CCEA GCSE PHYSICS

PHYSICS



EXAM QUESTION PACK

UNIT P2 FOUNDATION TIER GPH21 PAPERS

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016

Science: Physics

Unit 2

Foundation Tier

GPH21

[GPH21]

FRIDAY 24 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.
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 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 **2(c)(ii)**.

9868

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1 **(a)** The diagram below shows four of the seven members of the electromagnetic spectrum. They are arranged in order of increasing wavelength.

Gamma waves		Ultraviolet light		Infrared light		Radio waves

Short wavelength ⟶ Long wavelength

(i) Identify the three missing members of the electromagnetic spectrum by writing their names in the appropriate parts of the diagram. [3]

Different members of the electromagnetic spectrum have different uses.

(ii) Draw a line between appropriate points below to join the wave with its use.

Wave		**Use**
Gamma waves	•	• Detect forged banknotes
Ultraviolet light	•	• Long distance communication
Infrared light	•	• TV remote controls
Radio waves	•	• Sterilisation of medical equipment

[4]

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(b) One kind of earthquake wave is called an L-wave.

In L-waves the particles of the material vibrate perpendicular to the direction of propagation. A particular L-wave has a frequency of **0.002 Hz** and a wavelength of **2 500 000 m**.

(i) Which **one** of the following statements about L-waves is true?
Tick (✔) the appropriate box.

L-waves are transverse. ☐

L-waves are longitudinal. ☐

L-waves are neither transverse nor longitudinal. ☐

[1]

(ii) Explain what is meant by a wavelength of **2 500 000 m**.

_____

_____

_____

_____ [2]

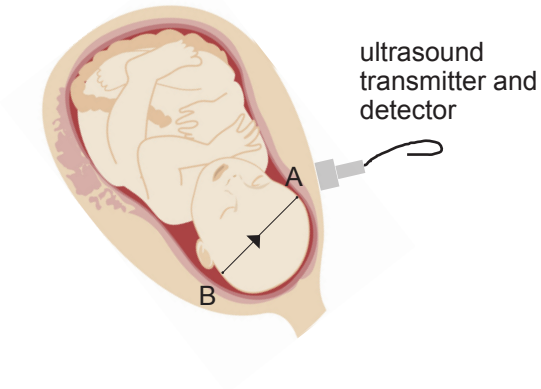
(iii) Use the information above to calculate the speed of this L-wave. Give your answer in m/s.

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

Speed = _____ m/s [4]

[Turn over

(c) Ultrasound can be used to measure the diameter of the head of a baby in the womb. The ultrasound is passed through the womb and the baby's head. The time for the ultrasound to travel from **B to A** is measured.



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(i) What name is given to the reflection of a sound wave?

_____ [1]

(ii) It takes **0.00006** seconds for the ultrasound to travel from point B to point A.
Ultrasound travels at a speed of **1500 m/s** in a baby's head.
Calculate the width of the baby's head.
Give your answer in m.

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

Width of baby's head = _____ m [4]

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(iii) Explain why it is better to use ultrasound rather than X-rays when monitoring the development of a baby in the womb.

_____

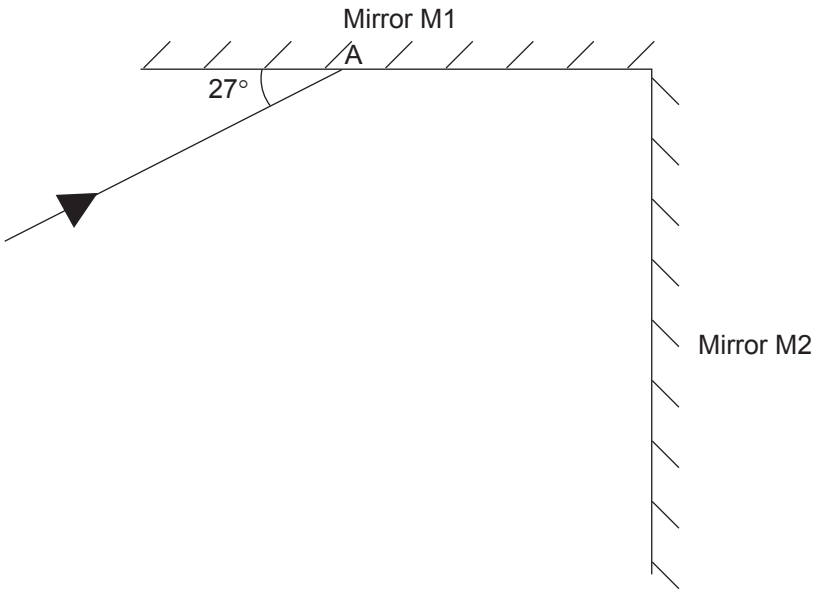
_____

_____ [1]

[Turn over

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24GPH2105

2 **(a)** Two mirrors, M1 and M2, are placed at right angles to one another.
The diagram below shows a ray of light incident on mirror M1 at point A.



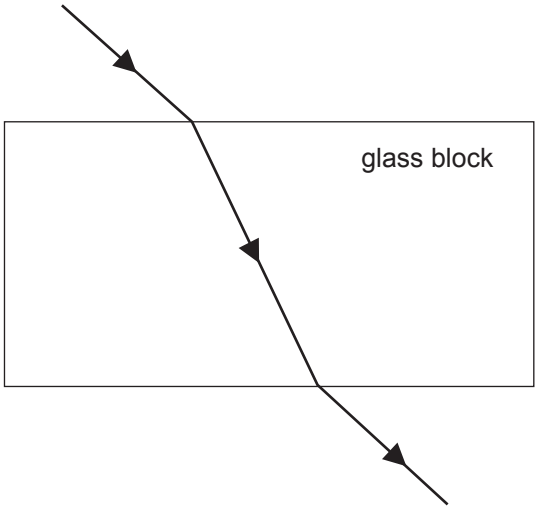
(i) Calculate the angle of reflection at point A.

Angle of reflection = _____ ° [1]

(ii) On the diagram above draw, as accurately as you can, the reflected ray from A and from mirror M2. [2]

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(b) The diagram below shows a ray of light passing through a rectangular glass block.



(i) What name is given to the bending of the light when it passes from air into glass?

_____ [1]

(ii) **Using a ruler** draw the normal at the point where the light enters the glass. Label the normal with the letter "N". [1]

(iii) Mark **clearly** on the diagram the angle of incidence in air with the letter "**i**" and the angle of refraction in the glass with the letter "**r**". [1]

(iv) What causes the light to change direction in the way shown in the diagram when it passes from air into glass?

_____

_____

_____ [2]

[Turn over

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(c) (i) State carefully what is meant by the focal length of a converging lens.

_____

_____

_____ [1]

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(ii) Describe **in detail** how you would use **a distant object** to measure the focal length of a converging lens. In your description you must:

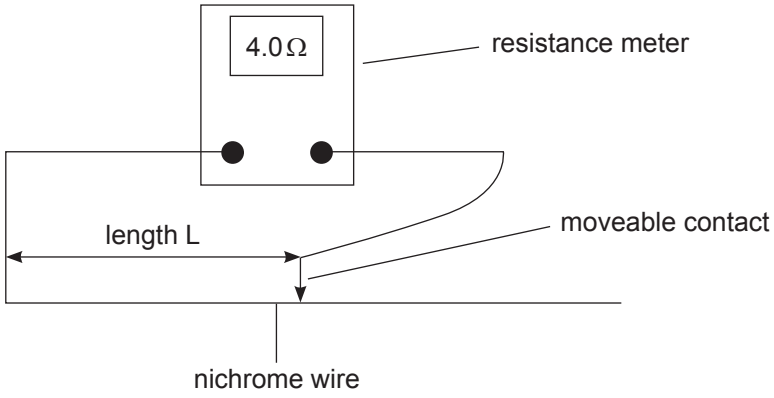
- state the apparatus you use;
- describe fully what you would do;
- state what measurement(s) you must make to find the focal length;
- state what you would do to ensure your measurement of the focal length is as accurate as possible.

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

[6]

[Turn over

3 **(a)** A student was given a resistance-meter, which measures resistance directly, and a length of nichrome resistance wire.
She connected the circuit shown below and recorded the resistance of various lengths of the wire.



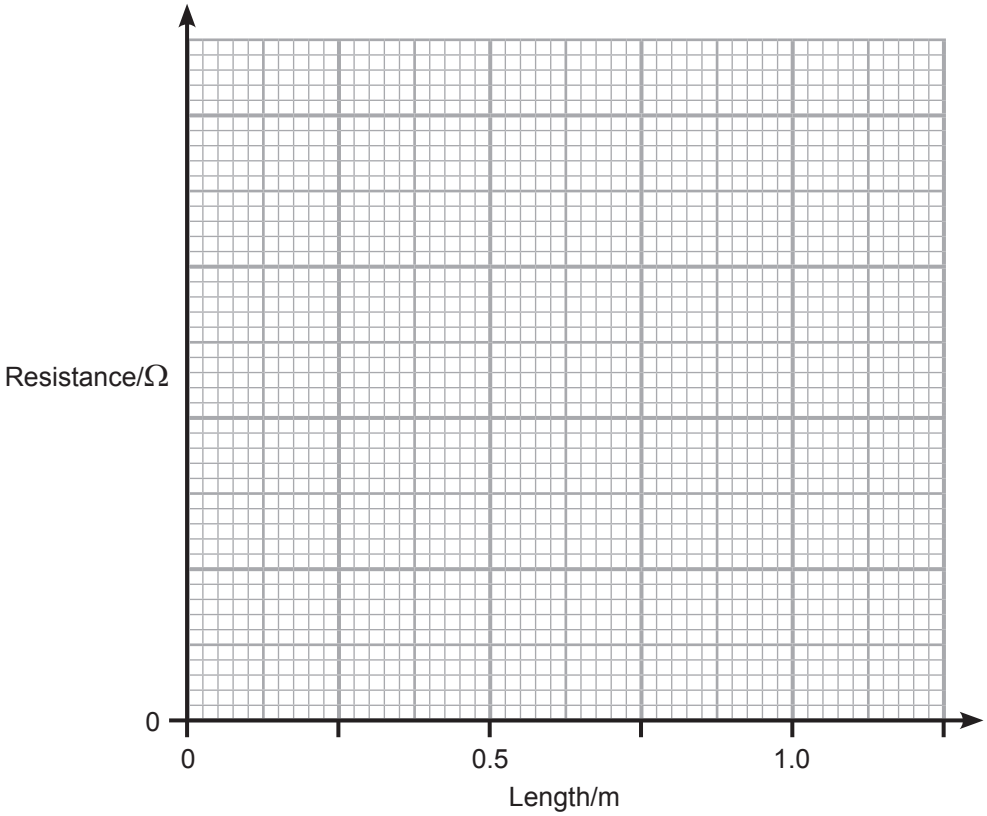
Her results are recorded in the table below.

Length of wire/m	0.00	0.25	0.50	0.75	1.00
Resistance/Ω	0.0	4.0	7.0	12.0	17.0

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(i) Using the results in the table and the grid below plot a graph of the points and draw the **line of best fit**.

[4]



(ii) The relationship between the resistance R and length L of the wire is of the form

$$\mathbf{R = k \times L}$$

Explain how you could obtain the value of k from the graph.

_____ [1]

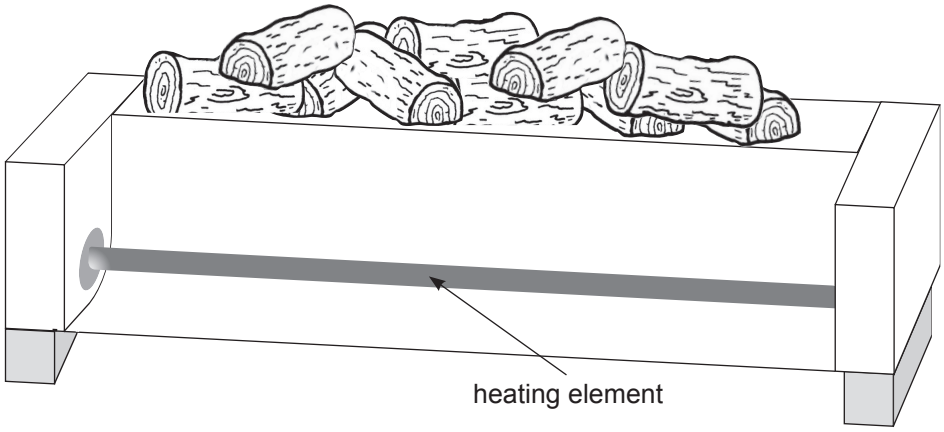
(iii) **Using your graph** find the value of k and include a unit for it.

k = _____ [2]

[Turn over

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(b) Nichrome resistance wire is often used to make the heating elements for electric heaters.



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The heater has an electric power rating of 720 W when operated from a 240 V mains supply.

(i) Using the equation for electrical power calculate the current flowing through the heating element.

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

Current = _____ A [2]

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(ii) Using your answer to part **(b)(i)** calculate the resistance of the nichrome wire used in the heating element.

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

Resistance = _____ Ω [2]

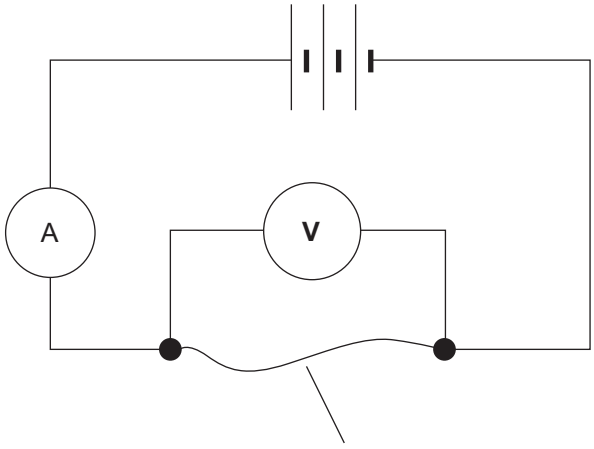
(iii) The nichrome wire used is known to have a resistance of 40 Ω per metre of length. What length of wire is required to make the heating element?

Length = _____ m [2]

[Turn over

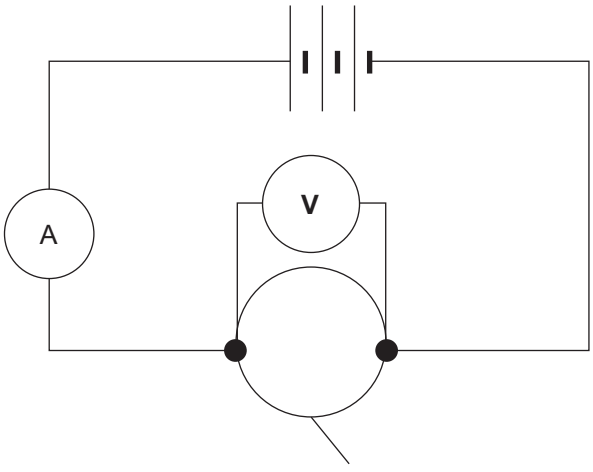
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(c) The circuit below was set up.



The ammeter read 0.2A and the voltmeter 4.8V which meant that the wire had a resistance of 24Ω.

The wire was removed and shaped into a circle with the voltmeter connected across the diameter of the circle as shown below.



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(i) What would the voltmeter now read?

Voltmeter reading = _____ V [1]

(ii) Explain how you arrived at your voltmeter reading.

_____

_____ [1]

(iii) What would the resistance of each semicircle or half of the wire be?
Remember the complete wire had a resistance of 24 Ω.

Resistance of each half = _____ Ω [1]

(iv) Now calculate the resistance of the wire in the circuit when it is formed into a circular loop.

Resistance of circular wire loop = _____ Ω [2]

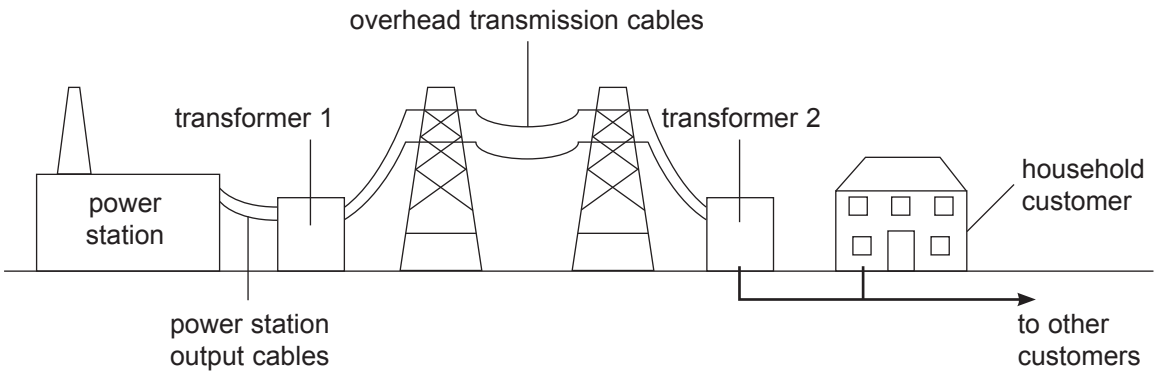
(v) What would the ammeter now read?
Remember the original ammeter reading was 0.2A.

Ammeter reading = _____ A [2]

[Turn over

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4 **(a)** The diagram below represents the distribution network for electricity from the power station to users such as households.



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(i) What type of transformer is transformer 1?

_____ [1]

(ii) What type of transformer is transformer 2?

_____ [1]

(iii) Explain fully why transformer 2 is used at the position shown.

_____

_____ [2]

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(iv) Energy is lost in several locations in the network and all this is paid for by the customers. The overhead cables which stretch for many kilometres around the countryside are a main source of energy loss.

Explain fully what the electricity companies do to reduce this energy loss after it leaves the power station.

_____

_____

_____

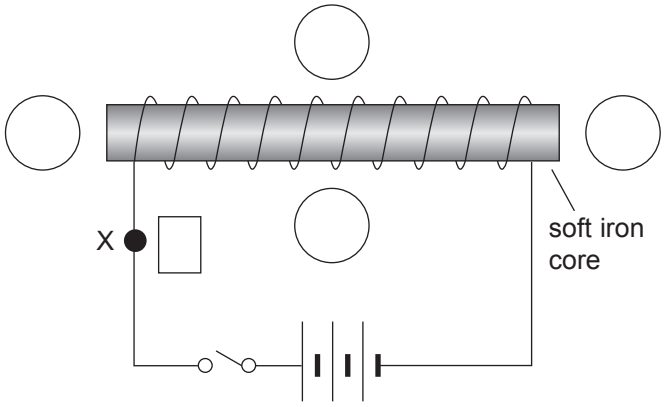
_____

_____ [3]

[Turn over

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(b) The diagram below shows a simple electromagnet.



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(i) The switch is closed. At the point marked X show the direction of the current flow by drawing an arrow in the box beside it. [1]

(ii) On the soft iron core mark clearly the magnetic North and South poles. [1]

(iii) The circles represent the position of a magnetic compass.
Mark an arrow in each of the circles to show the direction of the magnetic field at each position. [2]

(iv) The wire used to wind the coil of the electromagnet is insulated.
Explain why this must be the case.

_____

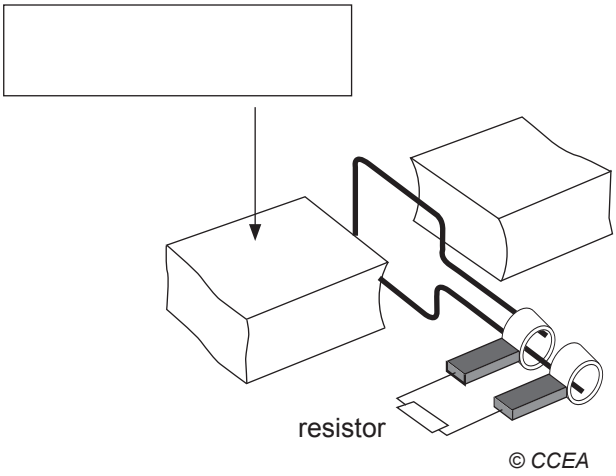
_____

_____

_____ [2]

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(c) The diagram below shows a simple generator.



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(i) Name the part marked by the arrow. Write your answer in the box provided.

[1]

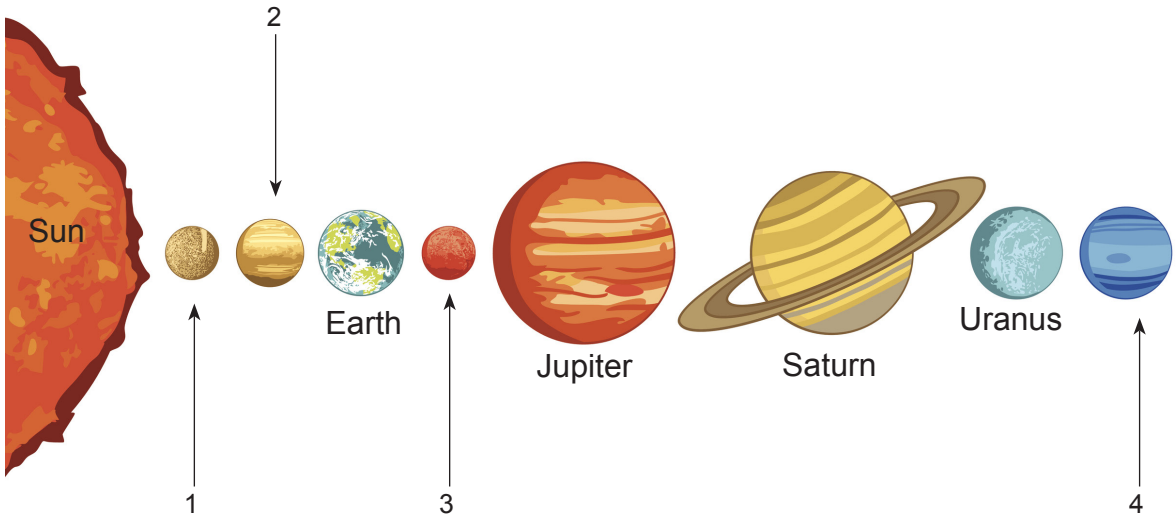
(ii) When the coil is rotated a current passes through the resistor.
What type of current is produced, a.c. or d.c.?

_____ [1]

[Turn over

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5 **(a)** The diagram below shows our Sun and the planets that make up the Solar System.



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(i) Name the planets marked by numbers.

1 _____ 2 _____

3 _____ 4 _____

[4]

(ii) What provides the centripetal force that keeps planets in orbit?

_____ [1]

(iii) The Solar System was probably formed from a large cloud of material known as a nebula. Name one piece of evidence that supports this view.

_____

_____

_____ [1]

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(b) Although we cannot travel to stars we know they are mainly composed of two gases.

(i) Name these two gases.

1. _____ 2. _____

[2]

(ii) How do we know that stars are mostly composed of these two gases?

_____

_____ [1]

(iii) Stars like our Sun produce very large amounts of energy. What is the name of the process responsible for this energy production?

_____ [1]

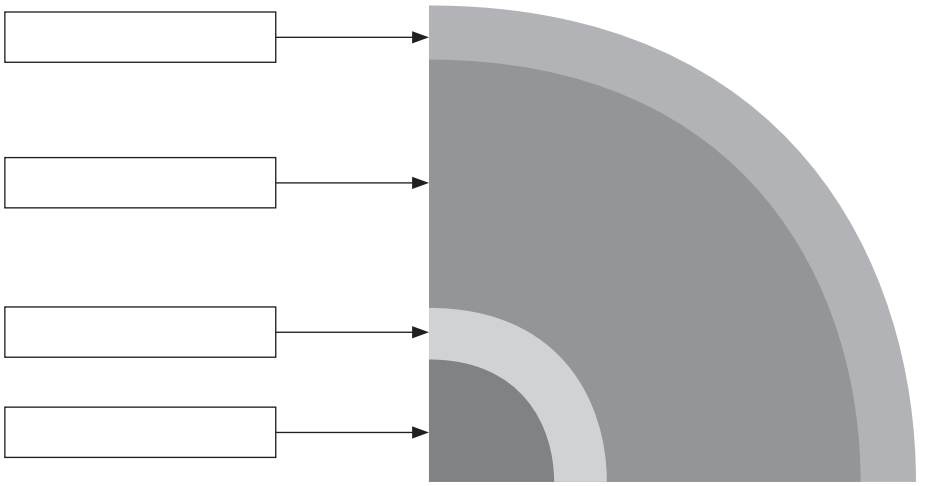
[Turn over

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6 **(a)** The diagram below shows a cross section through the Earth.

(i) On the diagram name the four layers into which the Earth is divided.
Write your answers in the boxes provided.
Choose your answers from the words below.

outer core	**crust**	**mantle**
atmosphere	**inner core**	**ocean**



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[4]

(ii) What name is given to the crust and the solid portion of the upper mantle?

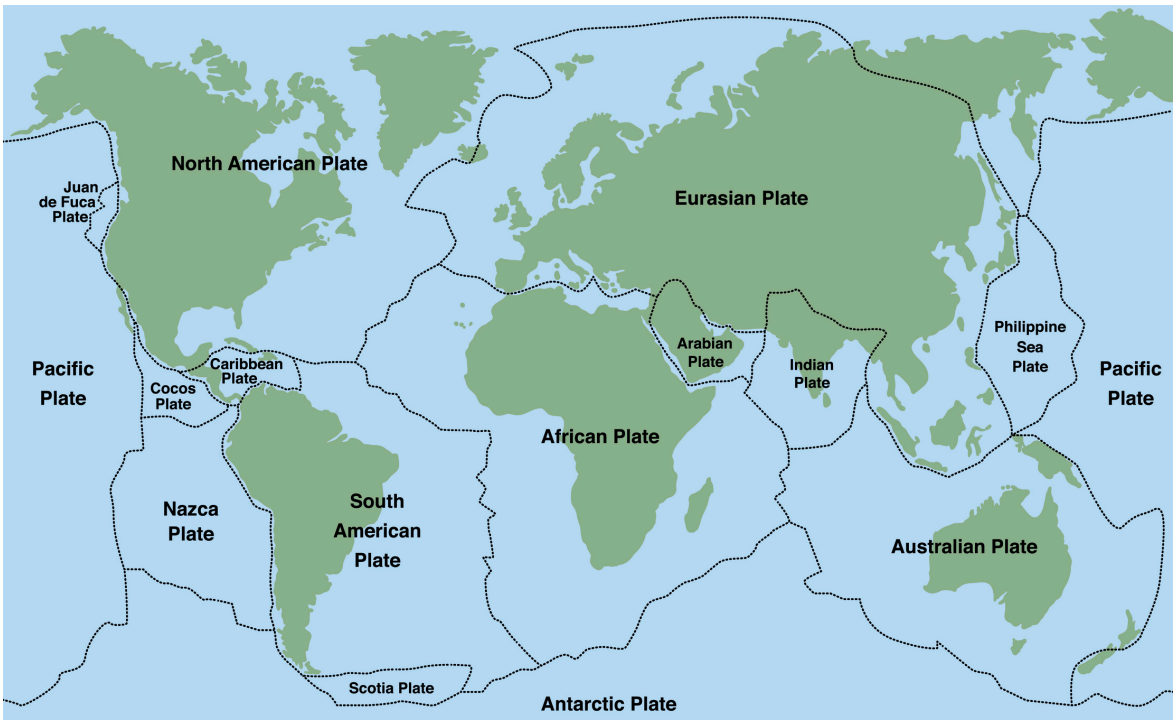
_____ [1]

(iii) What two metals are the constituents of the innermost layers?

_____ and _____ [2]

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(b) The rigid outermost shell of the Earth is broken up into sections as shown below. These sections are known as tectonic plates.



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Explain how earthquakes occur at some plate boundaries.

_____

_____

_____

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

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Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

Examiner Number

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General Certificate of Secondary Education
2016

Science: Physics

Unit 2

Foundation Tier

[GPH21]

FRIDAY 24 JUNE, MORNING

MARK SCHEME

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General Marking Instructions and Mark Grids

Introduction
Mark schemes are intended to ensure that the GCSE examination is marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses
In marking the examination papers, examiners should be looking for a quality response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking
Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, the examiners should seek the guidance of the Supervising Examiner.

Positive marking
Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

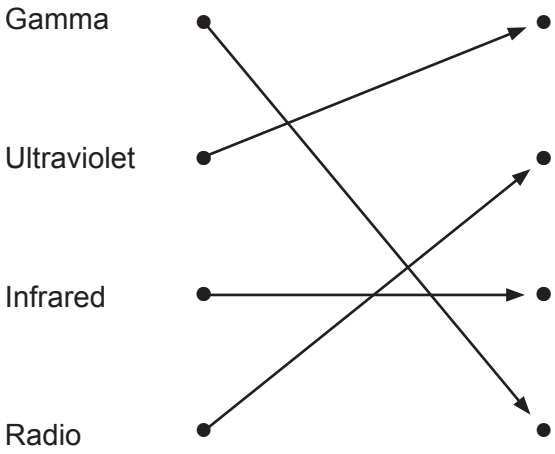
Awarding zero marks
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark scheme
Mark Schemes for questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

1 **(a)** **(i)** In order X-rays, Visible, Microwaves [3]

(ii)



[4]

(b) **(i)** Transverse [1]

[1] [1]

(ii) distance between successive crests/troughs is 2 500 000 m [2]
give credit for a correct diagram
between peaks/troughs award [1]

(iii) $v = f\lambda$ must be an equation [1]
$= 0.002 \times 2\,500\,000$ [2]
$= 5000$ (m/s) [1] [4]

(c) **(i)** echo [1]

(ii) distance = speed × time [1]
= 1500 × 0.00006 [2]
= 0.09 (m) [1] [4]

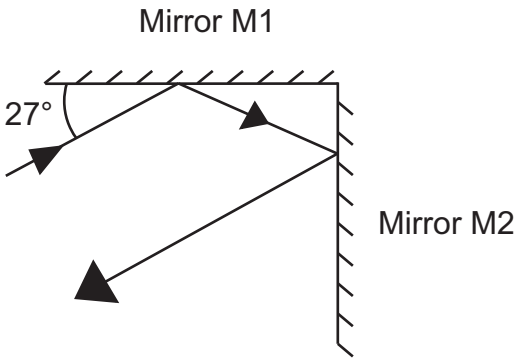
(iii) X-rays kill/damage cells or are harmful to baby/change of DNA/suggestion of danger or damage
or
ultrasound does not/less harmful
('it' implies ultrasound) [1]

AVAILABLE MARKS

20

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					AVAILABLE MARKS
2	(a)	(i)	Angle of reflection = 63(°)	[1]	
		(ii)	Judge angles and direction by eye (Incident and reflected ray parallel)	[2]	



	(b)	(i)	Refraction	[1]	
		(ii)	Normal drawn (and marked N) on both sides of boundary/ interface	[1]	
		(iii)	Angles of incidence and refraction marked both required	[1]	
		(iv)	Light slows down Change of speed give [1] Light speeds up give [0]	[2]	
	(c)	(i)	Distance from the lens or optical centre to principal focus or focal point/or point to which parallel rays converge (meet) Give credit for a correct diagram	[1]	
		(ii)	**Indicative content:** Lens (in a holder) Screen/white sheet/wall/paper Metre rule/ruler/tape measure Choice of distant object, e.g. a tree/window/more than 5 m away Move lens until sharp image formed (on screen)/move screen Focused or clear means sharp Measure distance from lens to screen Repeat **and** average (both required)		

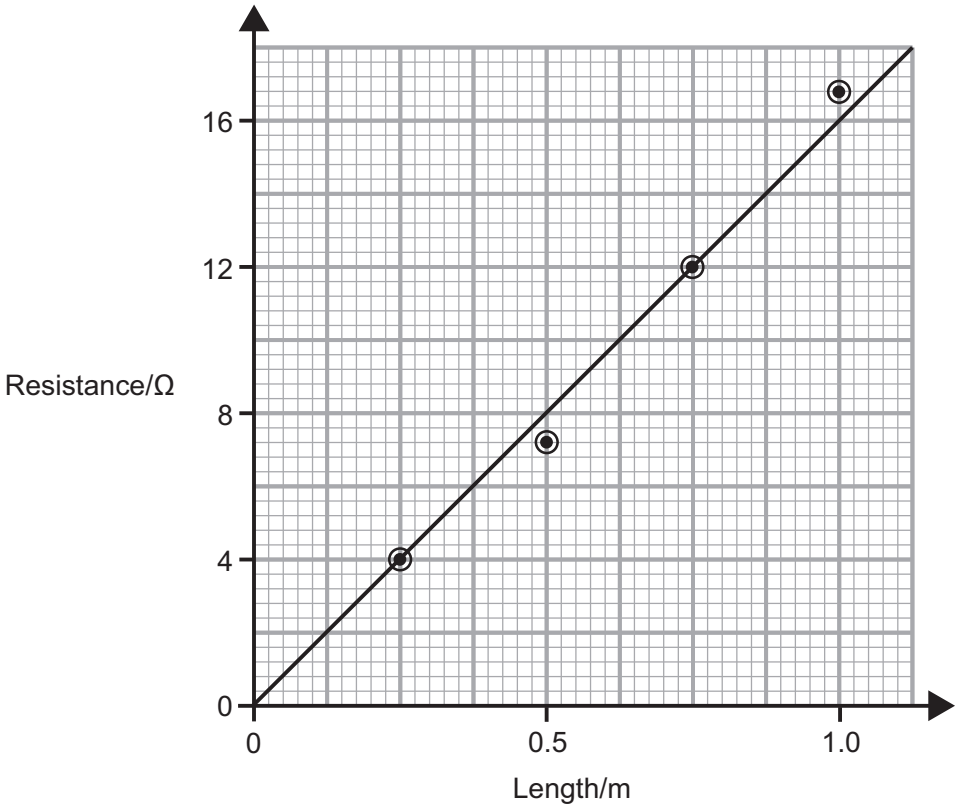
Response	Mark
Candidates describe in detail using good SPG **at least 5 points** shown opposite. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good SPG **at least 3 points** shown opposite. The form and style are of a high standard and specialist terms are used appropriately on some occasions.	[3]–[4]
Candidates make some reference to **one of the points** shown opposite using good SPG. The form and style are of a satisfactory but there is limited use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6] 15

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AVAILABLE MARKS

3 **(a)** **(i)** Suitable choice of scale on resistance axis [1]
At least half of the grid used.
Points correctly plotted ± 1 square
[$\frac{1}{2}$] each round up to max [2] [2]
Any (best) line fit through origin and through one other point [1] [4]



(ii) Find the gradient/k = $\frac{R}{L}$/divide R by L/put values into equation [1]

(iii) Gradient = rise/run = 16 ± 1 consistent with their line [1]
Unit = Ω/m or $\frac{\Omega}{m}$ [1] [2]

(b) **(i)** I = P/V or 720/240 [1]
= 3 (A) [1] [2]

(ii) R = V/I or 240/3 ecf from **(i)** or P = I^2R or P = $\frac{V^2}{R}$ [1]
= 80 (Ω) R = 80 (Ω) R = 80 (Ω) [1] [2]
(correct subs get 1 mark)

(iii) length = 80/40 ecf from **(ii)** [1]
= 2 (m) [1] [2]

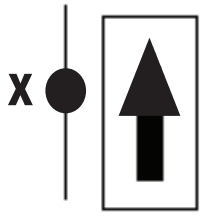
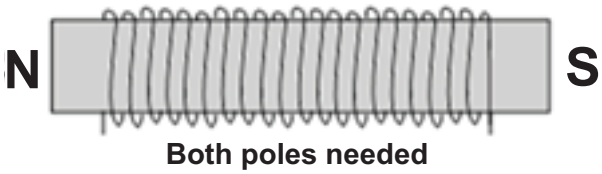
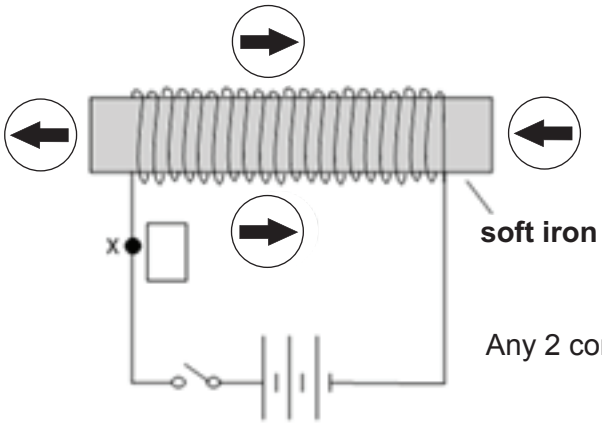
(c) **(i)** 4.8 V [1]

(ii) Cells/battery/power or voltage supply has not changed/ parallel circuit
If **(c)(i)** is wrong or missing **(c)(ii)** = [0] [1]

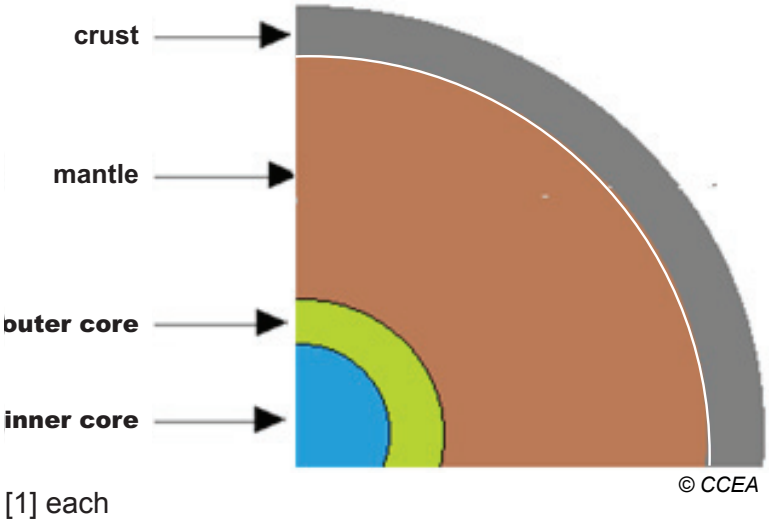
(iii) 12 (Ω) [1]

(iv) New resistance = 12/2 allow ecf from **(c)(iii)** [1]
= 6 (Ω) [1] [2]

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						AVAILABLE MARKS
	(v)	New current = 4.8/6 No ecf from **(c)(i)**				
		or Resistance now $\frac{1}{4}$ of original value		[1]		
		= 0.8 (A) so current is 4 times as great		[1]	[2]	20
4	**(a)**	**(i)** Step up			[1]	
		(ii) Step down			[1]	
		(iii) To reduce the voltage		[1]		
		To safe value/named voltage 220–240 V/suitable voltage for appliances		[1]	[2]	
		(iv) The voltage at the power station is stepped up		[1]		
		This reduces the current in the transmission cables		[1]		
		This reduces the heat loss in the cables/energy loss/ power loss		[1]	[3]	
	(b)	**(i)**  Can be outside box near X			[1]	
		(ii)  **no ecf** May be inside circle **Both poles needed**			[1]	
		(iii)			[$\frac{1}{2}$] each, round down [2]	
		 **no ecf** **soft iron core** Any 2 correct arrows gets 2 marks				
		(iv) To make the current flow around the iron core		[1]		
		otherwise electromagnet would not work		[1]	[2]	
		or to prevent short circuit/current does not flow through core or core also conducts To prevent electronic shock – give [0]				
	(c)	**(i)** Magnet			[1]	
		(ii) a.c.			[1]	15

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						AVAILABLE MARKS
5	**(a)**	**(i)**	1 = Mercury 2 = Venus 3 = Mars 4 = Neptune [1] each		[4]	
		(ii)	The gravity (of the Sun)		[1]	
		(iii)	The planets (orbit) in the same plane/move in same plane or orbit/spin around the Sun/move in the same direction		[1]	
	(b)	**(i)**	Hydrogen Helium	[1] [1]	[2]	
		(ii)	Light or spectra from/of the stars/Sun		[1]	
		(iii)	Nuclear fusion		[1]	10
6	**(a)**	**(i)**	 © CCEA [1] each		[4]	
		(ii)	Lithosphere		[1]	
		(iii)	Iron Nickel	[1] [1]	[2]	
	(b)		They move (slowly)/collide They stick/get caught Sudden movement/jerk/lurch	[1] [1] [1]	[3]	10
					Total	**90**

Rewarding Learning

General Certificate of Secondary Education
2015

GCSE: Physics

Unit 2

Foundation Tier

[GPH21]

FRIDAY 19 JUNE, MORNING

MARK SCHEME

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General Marking Instructions and Mark Grids

Introduction

Mark schemes are intended to ensure that the GCSE examination is marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, the examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark scheme

Mark schemes for questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

							AVAILABLE MARKS
1	(a)	(i)	By a sound (wave)			[1]	
		(ii)	Vibrate		[1]		
			parallel to wave direction		[1]	[2]	
		(iii)	It (ball) moves up and down			[1]	
		(iv)	$\frac{10}{20}$ = 0.5		[1]		
			Hz		[1]	[2]	
		(v)	V = fλ = 0.5 × 1.2 ecf for frequency from **(iv)**		[1]		
			= 0.6		[1]	[2]	
		(vi)	Refraction			[1]	
		(vii)	They slow down – no credit for change direction		[1]		
			As they enter **shallow** water		[1]	[2]	
	(b)	Longer:	Infrared	Microwaves	Radio	[1]	
		Use:	Heating/ Remote	Communications	Communication	[1]	
		Shorter:	Ultraviolet	X-ray	Gamma	[1]	
		Use:	Sunbeds/ Forgeries	Diagnose broken bones	Cancer treatment	[1]	[4]
		The name of the wave to reflect the wavelength. Must get name correct to access use mark The use of the wave to reflect the name of the wave					
	(c)	(i)	Best fit line			[1]	
		(ii)	No – line does not pass through 0,0 **or** origin **or** doubling the temperature does not double speed			[1]	
		(iii)	342.8 $\pm$ 0.4 (m/s)			[1]	
		(iv)	V = 330 + 0.7 × 25		[1]		
			= 347.5		[1]	[2]	20
2	(a)	(i)	The normal, angles of incidence and reflection marked			[3]	
		(ii)	30°			[1]	
		(iii)	Ray from head to eye		[1]		
			So that i = r (judge by eye)		[1]		
			Arrows on both rays		[1]	[3]	
		(iv)	Ray from chin to eye		[1]		
			So that i = r (judge by eye)		[1]	[2]	
		(v)	5 + 6 11 (cm)			[2]	

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(b) **(i)** Move lens until image of tree on screen, adjust until it is sharp [2]

(ii) Distance from lens to screen [1]

(iii) Repeat take average/or use more distant object, e.g. the Sun [1]

AVAILABLE MARKS

15

3 **(a)** **(i)** No [1]
The circuit is incomplete [1] [2]

(ii) I = V/R = 12/10 [1]
=1.2 (A) [1] [2]

(b)

Switch S_1	Switch S_2	Fan	Heater	Hairdryer	
Open	Open	Off	Off	Off	[1]
Open	Closed	Off	Off	Off	[1]
Closed	Open	On	Off	Cold	[1]
Closed	Closed	On	On	Warm	[1] [4]

Mark by row

(c) **(i)** Lamp in series with ammeter and variable PSU
(or battery with rheostat) [1]
Voltmeter in parallel with lamp [1]
Symbols correct for ammeter, voltmeter, lamp [1]
Complete circuit [1] [4]

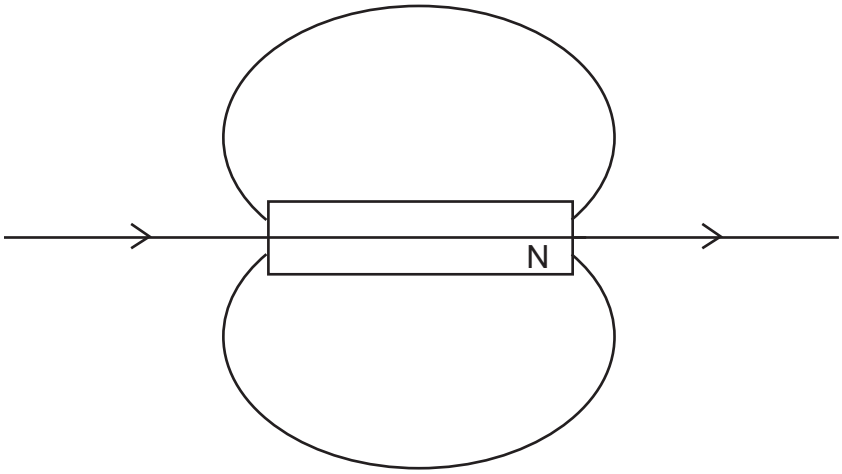
(ii) Indicative Content:
1. Switch on PSU/battery/close switch **or** indicate circuit is on
2. Record current } find or measure **or** { reading on ammeter
3. Record voltage } { reading on voltmeter
4. In a table or plot graph
5. Adjust rheostat or PSU voltage
6. Take range of current and voltage measurements

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar any **five** of the points in the Indicative Content. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good spelling, punctuation and grammar **at least three** of the points in the Indicative Content. The form and style are of a high standard and specialist terms are used appropriately most of the time.	[3]–[4]
Candidates describe in detail using good spelling, punctuation and grammar **at least one** of the points in the Indicative Content. The form and style are of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6]

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						AVAILABLE MARKS
		(iii)	Curve of decreasing gradient	[1]		
			Through origin	[1]	[2]	20
4	**(a)**	**(i)**	Arrow vertically DOWN		[1]	
		(ii)	One straight line (through core) and out	[1]		
			Two loops, one above one below from one end to the other	[2]		
			Direction from the right end to the left end one arrow	[1]	[4]	



Conflicting arrows – no credit for direction
Crossing or touching line [–1]

	(b)	**(i)**	D.C. – flows in only one direction	[1]		
			A.C. – reverses or changes direction	[1]		
			regularly (or repeatedly)	[1]	[3]	
		(ii)	Top diagram – A.C.	[1]		
			Bottom diagram – A.C.	[1]	[2]	
	(c)	**(i)**	Iron		[1]	
		(ii)	(In order) – step-up, increase, step-up		[3]	
		(iii)	Step-up		[1]	15

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					AVAILABLE MARKS
5	**(a)**	**(i)**	1 – Asteroids; 2 – Neptune; 3 – Venus; 4 – Saturn $\left[\frac{1}{2}\right]$ each round up	[2]	
		(ii)	**Rocky planet** – Mercury, Earth or Mars or Venus **Gaseous planet** – Jupiter or Uranus or Saturn or Neptune Both required	[1]	
		(iii)	Hydrogen, helium both needed H or He accept symbols	[1]	
		(iv)	(Nuclear) fusion correct spelling	[1]	
	(b)		Geocentric – planets and Sun revolve around the Earth, but in Heliocentric planets revolve around the Sun.	[1]	
	(c)	**(i)**	The (Catholic) Church/The Pope	[1]	
		(ii)	Retrograde/apparent looping motion of the planets; Venus is sometimes closer to Earth than Mars/phases for Venus and Mars/planets phases of Moon Any **one**	[1]	
	(d)		Flight time too long for a human lifetime (accept today's spacecraft too slow) Spacecraft could not carry sufficient food stocks. Spacecraft could not carry sufficient fuel stocks. Little to no chance of return to Earth should a problem arise. Long time delay in relaying of signals/messages between Earth and craft. Any **two** points Any acceptable realistic answer	[2]	10
6	**(a)**		From the top: crust mantle inner core outer core	[4]	
	(b)		The plates move or rub against each other They stick/catch There is a sudden movement/jerk/jolt/lurches/sudden release	[3]	
	(c)		Friction between plates (heats and melts) the rock/crust/plates Magma lava	[3]	10
				Total	**90**

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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)**.

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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]

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

(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]

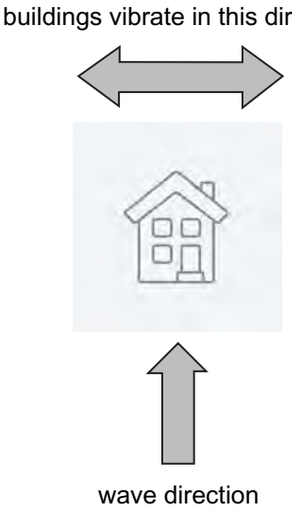
(ii) Complete the table below to show what happens when light waves are **refracted as they travel from air into glass**.
Choose your answer from increases, decreases or stays the same.

	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.



© RaStudio / iStock / Thinkstock

(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

(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

[Turn over

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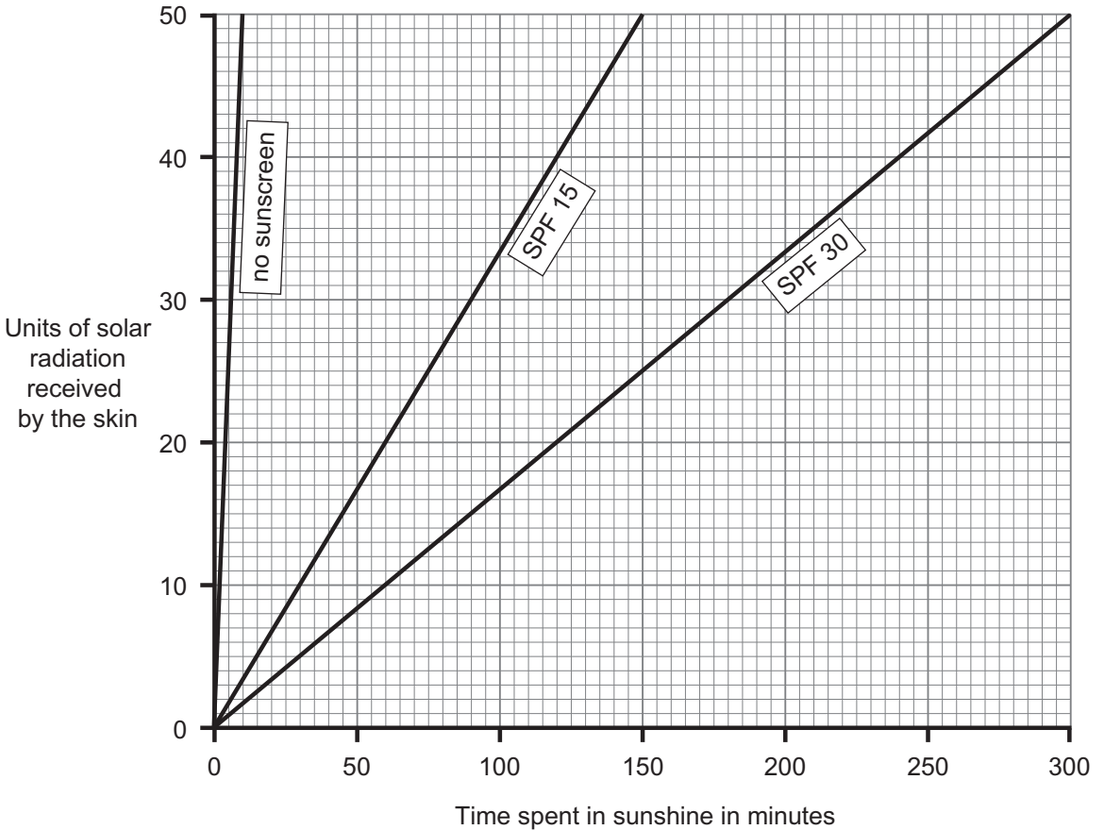
Examiner Only	
Marks	Remark

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

(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]

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(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	

[Turn over

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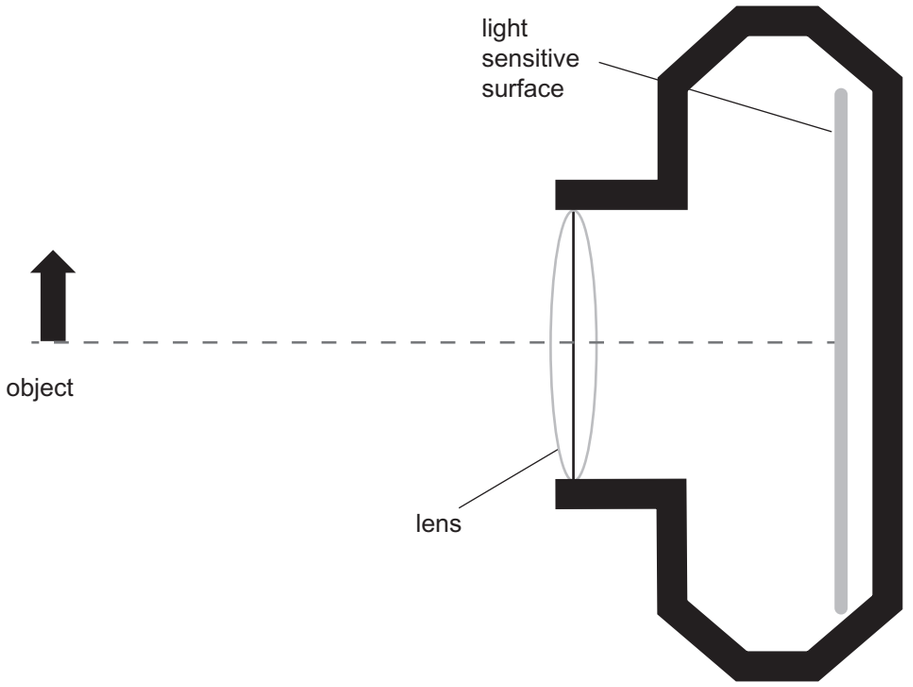
2 **(a)** **(i)** What is meant by the focal length of a converging lens?

Examiner Only	
Marks	Remark

_____

_____ [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]

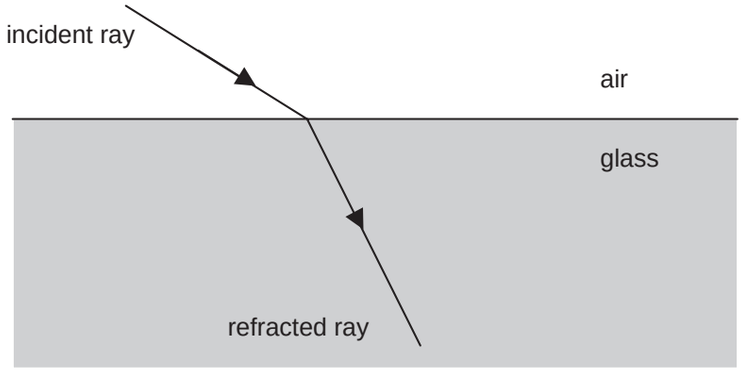
(iii) The image in the camera is real.
What is meant by a real image?

_____

_____ [1]

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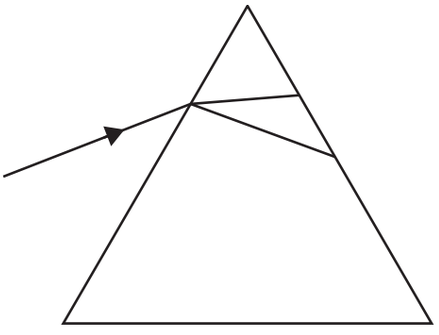
(b) When a ray of light is passed through a glass block it is refracted. The diagram below shows a ray of light incident on a glass block. The refracted ray is also shown.



(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]

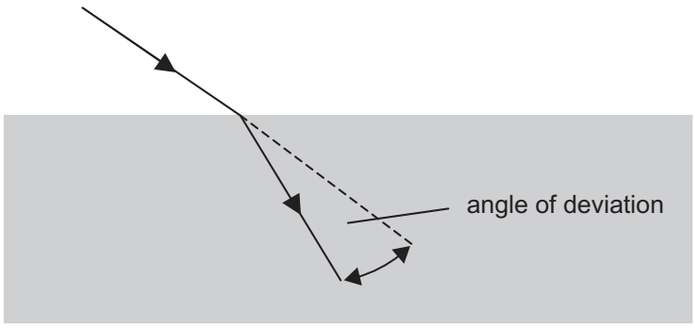
(iii) The diagram shows the dispersion of white light by a glass prism. Complete the diagram to show the path of red and violet rays as they leave the prism.
Label each ray with its colour.



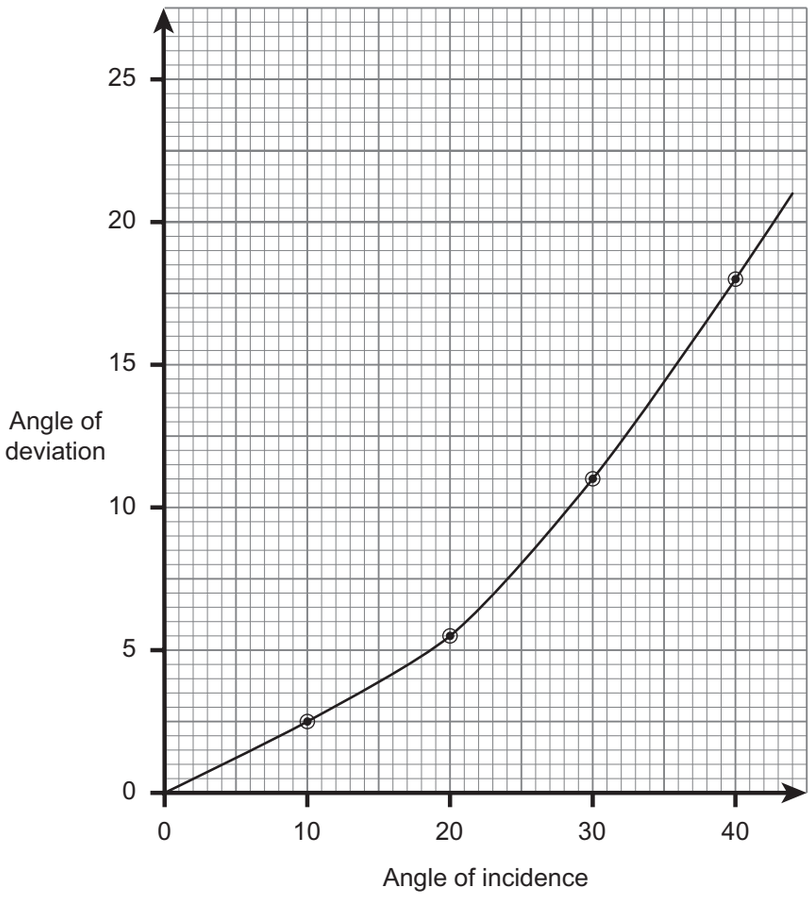
[1]

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.



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

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(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**.



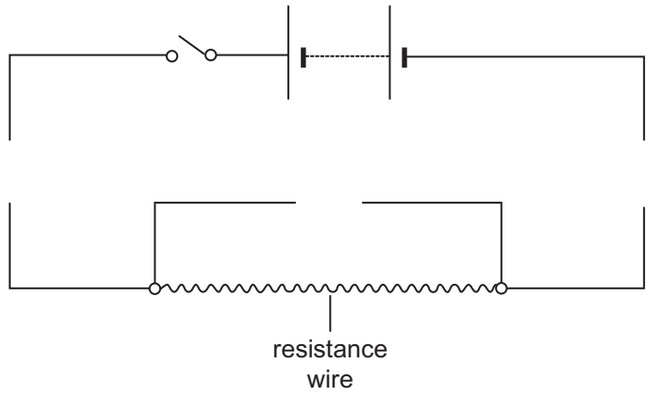
[1]

Examiner Only	
Marks	Remark
Total Question 2	

[Turn over

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3 A pupil wishes to measure the resistance of different lengths 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.

_____

_____

_____

_____

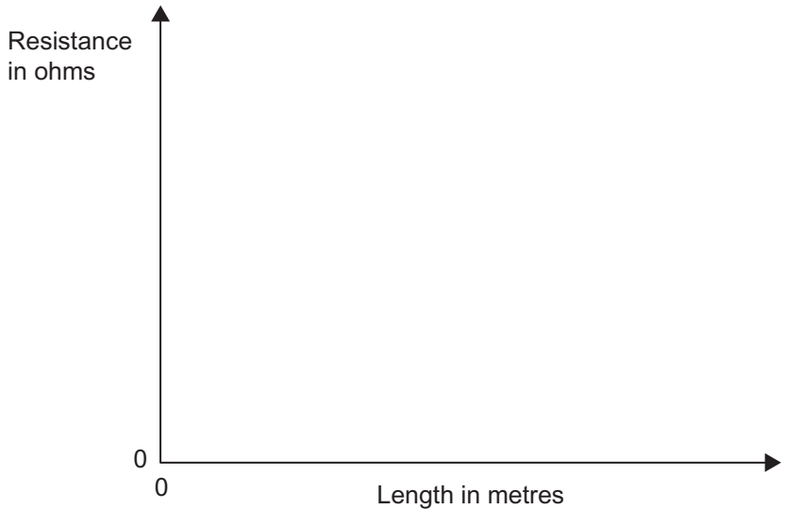
_____

_____ [2]

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 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]

Examiner Only	
Marks	Remark

[Turn over

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Examiner Only	
Marks	Remark

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



Electric Toaster

240 V | 960 W

© iStock/Thinkstock

(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.

_____

_____

_____

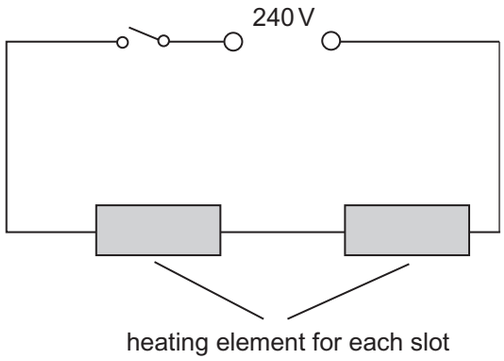
_____

_____ [2]

[Turn over

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(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.

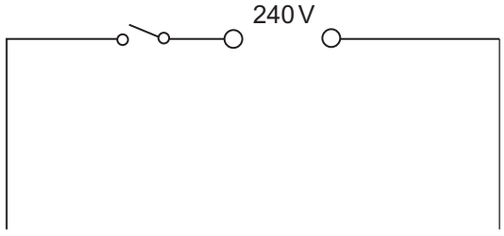
_____

_____

_____ [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)

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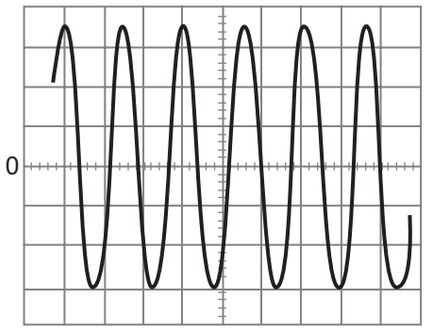
Examiner Only	
Marks	Remark

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]

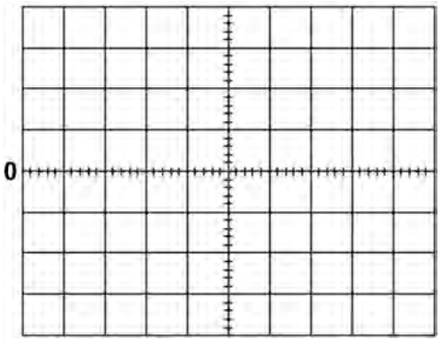
(ii) How can you tell from the sketch that the electrical signal has a constant frequency?

_____

_____ [1]

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(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]

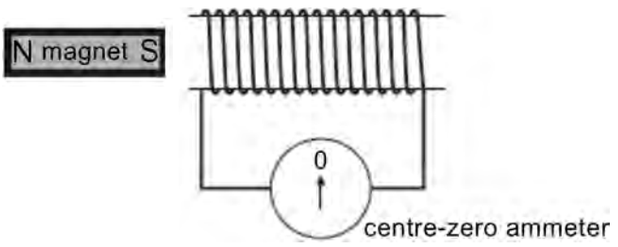
Examiner Only	
Marks	Remark

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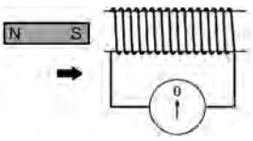
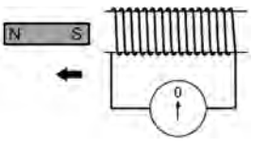
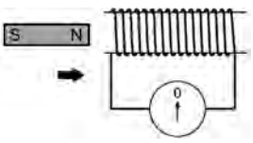
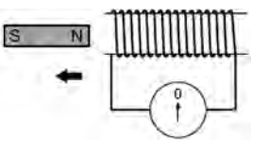
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Examiner Only	
Marks	Remark

(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 	

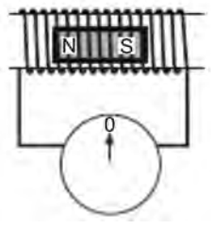
(i) Complete the results table above to show the deflection, if any, of the ammeter needle. [3]

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(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]

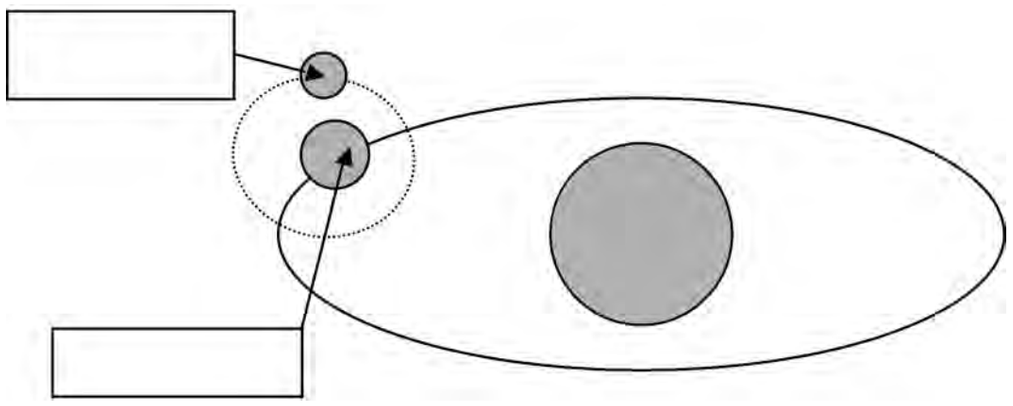
Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

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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]

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(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	

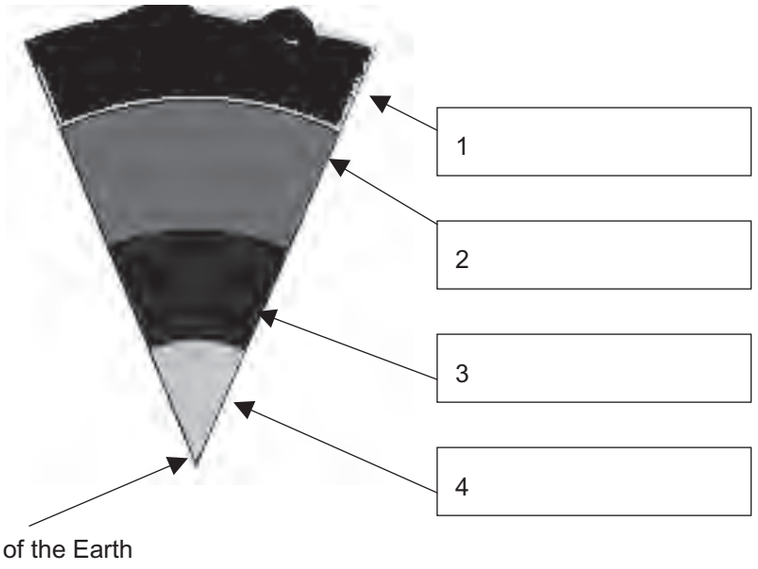
[Turn over

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]

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(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	

THIS IS THE END OF THE QUESTION PAPER

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Question Number	**Marks**
1	
2	
3	
4	
5	
6	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2014

GCSE Physics

Unit 2

Foundation Tier

[GPH21]

MONDAY 23 JUNE, MORNING

MARK SCHEME

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General Marking Instructions and Mark Grids

Introduction
Mark schemes are intended to ensure that the GCSE examination is marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses
In marking the examination papers, examiners should be looking for a quality response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking
Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, the examiners should seek the guidance of the Supervising Examiner.

Positive marking
Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark scheme
Mark Schemes for questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

					AVAILABLE MARKS
1	(a)	(i)	So the phones can be **fairly** compared	[1]	
		(ii)	Very close to legal limit (for adults), so smaller SAR for children **or** Children get a larger dose/children's skulls are thinner/children's bodies are still developing/children's brains are smaller/absorbs more energy/smaller body mass/smaller brain/child more affected (health)	[2]	
		(iii)	Use an earphone/earpiece (to keep mobile phone far from head) or use text messages/hands-free/use loudspeaker mode/less often	[1]	
	(b)	(i)	**Reflection** Frequency Same Wavelength Same Speed Same	[3]	
		(ii)	**Refraction** Frequency Same Wavelength Decreases/smaller Speed Decreases	[3]	
	(c)	(i)	Transverse	[1]	
		(ii)	Vibrations/oscillations [1] perpendicular/at 90° to direction of energy transfer/wave direction [1]	[2]	
		(iii)	$v = f\lambda$ [1] $= 1.3 \times 2700$ [2] $= 3510$ (m/s) [1]	[4]	
	(d)	(i)	Ultraviolet	[1]	
		(ii)	10 minutes	[1]	
		(iii)	300 – 150 = 150 (minutes)	[1]	20

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2 **(a)** **(i)** (Focal length) is the distance between optical centre of lens and the (principal) focus or focal point. [1]

(ii) Ray from top of object
1. Through centre of lens – no deviation – to film [1]
2. Parallel to the axis – refracted at lens – meets first ray on film [1]
3. Image correctly and clearly identified on film [1]
Ruler used and an arrow (correct direction) on at least one ray [1] [4]

(iii) Rays of light pass through it or it can be projected on a screen [1]

(b) **(i)** Normal drawn and angle of incidence marked [1]

(ii) Normal drawn and angle of refraction marked [1]

(iii) Both rays refracted downwards
Red above, violet below } both required [1]

(c) **(i)** It is not a straight line **or** doubling of values not present [2]

(ii) Calculations, e.g. $\frac{5.5}{20} = 0.28$ and $\frac{18}{40} = 0.45$ [2]

or $\frac{20}{5.5} = 3.63$ and $\frac{40}{18} = 2.2$

or $\frac{20}{40} = 0.5$ and $\frac{5.5}{18} = 0.3$

or $\frac{40}{20} = 2$ and $\frac{18}{5.5} = 3.3$

or $2 \times 20 = 40$ $2 \times 5.5 \neq 11$ Does not double

Not a constant ratio [1] [3]

Accept angles other than 20 and 40

(iii) Ray passes through
no deviation [1]

AVAILABLE MARKS

15

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						AVAILABLE MARKS
3	(a)	(i)	Ammeter in series with wire	[1]		
			Variable resistor in series with wire	[1]		
			Voltmeter in parallel with wire	[1]	[3]	
			If any one symbol wrong max [2]			
		(ii)	To prevent the wire heating/allow wire to cool	[1]		
			Heat affects the resistance/temperature affects resistance	[1]	[2]	
		(iii)	Straight line through origin		[1]	
		(iv)	60/80 of 12	[1]		
			9 (Ω)	[1]	[2]	
	(b)	(i)	Power or energy used per second or 960 J/s		[1]	
		(ii)	P = IV or I = P/V	[1]		
			960 = 240 × I	[1]		
			I = 960/240 = 4 (A)	[1]	[3]	
		(iii)	R = V/I **or** P = V^2/R possible e.c.f. from **(ii)** for I value	[1]		
			= 240/4 960 = 240^2/R	[1]		
			= 60 (Ω) R = 240^2/960 = 57 600/960 = 60 (Ω)	[1]	[3]	
		(iv)	Electrons (moving along the wire) collide with atoms	[1]		
			Atoms gain energy (heat)	[1]	[2]	
	(c)	(i)	Elements are in series		[1]	
		(ii)	Two elements in parallel	[1]		
			Switch in series with at least one element	[1]	[2]	20
			Must be a working circuit			
			or both in series with 2-way switch for one element			

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						AVAILABLE MARKS
4	(a)	(i)	Alternating (current)		[1]	
		(ii)	Direct (current)		[1]	
	(b)	(i)	Trace repeatedly crosses time axis **or** repeatedly changes from + to – **or** changes direction		[1]	
		(ii)	Time interval or distance between peaks or troughs does not change, waves equally spaced wavelength ⇒ 0		[1]	
		(iii)	Any curve/line or variation that **does not cross the time axis**	[1] [1]	[2]	
		(iv)	d.c. source – battery/cell/battery charger		[1]	
		(v)	a.c. source – mains/transformer/laboratory PSU		[1]	
	(c)	(i)	Deflections (Left) **Right** **Right** **Left**	[1] [1] [1]	[3]	
		(ii)	Current in opposite directions **or** similar statement		[1]	
		(iii)	No deflection No magnetic field lines cut/requires movement of magnet		[1] [1]	
		(iv)	Electrical generator/transformer/microphone/magnetic tape		[1]	15

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					AVAILABLE MARKS
5	**(a)**	Moon [1] Earth [1]		[2]	
	(b)	**(i)** It is too distant or spacecraft too slow and takes more than a lifetime to reach		[1]	
		(ii) Radio/TV signals		[1]	
	(c)	Indicative content 1. Gases 2. Hydrogen (and helium) and dust 3. Gravity shrinks the gas cloud/pressure increases/causes spiralling 4. A large clump forms at centre/density increases 5. Centre heats up **or** temperature rises (to x million degrees) 6. Nuclear fusion starts			

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar **at least 5 points** shown above and the precaution is clearly stated. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good spelling, punctuation and grammar **at least 3 points** shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[3]–[4]
Candidates make some reference to **one or two of the main points** shown above using satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6] 10

6	**(a)**	**(i)** 1 = crust 2 = mantle 3 = outer core 4 = inner core [1] each		[4]	
		(ii) Crust Inner core Mantle } any 2		[2]	
		(iii) Nickel		[1]	
		(iv) Lithosphere		[1]	
	(b)	(Tectonic activity means) the Earth plates move [1] Earthquake is due to them suddenly moving or jolting or lurch after being stuck [1]		[2]	10
			Total		**90**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2013

Science: Physics

Unit P2

Foundation Tier

[GPH21]

GPH21

MONDAY 24 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.
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

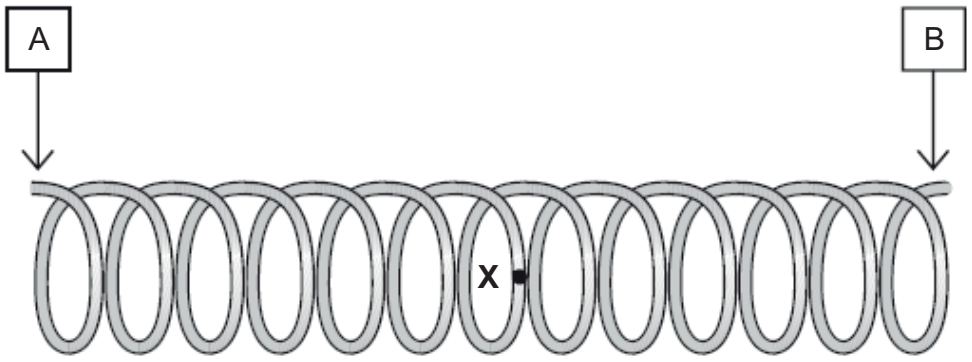
The total mark for this paper is 90.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in question **4(b)**.

20GPH2101

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Examiner Only	
Marks	Remark

1 **(a)** A stretched spring rests on a table.
A wave travels from end A to end B.



Describe **carefully** how point **X** will move when

(i) a **transverse** wave passes along the spring;

_____

_____

_____ [2]

(ii) a **longitudinal** wave passes along the spring.

_____

_____

_____ [2]

(iii) Give another example of a transverse wave and another example of a longitudinal wave.

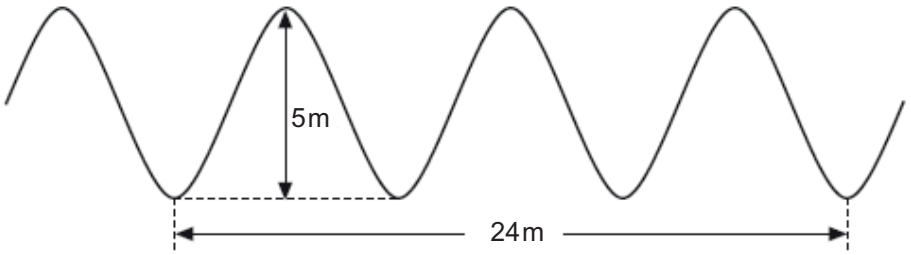
Transverse: _____

Longitudinal: _____ [2]

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(b) The outline of sea waves is shown below. The diagram is not to scale.

Examiner Only	
Marks	Remark



(i) What is the amplitude of the waves? _____ m [1]

(ii) What is the wavelength of the waves? _____ m [1]

In 60 seconds 15 waves pass the end of a pier.

(iii) Calculate the frequency of the waves.
You are advised to show clearly how you get your answer.
Remember to provide the unit with your answer.

Frequency = _____ [2]

(iv) Calculate the speed of the waves.
You are advised to show clearly how you get your answer.

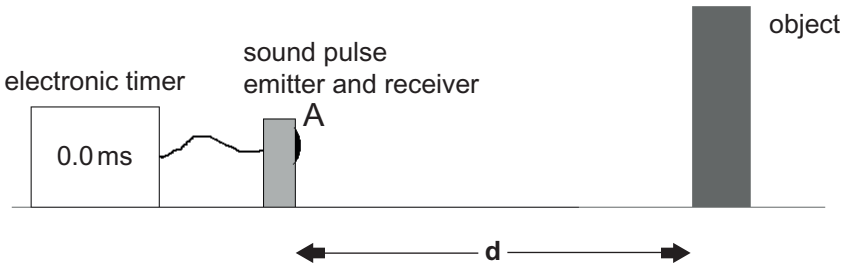
Speed = _____ m/s [2]

[Turn over

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Examiner Only	
Marks	Remark

(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.

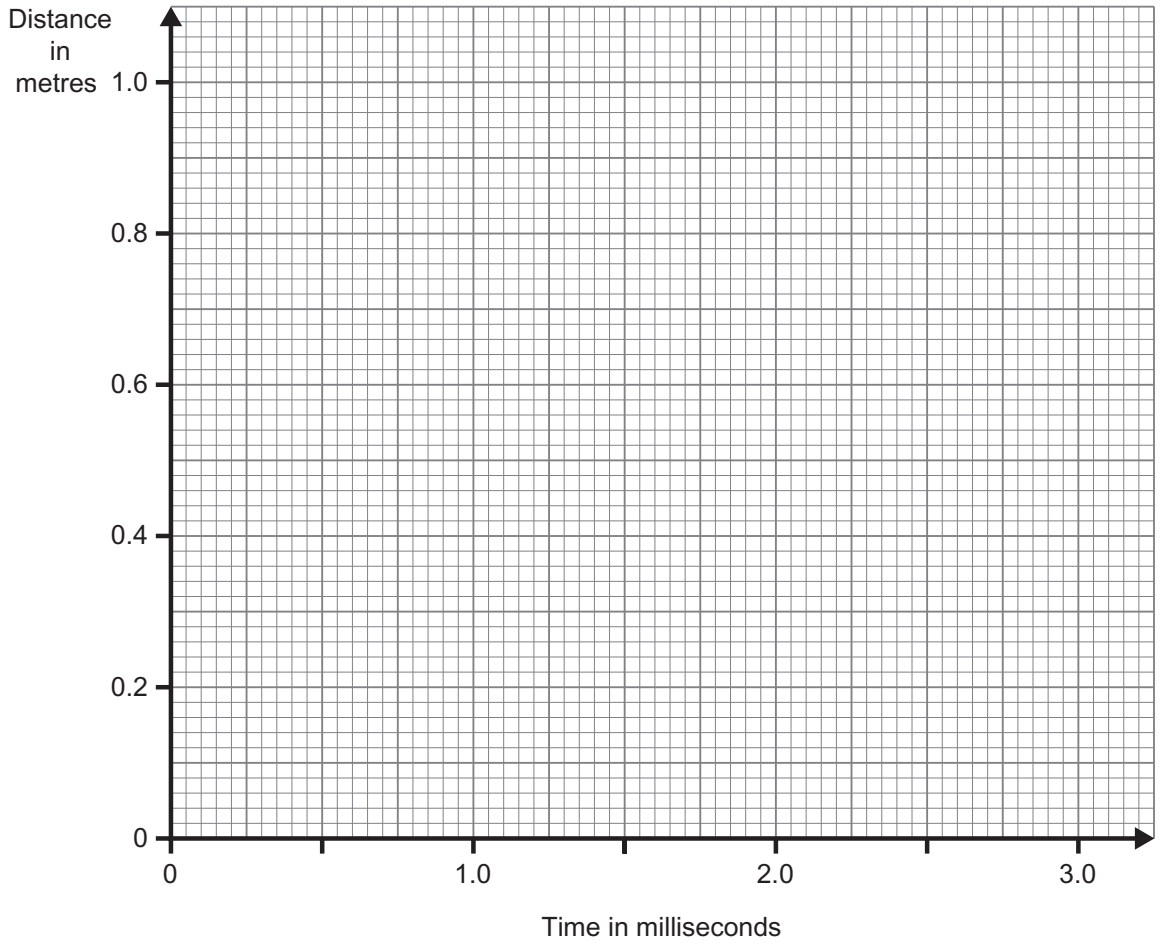
$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

(1 ms = 1 millisecond = 0.001 s)

Speed of sound = _____ m/s [3]

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(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]

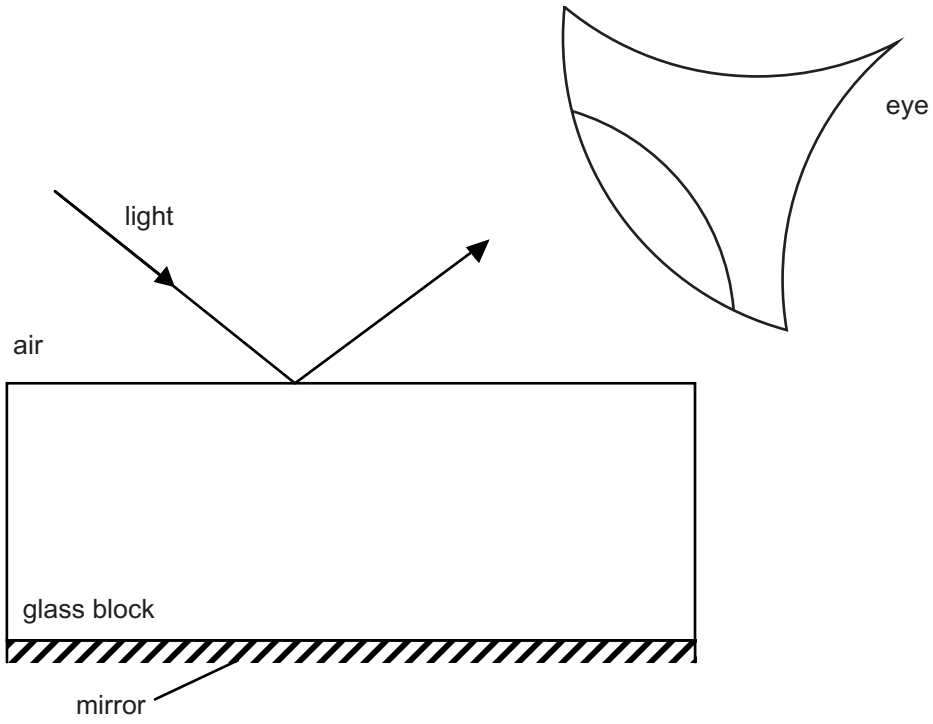
Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

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Examiner Only	
Marks	Remark

2 **(a)** The diagram shows a ray of light incident on a glass block.
Some of the light is reflected at the top surface and some of the light passes through the glass and is reflected at the opposite side which has a mirrored surface.



(i) Complete the path of the ray of light through the glass block and back out into the air towards the person viewing it as shown in the diagram. [3]

(ii) Explain, in terms of the speed of light, why the ray of light takes the path you have drawn in the glass.

_____

_____ [2]

(iii) What is the relationship between the angle of incidence and the angle of reflection?

_____ [1]

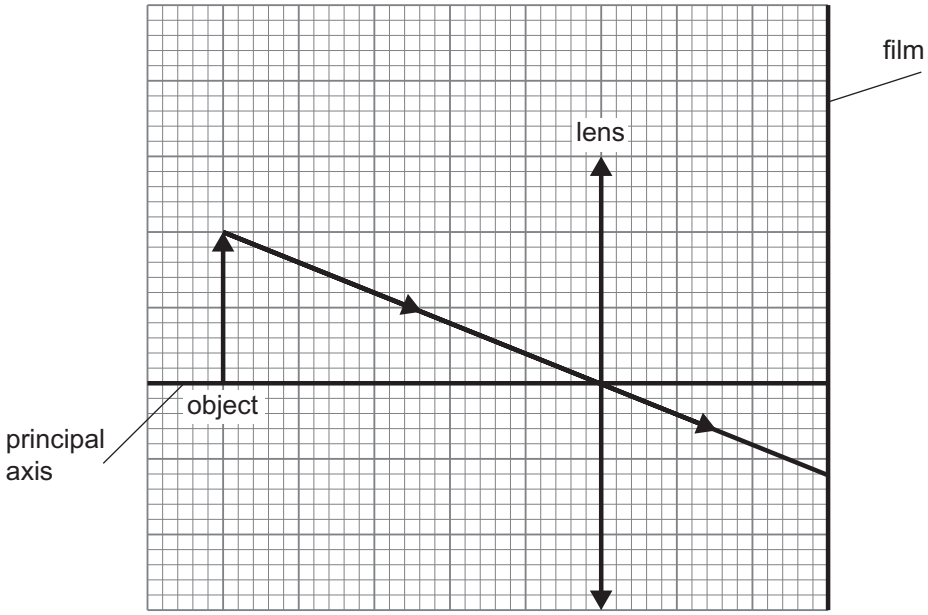
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(b) Catherine is given a converging lens. Describe how she could use a distant object to find the focal length of the lens.
You may use the space below for a diagram.

Examiner Only	
Marks	Remark

[3]

(c) In a camera, a lens is used to form an image on the film.
The diagram below, which is **full scale**, shows the lens of a camera and the film.
The lens is adjusted so that a sharp image is formed on the film.



(i) What type of lens is used in this camera?

_____ [1]

(ii) The first ray from the top of the object has been drawn.
Draw a second ray from the top of the object so that the position of the principal focus (focus) of the lens can be found.
Mark the focus with an F. [2]

(iii) What is the focal length of the lens?

_____ cm [1]

(iv) Which **two** of the words listed below describe the properties of the image formed on the film? Circle those that are correct.

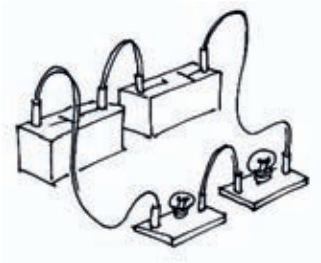
Virtual Diminished Real Magnified Upright [2]

Examiner Only	
Marks	Remark
Total Question 2	

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Examiner Only	
Marks	Remark

3 **(a)** The diagram below shows two 1.5 V cells connected to two lamps. The two lamps are lit.



(i) In the space below draw the circuit diagram, using the standard symbols, for the circuit shown above.

[4]

(ii) When the two lamps are lit the current flowing in the circuit is 0.2 A. Each cell provides a voltage of 1.5 V.
Calculate the total resistance of the circuit.
You are advised to show clearly how you get your answer.
Remember to give a unit with your answer.

Resistance = _____ [4]

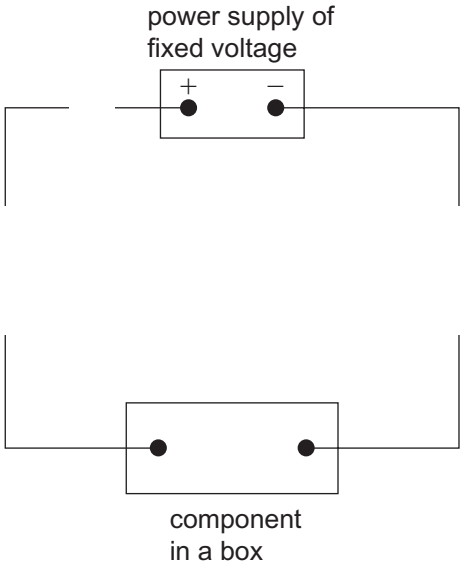
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Examiner Only	
Marks	Remark

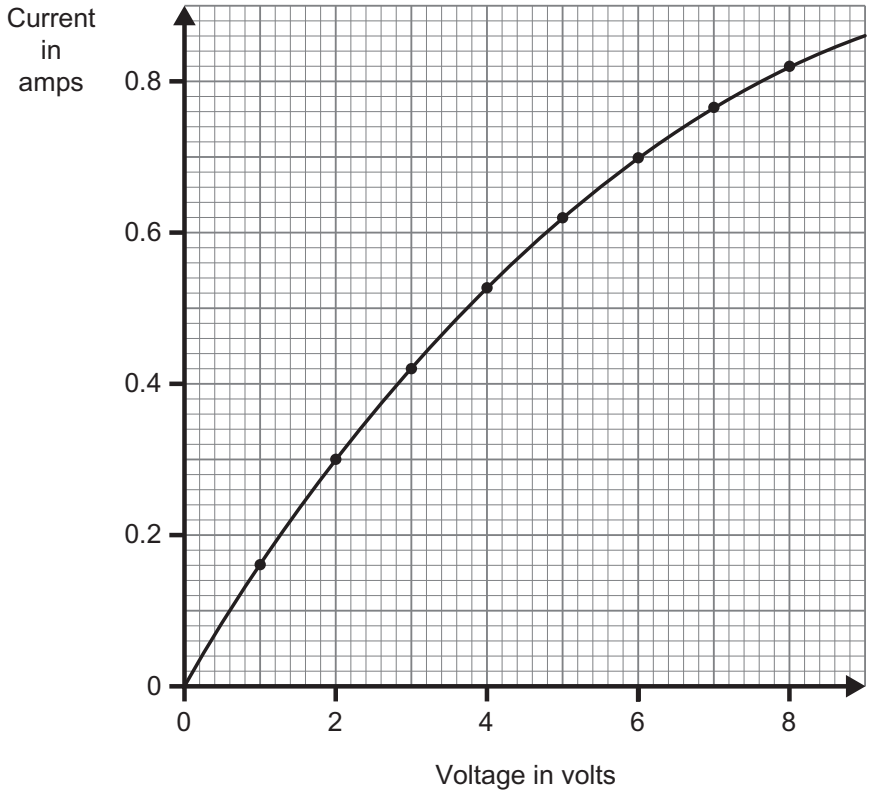
(b) Zoe was given a sealed box containing a component that conducts electricity.
Two terminals attached to the box allowed her to connect it to a circuit.
To find out what the component was she decided to investigate how the current passing through the component depended on the voltage across it.

(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]



The results of her investigation are shown in the graph opposite.

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Examiner Only	
Marks	Remark

(ii) Is the current proportional to the voltage? Explain your answer.

_____

_____

_____ [2]

(iii) Does the resistance of the component remain constant as the current and voltage are changed? Explain your answer.

_____

_____

_____ [2]

(iv) What type of component is inside the box?

_____ [1]

[Turn over

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(c) The photograph shows a girl touching an electrostatic generator. The generator gives the girl's hair a positive charge.



© Ted Kinsman / Science Photo Library

(i) Describe how her hair acquires a positive charge.

_____

_____

_____ [1]

(ii) When she touches an object a small spark is seen.
What particles are moving in the spark and in what direction do they move?

1. The particles are _____

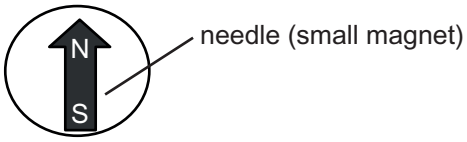
2. The direction in which they move is _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 3	

Examiner Only	
Marks	Remark

4 **(a)** The diagram below shows a plotting compass which consists of a needle (small magnet) pivoted so that it can move freely. When a magnet is not present it points in the direction shown.



(i) When the plotting compass is placed close to a bar magnet the needle of the plotting compass points in the direction shown below.
Explain why this happens.

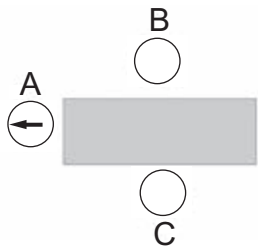


_____

_____

_____ [1]

In the diagram below, a plotting compass shows the direction of the magnetic field of the bar magnet at position A.



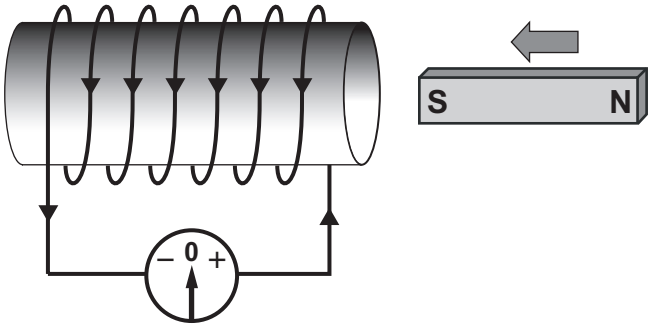
(ii) Draw arrows in the circles to show the directions of the magnetic field at points B and C. [2]

(iii) Mark with an S, on the diagram, the south pole of the magnet. [1]

[Turn over

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(b) The diagram below shows a bar magnet and a coil of wire. The coil of wire is connected to a sensitive ammeter which reads zero when the pointer is in the middle.



Describe, carefully, what is observed when the magnet is moved **slowly** into the coil from the right, held there **stationary** for a few seconds before being removed **quickly** again to the right.

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

[6]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

(c) (i) Explain, fully, the difference between direct current (d.c.) and alternating current (a.c.).

_____

_____

_____

_____

_____ [3]

(ii) Name one source of **d.c.** and one source of **a.c.**

d.c. source _____

a.c. source _____ [2]

Total Question 4	

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Examiner Only	
Marks	Remark

5 **(a)** **(i)** Name the generally accepted scientific model which describes the formation of the Universe.

_____ [1]

(ii) According to this model how old is the Universe?

_____ years [1]

(iii) The light from distant galaxies is red shifted. What is meant by red-shift?

_____

_____ [1]

(iv) What is the explanation of this red-shift?

_____

_____

_____ [1]

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(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]

(c) Give two uses for artificial satellites that orbit the Earth.

1. _____

2. _____

[2]

Examiner Only	
Marks	Remark
Total Question 5	

Examiner Only	
Marks	Remark

6 The Earth is made up of a number of layers. **Diagram A** below shows the topmost layer. This topmost layer is divided into two layers.

(i) On **Diagram A**, label the topmost layer and the two layers it is divided into. Write the names in the boxes provided.

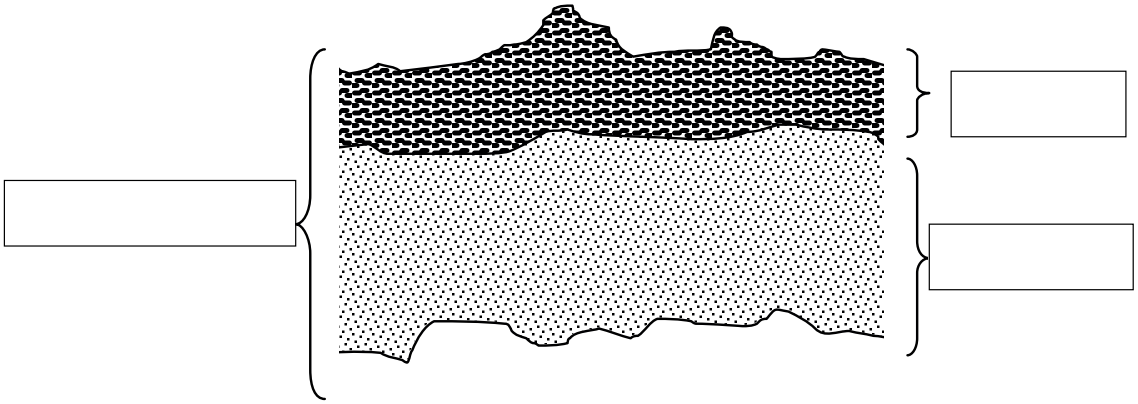


Diagram A [3]

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

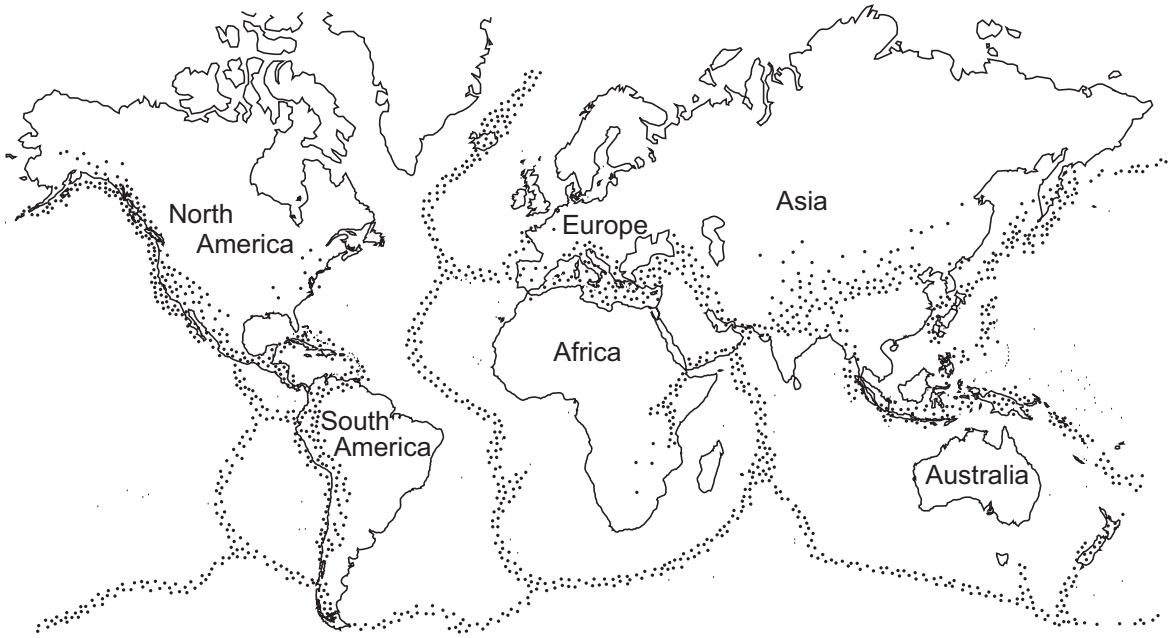


Diagram B

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

[1]

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

[3]

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

[3]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark
Total Question 6	

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Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2013

Physics

Unit 2

Foundation Tier

[GPH21]

MONDAY 24 JUNE, MORNING

MARK SCHEME

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General Marking Instructions and Mark Grids

Introduction
Mark schemes are intended to ensure that the GCSE examination is marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses
In marking the examination papers, examiners should be looking for a quality response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking
Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, the examiners should seek the guidance of the Supervising Examiner.

Positive marking
Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark scheme
Mark Schemes for questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

						AVAILABLE MARKS
1	(a)	(i)	**Transverse**			
			vibrates	[1]		
			perpendicular to line AB/up and down	[1]	[2]	
		(ii)	**Longitudinal**			
			vibrates	[1]		
			parallel to line AB/left and right/back and forwards	[1]	[2]	
		(iii)	**Transverse**			
			Any **named** em wave **or** water wave **or** wave on string	[1]		
			Longitudinal			
			Sound **or** Ultrasound	[1]	[2]	
	(b)	(i)	Amplitude = 2.5 (m)		[1]	
		(ii)	Wavelength = 8 (m)		[1]	
		(iii)	Frequency = 15/60 **or** 0.25	[1]		
			Hz – insist	[1]	[2]	
		(iv)	$v = f\lambda$ **or** 0.25×8 **or** $\frac{15}{60} \times 8$ e.c.f.s from **(ii)** and **(iii)**	[1]		
			= 2 (m/s)	[1]	[2]	
	(c)	(i)	Round trip halved			
			0.6, 1.3, 1.7, 2.4, 3.0 At least 4 correct		[1]	
		(ii)	Speed = 1.0/0.003	[2]		
			= 333 (m/s)	[1]	[3]	
			Failure to convert ms to s give maximum [1]			
		(iii)	Points plotted, using their values	[2]		
			Best fit straight line or curve consistent with their points	[1]	[3]	
			If maximum of two points inaccurate give [1]			
			A series of short lines give [0]			
		(iv)	0.48 to 0.52 – No e.c.f. from graph in **(iii)**		[1]	20

						AVAILABLE MARKS
2	(a)	(i)	Ray bent towards the normal in glass	[1]		
			Reflected ray at mirror so that i = r (judge by eye)	[1]		
			Emergent ray bent away from normal and parallel to incident ray	[1]	[3]	
		(ii)	In the glass the light slows Change of speed give [1]		[2]	
		(iii)	At reflection angle of incidence = angle of reflection		[1]	
	(b)		Move lens away from screen or vice versa until a sharp image seen Measure distance from lens to screen Give credit for information shown on any relevant diagram		[3]	
	(c)	(i)	Converging		[1]	
		(ii)	Ray from top parallel to Pr axis refracted to meet drawn ray at film	[1]		
			Focus marked where ray cut principal axis	[1]	[2]	
		(iii)	Measurement consistent with correct diagram 1.9 ± 0.1 cm		[1]	
		(iv)	Real, diminished		[2]	15

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						AVAILABLE MARKS
3	(a)	(i)	Two cells in series	[1]		
			Two bulbs or lamps in series	[1]		
			Correct symbols	[1]		
			A working circuit	[1]	[4]	
			If not award symbol mark, maximum [1]			
			Not all symbols correct [2] maximum			
		(ii)	R = V/I	[1]		
			= 3.0/0.2	[1]		
			= 15	[1]		
			Ω (unit maximum)	[1]	[4]	
	(b)	(i)	Switch in series with power supply	[1]		
			Ammeter in series	[1]		
			Voltmeter in parallel with box	[1]		
			Variable resistor in series with power supply	[1]	[4]	
			Correct symbols required			
		(ii)	Not proportional	[1]		
			Graph is not a straight line passing through 0,0 **or** I does not double when V doubles **or** graph not a straight line **or** graph is a curve	[1]	[2]	
		(iii)	No	[1]		
			The gradient changes **or** at least **two** values of resistance calculated	[1]	[2]	
		(iv)	(Filament) bulb or lamp		[1]	
	(c)	(i)	Negative charges removed		[1]	
		(ii)	Electrons	[1]		
			from object to her	[1]	[2]	20

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AVAILABLE MARKS

4 **(a)** **(i)** The N pole of the bar magnet repels the N pole of the compass **or** it attracts the S pole of the compass [1]

(ii) B to the right [1]
C to the right [1] [2]

(iii) S pole at the right end [1]

(b) **Indicative content**

1. A (momentary) deflection when magnet moved in
2. No deflection when magnet stationary
3. A (momentary) deflection when magnet moved out
4. When moved out deflection is larger
5. Direction is opposite

Response	**Marks**
Candidates describe in detail using good spelling, punctuation and grammar **all the main points** shown above. The form and style is of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good spelling, punctuation and grammar **any three points** shown above. The form and style is of a high standard and specialist terms are used appropriately at all times.	[3]–[4]
Candidates make some reference to **one or two of the main points** shown above using satisfactory spelling, punctuation and grammar. The form and style is of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6]

(c) **(i)** a.c. reverses/changes direction [1]
repeatedly [1]
d.c. current is always in the same direction [1] [3]

(ii) d.c. battery/cell/lightning/d.c. generator [1]
a.c. mains/power stations/transformers/a.c. generator [1] [2]

15

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					AVAILABLE MARKS
5	**(a)**	**(i)**	Big Bang	[1]	
		(ii)	12 to 15 **billion** years	[1]	
		(iii)	Light has a longer wavelength (than expected) **or** moved to red end of spectrum	[1]	
		(iv)	The Universe is expanding **or** These galaxies are moving away from us	[1]	
	(b)	1. Gas and dust cloud shrinks 2. This is due to gravity 3. It heats up 4. eventually hot enough for a star to shine 5. Small clumps form the planets	Any 3 of 5 for [3]		
		Evidence – all planets lie in same plane or orbit the Sun in the same direction		[4]	
	(c)	Any **two** of: communications/TV/weather/espionage/astronomy		[2]	10

					AVAILABLE MARKS
6	**(i)**	Left – Lithosphere	[1]		
		Top right – Crust	[1]		
		Bottom right – Mantle (upper)	[1]	[3]	
	(ii)	The (**crust** of the) Earth is made up of plates		[1]	
	(iii)	The plates are moving (slowly)	[1]		
		Some of the plates stick	[1]		
		then move suddenly **essential**	[1]	[3]	
	(iv)	Friction between moving plates	[1]		
		produces heat (to melt the rocks)	[1]		
		molten rock (magma) reaches the surface	[1]	[3]	10
				Total	**90**