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1172956826

PHYSICS **0625/33**

Paper 3 Theory (Core) **May/June 2024**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / s^2).

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

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1 A girl is cycling along a straight horizontal road.

Fig. 1.1 shows the **directions** of the forces acting on the cyclist as she cycles in the direction of force C.

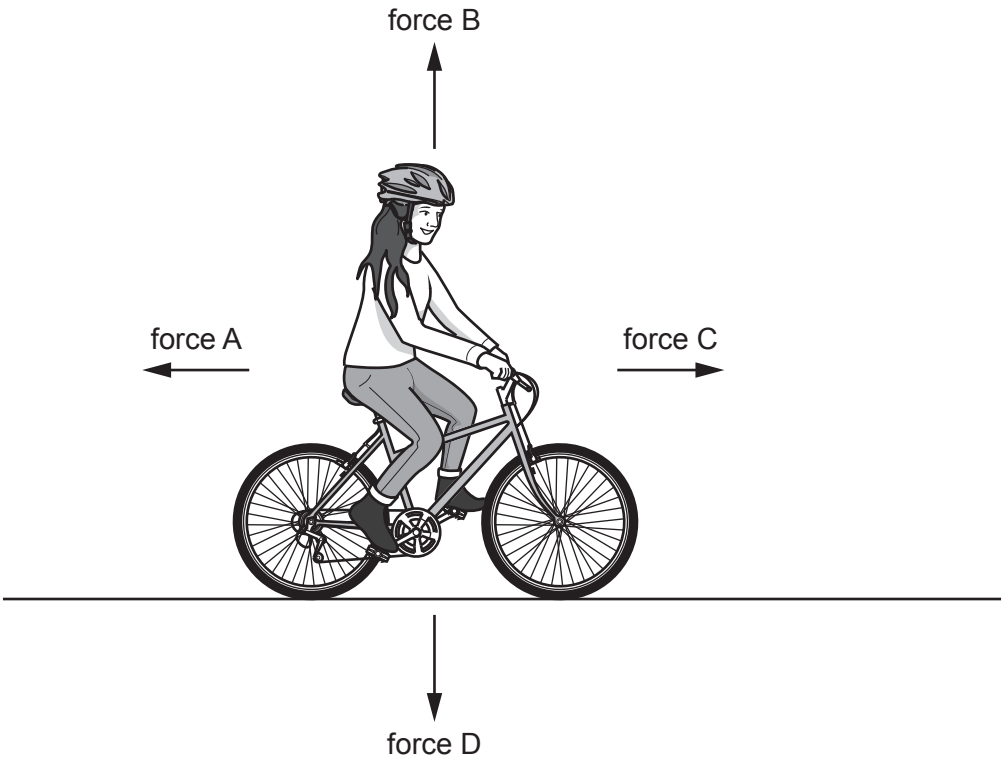


Fig. 1.1

(a) State which force shows the direction of:

(i) the force due to gravity ..... [1]

(ii) the force due to air resistance. ..... [1]

(iii) Force A changes and becomes larger than force C.

State any effect this change has on the motion of the cyclist.

..... [1]

(b) Another cyclist travels a distance of 250 m in a time of 21 s.

(i) Calculate the average speed of the cyclist.

average speed = ... m/s [3]

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(ii) The cyclist exerts a force of 36 N to move the cycle forwards.

Calculate the work done by this force when the cyclist travels 250 m. Include the unit.

work done = ...

unit .....
[4]

[Total: 10]

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2 Fig. 2.1 shows a road sign on the ground.

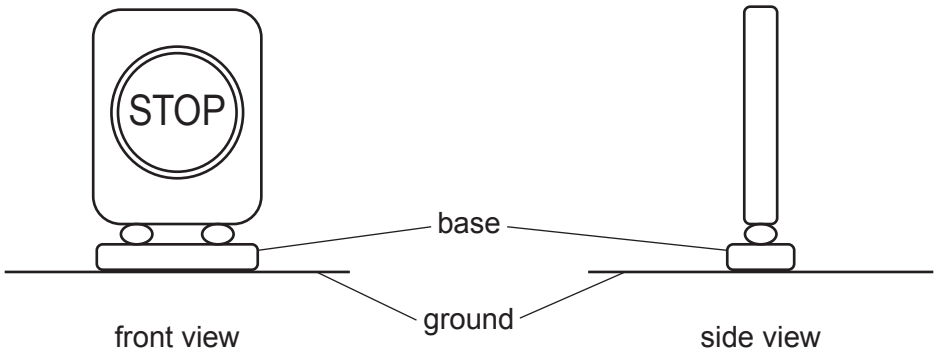


Fig. 2.1

(a) A strong wind blows and the sign begins to fall over. A man catches the sign before it falls completely.

Fig. 2.2 shows the force applied to the sign by the man.

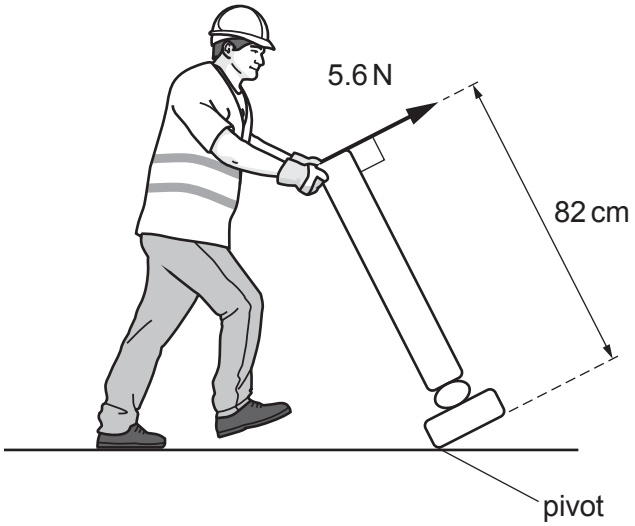


Fig. 2.2

Calculate the moment of the 5.6N force about the pivot. Use the information in Fig. 2.2.

moment = ... N cm [3]

(b) The sign needs to be easy to move and stable. The base **cannot** be fixed to the ground.

Suggest how to change the base so that the sign is more stable. Explain your answer.

suggestion .....

explanation .....
[2]

[Total: 5]

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3 Fig. 3.1 represents a hydroelectric power station transmitting electrical energy to homes and factories far away.

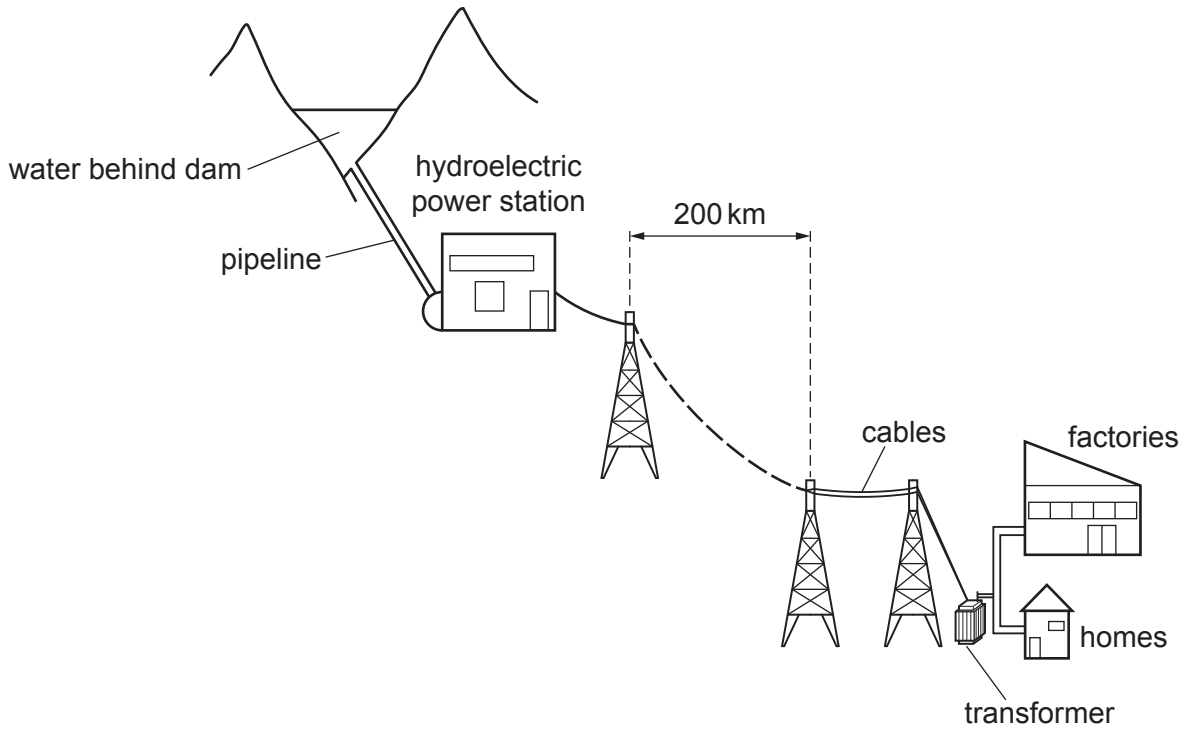


Fig. 3.1

(a) (i) State the energy store for the water behind the dam.

..... [1]

(ii) In the list of equipment, draw a ring around each item that a hydroelectric power station requires.

boiler **cooling tower** **generator** **solar cell** **turbine**

[1]

(b) (i) State the type of transformer shown in Fig. 3.1.

..... [1]

(ii) Give **two** reasons why the power station uses high voltages to transmit electrical energy over long distances.

1 .....

.....

2 .....

.....

[2]

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(c) Hydroelectric power stations may replace coal-fired power stations.

State **two** advantages and **two** disadvantages of using hydroelectric power stations compared with coal-fired power stations. Do **not** include building or maintenance costs.

advantages

1 .....

.....

2 .....

.....

disadvantages

1 .....

.....

2 .....

.....

[4]

[Total: 9]

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4 **(a)** Fig. 4.1 represents the arrangement of particles in a solid.

solid

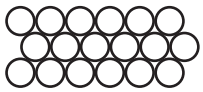


Fig. 4.1 (not to scale)

gas

Fig. 4.2

(i) Describe the motion of the particles in a solid.

..... [1]

(ii) On Fig. 4.2, draw at least 10 particles, to show the arrangement of the particles in a gas. [2]

(iii) Describe the motion of the particles in a gas.

.....

..... [2]

(b) At the beginning of a lesson, students measure the mass of water in a shallow dish.
Fig. 4.3 shows the mass of water at the beginning of the lesson.
Fig. 4.4 shows the mass of water at the end of the lesson.

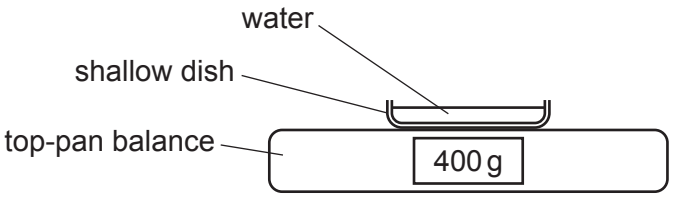


Fig. 4.3

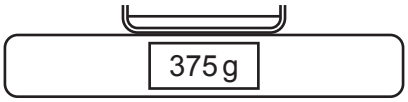


Fig. 4.4

The students find that the mass of water in the shallow dish decreases during the lesson.

(i) State the name of the process that decreases the mass of water in the shallow dish.

..... [1]

(ii) Describe the process that decreases the mass of water in the shallow dish. Use ideas about particles.

.....

.....

..... [2]

[Total: 8]

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5 Fig. 5.1 represents an arrangement for heating water. The hot water is stored in the metal container.

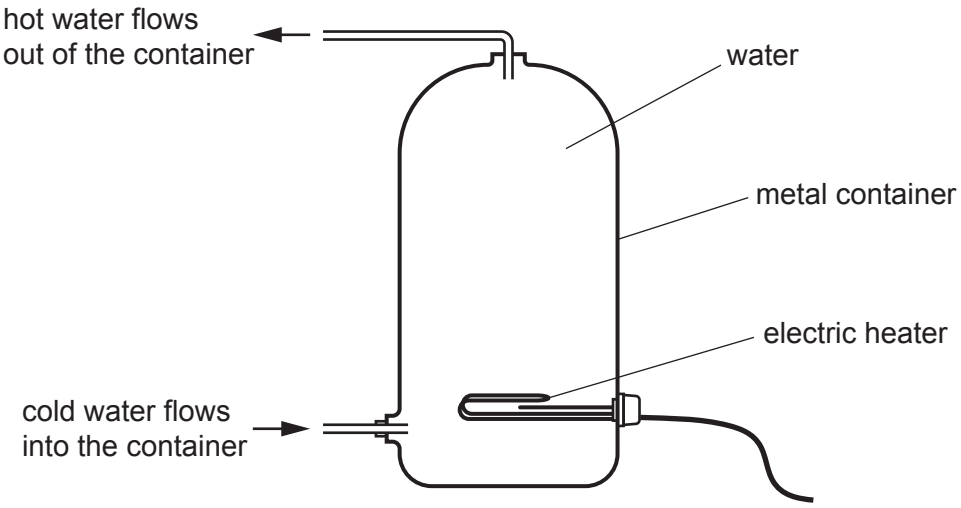


Fig. 5.1 (not to scale)

(a) Explain why the hot water is available at the top of the container. Use ideas about density.

.....

.....

.....

..... [3]

(b) The electric heater is switched on for one hour every morning.

(i) State the name of the process that transfers thermal energy through the walls of the metal container.

..... [1]

(ii) Suggest **one** way of keeping the water hot after the heater is switched off.

.....

..... [1]

[Total: 5]

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6 **(a)** State the name of the type of wave in which the direction of vibration is at right angles to the direction of travel.

..... [1]

(b) A teacher uses a ripple tank to demonstrate a wave property. Fig. 6.1 shows the ripple tank viewed from above. The crests of the wave are travelling from left to right.

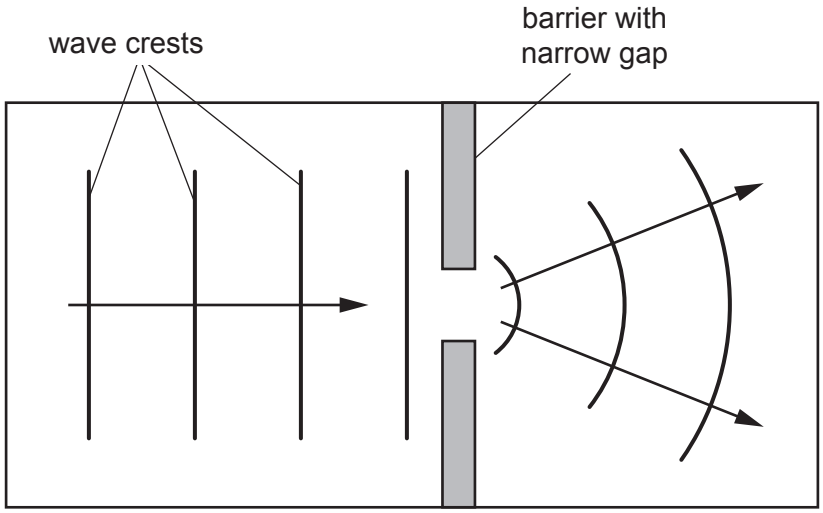


Fig. 6.1

(i) Complete the sentence about the wave property demonstrated in Fig. 6.1.

Choose **one** word from the list.

diffraction **dispersion** **reflection** **refraction**

The wave property demonstrated in Fig. 6.1 is ..... . [1]

(ii) On Fig. 6.1, indicate **one** wavelength. Label your answer with the letter 'w'. [1]

(c) In a different ripple tank, the wavelength of the wave is 5.1 cm.
The speed of the wave is 42 cm / s.

Determine the frequency of the wave.

frequency = ... Hz [3]

[Total: 6]

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7 **(a)** Fig. 7.1 shows a ray of red light incident on a glass prism at point P.
The ray of red light is refracted at point P.

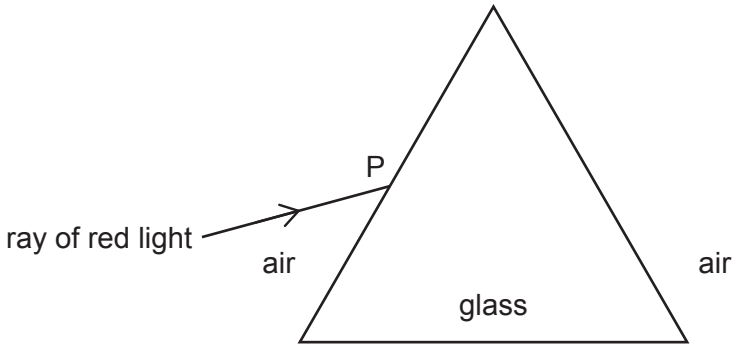


Fig. 7.1

On Fig. 7.1:

(i) draw the normal at point P [1]

(ii) draw the path of the ray of red light through the glass prism and into the air. [2]

(b) A ray of blue light replaces the ray of red light. The angle of incidence for the blue ray entering the prism is the same as in Fig. 7.1.

Describe any difference between the path of the blue ray in the prism and the path of the red ray in the prism.

.....

..... [1]

(c) Another ray enters the glass prism and is totally internally reflected.

State **two** conditions for a ray to be totally internally reflected.

1 .....

.....

2 .....

.....
[2]

[Total: 6]

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8 Fig. 8.1 shows part of a circuit for measuring the resistance of a lamp.

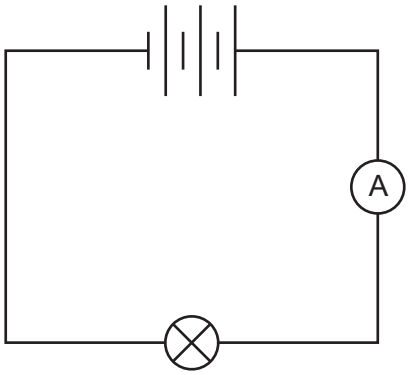


Fig. 8.1

(a) Draw on Fig. 8.1 to show how to connect a voltmeter to measure the potential difference across the lamp. Use the electrical symbol for a voltmeter.

[2]

(b) The current in the lamp is 0.41 A and the potential difference across the lamp is 12 V.

Calculate the resistance of the lamp.

resistance = ... Ω [3]

(c) Calculate the electrical power transferred in the lamp. Include the unit.

power transferred = ...

unit .....
[4]

[Total: 9]

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9 **(a)** Fig. 9.1 shows three devices: a compass, a transformer and an electromagnet. The main parts of the devices are labelled.

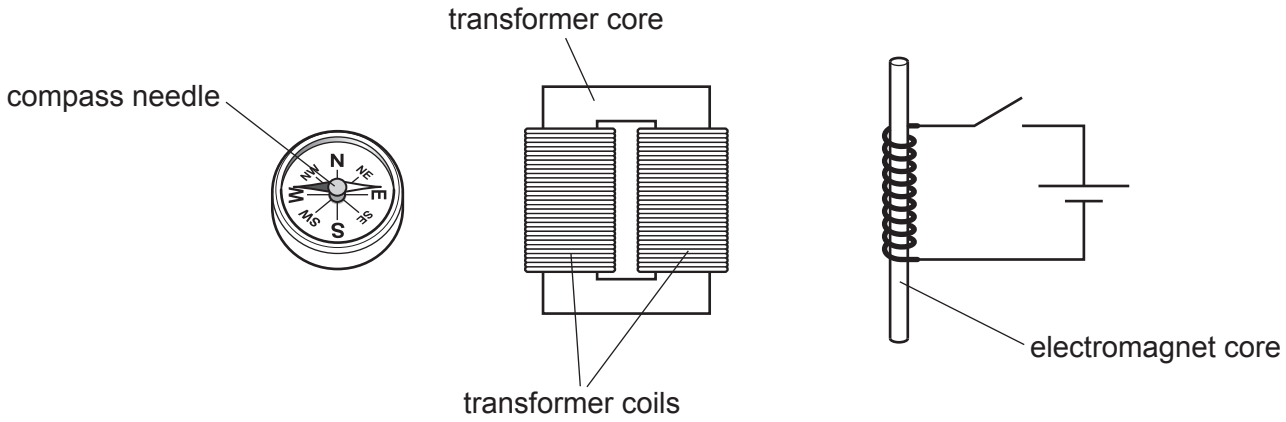


Fig. 9.1

Complete Table 9.1 by adding a suitable metal for each part. Choose from the metals in the list.

Each metal can be used once, more than once or not at all.

aluminium **copper** **soft iron** **silver** **steel**

Table 9.1

part	metal
compass needle	
transformer core	
transformer coils	
electromagnet core	

[2]

(b) The primary coil of a transformer is connected to a mains supply of 220 V a.c.
The primary coil has 1500 turns and the secondary coil has 650 turns.

Calculate the output voltage of the secondary coil.

output voltage = ... V [3]

[Total: 5]

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10 **(a)** The nuclide notation for an atom of protactinium-234 is:

$$^{234}_{91}Pa$$

(i) State the number of protons in an atom of protactinium-234. ..... [1]

(ii) State the number of nucleons in an atom of protactinium-234. ..... [1]

(b) Three forms of the element protactinium are: protactinium-234, protactinium-230 and protactinium-233.

State the name given to these different forms of the same element.

..... [1]

(c) A teacher demonstrates radioactive decay by using a sample of protactinium-234m.

(i) The sample emits beta (β)-particles.

State the nature of a beta (β)-particle.

..... [1]

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(ii) The teacher obtains data for a decay curve. Fig. 10.1 shows the decay curve for the sample of protactinium-234m.

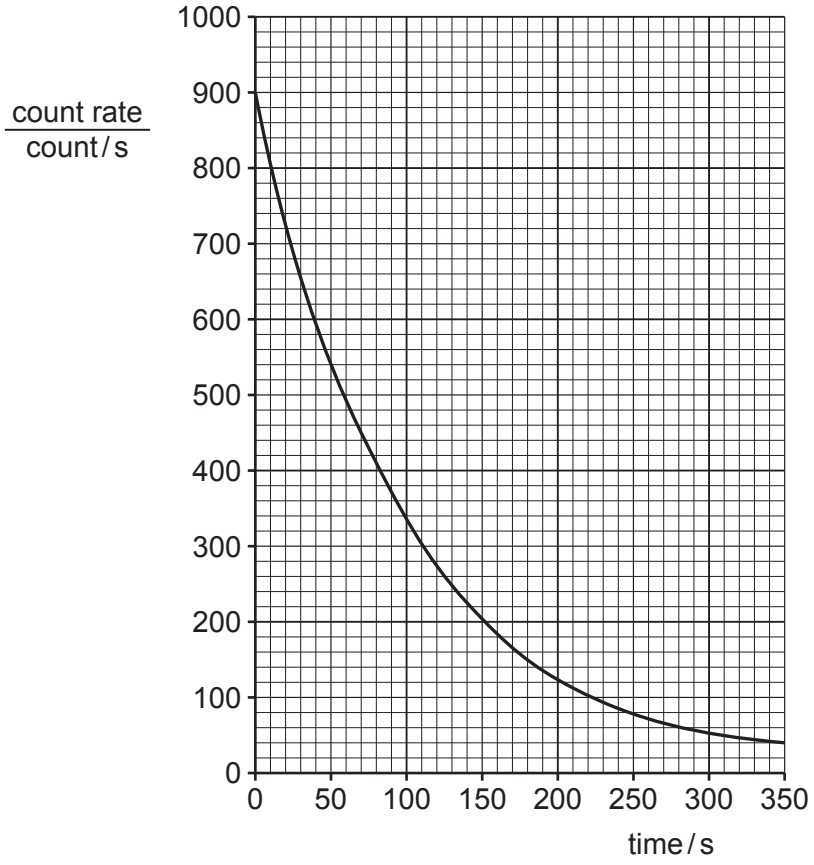


Fig. 10.1

Calculate the half-life of protactinium-234m using the information in Fig. 10.1. Clearly show your working on the graph or in the space provided.

half-life = ... s [3]

(iii) Suggest a reason why the half-life of protactinium-234m makes it suitable for this demonstration in a lesson.

.....

..... [1]

[Total: 8]

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11 **(a)** The Solar System contains a number of objects. Some of these objects are listed.

asteroids **planets** **the Moon** **the Sun**

Write these objects in order of their size.

smallest					largest

[2]

(b) Redshift is an increase in the observed wavelength of the light emitted from distant galaxies.

(i) State what redshift indicates about the movement of distant galaxies.

..... [1]

(ii) State why redshift in the light from distant galaxies supports the Big Bang Theory.

.....

..... [1]

(c) **(i)** Define one light-year.

..... [1]

(ii) Scientists can send spacecraft to planets. There are many planets outside the Solar System.

Suggest **one** reason, other than cost, why scientists do **not** send spacecraft to planets outside the Solar System.

.....

..... [1]

(d) An electromagnetic wave travels from the Sun to the Earth in a time of 500 s.
The speed of the electromagnetic wave in space is 3.0×10^8 m / s.

Calculate the distance between the Sun and the Earth.

distance = ... m [3]

[Total: 9]

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