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

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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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

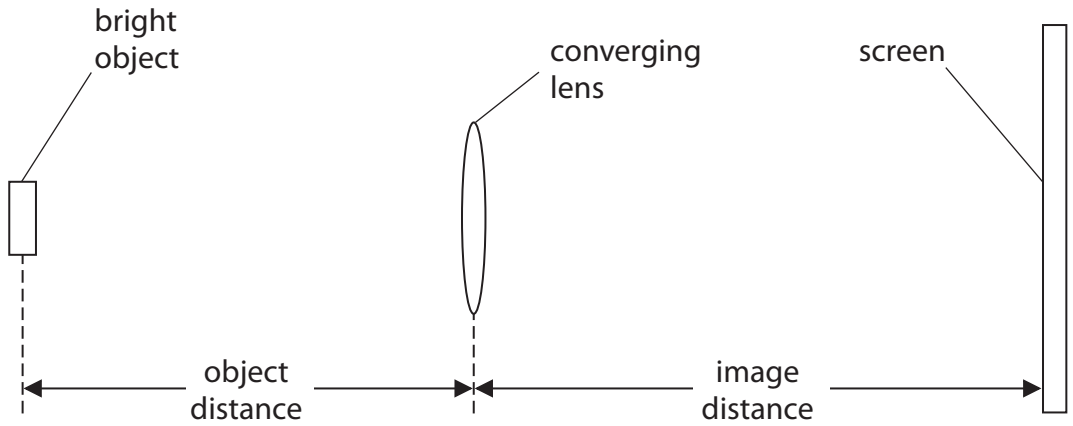
1 Improvements in scientific equipment have made it possible for scientists to observe the Universe in greater detail.

(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

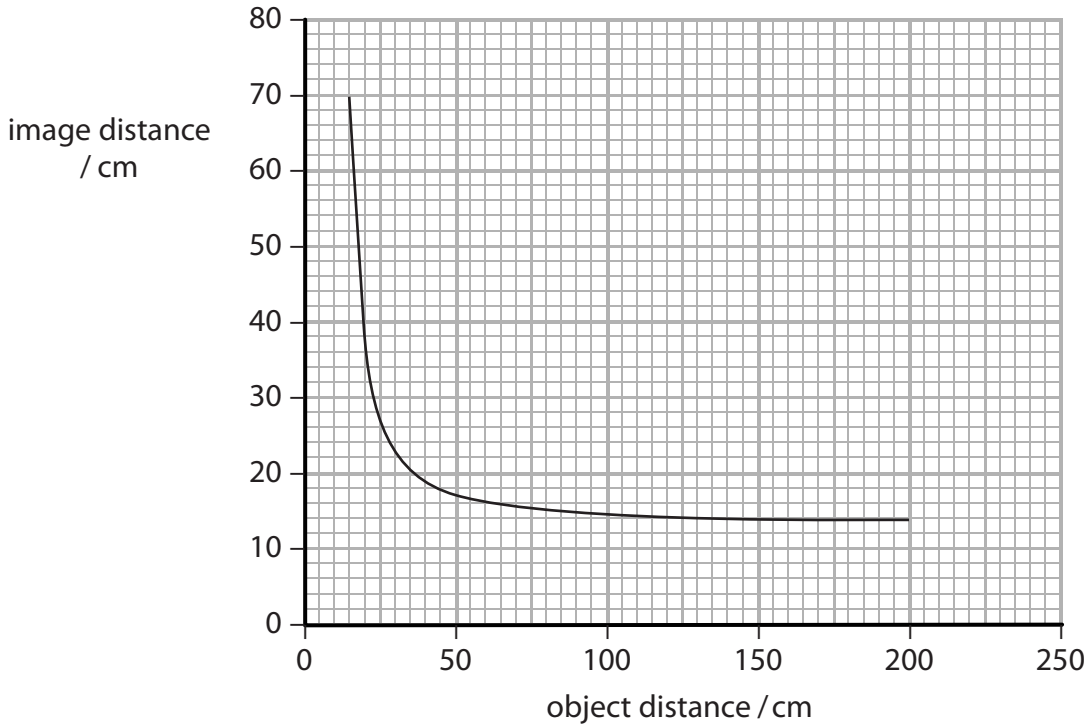
☒ **A** upright and real

☒ **B** inverted and real

☒ **C** upright and virtual

☒ **D** inverted and virtual

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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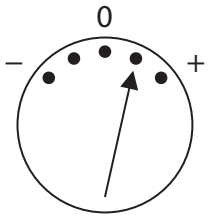
(Total for Question 1 = 8 marks)

2 A meter is connected to a coil of wire.

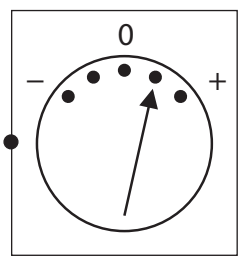
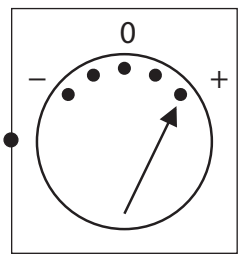
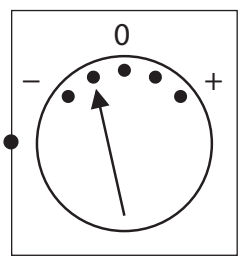
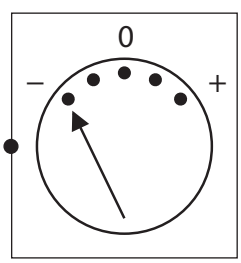
When the **south** pole of a magnet moves into the top of the coil, the meter looks like this.



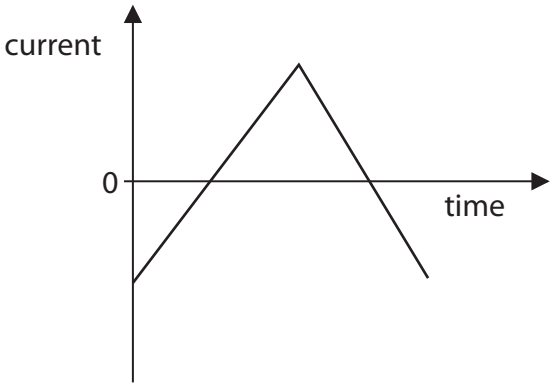
(a) Draw a line from each 'movement of the magnet' to the 'appearance of the meter'.

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

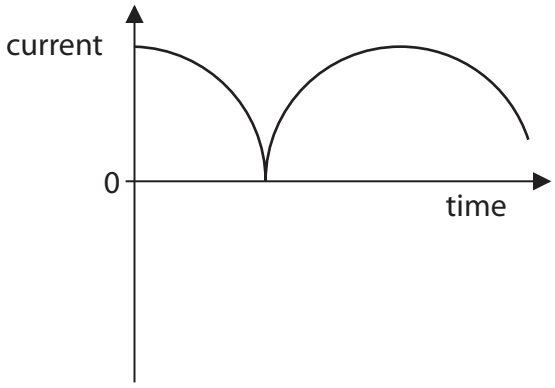
(2)

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	
	

(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.

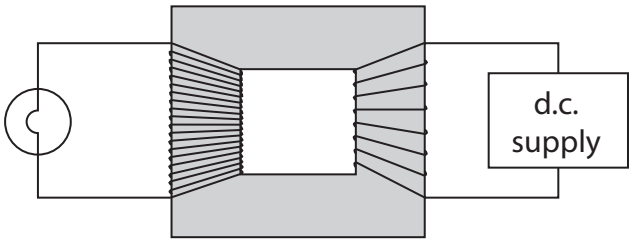


Diagram 1

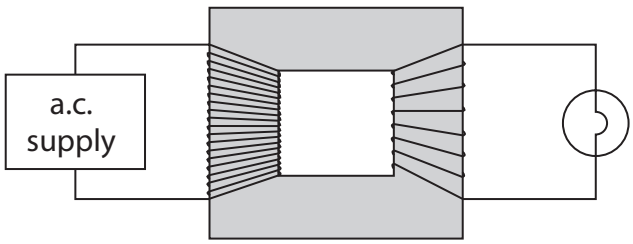


Diagram 2

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)

(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)

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

(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)

.....

.....

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.....

(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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.....

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(Total for Question 3 = 10 marks)

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

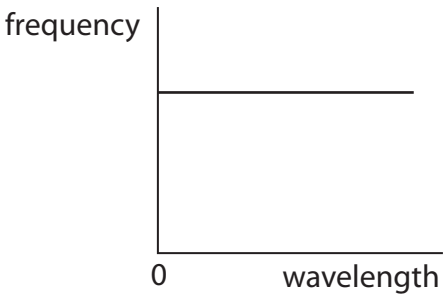
(ii) X-rays and gamma rays are electromagnetic waves.

Which of these graphs is correct for electromagnetic waves?

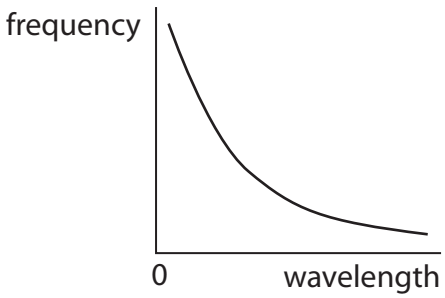
Put a cross (☒) in the box next to your answer.

(1)

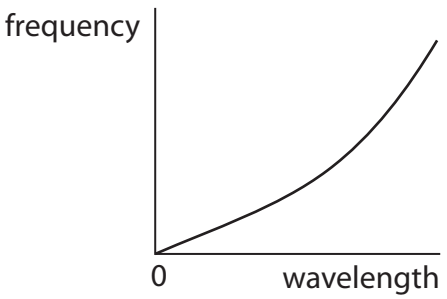
☒ **A**



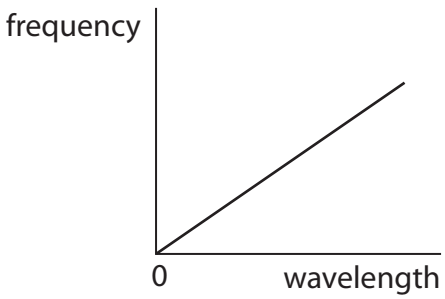
☒ **B**



☒ **C**



☒ **D**



(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)

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)

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

(2)

(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

*(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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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

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

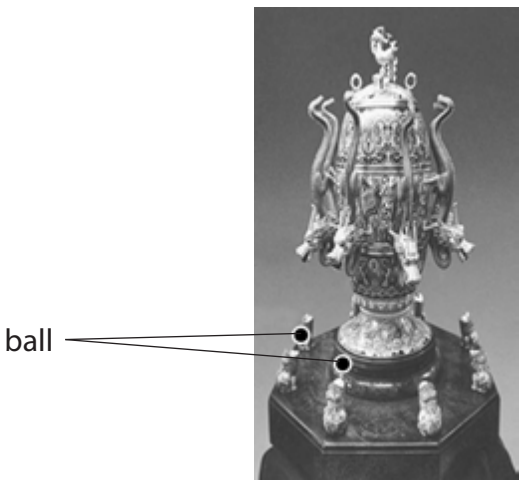
Each instrument had 'Dragons' and 'Toads' as shown in photograph 1.

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.

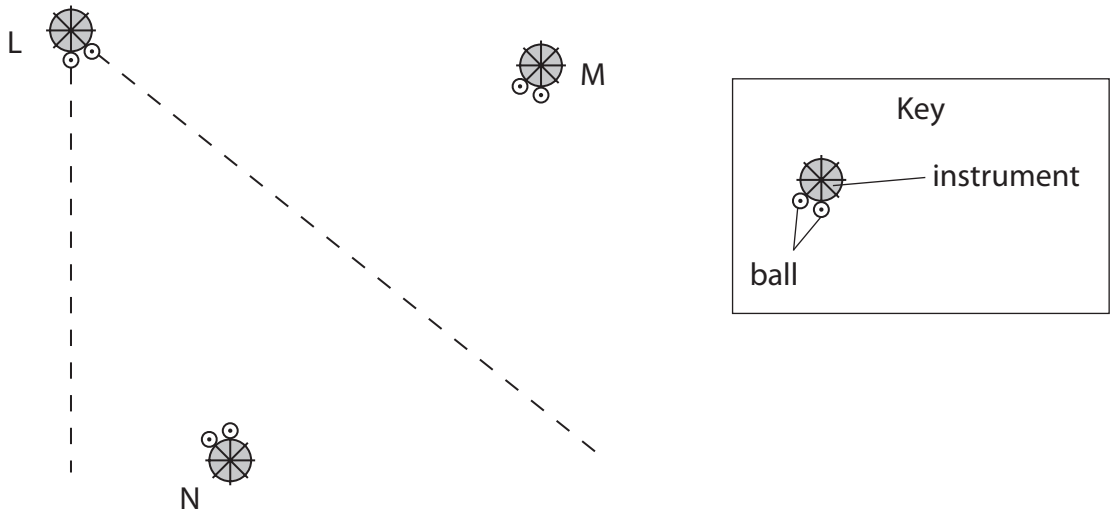
The balls have been caught by two toads below the dragons.

Balls only drop in the direction towards the earthquake.

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

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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