



Rewarding Learning

General Certificate of Secondary Education
2022–2023

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3

Higher Tier



[GSA32]

GSA32

THURSDAY 25 MAY 2023, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

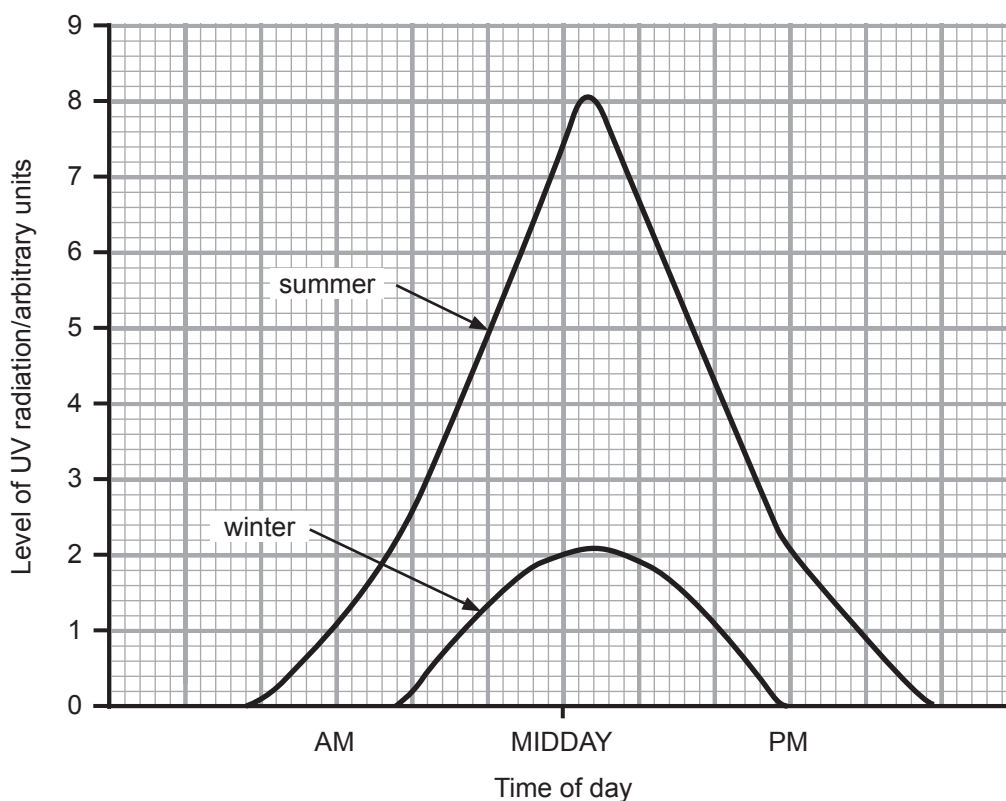
Quality of written communication will be assessed in Question 4.

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28GSA3201

- 1 The graph below shows how the level of ultraviolet (UV) radiation from the Sun changed during a typical summer and winter day.



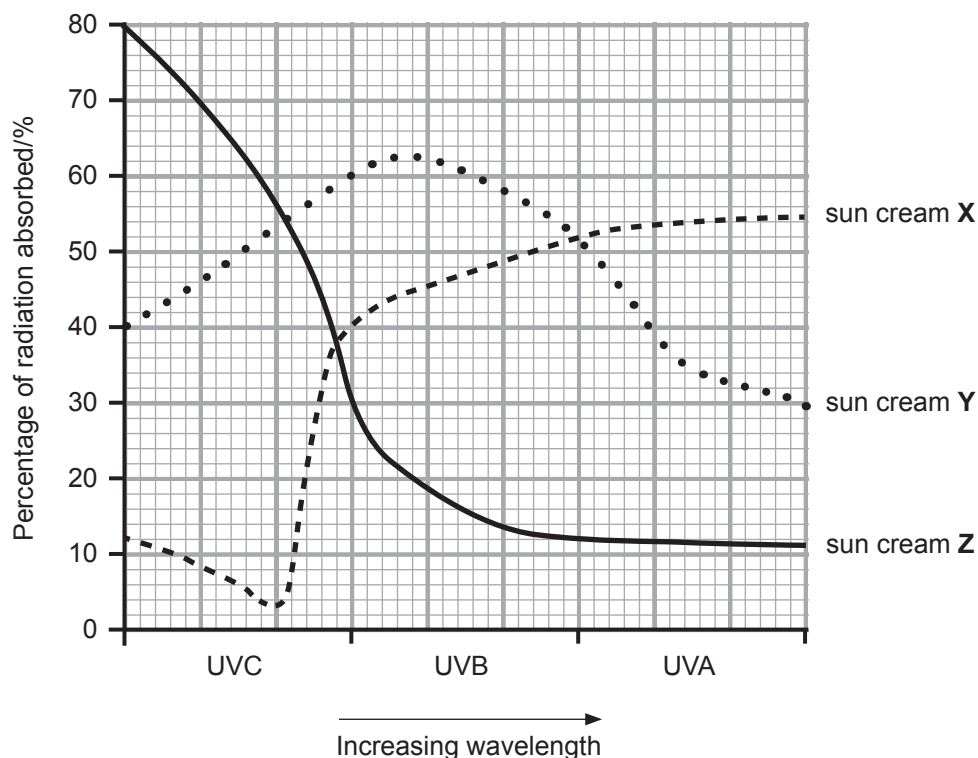
Skin needs to be protected by sun cream when the level of UV radiation goes above **3** arbitrary units.

- (a) Use information from the graph to suggest why sun cream sales are less in winter.

_____ [1]



- (b) Ultraviolet radiation is made up of UVA, UVB and UVC. The graph below shows the percentage of these UV radiations absorbed by different sun creams.



UVB causes the greatest amount of sunburn.

- (i) Which sun cream **X**, **Y** or **Z** would be most useful in trying to avoid sunburn?

_____ [1]

- (ii) Apart from sunburn, give **one** harmful effect that ultraviolet radiation can have on humans.

 _____ [1]

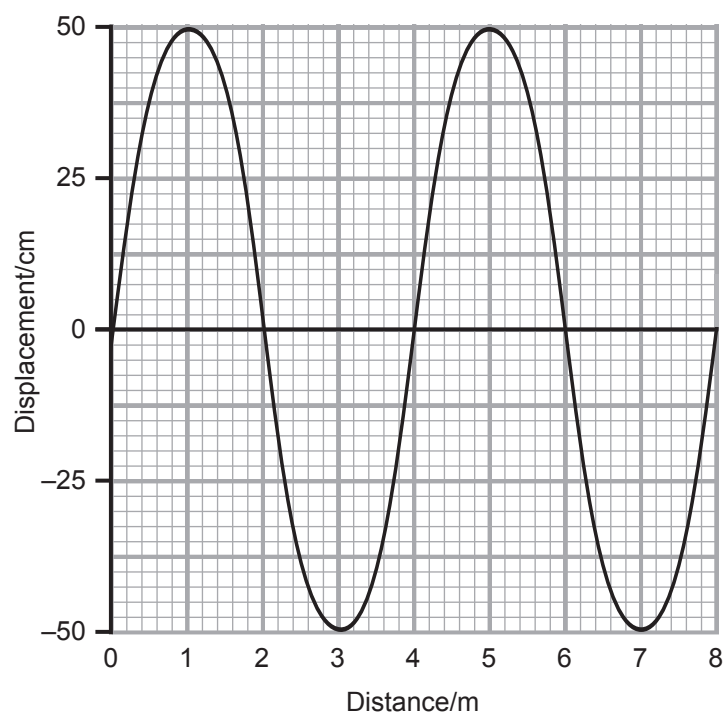
- (c) Give **one** useful application of ultraviolet radiation.

_____ [1]

[Turn over



2 The diagram below represents a water wave.



(a) What are the wavelength and amplitude of this water wave?

wavelength _____ m

amplitude _____ cm [2]



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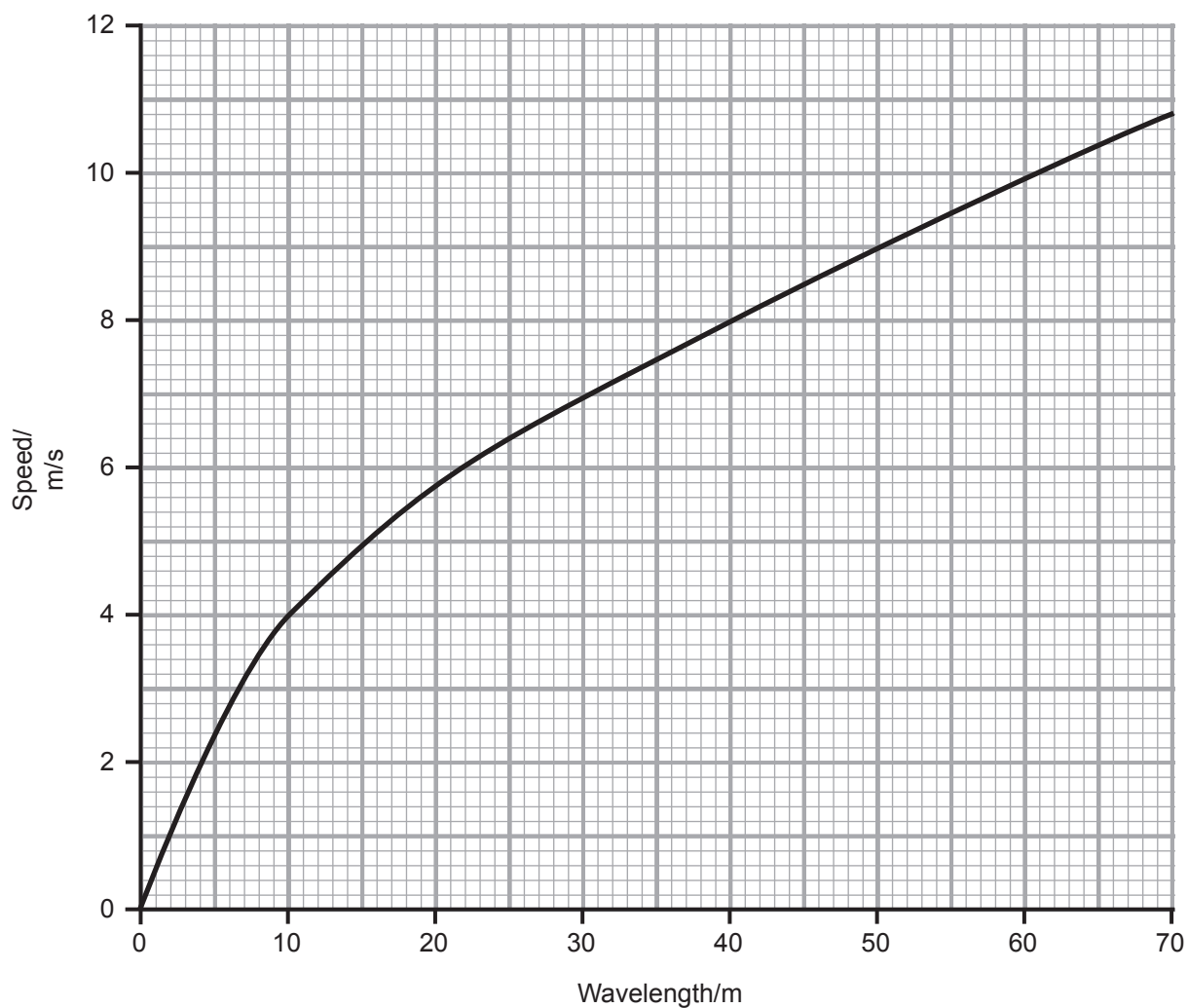
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[Turn over



28GSA3205

- (b) The graph below shows how the speed of a deep ocean wave depends on its wavelength.



- (i) Calculate how many times faster a wave with a wavelength of 40 m travels compared to a wave with a wavelength of 10 m.

_____ [1]



(ii) Use the equation:

$$\text{frequency} = \frac{\text{wave speed}}{\text{wavelength}}$$

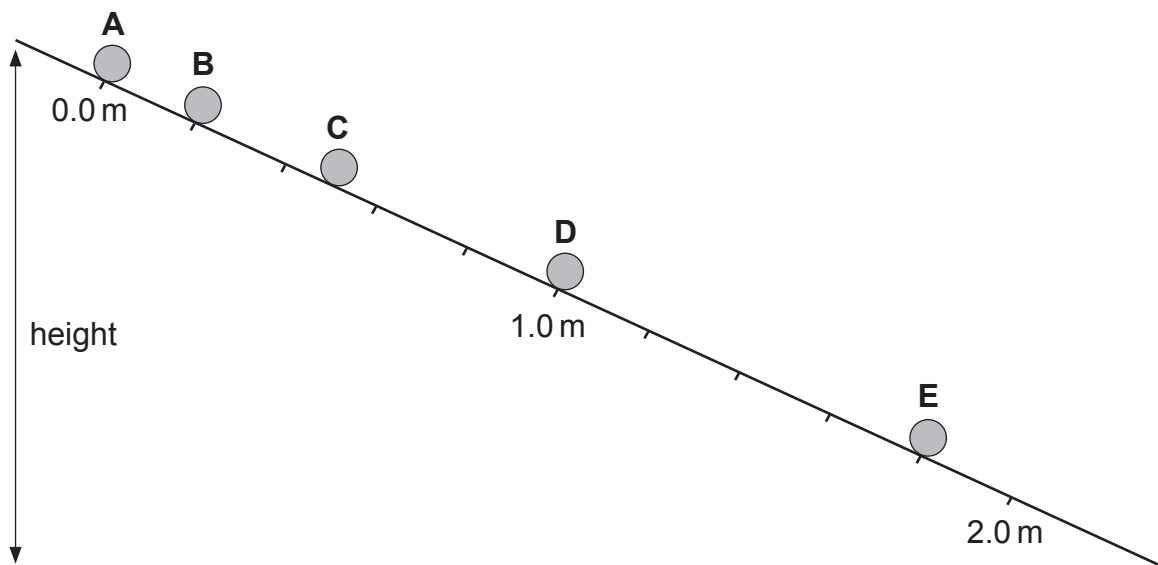
to calculate the frequency of a wave with a wavelength of 50 m.

(Show your working out.)

_____ Hz [2]



- 3 (a) The diagram below shows five positions of a ball (**A**, **B**, **C**, **D** and **E**) as it rolls down a slope.



- (i) What is the distance travelled by the ball from **A** to **E**?

_____ m [1]

It takes 0.5 s for the ball to roll between each position.

- (ii) What is the time taken for the ball to travel from **A** to **E**?

_____ s [1]

- (b) Use the equation:

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

to calculate the average speed as the ball rolled from **A** to **E**.

_____ m/s [1]



(c) Explain how the diagram shows that the ball is accelerating.

[1]

(d) What change, if any, would there be in the average speed of the ball if the height of the slope was reduced?

[1]

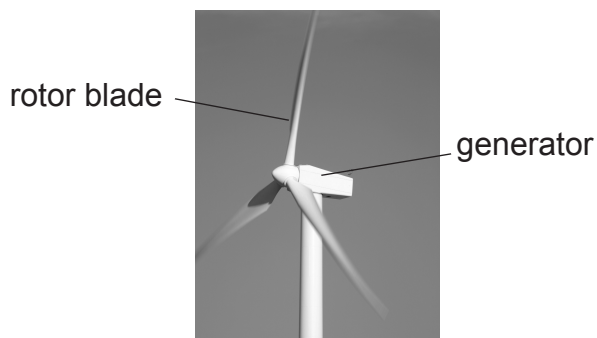
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28GSA3209

- 4 Electricity can be generated using a wind turbine. Wind is an example of a renewable source.



Describe why there is a recent increase in the use of renewable sources for generating electricity.

Your answer should include:

- a definition of a renewable source;
- **two** other examples of renewable sources;
- a description of how the **generator** on a wind turbine produces electricity; and
- **one** disadvantage of generating electricity from wind.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.





[6]

[Turn over

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28GSA3211

- 5 The photograph below shows ultrasound being used in a hospital.



- (a) What is meant by the term **ultrasound**?

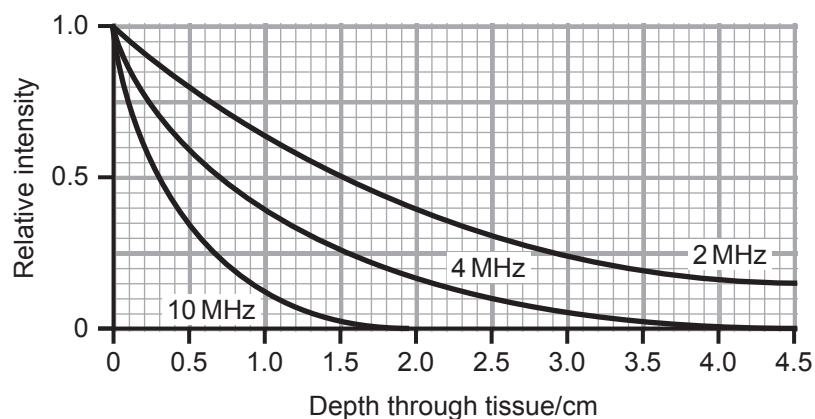
_____ [1]

- (b) Ultrasound is a longitudinal wave. Describe fully the movement of particles in a longitudinal wave.

_____ [2]



- (c) The graph below shows how the relative intensity of ultrasound waves, with different frequencies, changes as they move through soft tissue.



- (i) At what depth does a 2 MHz wave have half its original intensity?

_____ cm [1]

- (ii) Give **two** conclusions that can be made from the information in this graph.

1. _____

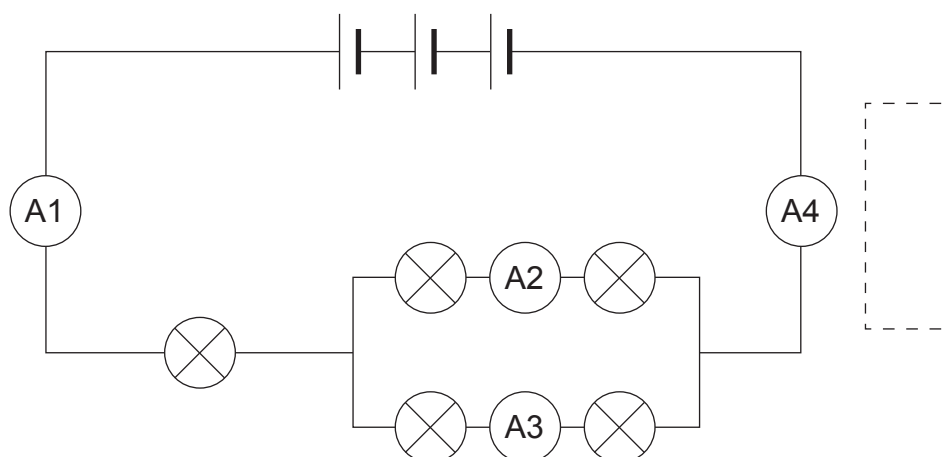
 2. _____

- [2]

[Turn over



- 6 The circuit below was used to investigate current flow through five identical bulbs.



- (a) Draw an arrow in the dotted box above to show the direction of the flow of electrons.

[1]

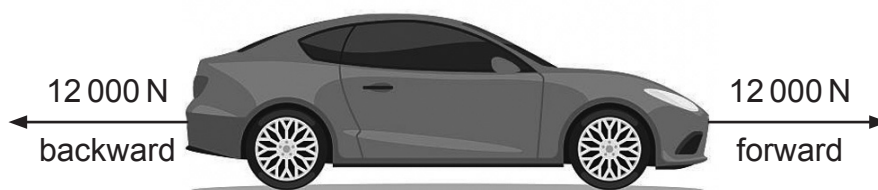
- (b) If ammeter **A1** reads 0.8 A, what will be the readings on ammeters **A2** and **A4**?

A2 _____ A

A4 _____ A [2]



- 7 (a) The diagram below shows the forces acting on a **moving** car.



- (i) Explain fully, in terms of forces, the movement of this car.

_____ [2]

- (ii) Calculate the resultant force acting on this car if the forward force is increased to 15 000 N.

_____ N [1]

- (iii) What causes the backward force of 12 000 N acting on this car?

_____ [1]

- (b) A resultant force of 4000 N acts on another car with a mass of 1100 kg.

Use the formula:

$$\text{resultant force} = \text{mass} \times \text{acceleration}$$

to calculate the acceleration of this car.

Give your answer to 1 decimal place.

(Show your working out.)

_____ m/s² [3]

[Turn over]



- 8 (a) The photograph below shows part of an ancient scroll.



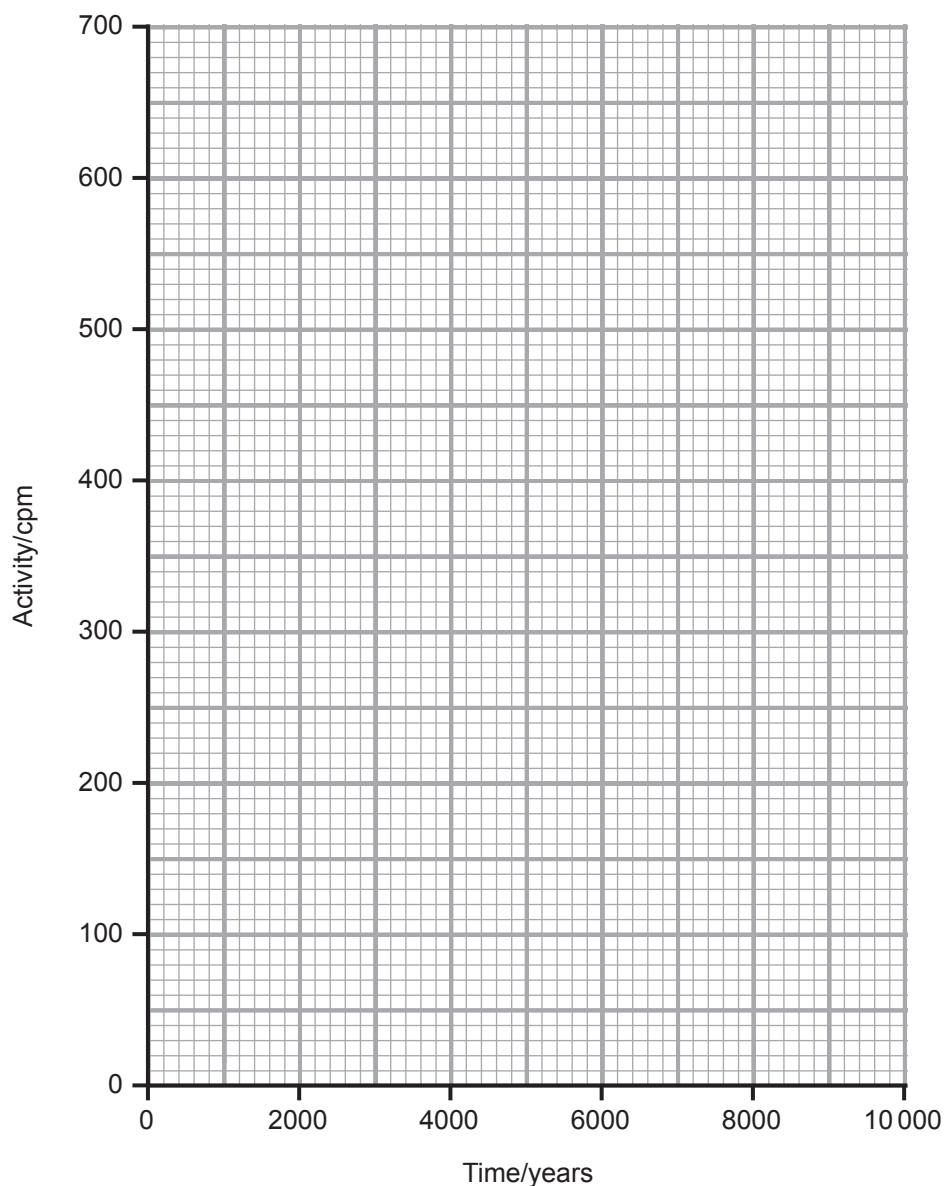
The age of the scroll was found using the radioactive decay of carbon-14 in a process called carbon dating.

The table below shows how the activity of carbon-14 changes with time.

| Time/years | Activity/cpm |
|------------|--------------|
| 0 | 640 |
| 2500 | 470 |
| 5000 | 350 |
| 7500 | 260 |
| 10 000 | 190 |

- (i) On the grid opposite plot and draw a line graph for this information. [3]





- (ii) The activity of carbon-14 from this scroll is now 490 cpm.
Use the graph to find the age of the scroll.

_____ years [1]

- (b) Carbon-14 has a half-life of 5700 years. What is meant by the term **half-life**?

_____ [2]

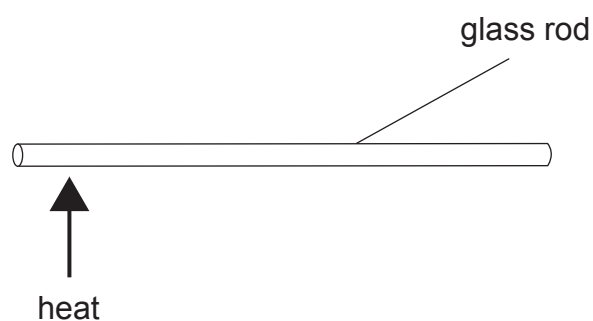
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28GSA3217

- 9 The diagram below shows a glass rod being heated.

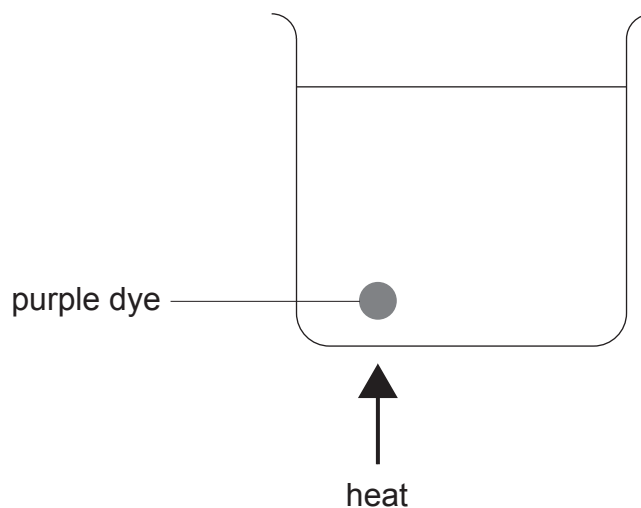


Glass is a poor conductor because it does **not** have free electrons but some heat can still travel through the rod.

- (a) Explain fully, in terms of atoms, how heat travels through the glass rod.

_____ [2]

- (b) The diagram below shows purple dye being used to demonstrate heat transfer in water.



- (i) Name the method of heat transfer being demonstrated in this experiment.

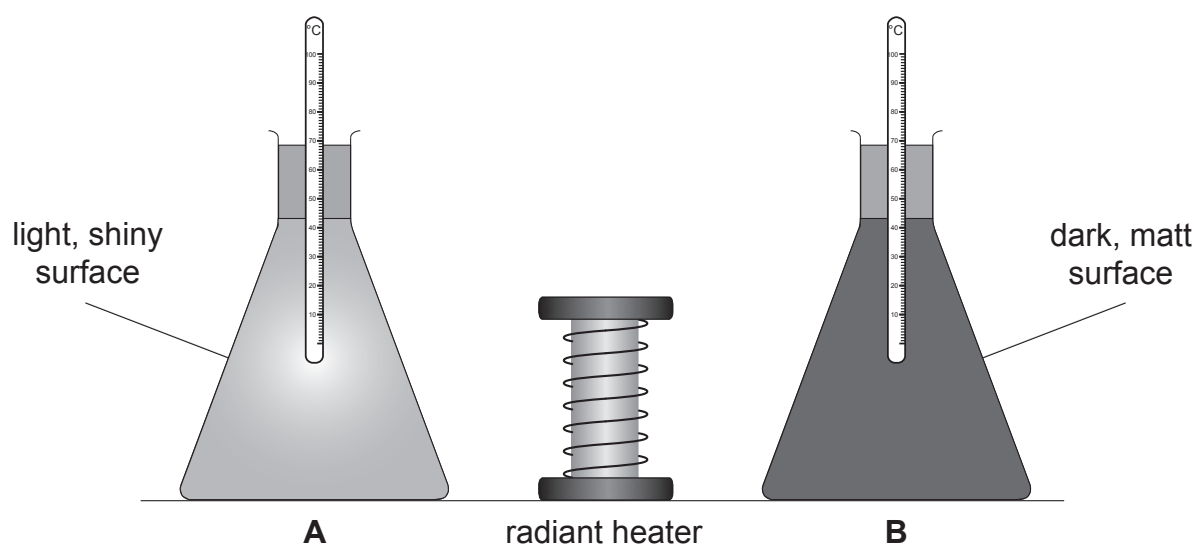
_____ [1]



(ii) Describe what would be observed during this experiment.

[1]

The diagram below shows two conical flasks (**A** and **B**). They contain the same amount of water at the same temperature and are placed an equal distance away from the radiant heater.



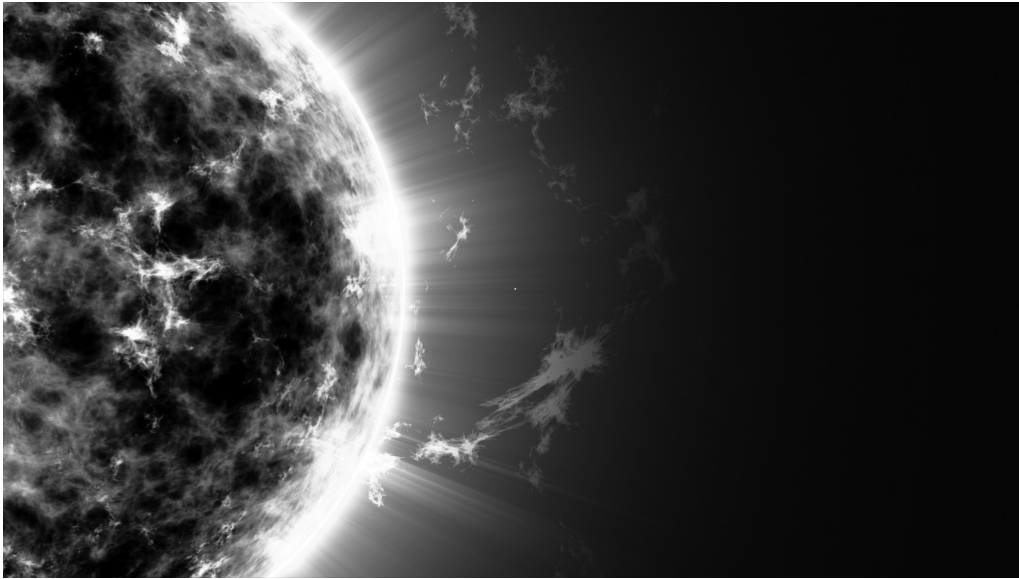
(c) Which flask (**A** or **B**) will heat up the quickest? Explain your answer.

[1]

[Turn over]



10 The photograph below shows the Sun, the closest star to Earth.



(a) Explain fully the formation of the Sun.

[3]



(b) The table below gives information about five galaxies.

| Galaxy | Distance from Earth/ light years ($\times 10^6$) | Speed away from Earth/ m/s ($\times 10^3$) |
|--------|---|---|
| A | 9.0 | 20 |
| B | 11.2 | 23 |
| C | 2.8 | 6 |
| D | 9.8 | 21 |
| E | 4.8 | 10 |

(i) Give the trend shown by this information.

_____ [1]

(ii) Which galaxy (A, B, C, D or E) will show the greatest red-shift?
Explain your answer.

_____ [1]

(iii) Red-shift is a piece of evidence that supports the Big Bang theory.
What age is the Universe according to the Big Bang theory?

_____ [1]

(iv) What is meant by the term **light year**?

_____ [1]

[Turn over



The table below gives data for five different satellites orbiting the Earth.

| Satellite | Time taken to orbit the Earth/min | Mass of satellite/kg |
|-----------|-----------------------------------|----------------------|
| V | 93 | 41 900 |
| W | 99 | 280 |
| X | 103 | 630 |
| Y | 228 | 400 |
| Z | 1440 | 2030 |

- (c) What effect, if any, does mass have on the time taken for the satellite to orbit the Earth?

[1]





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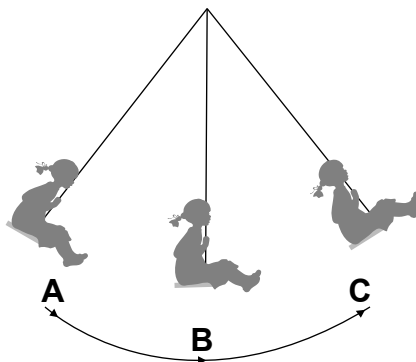


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- 11 (a) State the Principle of Conservation of Energy.

[1]

The diagram below shows a child on a swing moving from **A** to **C**.



- (b) Describe fully the energy changes as the swing moves from **A** to **B**.

[2]

- (c) The child and swing have a mass of 20 kg and at one position have a velocity of 5 m/s.

Use the equation:

$$\text{kinetic energy} = \frac{1}{2}mv^2$$

to calculate the kinetic energy of the child on the swing at this position.
(Show your working out.)

J [2]



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| Question Number | Marks |
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Examiner Number

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