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# Cambridge IGCSE™

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**PHYSICS** **0625/43**

Paper 4 Theory (Extended) **October/November 2025**

**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 **20** pages. Any blank pages are indicated.

DC (WW/CGW) 346277/3

**1** **(a)** A hard ball is dropped vertically downwards.

Fig. 1.1 shows the speed–time graph for the ball from when it is dropped until it hits the ground.

Air resistance is ignored.

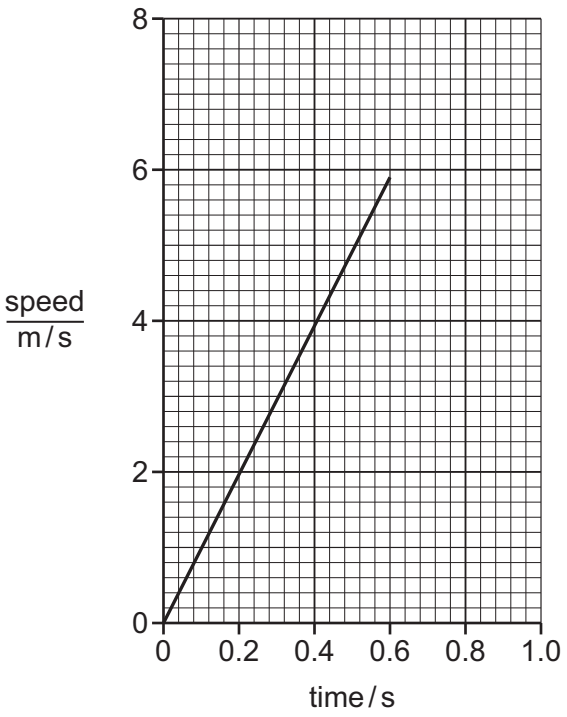


**Fig. 1.1**

**(i)** Describe the motion of the ball in Fig. 1.1.

.....

..... [1]

**(ii)** Show that the distance travelled by the ball is 1.8 m.

[2]

**(iii)** The mass of the ball is 0.54 kg. Calculate the gravitational potential energy stored in the ball immediately before it is dropped.

gravitational potential energy = ..... [2]

**(iv)** Determine the kinetic energy of the ball when it has fallen half way to the ground.

kinetic energy = ..... [1]

**(b)** The same ball is dropped from an aeroplane. Air resistance acts on the ball.

Explain how the vertical motion of the ball changes, from when it is dropped to just before it hits the ground.

Use the idea of forces in your answer.

.....

.....

.....

.....

..... [3]

**(c)** A soft ball is dropped by a student so that it bounces on the ground.

Fig. 1.2 shows the height–time graph for the ball. The height is measured from the ground.

The ball bounces four times.

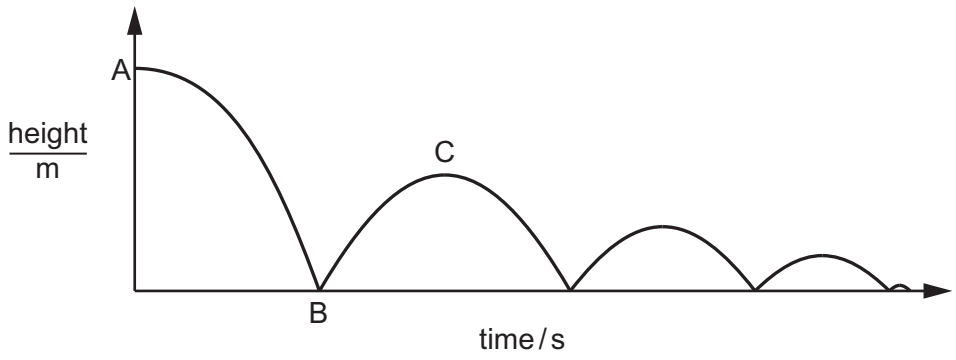


**Fig. 1.2**

Explain why the change in height of the ball between B and C is less than the change in height between A and B.

.....

.....

.....

..... [2]

[Total: 11]

**2** A cricket ball is travelling at a speed of 25 m / s horizontally through the air. The mass of the ball is 0.14 kg.

A player catches the ball and the ball comes to rest.

**(a)** Calculate the change in momentum of the ball during the catch.

change in momentum = ..... [2]

**(b)** The player's hands are in contact with the moving ball for 9.7 ms.

Calculate the horizontal force exerted by her hands to bring the ball to rest.

force = ..... [3]

[Total: 5]

**3** **(a)** Fig. 3.1 shows a Sankey diagram for the power transfer in a coal-fired power station.

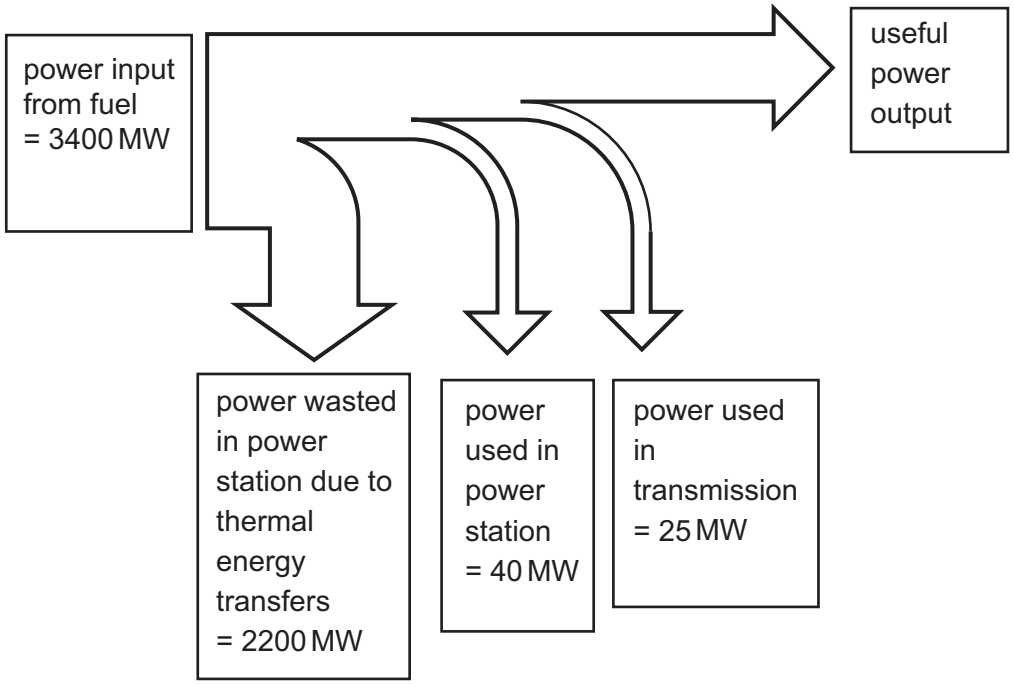


**Fig. 3.1**

**(i)** Show that the useful power output from the power station is approximately 1100 MW.

[2]

**(ii)** Calculate the efficiency of the power station.

efficiency = ..... [2]

**(b)** Describe how useful energy may be obtained from geothermal resources.

.....

.....

.....

.....

..... [2]

[Total: 6]

**4** **(a)** **(i)** A rectangular glass tank contains 3.0 $m^3$ of liquid. The mass of the liquid is 2800 kg. Calculate the density of the liquid.

density = ..... [1]

**(ii)** A metal block is placed in the tank and it sinks to the bottom. The top surface of the block is 1.1 m below the surface of the liquid.

Fig. 4.1 shows the block on the bottom of the tank.

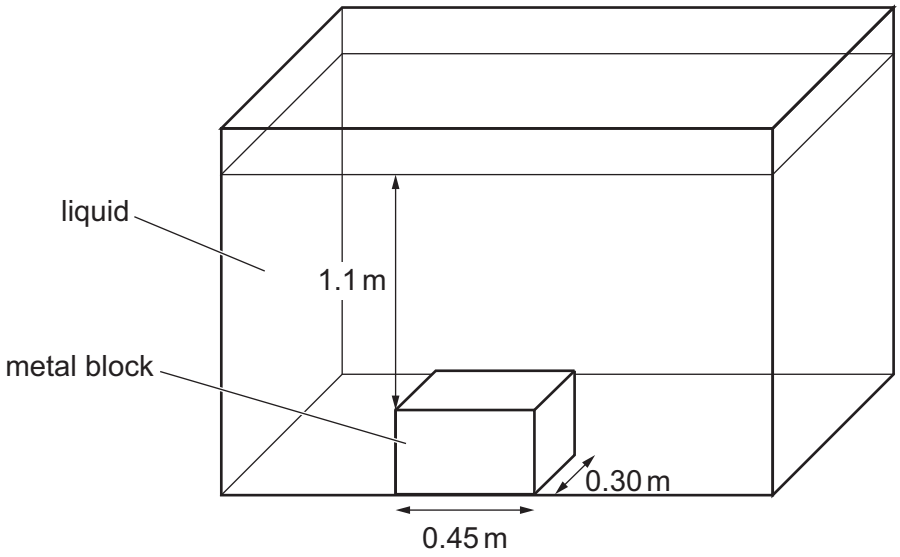


**Fig. 4.1**

Calculate the force exerted by the liquid on the top of the block.

force on top of the block = ..... [4]

**(b)** Fig. 4.2 shows part of a steel railway track. There are small gaps between sections of the rail.

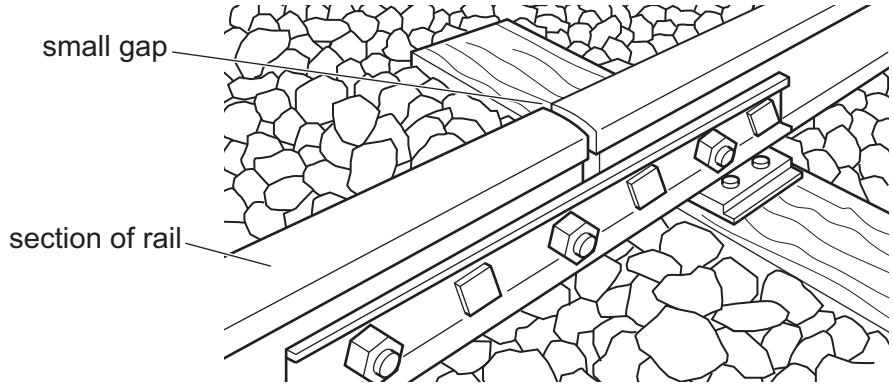


**Fig. 4.2**

State why gaps are needed between the sections of rail. Explain your answer in terms of particles.

statement .....

explanation .....

.....

[2]

**(c)** Fig. 4.3 shows a saucepan of boiling water on the heating ring of an electric cooker.

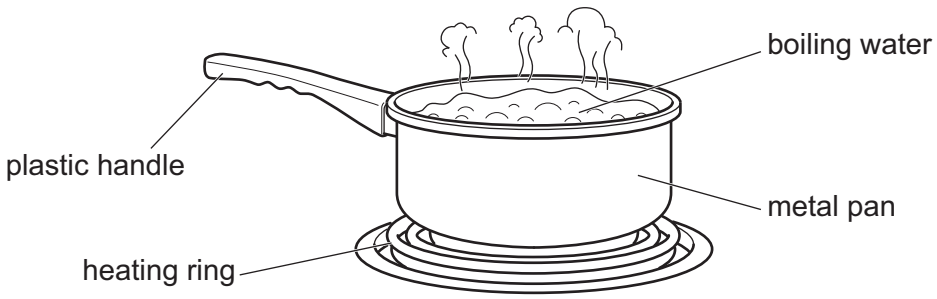


**Fig. 4.3**

The handle is made from plastic.
Explain why this material is suitable.

.....

.....

..... [2]

[Total: 9]

**5** **(a)** **(i)** Electromagnetic waves have many uses.

On Fig. 5.1 draw **one** line from each use to the region of the electromagnetic (e-m) spectrum it uses.

| Use | Region of e-m spectrum |
|---|---|
| security marking | gamma rays |
| Bluetooth | ultraviolet |
| optical fibres | infrared |
| detection of cancer | radio waves |

**Fig. 5.1**

[2]

**(ii)** State **one** advantage of using microwaves compared with radio waves to transmit mobile (cell) phone signals.

.....

..... [1]

**(b)** Describe the difference between transverse waves and longitudinal waves.

.....

.....

.....

..... [2]

**(c)** Fig. 5.2 shows a simplified diagram of seismic P-waves travelling through the Earth. The paths of the waves are curved.
Seismic waves are produced by rock movements in earthquakes.

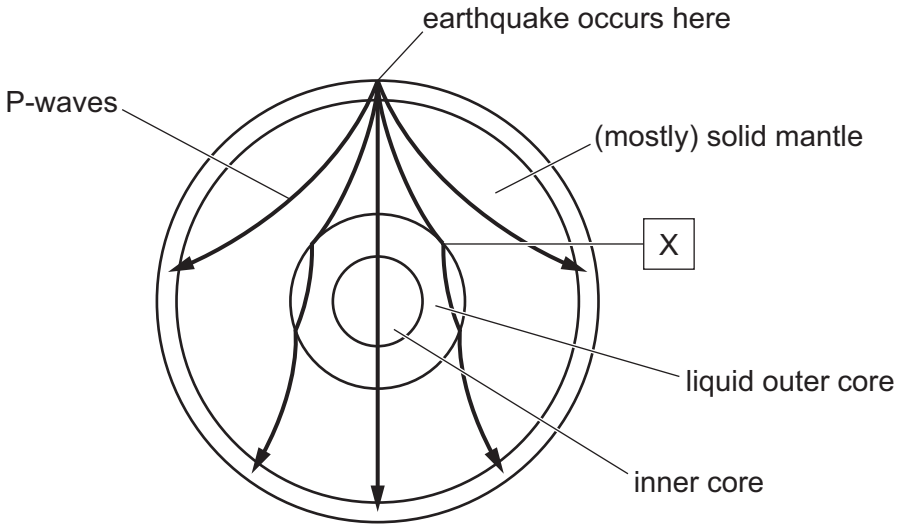


**Fig. 5.2** (not to scale)

**(i)** State the type of wave that P-waves can be modelled as.

..... [1]

**(ii)** At point X, the P-wave travels from the solid mantle to the liquid core. There is a sudden change in direction of the path of the wave.

Explain the change in direction of the P-wave at point X.

.....

.....

..... [2]

**(d)** The Earth's surface absorbs incoming radiation from the Sun and also emits thermal radiation from its surface.

Over the past 50 years, scientists estimate that the average temperature of the Earth's surface has increased by approximately 0.75 °C.

Explain what is causing this average temperature rise.

.....

.....

.....

..... [2]

[Total: 10]

**6** **(a)** Fig. 6.1 shows a circuit which includes an LDR (light-dependent resistor).

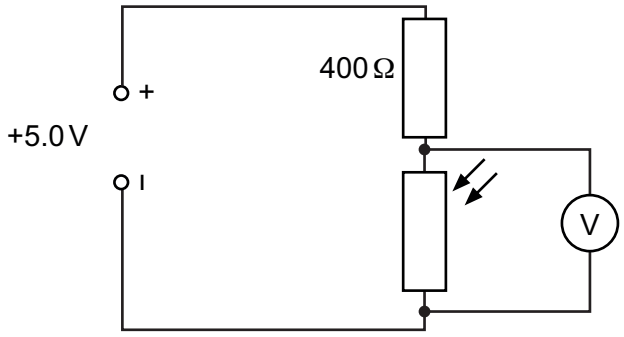


**Fig. 6.1**

The LDR is in a brightly lit room. The voltmeter reads 1.8 V.

**(i)** Calculate the current in the 400 Ω resistor.

current = ..... [3]

**(ii)** The light level in the room changes from bright to dark.

State and explain the effect on the voltmeter reading.

statement .....

explanation .....

.....

.....

.....

[3]

**(b)** Fig. 6.2 shows two light-emitting diodes (LEDs) connected in parallel in a circuit. R is a red LED and G is a green LED.

The voltmeter across the LEDs shows a potential difference (p.d.) of 2.0 V.

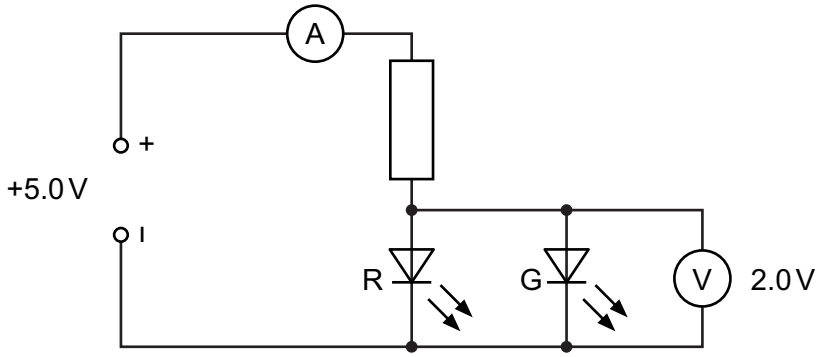


**Fig. 6.2**

**(i)** Fig. 6.3 shows a current-p.d. graph for the LEDs.

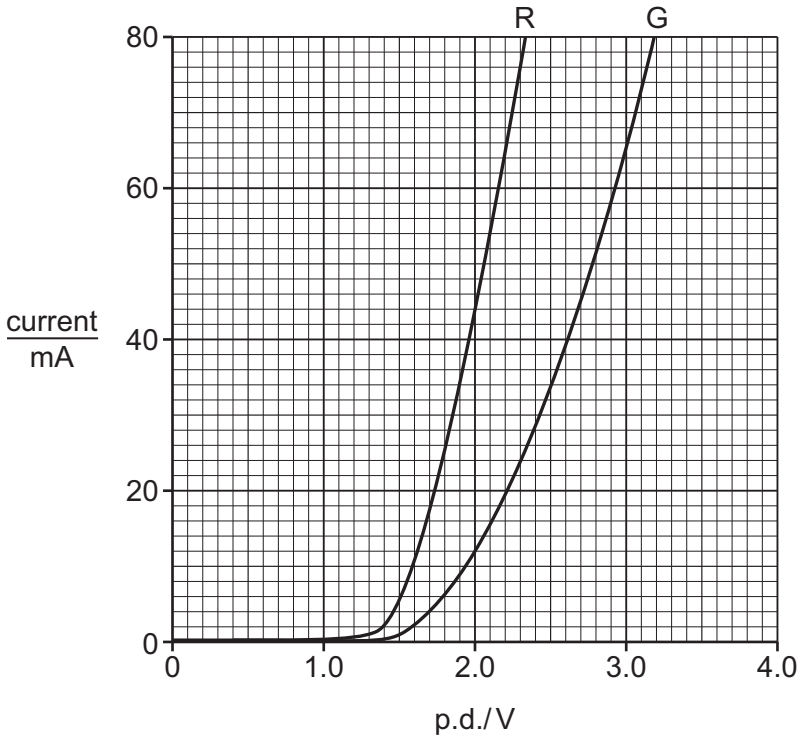


**Fig. 6.3**

Use Fig. 6.3 to determine the current in the ammeter.

current = ..... [2]

**(ii)** The connections to the power supply are reversed. State the reading on the ammeter.

current = ..... [1]

[Total: 9]

**7** Fig. 7.1 shows a simple a.c. generator.

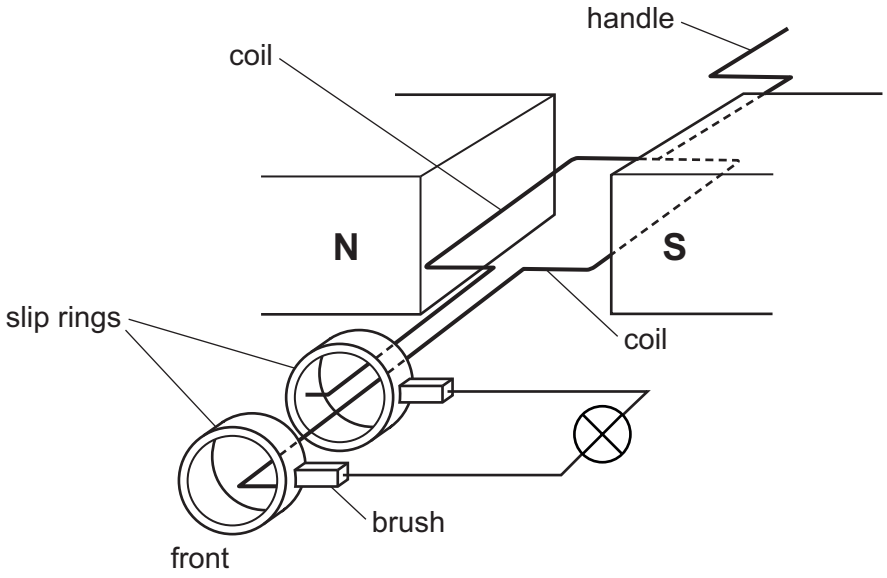


**Fig. 7.1**

**(a) (i)** Explain the function of the slip rings and brushes.

.....

.....

..... [1]

**(ii)** Describe how an alternating current is generated in the lamp.

.....

.....

.....

.....

.....

..... [3]

**(iii)** State **two** possible changes that cause a larger maximum current in the lamp.

1 .....

2 .....

[2]

**(b)** Fig. 7.2 is a graph to show how the electromotive force (e.m.f.) varies with time for the coil.

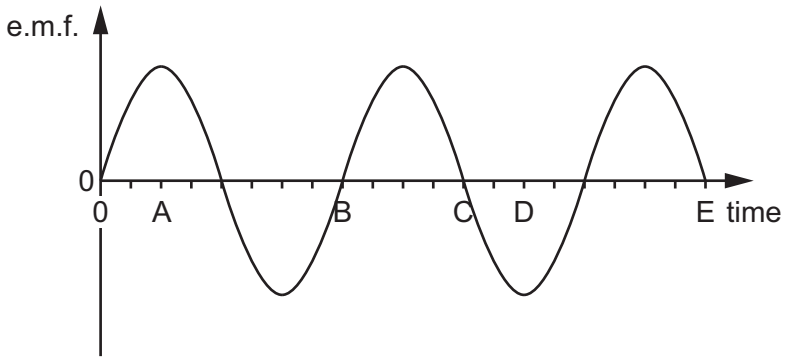


**Fig. 7.2**

**(i)** Determine how many revolutions the coil has made, from time = 0 to E.

number of revolutions = ..... [1]

**(ii)** Fig. 7.3 shows the end view of the position of the plane of the coil at time = 0. The coil is rotating anti-clockwise.

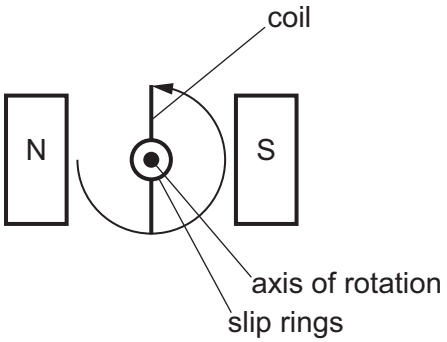


**Fig. 7.3**

On Fig. 7.4, draw **four** lines to match the coil position to the times A, B, C and D. The coil is viewed from the front.

Each coil position may be used once, more than once or not at all.

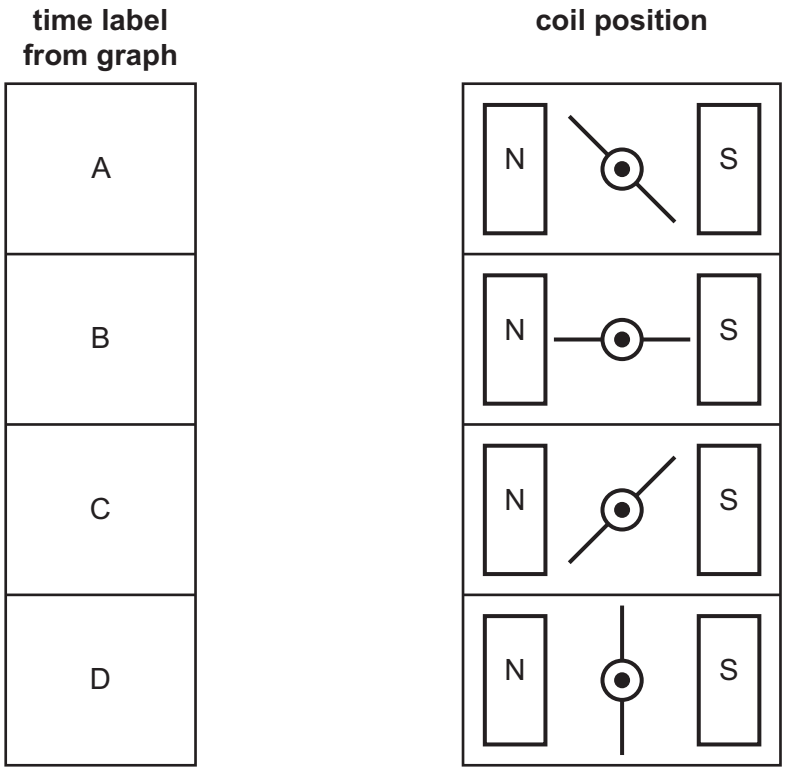


**Fig. 7.4**

[3]

[Total: 10]

**8** **(a)** Alpha ($\alpha$) particles are directed at a very thin sheet of gold foil.

The following observations provide evidence for the nuclear model of the atom.

State what conclusions may be made about the model of the atom from these observations.

**(i)** Observation: most of the particles pass straight through the foil.

conclusion .....

.....

..... [1]

**(ii)** Observation: a few particles bounce back or are deflected through large angles.

conclusion .....

.....

..... [1]

**(b)** Fig. 8.1 shows three beams of ionising radiation, alpha, beta and gamma, passing between two parallel plates. The plates are charged and there is a uniform electric field between them.

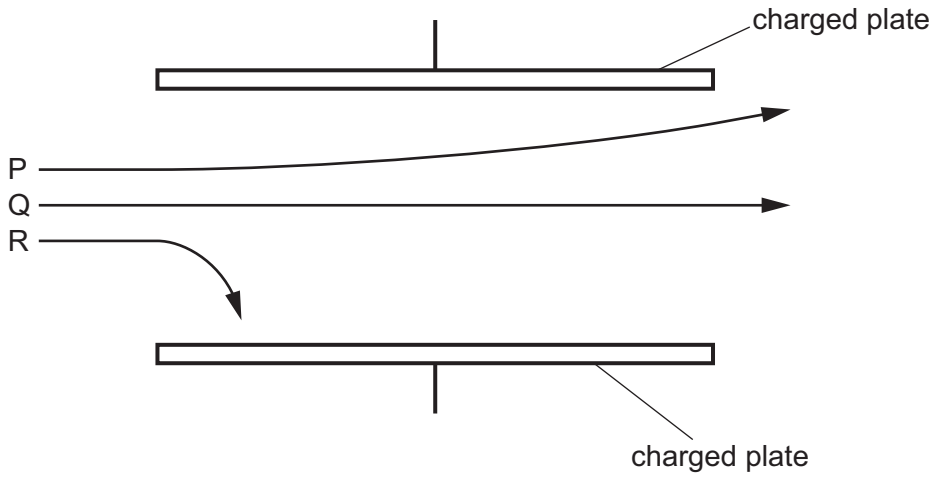


**Fig. 8.1**

**(i)** State and explain which path P, Q or R shows a beam of alpha particles.

path .....

explanation .....

.....

.....

[2]

**(ii)** State and explain the direction of the electric field between the plates.

direction .....

explanation .....

.....

.....

[1]

**(c)** Curium-242 is a radioactive isotope. It emits alpha particles. It has a half-life of 160 days.

After 480 days, the mass of curium-242 in a sample is $2.4 \times 10^{-3}$ g.

Calculate the initial mass of curium-242 in the sample.

initial mass of curium-242 = ..... [2]

[Total: 7]

9 **(a)** Cosmic microwave background radiation (CMBR) can be observed in every direction in space around us.

**(i)** State when CMBR was produced.

..... [1]

**(ii)** State and explain how the wavelength of this radiation has changed since it was formed.

.....

.....

..... [2]

**(b)** Table 9.1 shows data about planets in our solar system.

**Table 9.1**

| planet | average radius of orbit around the Sun / $10^6$ km | time for one orbit / Earth years | average surface temperature / °C |
|---|---|---|---|
| Venus | 108 | 0.62 | 460 |
| Earth | 150 | 1.00 | 15 |
| Mars | 228 | 1.90 | –65 |
| Jupiter | 778 | 12.00 | –110 |
| Saturn | 1430 | 29.00 | –140 |

**(i)** The orbit of Venus is approximately circular.

Calculate the average orbital speed $v$ of Venus. Give your answer in km / h.

orbital speed = ..... km / h [3]

**(ii)** State how the average surface temperature of a planet changes as its distance from the Sun increases.

..... [1]

[Total: 7]

**10** **(a)** Sketch a diagram to show the orbital path of a comet around the Sun.

Mark the position of the Sun on your diagram using an S.

[2]

**(b)** Draw a cross on your diagram to show where the comet is travelling with the slowest speed. Label the cross **L**. [1]

**(c)** Explain why the speed of a comet changes as it travels around its orbit.

Use the conservation of energy in your explanation.

.....

.....

.....

..... [3]

[Total: 6]

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**PHYSICS** **0625/42**

Paper 4 Theory (Extended) **February/March 2026**

**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. Do **not** use correction fluid or tape.
- 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 [ ].

**1** A student cycles from home to school. Figure 1.1 shows the distance–time graph for this journey.

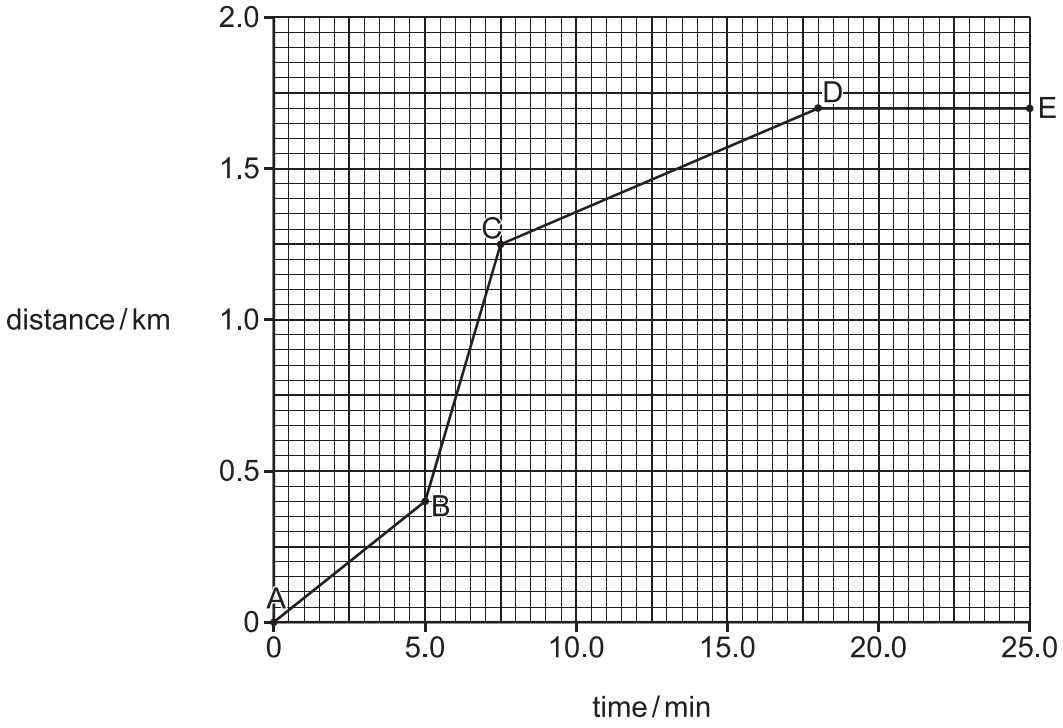


**Figure 1.1**

**(a)** State the distance between home and school.

distance = ..... km [1]

**(b)** State **one** point, A, B, C, D or E which identifies a time when:

1 the student accelerates .....

2 the student decelerates .....

[2]

**(c)** Use Figure 1.1 to calculate the student's maximum speed in km / h.

maximum speed = ..... km / h [3]

[Total: 6]

**2** Figure 2.1 shows a ship made of steel floating on the sea.

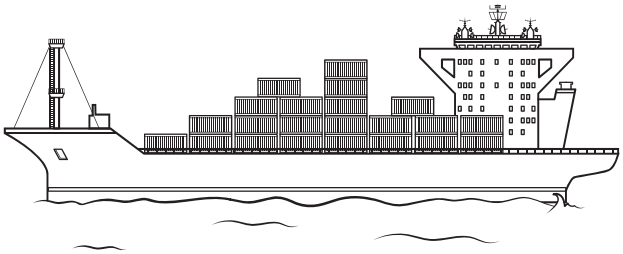

**Figure 2.1**

**(a) (i)** State the equation that links density, mass and volume.

..... [1]

**(ii)** The density of steel is 7900 kg / $m^3$. The mass of a solid steel cube is 110 kg.

Calculate the volume of the steel cube.

volume = ..... $m^3$ [1]

**(iii)** The density of sea water is 1030 kg / $m^3$.

State why the solid steel cube sinks when placed in sea water.

.....

..... [1]

**(iv)** Explain why the steel ship in Figure 2.1 floats on the sea water.

.....

.....

..... [2]

**(b)** The mass of the ship is $3.5 \times 10^7$ kg. The ship accelerates at $0.75\,m/s^2$.

**(i)** Calculate the force which causes this acceleration.

force = ..... N [2]

**(ii)** Explain why the force provided by the ship's engine must be larger than the value in **2(b)(i)**.

.....

..... [2]

[Total: 9]

**3** Figure 3.1 shows a polar bear and a person standing on thick ice. The figures are drawn to a scale of 1 cm : 100 cm

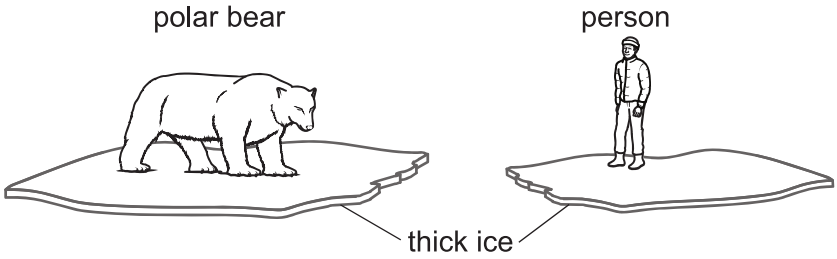


**Figure 3.1**

Table 3.1 contains information about the polar bear and the person.

**Table 3.1**

| | **polar bear** | **person** |
|---|---|---|
| mass / kg | 590 | 84 |
| area in contact with ice / $m^2$ | 1.12 | 0.020 |

**(a) (i)** Calculate the weight of the polar bear.

weight = ..... N [1]

**(ii)** Calculate the pressure that the polar bear exerts on the ice.

pressure = ..... Pa [2]

**(iii)** Use the numbers to complete each equation.

Each number may be used once, more than once or not at all.

0.125 7.0 8.0 56 392

mass of polar bear = ..... × mass of person

area of polar bear in contact with ice = ..... × area of person in contact with ice

pressure exerted by person = ..... × pressure exerted by polar bear

[2]

**(b)** Under the ice is sea water with a density of 1030 kg / $m^3$.

Calculate the change in pressure $\Delta p$ between the top of the sea water and a depth of 2.50 m.

$\Delta p$ = ..... Pa [2]

[Total: 7]

**4** An outdoor heater warms people sitting outside. Figure 4.1 shows the heater.

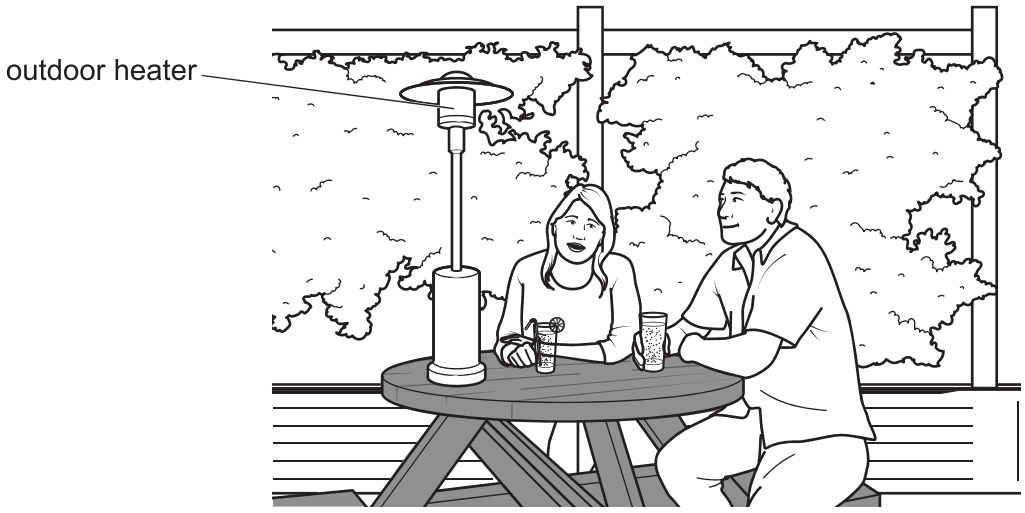


**Figure 4.1**

**(a)** State the method of thermal energy transfer that warms the people.

..... [1]

**(b)** **(i)** Complete the sentences about energy transfers that warm the table.

The heater transfers energy to the ..... store of the table. The temperature of the table increases. The rate of energy ..... by the table is greater than the rate of energy ..... by the table. [2]

**(ii)** One of the people puts a white cloth over the table. Explain why the white cloth causes the temperature of the table to decrease.

.....

..... [2]

**(c)** The heater has a power of 2.5 kW. The heater is switched on for 3 hours.

Calculate the energy, in kWh, transferred electrically by the heater.

energy = ..... kWh [2]

[Total: 7]

**5** **(a)** Atmospheric pressure is $1.0 \times 10^5$ Pa. A volume of 1.02 $m^3$ of air at atmospheric pressure is pumped into a car tyre. The pressure of the air when it is inside the tyre is $2.6 \times 10^5$ Pa.

Calculate the volume of the air when it is in the car tyre.

volume = ..... $m^3$ [3]

**(b)** **(i)** Describe the structure of a gas in terms of the separation, arrangement and motion of particles.

separation .....

.....

arrangement .....

.....

motion .....

.....

[3]

**(ii)** Explain, in terms of particles, why the internal energy of the gas decreases when the gas is at a lower temperature.

.....

..... [2]

[Total: 8]

**6** Figure 6.1 is a full-scale drawing of an object O, a thin converging lens L and the image I of object O.

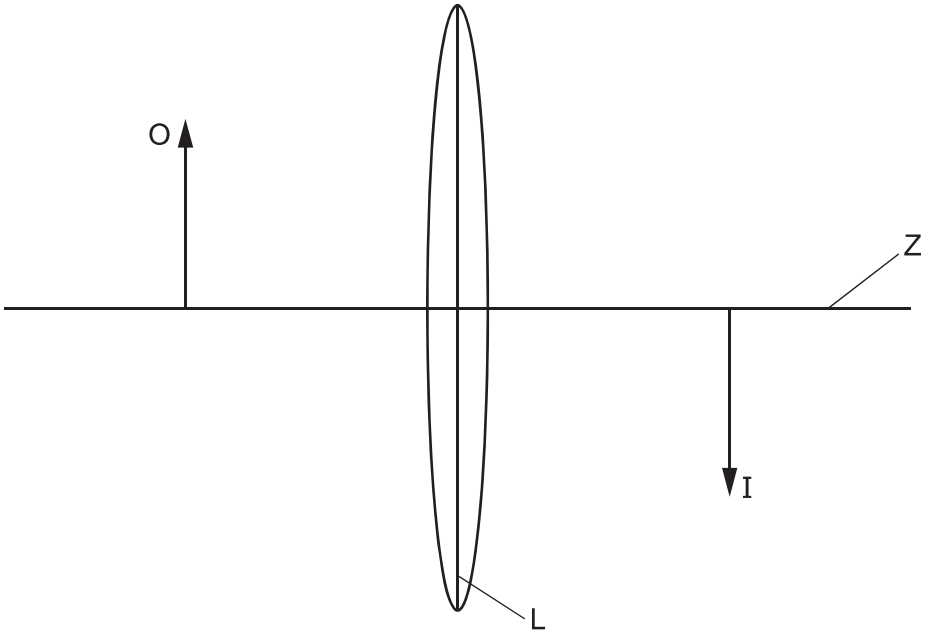


**Figure 6.1**

**(a) (i)** Identify Z.

..... [1]

**(ii)** Determine the focal length of the lens L. Show any working in the space provided or on Figure 6.1.

focal length = ..... cm [2]

**(iii)** The image in Figure 6.1 is inverted.

State **two** other characteristics of the image.

1 .....

2 .....

[2]

**(b)** Figure 6.2 shows a different converging lens with a focal length F.

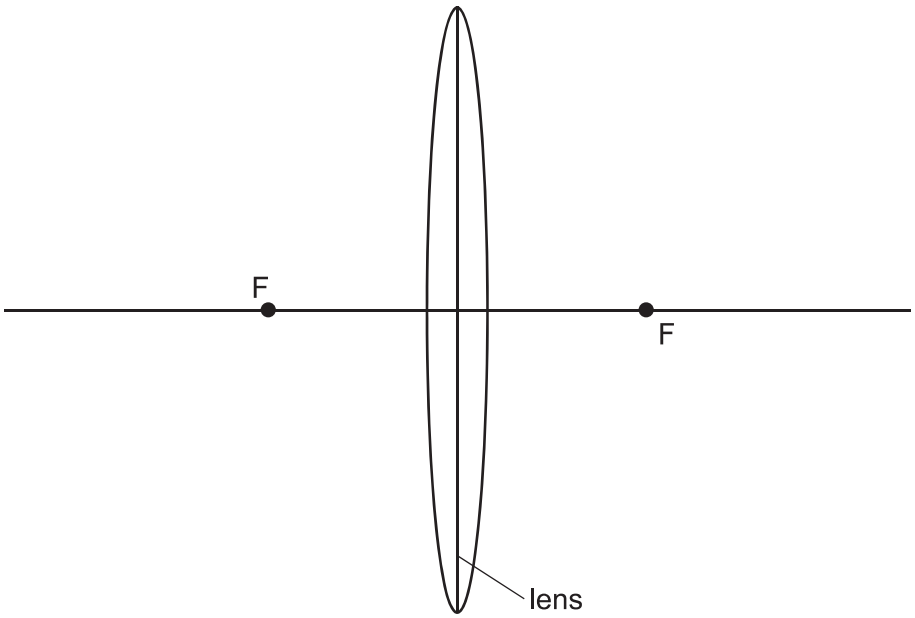


**Figure 6.2**

**(i)** The lens in Figure 6.2 is used as a magnifying glass.

Draw an X on Figure 6.2, to show a position for an object which produces a magnified image. [1]

**(ii)** Put a tick (✓) alongside the **two** statements which describe the position of the magnified image.

| | |
|---|---|
| on the opposite side of the lens to the object | |
| on the same side of the lens as the object | |
| the same distance from the lens as the object. | |
| closer to the lens than the object | |
| further away from the lens than the object | |

[1]

[Total: 7]

7 Figure 7.1 shows two identical cells in series with a thermistor and a fixed resistor.

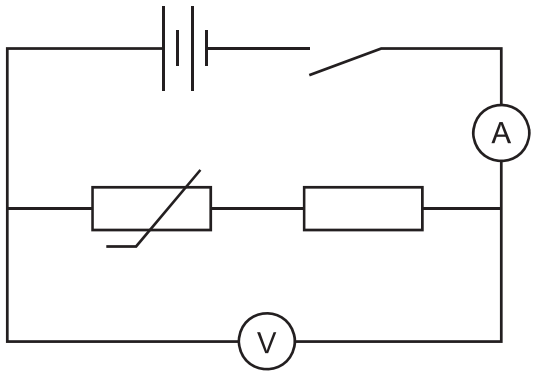


**Figure 7.1**

The switch is closed. The reading on the voltmeter is 9.0 V. The reading on the ammeter is 4.6 mA.

**(a)** Determine the e.m.f. of one cell. Give the unit.

e.m.f. = ..... unit ..... [2]

**(b)** Complete the sentence to define electric current.

Electric current is the amount of ..... passing a point

per unit ..... .

[1]

**(c)** The resistance of the fixed resistor is 480 Ω.

Calculate the resistance of the thermistor.

resistance = ..... Ω [3]

**(d)** The thermistor is placed in a beaker of ice. The temperature of the thermistor decreases. State how this change in temperature affects the readings on the voltmeter and ammeter.

voltmeter .....

ammeter .....

[1]

[Total: 7]

8 A transformer steps down high-voltage electricity. The transformer has 6200 turns on the primary coil and 43 turns on the secondary coil. The output voltage is 230 V.

**(a) (i)** Calculate the input voltage in the step-down transformer.

input voltage = ..... V [2]

**(ii)** A 2.2 kW kettle is connected to the secondary coil of the transformer.

Calculate the current in the primary coil of the step-down transformer. Assume the transformer is 100% efficient.

current = ..... A [3]

**(b)** A power station produces 1.3 GW of electricity. A transformer at the power station steps up the voltage before the electricity is transmitted. This reduces the power loss during transmission.

**(i)** State the equation for power loss in electricity transmission.

..... [1]

**(ii)** Explain how the step-up transformer reduces power losses during electricity transmission.

.....

.....

..... [2]

[Total: 8]

**9** Figure 9.1 shows a beam of $\alpha$-particles and $\gamma$-radiation entering an electric field between two charged metal plates P and Q.

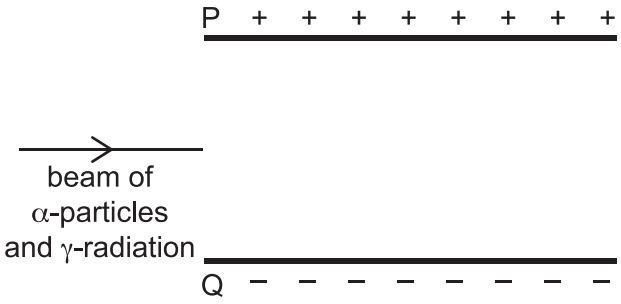


**Figure 9.1**

**(a)** On Figure 9.1, draw the path of:

1 the $\alpha$-particles inside the electric field. Label this line $\alpha$.

2 the $\gamma$-radiation inside the electric field. Label this line $\gamma$.

[3]

**(b)** A student places a sheet of paper in the path of the beam before it reaches the electric field. State how this affects the path of the $\alpha$-particles and $\gamma$-radiation inside the electric field.

$\alpha$-particles .....

$\gamma$-radiation .....

[2]

**(c)** The beam of $\alpha$-particles and $\gamma$-radiation in Figure 9.1 is replaced by a beam of $\beta$-particles.

State and explain the path of the $\beta$-particles in the electric field. Use ideas about electrostatic force in your answer.

statement .....

explanation .....

.....

[3]

[Total: 8]

**10** **(a)** Planetary nebulae form as part of the life cycle of stars.

**(i)** Complete the sentence about a planetary nebula.

Stars expand when they run out of hydrogen to fuel nuclear reactions.

A ..... forms a planetary nebula. [1]

**(ii)** State what is at the centre of a planetary nebula.

..... [1]

**(b)** A planetary nebula emits blue light and red light at two specific wavelengths: $5.0 \times 10^{-7}$ m and $6.6 \times 10^{-7}$ m.

**(i)** Explain why the light with a wavelength of $5.0 \times 10^{-7}$ m is the blue light.

.....

..... [1]

**(ii)** The speed of light in a vacuum is $3.0 \times 10^{8}$ m/s.

Calculate the frequency of the blue light.

frequency = ..... Hz [2]

[Total: 5]

**11** The average orbital speed $v$ of an object in the Solar System is defined by the equation

$$v = \frac{2\pi r}{T}$$

**(a)** Define the terms $r$ and $T$ in this equation.

$r$ is .....

$T$ is .....

[2]

**(b)** The average orbital speed of Saturn is 9600 m / s.

**(i)** Explain why the orbital speed is an average value.

.....

.....

..... [2]

**(ii)** Saturn is $1.4 \times 10^{12}$ m from the Sun.

Show that one Saturn year is approximately equal to 30 Earth years.

[4]

[Total: 8]

 