Paper Reference(s) 5PH1H/01
Edexcel GCSE

Physics/Science
Unit P1: Universal Physics
Higher Tier

Thursday 24 May 2012 – Morning
Time: 1 hour plus your additional time allowance

INSTRUCTIONS TO CANDIDATES
Write your centre number, candidate number, surname, initials and your signature in the boxes below. Check that you have the correct question paper.

Centre No.								
Candidate No.								
Surname								
Initial(s)								
Signature								
Paper Reference	5	P	H	1	H	/	0	1

Q40242A

PEARSON

Use BLACK ink or ball-point pen.
Answer ALL questions.
Answer the questions in the spaces provided – there may be more space than you need.

MATERIALS REQUIRED FOR EXAMINATION

Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS

Nil

INFORMATION FOR CANDIDATES

- **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 TO CANDIDATES

- **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.**

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

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

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

$$\frac{\text{primary voltage}}{\text{secondary voltage}} =$$

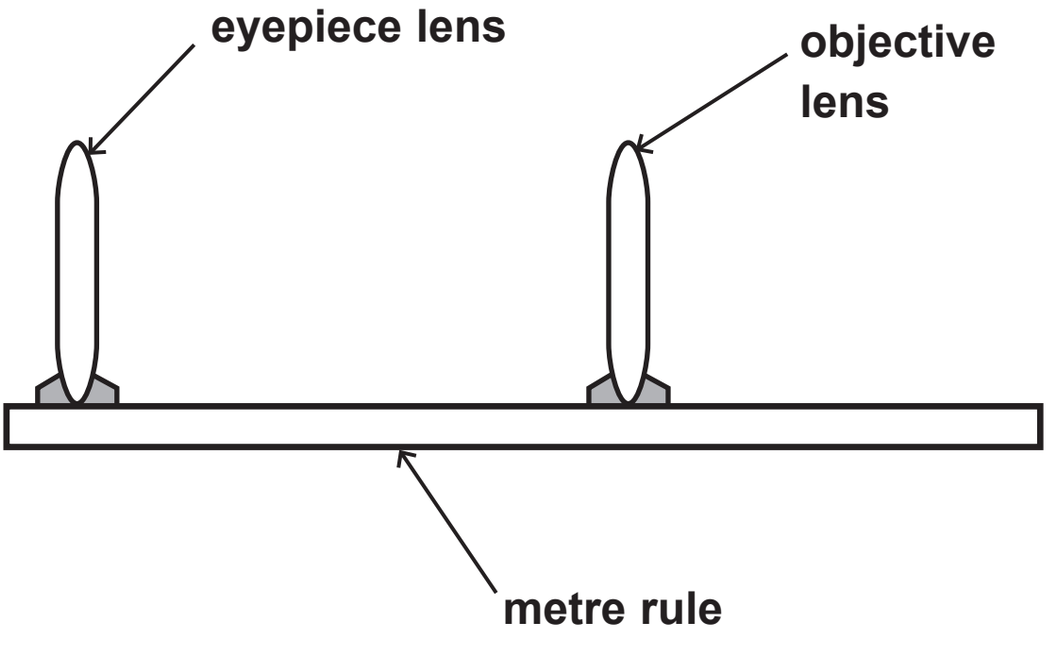
$$\frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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.



(Question continues on next page)

(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 mark)

- ☐ **A** concave
- ☐ **B** converging
- ☐ **C** diverging
- ☐ **D** reflecting

(Question continues on next page)

(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 mark)

☐ A the right way up and smaller

☐ B the right way up and bigger

☐ C upside down and smaller

☐ D upside down and bigger

(Question continues on next page)

(ii) Describe how the position of this image can be shown. (2 marks)

(c) State the purpose of the eyepiece. (1 mark)

(Question continues on next page)

(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 marks)

time = _____ s

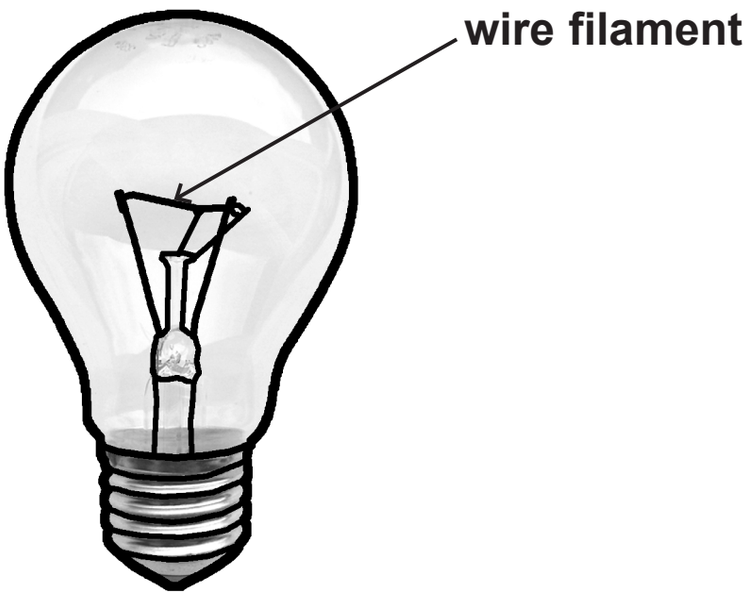
Q1

(Total 8 marks)

(Questions continue on next page)

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 marks)

(ii) Draw a labelled energy flow diagram to show what happens to 100 J of electrical energy supplied to the lamp. (2 marks)

(Question continues on next page)

(b) Many people choose to buy expensive low-energy lamps instead of cheaper filament lamps.

Give TWO reasons for this. (2 marks)

(Question continues on next page)

(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 marks)

Q2

(Total 9 marks)

(Questions continue on next page)

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 marks)

(Question continues on next page)

(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 mark)

☐ A the amplitude of infrasound is too big

☐ B the frequency of infrasound is too low

☐ C the speed of infrasound is too fast

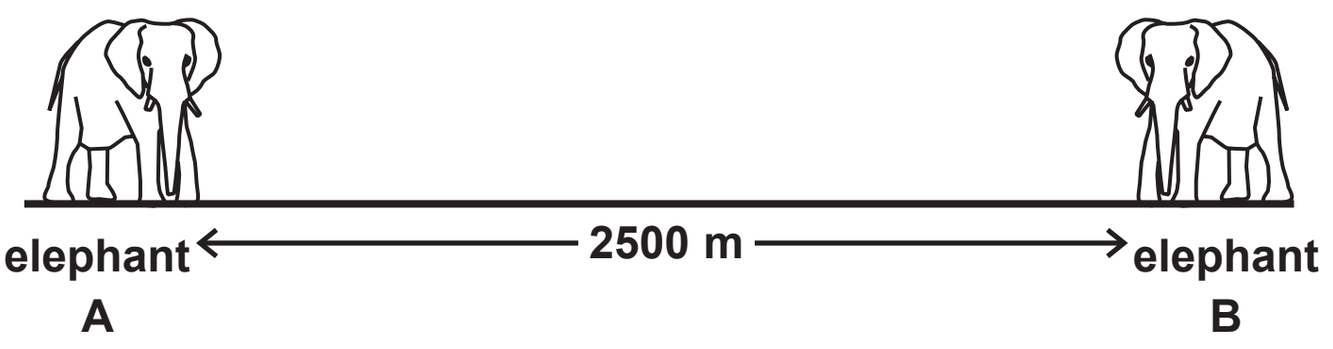
☐ D the wavelength of infrasound is too short

(Question continues on next page)

(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.

(Question continues on next page)

(i) Show that the minimum time for elephant A to call and hear an answer from elephant B is about 15 s. (3 marks)

(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 mark)

(Question continues on next page)

(d) Describe a use of infrasound that does not involve animals. (2 marks)

Q3

(Total 9 marks)

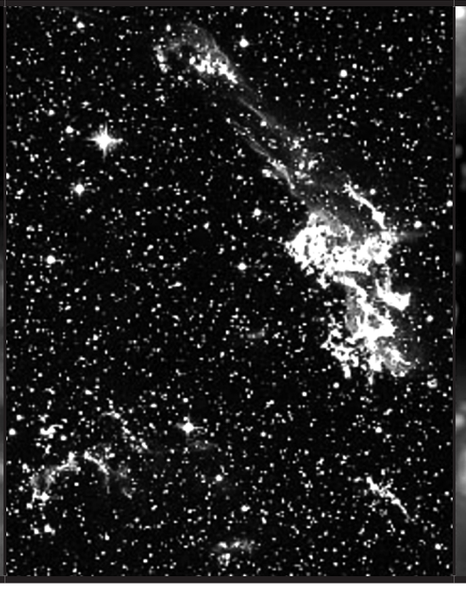
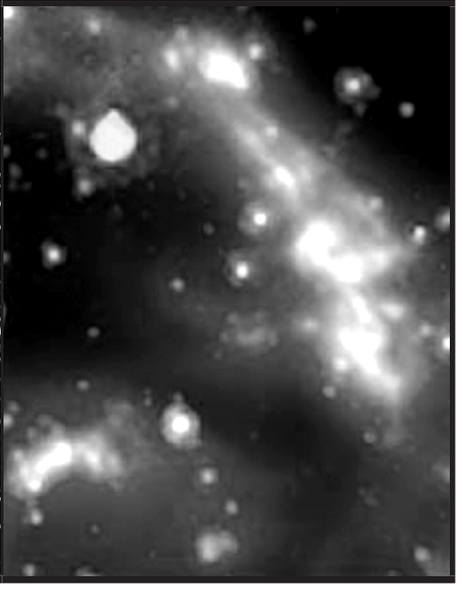
(Questions continue on next page)

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
		

(Question continues on next page)

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

A supernova is

(1 mark)

☐ 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

(Question continues on next page)

(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 mark)

longest wavelength →		shortest wavelength
_____	_____	_____
_____	_____	_____

(Question continues on next page)

(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 marks)

(Question continues on next page)

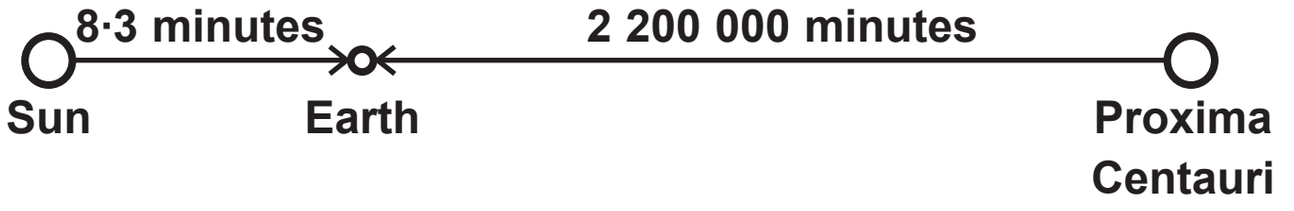
(b) Most space telescopes orbit the Earth but the Spitzer telescope stays behind the Earth to hide from the Sun.

Suggest why this is necessary. (2 marks)

(Question continues on next page)

(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



(Question continues on next page)

(i) By calculation, compare the distance of Proxima Centauri from the Earth with the distance of the Sun from the Earth. (2 marks)

(Question continues on next page)

(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 mark)

Q4

(Total 10 marks)

(Questions continue on next page)

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 mark)

_____

_____

_____

(Question continues on next page)

(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 marks)

current = _____ A

(Question continues on next page)

(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 marks)

power = _____ MW

(Question continues on next page)

*(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 marks)

(Continue your answer on next page)

Q5

(Total 12 marks)

(Questions continue on next page)

ELECTROMAGNETIC WAVES

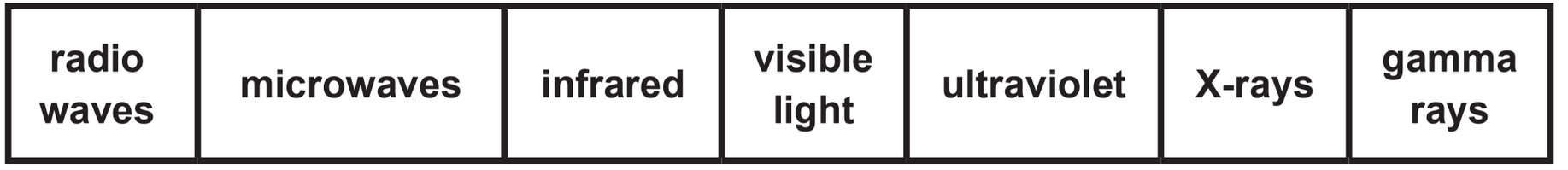
6 (a) The diagram on page 32 shows the parts of the electromagnetic spectrum.

(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 mark)

- ☐ **A infrared and microwaves**
- ☐ **B infrared and radio waves**
- ☐ **C microwaves and radio waves**
- ☐ **D radio waves and X-rays**

(Question continues on next page)



(Questions continue on next page)

(Turn over)

(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 mark)

☐ A faster speed than ultraviolet

☐ B higher frequency than ultraviolet

☐ C lower frequency than ultraviolet

☐ D smaller wavelength than ultraviolet

(Question continues on next page)

(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 marks)

(Question continues on next page)

(ii) Explain why ultraviolet radiation is likely to be more dangerous to humans than infrared radiation. (2 marks)

(Question continues on next page)

*(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 marks)

(Continue your answer on next page)

(Continue your answer on next page)

Q6

(Total 12 marks)

TOTAL FOR PAPER = 60 MARKS

END