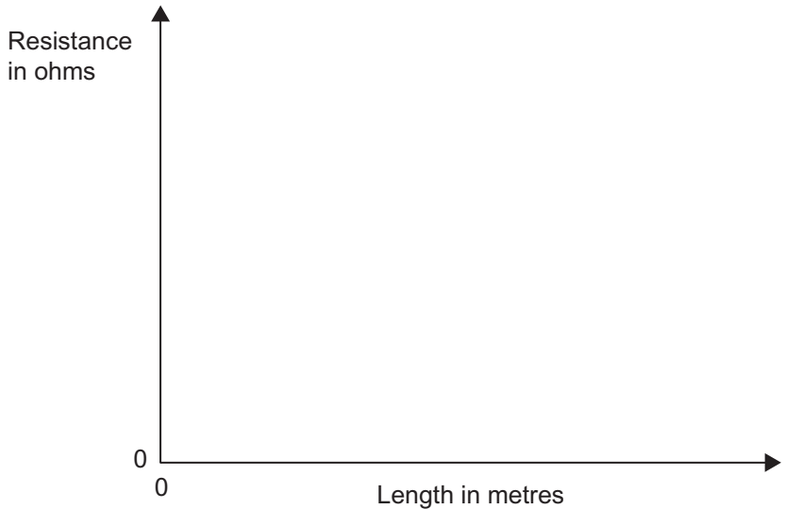
_____

_____ [2]

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

Examiner Only	
Marks	Remark

(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 Ω.
Calculate the resistance of a 60 cm length of the same wire.

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

Resistance = _____ Ω [2]

[Turn over

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

Examiner Only	
Marks	Remark

Electric Toaster

240 V | 960 W

(i) What property of the toaster does the term 960 W describe?

_____ [1]

(ii) 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]

(iii) Calculate the resistance of the wire used in the toaster.

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

Examiner Only

Marks	Remark

Resistance = _____ Ω [3]

(iv) The toaster generates heat energy by passing electrical current through a length of nichrome resistance wire. Using the free electron model, for current flow, explain how heat is generated in the wire.

_____

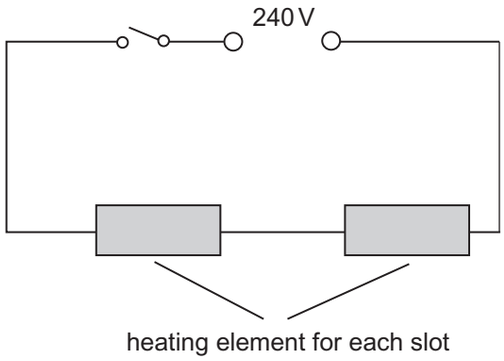
_____

_____

_____

_____ [2]

(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 if only one slice of toast is required. The diagram below shows the basic circuit for the toaster.



(i) Explain why it is **not** possible to have only one element on.

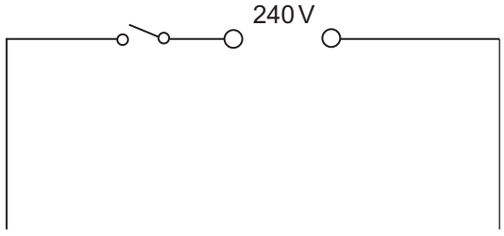
_____

_____

_____ [1]

(ii) 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
Total Question 3	

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(Questions continue overleaf)

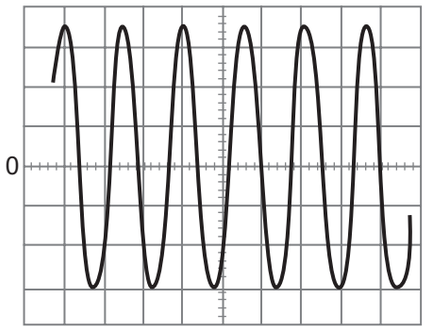
Examiner Only	
Marks	Remark

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.?

_____

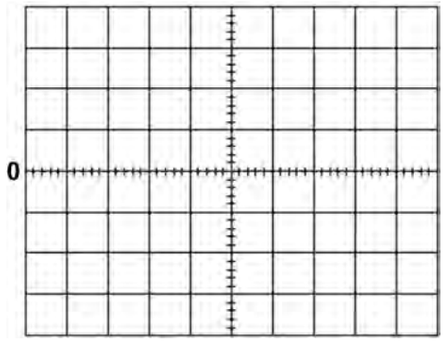
_____ [1]

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

_____

_____ [1]

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



[2]

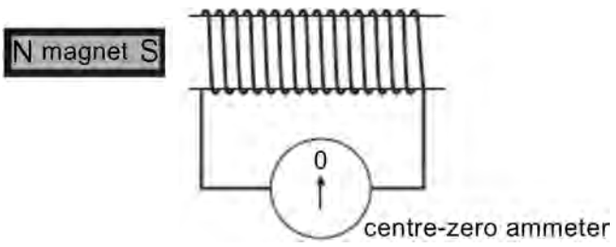
(iv) Name a source of d.c. _____ [1]

(v) Name a source of a.c. _____ [1]

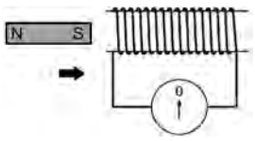
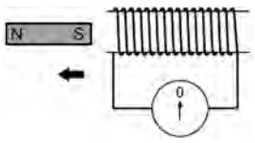
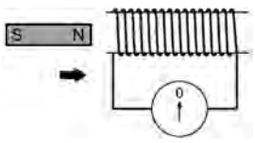
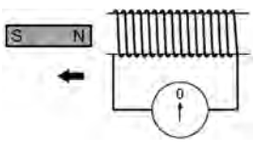
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(c) Caroline is investigating electromagnetic induction using a bar magnet, a coil of wire and a centre-zero ammeter.



When Caroline moves the south pole of the magnet towards the coil, the ammeter needle deflects to the left. This deflection has been entered into her results table below.

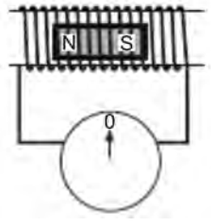
Movement of magnet	Deflection: LEFT, RIGHT or NONE
South pole moves towards coil 	***LEFT***
South pole moves away from coil 	
North pole moves towards coil 	
North pole moves away from coil 	

(i) Complete the results table above to show the deflection, if any, of the ammeter needle. [3]

(ii) Describe the difference between an ammeter deflection to the left and one to the right **in terms of electric current**.

_____ [1]

Caroline moves the bar magnet into the coil and leaves it there.



(iii) Describe and explain what is observed on the ammeter when the magnet is stationary inside the coil.

Description: _____

_____ [1]

Explanation: _____

_____ [1]

(iv) Producing an electric current using a coil and a magnet is called electromagnetic induction. Write down the name of a piece of industrial or scientific equipment which uses electromagnetic induction.

_____

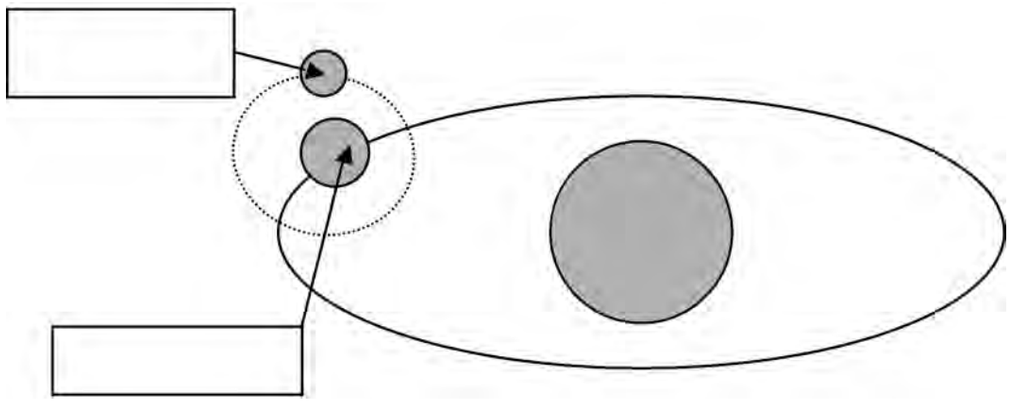
_____ [1]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

Examiner Only	
Marks	Remark

5 **(a)** The diagram below shows the Sun, Earth and Moon.
Write the names of those objects indicated by arrows inside the boxes provided.



[2]

(b) **(i)** With the present method of space travel, why is it unlikely that we will ever travel to a planet outside our solar system?

_____

_____

_____ [1]

(ii) State one piece of evidence that the inhabitants of another planet might detect, that would show that life exists on Earth.

_____

_____ [1]

(c) The photograph below shows a nebula. It is believed that our solar system was formed from a nebula. The bright spots are stars.

© Science Photo Library

Describe what a nebula consists of and explain the stages that a nebula goes through as it forms a star.

In this question you will be assessed on your written communication skills including the use of specialist science terms.

[6]

Examiner Only	
Marks	Remark
Total Question 5	

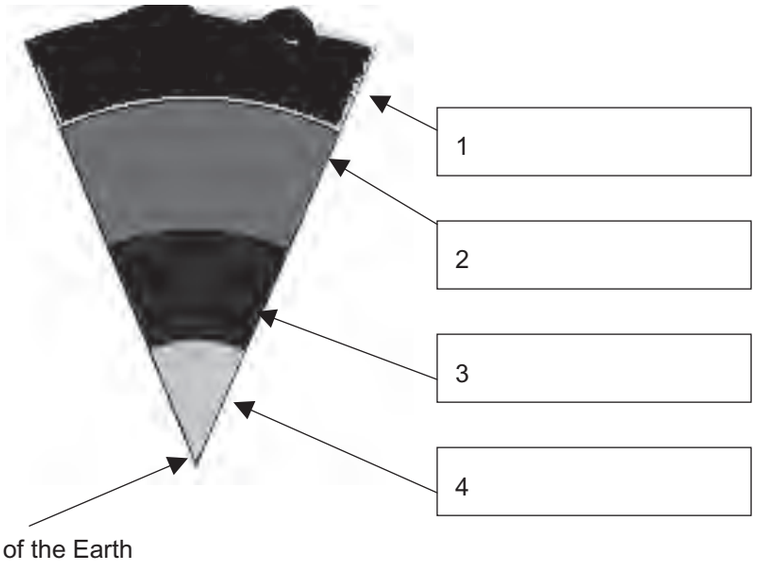
[Turn over

Examiner Only	
Marks	Remark

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.
Choose your answers from the words listed below.

Inner Core **Mantle** **Crust** **Outer Core** **Water** **Air**



[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.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 6	

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For Examiner's use only	
Question Number	**Marks**
1	
2	
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5	
6	
Total Marks	

Examiner Number