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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Thursday 16 January 2020

Afternoon (Time: 1 hour 15 minutes) | Paper Reference **4PH1/2PR**

Physics

Unit: 4PH1

Paper: 2PR

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.*
- Show all steps in any calculations and state the units.
- 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 ☒.

Information

- The total mark for this paper is 70.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- 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.

energy transferred = current × voltage × time $\quad E = I \times V \times t$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)

$$v^2 = u^2 + (2 \times a \times s)$$

pressure × volume = constant $\quad p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken}} \qquad F = \frac{(mv - mu)}{t}$$

$$\frac{\text{change of wavelength}}{\text{wavelength}} = \frac{\text{velocity of a galaxy}}{\text{speed of light}} \qquad \frac{\lambda - \lambda_0}{\lambda_0} = \frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$$

change in thermal energy = mass × specific heat capacity × change in temperature

$$\Delta Q = m \times c \times \Delta T$$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

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Answer ALL questions.

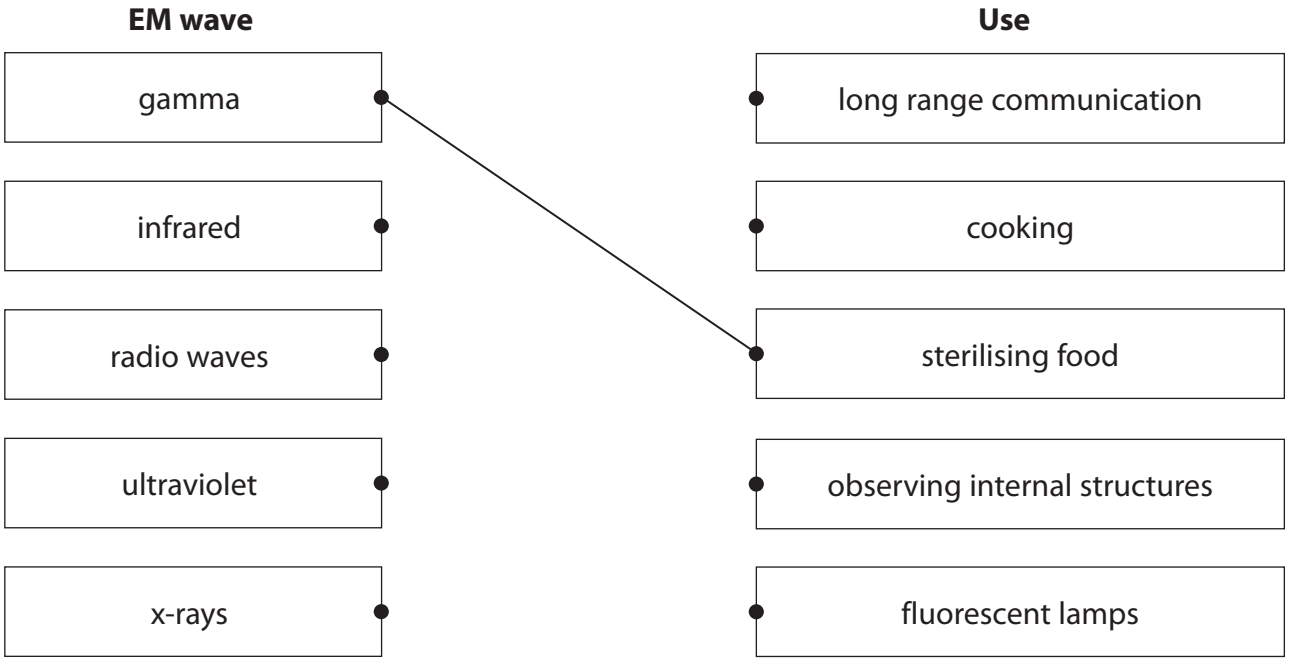
1 This question is about electromagnetic (EM) waves.

(a) The boxes show some EM waves and their uses.

Draw one straight line from each EM wave to its correct use.

One has been done for you.

(3)



(b) Which of these is a hazard of microwave radiation?

(1)

☒ **A** blindness

☒ **B** cell mutation

☒ **C** internal heating of tissue

☒ **D** skin burns

(c) State the name of an electromagnetic wave with a wavelength longer than microwave radiation.

(1)

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(Total for Question 1 = 5 marks)

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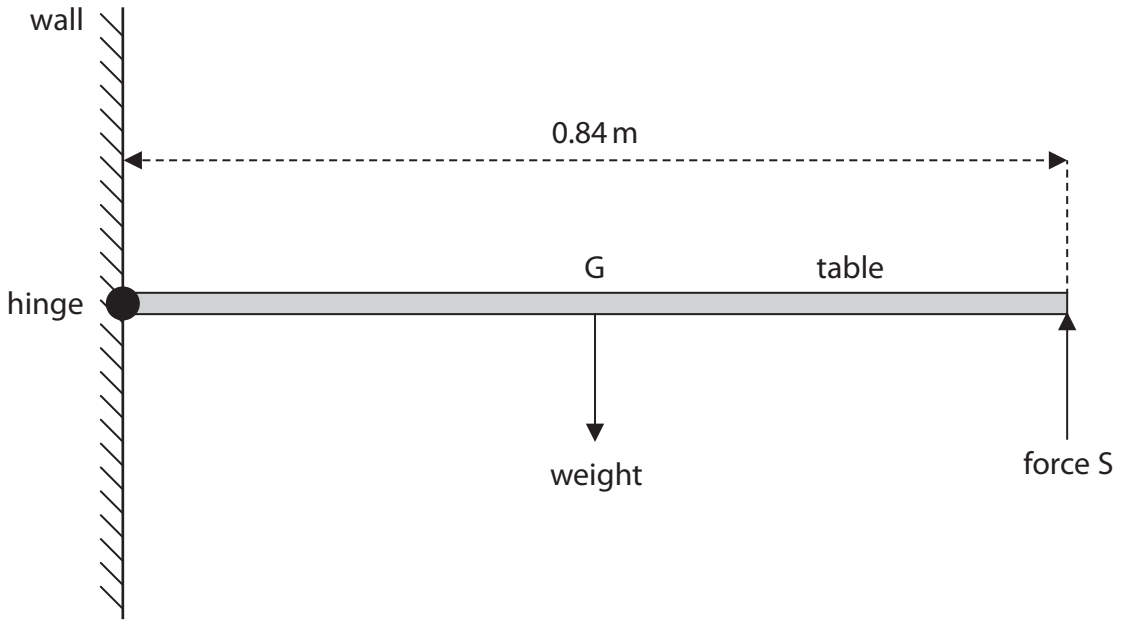
2 This question is about a folding table.

The diagram shows some of the forces acting on the table.



(a) The weight of the table acts through point G.

State the name of point G.

(1)

.....

(b) State the formula linking moment, force and perpendicular distance from the pivot.

(1)

(c) The moment of the weight force of the table about the hinge is 92 N m.

By using the principle of moments, calculate the force S that a person applies to keep the table in equilibrium.

(3)

force S = ... N

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(d) State Newton's third law.

(1)

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(e) State the magnitude and the direction of the force that the table applies to the person holding the table.

(2)

magnitude = ... N

direction = ...

(Total for Question 2 = 8 marks)

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3 This question is about momentum.

Diagram 1 shows a neutron approaching a uranium-235 nucleus.

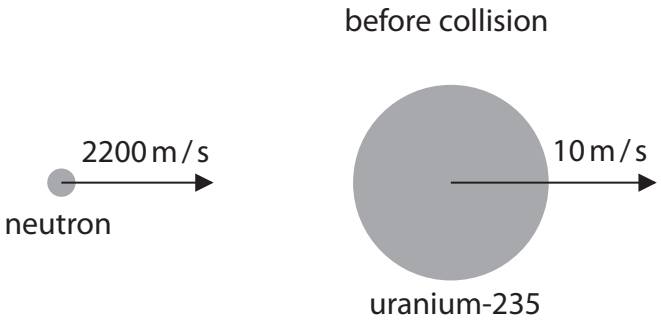

Diagram 1

(a) State the formula linking momentum, mass and velocity.

(1)

(b) Calculate the momentum of the neutron.

Give a unit with your answer.

[mass of neutron = 1.67×10^{-27} kg]

(3)

momentum = ... unit .....

(c) State what is meant by the term **conservation of momentum**.

(1)

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(d) Diagram 2 shows that when the neutron collides with the uranium-235 nucleus, they combine to give a uranium-236 nucleus.

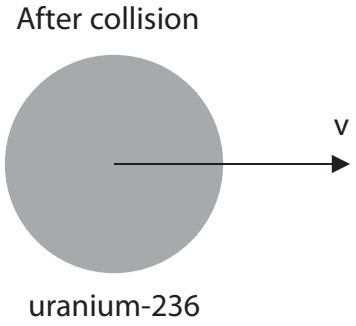

Diagram 2

Use conservation of momentum to calculate the velocity, v, of the uranium-236 nucleus.

[mass of uranium-235 nucleus = 3.99×10^{-25} kg]

[mass of uranium-236 nucleus = 4.01×10^{-25} kg]

(4)

v = ... m/s

(Total for Question 3 = 9 marks)

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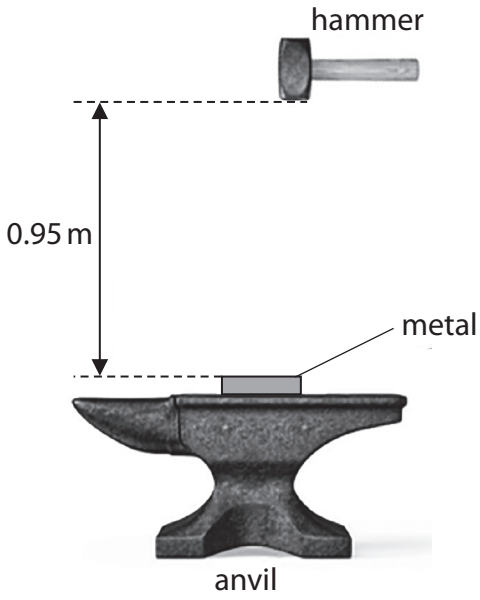
4 A metalworker uses a hammer of mass 1.8 kg to deform a piece of metal on an anvil.



(a) (i) Calculate the increase in the hammer's gravitational potential energy (GPE) store when the hammer is raised through a height of 0.95 m above the metal.

[GPE gained = mass × gravitational field strength × height]

(2)

GPE increase = ... J

(ii) The metalworker moves the hammer down to strike the metal.

The hammer must have at least 21 J of energy in its kinetic energy (KE) store as it hits the metal to deform it.

Explain why the metalworker must do at least 4 J of mechanical work on the hammer to deform the metal.

(2)

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(b) (i) Calculate the velocity of the hammer just before it strikes the metal.

[KE of hammer = 21 J]

(4)

velocity = ... m/s

(ii) When the hammer hits the metal, the hammer comes to rest without rebounding.

Calculate the mean (average) force needed to bring the hammer to rest in a time of 0.12 s.

(2)

mean force = ... N

(Total for Question 4 = 10 marks)

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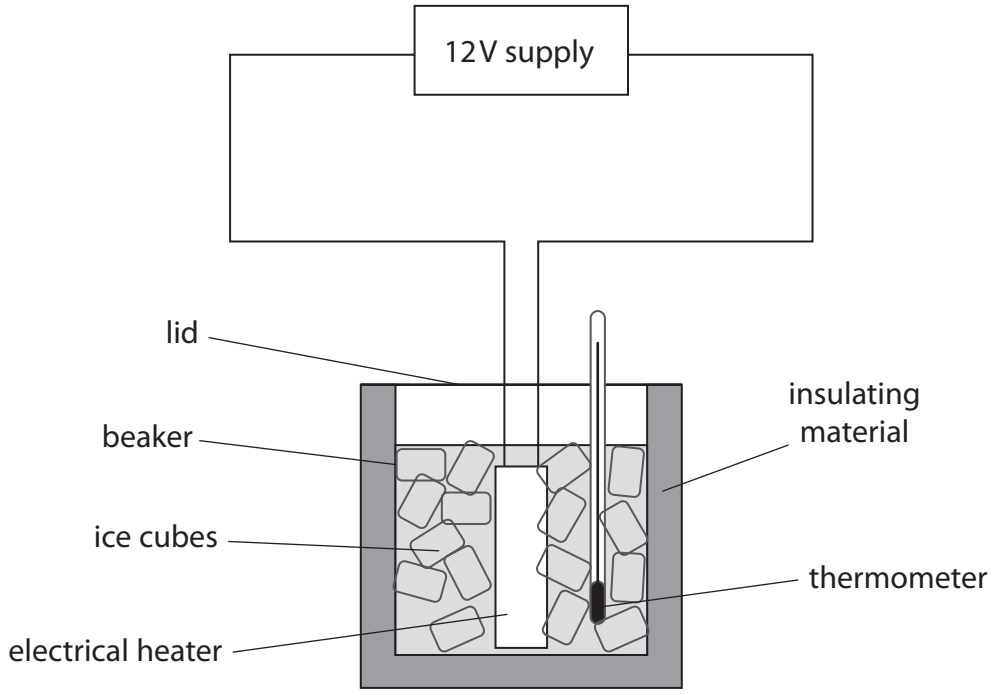
5 A student does an investigation to determine the temperature-time graph for water as it changes state from ice to liquid water.

The diagram shows the student's apparatus.



The ice has an initial temperature of –17 °C.

After 5 minutes, the ice begins to melt.

After a further 6 minutes, all the ice has melted.

The investigation continues for a total time of 20 minutes.

(a) (i) Sketch a graph on the axes to show how the temperature changes with time.

Assume that the rate of energy transfer from the heater to the ice cubes is constant.

(3)



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(ii) Suggest a precaution the student should take to obtain high quality data.

(1)

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(b) During the experiment the heater transfers 2500 J of energy to the beaker.

The beaker has a specific heat capacity of 880 J / kg °C and a mass of 48 g.

Calculate the increase in the temperature of the beaker.

(3)

temperature increase = ... °C

(Total for Question 5 = 7 marks)

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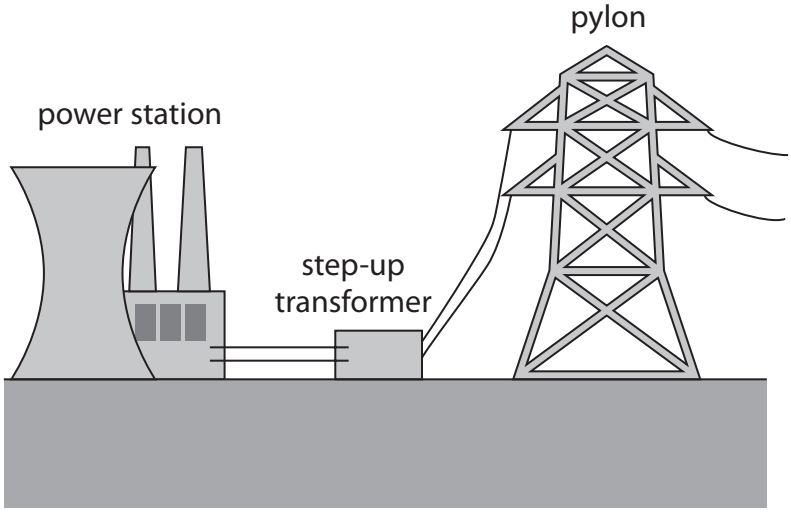
6 The diagram shows the first stages in a method of transferring energy electrically through long distances.



The table shows data about the step-up transformer.

number of turns in primary coil	2600
input voltage in kV	15
output voltage in kV	330

(a) (i) State the formula linking input voltage, output voltage, number of primary turns and number of secondary turns for a transformer.

(1)

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

(3)

number of turns = ...

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(b) Explain why step-up and step-down transformers are used in the large-scale transmission of electricity.

You may draw a diagram to support your answer.

(4)

(Total for Question 6 = 8 marks)

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7 This question is about a proton moving in a uniform magnetic field.

(a) Describe how to use two permanent magnets to produce a uniform magnetic field.

You may draw a diagram to support your answer.

(2)

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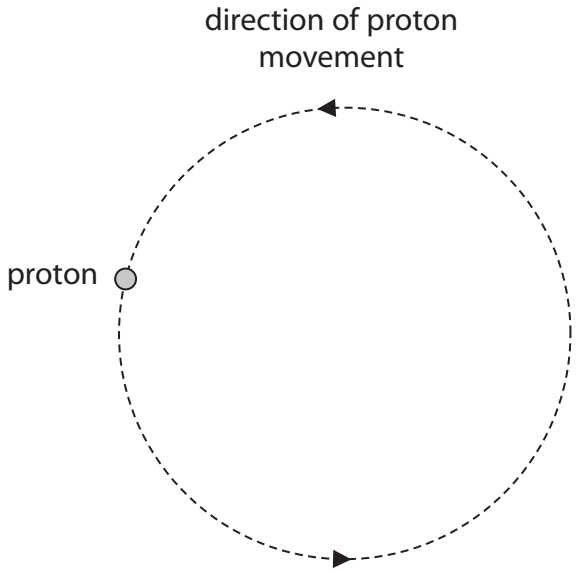
(b) The diagram shows a proton moving in a circular path at constant speed in a uniform magnetic field.

This motion is similar to the movement of a planet in the Solar System.



(i) Draw an arrow to show the direction of the force on the proton.

(1)

(ii) Accurately measure the diameter of the proton's path.

(2)

diameter = ... cm

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(iii) The proton completes one orbit of its circular path in a time period of 8.7×10^{-6} seconds.

Calculate the orbital speed of the proton.

(3)

orbital speed = ... m/s

(Total for Question 7 = 8 marks)

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8 Diagram 1 shows two identical buzzers connected with springs.

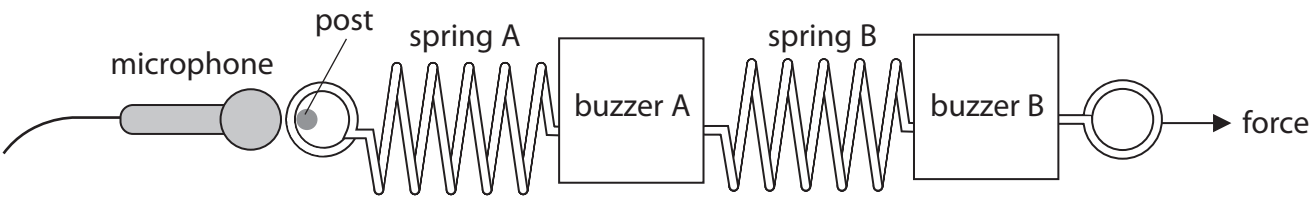

Diagram 1

Spring A is connected to a post.

A force acts on the apparatus for a short period of time, pulling both buzzers to the right.

During this time, buzzer A moves 2 cm and buzzer B moves 4 cm.

(a) (i) Explain why buzzer B travels with twice the average speed of buzzer A.

(2)

(ii) A student connects the microphone to an oscilloscope to measure the frequency of sound from the two buzzers while the force acts on the arrangement.

Explain the difference in the measured frequencies of sound from buzzer A compared to buzzer B.

(3)

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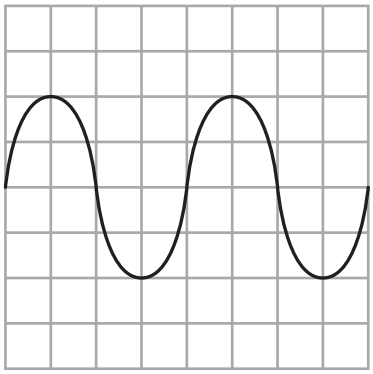
(b) Diagram 2 shows an oscilloscope trace.

The trace represents the sound wave received by the microphone from buzzer A.



Oscilloscope settings
y direction: 1 square = 0.1 V
x direction: 1 square = 2 ms

Diagram 2

Measure the period of the sound waves from buzzer A.

Give your answer in standard form.

(3)

period = ... s

(c) Diagram 3 shows two distant galaxies and the Earth.

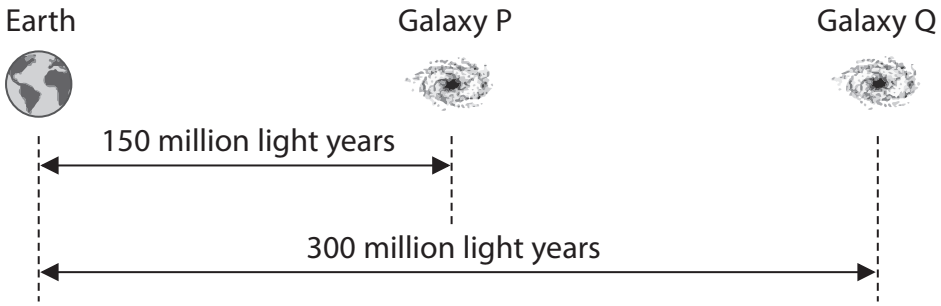


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Diagram 3

Light emitted from a nearby star has a wavelength of 590 nm.

The light from an identical star in galaxy P arrives at the Earth.

The wavelength of the light from the star in galaxy P is 600 nm.

(i) Calculate the change in wavelength for light from the star in galaxy P.

(1)

change in wavelength = ... nm

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(ii) Galaxy Q is twice as far away from the Earth as galaxy P.

Suggest how the speed of galaxy Q relates to the speed of galaxy P.

(1)

(iii) Suggest a value for the change in wavelength of light from an identical star in galaxy Q when the light arrives at the Earth.

(1)

change in wavelength = ... nm

(iv) Explain how comparing the speeds of the two galaxies provides evidence for the Big Bang theory.

(4)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 70 MARKS

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