

	Cer	ntre Ni	umber

C	andid	ate Nu	ımber

General Certificate of Secondary Education 2014

GCSE Physics

Unit 2

Higher Tier



[GPH22]

GPH22

MONDAY 23 JUNE, MORNING

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

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

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

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

INFORMATION FOR CANDIDATES

The total mark for this paper is 115.

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

Quality of written communication will be assessed in Question **2(c)** and Question **5(a)**.



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	pho To b	nes.	e, for adults , for three difference, phone must have a SAR va	
		Mobile phone	SAR value in W/kg	
		х	0.15	
		Y	0.85	
		Z	1.85	
	(ii)		ngth of the call as short as puser of a mobile phone take nuch radiation?	
				[1]

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refracted as t	table below to show what happens when light waves are hey travel from air into glass. answer from increases, decreases or stays the same.
	increases/decreases/stays the same
Frequency	
Wavelength	
Speed	
	[3]
	eismic wave, called an S-wave, causes buildings on the rate parallel to the Earth's surface. buildings vibrate in this direction wave direction
	© RaStudio / iStock / Thinkstock
	vaves are either longitudinal or transverse. What type of seismic S-wave?
	[1]
(ii) Explain th	e reason for your answer to part (c)(i).
	[2]



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(iii) An S-wave has a speed of 3.5 km/s in the Earth's crust and its frequency is 1.3 Hz. Calculate its wavelength. Give your answer in metres.	Examiner Marks F	r Only Remark
You are advised to show clearly how you get your answer.		
Wavelength = m [4]		
The vibrations caused by earthquakes are detected by a seismometer. The graph produced is called a seismograph.		
The full-scale diagram below shows a seismograph.		
0cm 1 2 3 4 5 6 7		
(iv) Using the ruler shown in the diagram measure the horizontal distance between the peaks X and Y. Each 1 cm on the scale represents a time of 0.8 s.		
Convert your measured distance to a time and use your answer to calculate the frequency of the seismic wave in the region XY.		
Remember the region XY shows two complete waves.		

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Frequency = __

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(Question 1 continues overleaf)

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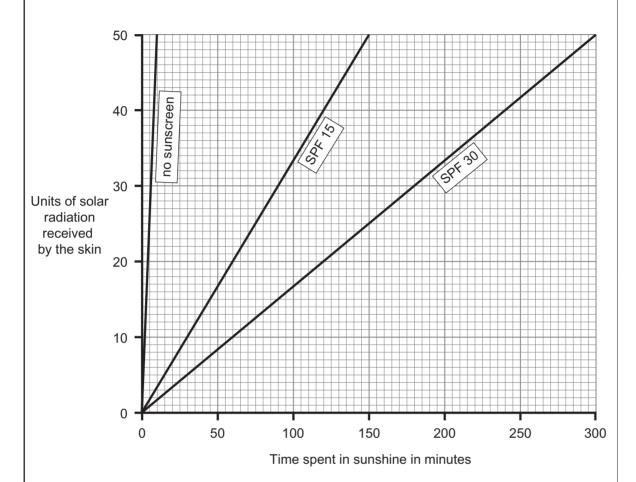


(d) The longer you sunbathe, the more ultraviolet solar radiation your skin receives.

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

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

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



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

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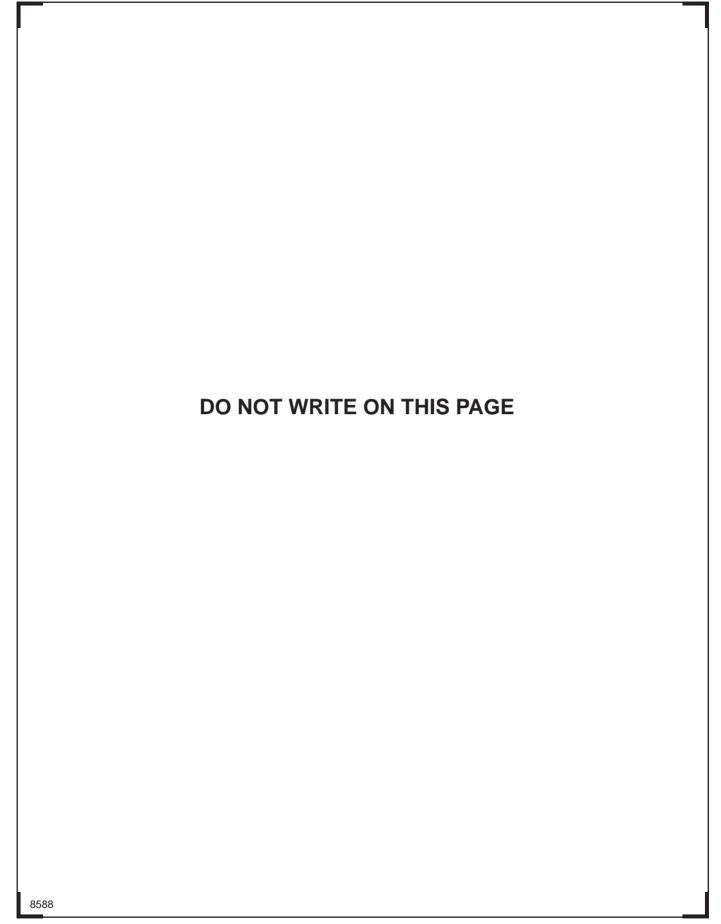
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SPF = [2]	
You are advised to show clearly how you get your answer.		
maximum time spent in the sun, calculate what minimum SPF factor is required for someone who wants to stay in the sun for 2 hours without getting sunburn.		
(ii) By considering the relationship between the SPF factor and the		
For those who use sunscreen lotions, the length of time they can stay in the sun before they get sunburn is directly proportional to the SPF factor of the sunscreen lotion used.		Rema







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(i)	Give three properties of the image on the light sensitive surface	e.
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	2	
	3	[3]
(ii)	On the full-scale diagram below, 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 maclearly the image.	
	light sensitive surface	
object		
	lens	
		[4]
		1,1



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

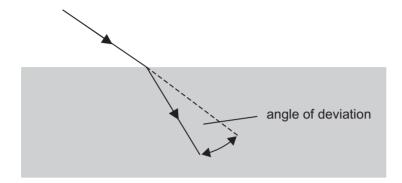


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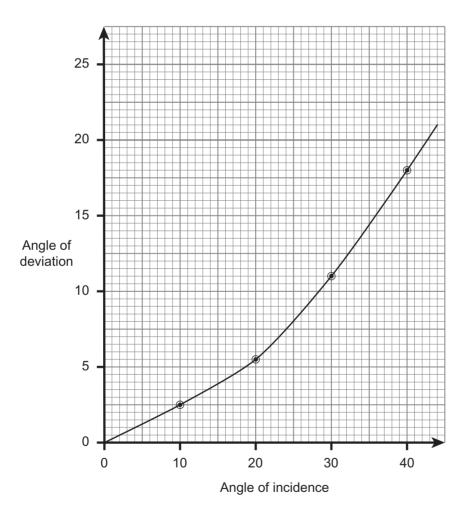
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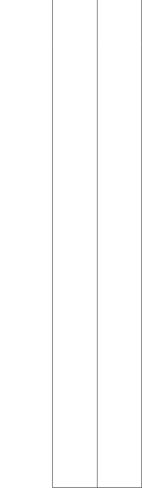
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As part of a physics lesson Joanne used the set-up shown above to measure the angle of deviation for a range of angles of incidence. The results she obtained are plotted on the grid below.







(i)	As shown on the grid Joanne drew a curve through the points.
V	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]
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	(c)	Describe, in detail, how you would measure experimentally the critical angle for glass using a semicircular glass block. You may complete the diagram to help your answer.		Examine larks	r Only Remark
		In this question you will be assessed on your written communication skills including the use of specialist science terms.			
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Examine Marks	A pupil wishes to measure the resistance of a length of resistance wire. They are given the following incomplete circuit diagram.
	resistance wire
	(a) To help ensure reliable results the pupil decides to take three sets of values for current and voltage for each length of wire.
	(i) Using the correct circuit symbols complete the above circuit to show how a voltmeter, an ammeter and a variable resistor should be connected. [3]
	(ii) During the investigation the pupil only closes the switch when taking a set of readings. One reason for doing this is to help conserve the energy of the battery but there is also another important reason. State what this other reason is and explain why this is good experimental practice.
	[2]
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The pupil used the circuit to measure the resistance of different Examiner Only Marks Remark 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. Resistance in ohms 0 0 Length in metres (iv) An 80 cm length of this wire was found to have a resistance of 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]

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(v)	Calculate the resistance of a piece of this wire of length 120 cm and area of cross section half of that of the one in part (iv) .
	You are advised to show clearly how you get your answer.
	Resistance = Ω [2]
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(b) The picture below shows an electric toaster and the label attached to it.

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Electric Toaster

240 V

960 W

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

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

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

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

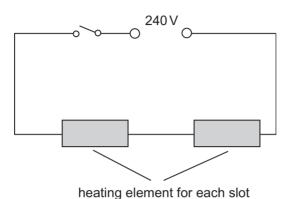
Resistance =
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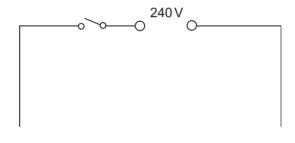
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(c) The toaster shown in the picture, which can take two slices of bread, always has both toasting slots switched on when in use. This wastes electrical energy for a lot of people who wish to make only one slice of toast. The diagram below shows the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



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

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



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

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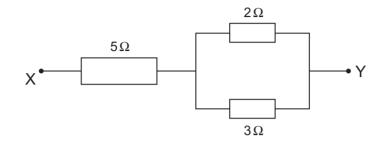
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You are advised to show clearly how you get your answer.



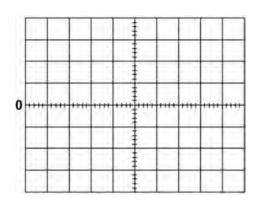
Total resistance = Ω [2]

Total Question 3



	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]
	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.?
	(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 voltage was a changing d.c.

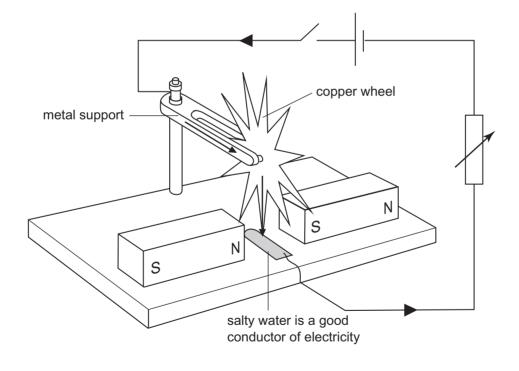


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(c) Below is a sketch of a piece of apparatus which can be seen in some science museums. It consists of a star-shaped wheel made of copper which can rotate in the vertical plane, with one point of the wheel dipping into a pool of salty water. A wire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

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



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	magnetic field, perpendicular to the spoke dipping into the salty ater, is provided by two magnets, one on either side of the wheel.
(i)	Describe and explain fully what would be observed happening to the wheel when the switch is closed.
	Description:
	[2]
	Explanation:
	[2]
	hen the switch is closed the variable resistor is adjusted so that the rrent flowing in the wheel is increased.
(ii	What effect, if any, would this have on the wheel?
	[1]
to	ne switch is opened and both magnets are now turned round so as reverse the direction of the magnetic field at the spoke dipping into e salty water.
(ii	i) The switch is closed again. In what way, if at all, would the behaviour of the copper wheel be different from your answer to (i)?
	[1]

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(d)	Transformers are used to reduce the 240 V mains voltage to run electric fences on farms in Britain.			er Only Remark
	One turr	e of the transformer coils has 480 turns, the other coil has 160 ns.		
	(i)	What is the number of turns on the primary and secondary coils?		
		Number of turns on the primary coil =		
		Number of turns on the secondary coil =[2]		
	(ii)	Calculate the output voltage of the transformer.		
		You are advised to show clearly how you get your answer.		
		Output voltage = V [6]		
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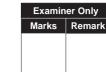
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5 (a) The photograph below shows a nebula. It is believed that our solar system was formed from a nebula. The bright spots are stars.





© 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				
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	further expansion and cooling of the Universe allows hydrogen nuclei to form	
	further expansion and cooling allowing electrons to combine with neutrons and protons to form atoms of hydrogen	
	4. rapid expansion and cooling of the Universe	
	start [2]	
(ii)	What is cosmic microwave background radiation?	
(ii)	What is cosmic microwave background radiation?	
(ii)	What is cosmic microwave background radiation?	

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(c)	Gravity has played and continues to play an important part in the Universe. Describe three of the roles that gravity plays in the shaping of the Universe.	Examiner Only Marks Rema
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	Several ideas have been put forward about the final fate of the					
(d)	Univ	Examir Marks	ner Only Remark			
		each one listed below give a brief description of what might pen to the Universe.				
	(i)	Big Freeze				
	(ii)	Big Crunch				
	(iii)	Big Bounce				
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ine	Earth is divided into layers. se layers have different properties and compositions.	Exa Mark	niner Onl s Rema
(i)	On the diagram below label each of the layers marked by arrow Write the name in the box provided.	vs.	
	3		
	centre of the Earth	[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.		
(iii)		[1]	
		[1]	

[Turn over

	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.		Examin Marks	er Only Remark
-		[2]		
	Most volcanoes are also produced as a result of tectonic activity. The diagram below shows what happens. volcano level magma			
	Adapted from: © The Why Files – University of Wisconsin - Madison			
	(i) Describe what is shown happening in this diagram.			
((ii) What energy is required to form magma shown in the diagram and what is the source of this energy?	 [3]		
	and what is the source of this ellergy!	[2]	Total Qu	lestion 6

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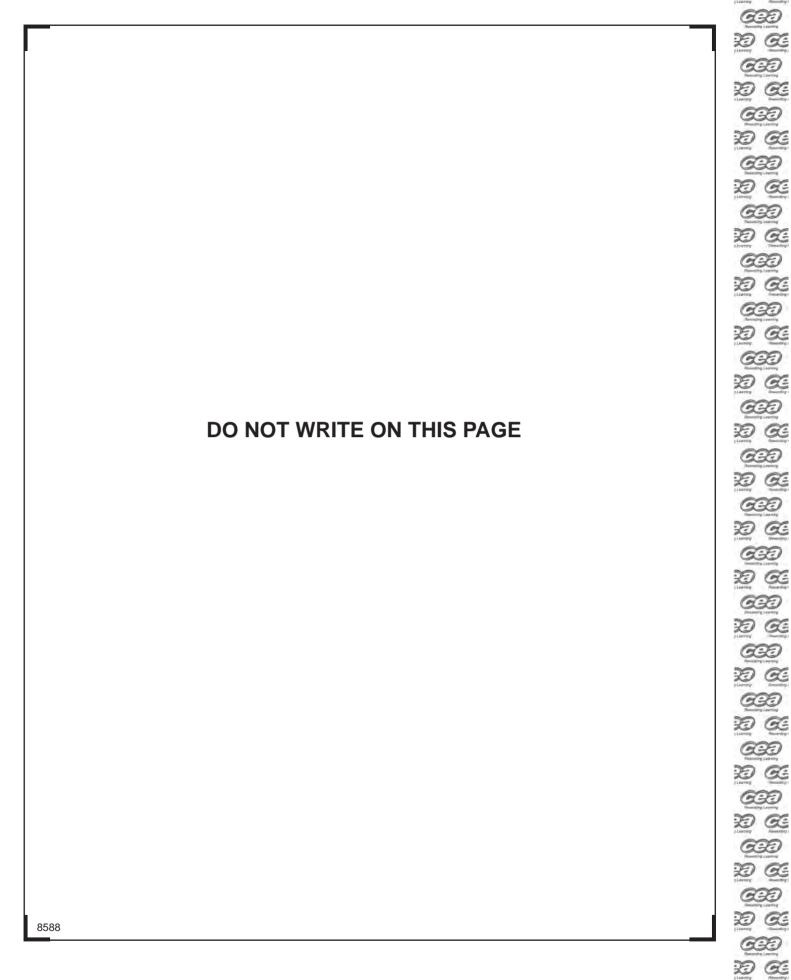
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