EDEXCEL GCSE PHYSICS

PHYSICS



EXAM QUESTION PACK

UNIT P1 HIGHER TIER 5PH1H PAPERS

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Science

Unit P1: Universal Physics

Higher Tier

Wednesday 24 January 2018 – Morning
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

wave speed = $\frac{\text{distance}}{\text{time}}$ $v = \frac{x}{t}$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

power = $\frac{\text{energy used}}{\text{time taken}}$ $P = \frac{E}{t}$

efficiency = $\frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\%$

$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

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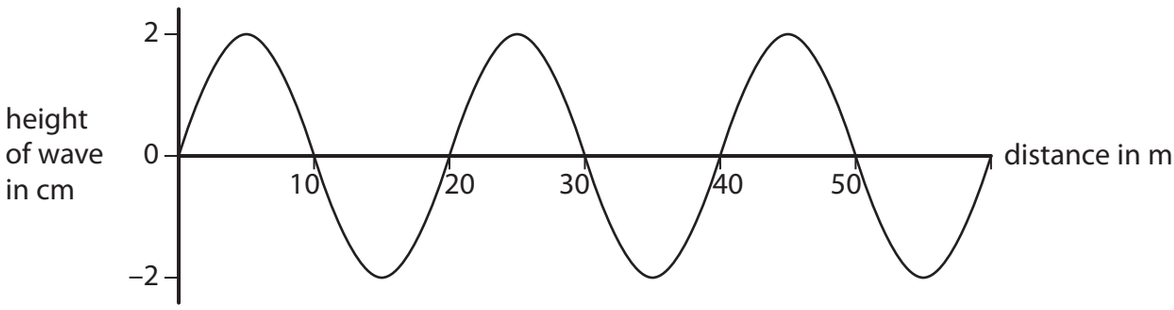
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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Waves

1 (a) The graph shows details about a wave.



(i) What is the amplitude of the wave?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 2 cm

☒ **B** 4 cm

☒ **C** 10 m

☒ **D** 20 m

(ii) The speed of the wave is 30 m/s.

Calculate the frequency of the wave.

(3)

frequency = ... Hz

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(b) (i) The focal point of a lens is the point where rays from a distant object meet after passing through the lens.

Describe what is meant by the term **focal length** of a lens.

(2)

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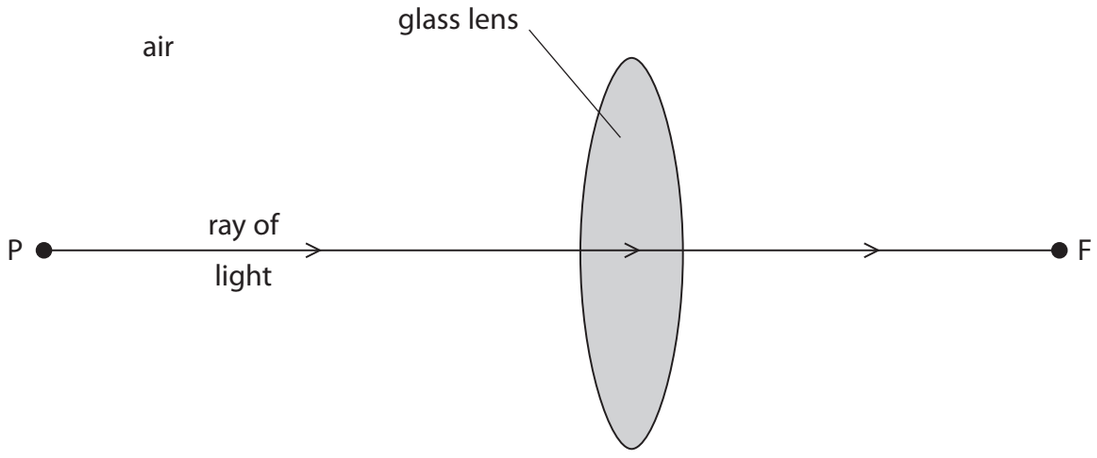
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(ii) The diagram shows a ray of light from an object at P.

The ray travels through a glass lens to the focal point, F, of the lens.



Sketch a graph to show how the speed of the ray varies as it travels from P to F.
Speed of the ray in air is 3×10^8 m/s.
No calculation is required.

(2)



(Total for Question 1 = 8 marks)

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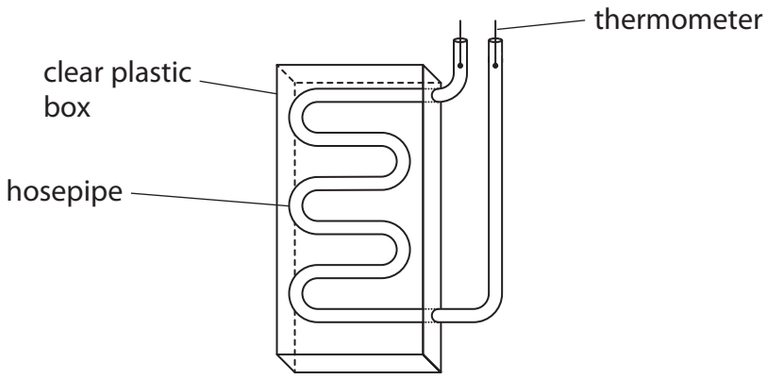
Heating water

2 A student uses a red hosepipe to make a solar water heater.

The hosepipe is full of water.

The student coils the hosepipe and fixes it into a clear plastic box as shown.

There is a thermometer in each end of the hosepipe.



The Sun shines on the hosepipe and heats the water.

(a) The student now paints the hosepipe to make it more efficient at absorbing heat.

Which of these coloured paints would be the best to use?
Put a cross (☒) in the box next to your answer.

(1)

☒ **A** black

☒ **B** grey

☒ **C** silver

☒ **D** white

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(b) The solar heater is kept in a cool place overnight.

In the morning, the student brings the solar heater out into the bright sunshine.

The student records the temperature on the thermometers from sunrise to sunset on a sunny day.

Explain what happens to the temperature of the water in the hosepipe during the day, from sunrise to sunset.

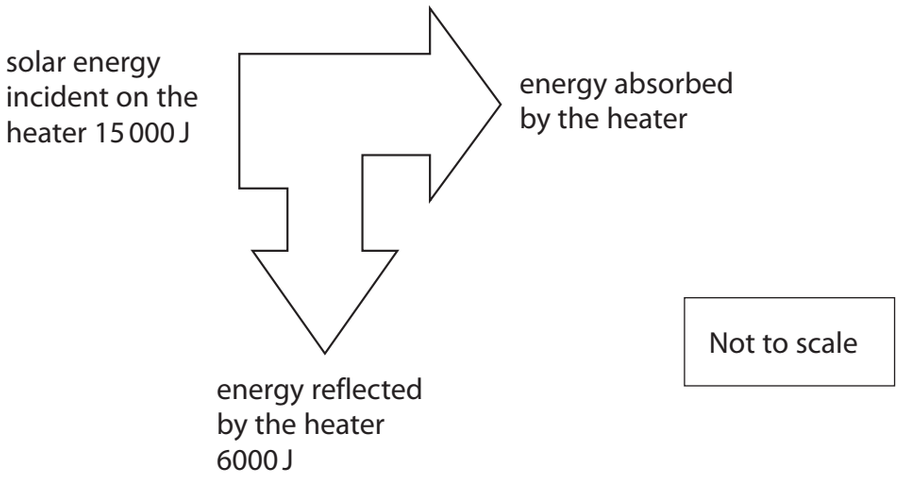
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(c) Some of the solar energy incident on the solar heater is reflected.

The rest of the solar energy is absorbed.

The diagram gives some information about energy transfers during the first 300 s.



Calculate the efficiency of the heater.

(3)

efficiency = ...

(Total for Question 2 = 8 marks)

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The Solar System

3 (a) State the name of the force that keeps the Moon in orbit around the Earth.

(1)

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(b) Explain why the distance between the Earth and Jupiter changes a lot but the distance between the Earth and the Moon stays almost the same.

(2)

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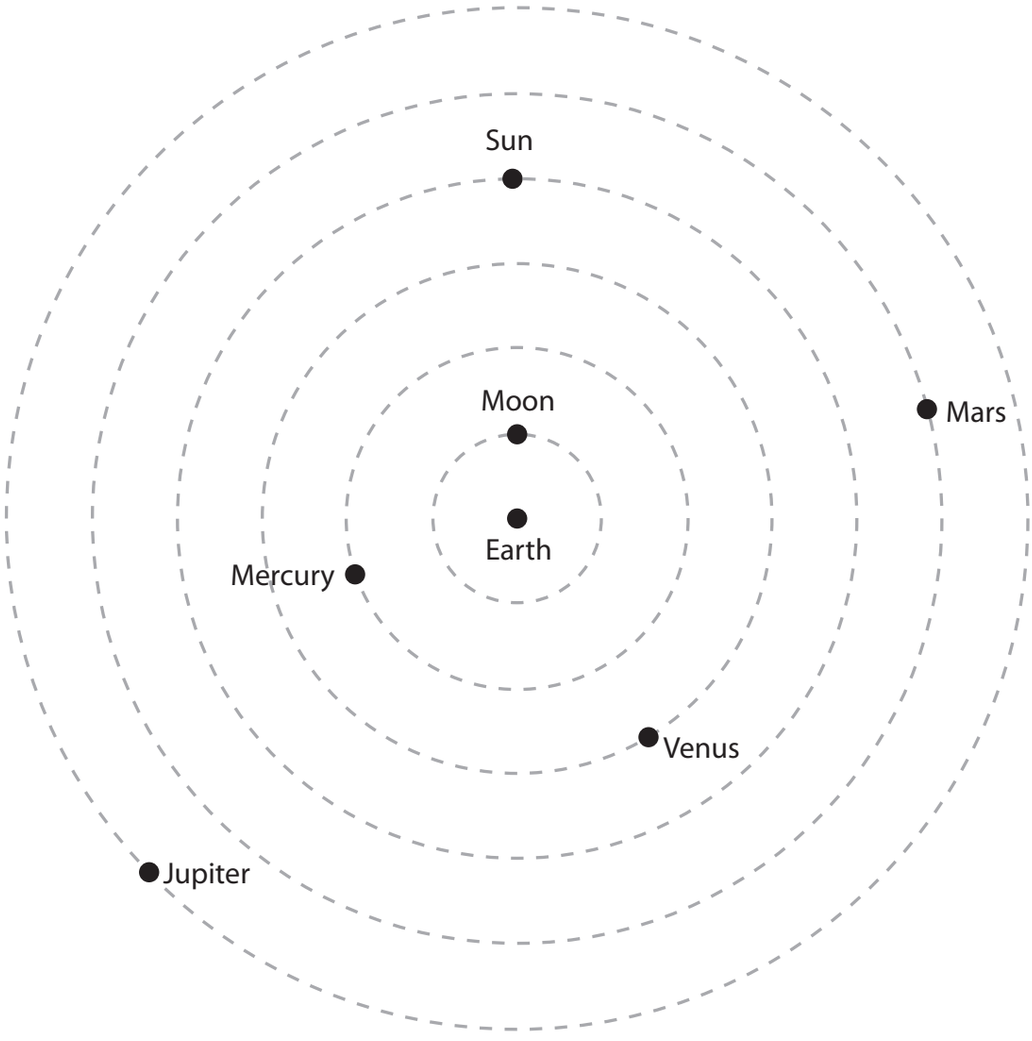
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(c) The diagram shows how people used to think the Solar System was arranged.

The dashed circles represent orbits.



(i) State **one** way that this model agrees with the currently accepted model of the Solar System.

(1)

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(ii) State **two** ways this diagram could be changed to make it more like the currently accepted model of the Solar System.

(2)

1 .....

.....

2 .....

.....

(iii) Galileo used a telescope to observe Jupiter.

Explain how his observations provided evidence for the currently accepted model of the Solar System rather than evidence for the previous model.

(3)

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(Total for Question 3 = 9 marks)

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An electric motor

4 Students investigate the efficiency of an electric motor.

(a) The students measure the input power and the output power of the motor.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The power of the motor is the rate of transfer of

(1)

☒ **A** charge

☒ **B** current

☒ **C** energy

☒ **D** voltage

(b) The motor uses an alternating current (a.c.).

Sketch a graph for an alternating current of frequency 0.5 Hz.

(2)



(c) The electric motor has an efficiency of 40%.

Explain what is meant by an **efficiency of 40%**.

(2)

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(d) The motor has a power rating of 15 W.

The motor runs at this power for 3 minutes.

The cost of electricity is 20 p per kilowatt-hour.

(i) Calculate the energy supplied to the motor in 3 minutes.

State the unit.

(3)

energy supplied = ... unit .....

(ii) Calculate the cost of running the motor for 3 minutes.

(3)

cost = ... p

(Total for Question 4 = 11 marks)

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Waves in action

5 (a) Earthquakes produce seismic waves and infrasound waves.

Which row of the table is correct for these waves?

Put a cross (☒) in a box to show your answer.

(1)

	seismic waves are	infrasound waves are
☒ **A**	transverse only	transverse only
☒ **B**	transverse only	longitudinal only
☒ **C**	longitudinal and transverse	transverse only
☒ **D**	longitudinal and transverse	longitudinal only

(b) A P-wave travels in the mantle of the Earth at an average speed of 12 000 m/s.

This P-wave travels a distance of 5800 km.

Calculate the time this takes.

(3)

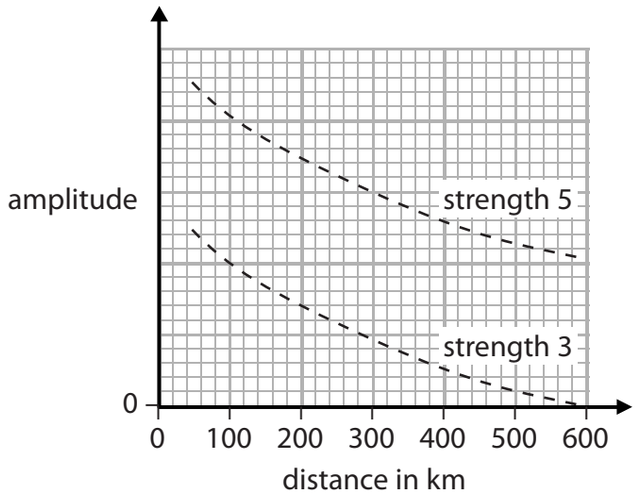
time of travel = ... s

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(c) The amplitude of a seismic wave in the Earth's surface varies with the distance from where the earthquake occurs.

The graph shows this variation in amplitude for two earthquakes of different strengths.



Compare how the amplitude values vary with distance for the two earthquakes.

(2)

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*(d) Waves are also used in sonar.

Explain how a sonar pulse from one submarine can be used to determine the distance to a second submarine.

(6)

(Total for Question 5 = 12 marks)

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Radiation

6 Radiation is used in many different ways.

(a) Which of these can be used both for communication and for cooking?

Put a cross in the box (☒) next to your answer.

☒ **A** infrared radiation

☒ **B** gamma radiation

☒ **C** ultraviolet radiation

☒ **D** X-radiation

(1)

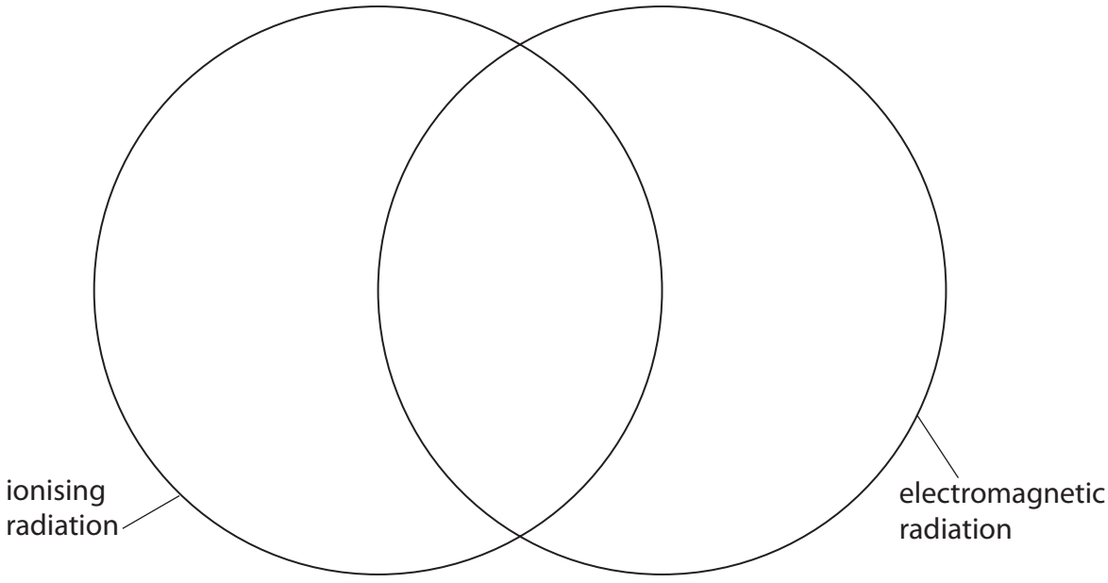
(b) The word box contains the names of three types of radiation.

beta radiation	microwaves	X-rays

Use this diagram to classify the three types of radiation given in the word box.

Write the name of each type of radiation in the correct section of the diagram.

(2)



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(c) Some telescopes are located on high mountains.
This is to reduce the effects of light pollution.

These ground-based telescopes are still limited in the information they can gather.

Explain the limitations of ground-based telescopes in observing stars.

(3)

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*(d) Herschel discovered invisible rays just beyond one end of the visible spectrum.

Another scientist discovered invisible rays just beyond the other end of the visible spectrum.

Explain how their two experiments led to these discoveries.

You may draw labelled diagrams to help with your answer.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

January 2018

Pearson Edexcel GCSE
In Physics (5PH1H)
Paper 01

edexcel

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January 2018
Publications Code 5PH1H_01_1801_MS
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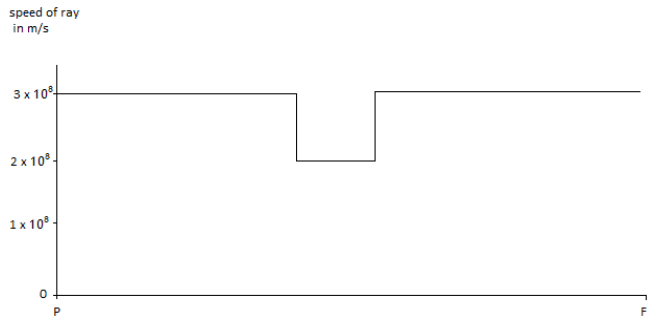
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Acceptable answers	Mark
1ai	**A** 2 cm		**(1)**

Question Number	Answer	Acceptable answers	Mark
1aii	wavelength from graph 20 (m) (1) rearrangement (1) $f = v/\lambda$ evaluation (1) 1.5 (Hz)	 f = 30/20 scores 2 marks 30/10 or ecf from mp1 award for ecf award full marks for correct answer without working	**(3)**

Question Number	Answer	Acceptable answers	Mark
1bi	distance (1) between lens and focal point (1)	how far	**(2)**

Question Number	Answer	Acceptable answers	Mark
1bii		horizontal line shown before and decreasing speed when enters lens (1) goes up to horizontal line after the lens at original height (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	A black		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	An explanation linking any two logically ordered pairs from temperature rises {initially/in the morning} (1) (because) the hose absorbs energy (1) reaches a {constant/maximum} temperature (1) (when) absorption rate = emitted rate (1) temperature falls in afternoon as energy {emitted/ radiated} (1) more energy emitted (than absorbed) (1)	 (initially) heats up because sunlight/heat is absorbed at a greater rate than heat is emitted starts to cool (when) emitted rate is greater than absorption rate idea of absorbing and emitting simultaneously scores 2	**(4)**

Question Number	Answer	Acceptable answers	Mark
2(c)	9000 (J) absorbed by the heater (1) (efficiency = useful energy out /total energy in) substitution (1) 9000/15 000 (x100) evaluation (1) 60 (%) or 0.6	 award full marks for correct answer without working award 2 marks if working shows 6000 used to give answer 40%	**(3)**

Question Number	Answer	Acceptable answers	Mark
3a	gravitational pull (1)	accept gravity gravitational do not award if energy or potential is mentioned do not award if anti-gravity	**(1)**

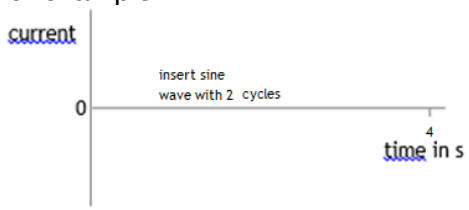
Question Number	Answer	Acceptable answers	Mark
3b	An explanation linking Earth is always (roughly) at centre of Moon's orbit (1) Earth and Jupiter are sometimes at {same side / opposite sides} of orbit (around Sun) (1)	Moon's orbit is (nearly) circular Earth and Jupiter orbit the Sun at different speeds/radii the two points can be scored by a suitably labelled diagram Moon orbits Earth and Jupiter orbits Sun = 1 mark if no other scored	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	Moon orbits Earth (1)	Moon's orbit is circular planets' orbits are circular accept named planet accept correct order for relative orbital radii of named planets all planets are orbiting a central body	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	any two from Sun placed at centre (1) Earth placed where Sun is (1) Moon moved to new Earth position (1) idea of ellipses (1) add more planets / moons / asteroids /comets etc (1)	scale of orbits/planet's size allow orbits should be ***slightly*** oval swap Sun and Moon scores 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(iii)	Explanation linking three from telescope to enlarge (objects looked at) (1) saw moons (1) orbiting Jupiter (1) (meant that) not everything orbited the Earth (1)	 the Earth was not at the centre of everything / the Solar System condone Sun at centre (of Solar System)	 **(3)**

Question Number	Answer	Acceptable answers	Mark
4a	**C** energy		**(1)**

Question Number	Answer	Acceptable answers	Mark
4b	line above and below 0 line (1) two cycles shown (dop) (1) for example  	more than one cycle shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
4c	(only) 40% of {energy / power} supplied (1) is put to intended use (1)	ORA ie 60% of {energy / power} supplied is wasted	**(2)**

Question Number	Answer	Acceptable answers	Mark
4di	substitution (1) 15 x 180 evaluation (1) 2700 unit (1) J / joule(s)	15 x 3 allow full marks for answer of 7.5×10^{-4} kWh Joules, jewels award full marks for correct answer without working	**(3)**

Question Number	Answer	Acceptable answers	Mark
4dii	(3minutes =) 0.05 (hours) (1) substitution (1) (15/1000) x 0.05 x 20 evaluation (1) 0.015	allow ecf from 4di if the unit given there is kWh award 1 for any power x any time x 20	**(3)**

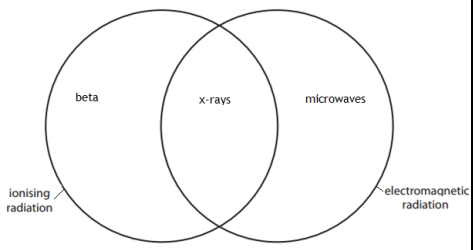
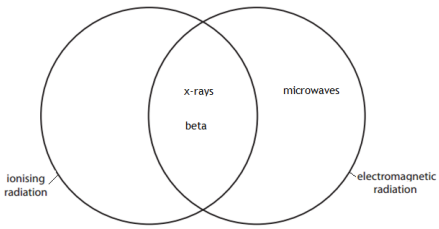
Question Number	Answer	Acceptable answers	Mark
5a	**D** longitudinal and transverse / longitudinal only		**(1)**

Question Number	Answer	Acceptable answers	Mark
5b	rearrangement (1) time = distance ÷ speed substitution (1) time = $5.8 \times 10^6 \div 12\,000$ evaluation (1) 480 (s)	allow substitution and rearrangement in either order ignore POT errors until evaluation allow 483 and anything which rounds to 480 award full marks for correct answer without working	**(3)**

Question Number	Answer	Acceptable answers	Mark
5c	A description which includes the following variation in amplitude between earthquakes (1) e.g. at a given distance, amplitude is greater for strength 5 variation in amplitude with distance (1) e.g. for a given earthquake, amplitude decreases with distance	strength 5 is always higher than strength 3 / strength 3 approaches 0 before strength 5	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	An explanation including some of the following points • sonar is ultrasound • travels through water at the speed of sound (1500 m/s) • signal travels through the water • strikes other submarine • signal reflected by other submarine • reflected signal detected on the first submarine • time between emission and detection measured • either time halved and distance between submarines calculated /or distance wave travelled calculated and halved to give distance between submarines • calculation done using x = v x t A labelled diagram can be awarded to a maximum of level 2, 4 marks If conflict, go with words.	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation e.g. A sonar wave (ultrasound pulse) (goes across and) is reflected AND timed. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation e.g. An ultrasound signal (travels through the water and) is reflected AND timed {{AND distance found by halving {the total time or the total distance} OR linking to either the speed equation or the speed of the wave.}} • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation e.g An ultrasound signal is emitted and reflected. The time is measured AND distance found by halving {the total time or the total distance} AND linking to either the speed equation or the speed of the wave • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6a	**A** infrared radiation		**(1)**

Question Number	Answer	Acceptable answers	Mark
6b	 1 mark for beta in correct region as shown 1 mark for both x-rays AND microwaves in correct regions as shown	 Scores 1 mark for x-rays AND microwaves in correct regions	**(2)**

Question Number	Answer	Acceptable answers	Mark
6c	An explanation linking three from: ground based telescopes restricted (mainly) to visible spectrum (1) (stars emit) wavelengths from the whole spectrum (1) the atmosphere absorbs some of the wavelengths (1) (and so) does not reach Earth's surface (1)	cannot be seen by day in visible light light pollution clouds etc **ignore** unqualified '(air) pollution'	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	• Herschel – IR Ritter – UV • production of spectrum • using prism • (Herschel) took temperature at different colours • found increased towards red end • thermometer beyond red • was hottest • (Ritter) used sensitive (silver chloride) paper at different colours • found blackened quick towards violet • paper beyond violet • blackened quickest • invisible rays were not suspected beforehand at either end A labelled diagram can score up to level 2, 3 marks. If conflict, go with words.	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation including linking of names and regions of e-m spectrum OR a description of any one experiment OR linking the results of one experiment and the conclusion it produced • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation including linking of names and regions of e-m spectrum AND {a description of any one experiment OR linking the results of one experiment and the conclusion it produced} • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation including a description of any one experiment, linking the results of that experiment to the conclusion it produced AND some detail about the second experiment • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Science

Unit P1: Universal Physics

Higher Tier

Wednesday 24 May 2017 – Afternoon
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 8 8 0 1 A 0 1 2 0

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Improvements in scientific equipment

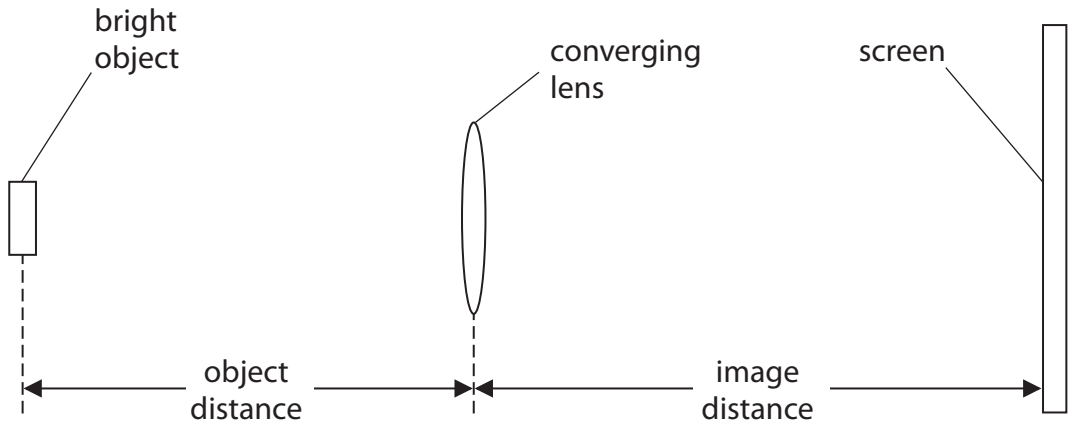
1 Improvements in scientific equipment have made it possible for scientists to observe the Universe in greater detail.

(a) The invention of the refracting telescope is an example.

Refracting telescopes use converging lenses.

A student investigates the properties of a converging lens.

The diagram shows the equipment he uses.



He moves the screen to produce a sharp image of the bright object on the screen.

He measures the image distances for several object distances.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The image on the screen is always

☒ **A** upright and real

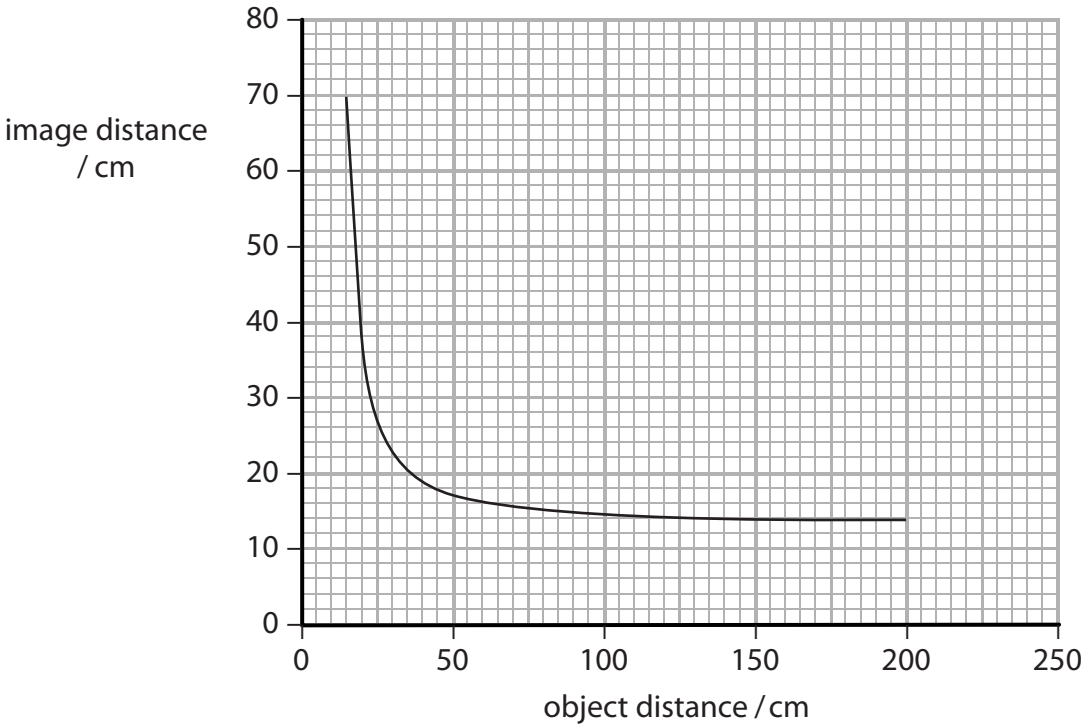
☒ **B** inverted and real

☒ **C** upright and virtual

☒ **D** inverted and virtual

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The graph shows the student's results.



(ii) State what is meant by the focal length of a converging lens.

(1)

.....

.....

(iii) Use the graph to estimate a value for the focal length of the lens.

(1)

focal length = ...

(b) Another scientific improvement was the invention of the reflecting telescope.

Describe the main difference between how a reflecting telescope works and how a refracting telescope works.

(2)

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(c) Explain one other improvement that has allowed scientists to observe the Universe in more detail.

(3)

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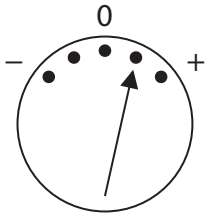
(Total for Question 1 = 8 marks)

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Induction

2 A meter is connected to a coil of wire.

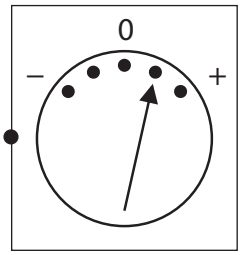
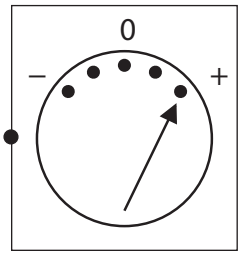
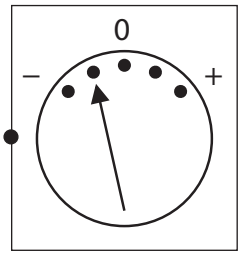
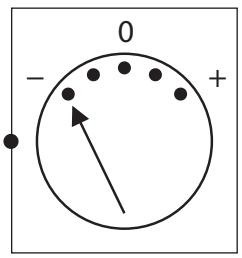
When the **south** pole of a magnet moves into the top of the coil, the meter looks like this.



(a) Draw a line from each 'movement of the magnet' to the 'appearance of the meter'.

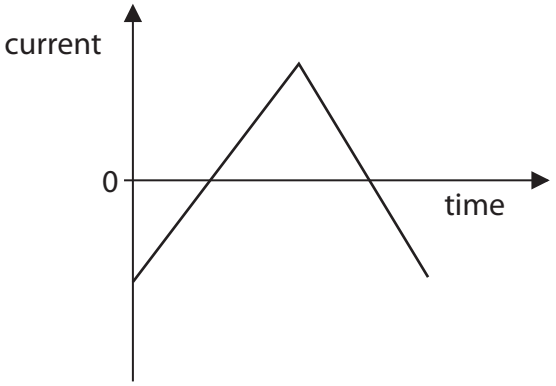
Each meter diagram may be used once, twice or not at all.

(2)

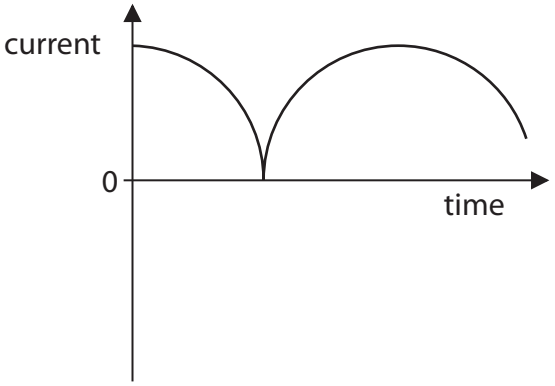
movement of magnet	**appearance of the meter**
The **north** pole of the magnet goes into the top of the coil faster than before	
	
The **south** pole of the magnet comes out of the top of the coil faster than before	
	

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(b) Two graphs are labelled P and Q.



graph P



graph Q

Explain why graph P shows an alternating current and graph Q does not.

(2)

(c) A student connects a lamp and a power supply to a transformer as shown in Diagram 1.

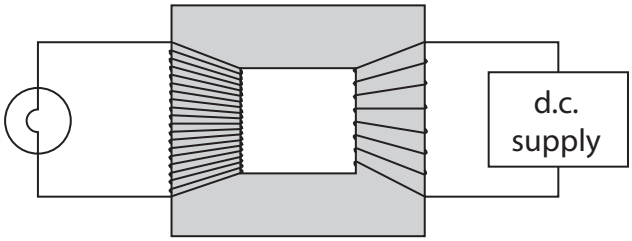


Diagram 1

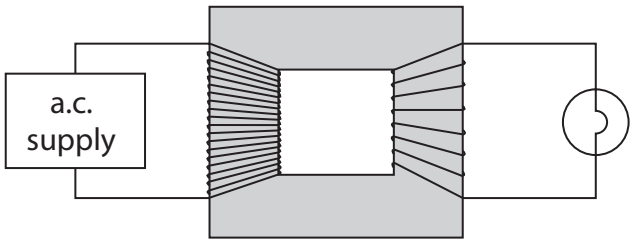


Diagram 2

The lamp does **not** glow.

He then connects the same lamp to the other side of the transformer and uses a different power supply, as in Diagram 2.
Now the lamp glows.

State why the lamp glows when connected as shown in Diagram 2, but does not glow when connected as shown in Diagram 1.

(1)

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(d) A step-down transformer has 20 turns on one coil and 500 turns on the other.

One end of the transformer is connected to a power supply and the other end to an appliance which needs 12 V.

Calculate the voltage of the supply.

(4)

voltage of supply = ... V

(Total for Question 2 = 9 marks)

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An electric fire

3 A student connects an electric fire to the mains supply.



The power rating of the fire is 2.5 kW.

(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

A power of 2.5 kW is the same as

☒ **A** 2500 amps per volt

☒ **B** 2500 joules per amp

☒ **C** 2500 joules per second

☒ **D** 2500 joules per volt

(ii) 1 kW h of electricity costs 20p.

Calculate the cost of keeping the fire on for 12 minutes.

(2)

cost of electricity = ... p

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(iii) The electric fire is set to its maximum setting and connected to the 230 V mains supply.

Calculate the current in the electric fire.

(3)

current = ... A

(b) (i) When the student leaves the electric fire on for a long time, the temperature of the wire element rises to 1100 °C and stays there.

Explain how it is possible for the element to stay at a constant temperature even though the electric fire is on.

(2)

.....

.....

.....

.....

(ii) The mains voltage falls to 210 V but the fire remains switched on.

Describe what happens to the temperature of the element.

(2)

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(Total for Question 3 = 10 marks)

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X-rays and gamma rays

4 (a) X-rays and gamma rays are both ionising radiations.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Another example of an ionising radiation is

☒ **A** infrared

☒ **B** microwave

☒ **C** radio

☒ **D** ultraviolet

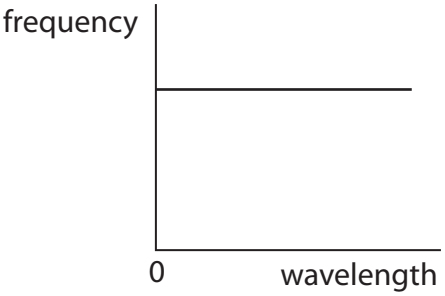
(ii) X-rays and gamma rays are electromagnetic waves.

Which of these graphs is correct for electromagnetic waves?

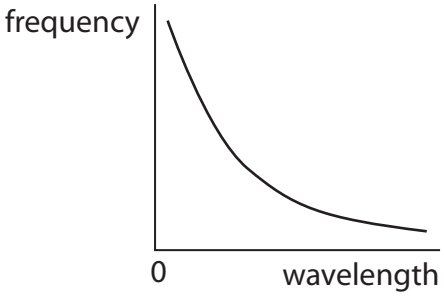
Put a cross (☒) in the box next to your answer.

(1)

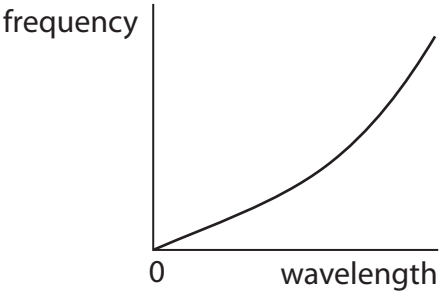
☒ **A**



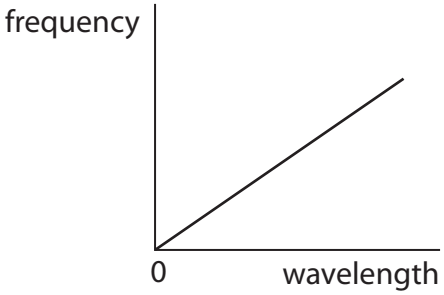
☒ **B**



☒ **C**



☒ **D**



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(b) X-rays and gamma rays can have the same frequencies.

One way of distinguishing between X-rays and gamma rays is to refer to how they are produced.

X-rays are emitted when high energy electrons collide with a metal target.

Describe how gamma rays are produced.

(2)

(c) X-rays and gamma rays have different uses.

Describe **one** use for X-rays and **one** use for gamma rays.

(3)

(d) Electromagnetic radiation with a frequency of 2.8×10^{19} Hz could be either X-rays or gamma rays depending on the source.

Calculate the wavelength of this radiation.

The speed of the radiation is 3.0×10^{8} m/s.

(3)

wavelength = ... m

(Total for Question 4 = 10 marks)

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The origin of the Universe

5 (a) Red giant and red shift are terms used in astronomy.

(i) Describe what is meant by **red giant**.

(2)

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.....

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.....

(ii) Describe what is meant by **red shift**.

(2)

.....

.....

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.....

(b) A spectrum is produced on Earth.

One of the lines in the spectrum has a wavelength of 434 nm.
The same line in a spectrum of light from a distant galaxy has a wavelength of 478 nm.
The speed of light is 3.00×10^8 m/s.

Another term used in astronomy is recessional speed.

Use the equation to calculate the recessional speed of the galaxy.

$$\text{recessional speed} = \frac{\text{change in wavelength}}{\text{original wavelength}} \times \text{speed of light}$$

(2)

recessional speed = ... m/s

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*(c) The Big Bang and the Steady State are two theories about the origin of the Universe.
Both theories are supported by observations of red shift.
Scientists have rejected the Steady State theory.

Compare the Big Bang theory with the Steady State theory and discuss the evidence which has led scientists to reject the Steady State theory.

(6)

(Total for Question 5 = 12 marks)

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Waves in the Earth

6 (a) Elephants communicate using waves of frequency 10 Hz.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer. **(1)**

These waves can be described as

☒ **A** electromagnetic

☒ **B** infrasound

☒ **C** supersonic

☒ **D** ultrasound

(ii) State the value of the minimum frequency for **ultrasound**. **(1)**

..... Hz

(iii) Suggest why humans are unable to hear the waves used by the elephants. **(2)**

.....

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.....

(b) Complete the sentence by putting a cross (☒) in the box next to your answer. **(1)**

When earthquake waves in a solid reach the boundary between the solid and a liquid,

☒ **A** P-waves cannot reflect at the boundary

☒ **B** P-waves cannot refract at the boundary

☒ **C** S-waves cannot reflect at the boundary

☒ **D** S-waves cannot refract at the boundary

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*(c) In ancient China, scientists used instruments to find the origin of an earthquake.

Each instrument had 'Dragons' and 'Toads' as shown in photograph 1.

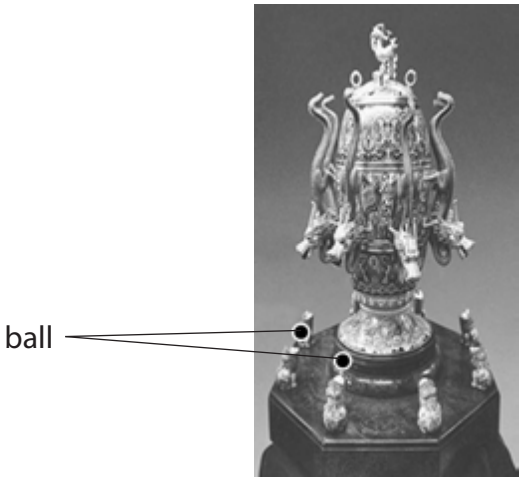


photograph 1

Photograph 1 shows the instrument set up, ready to detect an earthquake.

Each dragon holds a ball in its mouth.

During earthquakes, balls drop from dragons' mouths and are caught by the toads underneath.



photograph 2

Photograph 2 shows the instrument after an earthquake.

The balls have been caught by two toads below the dragons.

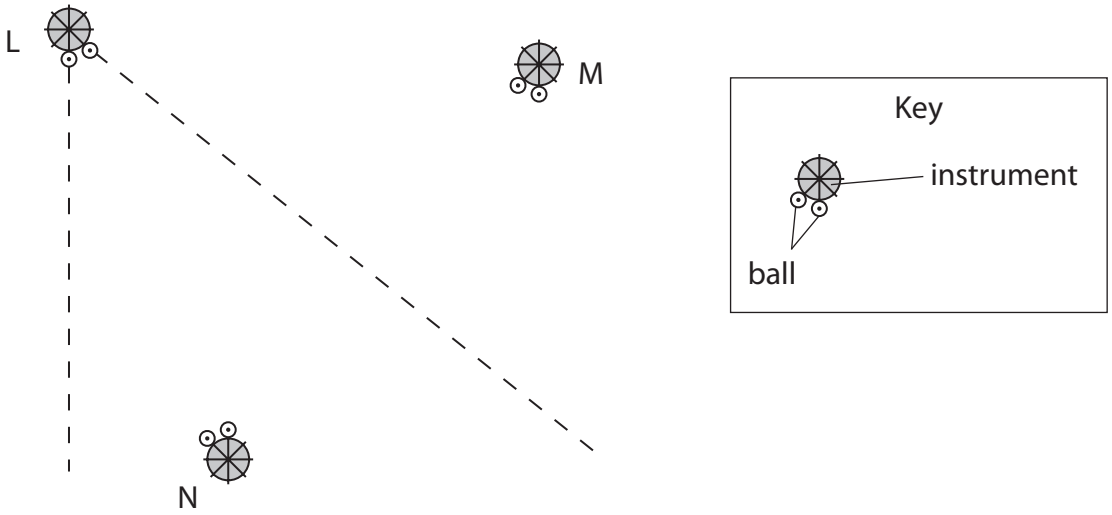
Balls only drop in the direction towards the earthquake.

If two balls drop, then the direction of the earthquake is somewhere between them.

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The diagram represents a map and shows three of these instruments at three different towns, L, M and N.

Two balls have dropped at each place as shown.



The direction from the instrument at L is between the two dashed lines from the centre of L.

Describe how the data in the diagram can be used to find where the earthquake occurred.

Complete the diagram to support your answer.

(6)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Final)

Summer 2017

Pearson Edexcel GCSE

In Physics (5PH1H) Paper 1H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a) (i)	☒ **B** inverted and real **The only correct answer is B** **A** t is not correct because he image is never upright in this arrangement **C** is not correct because a virtual image cannot be obtained on a screen **D** is not correct because a virtual image cannot be obtained on a screen		**(1)**

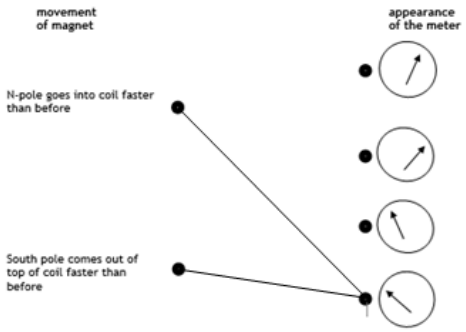
Question number	Answer	Acceptable answers	Marks
1 (a) (ii)	image distance when object is a long way away(1)	distance between (centre of) lens and {focal point/principal focus/ (point) where parallel rays meet (after lens)} NOT just where the image is formed 1/power(of lens)	**(1)**

Question number	Answer	Acceptable answers	Marks
1 (a) (iii)	14 ± 2 (cm) 12 to 16 (cm) (1)	0.12 to 0.16 (m)	**(1)**

Question number	Answer	Acceptable answers	Marks
1 (b)	Description to include two of the following for a reflecting telescope: converging mirror (1) (mirror) is used as an objective (1) a real image is formed (by reflection) (1)	 concave mirror(s) mirror(s) rather than lens(es) are used to collect light allow answers in terms of greater aperture for one mark	**(2)**

Question number	Answer	Acceptable answers	Marks
1 (c)	Explanation linking: relevant invention (1) eg 1.radio telescope 2. camera how it improves things – linking directly to first mark point (2) eg 1.new information as collects data/signals from other regions of em spectrum 2. brighter image as collects light over long period of time	 (named) space telescope / adaptive optics / radio etc telescope / cameras / arrays /rover	**(3)**

(Total for Question 1 = 8 marks)

Question number	Answer	Acceptable answers	Marks
2 (a)	One mark for each line correct  	if more than 2 lines used deduct 1 mark for each extra line	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (b)	Explanation linking: current changes direction for P (1) but current does not change direction for Q (1)	 In P current has both +ve and –ve values /(values/graph/line) above and below zero Q always +ve / always above zero	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (c)	transformers work on ac	transformers do not work with d.c.	**(1)**

Question number	Answer	Acceptable answers	Marks
2 (d)	Identification of coils (1) i.e. 500 turns is N_p or 20 turns is N_s Substitution (1) $\frac{Vp}{12} = \frac{500}{20}$ (scores 2 marks) Transformation (1) $\frac{Vp}{12} = \frac{500 \times 12}{20}$ (scores 3 marks) evaluation (1) 300 (V)	Award full marks for correct answer with no working Transformation may take place before substitution ecf coil identification $\frac{Vp}{12} = \frac{20}{500}$ for 1 mark $Vp = \frac{20}{500} \times 12$ for 2 marks Vp = 0.48 (V) for 3 marks	**(4)**

(Total for Question 2 = 9 marks)

Question number	Answer	Acceptable answers	Marks
3 (a)(i)	☒ **C** 2500 joules per second **The only correct answer is C** **A** is not correct because amps per volt is not equivalent to joules per second **B** is not correct because joules per amp is not equivalent to joules per second **D** is not correct because joules per volt is not equivalent to joules per second		**(1)**

Question number	Answer	Acceptable answers	Marks
3 (a)(ii)	substitution (1) $\frac{2.5 \times 12 \times 20}{60}$ evaluation (1) 10 (p)	Award full marks for correct answer with no working allow 600 (p) for 1 mark	**(2)**

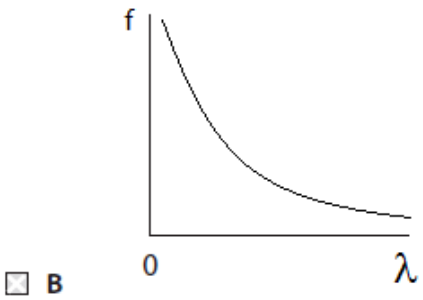
Question number	Answer	Acceptable answers	Marks
3 (a)(iii)	substitution (1) 2500 = 230 x I transformation (1) current = power / voltage $\frac{2500}{230}$ evaluation (1) 11 (A)	Award full marks for correct answer with no working Allow either order for transformation and substitution ignore powers of 10 until evaluation 10.87 (A) numbers that round to 11 (A)	**(3)**

Question number	Answer	Acceptable answers	Marks
3 (b)(i)	An explanation linking energy {radiated / emitted / given out/output} (1) at the same rate as it is taken {in / from the supply}/input (1)	 allow heat/infrared for energy dependent on first marking point power radiated/out/output = power supplied/in/input scores 2 marks	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (b)(ii)	An description including (the temperature) falls/drops (1) to a lower equilibrium value (1) 2nd mark depends on 1st	 accept constant/steady for equilibrium	**(2)**

(Total for Question 3 = 10 marks)

Question number	Answer	Acceptable answers	Marks
4 (a)(i)	☒ **D** Ultraviolet **The only correct answer is D** **A** is not correct because infrared is not an ionising radiation **B** is not correct because microwave is not an ionising radiation **C** is not correct because radio is not an ionising radiation		**(1)**

Question number	Answer	Acceptable answers	Marks
4 (a)(ii)	B  ☐ B **The only correct answer is B** **A** is not correct because graph **A** does not show that as wavelength increases frequency decreases **C** is not correct because graph **C** does not show that as wavelength increases frequency decreases **D** is not correct because graph **D** does not show that as wavelength increases frequency decreases		**(1)**

Question number	Answer	Acceptable answers	Marks
4 (b)	Description to include: from/emitted by radioactive sources/ nuclei (1) all the time/constantly (1)	 from (nuclei) of unstable atoms or radioactive atoms/isotopes/materials/rocks randomly /(nuclear) decay/ nuclear reactions/ fission/fusion positron - electron annihilation/collision scores 2	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (c)	Description to include: a use for X-rays (1) a use for gamma rays (1) further detail about one of them (1)	 e.g. X-rays to look at bones/skeleton scores 1 mark to look at/for broken bones scores 2 e.g. gamma sterilise 1 mark sterilise food/ medical equipment 2 marks accept detect and treat cancer 2 marks	**(3)**

Question number	Answer	Acceptable answers	Marks
4 (d)	substitution (1) $3.0 \times 10^{8} = 2.8 \times 10^{19} \times \lambda$ transformation (1) $\frac{3.0 \times 10^{8}}{2.8 \times 10^{19}}$ evaluation (1) 1.1×10^{-11} (m)	Award full marks for correct answer with no working Allow either order for transformation and substitution ignore powers of 10 until evaluation 1.07×10^{-11} (m) numbers that round to 1.1×10^{-11} $1.071428571 \times 10^{-11}$ 1×10^{-11}	**(3)**

(Total for Question 4 = 10 marks)

Question number	Answer	Acceptable answers	Marks
5 (a)(i)	Description including any two from: (red giant) one/next stage/phase in the life of a star (1) (after) main sequence (1) hydrogen runs out (1)	two clear stages referred to similar in mass to the Sun/ expands/cools/ before white dwarf fuel runs out/helium fusion starts next stage in the life of the Sun scores two marks	**(2)**

Question number	Answer	Acceptable answers	Marks
5 (a)(ii)	Description including: increase in (observed) wavelength of light /longer (observed) wavelength of light (1) from a galaxy/star moving away (from us) (1)	decrease in (observed) frequency of light / lower (observed) frequency of light ignore moving to the red end of (visible) spectrum. ignore planets moving away ignore universe expanding	**(2)**

Question number	Answer	Acceptable answers	Marks
5 (b)	change in λ (1) 478-434 (nm) evaluation (1) 3.04×10^7 (m/s)	Award full marks for correct answer with no working 44 ignore powers of ten error until evaluation 30414746.54 allow 1 mark max if original λ taken as 478 nm and evaluated to 2.76×10^7 (m/s) 27615063	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A comparison including some of the following points: Big Bang theory • Universe is expanding • Universe had a beginning • Universe started with an 'explosion' • Universe cooling / density decreasing Steady State • Universe is expanding • Universe did not have a beginning • (allow) Universe has always been there • Universe the 'same' at any time/place evidence against Steady State • cosmic microwave background radiation (CMBR) supports only BB • indicates a cooling Universe	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description including two points from indicative content. e.g. BB - Universe is expanding and had a beginning • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple comparison including a similarity and a difference e.g. BB - Universe is expanding and had a beginning , SS is also expanding but has always been there • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed comparison involving a similarity and a difference and a reason why SS not supported e.g. BB - Universe is expanding and had a beginning , SS is also expanding but has always been there .CMBR only supports BB • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

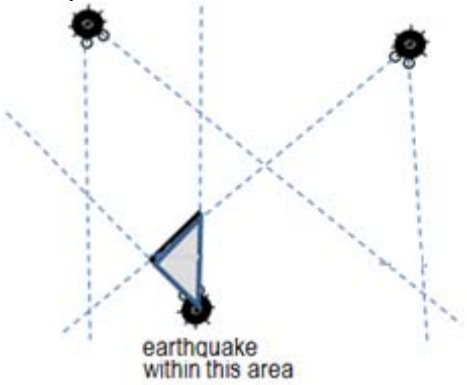
(Total for Question 5 = 12 marks)

Question number	Answer	Acceptable answers	Marks
6 (a)(i)	☒ **B** infrasound **The only correct answer is B** **A** is not correct because elephants do not communicate using electromagnetic waves of frequency 10 Hz **C** is not correct because supersonic refers to a speed greater than that of sound **D** is not correct because the frequency of ultrasound is greater than 20 000 Hz		**(1)**

Question number	Answer	Acceptable answers	Marks
6 (a)(ii)	20 000 (Hz)	20 kHz a number between 20 000 and 20 001(Hz)	**(1)**

Question number	Answer	Acceptable answers	Marks
6 (a)(iii)	suggestions which: make reference to frequency (1) idea of below range of human/our hearing (1)	Hz hertz outside/beyond for below **NOT** above "too low" must be linked to frequency	**(2)**

Question number	Answer	Acceptable answers	Marks
6 (b)	☒ D S-waves cannot refract at the boundary **The only correct answer is D** **A** is not correct because P-waves can reflect at the boundary **B** is not correct because P-waves can refract at the boundary **C** is not correct because S-waves can reflect at the boundary		**(1)**

Question Number		Indicative Content	Mark
QWC	***6 (c)**	A description including some of the following points • Draw two lines from M • Straight • Through ball and centre of instrument • Draw two lines from N • To show limits of directions from each place • Find position/area which is within all three limits  	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of method e.g. draw (two) lines from M and (two) lines from N • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of method e.g. draw two straight lines from M and two straight lines from N that appear (by eye) to pass through the ball and the centre of the instrument. Some of the lines cut each other. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of method e.g. draw two straight lines from M and two straight lines from N that appear (by eye) to pass through the ball and the centre of the instrument. Some of the lines cut each other. AND an approximate area/position shown clearly on the diagram or referred to in the text. • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately. • spelling, punctuation and grammar are used with few errors	

(Total for Question 6 = 11 marks)

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Science

Unit P1: Universal Physics

Higher Tier

Wednesday 25 May 2016 – Afternoon
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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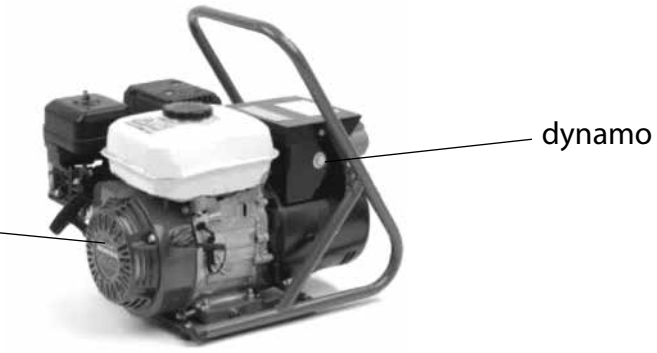
Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A petrol-driven generator

1 The photograph shows a portable petrol-driven generator.



The small petrol engine drives the dynamo.
The dynamo generates electricity.
This arrangement is not efficient in generating electricity.

(a) Apart from efficiency, state one advantage and one disadvantage this petrol-driven generator has, when compared with a small wind-powered generator.

(i) Advantage

(1)

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(ii) Disadvantage

(1)

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(b) The table gives some data about the small petrol engine.

energy transferred to surroundings in each second	5200 J
energy supplied to dynamo in each second	2800 J

(i) Calculate the total energy supplied to the petrol engine in each second.

(1)

total energy supplied to the petrol engine in each second = ... J

(ii) Use the data to calculate the efficiency of the petrol engine.

(2)

efficiency = ... %

(c) The dynamo generates an electric current by induction.

Explain what is meant by induction of a current.

(3)

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(Total for Question 1 = 8 marks)

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The Universe

2 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The Milky Way is part of

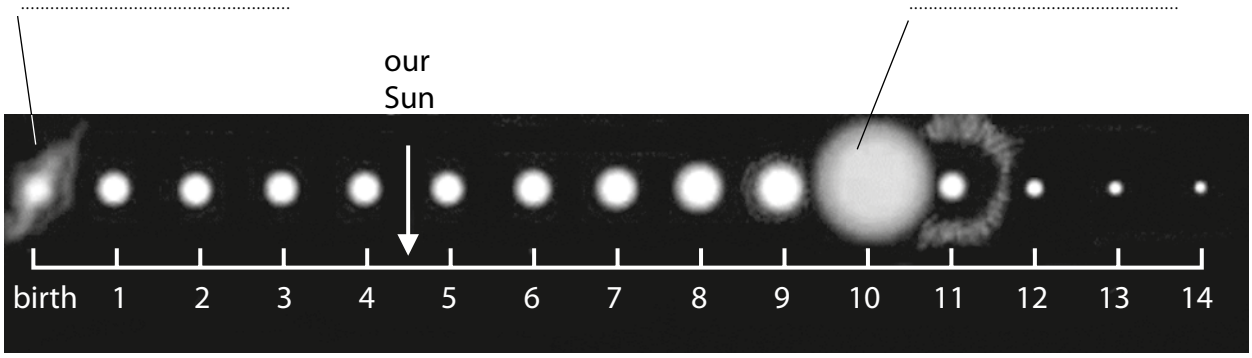
(1)

- ☒ **A** the Solar System but not the Universe
- ☒ **B** the Universe but not the Solar System
- ☒ **C** both the Solar System and the Universe
- ☒ **D** neither the Solar System nor the Universe

(b) The diagram shows the stages in the evolution of a star like our Sun.

The sizes of the star are not drawn to scale.

The position of our Sun now is shown.



birth age in billions of years (approx.)

(i) Label the two stages indicated.

(2)

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The time it will take for our Sun to become a white dwarf from now is about

(1)

- ☒ **A** 7.5 billions of years
- ☒ **B** 11 billions of years
- ☒ **C** 14 billions of years
- ☒ **D** 16 billions of years

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(c) Another main sequence star has a mass much greater than the mass of our Sun.

State the next stages in the evolution of this star, before it becomes a neutron star.

(2)

(d) In a main sequence star, fusion in the core generates thermal energy. As a result, the hydrogen and helium ions are pushed outwards.

Explain why these ions do not just quickly move outwards.

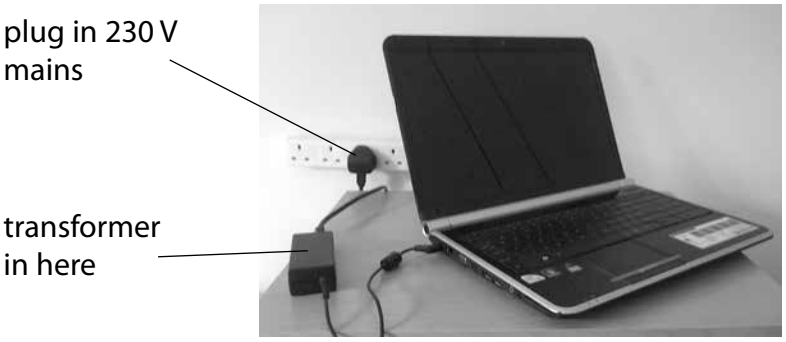
(2)

(Total for Question 2 = 8 marks)

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Power

3 The photograph shows a laptop computer plugged into the 230 V mains.



(a) The laptop is left on standby.

Its power consumption from the mains is 3.2 W.

The cost of 1 kWh of electrical energy is 14 p.

Calculate the cost of leaving the laptop on standby for 24 hours.

(3)

cost = ... p

(b) When the laptop is in normal use, its power consumption from the mains is 97 W.

Calculate the current drawn from the mains.

(3)

current = ... A

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(c) The transformer shown in the photograph steps down the mains voltage of 230 V to 9.2 V.

The primary coil of the transformer has 4700 turns.

(i) Calculate the number of turns on the secondary coil.

(3)

number of turns = ...

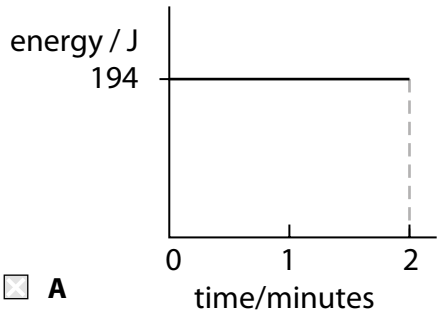
(ii) The laptop is switched on and works normally for 2 minutes.

Which graph shows the energy supplied by the mains in this time?

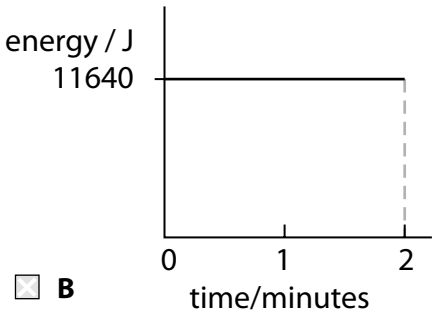
Put a cross (☒) in the box next to your answer.

(1)

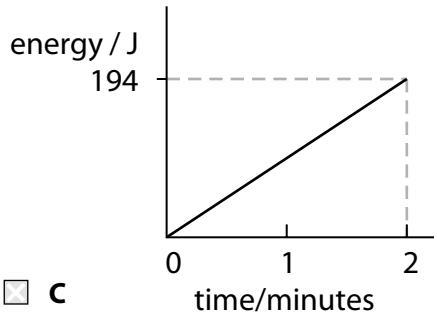
☒ **A**



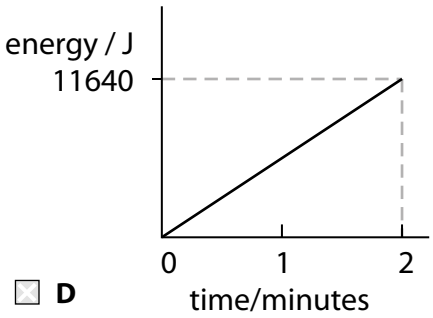
☒ **B**



☒ **C**



☒ **D**



(Total for Question 3 = 10 marks)

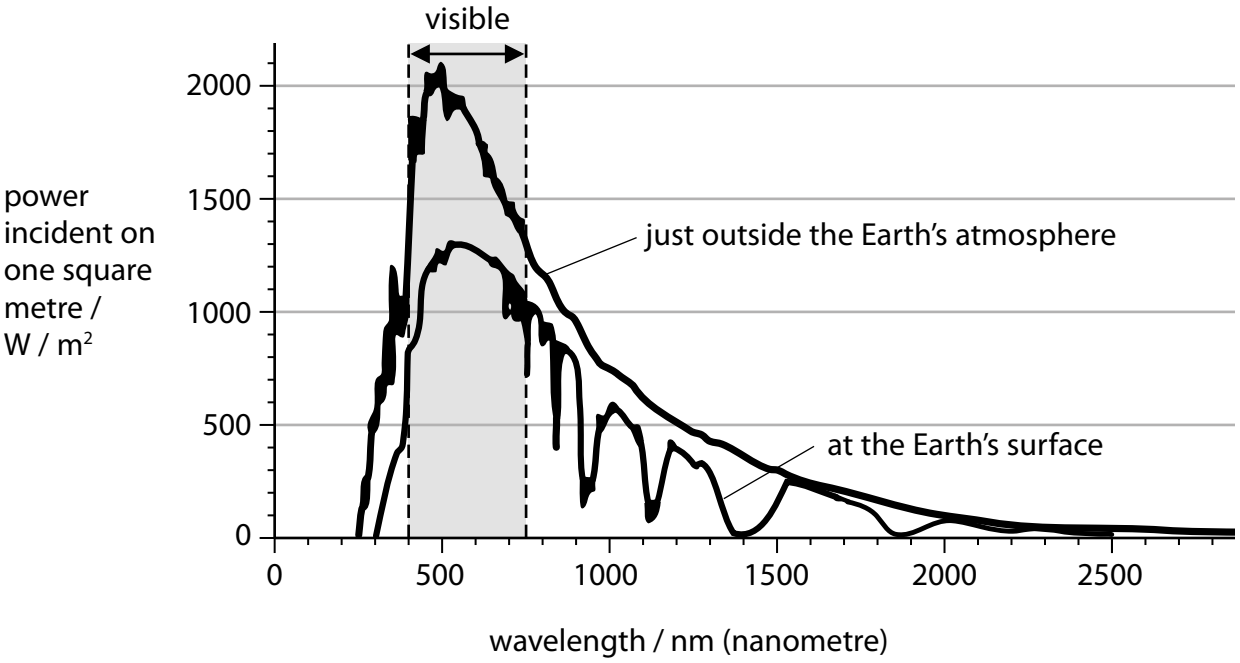
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Radiation from our Sun and from other stars

4 (a) Our Sun emits different amounts of radiation at different wavelengths.

The graphs show how much radiation is measured for a given wavelength

- just outside the Earth's atmosphere
- at the Earth's surface.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The minimum wavelength of radiation received from our Sun at the Earth's surface is about

(1)

☒ **A** 0 nm

☒ **B** 250 nm

☒ **C** 310 nm

☒ **D** 520 nm

(ii) Name the type of radiation that has a wavelength of 800 nm.

(1)

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(iii) Suggest why there is a difference in the two graphs at a wavelength of 1850 nm.

(2)

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(b) The velocity of light in a vacuum is 300 000 000 m/s (3×10^8 m/s).

1 nm = 10^{-9} m (1 / 1 000 000 000 m)

Calculate the frequency of radiation that has a wavelength of 800 nm. Give the unit.

(4)

frequency = ... unit .....

(c) Some light is emitted with a wavelength of 600.0 nm from our Sun.
When measured in the spectrum of another star, the light has a wavelength of 598.8 nm.

Explain what information this gives about the star.

(2)

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(Total for Question 4 = 10 marks)

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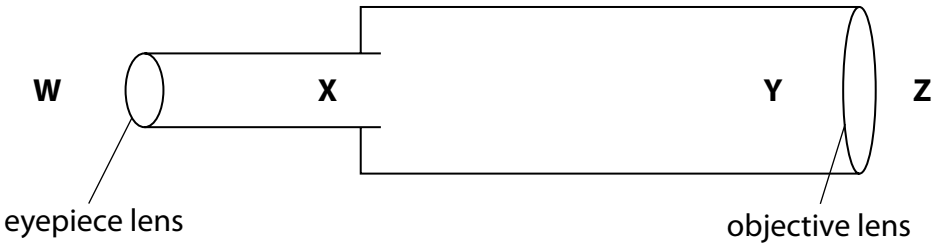
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Refraction

5 (a) The diagram shows a telescope consisting of two converging lenses.



The telescope is used to look at the Moon.

The objective lens produces a real image of the Moon.

(i) Which position on the diagram shows where the real image of the Moon is formed?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** position **W**

☐ **B** position **X**

☐ **C** position **Y**

☐ **D** position **Z**

(ii) Describe the function of the eyepiece lens.

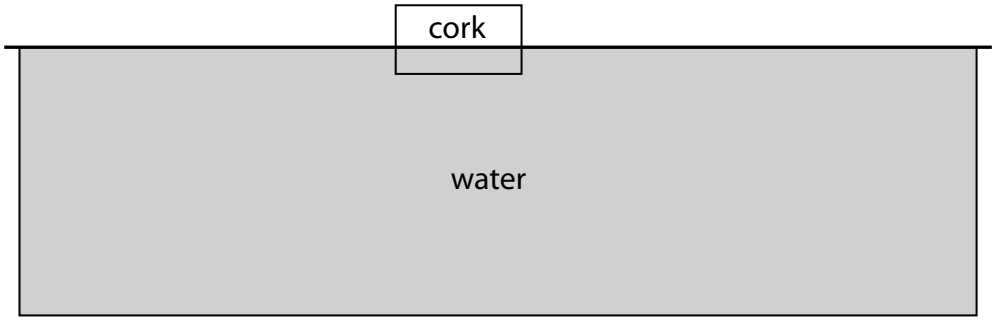
(2)

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(b) (i) A cork floats on some water.



Describe how this arrangement can be used to show whether waves on the water surface are transverse or longitudinal.

You may add to the diagram to help your answer.

(3)

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*(ii) The diagram shows water waves approaching a boundary between deep water and shallow water. The arrow shows the direction of travel of the water waves.

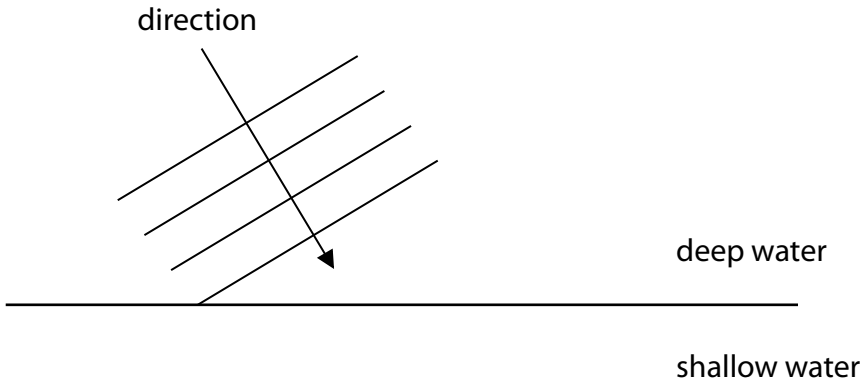
The wave speed in the shallow water is less than the wave speed in the deep water.

The frequency of the waves in the shallow water is the same as their frequency in the deep water.

Explain what happens to the direction and the wavelength of these waves when they pass from the deep water into the shallow water.

You may add to the diagram to help with your answer.

(6)



(Total for Question 5 = 12 marks)

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Earthquakes and the interior of the Earth

6 (a) Which row correctly lists the three parts of the Earth in order of their distance from its centre?

Put a cross (☒) in the box next to your answer.

(1)

	nearest centre →		furthest from centre
☒ **A**	crust	mantle	outer core
☒ **B**	mantle	crust	outer core
☒ **C**	outer core	crust	mantle
☒ **D**	outer core	mantle	crust

(b) Explain why it is difficult to predict when a tsunami will occur.

(2)

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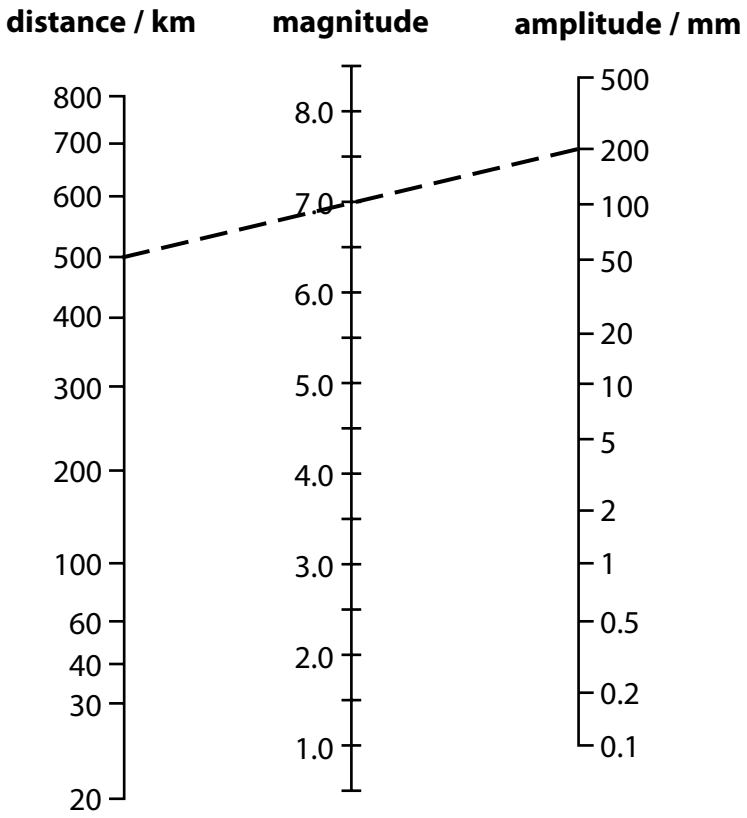
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(c) The chart is based on the Richter scale.

To work out the magnitude of an earthquake on the Richter scale:

- mark the **distance** and **amplitude** of the earthquake on the scales
- join these with a straight line
- read off the **magnitude** on the central scale.



The seismic wave from an earthquake has an amplitude of 200 mm at a distance of 500 km from a seismic station.

This gives a magnitude of 7.0 on the Richter scale.

The table shows information about **one** other, different, earthquake.

Complete this table.

(3)

distance from earthquake / km	amplitude / mm	magnitude
100	1	3
300	0.1	
	2	

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*(d) Scientists have used the properties of seismic waves to develop various models of the Earth's interior.

Explain how some of the properties of P-waves and S-waves lead to the present model of the Earth's interior.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Physics (5PH1H) Paper 01
Unit P1: Universal Physics

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Summer 2016
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	Any one from portable (1) not weather dependent (1) takes up less space (1)	Reverse argument (RA) in each case can be {moved/used} anywhere ignore convenient/costs does not need wind condone (source) {(more) reliable/ always available/used any time} condone smaller 'It' refers to generator/petrol	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	Any one from uses {fossil fuel/petrol} (1) {non-renewable/finite/limited} resource (1) (exhaust) {fumes/gases} are {polluting /damage environment}(1)	RA in each case fuel costs ignore unqualified references to cost {petrol/fuel} may run out/not sustainable needs refilling constantly produces pollutants /condone pollutes emits named gases e.g.$C0_2$,CO, SO_2 contributes to acid rain/greenhouse effect/global warming not eco-friendly ignore references to noisy/ harmful 'It' refers to generator/petrol	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b) (i)	8000 (J)	(if answer wrong, give mark) for 5200 + 2800 (J) 8 **k**J (note k must be added)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b) (ii)	Substitution (1) 2800 (× 100 %) 8000 Evaluation (1) 35 %	ecf from 1(b)(i) 0.35 if 0.35 seen in working but rounded to 0.4 - award mark award full marks for correct answer even with no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	explanation linking any **three** of: • (idea of relative) movement(1) • (between) magnet/field/flux (1) • (and) coil/conductor/wire (1) • {emf/voltage } (produced) (1) • without { battery / contact }(1)	cut/cutting/change (of field/flux) the induced voltage makes current flow in a circuit =1 mark	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)	B the Universe but not the Solar System		**1**

Question Number	Answer	Acceptable answers	Mark
2bi	nebula red giant	must be in this order on page for nebula accept (some/cloud of) {dust/gas/hydrogen} condone protostar instead of nebula ignore 'stellar/planetary' do **NOT** accept red **super**giant	**2**

Question Number	Answer	Acceptable answers	Mark
2bii	A 7.5 billions of years		**1**

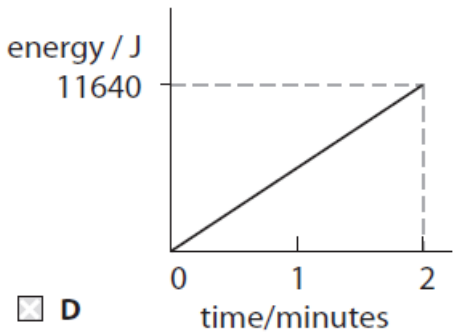
Question Number	Answer	Acceptable answers	Mark
2c	(to) <u>red **super**giant</u> (1) (and then) supernova (1)	condone <u>super red giant</u> ignore {bigger/massive} red giant must be in this order for 2 marks if reversed award 1 mark mention of supernova without red supergiant scores 1 beware of lists (e.g. -1 for each addition between red supergiant and supernova to min 0)	**2**

Question Number	Answer	Acceptable answers	Mark
2d	An explanation linking (force of) gravity (1) and **any one** from (gives) inwards (force on particles) (1) OR (which) balances outward force (on particles) (1)	 gravitational {force/pull} ignore GPE and pressure {inward/downwards/backwards} (pull) (force) is in (idea of) opposite direction to outwards push balances outward push upwards for outwards gravitational attraction (of particles) scores 2 marks inward force balances outward force =1 mark	**2**

Question Number	Answer	Acceptable answers	Mark
3(a)	conversion (1) 3.2 W = 0.0032 kW substitution (1) 0.0032 × 24 × 14 evaluation (1) 1.1 (p)	allow conversion and substitution in either order correct substitution of any power x time x cost (per unit) answers rounding up from 1.0752 to 1.1 =3 marks condone rounding to 1 (p) for 3 marks if some correct working shown any other answer using 10752 (to any {power of 10 / sig.fig.}) = 2 marks award full marks for the correct answer with no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)	substitution (1) 97 = 230 × I transposition (1) $\frac{\text{power}}{\text{voltage}}$ OR $\frac{97}{230}$ evaluation (1) 0.42 (A)	allow substitution and transposition in either order ignore power of 10 errors until evaluation mark allow numbers which round down to 0.42 (A) e.g. 0.42/0.42174 (A) for 3 marks award full marks for correct answer with no working unsupported 4.2 (A) OR 0.042 (A) score 2 condone rounding to 0.4 (A) condone use of 240 instead of 230 to give 0.402 so accept for 3	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	substitution (1) $\frac{230}{9.2} = \frac{4700}{N_s}$ transposition (1) $\frac{4700 \times 9.2}{230}$ (or in words/symbols) evaluation (1) 190	allow substitution and transposition in either order accept {? /their final answer or blank space} for N_s any arrangement of the equation $\frac{4700 \times 9.2}{230}$ or 4700/25 scores 2 marks award full marks for correct answer with no working allow 188/187.7 for 3 marks allow POT error for 2 marks	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	**D**  ☒ **D**		**1**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	**C** 310 nm		**1**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	infrared (radiation)	infra red/ infra-red/ir/IR (condone) heat (radiation)	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	suggestion including: (radiation) is absorbed (1) second mark can only be scored if first mark is scored by atmosphere (1)	blocked/stopped/reflected/filtered/scattered ignore 'can't pass through' condone any named EM radiation by named gases e.g. 'carbon dioxide absorbs' scores 2	**2**

Question Number	Answer	Acceptable answers	Mark
4b	transposition (1) (f =) v/λ OR c/□ substitution (1) $3 \times 10^{8} / 800 \times 10^{-9}$ evaluation (1) 3.75×10^{14} hertz / Hz (1)	allow substitution and transposition in either order 3×10^{8} / 800 shows transposition $3 \times 10^{8} / 800 \times 10^{-9}$ scores for transposition and substitution $3 \times 10^{8} =$ f x 800 x 10^{-9} just scores substitution mark ignore power of 10 errors until evaluation mark award full marks for correct answer with no working POT error gives 2 calculation marks, but check for unit e.g. kHz/GHz etc condone Hertz OR s^{-1} ignore hz or c.p.s accept correct SI prefix eg kHz, MHz, GHz, THz etc	**4**

Question Number	Answer	Acceptable answers	Mark
4c	An explanation linking star moving (relative to Earth) (1) and **any one** from wavelength is {smaller/decreased / shorter} (1) OR towards Earth (1)	 {blue shift / opposite of red shift} frequency is {larger / bigger / higher /increased} towards {'us' / (our) Sun} Max 1 mark if mark 2 and 3 contradict	**2**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**B** position **X**		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	Description to include: • magnify (1) second mark can only be scored if first mark is scored • image {of the Moon/formed by the objective lens} (1)	enlarge/make bigger etc ignore zoom/zoom in real/intermediate image image at X unqualified 'image' is insufficient ignore ideas of focusing	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	A description including any **three** of • make wave (on water surface) (1) • {look at / observe} movement of cork (1) • (if cork and wave move) in same directions, wave is longitudinal (1) • (if cork and wave move) at right angles then wave is transverse (1)	(cork moves) {horizontally /left and right} wave is longitudinal definition of longitudinal (cork moves) vertically /up and down wave is transverse definition of transverse full marks can be scored from a suitably labelled diagram	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(b)(ii)**	An explanation including some of the following points (Changes are in bold type: reasons follow a bullet point) **changes** **detail** **reason** wavelength changes decreases (because) speed decreases direction changes towards because speed decreases the normal left hand end meets surface first **Relevant technical terms are refract and normal.** **One at least should be mentioned at levels 2 and 3 for full marks.** **Marks can be scored for the use of *v = f λ* in any relevant way such as linking 'slower *v'* to '*smaller λ'* by saying *v is proportional to λ (at constant f)*** **Notes**: • A correct unlabelled diagram can score up to 3 marks. • If conflict, between words and diagram go with words. • Ignore density arguments • If candidate contradicts the question and states that wave speed increases causing direction to change to (further) away from the normal or refract away from the normal, the maximum mark is level 1, 2 marks.	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation including two simple changes OR one detailed change OR one simple change with a reason e.g. the wavelength changes and the direction changes OR the wavelength decreases OR the waves change direction because the speed is less • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• a simple explanation including one simple change, one detailed change AND a linked reason to either change e.g. the direction changes, the wavelength decreases because the waves slow down OR two detailed changes with reason not given/unclear for 3 marks e.g. the wavelength decreases and the wave bends towards the normal OR as shown on a diagram • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed explanation including two detailed changes AND a reason for each. e.g. the wavelength decreases because the waves slow down and the wave bends towards the normal because the left hand side slows down first • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6(a)	**D** outer core mantle crust		**1**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation linking (tsunamis are) caused by {earthquakes/volcanoes} (1) and **any one** from (idea that earthquakes/volcanoes etc.) are unpredictable (1) OR (earthquakes occur/jolt/slip) under the {sea/ocean/water} (1)	{movement/slipping} of (tectonic) plates landslides tsunamis occur after earthquake/ meteorites (sudden) jolt/slip/random/occur at any time ignore tsunamis are unpredictable 'they' refers to tsunamis	**2**

Question Number	Answer	Acceptable answers	Mark
6(c)	one mark per box correctly filled distance from earthquake / km: 100, 300, 60 amplitude / mm: 1, 0.1, 2 magnitude: 3, 3, 3	accept for middle row 3: 2.8-3.2 inc. accept distance value for another earthquake with amplitude 2 (mm) (by eye) accept a distance value within approx. 10% (in range 55 to 65 inc. for 60)	**3**

Question Number		Indicative Content	Mark
QWC	***6(d)**	An explanation linking some of the following points (properties are in bold type: contributions to understanding follow a bullet point) **Properties** • Contribution to understanding **mention of P- being longitudinal** **mention of S- being transverse** **speed (unchanging) and reflection** • idea of echolocation / thickness of Earth's crust / detecting boundary layers e.g. mantle and (outer) core **speed (changing) and refraction** • understanding of change in density of rocks (in the Earth's interior) /detecting boundary layers eg mantle and (outer) core **{longitudinal /P-} can travel through solids AND liquids** • idea of internal volumes of liquid/liquid (outer) core / solid inner core • shadow zone /absence of P-waves on side of the Earth **{transverse /S-} can {only travel through solids/not travel through liquids}** • shadow zone /absence of S-waves on opposite side of the Earth (to source of the S-waves) • idea of internal volumes of liquid/idea of liquid (outer) core Note: • Some marks can be awarded based on labelled diagrams. Unless detailed annotation is present, marks for the diagram are limited to level 2. • If conflict, between words and diagram go with words.	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation including at least two properties OR one property AND a possibly unconnected idea about the Earth's interior OR two vague and possibly unconnected ideas from contributions to understanding about the Earth's interior e.g. P-waves travel through solids and liquids, S-waves only travel in solids OR S-waves only travel through solids, the speed of waves change with density OR parts of the Earth are liquid and speed changes at different places inside the Earth. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• a simple explanation including at least two properties and the contribution to understanding of one of them e.g. P-waves travel through solids and liquids. S-waves only travel in solids, showing that the (outer) core is liquid. OR {P/S/Seismic} waves will bounce back from a boundary. S-waves only travel in solids, showing that the (outer) core is liquid. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed explanation correctly linking at least two properties and their associated contributions to understanding. The examples chosen should include reference to both P-waves and S-waves. e.g. P-waves travel through solids and liquids and can be detected on the opposite side of the Earth. S-waves only travel in solids, showing that there is a liquid (outer) core. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

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Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Science

Unit P1: Universal Physics

Higher Tier

Wednesday 20 May 2015 – Afternoon
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

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Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Energy from the Sun

1 The International Space Station (ISS) has several solar panels called wings.



The wings convert energy from the Sun into a form useful in the ISS.

(a) The energy reaching the ISS from the Sun is carried by waves which are

(1)

☒ **A** transverse and electromagnetic

☒ **B** electromagnetic but not transverse

☒ **C** transverse but not electromagnetic

☒ **D** neither transverse nor electromagnetic

(b) In one second, the useful energy available from one wing is 34.3 kJ.
The energy incident on the wing from the Sun is five times this amount.

What is the percentage efficiency of the wing?

(3)

efficiency = ... %

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(c) A wing is in direct sunlight.
The ISS is not receiving energy from the wing.
The temperature of the wing remains constant.

Explain why the temperature of the wing remains constant in these conditions.

(2)

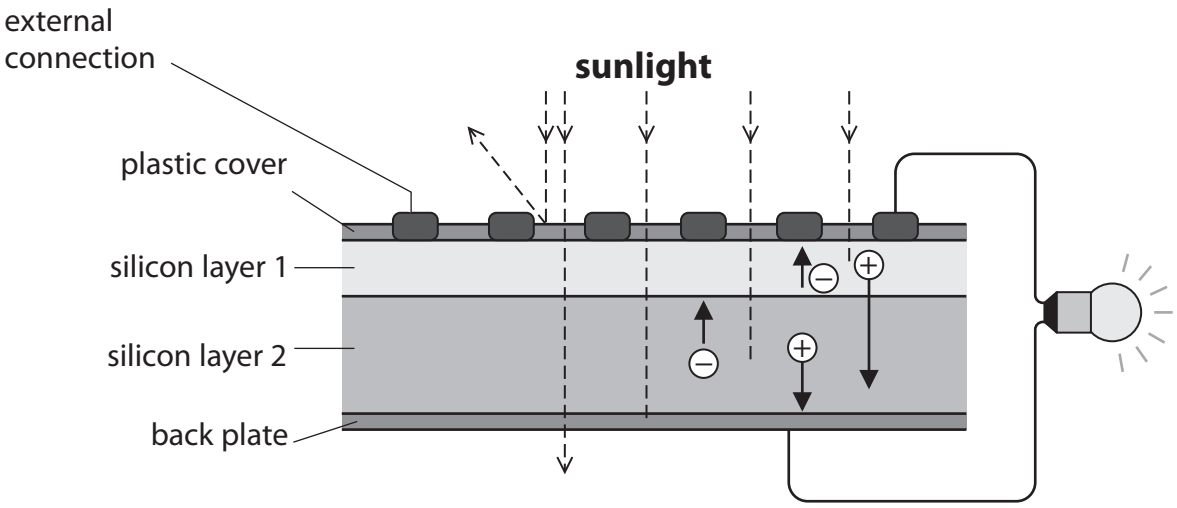
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(d) The diagram shows how a solar cell produces electricity when receiving energy from the Sun.
When energy from the Sun is absorbed in a silicon layer, it makes charges move.
This movement of charges produces a current.



Suggest **two** reasons why the efficiency of this solar cell at producing electricity from sunlight is less than 100%.

(2)

1 .....

.....

2 .....

.....

(Total for Question 1 = 8 marks)

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2 (a) Our Sun is a main sequence star.
It will stay as a main sequence star for millions of years, continuing to radiate energy.

(i) Our Sun was formed from a nebula.

Describe the formation of our Sun from nebula to main sequence.

(2)

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(ii) Our Sun will go through many stages.

Which of these stages will our Sun go through?

Put a cross (☒) in the box next to your answer.

(1)

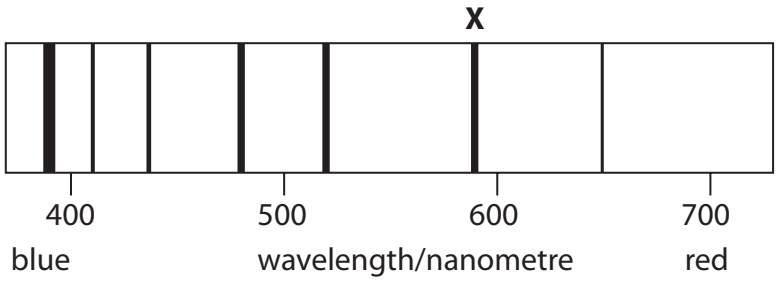
☒ **A** a black hole

☒ **B** a neutron star

☒ **C** a supernova

☒ **D** a white dwarf

(b) The diagram shows some lines in the spectrum of light from a nearby galaxy.
One of the lines is marked **X**.



(i) Line **X** will be in a different position in the spectrum of light from a much more distant galaxy.

Draw a line on the diagram to show a possible new position for line **X** in the spectrum of light from a much more distant galaxy.

Label this new line **Y**.

(1)

(ii) Explain why you have drawn line **Y** in this position on the diagram.

(2)

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(c) Two theories about the Universe are the Steady State Theory and The Big Bang Theory.

(i) The table shows some ideas about the Universe.

Which row of the table applies to the Steady State Theory?
Put a cross (☒) in the box next to your answer.

(1)

	the Universe.....	**the Universe.....**
☒ **A**	... is not expanding	... had a beginning
☒ **B**	... is expanding	... had a beginning
☒ **C**	... is not expanding	... did not have a beginning
☒ **D**	... is expanding	... did not have a beginning

(ii) State the name of the discovery that persuaded most scientists to prefer the Big Bang Theory to the Steady State Theory.

(1)

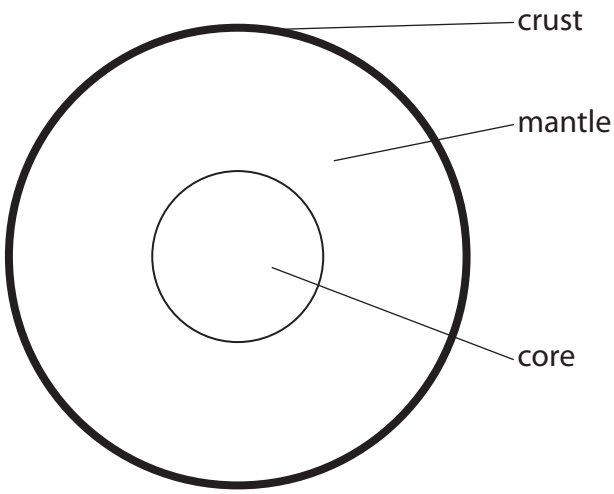
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(Total for Question 2 = 8 marks)

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Earthquakes

3 (a) The diagram shows a cross-section of the Earth.



The mantle is hotter near the core than near the crust.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

One reason for the mantle being hotter near the core is that

(1)

☒ **A** the Earth's crust is a solid

☒ **B** the Earth's core is a liquid

☒ **C** the Earth is radiating heat to space

☒ **D** the Earth is absorbing heat from space

(ii) Explain how this temperature difference causes the tectonic plates in the Earth's crust to move.

(2)

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(b) All earthquakes emit S-waves and P-waves.
Scientists determine the position of earthquakes by detecting these seismic waves.

(i) The S-waves and P-waves do not always travel in straight lines.

Explain why the S-waves and P-waves do not always travel in straight lines.

(2)

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(ii) S-waves and P-waves travel at different speeds.
The scientists use the (S–P) time to estimate how far away the earthquake is.

Suggest what is meant by (S–P) time.

(2)

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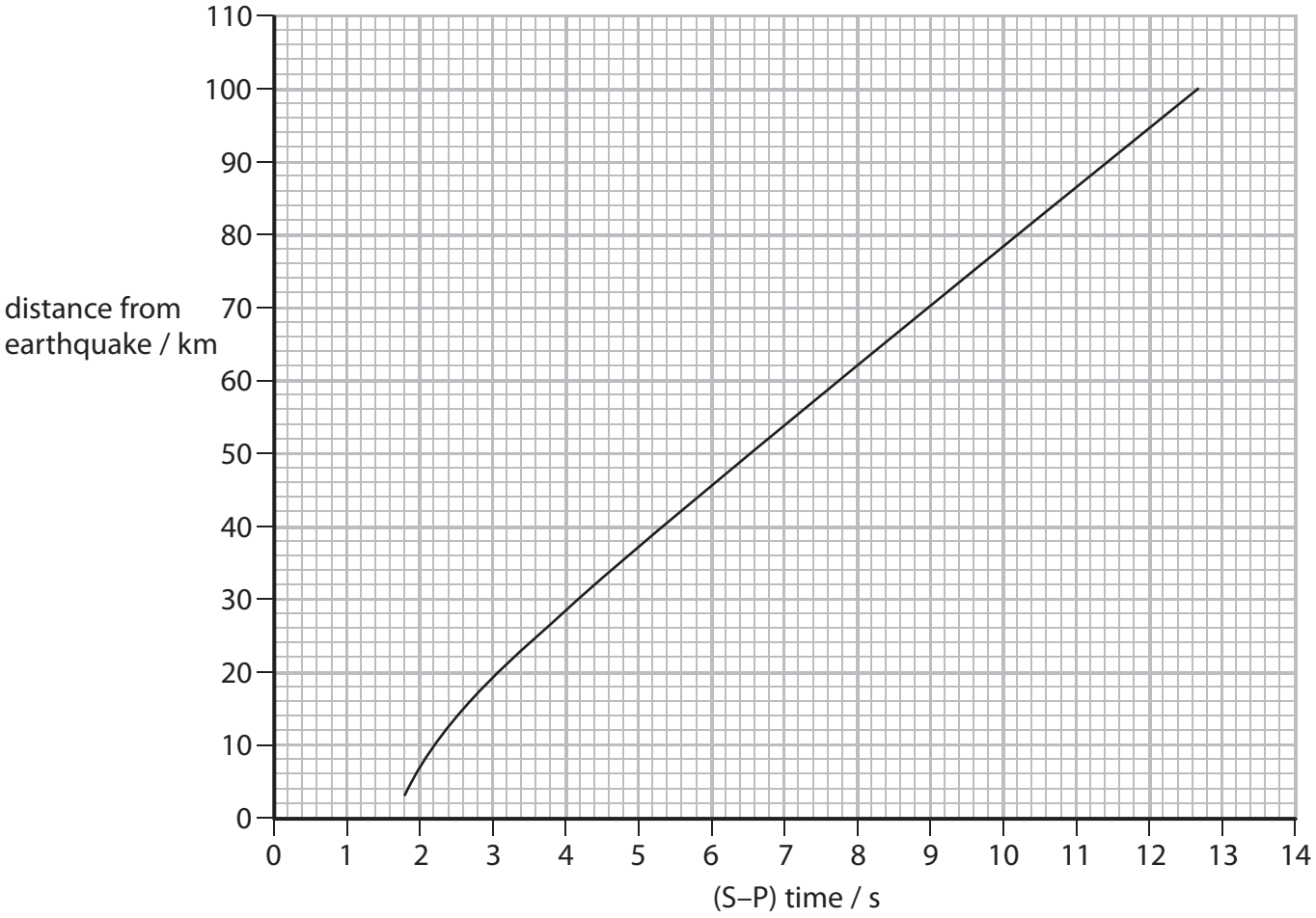
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(iii) Some scientists use the following equation to get a quick estimate of how far away an earthquake happened.

distance from earthquake in km = 8 × (S–P) time in seconds

The graph shows the relationship between the (S–P) time and the distance from the earthquake, measured along the Earth's surface.



Use values from the graph to evaluate the range of distances for which this estimate is reasonable.

(3)

(Total for Question 3 = 10 marks)

Using lenses

4 (a) State **two** advantages of using a camera, rather than the unaided eye, for studying stars.

(2)

1 .....

.....

2 .....

.....

(b) Galileo observed the moons of Jupiter.
Explain how these observations helped to change scientists' ideas about the Universe.

(3)

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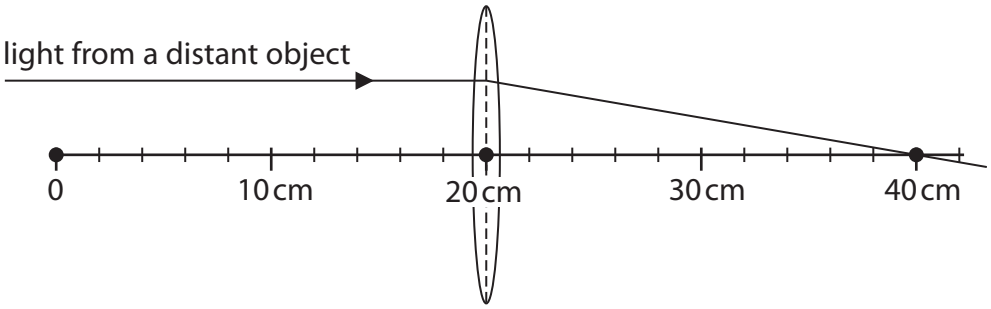
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(c) The diagram shows a thin lens placed at the 20 cm mark of a metre rule.



A ray has been drawn from a distant object.
Complete the sentence by putting a cross (☒) in the box next to your answer.

The focal length of the lens is

(1)

☒ **A** 10 cm

☒ **B** 20 cm

☒ **C** 30 cm

☒ **D** 40 cm

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(d) The linear magnification of a thin lens is given the symbol *M*.
The following equation for *M* is used for lenses in cameras.

$$M = \frac{f}{(d - f)}$$

where *f* is the focal length of the lens and *d* is the distance between the lens and an object.

A lens has a focal length of 12 cm.

(i) Use the equation to calculate *M* when the distance from an object to the lens is 14 cm

(2)

M = ...

(ii) Use the equation to calculate *M* when the distance from an object to the lens is 11 cm

(1)

M = ...

(iii) The table shows the magnifications produced by this lens for different distances between object and lens.

d / cm	*M*
3.0	–1.3
9.0	–4.0
15	4.0
21	1.3

Suggest what the sign of *M* indicates about the image produced by the lens.

(1)

.....

.....

(Total for Question 4 = 10 marks)

Using electromagnetic radiation

5 (a) A specific electromagnetic wave has a frequency greater than visible light.
The wavelength of this wave is longer than that of X-rays.

Complete the sentence by putting a cross (☒) in the box next to your answer.

This electromagnetic wave is

(1)

☒ **A** a gamma wave

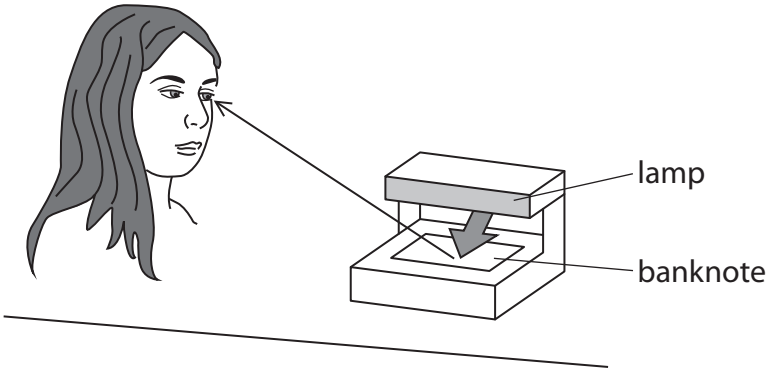
☒ **B** an infrared wave

☒ **C** a microwave

☒ **D** an ultraviolet wave

(b) The picture shows a woman checking that a banknote is genuine.

She is using a lamp which emits a radiation which is part of the electromagnetic spectrum.



Explain how **two** different electromagnetic radiations enable the woman to check the banknote.

(2)

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.....

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(c) A light wave from a star has a frequency of 6.67×10^{14} Hz and a wavelength of 4.50×10^{-7} m.

The star is 4.00×10^{16} m away from Earth.

Calculate the time it takes light from the star to reach the Earth.

(3)

time to reach Earth = ... s

*(d) Explain the differences between longitudinal and transverse waves.
Your explanation should refer to ultraviolet, ultrasound and seismic waves.

(6)

(Total for Question 5 = 12 marks)

Electricity

6 (a) A man monitors how much money he spends on electricity.
He uses a device which calculates the cost of electrical energy used.
He connects his 2.9 kW electric kettle to the 230 V mains supply.

(i) Calculate the current in the kettle element.

(3)

current = ... A

(ii) The device shows that in one week the total cost of the electrical energy used by the kettle is 97 p.
1kW h of electrical energy costs 17 p.

Calculate the length of time for which the kettle has been switched on during the week.

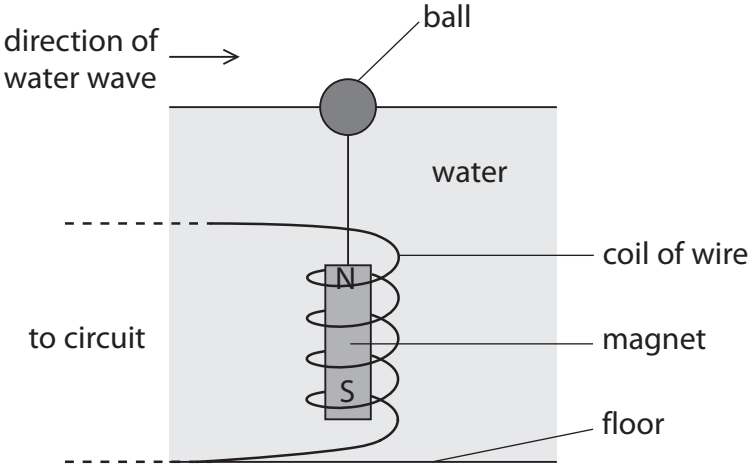
(3)

time = ...hours

*(b) The diagram shows a model used to generate electricity from water waves in a tank.

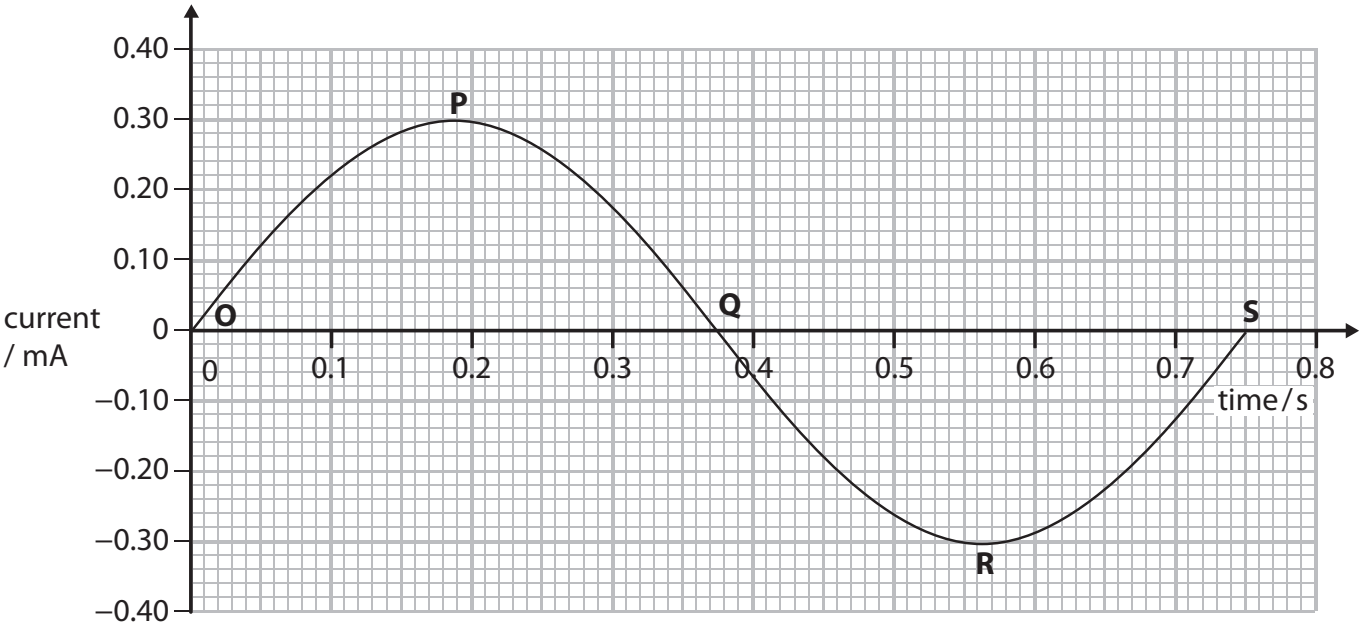
A ball floats on the surface of the water in the tank.
A coil of wire is fixed to the floor of the tank.
A magnet is suspended from the ball inside the coil.

When a wave is sent along the surface of the water the ball moves up and down.



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The graph shows the current induced in the coil.



Explain how this current is induced in the coil in the model.
You should refer to the model and to the labelled points on the graph in your answer.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Physics (5PH1H) Paper 01 Unit P1: Universal Physics

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Summer 2015
Publications Code UG042625
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	A transverse and electromagnetic		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	Evaluation 171.5 (1) Substitution (34.3/171.5) x 100 (1) Evaluation 20 (%) (1)	award full marks for correct answer with no working 34.3 x 5 [34.3 /(34.3 x 5)] x 100 [34.3 /(34.3 x 5)] [34.3 /171.5] Allow 0.2 or 1/5 for 3 marks	**(3)**

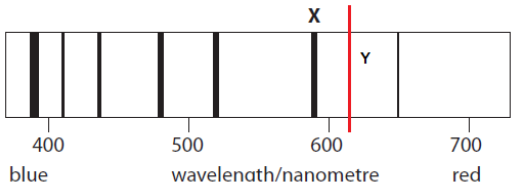
Question Number	Answer	Acceptable answers	Mark
1(c)	rate of {energy/heat} (from the Sun){absorbed/taken in} (1) equals rate of {energy/heat} {radiated/emitted/given out}(1)	Allow 'energy in = energy out' for 1 mark 'power in = power out' for 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	Any two suggestions from: reflection (from external connections/plastic cover)(1) absorption by {external connection/ plastic cover/back plate} (1) transmission (through back plate) (1)	Not all energy absorbed by silicon layer/absorbed by wrong parts	**(2)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	Description including any two of: • gravity (1) • (causes the) nebula to collapse/contract (1) • (causes the) temperature to increase (1)	Pulls {particles/gas} together Forms protostar ke transferred to thermal energy KE/GPE ->thermal GPE -> KE until it was hot enough to start the reaction until fusion starts	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	**D** white dwarf		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	Y drawn anywhere to the right of X e.g  	Accept any clear indication of where line should be line doesn't have to be labelled Reject lines both sides of X	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	explanation linking: • (distant) galaxy <u>moving away</u> (1) • (so) line shifted to longer λ(1)	shifted to red/redshift/lower frequency λ (appears to be) increasing Do not allow: galaxy appears red λ and f contradictions	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	**D** ..is expanding ... did not have a beginning		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	Cosmic Microwave Background (Radiation)	[order of words unimportant] CMB(R) reject 'CMB and red shift'	**(1)**

Total for Question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	**C** The Earth is radiating heat to space		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	An explanation linking any 2 of: • Hot material rises/cold material falls (1) • (causes) material under the plate to move sideways (1) • (because of) uneven heating (1)	convection current in the {mantle/magma/under plates} heat from core warms mantle near core IGNORE temperature difference (in stem)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	an explanation linking: • change in wave speed (1) • (with) change in {density/state of the rock/media/material} (1)	Refraction S-waves reflected Accept change from solid to liquid or vice versa IGNORE reference to gas	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	suggestion to include: • the time difference (1) • of S and P waves {arriving/reaching /detected/recorded} (same place) (1)	Allow P-waves travel faster ORA for 1 mark, if no other mark scored	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	• Identifies two points on the graph • Evidence of calculation or comparison to the equation • Draws a suitable conclusion	May be scored by points marked on graph Accept appropriate comment shape of graph e.g. Graph not straight at short distances or Graph nearly straight at long distances works better for long distances than short distances	**(3)**

Total for Question 3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
4(a)	Any two suitable such as: • Measurements can be taken (1) • Permanent record/evidence (1) • Can be magnified (1) • Can detect waves outside visible part of spectrum (1) • Long exposure (to see faint objects/track objects) (1)	 Analysis/compare 'can record data' Taking photo is insufficient zoom in/show more detail can detect gamma rays, X-rays, ultraviolet, infrared Allow collect more light IGNORE better, brighter, clearer	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	An explanation linking: • (Idea of) geocentric model believed initially (1) • Observation of moons orbiting Jupiter (rather than Earth) (1) • (Idea of) heliocentric model then preferred (1)	 Initially everything {orbits/goes around} Earth Accept 'going around' for 'orbiting' Then everything {orbits/goes around} Sun Accept stopped believing geocentric Accept then not everything orbits the Earth	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)	**B** 20 cm		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)(i)	Substitution 12/(14-12) (1) Evaluation 6.0 (1)	Award full marks for correct with no working Ignore any units	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)(ii)	-12	Negative sign essential	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)(iii)	Suggestion to include one of: • Shows whether it is real or virtual (1) • A positive sign for magnification indicates a {real image/inverted image/opposite side of lens to object} (1)	Allow shows whether it is inverted or upright Allow shows which side of lens image is formed A negative sign for magnification indicates a {virtual image/upright image/same side of lens as object} IGNORE simple reference to magnification	**(1)**

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)	**D** an ultraviolet wave		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	Ultraviolet (from lamp) absorbed (by fluorescent substance/bank note) (1) (which) emits {visible/light} (into eye) (1)	Allow UV for ultraviolet Allow 'taken in' for absorbed Allow 'given out'/releases/fluoresces for emits 'Fluoresces' on its own is insufficient Mention of both ultraviolet AND visible/light only, scores 1 mark only	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)	Substitution (1) (Speed =) $6.67 \times 10^{14} \times 4.5 \times 10^{-7}$ Transposition AND substitution (1) (time =) $\frac{4 \times 10^{16}}{(6.67 \times 10^{14} \times 4.5 \times 10^{-7})}$ Evaluation (1) 1.33×10^{8} (s)	Award full marks for correct answer with no working 3×10^{8} (m/s) seen anywhere $\frac{4 \times 10^{16}}{3 \times 10^{8}}$ ECF candidate's speed maximum 2 marks Allow answers which round to 130 000 000 IGNORE Power of Ten error until evaluation	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	An explanation including some of the following points • Longitudinal {vibrations/oscillations} are {along/parallel to/in the same direction as} the direction of {travel/energy transfer} • Transverse {vibrations/oscillations} are {across/perpendicular to/90° to/right angles to} the direction of {travel/energy transfer} • Ultraviolet waves are transverse • Ultrasound waves are longitudinal (ignore sound – not on list) • Some seismic waves are longitudinal and some are transverse • P waves are longitudinal • S waves are transverse • Longitudinal waves need a material for the vibrations whereas electromagnetic waves can pass through a vacuum **IGNORE** irrelevant material	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation of: EITHER the {vibration/movement} direction and direction of {travel/movement} for transverse or longitudinal wave OR correctly identifying the wave type for at least one example from the list, e.g. o Longitudinal waves move in the same direction as the wave moves o Ultraviolet waves are transverse • the answer communicates ideas using simple language and uses limited scientific terminology
2	3 - 4	• a simple explanation linking: EITHER directions of {vibration/oscillation} and wave travel for both types of wave OR direction of {vibration/oscillation} and wave travel of one type of wave with at least one example of a wave from the list OR the direction of 'movement' and direction of {travel/movement} for transverse AND longitudinal waves AND correctly identifying the wave type for at least one example from the list e.g. o In longitudinal waves the vibrations are in the same direction as the wave travels. In transverse waves the vibrations are at right angles to the direction the wave travels. o In longitudinal waves the vibrations are in the same direction as the wave travels. Ultraviolet waves are transverse. o Longitudinal waves move in the same direction as the wave moves. Transverse waves move at right angles to the direction the wave moves. Ultrasound waves are longitudinal. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed explanation clearly differentiating between the directions of {vibration/oscillation} for longitudinal AND transverse waves AND at least one example of each type of wave from the list, e.g. o In longitudinal waves the vibrations are in the same direction as the wave travels. In transverse waves the vibrations are at right angles to the direction the wave travels. Ultrasound waves are longitudinal and ultraviolet waves are transverse. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	Substitution (1) 2900 = 230 × current Transposition (1) $\frac{2900}{230}$ Evaluation (1) 13 (A)	Award full marks for correct answer with no working Allow substitution and transposition in either order Ignore powers of ten errors until evaluation Allow numbers which round up to 13	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	Substitution (1) 97 = 2.9 × time × 17 Transposition (1) $\frac{97}{2.9 \times 17}$ OR $\frac{97}{49.3}$ Evaluation (1) 2.0 (h)	Award full marks for correct answer with no working Allow substitution and transposition in either order Ignore powers of ten errors until evaluation Allow $\frac{97}{17} = 5.7$ for 1 mark Allow numbers which round up to 2.0	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	An explanation including some of the following points • a current/voltage/emf is induced when there is relative movement between a magnet and a coil of wire • the current is bigger when the movement is faster • the current is alternating/regularly changing direction • the current is zero when the magnet is not moving • points P and R on the graph correspond to the fastest movement of the magnet • the magnet is changing direction at points O, Q, S on the graph (quoting positive and negative current values from graph is sufficient to indicate a change in direction of current on graph) • the magnet is at the top/bottom of its movement at points O, Q, S on the graph • the magnet is not moving at points O, Q, S on the graph IGNORE references to number of turns or stronger magnet	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation linking induced current to idea of movement of magnet OR limited reference linking graph to type of current with no link to model e.g. magnet moving in coil (induces a current) / (magnetic) field lines cut coil OR (the graph shows) an alternating current • spelling, punctuation and grammar are used with limited accuracy • the answer communicates ideas using simple language and uses limited scientific terminology
2	3 - 4	• a simple explanation linking the motion of the magnet to the size/direction of the induced current OR {a limited explanation linking induced current to idea of movement of magnet AND limited reference linking graph to type of current with no link to model} e.g. Magnet moving in the coil induces a current. The faster it moves the bigger the induced current. OR Magnet moving in the coil induces a current. When the magnet changes direction, the current changes direction. OR Magnet moving in the coil induces a current. The graphs shows an alternating current. OR Magnet moving in the coil induces a current. The current is positive at P and negative at R. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately
3	5 - 6	• a detailed explanation linking the motion of the magnet to the size/direction of the induced current AND reference to graph for one factor e.g. Magnet moving in the coil induces a current. The faster it moves the bigger the induced current. The magnet is moving fastest at point P on the graph. OR Magnet moving in the coil induces a current. When the magnet changes direction the current changes direction. At P and R the magnet is moving in opposite directions. OR Magnet moving in the coil induces a current. The current is positive at P and negative at R. The magnet is moving up at P and down at R. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 6 = 12 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Science

Unit P1: Universal Physics

Higher Tier

Monday 19 May 2014 – Afternoon
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Electromagnetic waves

1 (a) Microwaves and X-rays are both electromagnetic waves.

(i) Which row of the table is correct for microwaves and X-rays in a vacuum?

Put a cross (☒) in the box next to your answer.

(1)

	their speeds are	their frequencies are
☒ **A**	different	different
☒ **B**	different	the same
☒ **C**	the same	different
☒ **D**	the same	the same

(ii) State **one** harmful effect of X-rays on living matter.

(1)

.....

.....

(b) X-rays are ionising radiation.

(i) State **one** other ionising radiation in the electromagnetic spectrum.

(1)

.....

.....

(ii) State **one** use of an ionising radiation.

(1)

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(c) (i) State **one** way in which microwave radiation can be harmful to people.

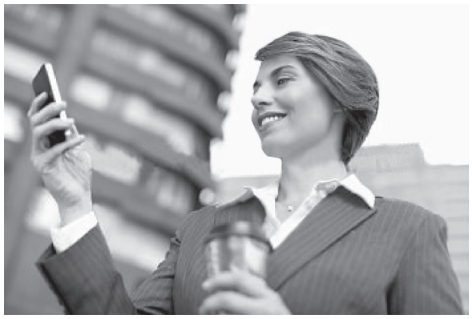
(1)

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The microwaves used in ovens have a frequency of about 2450 MHz.
Mobile phones emit microwaves with a frequency of about 2000 MHz.





Microwave ovens have shielding to protect people from the microwave radiation.

(ii) Suggest why the same shielding is **not** necessary for mobile phones.

(3)

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(Total for Question 1 = 8 marks)

Transformers

2 The photograph shows a step-down transformer.



(a) Explain why step-down transformers are used in the transmission of electricity in the National Grid.

(2)

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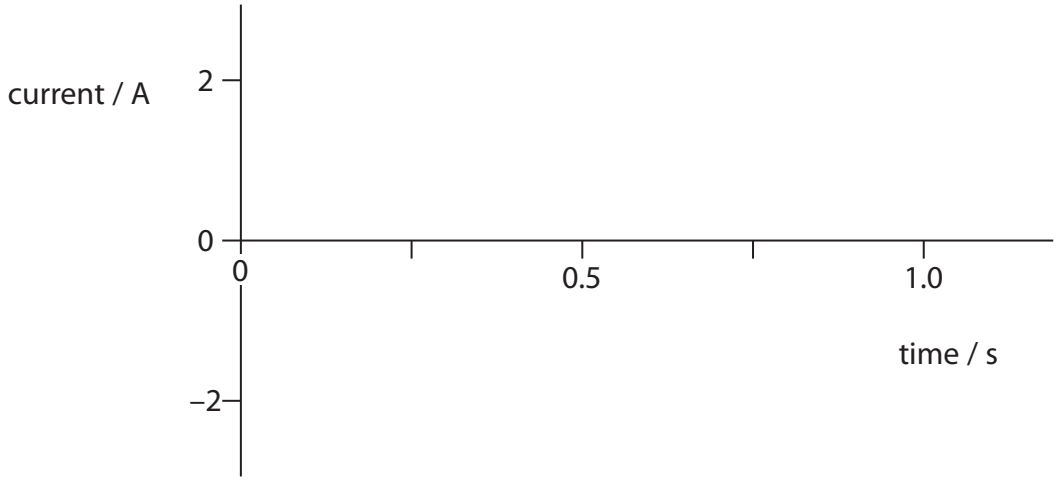
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(b) Transformers need alternating current to work properly.
Sketch a graph of an alternating current with a frequency of 2 Hz.

(2)



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(c) A transformer has 2400 turns on the primary coil and 100 turns on the secondary coil.

Calculate the secondary voltage if the primary voltage is 12 V.

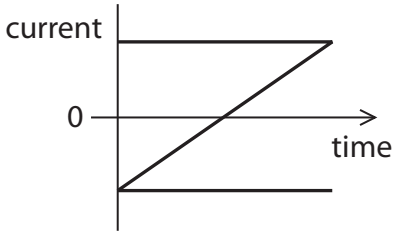
(3)

secondary voltage = ... V

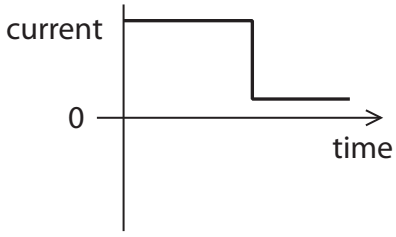
(d) Opening the switch in a circuit produces the opposite magnetic effect to closing the switch.
A scientist connected a switch, a fixed resistor and a battery to the primary coil of a step-up transformer. The scientist also connected a fixed resistor across the secondary coil.
The scientist switched the circuit on and then later switched it off.

Which of these best represents the current in the secondary coil?

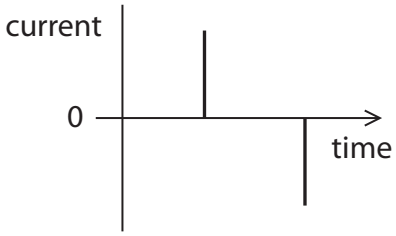
(1)



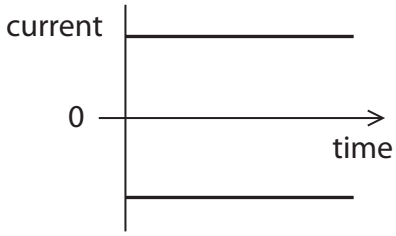
☒ **A**



☒ **B**



☒ **C**



☒ **D**

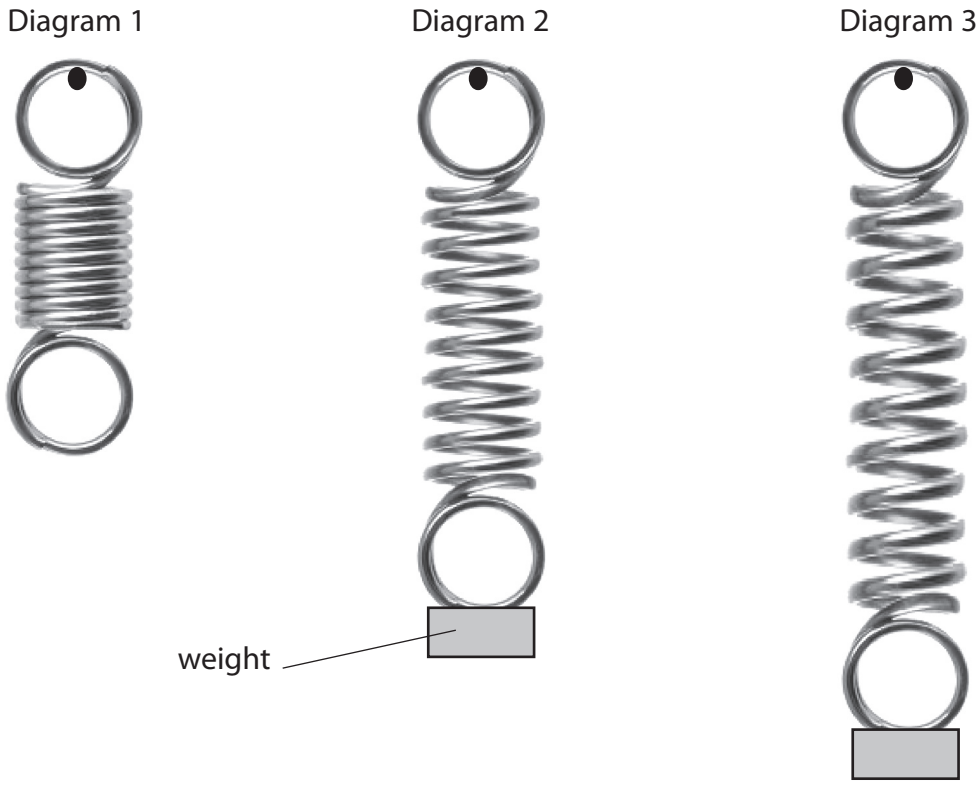
(Total for Question 2 = 8 marks)

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Springs and shock absorbers

3 (a) The diagrams show a spring hanging from a nail.

- In Diagram 1 there is no weight on the spring.
- Diagram 2 shows the spring after a weight is added.
- Diagram 3 shows the spring after the weight has been pulled down slightly.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

When held stationary as in Diagram 3,

(1)

☒ **A** the spring has zero elastic potential energy

☒ **B** the weight has equal amounts of elastic potential and kinetic energy

☒ **C** the weight has more kinetic energy than gravitational potential energy

☒ **D** the spring has more elastic potential energy than the weight has kinetic energy

(ii) The spring is stretched from the position shown in Diagram 2 to the position shown in Diagram 3.
The spring is then released.
Describe the energy changes that take place until the spring stops vibrating.

(3)

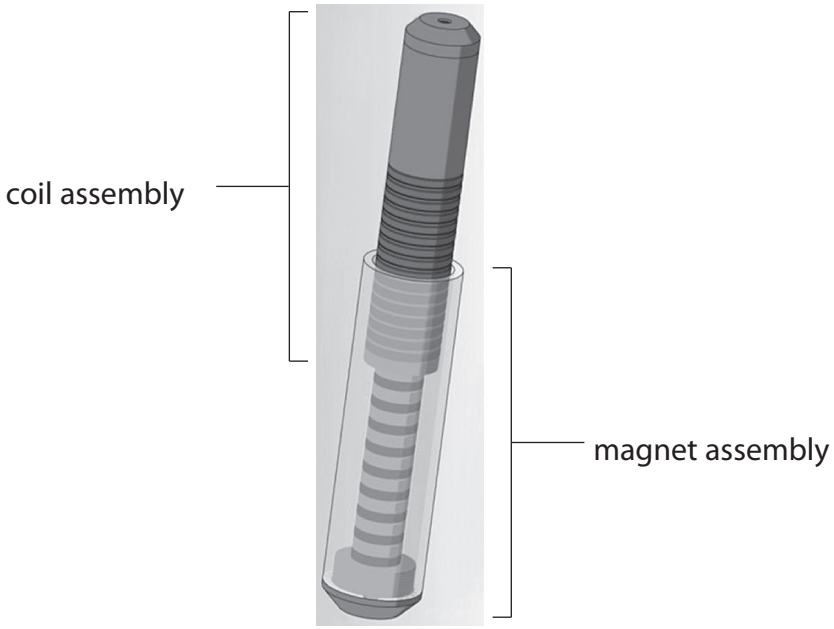
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(b) Shock absorbers with springs are used on some motorcycles.
These shock absorbers reduce the bounce on an uneven road.
A new shock absorber has been developed to convert some of the movement energy into another form.
It consists of magnets which slide inside a coil when the motorcycle goes over a bump.



Some of the energy which would otherwise be wasted can be recovered and so fuel is saved.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

This device is designed to

(1)

☒ **A** increase the thermal energy obtained from the fuel

☒ **B** increase the efficiency of the motorcycle

☒ **C** decrease the speed of the motorcycle

☒ **D** decrease the braking power of the motorcycle

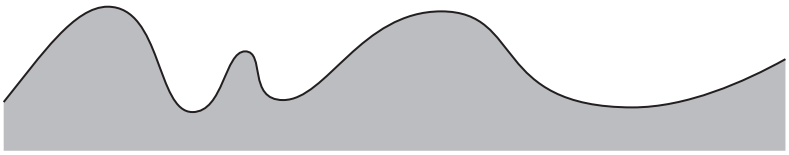
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(ii) Explain how this new type of shock absorber can provide electrical energy.

(2)

(iii) The diagram shows the bumps on the surface of two roads, L and M.
Explain why the device will transfer more energy on road L than on road M for a motorcycle travelling at the same speed.

(3)



road L



road M

(Total for Question 3 = 10 marks)

Meteors and earthquakes

4 The photograph shows a meteor exploding above Russia in 2013.



(a) The noise from the explosion was described as the loudest sound ever detected on Earth.
However, human beings could not hear this sound.
State the **two** sound frequency ranges that human beings cannot hear.

(2)

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.....

(b) Meteors sometimes collide with the Earth's surface.
These collisions produce both P-waves and S-waves.

(i) Which of the following is correct for a P-wave?

Put a cross (☒) in the box next to your answer.

(1)

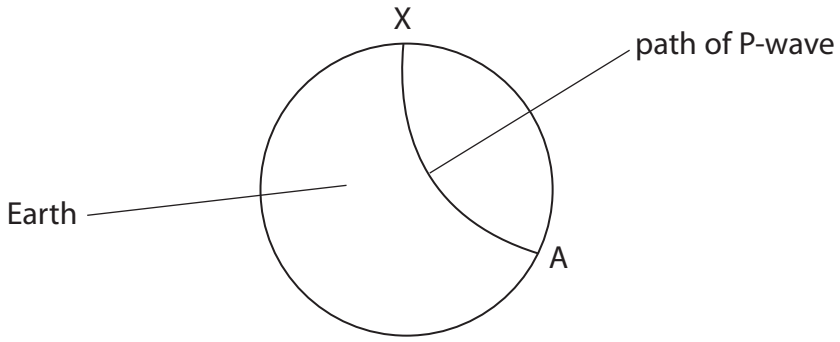
☒ **A** It is a transverse wave travelling faster than an S-wave.

☒ **B** It is a transverse wave travelling slower than an S-wave.

☒ **C** It is a longitudinal wave travelling faster than an S-wave.

☒ **D** It is a longitudinal wave travelling slower than an S-wave.

The diagram shows the path of a P-wave.
The P-wave travels from the collision at X, through the Earth, to another point, A.



(ii) Explain why the path of the P-wave is not a straight line.

(2)

(iii) Explain why there are regions on the Earth's surface where S-waves from the collision at X cannot be detected. You can add to the diagram to help your answer.

(3)

(iv) Describe how a meteor colliding with the Earth could set off an earthquake.

(2)

(Total for Question 4 = 10 marks)

Galileo and Jupiter

5 This picture shows Galileo holding a telescope.



(a) Explain the purpose of the eyepiece in a telescope.

(2)

(b) Galileo drew pictures of his observations of Jupiter.
Nowadays we can take photographs.
Suggest how photographs would have helped Galileo.

(1)

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(c) The telescope collects light reflected from Jupiter.
The light has a frequency of 4.30×10^{14} Hz and a speed of 3.00×10^{8} m/s.
Calculate the wavelength of the light.

(3)

wavelength = ... m

*(d) Galileo's observations of the moons of Jupiter disproved the geocentric model. However, these observations were not enough to prove the heliocentric model of the Solar System.
Explain why Galileo's observations disproved one model but were not enough to prove the other model.

(6)

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(Total for Question 5 = 12 marks)

Changing Universe

6 A long time ago scientists thought that the Universe never changed.

Now there is evidence to show that stars progress through various stages and that the Universe is expanding.

(a) Our Sun is in its main sequence stage.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A star of much greater mass than the Sun will eventually become

(1)

☒ **A** a black hole

☒ **B** a protostar

☒ **C** a red dwarf

☒ **D** a white dwarf

(ii) Describe how the Sun reached its main sequence stage.

(3)

(iii) Scientists can estimate the age of a star. They want to find the age of the oldest star.

Suggest why knowing the age of the oldest star is not enough to tell scientists the age of the Universe.

(2)

*(b) Edwin Hubble discovered that the Universe was expanding.
He did this by using observations of red-shift.
Explain what red-shift is and how it provides evidence that the Universe is expanding.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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Summer 2014
Publications Code UG040008
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Question Number	Answer	Acceptable answers	Mark
1(a)(i)	C travel with the same speeds in a vacuum, have different frequencies		**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (a)(ii)	{damage to/ionise/mutate} {cells / DNA/tissue/ organs/ fetus} / cause {cancer/tumour}	kills cells/bacteria	**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (b)(i)	Gamma, γ, 8, ϒ	UV, ultraviolet (rays/waves/radiation) Ignore X-rays	**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (b)(ii)	one correct use (for UV/X-ray/gamma ray)	for example, (UV) – sunbeds, sterilise, detect banknotes (X-ray) - viewing internal organs / broken bones/airport security (gamma ray) – treat /cure cancer, kill {cells/bacteria} If one incorrect example is given, this mark is lost	**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (c)(i)	one from: MP1 heating of (body/human/internal) {cells / organs/tissues} (1) MP2 {heating/boiling/exciting / vibrating} water (in the body) (1)	Accept heating of blood Ignore damages, burns, cancer, mutates, heating (on its own), skin	**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (c)(ii)	explanation to include any **three** of: MP1 (Phones/ they) use lower frequencies / RA (1) MP2 lower frequency: lower energy / RA (1) MP3 lower {frequency/energy} less (potential) danger / RA (1) MP4 (phones /they) emit less (intense) radiation RA (1) MP5 phones are less powerful (1)	wavelength can suitably replace frequency eg use longer wavelength condone use lower MHz (comparison needed not just values quoted) Accept lower frequency (not energy) does {less /no} {damage/harm} for 2 marks ignore references to penetration ignore references to energy replacing power here For 2 marks -The resonant frequency of water molecules is the same as the oven frequency	**(3)**

(Total for Question 1 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
2(a)	An explanation linking two from MP1 (so that they) decrease the (high) voltages (1) MP2 high voltages used for efficiency/energy saving (1) MP3 (step-down transformers) used {near / for} {homes / factories/appliances} (1) MP4 (so that it is) safer (1)	**stepping down voltage reducing from {high / eg 200 000 V} to {low / e.g.230 V} voltage** **low current used for efficiency / energy saving** less risk of electrocution high voltages are dangerous	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	one line / curve above **and** below x-axis (1) two complete cycles in the 1.0 s (1)	one complete cycle in 0.5 s	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	Transposition (1) $V_s = V_p \times n_s/n_p$ Substitution (1) $(V_s =) \frac{12 \times 100}{2400}$ Evaluation (1) 0.5 (V)	Substitution and transposition in either order i.e. if $\frac{12 \times 100}{2400}$ is seen this scores 2 If they sub Vp, Np and Ns correctly, ignore anything for Vs even a blank Calculation may be done using <u>turns ratio</u> Correct answer no working = full marks answer (no working) with POT error =2 (eg 5 or 0.05) Ignore powers of 10 until evaluation	**(3)**

Question Number	Answer	Acceptable answers	**Mark**
2(d)	C		**(1)**

(Total for Question 2 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	D the spring has more elastic potential energy than the weight has kinetic energy		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	A description including three from MP1 Elastic potential energy /EPE (in stretched spring) (1) MP2 (EPE is) transferred to KE (initially) (1) MP3 change from KE to GPE or vice versa(1) MP4 (correct idea of) energy changes continuing MP5 {total mechanical energy /kinetic +potential energy} decreases (continuously) (1) MP6 (Eventually all is transferred to) {thermal/heat} (energy) (1)	care should be taken not to award marks for contradictory examples Starting point for description does not matter Ignore sound energy EPE becomes/goes to KE (initially) condone amplitude decreases to zero KE or PE 'lost' to surroundings	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	B increase the efficiency of the motorcycle		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	MP1 (bump produces) relative motion (1) MP2 (motion between magnet and coil) {induces / generates} voltage (1)	coil moves round magnet/magnet moves {into/out of} coil / coil {cuts / moves across} magnetic field ignore magnets slide inside a coil (see stem) electromagnetic induction condone {induces / generates } {current/electricity} ignore (see stem) electrical energy provides / produces	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	An explanation linking MP1 {more/frequent} bumps (1) (idea of shorter time / increased frequency) MP2 (bigger bumps produce) bigger amplitude / move more up and down (idea of bigger size) (1) MP3 (so) {induced voltage /voltage generated} is larger (1)	 idea of up and down for bump (coil / magnets) move up and down {faster / more often} (coil/magnets) move {further/higher/bigger distance} (up and down) {induced current/current generated} is larger electromagnetic induction gives more voltage/current condone more electricity/electrical energy is {induced / generated} allow once for MP1 (if MP1 or MP2 is not scored): 'bumpier' 'go in and out more'	**(3)**

(Total for Question 3 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
4 (a)	• below 20 Hz (1) • above {20 000 Hz / 20 kHz} (1) If Hz or kHz is not seen somewhere, the maximum score is 1 mark.	infrasound ultrasound (in either order) (no units needed for the names)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (b)(i)	C it is a longitudinal wave travelling faster than an S wave		**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (b)(ii)	Explanation linking the following:- MP1 refraction /changing speed (1) MP2 (due to) changing {material/medium /rock type / density} (1)	ignore changes in direction/ bending (in this case) rock becomes {more / less} {dense / compact}	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (b)(iii)	Explanation linking the following:- MP1 (S / transverse waves) they cannot travel through liquid (1) MP2 Earth's core is (at least part) {liquid/molten} (1) MP3 (so) (S waves) they cannot travel through core (to other side of Earth) (1)	Check diagram for creditworthy points. they can only travel through solids may be stated in part (ii) (S / transverse waves) they cannot be detected on opposite side of the Earth to (collision site / earthquake)	**(3)**

Question Number	Answer	Acceptable answers	Mark
4 (b)(iv)	Suggestion to include any two from: MP1 idea that {kinetic energy/force/ momentum} of meteor might cause the earthquake (1) MP2 (earthquakes happen where) plates slide {past/over/under/away from/against} each other (1) MP3 (plates move) suddenly MP4 (meteor collision) starts seismic waves /P/S (1)	(meteor) it has large amount of kinetic energy (earthquakes happen where) plates collide rub/move for slide (earthquakes happen when) large amount of energy released in / near Earth's surface (plates) jolt/jerk vibrations passing through the Earth condone earthquake waves {kinetic energy/force /momentum} of meteor can cause the plates to slide past each other = 2	**(2)**

(Total for Question 4 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)	An explanation linking any two of: MP1 magnify (1) with one of: MP2 the (real) image from objective (lens) (1) MP3 to provide greater detail (1)	 enlarges / bigger ignore zooming the real image (in the telescope) / image at focal point ignore make it clearer inversion of image focuses image	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	One sensible suggestion, such as • made recording results {easier /quicker} (1) • results more convincing to other people (1) • photograph is to scale (1)	For example, don't have to keep looking through telescope would be (better) proof / evidence (i.e. between geo- and helio-centric models) (eg multiple photographs would prove movement/orbit of moons) (photograph) is more {accurate / precise / reliable}/ can measure (relative) separations of moons (from planet) better ignore more detail/clearer/zooming	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(c)	Substitution (1) $3.0 \times 10^{8} = 4.3 \times 10^{14} \times \lambda$ Transposition (1) $(\lambda =) \quad \frac{3.0 \times 10^{8}}{4.3 \times 10^{14}}$ Evaluation (1) 6.98×10^{-7} (m)	Substitution and transposition in either order Ignore triangle correct answer no working = 3 power of ten error = 2 to at least 2sf (eg 7.0/6.97.....)x10^{-7} Ignore powers of 10 until evaluation	**(3)**

Question Number		Indicative content	Mark
QWC	***5(d)**	A description to include some of the following points description of models • geocentric • heliocentric description of one set of observations of Jupiter's moons explanation of how observation contradicts geocentric but does not prove the other NB beware that you do not reward repetitions of the question stem	**(6)**
Level	**0**	no rewardable material	
1	**1-2**	• a limited explanation of the geocentric **AND** the heliocentric model such as *geocentric model said everything orbited the Earth while the other was for everything going round the Sun.* **OR** clearly explains the one model and describes Galileo's observations *eg geocentric model said everything orbited the Earth but Galileo observed that Jupiter had moons going around it* • the answer communicates ideas using simple language and uses limited scientific terminology e.g. allow confusion between geocentric and heliocentric • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a simple explanation of geocentric **AND** heliocentric models **AND** Galileo's observations of Jupiter's moons/explains heliocentric not proved e.g. *The geocentric model said everything orbited the Earth while the heliocentric was for everything orbiting the Sun. Galileo observed that Jupiter had moons orbiting around it.* • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately e.g. correct use geocentric and heliocentric • spelling, punctuation and grammar are used with some accuracy	
3	**5-6**	• a detailed explanation of geocentric **AND** heliocentric models **AND** the role of Galileo in providing evidence against the geocentric **BUT** not enough for the heliocentric such as *The geocentric model said everything orbited the Earth while the heliocentric was for everything orbiting the Sun. Galileo's observations that Jupiter had moons orbiting arou(nd it showed that the geocentric model was wrong **but not** that Jupiter or anything else went around the Sun.* • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately e.g. distinguishes between the necessary and insufficient conditions • spelling, punctuation and grammar are used with few errors	

(Total for Question 5 = 12 marks)

Question Number	Answer	Acceptable answers	Mark
6 (a)(i)	A a black hole (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
6 (a)(ii)	A description including three from: MP1 in a nebula (1) MP2 (particles) attracted / come together by (force of) gravity (1) MP3 pe/ke transferred to thermal/heat energy (gas begins to glow and forms protostar) (1) MP4 until {hot / pressure / dense} enough to start nuclear reaction /fusion (1)	gas / gas and dust core becomes hot / pressure increases / density increases until fusion of hydrogen starts hydrogen starts to become helium condone "hydrogen burning"	**(3)**

Question Number	Answer	Acceptable answers	Mark
6 (a)(iii)	A suggestion involving two from: MP1 the oldest star had not yet appeared when the {Big Bang happened / universe started}(1) MP2 the Universe is older than the oldest star MP3 star takes time to form (1) MP4 can't be certain of this time (1)	stars formed after the Big Bang the age of the oldest star is the minimum age of the Universe estimation is not the same as accurate measurement can't be sure there isn't an older star	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	An explanation including some of the following points • light shifted to red end of spectrum • light waves are stretched so wavelength increases • reference to black or spectral lines moving to 'red end' (of absorption spectrum) • frequency of wave from a moving source changes • decrease in frequency means source moving away • increase in frequency means source moving towards us • red shift shows galaxies are moving away from us • greater red shift indicates galaxy moving away faster • further away galaxies give greater red shift • (nearly) all galaxies show red-shift • red shift shows decrease in frequency • blue shift shows increase in frequency • therefore galaxies are moving apart • [mention of Doppler effect] • [outline of Doppler effect]	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation e.g. (light from) {galaxy / planet /object} moving away from us is shifted to red end of the spectrum OR red shift means {galaxy / planet /object) is moving away from us • the answer communicates ideas using simple language and uses limited scientific terminology e.g. correct use of change of colour and movement • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• a simple explanation involving detail of meaning of different red shifts OR involving frequency / wavelength e.g. red shift shows galaxies moving away from us. More distant galaxies give greater red shift showing they are travelling faster away. OR light from galaxies/stars moving away is shifted to red end of the spectrum because of an (apparent) {increase in the wavelength/decrease in the frequency} (of light). • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately e.g. correct use of the terms galaxy/star, frequency, wavelength • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed explanation correctly interpreting the (apparent) drop in frequency / increase in wavelength e.g. light from (most) galaxies is shifted towards the red end of the spectrum because of an {increase in the wavelength/decrease in the frequency}. This indicates that (most) galaxies are moving away from us, hence showing the Universe is expanding • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately e.g. linkages must be clear between red-shift, movement and expansion of the Universe • spelling, punctuation and grammar are used with few errors

(Total for Question 6 = 12 marks)

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Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Physics/Science

Unit P1: Universal Physics

Higher Tier

Wednesday 5 June 2013 – Afternoon **Time: 1 hour**	Paper Reference **5PH1H/01**

You must have: Ruler, Calculator	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

wave speed = $\frac{\text{distance}}{\text{time}}$ $v = \frac{x}{t}$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

power = $\frac{\text{energy used}}{\text{time taken}}$ $P = \frac{E}{t}$

efficiency = $\frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\%$

$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Theories and observations

1 During the twentieth century red-shift and CMB radiation were discovered.

They have provided scientists with data to test theories of the origin of the Universe.

(a) (i) Complete the following sentence.

(1)

CMB is an abbreviation for .....

(ii) State which theory about the origin of the Universe is supported by the existence of CMB.

(1)

.....

(iii) There is a red-shift in the light received from some galaxies.
State what is meant by red-shift.

(1)

.....

.....

(iv) Some galaxies show greater red-shift than others.
Explain what this suggests about the Universe.

(2)

.....

.....

.....

.....

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(b) Stars have different stages in their evolution.

(i) Which of these gives the next stages in the evolution of the Sun?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** white dwarf then black hole

☒ **B** neutron star then white dwarf

☒ **C** red giant then supernova

☒ **D** red giant then white dwarf

(ii) Modern telescopes can provide us with more data than the telescopes used 100 years ago.
Explain what additional data can be collected and processed using modern telescopes.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

Investigating electric motors

2 Some students investigate the efficiency of electric motors.

(a) (i) The students find that one electric motor has an efficiency of 60%.

Explain in terms of energy what is meant by an efficiency of 60%.

(2)

.....

.....

.....

.....

(ii) The students use some motors to lift weights.

The students measure the input power and output power of two motors.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The power of a motor is the rate at which it transfers

(1)

☒ **A** current

☒ **B** energy

☒ **C** voltage

☒ **D** charge

(iii) The first motor has a power rating of 20 W.

The motor is used for 15 s.

Calculate the energy supplied to the motor.

(2)

energy supplied to the motor = ... J

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(iv) In the second motor, the useful output power was 18 W when the input power was 24 W.
Calculate the efficiency of this motor.

(2)

efficiency = ... %

(b) One of the students states that all of the energy supplied to a motor is transferred into other forms.

Complete the following sentence by putting a cross (☒) in the box next to your answer.
This statement is one example of the idea of

(1)

- ☒ **A** renewable energy
- ☒ **B** conservation of energy
- ☒ **C** non-renewable energy
- ☒ **D** sustainable energy

(Total for Question 2 = 8 marks)

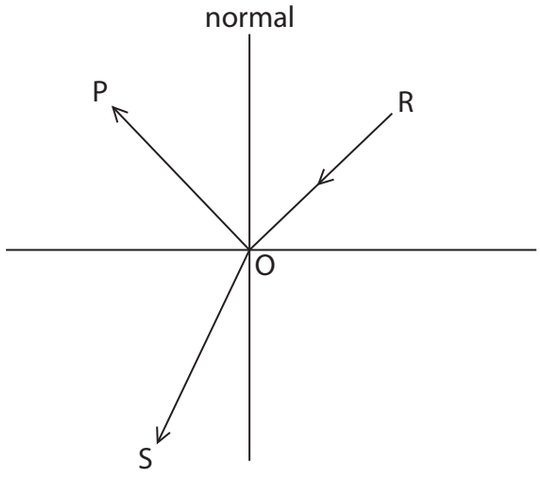
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Refraction, telescopes and the Solar System

3 When light strikes a glass surface it can be both refracted and reflected.

(a) The diagram shows the possible paths for a ray of light which strikes a surface at the point O.



(i) Which of the lines show the possible path of a ray of light passing from air into glass?

Put a cross (☒) in the box next to your answer.

(1)

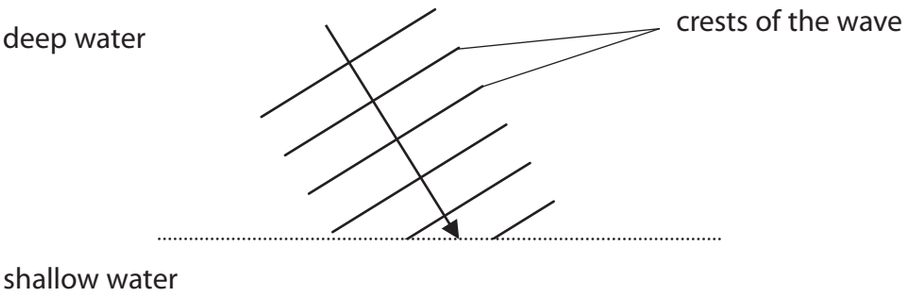
☒ **A** POS

☒ **B** POR

☒ **C** ROP

☒ **D** ROS

(ii) The diagram shows a water wave going from deep water into an area of much shallower water. The wave is refracted at the boundary between deep water and shallow water.



Which row of the table is correct for what happens when the wave is refracted?

Put a cross (☒) in the box next to your answer.

(1)

	speed	direction
☒ **A**	stays the same	changes
☒ **B**	stays the same	stays the same
☒ **C**	changes	changes
☒ **D**	changes	stays the same

(b) In 1610 Galileo used a refracting telescope to observe the planet Jupiter.

(i) Explain how a refracting telescope produces a magnified image of Jupiter.

(3)

P 4 1 9 4 3 A 0 1 0 2 4

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(ii) In 1610, the geocentric model of the Solar System was commonly accepted.

Explain how Galileo's observations contradicted the geocentric model.

(3)

.....

.....

.....

.....

.....

.....

(c) Light travels the 150 million km from the Sun to the Earth in about 500 s.
It takes about 2100 s for light to reach the Earth from Jupiter.
Using this information, calculate the approximate distance of Jupiter from the Earth.

(2)

distance of Jupiter from the Earth = ... million km

(Total for Question 3 = 10 marks)

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Earthquakes

4 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Waves from an earthquake are

(1)

- ☒ **A** transverse waves only
- ☒ **B** electromagnetic waves only
- ☒ **C** both transverse and electromagnetic waves
- ☒ **D** both transverse and longitudinal waves

(b) The Earth's surface is made up of many tectonic plates.
The interior of the Earth is a source of thermal energy.

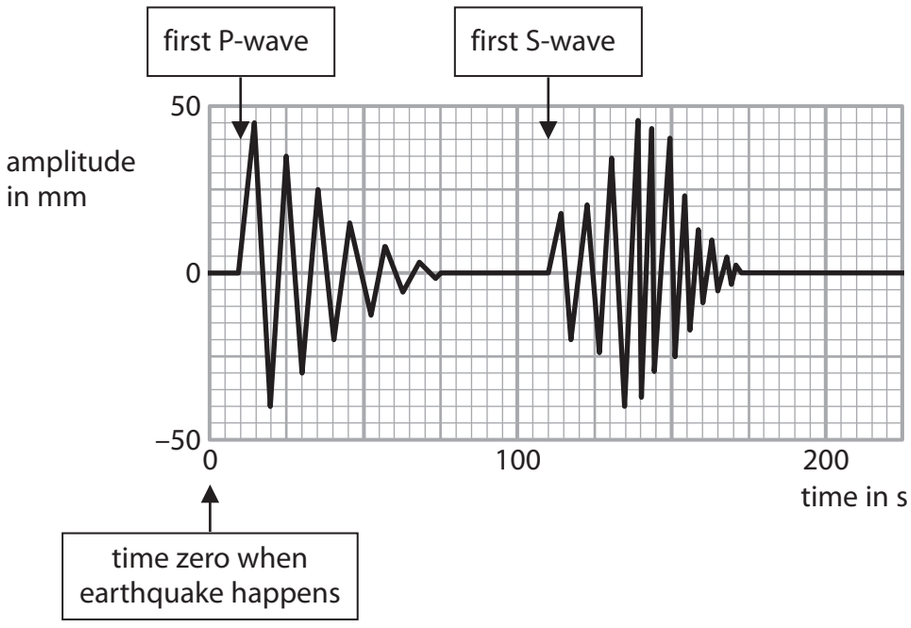
Describe how this thermal energy can cause earthquakes.

You may draw a labelled diagram to help with your answer.

(3)

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(c) The chart shows the arrival of earthquake waves at an earthquake monitoring station.



The S – P time (S minus P time) for earthquake waves is the time difference between the arrival of the first P wave and the first S wave.

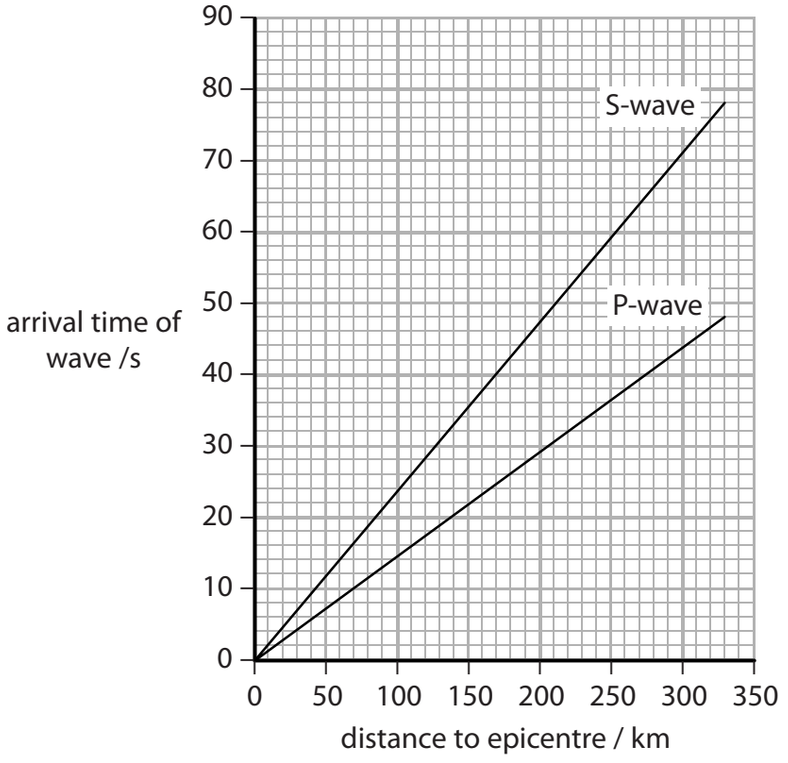
Use the chart to estimate the S – P time for the earthquake waves shown.

(2)

S – P time = ... seconds

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(d) The location of an earthquake is known as an epicentre.
The S – P time for earthquake waves can be used to estimate the distance between the monitoring station and the epicentre.
The graph shows how the arrival times of S and P waves are related to their distances from the epicentre of an earthquake.



The S – P time for a particular earthquake was 20 seconds.
Use the S – P time to estimate the distance between the monitoring station and the epicentre of this earthquake.

(2)

distance to epicentre of earthquake = ... km

P 4 1 9 4 3 A 0 1 4 2 4

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(e) Many earthquakes and volcanoes are linked to the production of infrasound waves.

Describe what is meant by **infrasound waves**.

(2)

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

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Electromagnetic spectrum

5 The electromagnetic spectrum is continuous.
Different regions of the spectrum have different properties.

(a) (i) Name an electromagnetic wave that is also an ionising radiation.

(1)

.....

(ii) Genuine banknotes contain a special ink.
This ink is invisible under normal light.

Suggest why the ink glows when ultraviolet radiation is shone on it.

(2)

.....

.....

.....

.....

(b) An electromagnetic wave has a frequency of 7×10^9 Hz.
The speed of the wave is 3×10^8 m/s.
Calculate the wavelength of the wave.

(3)

wavelength = ... m

P 4 1 9 4 3 A 0 1 6 2 4

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*(c) Radiation from different regions of the electromagnetic spectrum can affect the human body in many ways.

Discuss the different ways in which excessive exposure to electromagnetic radiations of various frequencies may cause damage to the human body.

(6)

(Total for Question 5 = 12 marks)

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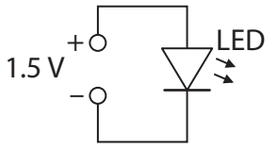
Using light emitting diodes (LEDs)

6 (a) What is the name of the device used to change the size of an alternating voltage?

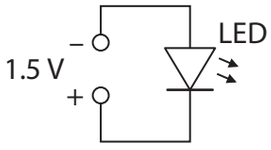
(1)

.....

(b) A light emitting diode (LED) can only emit light when connected correctly to a potential difference.



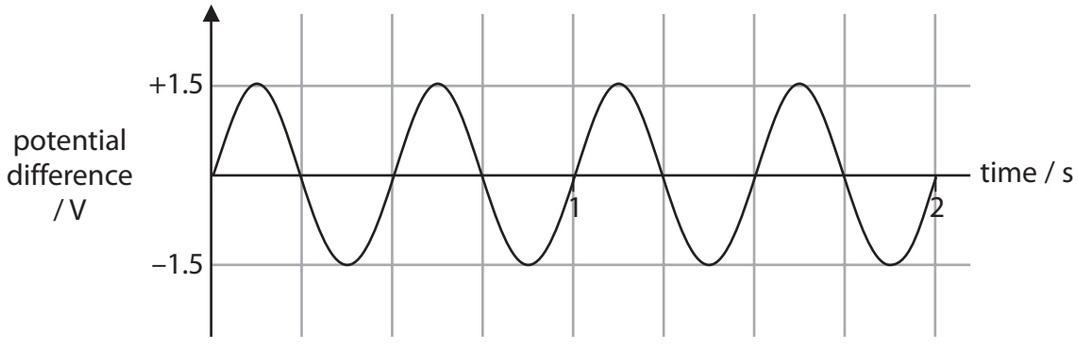
LED emits light



LED does **not** emit light

Use this information to suggest what happens when this alternating voltage is connected across the LED.

(2)



.....

.....

.....

.....

P 4 1 9 4 3 A 0 1 9 2 4

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(c) A LED lamp has a power rating of 3 W.
The voltage across the lamp is 12 V.
Calculate the current in the lamp.

(3)

current in the lamp = ... A

*(d) Some research has been carried out into replacing fluorescent lamp fittings with LED fittings.



photo of stairwell
with fluorescent fitting



photo of stairwell
with LED fitting

The data in the table is taken from the report of a trial using LEDs to light stairwells and corridors in a large building.

total energy saved each year by using LEDs	3 000 kW h
LED fitting cost	£2 000
CO_2 saving each year by using LEDs	1.6 tonnes
change in lighting levels by using LEDs	200%
average price of electrical energy	14 p / kW h
average lifetime of LED fittings	50 000 hours
average lifetime of fluorescent fittings	10 000 hours

P 4 1 9 4 3 A 0 2 0 2 4

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Use the information to discuss the benefits of replacing fluorescent fittings with LED fittings.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2013

GCSE Physics (5PH1H)
Paper 01

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Summer 2013
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	cosmic microwave background (radiation) all three words needed		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	(the) Big Bang (theory)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	change in the (observed) frequency **or** wavelength of light/radiation (received from a distant galaxy)	light/absorption lines is/are shifted toward red end of spectrum light/radiation has longer wavelength/lower frequency waves are more spread out/stretched Ignore references to sound or colour of light eg galaxies/light appear(s) red(er)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iv)	An explanation linking the following:- It/the Universe is expanding (1) some galaxies are (moving)faster (than others) (1)	they/ galaxies are moving further/away (from the Earth/us) the further away the galaxy is the greater the red-shift/the faster the galaxy is moving (some galaxies) are moving away faster (than others) gains 2 marks IGNORE references to planets/stars	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	D red giant then white dwarf		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	an explanation linking **two** of the following: • Different/more wave(length)s/frequencies (now) detected/collected (1) • because telescopes positioned above Earth's atmosphere or by radio telescopes (1) OR • weaker signal(s) (now) detected/collected (1) • because modern telescopes are more powerful/have greater magnification **or** positioned above Earth's atmosphere/ on top of mountains (1) If no other marks awarded allow 1 mark for idea that: Electronic(s)/computers can process/improve the data/signal information/waves/radiation	named type of em radiation accept CMB for microwave space telescope or named space telescope (because) less or no light/radiation is absorbed by Earth's atmosphere Accept named space telescope eg Hubble/Planck/Compton etc Ignore references to clearer images/more detail/can see further/photographs	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	An explanation linking • 60 % of {total/electrical/input/output} energy (is used/transferred) (1) • into/is kinetic/useful energy (1) If no other marks scored accept: 60% (of the energy produced by the motor) is useful/40% is wasted for 1 mark	**Accept reverse argument ie** 40 % of {total/electrical/input/output} energy (is/transferred) into/lost as/thermal (heat)/waste energy	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	☒ **B** energy		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	substitution 20 x 15 (1) evaluation 300 (J) (1) If no other mark scored award 1 mark for correct transposition ie E= P x t Ignore any unit given by candidate	Power of 10 error maximum of 1 mark eg 300 000 (J) gains 1 mark Give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iv)	substitution 18 ÷ 24 (x 100) (1) evaluation 0.75 or 75% (1) Ignore any unit given by candidate	Power of 10 error maximum of 1 mark give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	☒ **B** conservation of energy		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	☒ D ROS		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	☒ C changes changes		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	An explanation linking **three** of the following: • the (objective) lens (1) • collects light (from Jupiter) (1) • focuses/converges/refracts the light (1) • (objective) produces a real image (1) • (at the) focal point (1) • (Image is viewed by the) eyepiece lens (1) • (Eyepiece) produces a virtual image (1)	Marks can be awarded for a labelled diagram	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	An explanation linking the following: (the geocentric model) • has the Earth at the centre of the Universe/solar system / everything orbits the Earth (1) (but Galileo observed) • moons of Jupiter (1) • (so) not all things orbit the Earth/ geocentric model is wrong (1)	**Accept alternative argument:** Galileo observed moons/stars/objects Orbiting/going round Jupiter (this) suggested that not everything orbits the Earth	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)	2100/500 = 4.2 (1) 4.2 x 150 = 630 (million km) (1) Accept ratios as speed is constant 150/500 = distance to Jupiter/2100 OR Distance to Jupiter = (150/500) x 2100 Either for 1 mark	Power of 10 error maximum of 1 mark (speed of light) about 150 000 000 ÷ 500 = 300 000 (km/s) (1) (distance to Jupiter)= 300 000 x 2 100 = 630 000 000 km (1) / = 630 (million km) An answer with no calculation of 630 (million km) gains 2 marks If an answer of 630 million/ 630 000 000 is given with correct working award both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	☒ **D** both transverse and longitudinal waves		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	A description including **three** of the following points • molten rock/magma (in mantle) (1) • convection currents (in mantle) (1) • plates move (1) • build up of pressure/force/energy (when plates (not) sliding over/under/past (each other)) (1) • sudden movement when pressure becomes too great/is released (1) • This sudden movement of plates is an earthquake (1)	Marks can be awarded on a labelled diagram Description of convection currents or arrows on diagram plates rub together Jolt/jerk when pressure becomes too great/ is released	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)	relevant values 110 and 10 seen anywhere(1) 100 (s) (1) **acceptable range 95 to 105** (s)	(could be on chart) tolerance +/- 5 s give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	any vertical line of 10 squares on graph between P- wave and S-wave (1) OR times eg 52 (s) – 32(s) Range (48 to 56) – (29 to 35) 220 (km) (1)	Range 9 to 11 squares range 200 to 240 (km) give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)	a description including **two** of the following: • longitudinal / sound (wave) (1) • (frequency) less than 20 Hz (1)	Frequency below range/too low for (normal) human ear	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	Gamma/ γ (wave(s)/ ray(s)/radiation)	X-rays/ radiation	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	Any two from It fluoresces (1) UV (radiation) transfers/gives energy to ink/ink absorbs energy from UV (radiation) (1) (energy from UV is)(re-)radiated/(re)- emitted by ink at lower frequency/as (visible) light (1)	fluorescent Ink/it absorbs UV (light/radiation) Ignore UV is reflected as visible light Ignore luminous emits visible light	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	transposition $\lambda = v/f$ (1) substitution $\lambda = 3 \times 10^8/7 \times 10^9$ (1) evaluation 0.043 (m) (1) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. $3 \times 10^8/7 \times 10^9$ gains 2 marks Accept any number of sig.figs. that rounds to 0.04 0.04 , 0.0428 (m) (1) Give full marks for correct answer with no working. 0.04 x any other power of 10 = 2 marks	**(3)**

Question Number		Indicative Content	Mark
QWC	***5c**	A discussion including some of the following points Possible dangerous e-m radiations Microwaves Infrared Ultraviolet (UV) X-rays gamma rays Correctly linked to Internal heating of body cells (microwaves) Skin burns (infrared) Damages skin cells/sunburn (UV) Damages eyes (UV) Can cause skin cancer (UV) Can cause cataracts (UV) Damage to cells inside the body(X-rays) Mutate/ kill cells in the body (gamma) Damages DNA (X-rays and gamma rays) Link to frequency As the frequency increases/wavelength decreases (microwave -> gamma) the waves become more penetrating and do more damage/danger as they have more energy.	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. gives at least 2 correct radiations and links both to correct damage OR at least 2 correct radiations named with link to correct damage from one and idea that frequency is linked to damage OR just has link between higher frequency and more damage/dangerous e.g. infrared burns your skin and X-rays can damage cells. OR X-rays have a higher frequency than microwaves and can cause cancer OR Higher frequencies cause more damage to cells. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. gives most of the correct radiations and links to correct damage, at least one with detail of the damage that is caused OR links two to detail of the damage, AND has a link between frequency and energy/danger e.g. Microwaves are absorbed by water in body cells. UV can cause skin cancer and damages your eyes. X-rays and gamma rays can damage cells inside your body OR Gamma and X-rays can penetrate deep into the body. Gamma does most damage as it has the highest frequency. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. gives most of the correct radiations with links to detail of the damage AND explains the link between frequency	

		and energy/danger. e.g Microwaves heat up the water in cells. UV can cause cataracts. Gamma rays are the most penetrating and can mutate cells inside the body because they have the highest frequency. • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6(a)	transformer	Step-up transformer Step-down transformer	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	A suggestion to include any 2 of the following • (LED) turns on and off • as voltage/current {changes direction/from +ve to –ve/ twice each second } (1) • (LED) on for (+ve) part of cycle (1) • (LED) off for (-ve) part of cycle (1)	 Flash(es) / flicker(s) (on and off) current changes every 0.25 s /4 times each second Turns on twice each second = 2 marks Only on when voltage/current is +ve gains both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	substitute (1) 3 = I x 12 transformation (1) I = 3 ÷ 12 evaluation (1) 0 .25 (A) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. Accept any number of sig. figs. that rounds to 0.25 (A) 250 mA gains 3 marks give full marks for correct answer, no working 2.5 x any other power of ten = 2 marks eg 25 (A) gains 2 marks	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A discussion including some of the following points • improved lighting levels for LEDs • energy savings per year for LEDs or calculation of payback time • calculation of energy savings over lifetime of LEDs or calculation of monetary savings by using LEDs per year • link to savings in fossil fuels for LEDs or link to reduced CO_2 produced for LEDs and reduced global warming • comparison of lifetimes and maintenance cost	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited discussion of benefits using some pieces of the information provided, e.g. LEDs last 40 000 hours longer and the lighting levels are 200% brighter. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple discussion of benefits using some pieces of the information and processing one of them OR 2 processed pieces of information. e.g. LEDs save 3000 kW h of energy each year and are much brighter. The money they save each year compared to fluorescents is £420. OR The payback time for the LEDs is about 5 years and in that time they would have to pay for the fluorescent lights to be replaced 5 times. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed discussion of benefits using processed information covering more than half of the data points in the table e.g. LEDs use less energy each year and this means that fossil fuel reserves are not used up as quickly. The LEDs save £420 each year and have a payback time of about 5 years. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Physics/Science

Unit P1: Universal Physics

Higher Tier

Thursday 7 March 2013 – Morning
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Waves and the Solar System

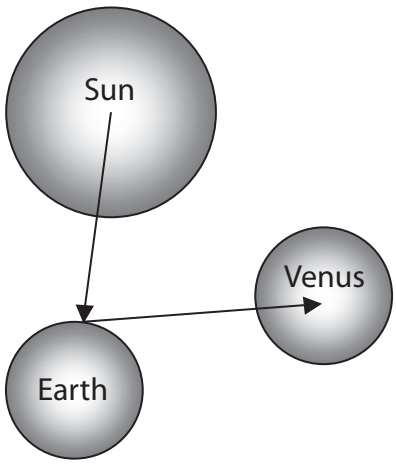
1 (a) Galileo was one of the first scientists to use a telescope to study Venus.

(i) Which of these diagrams best shows how light waves enable us to see Venus?

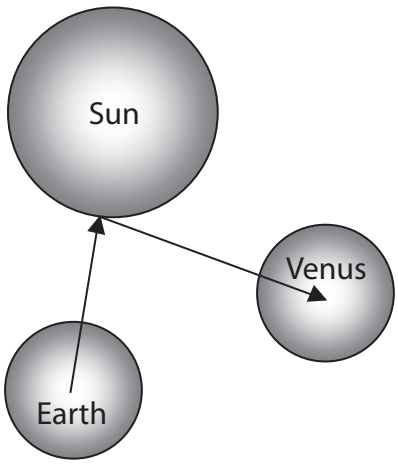
Put a cross (☒) in the box next to your answer.

(1)

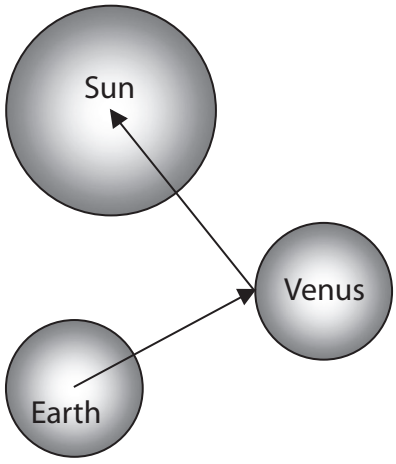
Not to scale



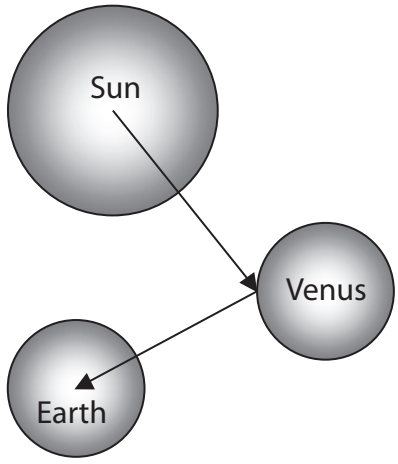
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(ii) Use words from the box to complete the sentences.

(2)

asteroids	comets	geocentric	heliocentric
moons	particle	stars	

Galileo also used his telescope to observe the ..... of Jupiter.

His observations provided evidence to support the ..... model of the Solar System.

(iii) Describe how a reflecting telescope is different from the simple telescope which Galileo used.

(2)

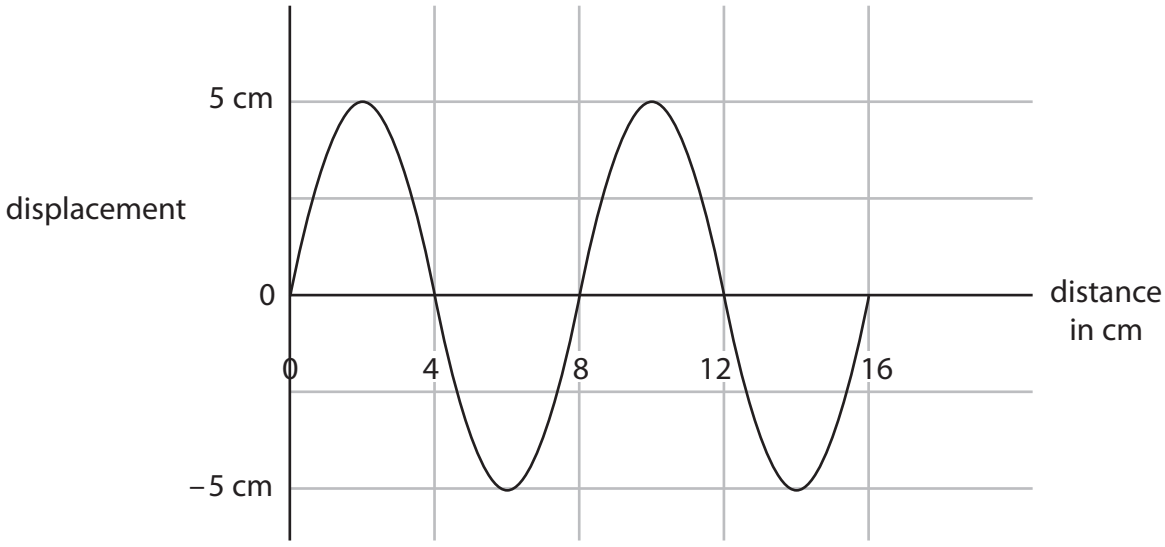
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(b) (i) The diagram represents a wave.



State the amplitude and wavelength of the wave.

(2)

amplitude of the wave = ... cm

wavelength of the wave = ... cm

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(ii) 20 waves are sent out in 4 seconds.

Complete this sentence by putting a cross (☒) in the box next to your answer.

The frequency of the wave is

(1)

☒ **A** 0.2 Hz

☒ **B** 5 Hz

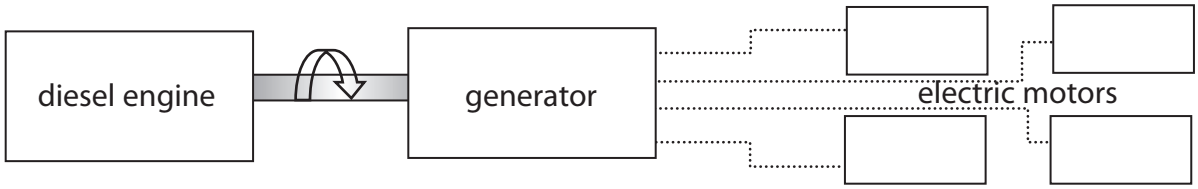
☒ **C** 20 Hz

☒ **D** 80 Hz

(Total for Question 1 = 8 marks)

Energy changes

2 (a) A train is powered by a diesel engine.
The diesel engine is used to turn a generator.
The generator provides electricity for electric motors which drive the wheels.



(i) Draw one straight line from each train part to its useful energy transfer.

(3)

train part	**useful energy transfer**
diesel engine	chemical to electrical
	chemical to kinetic
generator	electrical to kinetic
	kinetic to chemical
motor	kinetic to electrical

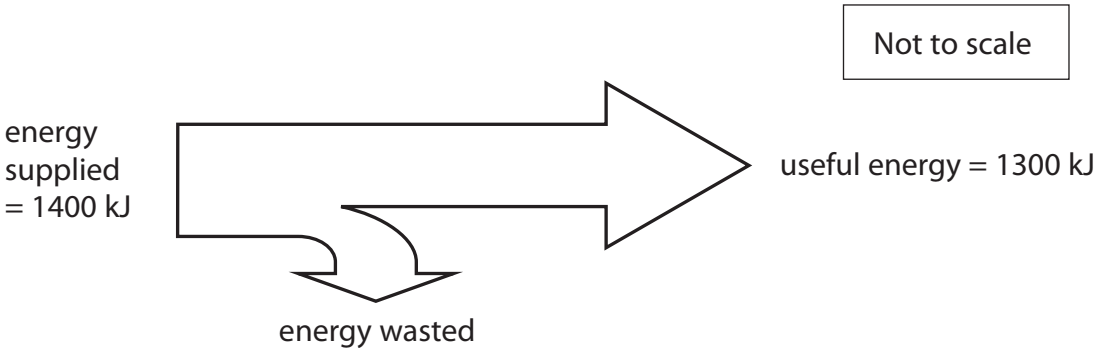
(ii) State **one** example of a non-useful energy transfer in the motor.

(1)

.....

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(b) The diagram represents the energy transfer in one second in the generator.



(i) Calculate the amount of energy wasted in one second in the generator.

(1)

energy wasted = ... kJ

(ii) Calculate the efficiency of the generator.

(2)

efficiency of generator = ...

(c) The electric motors which drive the wheels are painted black.

Suggest why the motors are painted black.

(1)

.....

.....

(Total for Question 2 = 8 marks)

The Universe

3 (a) Which row of the table shows these objects in the correct order of size?

Put a cross (☒) in the box next to your answer.

(1)

	smallest →		biggest
☒ **A**	Milky Way	Solar System	Universe
☒ **B**	Milky Way	Universe	Solar System
☒ **C**	Solar System	Universe	Milky Way
☒ **D**	Solar System	Milky Way	Universe

(b) Some visible light telescopes are located in space.

Other visible light telescopes are located on the Earth's surface.

Explain why the images produced by telescopes on Earth are less clear than the images produced by telescopes in space.

(2)

.....

.....

.....

.....

(c) This simplified diagram compares spectra of light from the Sun and two galaxies.



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The light from galaxy 1 and galaxy 2 both show redshift.

Explain what these redshifts predict about the position and movement of the two galaxies.

(3)

(d) Scientists have studied stars to discover how stars evolve.

They know that stars form in a nebula when clouds of dust and gas are pulled together by gravity.

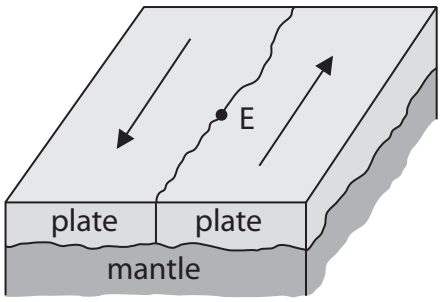
Describe how this process continues for stars much more massive than the Sun.

(4)

(Total for Question 3 = 10 marks)

Earthquakes

4 (a) The diagram shows part of the boundary between two tectonic plates.



(i) Complete this sentence by putting a cross (☒) in the box next to your answer.

The plates are being steadily pushed in opposite directions by

(1)

☒ **A** convection currents in the mantle

☒ **B** reflection of waves from the Earth's core

☒ **C** tsunami waves in the ocean

☒ **D** volcanic eruptions on the surface

(ii) An earthquake occurs.
Its epicentre is at the place marked E on the diagram.
Describe what happens at the plate boundary to cause this earthquake.

(2)

.....

.....

.....

.....

(b) The earthquake causes seismic waves.

(i) S waves are one type of seismic wave. They travel at 0.65 km/s.
There is a seismometer 80 km away from point E.
Show that it takes about 2 minutes for the S waves from the earthquake to reach the seismometer.

(2)

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(ii) P waves are another type of seismic wave.
They travel about 10 times more quickly than S waves.

Describe how scientists can use seismometer records of P and S waves to locate the epicentre.

(3)

(iii) Seismic waves have a frequency of about 15 Hz.
P waves have a much smaller amplitude than S waves.

Some people claim that animals can detect an earthquake before people are aware of it.
Suggest an explanation for this.

(2)

(Total for Question 4 = 10 marks)

The electromagnetic spectrum

5 (a) Skin cancer can be caused by radiation from the Sun.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The radiation that causes skin cancer is

(1)

- ☒ **A** ultraviolet radiation
- ☒ **B** radio waves
- ☒ **C** microwaves
- ☒ **D** infrared radiation

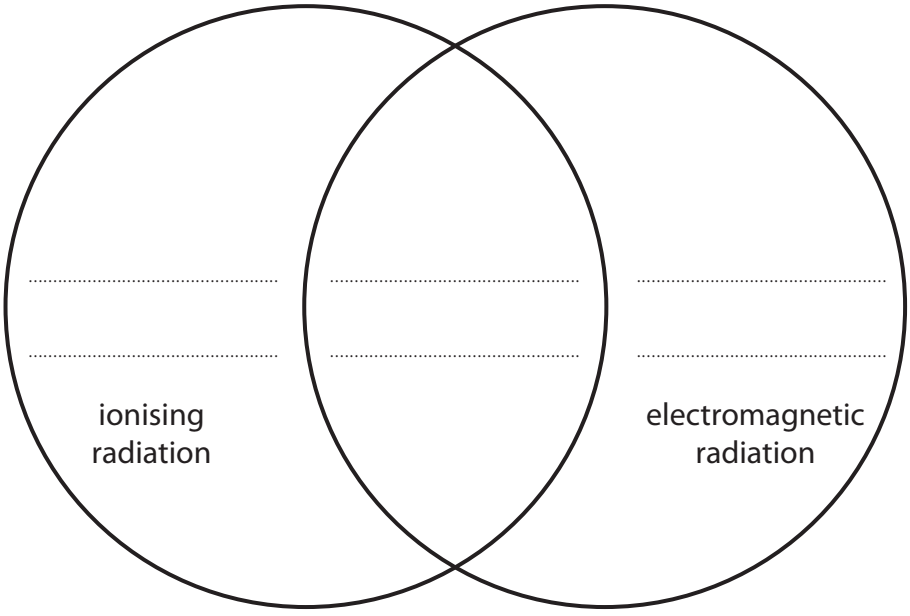
(b) The word box contains the names of three types of radiation.

gamma rays	infrared radiation	alpha particles

Use this diagram to classify the three types of radiation given in the word box.

Write the name of the radiation in the correct section of the diagram.

(2)



(c) Which of these is correct for all electromagnetic waves in a vacuum?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** they have the same frequency
- ☒ **B** they have the same wavelength
- ☒ **C** they are transverse waves
- ☒ **D** they are longitudinal waves

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(d) Describe a use of gamma radiation.

(2)

*(e) Herschel and Ritter carried out experiments that contributed to the discovery of infrared and ultraviolet radiation.

Explain how the results of the experiments carried out by Herschel and Ritter led to these discoveries.

(6)

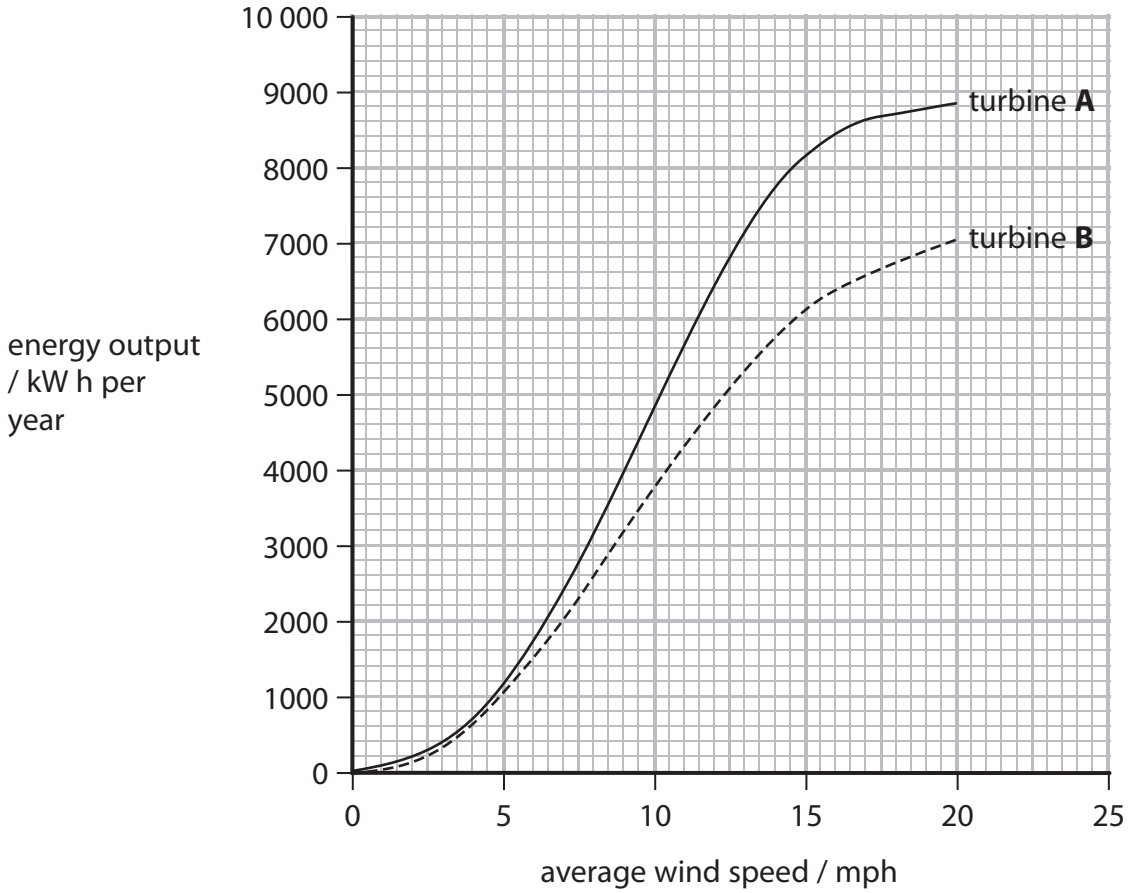
(Total for Question 5 = 12 marks)

Generating electrical energy

6 (a) Eric owns a small farm where chicks are hatched from eggs.

He is considering generating his own electricity to heat and light a barn rather than using electricity from the National Grid.

This graph shows how the energy output varies with wind speed for two different wind turbines, **A** and **B**.



The average wind speed at Eric's farm is 13 mph.
The total heating and lighting in the barn requires 6000 kW h of electrical energy each year.

(i) Use the data in the graph to recommend the best turbine for Eric's barn.

(1)

The best turbine is ..... because.....

.....

.....

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(ii) Eric pays 14p per kW h for electrical energy supplied by the National Grid.
Calculate how much he could expect to save each year by using the energy from this wind turbine to heat and light the barn.

(2)

annual saving = £.....

(iii) Eric looks at the cost of installing the turbine.

State how he should work out the payback time.

(1)

.....

.....

(iv) The chicks need to be kept warm at all times.
Eric uses halogen lamps to provide heat and light for most of the day.
Eric thinks about changing his halogen lamps for energy saving lamps.
Suggest why this might not actually be a benefit.

(2)

.....

.....

.....

.....

*(b) There are several large-scale energy resources which are suitable alternatives to fossil fuels in some situations.
Two of these alternatives are hydro-electric power and solar power.

Compare hydro-electric power with solar power as energy resources for the large-scale generation of electricity.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

March 2013

GCSE Physics
5PH1H/01

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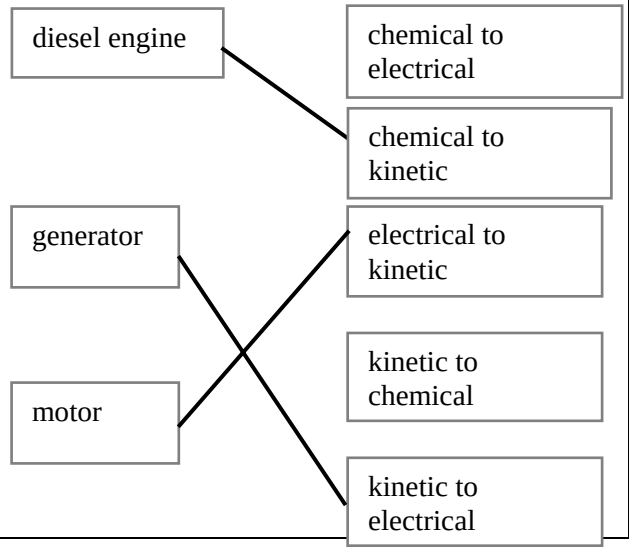
Question Number	Answer	Acceptable answers	Mark
1(a)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	moons (1) heliocentric (1)	must be in correct order	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	A description including two of the following points Reflecting telescope has mirror(s) (1) Galilean telescope has only lenses (1) Reflecting telescope can gather more light / can have a larger objective (1) Image viewed from the side of reflecting telescope (1) Image viewed from end of Galilean telescope. (1)	refracting telescope reverse argument	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	5 (cm) (1) 8 (cm) (1)	+5 -5 0.08 m 80 mm	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (ai)	A line connecting a train part with a useful energy transfer as shown below (1) Train part transfer useful energy  	Lines need not be straight Ignore any arrow heads drawn Note: if more than one line is drawn from a train part then zero mark for that train part.	**(3)**

Question Number	Answer	Acceptable answers	Mark
2 (aii)	(transfer of energy to) thermal (1)	heat/sound	**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (bi)	1400 – 1300 (= 100) (kJ) (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (bii)	Substitution (1) 1300 / 1400 x 100 Evaluation (1) 93(%) or 0.93	A value which rounds to 93(%) or 0.93 Correct answer with no working scores 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (c)	Any one from black is a good thermal radiator (1) (helps to) prevent motors overheating (1)	 (good) emitter (helps to) remove wasted energy/ heat (from the motor)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	An explanation linking any two of (presence of Earth's) atmosphere (1) causes light to be absorbed/reduced in intensity (1) causes distortion of the image(1) (more) **light** pollution (1) (bigger) variations in temperature (1)	Accept reverse argument (more) air/ clouds/ pollution/ dust blocked / (more) difficult to see through blurs the image / refracts the light	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking any three of galaxies moving (1) away from Earth / Sun (1) galaxy 2 (moving away) faster (than galaxy 1) (1) galaxy 2 is (likely to be) most distant galaxy (1)	galaxies are (moving) at different speeds / away from each other / universe is expanding	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(d)	A description including the following stages (up to 3 marks) Protostar (1) Main sequence star (1) (super) red giant (1) supernova (1) neutron star (1) (even more massive star can become) black hole (1) more massive stars have shorter life (1) Three stages in the correct sequence (1)		**(4)**

Question Number	Answer	Acceptable answers	Mark
4(ai)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(aii)	A description linking plates move / slip / separate (relative to each other) (1) sudden (release of energy) (1)	 plate rubs against each other friction between plates plate boundary shifts jerk / jolt	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(bi)	substitution (1) 0.65 = 80 / t transposition (1) t = 80 / 0.65 (123 seconds)	transposition and substitution can be in either order . Allow reverse calculations eg speed = 80/120 (1) = 0.67 (about 0.65) (1) or distance = 0.65 x 120 (1) = 78 km (about 80) (1).	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(bii)	A description linking any three detection of arrival of P and S waves (1) measurement of difference in arrival times (1) calculation of distance (from epicentre to station) (1) triangulation/using three / several stations (1)	Reward suitable labelled diagram	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	A suggestion including any two of the following Infrasound (1) some animals can hear waves below human frequency range / 20 Hz (1) they could hear P waves arriving before the (stronger) S waves arrive (1)	 Some animals have greater audio / tactile sensitivity than humans	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	alpha particles (In the left section) gamma rays (centre section) infrared radiation (right section) (2)	Any one in correct position for one mark, all three in correct position for two marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(d)	A description to include The purpose of using gamma radiation (1) Some relevant detail about how it achieves the purpose (1)	Purposes may include sterilising food /medical equipment detection / treatment of cancer imaging /detect flaws in materials	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(e)**	An explanation including some of the following points Results obtained: • Herschel: temperature on thermometer • Ritter: speed of darkening of silver chloride paper Trend of results: • Herschel: hotter towards red end • Ritter: quicker towards blue/violet end Extension of experiment to get more results: • Herschel: measure below red; found it even hotter • Ritter: measure above blue/violet; paper darkened quicker Conclusion: • Herschel: Must be radiation below red (Infra Red) • Ritter: Must be radiation above blue/violet (UV)	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of either some results or conclusions from either experiment. For example: They measured temperature across the spectrum and found that temperature changed. They put silver chloride paper in the spectrum and found that it darkened at different speeds with different colours. The answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple explanation of results and conclusions from both experiments . For example: Herschel measured the temperature across the spectrum and found it hotter towards the red end. This was infra red radiation. Ritter measured the darkening of chloride paper across the spectrum. It was quicker towards the violet end. They had discovered ultra violet. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation of all the results obtained from both experiments and the conclusions from these results. For example a response as for level 2 given above but with detail about results being obtained from outside the visible spectrum • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(ai)	Model A because Model A (can produce up to)7200kWh per year (at 13mph) / will produce 6000 kWh (with given wind speed). (1)	 Model B produces less than 6000kWh per year at 13mph /requires wind speed of more than 13mph to produce 6000kWh	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(aii)	Substitution (1) 0.14 x 6000 Evaluation (1) (£)840	Allow incorrect conversion of p to £ such as 0.014 x 6000 for 1 mark only 84 000 p correct answer with no working shown gains both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(aiii)	Divide the installation cost by the annual saving (to find the time in years) (1)	£840 for annual saving	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(aiv)	A suggestion linking (energy saving lamps) would not transfer so much thermal energy (1) he may have to use additional heating / lights (which would cost money to run/ purchase) (1)	 not get hot / produce so much heat reverse argument such as insufficient heat for chicks to thrive (Ignore references to light output.)	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	A discussion including some of the following points • Both HEP and Solar power are renewable • Both HEP and Solar power would save fossil fuels • HEP only possible in some locations • HEP requires reservoirs and damming of rivers • This can damage environment /takes a lot of land out of use • Energy from solar power installation is currently much less than energy from fossil fuel powered station • Solar power only suitable in certain locations • Solar power reliability dependent on constant sunshine • Neither of them cause atmospheric pollution	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description such as at least one relevant detail of each resource eg: Solar power doesn't give off atmospheric pollution. HEP generates more power than solar power. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple discussion such as one which gives comparisons between the two or at least an advantage and disadvantage of both. eg: HEP does not use fossil fuels but it can damage the environment where is it located. Solar power will never run out but it requires lots of light/land. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed comparison such as one which relates advantages and disadvantages of **both** HEP and solar power to a particular situation for possible large scale use e.g.: Solar power uses a renewable energy source but it currently does not produce as much energy as fossil fuel station where there is little sunlight. HEP can produce a lot more energy where there are hills and water but only possible in certain geographical locations. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Physics/Science

Unit P1: Universal Physics

Higher Tier

Thursday 8 November 2012 – Morning
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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1/1/1/1/1/

P 4 1 7 6 4 A 0 1 2 0

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FORMULAE

You may find the following formulae useful.

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

Answer ALL questions.

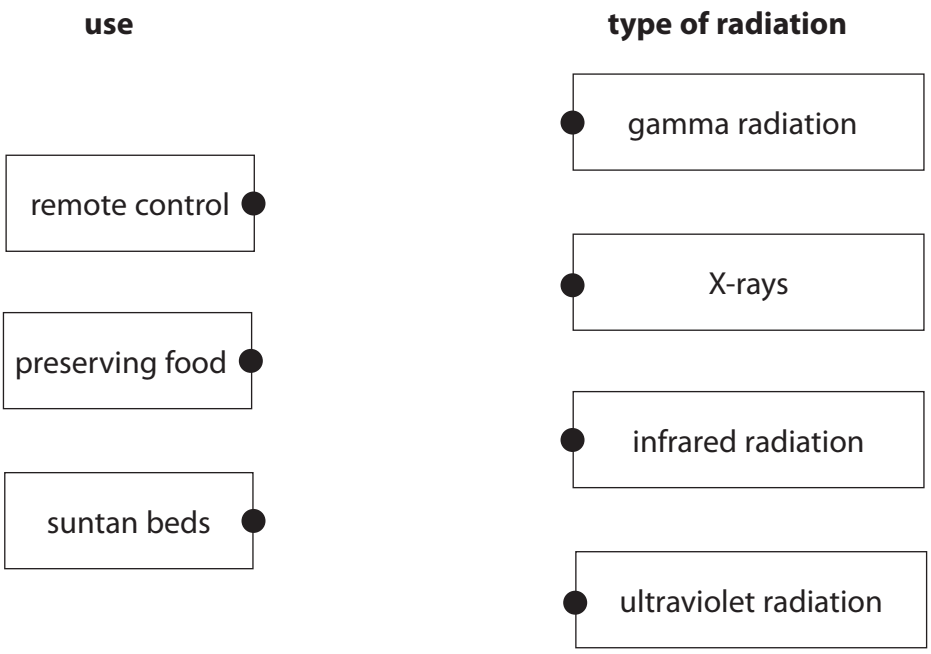
Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Electromagnetic spectrum

1 (a) Different types of electromagnetic radiation have different uses.

Draw one straight line from each use to the correct type of radiation.

(3)



(b) X-rays from a star travel to a space telescope in orbit around the Earth.

Explain why visible light from the same star takes the same time to reach the telescope.

(2)

.....

.....

.....

.....

(c) Which of these ionising radiations is from a radioactive source and is also part of the electromagnetic spectrum?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** alpha particles

☒ **B** beta particles

☒ **C** gamma rays

☒ **D** X-rays

(d) An X-ray of wavelength 2.0 nm has a frequency of 1.5×10^{17} Hz.

$1.0 \text{ nm} = 1.0 \times 10^{-9}$ m

Calculate the speed of the wave.

(2)

speed = ... m/s

(Total for Question 1 = 8 marks)

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Solar energy

2 There are two types of solar panels.

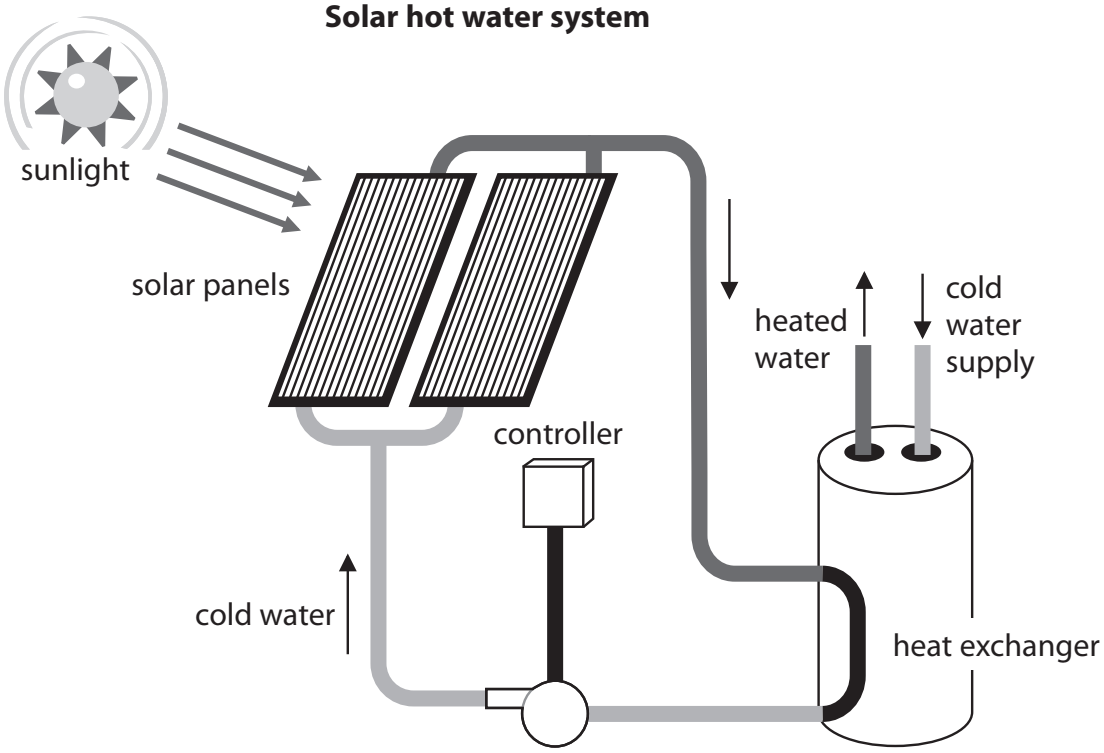
One type of solar panel uses the Sun's energy to heat water.

The other type uses solar cells to produce electricity.

(a) The diagram shows solar panels in a system used to heat water for a house.

Cold water goes into the panels and is heated by energy from the Sun.

Solar hot water system



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The solar heating panels are painted black because

(1)

☒ **A** black is a good absorber of heat

☒ **B** black is a good conductor of heat

☒ **C** black is a good radiator of heat

☒ **D** black is a good reflector of heat

(ii) On one sunny day no hot water is used in the house.

The water in the panels reaches a constant temperature even though the water is still absorbing energy from the Sun.

Explain why the temperature of the water in the panels becomes constant.

(3)

.....

.....

.....

.....

.....

.....

(b) The photograph shows a solar farm which uses many thousands of solar cells to generate electricity.



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(i) Which energy transfer takes place in a solar cell?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** chemical to electrical

☒ **B** electrical to light

☒ **C** electrical to chemical

☒ **D** light to electrical

(ii) A large solar farm has 21 700 solar panels and generates 5.0 MW of power.

1.0 MW = 1.0×10^6 W

Calculate the average power each panel produces.

(2)

average power produced by each panel = ... W

(iii) The solar farm receives 25 MW of power from the Sun to generate 5 MW of electrical power.

Calculate the efficiency of the solar farm.

(2)

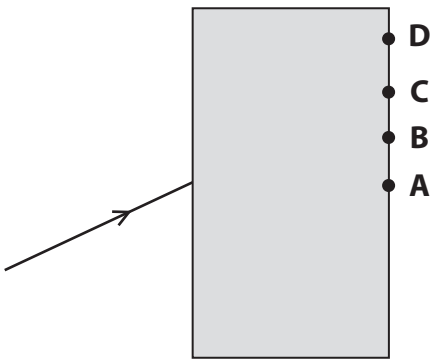
efficiency = ...

(Total for Question 2 = 9 marks)

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Refraction and telescopes

3 The diagram shows a ray of light incident on a glass block.



(a) (i) At which point is the ray of light shown likely to leave the glass block?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The ray of light changes direction when it enters the glass block because there is a change of

(1)

☒ **A** amplitude

☒ **B** frequency

☒ **C** speed

☒ **D** energy

(b) A student uses a lens to form a clear image of a house.
The image is formed on a piece of paper.
The house is a long way away.

Describe how the student should find the focal length of the lens.

(2)

(c) Galileo used a telescope to observe Jupiter.

His observations provided evidence to support the idea that the Earth is not the centre of the Universe.

Explain how Galileo's observations supported this idea.

(2)

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(d) A student looked for information about telescopes on the Internet.
He found this equation for the magnification of a simple telescope.

$$\text{magnification} = \frac{\text{focal length of lens furthest from the eye (the objective)}}{\text{focal length of lens nearest the eye (the eyepiece)}}$$

The information sheet given with a simple telescope states:

- the magnification is 40 times ($\times 40$)
- the focal length of the objective is 110 cm.

Calculate the focal length of the eyepiece.

(3)

focal length of eyepiece = ... cm

(Total for Question 3 = 9 marks)

Transformers

4 A small notebook computer has a power rating of 40 W.
The computer is connected to the mains supply through a step-down transformer.
The mains supply is a.c.

(a) (i) How much energy is supplied to the computer each second?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** 0.025 J
- ☒ **B** 4.0 J
- ☒ **C** 40 J
- ☒ **D** 240 J

(ii) Sketch an alternating current on the axes shown.

(1)



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(b) The step-down transformer has:

- 2400 turns on the primary coil
- 200 turns on the secondary coil
- a primary voltage of 230 V.

Calculate the voltage output of the secondary coil.

(3)

secondary voltage = ... V

(c) (i) Explain how transformers are used to improve the efficiency of power transmission in the National Grid.

(3)

.....

.....

.....

.....

.....

.....

(ii) Explain why flying a kite near power lines could be a danger to the person flying the kite.

(2)

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

Ultrasound

5 Ultrasound has many different applications.

(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Ultrasound is used for

(1)

- ☒ **A** cooking
- ☒ **B** communication between animals
- ☒ **C** communication with satellites
- ☒ **D** detecting forged bank notes

(ii) Explain why ultrasound rather than X-rays are used for foetal scanning.

(2)

.....

.....

.....

.....

(b) An ultrasound wave vibrates 30 000 times a second.

(i) State the frequency of the wave.

(1)

.....

(ii) Describe the motion of particles in a material when this ultrasound wave passes through.

(2)

.....

.....

.....

.....

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*(c) Explain how sonar is used by deep sea fishermen to detect the depth of a shoal of fish below the surface of the sea.

(6)

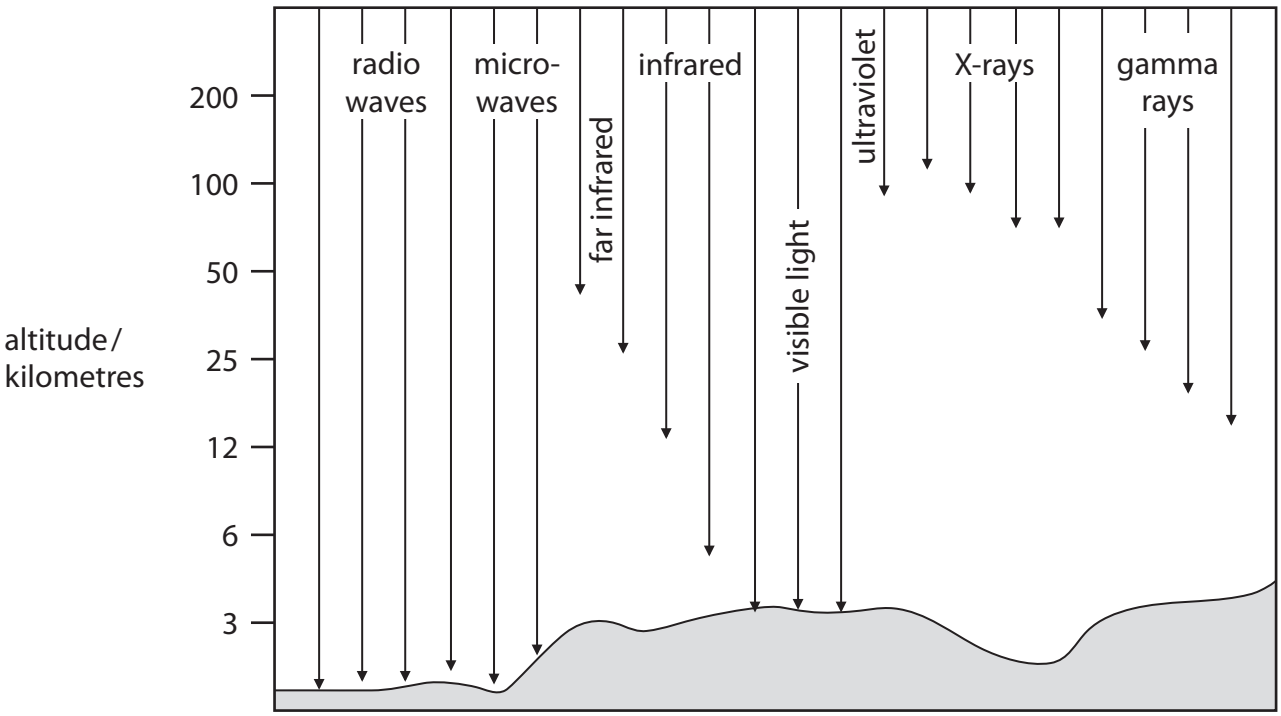
(Total for Question 5 = 12 marks)

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The Solar System

6 Not all electromagnetic radiation coming from space reaches the Earth's surface.

The diagram shows how far radiation from each part of the electromagnetic spectrum travels down through the atmosphere.



(a) (i) Name **one** type of radiation that can reach the surface of the Earth from stars.

(1)

.....

.....

(ii) Name **one** type of radiation from stars that cannot be detected at the Earth's surface but can be detected using satellites.

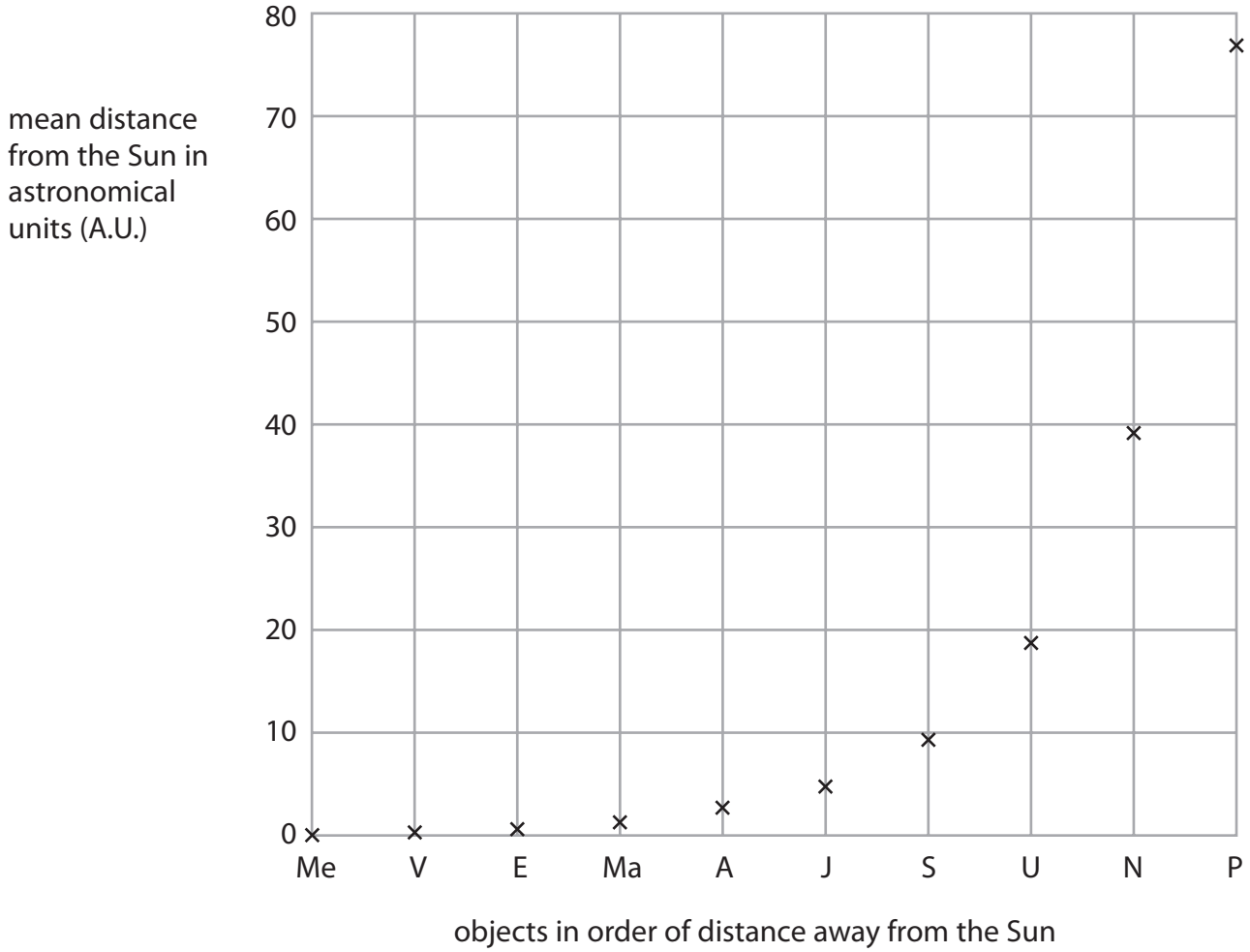
(1)

.....

.....

(b) Bode, a scientist, found a rule predicting the distance of objects from the Sun.

The chart shows the mean distances from the Sun predicted by Bode's rule.



[Me – Mercury; V – Venus; E – Earth; Ma – Mars; A – Asteroid Belt; J – Jupiter; S – Saturn; U – Uranus; N – Neptune; P – Pluto]

(i) Read, from the chart, the predicted values for the distance from the Sun to Neptune and from the Sun to Pluto.

(2)

Sun to Neptune .....

Sun to Pluto .....

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(ii) Bode's rule works well for all objects between Mercury and Uranus.
From scientific measurements, however, the actual mean distance from the Sun to Neptune is 30 A.U.
Some scientists think that Neptune was not part of the original Solar System.

Explain how the predicted value for Neptune supports the view of these scientists.

(2)

*(c) Scientists are using a variety of methods to search for life beyond Earth.

Discuss the problems involved in using these methods.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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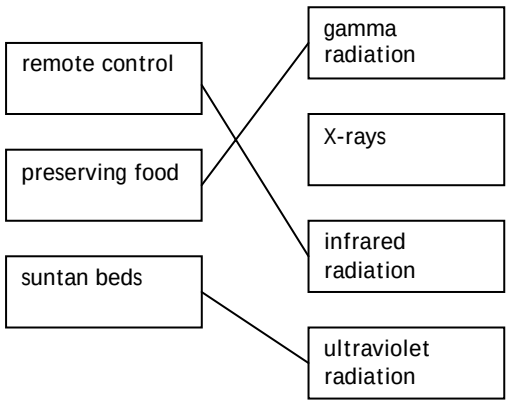
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GCSE Physics 5PH1H/01 Mark Scheme – November 2012

Question Number	Answer	Acceptable answers	Mark
1(a)	use type of radiation  3 correct = 3 marks 2 correct = 2 mark 1 correct = 1 mark	Two lines from a use negates that use	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)	An explanation including : • (all e-m waves) have same speed (1) • in {space/vacuum} (1)	(from equation) same speed and same distance = same time 3×10^8 m/s / speed of light	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	substitution ie (v =) $1.5 \times 10^{17} \times 2 \times 10^{-9}$ (1) evaluation ie (v =) 3×10^8 m/s (1)	[Remember that equations, including $v = f\lambda$ are given on page 2. Please do not credit] Give full marks for correct answer, no working 3 x any other power of 10 =1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	An explanation linking the following: • {energy / heat / radiation} is lost (1) • (heat lost) = heat gained / absorbed (1) • rate (of heat loss) = rate (of heat gained) (1)	given out /output for 'is lost' power lost = power gained =3 description of dynamic equilibrium =3 Ignore references to boiling water	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	substitution (1) 5 000 000 / 21 700 evaluation (1) 230 W	Ignore powers of 10 until evaluation 230.4 W Give full marks for correct answer, no working 2.3 x any other power of 10 = 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	substitution (1) 5 x 100 / 25 evaluation (1) 20(%)	0.2, 1/5 Give full marks for correct answer, no working 2 x any other power of 10 = 1 mark e.g. 200, 1/500	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	A description including: • measuring the {distance / space} (1) • between lens and {paper / image} (1)	Ignore moving paper or lens Ignore mention of focal point	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking any **two** of the following • moon(s) (1) • (appear to) orbit Jupiter (not Earth) (1) • (therefore) not everything orbits the Earth (1)	ignore planets/stars/objects Idea of movement near Jupiter '<u>geocentric</u> theory is wrong' (1) ignore: {orbits the Sun / does not orbit the Earth} ignore: Heliocentric is correct ignore: Earth not centre of Universe ignore: retrograde motion	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	rearrangement (1) ie fe = fo / M substitution (1) ie (fe =) 110 / 40 evaluation (1) ie (fe =) 2.8(cm)	rearrangement and substitution in either order appropriate substitution after <u>writing</u> incorrect rearrangement [e.g. M/f_o = 40/110 = 1 mark only] 2.75(cm) Give full marks for correct answer, no working	(3)

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	Any continuous line which has a section above and below the time axis without going (deliberately) back in time	Fractions of a cycle that meet the criteria Ignore anything appearing after the arrow on the time axis	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	substitution (1) 2400/200 = 230/ V_s transposition (1) (V_s =) 230 x 200/2400 Evaluation (1) (V_s =) 19 (V)	substitution and transposition in either order 230/12 = 2 marks (s&t) 200/10.43 = 2 marks (s&t) 19.2 (V) 19.17 (V) Give full marks for correct answer, no working 1.9 x any other power of 10 = 2	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	An explanation linking any **three** of the following • step-up transformer(s) (1) • increase voltages (1) • (this) reduces the current (1) • (which) reduces the {heat / thermal} {energy / power} losses (1)	Assume 'they' refers to transformers 'steps up the voltage' scores second MP only Reject for MP2 and MP3: 'increases voltage and current.' but beware: 'increases voltage and current decreases' = 2 marks ignore unqualified energy losses Allow reverse arguments for last two points, e.g. high current wastes more heat energy = 2 marks Ignore references to efficiency ignore step-down statements except where they contradict	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	An explanation linking **two** of the following • {kite / string} touching the power line (1) • {movement of charge / current} (1) • (electricity) {to earth / through the kite-flyer} (1) • giving (the kite-flyer) an <u>electric</u> shock (1)	anything which implies contact for touching eg 'caught up in' spark ignore energy ignore electricity to ground needs idea of 'through' not 'into' the person ignore 'completing the circuit' electrocution stopping heart	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	An explanation linking • {X- rays are / ultrasound is not} dangerous (1) • (because X-rays) can {damage / harm} {tissue / DNA} OR mutate cells OR reverse argument for ultrasound (1)	X-rays are ionising / ultrasound is not ionising ignore penetration/penetrating ignore bald harm / harmful for MP1 Ignore reference to frequency and energy X-rays cause cancer ignore foetus / baby / body Ignore unqualified 'mutation'	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b) (i)	30 000 Hz / hertz	30 kHz 0.03 MHz unit must be included	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	A description including particles {<u>vibrate</u> / <u>oscillate</u>} (1) (move) in the {same direction as / parallel to the direction } the wave travels (1)	'they' refers to particles to and fro back and forth ignore all up and down and side to side references Both points could be shown on a clear diagram with arrows or labels (e.g. compressions and rarefactions)	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	An explanation including some of the following points • sonar is ultrasound • travels through water at the speed of sound (1500 m/s) • ultrasound signal generated in the ship • signal emitted from the bottom of the ship • signal travels down through the water • strikes shoal of fish • signal reflected by fish • reflected signal detected on the ship • time between emission and detection measured • either time halved and depth of fish calculated /or distance wave travelled calculated and halved to give depth of fish • calculation done using $x = v \times t$ • comparison of depths of fish and of seabed	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation e.g. A sonar wave (ultrasound pulse) goes down and is reflected. OR An ultrasound pulse is sent from the boat and timed. • the answer communicates ideas using simple language and uses limited scientific terminology. • spelling, punctuation and grammar are used with limited accuracy.	
2	**3 - 4**	• a simple explanation e.g. An ultrasound signal goes down through the water and is reflected AND the time taken is measured. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. • spelling, punctuation and grammar are used with some accuracy.	
3	**5 - 6**	• a detailed explanation e.g An ultrasound signal is emitted and reflected. The time is measured AND depth is found by halving (the total time or the total distance) AND linking to either the speed equation or the speed of the wave or the depth of fish compared to sea depth. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately. • spelling, punctuation and grammar are used with few errors.	

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	Any one of • radio • visible • microwave	• infrared / IR • ultraviolet / UV	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	Any one of • X-ray • gamma ray • far infrared	• infrared / IR • ultraviolet / UV	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	N = 39 (A.U.) (1) P = 77 (A.U.) (1)	range 38 – 39 inclusive range 76-78 inclusive	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	An explanation linking • actual value for Neptune is {different from / lower than} predicted value (1) with **one** of these • (so) the rule does not work (for Neptune) (1) • the rule gives too high a value (1) • (so) Neptune might have been {captured / entered} from outside the original Solar System (1)	actual value for Neptune put on to chart by cross or dot etc. (no need for label) (1) (Neptune) is an anomaly ignore references to age of Neptune	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A discussion including some of the following points • Methods o space probes o soil experiments by landers o SETI o telescopes o robotic machines • Problems • expense / international collaboration needed • large distances involved o if problem difficult to correct o time to react to problem is long o time to respond to any communication would be long o complex technology ▪ for human visit ▪ for robot investigation ▪ fuel • recognition of alternative life-forms • pattern recognition o for SETI o communication if intelligent life-form • possibility of cross-contamination	**(6)**
Level	**0**	No rewardable content	
1	**1 – 2**	• a limited discussion including EITHER two named problems, OR two named methods, OR a named problem + a named method e.g. It would be expensive and the distances are large OR Space probes and SETI can be used OR can listen for communications, life beyond Earth may not be water based. • the answer communicates ideas using simple language and uses limited scientific terminology. • spelling, punctuation and grammar are used with limited accuracy.	
2	**3 – 4**	• a simple discussion including EITHER a problem with its associated method + some other named problem OR a detailed problem + one other named problem e.g. It is expensive to send a space probe to Mars; the distance to Mars very large OR It is difficult to search through the data from space because there is a huge amount of it. Also, any message would be hard to decode. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. • spelling, punctuation and grammar are used with some accuracy.	

3	**5 – 6**	• a detailed discussion including EITHER two problems with their associated method(s) + some other named problem OR two detailed problems + one other named problem OR a problem with its associated method + a detailed problem + one other named problem e.g. We can analyse radiowaves from space, but they take so long to arrive that the aliens that sent them could have already died out. It is very expensive to develop the technology needed to go to other planets. Also, we might not recognise alien life-forms there. OR It is difficult to search through the data from space because there is a huge amount of it. Radiowaves in space take a long time to arrive because the distances are so vast. It all costs a lot of money. OR It is very expensive to develop the technology needed to go to other planets. It is difficult to search through the data from space because there is a huge amount of it. Also, we might not recognise alien life-forms there. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately. • spelling, punctuation and grammar are used with few errors.

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Edexcel GCSE

Centre Number	Candidate Number

Physics/Science

Unit P1: Universal Physics

Higher Tier

Thursday 24 May 2012 – Morning
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

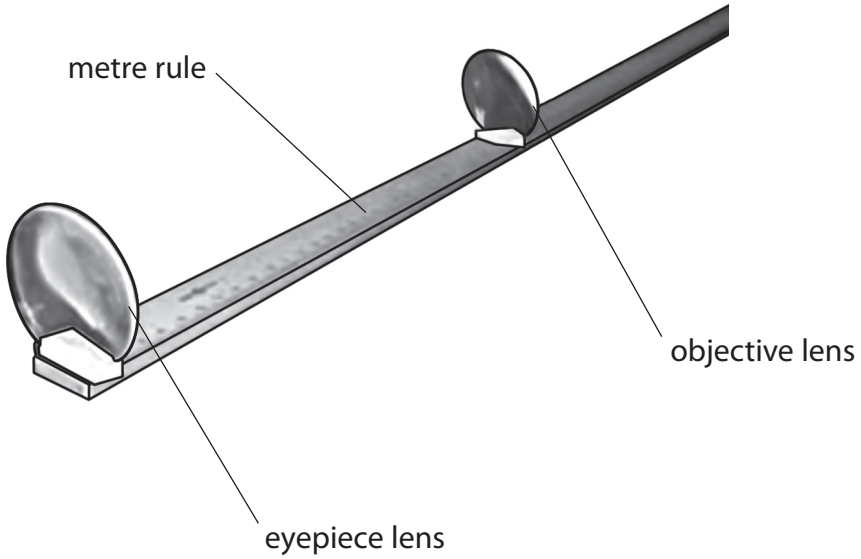
$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Refracting telescope

1 The diagram shows a simple telescope which can be made in the laboratory.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The type of lens used as the objective lens is

(1)

☒ **A** concave

☒ **B** converging

☒ **C** diverging

☒ **D** reflecting

(b) The objective lens produces an image of a distant object.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The image produced by the objective lens is

(1)

☒ **A** the right way up and smaller

☒ **B** the right way up and bigger

☒ **C** upside down and smaller

☒ **D** upside down and bigger

(ii) Describe how the position of this image can be shown.

(2)

.....

.....

.....

.....

(c) State the purpose of the eyepiece.

(1)

.....

.....

(d) The telescope is used to look at the planet Venus.
Assume that the distance from Venus to the Earth is 39 000 000 km.
The speed of light is 300 000 000 m/s.

Calculate the time it takes for light to travel from Venus to the Earth.

(3)

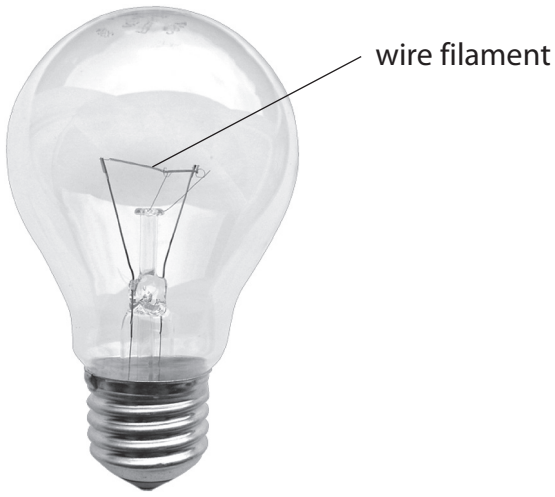
time = ... s

(Total for Question 1 = 8 marks)

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Lamps

2 This lamp has a wire filament that glows white hot when it is in use.



(a) A 100 W filament lamp is 15% efficient.

(i) Explain the meaning of the term **15% efficient**.

(2)

.....

.....

.....

.....

(ii) Draw a labelled energy flow diagram to show what happens to 100 J of electrical energy supplied to the lamp.

(2)

(b) Many people choose to buy expensive low-energy lamps instead of cheaper filament lamps.

Give **two** reasons for this.

(2)

(c) When a filament lamp is in use, the temperature of the wire filament remains at 2500 °C.

Explain why this temperature remains constant.

(3)

(Total for Question 2 = 9 marks)

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Elephants and infrasound

3 (a) Sound travels through the air as longitudinal waves.

Describe how the air particles move when a sound wave passes.

(2)

.....

.....

.....

.....

(b) Elephants call to each other using infrasound.
People cannot hear these infrasound calls.

Which of the following statements is the reason that people cannot hear infrasound?

Put a cross (☒) in the box next to your answer.

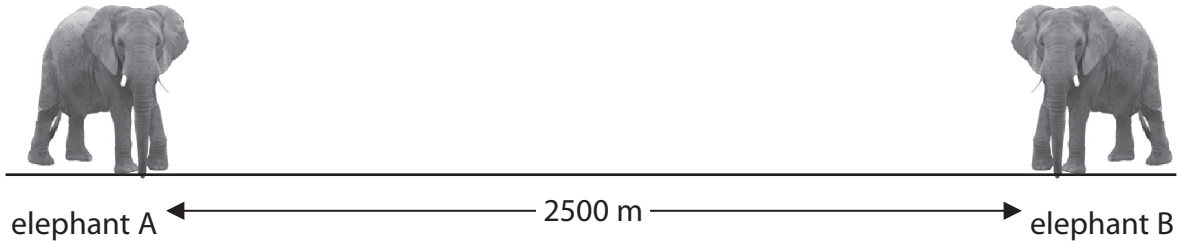
(1)

- ☒ **A** the amplitude of infrasound is too big
- ☒ **B** the frequency of infrasound is too low
- ☒ **C** the speed of infrasound is too fast
- ☒ **D** the wavelength of infrasound is too short

(c) Both infrasound waves and ultrasound waves are types of sound waves.
They are used by animals to communicate.

Two elephants use infrasound waves for long distance communication.
The distance between these two elephants is 2500 m.

not to scale



Elephant A emits an infrasound call.
When elephant B hears the infrasound, it calls back.
Elephant A hears the answering call from elephant B.
The speed of infrasound is 340 m/s.

(i) Show that the minimum time for elephant A to call and hear an answer from elephant B is about 15 s.

(3)

(ii) An elephant's infrasound call has a range of 4000 m.
Each infrasound call lasts between 2 s and 10 s.
Each elephant usually waits about 30 s before it calls again.

Suggest a reason why elephants wait 30 s before calling again.

(1)

.....

.....

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(d) Describe a use of infrasound that does not involve animals.

(2)

.....

.....

.....

.....

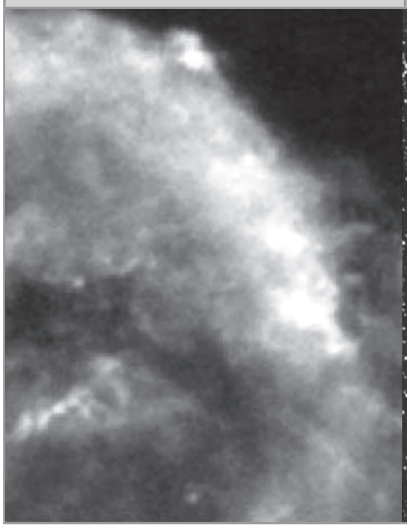
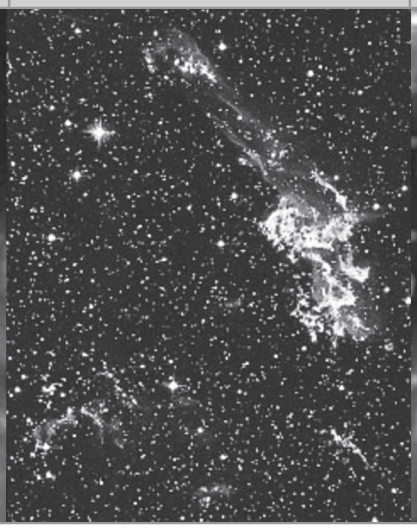
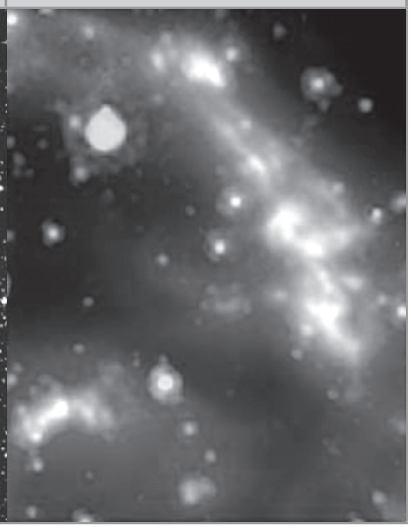
(Total for Question 3 = 9 marks)

Looking at our Universe

4 (a) Chandra, Hubble and Spitzer are space telescopes.

The photographs show exactly the same part of the Universe observed using the different telescopes.

The main object shown in each photograph is the same supernova.

Chandra's image using X-rays	Hubble's image using visible light	Spitzer's image using infrared
		

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A supernova is

(1)

☒ **A** a star in its main sequence

☒ **B** the appearance of a new star

☒ **C** the explosion of a massive star

☒ **D** the explosion of a white dwarf

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(ii) The waves that the three telescopes use are

X-rays

visible light

infrared

Complete the table by arranging these three waves in order of decreasing wavelength.

(1)

longest wavelength →		**shortest wavelength**
.....	.....	.....

(iii) Astronomers use different types of telescope, like Chandra, Hubble and Spitzer.

Explain how using these different telescopes gives a better understanding of the Universe.

(3)

.....

.....

.....

.....

.....

.....

(b) Most space telescopes orbit the Earth but the Spitzer telescope stays behind the Earth to hide from the Sun.

Suggest why this is necessary.

(2)

.....

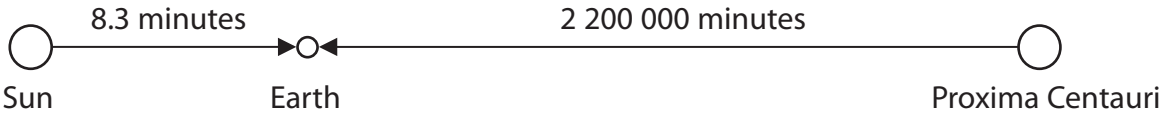
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(c) Outside our Solar System, the star closest to Earth is called Proxima Centauri.
Light from this star takes 2 200 000 minutes to reach the Earth.
Light from the Sun takes 8.3 minutes to reach the Earth.
The speed of light is 18 000 000 km/minute.

not to scale



(i) By calculation, compare the distance of Proxima Centauri from the Earth with the distance of the Sun from the Earth.

(2)

.....

.....

(ii) A light year is the distance that light travels in one year.

Astronomers usually give the distance from stars as a number of light years instead of a number of kilometres.

Suggest a reason for this.

(1)

.....

.....

(Total for Question 4 = 10 marks)

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Power from the wind

5 A windfarm generates electrical power from the wind.

(a) State **one** disadvantage of using the wind to generate electrical power.

(1)

.....

.....

(b) A windfarm generates 322 MW of electrical power.

The windfarm is connected to a transmission line at a potential difference of 132 kV.

(i) Calculate the current from the windfarm.

(3)

current = ... A

(ii) The windfarm produces 322 MW of power.
The windfarm is to be extended by adding 75 improved turbines.
The extended windfarm will then produce a total of 539 MW.

Calculate the power produced by each improved turbine.

(2)

power = ... MW

*(c) There is a plan to replace the existing transmission line from the windfarm with one at the higher potential difference of 400 kV.

The new transmission line will cross more than 200 km of mountains.
The cables will hang 50 m above the ground from 600 new, taller pylons.
Eventually, about 1000 of the old, shorter pylons will be removed.

Discuss the advantages and disadvantages of this plan.

(6)

(Total for Question 5 = 12 marks)

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Electromagnetic waves

6 (a) The diagram shows the parts of the electromagnetic spectrum.

radio waves	microwaves	infrared	visible light	ultraviolet	X-rays	gamma rays

(i) Which parts of the electromagnetic spectrum are used for both communication and cooking?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** infrared and microwaves

☒ **B** infrared and radio waves

☒ **C** microwaves and radio waves

☒ **D** radio waves and X-rays

(ii) Fluorescent substances absorb ultraviolet and emit visible light.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Visible light has a

(1)

☒ **A** faster speed than ultraviolet

☒ **B** higher frequency than ultraviolet

☒ **C** lower frequency than ultraviolet

☒ **D** smaller wavelength than ultraviolet

(b) Ultraviolet radiation and infrared radiation are emitted by the Sun and reach the surface of the Earth.

(i) Describe a harmful effect of ultraviolet radiation.

(2)

(ii) Explain why ultraviolet radiation is likely to be more dangerous to humans than infrared radiation.

(2)

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*(c) Herschel discovered invisible rays beyond one end of the visible spectrum.
Ritter discovered invisible rays beyond the other end of the visible spectrum.

Compare and contrast the two experiments leading to these discoveries.
You may draw labelled diagrams to help with your answer.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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Question Number	Answer	Acceptable answers	Mark
1(a)	**B** converging		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	**C** upside down and smaller		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	A description including the two of the following points • a paper / screen (between the objective and the eyepiece) (1) • move screen/lens (to and fro) (1) • to obtain an image which is in focus / clear / sharp (1)	Ignore: comments about image orientation or magnification at the focal point / focal length	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	to magnify the image (produced by the objective) (1)	increase image size make image bigger enlarge the image Ignore: comments about image orientation	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	transposition (1) t = x/v substitution (1) t = 39 000 000 000/300 000 000 evaluation (1) 130 (s)	Transposition and substitution may be in either order Transposition may be implied by correct figures Ignore powers of ten until final answer 39 000 000 ÷ 300 000 000 2mins 10sec give full marks for correct answer, no working give 2 marks for a power of 10 error, no working e.g. 0.13 (s)	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	An explanation linking the following points • 15 % of power /energy (1) • is transferred usefully (1) **Accept reverse argument** • 85% of power / energy (1) • is wasted (1)	15 W / 15 J/s / 15 J transferred as light converted into useful energy/ is not wasted	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	• two qualitative output labels (1) light (energy) and thermal /heat (energy) • a quantitative output label (1) 15 J for light/used /useful or on narrower arrow (of otherwise unlabelled Sankey diagram)	useful/used (energy) and wasted (85 J for heat/wasted or on broader arrow (of otherwise unlabelled Sankey diagram)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	Any **two** of the following reasons • Energy, e.g. (low-energy lamps) are more efficient / waste less energy / produce less heat (1) • Economy, e.g. (low-energy lamps) use less <u>electrical</u> energy /cost less to run / have a lower power (rating) (1) • Environment, e.g. using (low-energy lamps) reduces CO_2 emissions / saves fossil fuel (1) • Practical, e.g. (low-energy lamps) last longer / need replacing less often / (can be) easier to obtain (1)	Accept reverse arguments Accept 'they' for low-energy lamps idea of Payback, e.g. (low-energy lamps) are (more) cost effective (over time) Ignore unqualified environment statements filament lamps (have been) banned (in some countries)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking these three points • energy gain is from power supply(1) • energy loss is by radiation(1) • the loss and the gain are equal /at the same rate(1)	energy (comes) from the mains / supplied with electrical energy thermal/heat energy emitted infrared emitted the loss and gain are in equilibrium allow the filament gains <u>and</u> losses energy for (1) only	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(a)	A description including the following points • (Particles) vibrate/oscillate (1) • (vibration) parallel to direction of wave / propagation (1)	Both marks may be awarded for a clear diagram move backwards and forwards/to and fro/ push and pull Accept idea of (a series of) compressions and rarefactions in the same direction as wave travel /energy transfers **Accept** they vibrate in the same direction that the wave is going (for 2 marks)	**(2)**

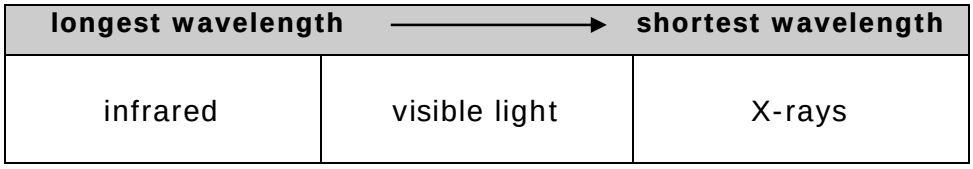
Question Number	Answer	Acceptable answers	Mark
3(b)	**B** the frequency of infrasound is too low		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	transposition (1) t = distance ÷ speed substitution (1) (2 x)2500 ÷ 340 evaluation (1) 14.7 (s)	**This is a "show that" question, there must be evidence of calculation** **Ignore** factor of 2 until final evaluation 2500 ÷ 340 = 2 marks 14.7 is evidence of calculation = 3 marks There are other ways to use the data e.g. 5000 ÷15 = 333 (m/s) (which is about 340 m/s) 2500 ÷7.5 = 333 (m/s) (which is about 340 m/s) **OR** 340 x 15 = 5100 (m) (which is about 5000 m) Give marks for transposition, substitution and evaluation clearly shown	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	Any **one** of the following points • idea of a conversation (1) • (4000 m is) a longer distance taking a longer time (to reach other elephant) (1) • time needed for waves to travel is about 24 s (1) • time gap between calls (sufficient) for elephant to hear a reply (1) • call lasts long enough to be identified by other elephants (OWTTE) (1)	longer distance and call takes (some) time waiting to see if there is a reply/response (from another elephant)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(d)	A description linking the following points • detecting/ locating/ monitoring (infrasound) (1) • volcanic eruptions / underground explosions / earthquakes /nuclear explosions / meteor strikes (1)	Ignore references to ultrasound and infrared idea of need for a detecting instrument (1) idea of infrasound (waves) travelling through a medium (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	**C** the explosion of a massive star		**(1)**

Question Number	Answer	Mark
4(a)(ii)	 All three must be correct	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	An explanation linking **three** of the following points • discovery of objects not detectable by visible light (1) • more information / data can be collected (1) • different (electromagnetic) waves can give different types of information (1) • produce magnified images (1) • (space telescopes) produce clearer images / images unaffected by Earth's atmosphere (1)	allow specific examples e.g. (discovery of) black holes/CMB / pulsars different telescopes provide different data/ images brighter/more detailed images ignore idea 'can see further' unless qualified	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)	Any **two** of the following points • Spitzer observes /uses infrared (1) • infrared is heat (1) • Sun produces (large amounts of) heat / infrared (1) • small amount of heat from distant galaxies would not be detected (amongst radiation from the Sun) (1)	ignore idea 'to protect telescope from heat/damage' infrared (waves)/heat from the Sun would interfere with/swamp/ruin image (of distant galaxies)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	calculate **one** distance (1) e.g. 1.49×10^{8} or 3.96×10^{13} evaluation (1) e.g. $(3.96 \times 10^{13} \div 1.49 \times 10^{8})$ = 265 000 e.g. inverse $(1.49 \times 10^{8} \div 3.96 \times 10^{13})$ 3.77×10^{-6} e.g. from comparison of times (2 200 000 ÷ 8.3) = 265 000	accept 149 400 000 or 39 600 000 000 000 265 060 265 771.18 Give 2 marks for a correct evaluation with no working shown or no distance calculation Give 2 marks for two correct distances and a correct comparative statement	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	the stars are so distant that a large unit of distance is needed	the numbers (of km or miles) would be too big (to understand)/ too long (to write down) (numbers of) light years are more manageable/ easier to understand	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)	Any **one** of the following points • unreliability (1) e.g. wind does not always blow / wind speed may be too high/too low • pollution (1) e.g. noise from wind turbines / wind turbines spoil the view	Ignore general references to weather ignore economic arguments the wind is unreliable only works when it is windy wind turbines can only use a (small) range of wind speeds visual pollution	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	transposition (1) current = power ÷ voltage substitution (1) 322 000 000 ÷ 132 000 evaluation (1) 2440 (A)	Transposition and substitution may be in either order Transposition may be implied by correct figures I = P ÷ V Ignore powers of ten until final answer i.e. give 2 marks for 322 ÷ 132 2439 (A) 2439.39….(A) 2.44 kA give full marks for correct answer, no working give 2 marks for a power of 10 error, no working e.g. 2.44 (A)	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	• calculation to find additional power generated e.g. 539 – 322 = 217 (MW) (1) • 2.9 (MW) (1)	217 without working 2.893 (MW) give full marks for correct answer, no working	**(2)**

Question Number		Indicative content	Mark
QWC	***5(c)**	A discussion to include some of the following points Social factors / economic factors • people may not like it (NIMBY) / pressure groups • cost arguments Environmental factors • spoiled view / risk of birdstrike • space for extra infrastructure eg. access roads / substations Associated hazards • danger from higher voltage • dangers from construction work in mountainous area • danger to maintenance crew from working at greater height Energy efficiency arguments • higher voltage leads to lower current • lower current means reduced heat losses • higher voltage means / lower current / can transmit energy further • reduced heat loss means improved efficiency Logical use of data • taller pylons can be seen from further away • net reduction in number of pylons / need to remove old ones • stronger materials needed for pylons / cables • need for new transformers Appropriate calculations • 1000 - 600 = 400 fewer pylons (approx) • current reduced by a factor of 132/400 (0.33)	**(6)**

Level	**0**	no rewardable material
1	**1-2**	• a limited discussion of the plan to replace the power transmission lines (or upgrade the wind farm) including two or more points, advantageous (A) or disadvantageous (D), which may appear as a list e.g. (A+D) is more efficient; is expensive OR (A+A) uses fewer pylons; current is lower OR (D+D) would spoil the view; high voltage is dangerous • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3-4**	• a simple discussion of the plan to replace the power transmission lines including two or more statements, advantageous (A) or disadvantageous (D), at least one of which links ideas e.g. (A) higher voltage *leads to* lower current + (D) if old pylons are removed they will go to waste OR (A) using higher voltage *means* energy can be transmitted further + (A) wasting less energy saves money OR (D) new pylons spoil the view more *because* they are taller + (D) danger to maintenance crew from working at greater height • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed discussion of the plan to replace the power transmission line, including an advantage (A) **AND** a disadvantage (D) both containing linked ideas, at least one of which shows use of the data e.g. (A) Increasing the voltage to 400 kV *leads to* a reduction in the current (needed to transmit the same power) + (D) higher voltages will *mean* that they need new transformers OR (A) it will be more efficient *because* less energy is wasted + (D) *even though* there will be 400 fewer pylons they will be taller and can be seen from further away • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	**A** infrared and microwaves		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	**C** lower frequency than ultraviolet		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	A description including **two** of the following points **Either** • UV penetrates the skin / can damage normal cells/ cause cell mutation/ionise cells (1) • can cause (skin) cancer / can cause premature ageing (1) **OR** • UV penetrates the eye / can damage/mutate cells in the eye (1) • can cause cataracts / damage to the retina (macular degeneration) (1)	Ignore “harm” or “harmful” Accept “tissue” for cells sunburn can cause (snow) blindness	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	An explanation linking two of the following points • (ultraviolet/it) has a higher frequency (than infrared) (1) • (therefore ultraviolet/it) has higher (photon) energy (1) • (ultraviolet/it) penetrates further /(ultraviolet/it) causes ionisation (1)	Accept reverse argument if clearly about IR has a shorter wavelength	**(2)**

Question Number		Indicative content	Mark
QWC	***6(c)**	A comparison including some of the following points **Similarities** • used white light from the Sun • glass prism • produced a visible spectrum **(Herschel's) infrared experiment** • used a thermometer to measure the temperature of different colours of the visible spectrum • temperature increased towards the red end • temperature increased more past the red end of the spectrum. • temperature rise was due to invisible rays named infrared **(Ritter's) ultraviolet experiment** • used silver chloride on paper this slowly turns black in visible light. • silver chloride turned black faster as the paper was put at the violet end of the spectrum • beyond the violet the silver chloride turned black even more rapidly • due to the presence of invisible rays (originally called chemical rays) now called ultraviolet	**(6)**

Level	0	no rewardable material
1	1 -2	• a limited description of **either** experiment including two or more basic points (written or shown on a labelled diagram) e.g. prism is made of glass; the colours of the spectrum are ROYGBIV OR (Herschel's) experiment discovered IR; he measured the temperature of the spectrum OR (Ritter) put sensitive (silver chloride) paper at different places in the spectrum; (Ritter's) experiment discovered UV • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 -4	• a simple description of **either** experiment including a statement linking two ideas **and** a point of similarity **or** difference with the other experiment e.g. (Herschel) moved a thermometer beyond the red end of the spectrum and the temperature increased **and** both (Herschel's and Ritter's) experiments use a prism to produce the spectrum (NB this last point could be shown in a labelled diagram) OR The sensitive paper that (Ritter) used turns black in visible light and it turns black quicker when moved beyond the violet end of the spectrum **and** (Ritter's) experiment shows ultraviolet rays but (Herschel's) experiment shows infrared rays (NB this last point could also be shown in a labelled diagram) • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 -6	• A detailed description including statements about each experiment that link ideas to show a point of similarity **AND** a point of difference e.g. (Herschel) measured the temperature of the colours and discovered a higher temperature beyond the red end **and** (Ritter) used sensitive (silver chloride) paper that turned black very quickly when moved beyond the violet end of the spectrum **and** both experiments use a prism to separate the colours of the spectrum **and** (Herschel's) experiment uses a thermometer instead of sensitive paper (already stated) • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

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Edexcel GCSE

Centre Number | Candidate Number

Physics/Science

Unit P1: Universal Physics

Higher Tier

Friday 2 March 2012 – Morning
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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Turn over for Question 1

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Energy transfers

1 Some students carry out investigations with an electric motor.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The students read the statement: 'All the energy supplied to the motor eventually ends up as thermal energy in the surroundings.'

This statement best describes the idea of

(1)

☒ **A** renewable energy

☒ **B** energy efficiency

☒ **C** sustainable energy sources

☒ **D** conservation of energy

(b) The students use the electric motor to lift a weight.
The current in the motor is 0.5 A.
The potential difference (voltage) across the motor is 6 V.

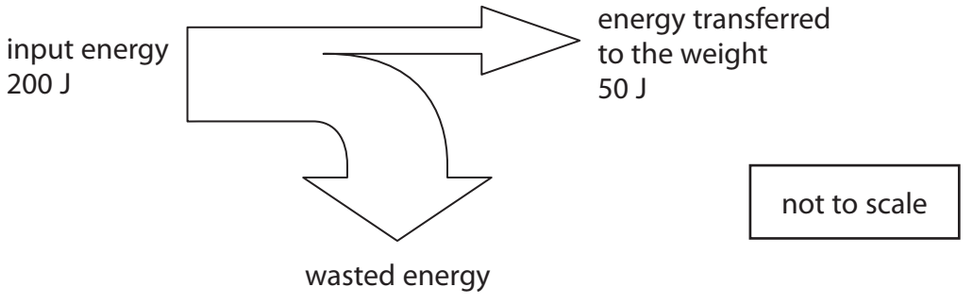
Calculate the input power to the motor.
State the unit.

(3)

input power = ... unit = ...

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(c) The diagram represents the energy transfers in the electric motor.



(i) How much energy is wasted?

(1)

wasted energy = ... J

(ii) Calculate the efficiency of the motor.

(2)

efficiency = ...

(d) The case of the motor is painted black.

Give a scientific reason why the case of the motor is painted black.

(1)

.....

.....

(Total for Question 1 = 8 marks)

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Earthquakes and seismic waves

2 (a) Earthquakes produce seismic waves and infrasound waves.

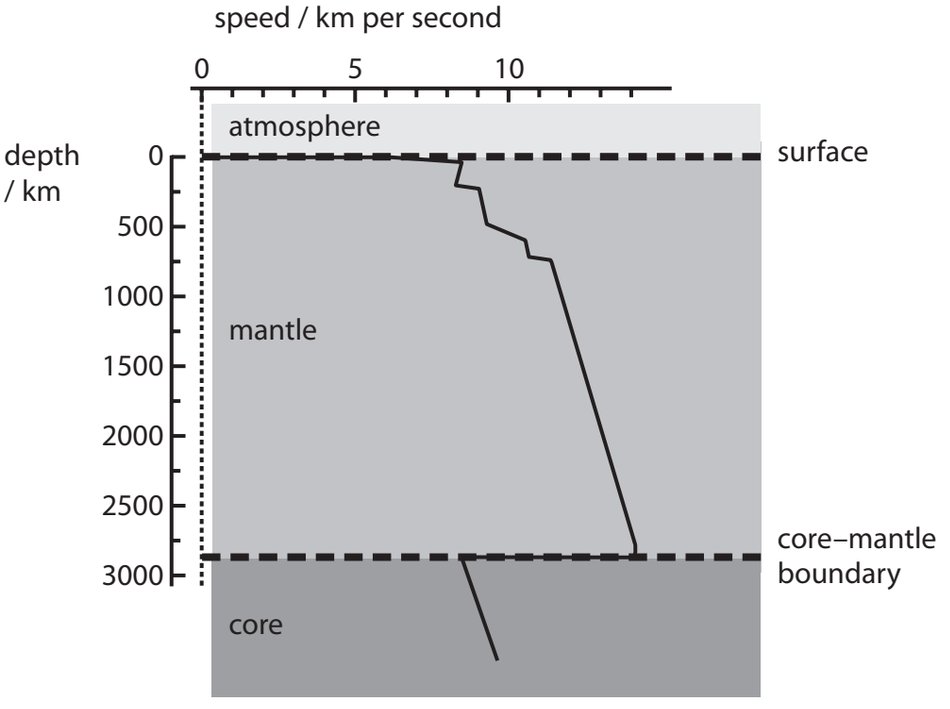
Which row of the table is correct for these waves?

Put a cross (☒) in a box to show your answer.

(1)

	seismic waves are	infrasound waves are
☒ **A**	longitudinal only	longitudinal and transverse
☒ **B**	longitudinal only	longitudinal only
☒ **C**	longitudinal and transverse	longitudinal and transverse
☒ **D**	longitudinal and transverse	longitudinal only

(b) The chart shows how the speed of P-waves varies with the depth in the Earth's mantle.



P 4 0 2 0 0 A 0 6 2 0

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(i) State what happens to a P-wave when it crosses from the mantle into the core.

(1)

.....

.....

(ii) Describe how the speed of a P-wave changes between a depth of 1000 km and 2500 km.

(2)

.....

.....

.....

.....

(iii) The average speed of a P-wave in the mantle is 12 km/s.
A P-wave travels vertically down from the surface and reflects from the core–mantle boundary back to the surface.
It travels a total distance of 5800 km.

Calculate the total time of travel for the wave.

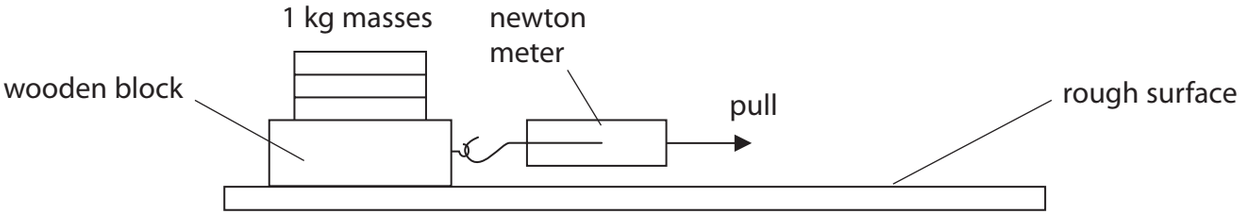
(3)

time = ... s

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(c) A class investigates the force needed to start a wooden block moving on a rough surface.

They use the apparatus shown.



Each student repeats the experiment five times.

A set of results for one student is shown in the table.

attempt	force needed to start block moving / N
1	30
2	57
3	26
4	48
5	39

All the students in the class get a similar wide range of results.

Explain what the results show about predicting earthquakes.

(2)

.....

.....

.....

.....

(Total for Question 2 = 9 marks)

P 4 0 2 0 0 A 0 8 2 0

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Turn over for Question 3

Solar power

3 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The output power of a solar panel is the rate of transfer of

(1)

☒ **A** current

☒ **B** electrons

☒ **C** energy

☒ **D** voltage

(b) A solar panel generates direct current.

(i) Describe the difference between direct current and alternating current.

(2)

.....

.....

.....

.....

(ii) The output from the solar panel is 60 V.

State why a transformer cannot be used to increase this voltage.

(1)

.....

.....

(c) Homeowners are being encouraged to fit solar panels to the roofs of their homes.

Explain why using solar panels to generate electricity for the National Grid benefits the environment.

(2)

.....

.....

.....

.....

.....

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(d) A homeowner fits a solar panel to her roof.
The cost of the solar panel is £4800.
The solar panel supplies an average of 800 kW h of electrical energy to the National Grid each year.
The homeowner is paid 40p for each kW h of energy supplied to the National Grid.

Calculate the payback time for the solar panels by selling energy to the National Grid.

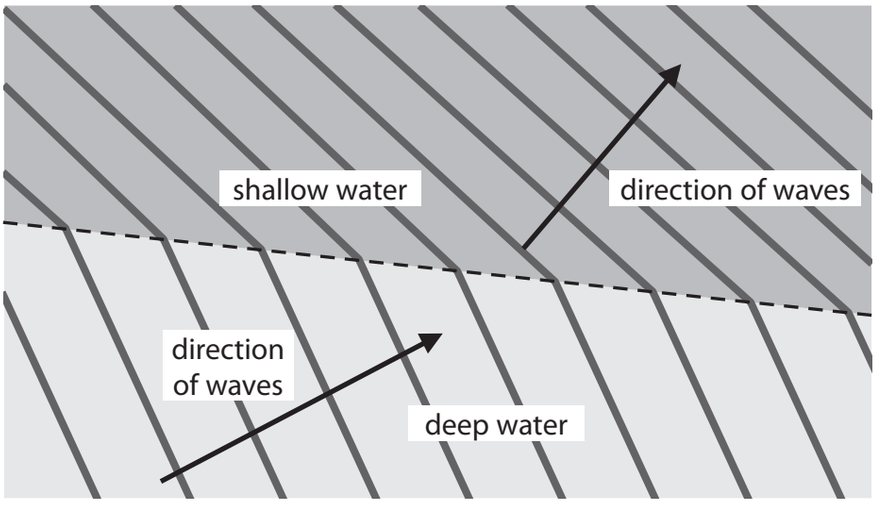
(3)

payback time = ... years

(Total for Question 3 = 9 marks)

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4 (a) The diagram represents water waves travelling from deep water into an area of much shallower water.



(i) State the name of the effect shown in this diagram.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

When the waves go from deep water to shallow water, the

(1)

☒ **A** frequency decreases

☒ **B** wavelength decreases

☒ **C** frequency increases

☒ **D** wavelength increases

(iii) Explain another change which can be seen from the diagram when the waves go from deep water to shallow water.

(2)

.....

.....

.....

.....

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(b) The velocity of the waves in deep water is 25 m/s.
The wavelength is 120 m.

Calculate the frequency of the waves.

(3)

frequency = ... Hz

(c) The photograph shows a floating buoy used to warn boats about shallow water.



The buoy has a lamp and a bell.

Explain the difference between transverse and longitudinal waves by referring to sound from the bell and the light from the lamp.

(3)

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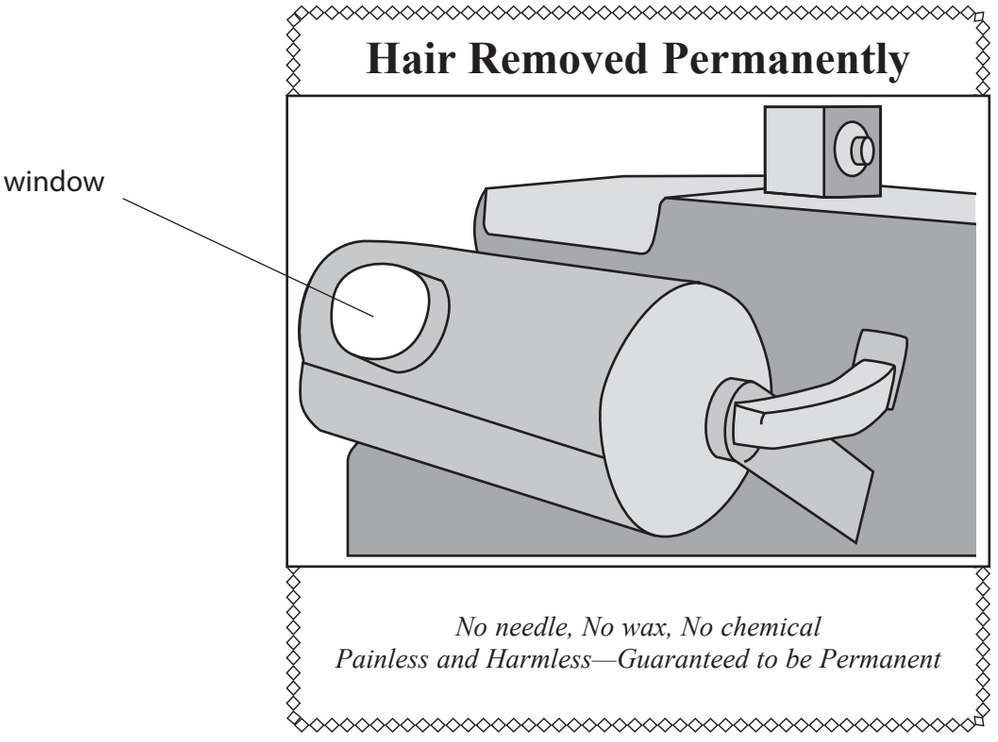
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(Total for Question 4 = 10 marks)

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Using X-rays

5 (a) The device shown in the picture was invented not long after the discovery of X-rays.
It emitted X-rays through the window.



In the 1920s, it was used to remove unwanted hair from the arm.
The patient placed her arm in front of the window.
The X-rays destroyed the hair roots.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

X-rays are

(1)

☒ **A** electromagnetic waves with very high frequency

☒ **B** electromagnetic waves with very long wavelength

☒ **C** electromagnetic waves which always have low energy

☒ **D** ionising radiations emitted by radioactive sources

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(ii) Some users believed that sunglasses would protect their eyes from the X-rays.

Explain how effective this would be as a precaution.

(2)

.....

.....

.....

(iii) This hair removal device was banned in 1940.
Many people who had used it for a long time had become seriously ill.

State **one** of the effects this machine may have had on them.

(1)

.....

.....

(iv) The device was advertised as 'harmless'.

Suggest why people used this device for many years.

(2)

.....

.....

.....

*(b) There is a hair removal device which is currently available in some specialist clinics. It uses a low energy infrared laser beam. The makers say that this is much less dangerous than the X-ray device.

By considering the dangers associated with both devices, discuss whether the infrared laser device should be put on general sale to the public.

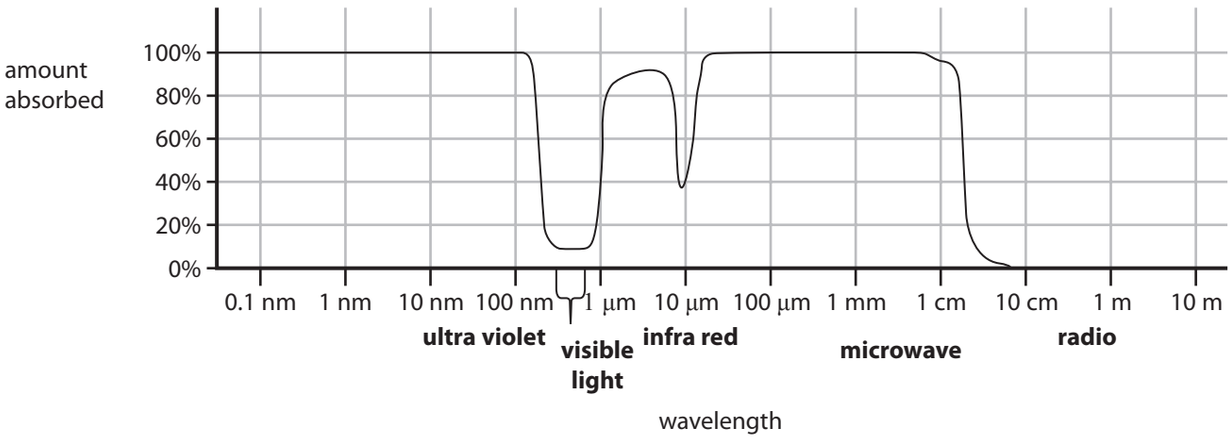
(6)

(Total for Question 5 = 12 marks)

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Observing the Universe

6 (a) The Earth's atmosphere absorbs electromagnetic radiation.
The diagram shows how the amount absorbed changes with wavelength.



(i) How much of the visible light from space is **absorbed** as it passes through our atmosphere?

Put a cross (☒) in a box to show your answer.

(1)

☒ **A** 0%

☒ **B** 10%

☒ **C** 90%

☒ **D** 100%

(ii) Large telescopes which collect visible light to explore the Universe are usually placed near the tops of mountains.
Suggest why radio telescopes do not have to be placed high up a mountain.

(1)

.....

.....

.....

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(iii) One theory of the origin of the Universe predicted that there should be cosmic background radiation with a wavelength of about 1 mm.

Explain why scientists had to wait until the development of space flight before they could study this radiation in detail.

(2)

(iv) The electromagnetic radiation from most galaxies has a red-shift.

Suggest why, when a galaxy has a very large red-shift, some of its visible light is not detected through the Earth's atmosphere.

(2)

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*(b) Scientists believe that the Universe is expanding.

Describe how careful observation of electromagnetic radiation from distant galaxies as well as from the whole of space gave evidence supporting the Big Bang Theory.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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GCSE Physics
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March 2012

Question Number	Answer	Acceptable answers	Mark
1(a)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 0.5 × 6.0 evaluation (1) 3 unit (1) W / watts	 give (2) for correct answer, no working 0.003 kW (3) 3 kW (2) J/s, VA Accept kW for unit with incorrect or no numerical answer	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	150 (J)	200 – 50 (J) 200 minus 50 (J)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	substitution (1) 50 ÷ 200 (x 100%) evaluation (1) 25 (%)	 0.25, 1/4 give (2) marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	(black) is a good {(thermal) emitter / radiator}	to keep the motor cool / eq ignore absorbing / conducting / insulating heat	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	(sudden) decrease in speed	refraction / change direction	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	a description linking • the (speed) increases (1) with any one of • as depth increases (1) • linearly (1) • from 11.8 to 14 (km/s) (1) • by 2.2	 accelerates travels further into the mantle / material becomes more dense steadily / evenly from >11 and < 12 to >13 and <14 2 to 3	 **(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	substitution (1) 12 = 5800 ÷ t transposition (1) t = 5800 ÷ 12 evaluation (1) 480 (s)	Substitution and transposition can be in either order 8 minutes A value which correctly rounds to 480 give full marks for correct answer, no working	 **(3)**

Question Number	Answer	Acceptable answers	Mark
2(c)	an explanation linking • impossible to predict earthquakes (1) with one of • (because) no pattern to {results/forces} (1) • (because) not able to predict force needed to make block start sliding (1) • the movement of (tectonic) plates is similar to the movement of the block (over the rough surface) (1)	difficult to predict results {(very) different/not (very) close/not concordant} as force needed for plates to start sliding is unpredictable (ignore references to strength of earthquake)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	a description including the following • direct current (the flow of charge) is only in one direction (1) • alternating current (the flow of charge periodically) {changes / reverses} {direction / eq} (1)	d.c stays {positive/negative} only goes positive and negative	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	any **one** of the following • transformers only change alternating {voltages / currents} • transformers will not work with direct current	It is {not alternating / direct} current	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking any **two** of the following • reduction of fossil fuels burnt (1) • less reliance on fossil fuels (1) • reduction of greenhouse gases / pollution/global warming (1) • increased use of renewable energy source (1) • less use of non-renewable energy source (1) • reduce need for additional power station building (1) • reduction of negative impact of specified type of power station (1)	conserving fossil fuel reserves reduction of correctly named pollutant / greenhouse gas solar energy is renewable fossil fuels are non-renewable	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	substitution (1) 800 x 0.4 / 800 x 40 evaluation of payment (1) (£)320 / 32000 (p) evaluation of payback time (1) 15 (years)	4800 / 0.4 = 12000 Kwh (to be sold) takes 12000 / 800 years substitution and transposition can be in either order allow power of 10 error in 15 for (2) give full marks for correct answer, no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	refraction	refracting	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	An explanation linking **two** of the following • change in direction (1) • towards the normal (1) • (resulting from) decrease in speed (1) • (because) the left hand part of the wavefront {hits the boundary first / slows down first} (1)	 bends Ignore away from normal change in speed (ignore increase in speed)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	substitution (1) 25 = 120 x f transposition (1) f = 25/120 evaluation (1) 0.21 (Hz)	substitution and transposition can be in any order 0.2 0.20 0.208(3...) give (3) marks for correct answer, no working Allow (2) marks for 20.8 stated with no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)	an explanation linking the following • light waves are transverse waves / sound waves are longitudinal (1) • in transverse waves oscillations are at right angle to the direction of travel (1) • in longitudinal waves oscillations are parallel to the direction of travel (1)	Allow up and down (or side to side) movement of lamp as evidence that water waves are transverse up and down. Side to side. 90^{o} labelled diagram correctly identifying both axes backwards and forwards, push and pull compressions and rarefractions	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
5 (a)(ii)	an explanation linking the following • very little effect / not effective (1) • X-rays can easily penetrate sunglasses (1)	would not protect eyes do not stop x-rays	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	cancer damage to cells damage to DNA damage to tissue damage to bones damage to skin damage to organs killing cells mutation mutating cells marks on skin sterilisation infertility re-arrangement of cell structure radiation poisoning	Ignore hair falling out	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iv)	A suggestion to include any **two** of the following • took a long time for effects to become apparent (1) • it was new /scientific (1) • risks not properly understood (1) • it removed hair successfully (1)	did not realise the damage it was doing believed that it was harmless / believed the advertisement people wanted to look attractive	**(2)**

Question Number		Indicative content	Mark
QWC	***5(b)**	A discussion to include some of the following facts • infrared frequency much lower than X-rays • X-rays very penetrating • X-rays potentially more dangerous to the operator • infrared can cause skin burns • laser is very concentrated • specialised clinics are controlled environments • safe operation depends on training • our knowledge of EM radiation is still not complete The discussion makes some of the following links • lower frequency of infrared makes it potentially less dangerous than X-rays • high penetration of X-rays makes it difficult provide adequate shielding • the concentration of energy by the infrared laser makes it more dangerous than otherwise • controlled environment of a clinic provides better safety and more thorough training • difficulty of ensuring proper maintenance /correct dosage if used domestically • lack of knowledge could mean there are long term effects still not known The discussion makes some of the following conclusions • easier shielding of infrared compared to X-rays means there is less risk to operators and /or patient • difficulty of ensuring proper control means it is not suitable for domestic use • lack of full understanding of long term effects means it is better to err on side of caution	**(6)**
Level	**0**	No rewardable material	
1	**1-2**	• the discussion gives at least two basic facts with no links OR a fact and a conclusion with no links e.g. Infrared can cause burns so it could be dangerous. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• the discussion gives a link (or comparison) between at least two facts for infrared and X-rays, eg. infrared has lower frequency than X rays so is less dangerous. We do not know enough about the dangers of infrared and it could still burn you • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed discussion which has at least two links or comparisons supporting a justified conclusion (about selling or dangers) eg. infrared has lower frequency than X rays so is potentially less dangerous but without proper training there is a danger of overexposure if people used it at home (therefore it should not be sold to the public) • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	radio waves are not absorbed by the atmosphere	not affected by {light pollution / clouds}	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a) (iii)	an explanation including **two** of the following • 1 mm waves are in the microwave region (1) • which is (completely) absorbed by atmosphere (1) • space flight enabled telescopes to be put above atmosphere /in space (1)	 they are microwaves cannot be (easily) detected on Earth we needed to go above atmosphere / into space	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iv)	an explanation linking the following • light might be shifted into infrared region (1) • (some) infrared is (strongly) absorbed by atmosphere (1)		**(2)**

Question Number		Indicative content	Mark
QWC	***6(b)**	A description to include some of the following facts: • observation of visible light led to discovery of red-shift. • galaxies are moving away from each other • CMBR detected in radio telescopes • space telescopes (such as COBE) gave more detail of CMBR • Big Bang and Steady State theories were proposed • distances to galaxies could be determined • Big Bang could explain red-shift • Steady State could explain red-shift The description gives some of the following details: • red-shift means lower frequency / longer wavelength • red-shift was greatest for the most distant galaxies • red-shift means universe is expanding • Big Bang / Steady State can explain an expanding universe • only Big Bang could explain CMBR • CMBR is residual radiation from the Big Bang The description gives some of the following reasons for scientists beliefs • observation of increasing red-shift with distance is a reason to believe in expanding universe	**(6)**
Level	**0**	No rewardable material	
1	**1-2**	• a limited description of either red-shift or CMBR, e.g. light from galaxies was red-shifted OR Red-shift is evidence for Big bang. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a description giving full detail of either red-shift or CMBR OR some detail of both red-shift and CMBR, e.g. light was seen to be shifted towards a longer wavelength. This means that the galaxies are moving away from each other. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 -6**	• a detailed description of how both red-shift and CMBR give supporting evidence for the Big Bang theory, e.g. light was seen to be shifted towards a longer wavelength. This means that the galaxies are moving away from each other so the Universe must be expanding. This is evidence for the Big Bang theory. Cosmic Background Radiation coming from all directions provides further evidence for the Big Bang. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Physics/Science

Unit P1: Universal Physics

Higher Tier

Wednesday 9 November 2011 – Morning **Time: 1 hour**	Paper Reference **5PH1H/01**

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

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Turn over ▶

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FORMULAE

You may find the following formulae useful

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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Question 1 Starts on Page 4

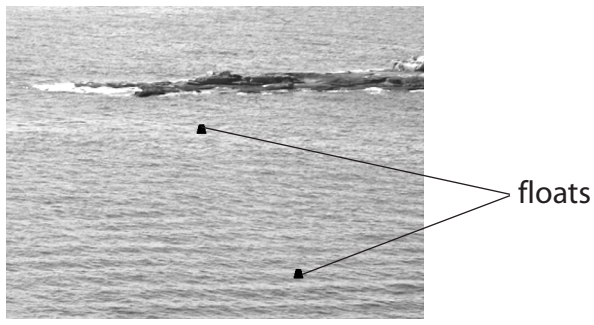
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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Waves carrying information

1 The photograph shows a wave in a bay.
The wave was made by a passing boat.



(a) Which of these best describes what is transferred by the water wave?

Put a cross (☒) in the box next to your answer.

(1)

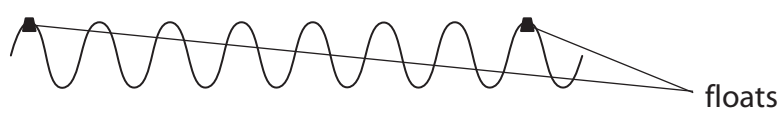
☒ **A** energy only

☒ **B** water only

☒ **C** both water and energy

☒ **D** neither water nor energy

(b) The diagram shows the wave as it passes by the two floats.



(i) The wavelength of the wave is 0.8 m.

Calculate the distance between the floats.

(2)

distance = ... m

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(ii) The frequency of the wave is 0.4 Hz.

How many complete wavelengths pass each float in 20 s?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 0.02

☒ **B** 0.8

☒ **C** 8

☒ **D** 50

(iii) A man on the shore observes the wave.

Suggest **one** piece of information the man could gain about the boat by observing the wave that made it.

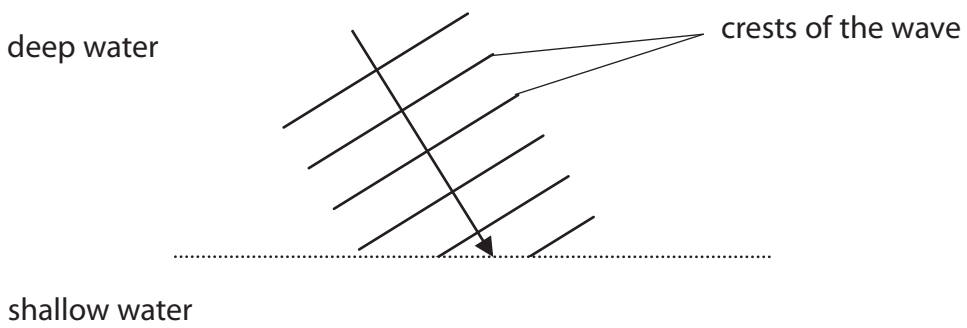
(1)

.....

.....

(c) The wave reaches shallow water before it reaches the shore.
Water waves travel more slowly in shallow water.

The diagram shows the wave as it reaches the shallow water.



Complete the diagram to show how the wave travels in the shallow water.

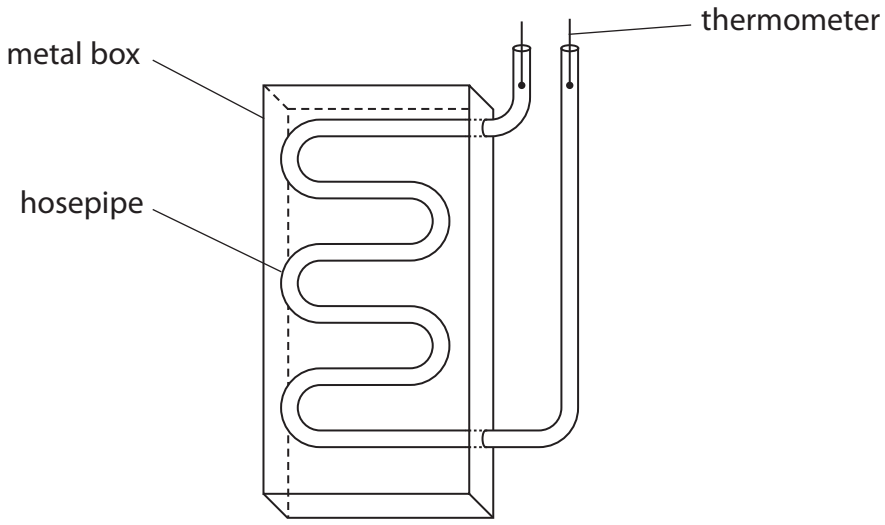
(3)

(Total for Question 1 = 8 marks)

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Solar heater

2 A student makes a solar water heater using a hosepipe.
He paints the hosepipe black and fills it with water.
He coils the hosepipe and fixes it into an open metal box as shown.



The student puts a thermometer in each end of the hosepipe.
The Sun shines on the hosepipe and heats the water.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The hosepipe is painted black because blackened surfaces are

(1)

☒ **A** good emitters of radiation

☒ **B** poor emitters of radiation

☒ **C** good absorbers of radiation

☒ **D** poor absorbers of radiation

(b) At first, the temperature of the water in the pipe increases.
After a while, the temperature becomes constant.

(i) Suggest **two** changes to the box which would increase the constant temperature reached.

(2)

1 .....

.....

2 .....

.....

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(ii) Explain why the water reaches a constant temperature.

(3)

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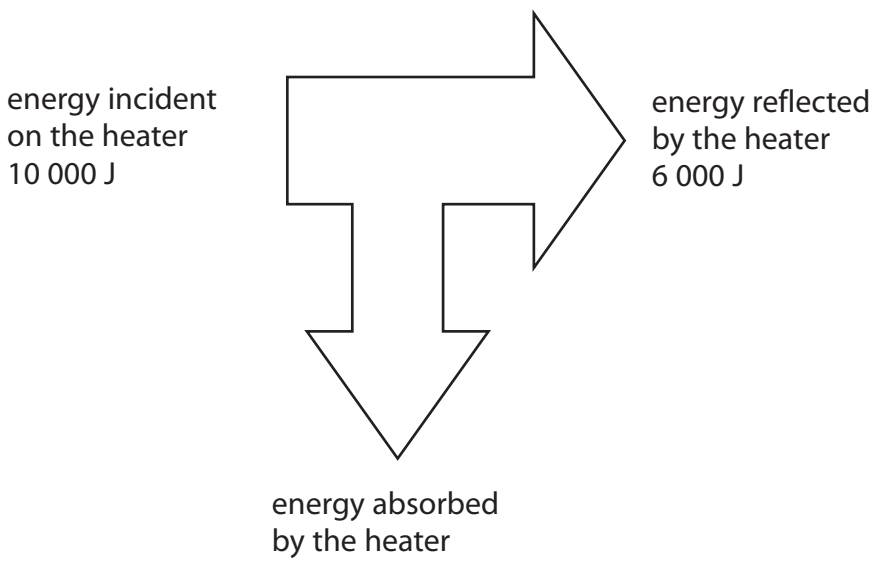
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(c) Some of the solar energy incident on the solar water heater is reflected.
The rest is absorbed.

The diagram gives some information about energy transfer during the first 200 s.



Calculate the power absorbed by the heater.

(2)

power = ... W

(Total for Question 2 = 8 marks)

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Electromagnetic waves

3 (a) Complete the sentences by putting a cross (☒) in the box next to your answer.

(i) All electromagnetic waves are

(1)

☒ **A** longitudinal and have the same amplitude in a vacuum

☒ **B** longitudinal and have the same speed in a vacuum

☒ **C** transverse and have the same amplitude in a vacuum

☒ **D** transverse and have the same speed in a vacuum

(ii) All electromagnetic waves have both uses and dangers.

Their potential danger increases when

(1)

☒ **A** frequency decreases and wavelength decreases

☒ **B** frequency increases and wavelength decreases

☒ **C** frequency decreases and wavelength increases

☒ **D** frequency increases and wavelength increases

(b) Some microwaves have a frequency of 1.5×10^{10} Hz.
They travel at a speed of 3.0×10^{8} m/s.

Calculate their wavelength.

(3)

wavelength = ... m

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(c) Infrared is used in an electric toaster.
Infrared is also used by a television remote control.



electric toaster



television remote control

Explain why using a television remote control does not burn anyone.

(2)

(d) Gamma rays can cause cancer.
Gamma rays can also be used to treat cancer.

Explain how gamma rays can do both.

(3)

(Total for Question 3 = 10 marks)

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P 4 0 1 7 9 A 0 1 0 2 0

Infrasound and earthquakes

4 (a) Which row of the table is correct for both infrasound radiation and infrared radiation?

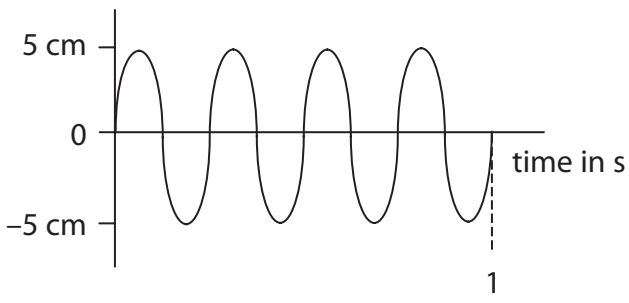
Put a cross (☒) in the box next to your answer.

(1)

	infrasound	infrared
☒ **A**	transverse	transverse
☒ **B**	transverse	longitudinal
☒ **C**	longitudinal	transverse
☒ **D**	longitudinal	longitudinal

(b) State the amplitude of this sound wave.

(1)



amplitude = ...

(c) Describe how infrasound differs from ultrasound.

(2)

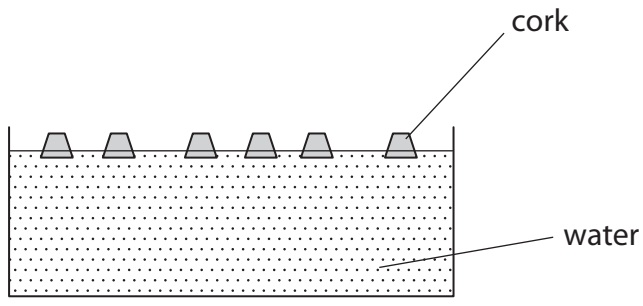
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(d) Earthquakes are sometimes caused when plates in the Earth's crust move.
The diagram shows some corks floating on water.

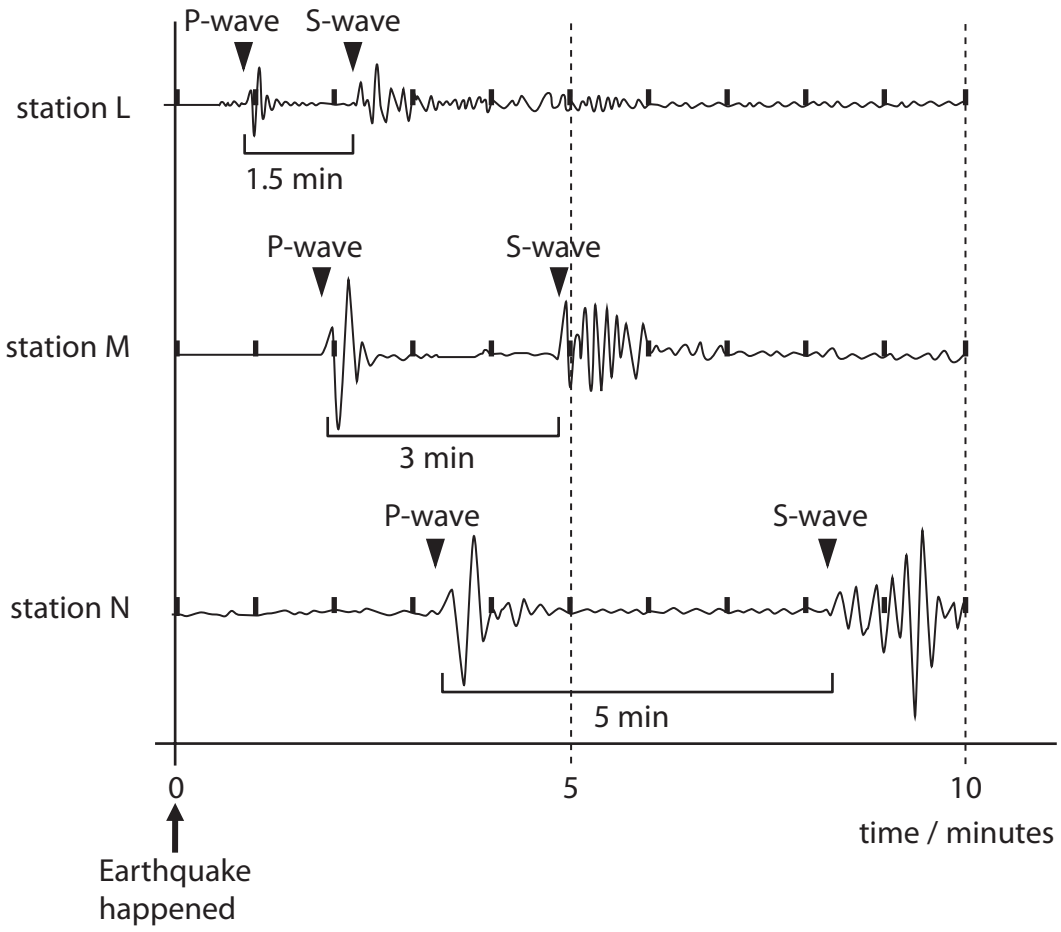


Explain how this model of corks on water could be used to demonstrate what causes the Earth's plates to move.
You may add to the diagram to help with your answer.

(3)

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(e) The movement of the Earth's plates can cause earthquakes.
The charts show the waves arriving at three research stations from the same earthquake.



A student suggested that the time between the arrival of the P-wave and the S-wave was proportional to the distance of the station from the earthquake.

Use the charts to evaluate whether this is correct or not.

(3)

(Total for Question 4 = 10 marks)

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Stars and the Universe

5 (a) The photograph shows a nebula and many stars.



(i) A nebula is a cloud of gas and dust from which stars are formed.

Describe the energy changes involved when a main sequence star forms from gas and dust.

(3)

(ii) Describe how the mass of a main sequence star will affect what the star finally becomes.

(3)

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*(b) While the origin of stars is well understood, there is still much debate about the origin of the Universe.
Two major theories about the origin of the Universe are the Big Bang and the Steady State theories.

Some evidence supports both theories.
Other evidence supports only one theory.

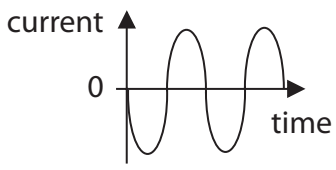
By considering the evidence, discuss why one of these theories is preferred by most scientists.

(6)

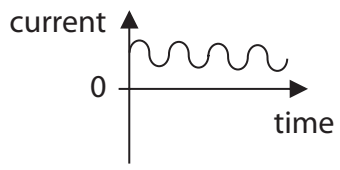
(Total for Question 5 = 12 marks)

Distribution of electricity

6 (a) Scientists say that graph 1 shows an alternating current while graph 2 shows a direct current.



graph 1



graph 2

The two graphs differ in several ways.

State the difference between the currents which makes one alternating and the other direct.

(1)

.....

.....

(b) A transformer is 100% efficient.

It has 200 turns on the primary coil and 3000 turns on the secondary coil.
The input voltage is 55 V.

(i) Show that the output voltage is about 800 V.

(3)

P 4 0 1 7 9 A 0 1 6 2 0

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(ii) Calculate the current in the secondary coil when the current in the primary coil is 0.50 A.

(2)

current in secondary coil = ... A

*(c) The diagram shows how electricity produced at a power station is transmitted to distant houses.



Transformers R and S are not 100% efficient.
By using transformers, energy losses in the transmission lines are reduced.

Explain how this reduction is achieved, even though some energy is wasted in the transformers themselves.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

November 2011

GCSE Physics
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5PH1H/01 Mark Scheme
November 2011

Question Number	Answer	Acceptable answers	Mark
1(a)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	(number of waves =) 7 (1) (distance between floats =)7 × 0.8 (1)	**Accept** 5.6 (m) give full marks for correct answer, no working e.c.f from number of waves if clear 6.4 (m) for 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	Any **one** from the following points • size (1) • mass (1) • speed (1) • direction of travel (1)	small light slow fast momentum how far away weight power ke	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	• change of direction (1) • towards the normal (1) • λ shorter than in deep water (1)	Ignore reflection of EITHER ray or wave must not reach normal if ray and wave contradict then no mark λ shorter for all complete waves in shallow water, at least 2 λ drawn, judge by eye	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	Any **two** from the following points • cover box with transparent material (1) • use of reflector (1) • method to increase energy supplied (1) • method to reduce energy loss (1) • paint (box) black/dull/matt (1)	use glass box mirror / foil {angle to sun} / {warmer place}/lens use insulating box / wooden box / lagging Ignore answers to do with hosepipe	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	An explanation linking the following points • pipe / water absorbs heat (1) • pipe radiates heat (1) • radiation (rate) increases with temperature(1) • (at constant temperature) absorption <u>rate</u> = radiation <u>rate</u> (1)	accept takes in for absorbs accept emits for radiates If no other marks given accept output = input or water boils for 1 mark	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(c)	4000 (1) (4000)/200 (1)	20 (W) give full marks for correct answer, no working accept for 1 mark 4000 10000/200 6000/200 16000/200	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	substitution: (1) $3.0 \times 10^{8} = 1.5 \times 10^{10} \times \lambda$ transposition: (1) $\lambda = c/f$ or $(\lambda =) \frac{3.0 \times 10^{8}}{1.5 \times 10^{10}}$ evaluation: (1) 0.02 (m)	Give full marks for correct answer, no working **Allow** substitution and transposition in either order if clear **Ignore** powers of 10 until evaluation e.g. 3/1.5 2 marks $\lambda = f/c$ (0) then 1.5/3 1 mark bald 1.5/3 0 mark 2×10^{-2} (m) ignore formula triangle	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking **two** of the following points • wavelength / frequency (1) • are different (1) **OR** • toaster on for longer (1) • (so) much more energy (1)	wavelength for toaster different from wavelength for remote. Scores 2 power / intensity of toaster greater than for remote for 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	An explanation linking **three** of the following points • gammas change cell growth / eq (1) • (so can) cause uncontrolled growth (1) • (but also can) be focussed to (kill cancer cells)(1) • without damaging other cells	kill / damage cells mutate/damage DNA concentrated / aimed at tumour / penetrate	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	5 (cm)	5.0, +5, -5, ±5 ignore unit	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	• A difference in f or λ (however described) (1) This difference correctly qualified by one of • Relationship to each other (1) • Relationship to audible sound (1) • Frequency or wavelength data (1)	Accept pitch for frequency IS has longer λ than audible (1) US>20kHz (1) IS has lower f (than US) (2 marks) information shown on a labelled sketch of the sound spectrum	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	An explanation linking the following points • corks as plates / water as mantle (1) • water heated (underneath) (1) • convection currents mentioned(1)	labels on diagram corks as crust / water as magma /lava reference to heat in the Earth arrow on diagram	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(e)	An evaluation linking the following points • (a)statement about either distance travelled or arrival times of any two waves (1) • (b)statement comparing any pair of S-P times (1) • correct comparison between (a) and(b)leading to a conclusion (1)	quantitative or qualitative quantitative or qualitative quantitative e.g. #1 station M is twice as far as station L, the S-P time is double, suggestion is OK. 3 marks e.g. #2 station N is (about) 3½ times as far as station L, but S-P time is 3⅓ times, so maybe not. 3 marks	**(3)**

(

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	A description including **three** of the following points • {gravitational (potential) energy / GPE} of gas and dust (1) • (GPE) changes to kinetic energy (1) • (ke) changes to thermal/heat/light (1) • (hot enough to release) nuclear energy (1)	Accept description of the process {gas and dust / it / nebula} pulled together by gravity (particles) move faster core becomes hot (hot enough for) nuclear fusion/reaction accept description shown as chain gpe → ke → thermal → nuclear	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	A description including the following points • reference to stars of different sizes (1) • {Sun/small/medium} becoming {white / black} dwarf (1) • more massive becoming a neutron star / black hole (1)	Sun and more massive/bigger star red giant / planetary nebula (red) supergiant / supernova	**(3)**

Question Number		Indicative content	Mark
QWC	***5(b)**	A discussion linking some of the following points red shift • linked to movement • both theories have expanding Universe • redshift support both CMB • linked to ageing Universe • Big Bang ageing , SS not • CMB supports Big Bang only • because only Big Bang has single origin	**(6)**
Level	**0**	no rewardable material	
1	**1-2**	• a **limited discussion** stating both pieces of evidence **or** limited detail about either red shift or CMB e.g. change in wavelength /red shift shows galaxies / stars moving away • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a **simple discussion** including both pieces of evidence **and** simple detail about **either** red shift **or** CMB e.g. a change in wavelength shows galaxies / stars moving away • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a **detailed discussion** describing both pieces of evidence and drawing a conclusion e.g. a change in wavelength shows galaxies / stars moving away **and** CMB shows Universe has been changing with time **and** redshift supports both theories, CMB supports only Big Bang because Steady State has constant Universe • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	alternating current can take positive and negative values RA (1)	a.c. above and below zero /the line a.c. goes one way and then the other RA	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	substitution: (1) $\frac{55}{V} = \frac{200}{3000}$ transposition: (1) $V = \frac{3000}{200} \times 55$ evaluation / comment: (1) 825(V) / which is about 800 (V)	**Allow** substitution and transposition in either order if clear $\frac{55}{\mathbf{825}} = \frac{200}{3000}$ scores 3 $\frac{55}{\mathbf{800}} = \frac{200}{3000}$ scores 1 Correct comparison of ratios scores 3 (15 and 14.5, 0.067 and 0.069)	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	• power input = power output (1) • I = 0.033 (A) (1)	power input = 55 x 0.5 (W) power input = 27.5 (W) I = 0.034 (A) Give full marks for correct answer no working	**(2)**

Question Number		Indicative content	Mark
QWC	***6(c)**	An explanation linking some of the following points **Basic ideas** • transmission lines have resistance • the current warms the transmission wires • energy is wasted as heat • transformers change voltage and/or current • R increase the voltage / RA for S • R decrease the current / RA for S **Linked ideas** • the long transmission lines have high resistance • power depends on both current and voltage • power = current × voltage ($P = I \times V$) • at high voltage, the same power needs less current • correct mention of turns ratio related to voltage change • a smaller current in a wire produces less heat • high voltage transmission saves more energy than is lost in the transformers	**(6)**
Level	**0**	no rewardable material	
1	**1-2**	• a limited explanation including some relevant details e.g. R steps up the voltage, S steps it down • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a simple explanation relating operation of transformers to heat loss in transmission lines and/or transformers e.g. R steps up the voltage so that less heat is lost in transmission lines **or** high voltage transmission saves more energy than is lost in the transformers • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation relating operation of transformers to current and energy losses in transmission lines and/or transformers e.g. R steps up the voltage so that, for the same power, I is less meaning less heat is lost in transmission lines • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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