Write your name here

Surname	Other names

Centre Number | | | | | |

Candidate Number | | | | |

Edexcel GCSE

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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P 4 1 9 4 3 A 0 1 2 4

PEARSON

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 ☒.

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)

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(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)

.....

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.....

(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

(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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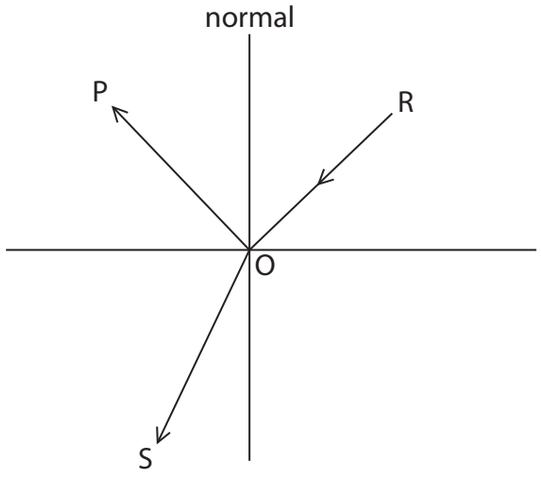
Refraction, telescopes and the Solar System

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)

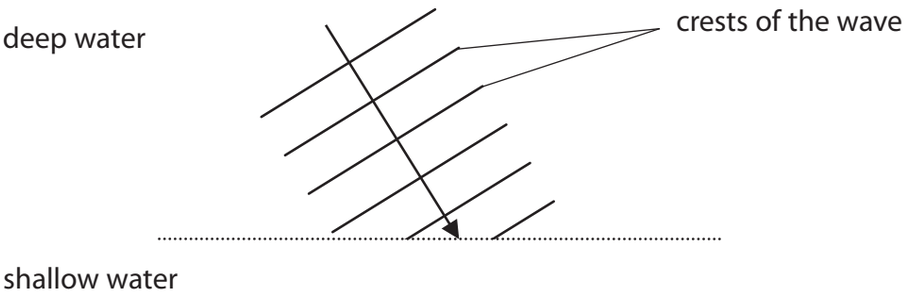
☒ **A** POS

☒ **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)

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

Explain how Galileo's observations contradicted the geocentric model.

(3)

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(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)

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

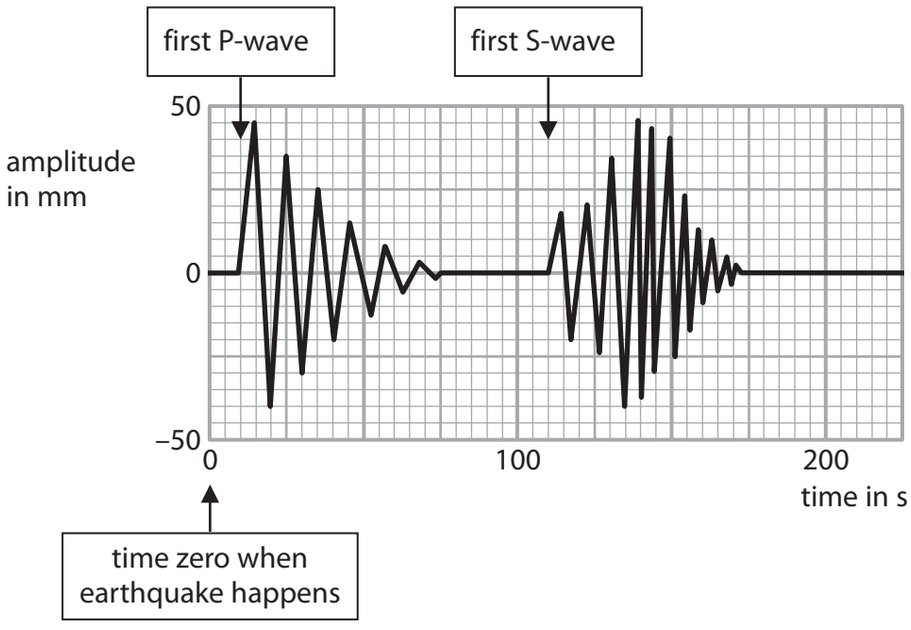
(b) The Earth's surface is made up of many tectonic plates.
The interior of the Earth is a source of thermal energy.

Describe how this thermal energy can cause earthquakes.

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

(3)

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



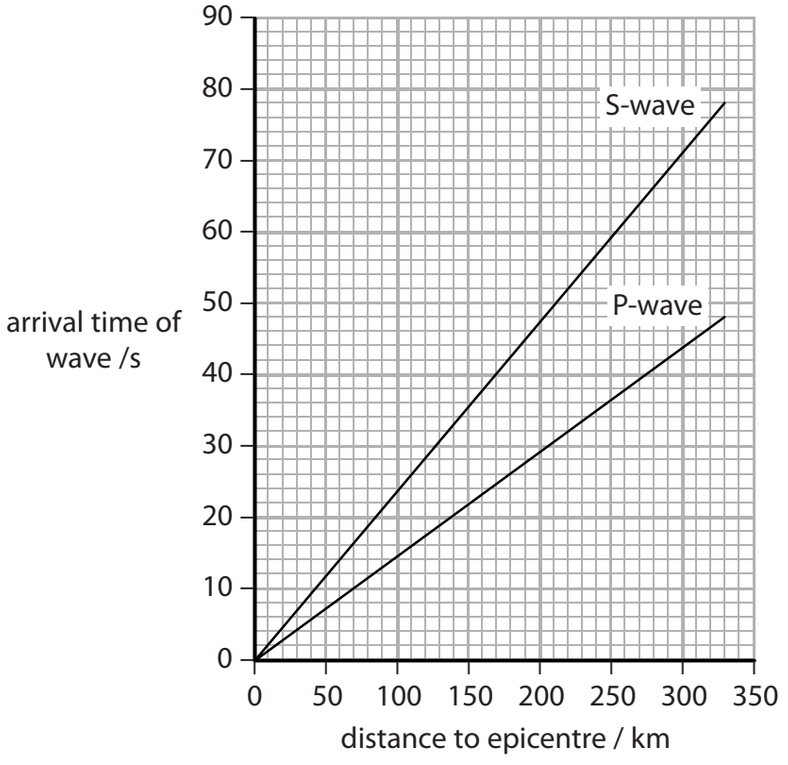
The S – P time (S minus P time) for earthquake waves is the time difference between the arrival of the first P wave and the first S wave.

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

(2)

S – P time = ... seconds

(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

(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)

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)

.....

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(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

*(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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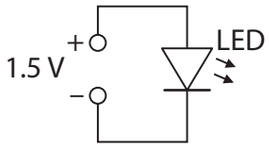
Using light emitting diodes (LEDs)

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

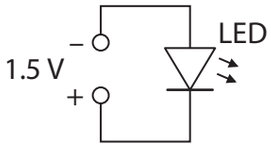
(1)

.....

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



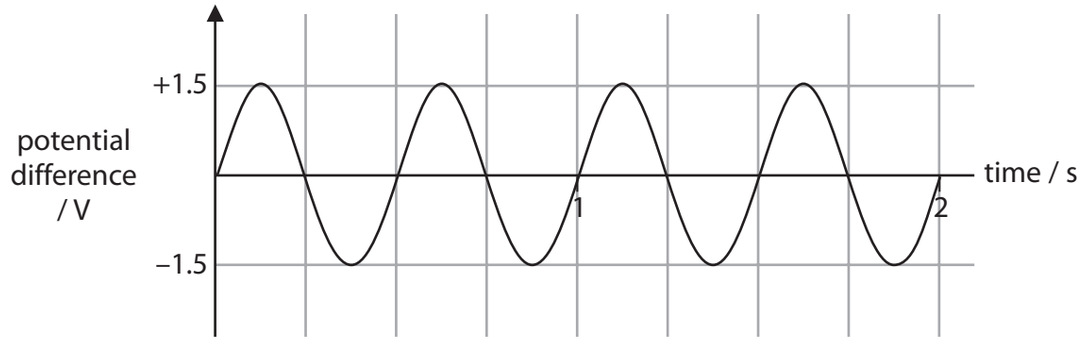
LED emits light



LED does **not** emit light

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

(2)



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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

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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