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8087076272

PHYSICS **0625/42**

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.

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1 **(a)** **(i)** State the difference between a scalar quantity and a vector quantity.

.....

..... [1]

(ii) In the list below, draw a line under each of the quantities that is a scalar quantity.

acceleration **mass** **momentum** **electric field strength**

energy **temperature**

[2]

(b) A tennis player throws a tennis ball into the air. The mass of the tennis ball is 5.8×10^{-2} kg. The tennis ball leaves the tennis player's hand and reaches a maximum height of 5.0 m above the point of release.

(i) Show that the initial velocity of the tennis ball is 9.9 m / s upwards.

[3]

(ii) Calculate the momentum of the tennis ball as it leaves the tennis player's hand.

momentum = ... [2]

[Total: 8]

2 **(a)** A truck moves with a constant acceleration. The speed of the truck increases from 13 m/s to 22 m/s. The time taken for this increase in speed is 4.5 s. The mass of the truck is 3700 kg.

(i) Calculate the resultant force acting on the truck.

resultant force = ... [3]

(ii) The engine of the truck provides the forward force on the truck. State **two** forces acting on the truck in the opposite direction to the forward force.

.....

.....

..... [2]

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(b) Fig. 2.1 shows a car as it travels round a circular racing track.

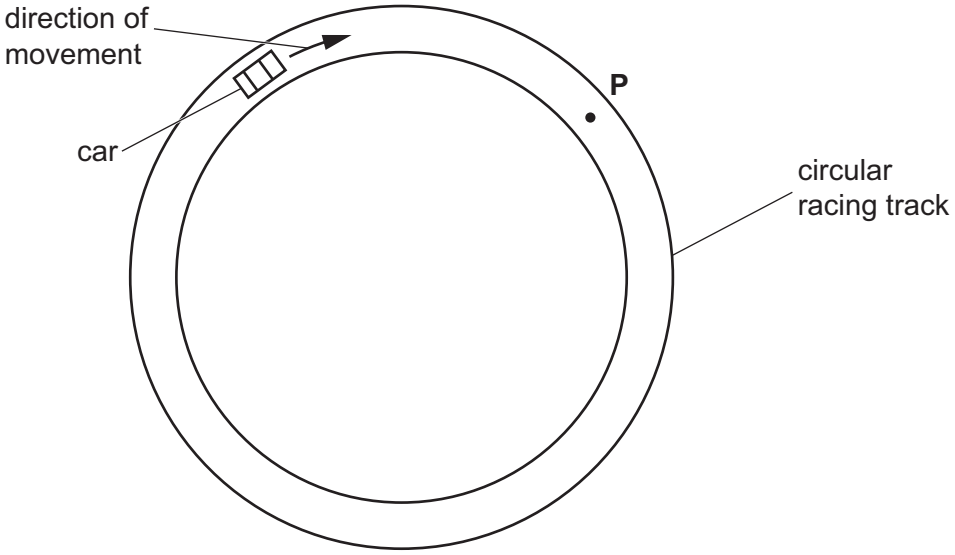


Fig. 2.1

(i) The car travels at constant speed.

On Fig. 2.1, draw an arrow to show the direction of the force acting on the car. [1]

(ii) A different car travels around the same track and slides off the track at point P.

State **two** possible reasons that cause the car to slide off the track.

.....

.....

.....

..... [2]

[Total: 8]

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3 Fig. 3.1 shows black solar panels installed on the roof of a house and a large rechargeable battery.

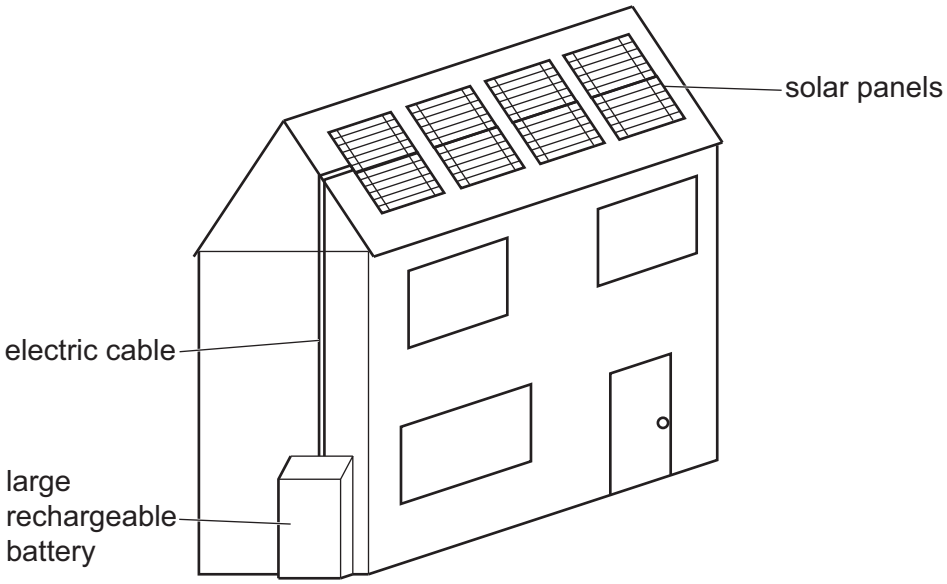


Fig. 3.1 (not to scale)

The solar panels produce electricity and give a maximum power output of 3.5 kW. The efficiency of the solar panels is 16%.

(a) State and explain **one** advantage of using black solar panels.

.....

.....

..... [2]

(b) Calculate the power received by the solar panels from the Sun.

power = ... [3]

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(c) The solar panels produce direct current (d.c.) and household appliances use alternating current (a.c.).

State the difference between alternating current and direct current.

.....

..... [1]

(d) Suggest **one** advantage of storing energy in the large rechargeable battery.

.....

..... [1]

(e) Calculate the charge that flows into the battery when there is a current of 4.0A for 2.0 hours.

charge = ... [3]

[Total: 10]

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4 Fig. 4.1 shows gas trapped in a cylinder by a piston.

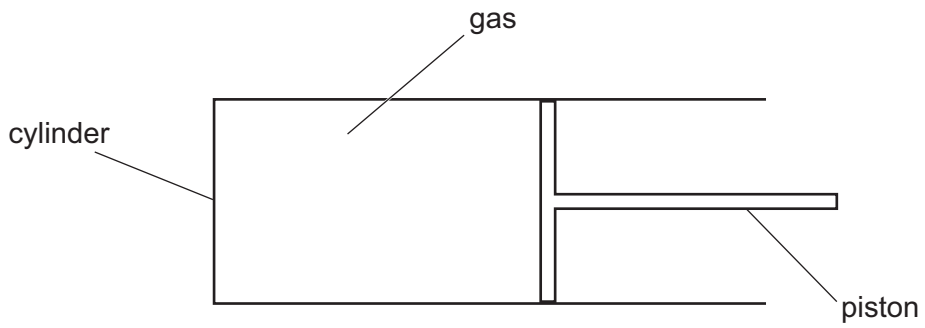


Fig. 4.1

(a) The volume of gas is 240 cm^3.
The piston is pushed to the left and is held in its new position.

(i) The pressure of the gas increases from 1.0×10^5 Pa to 1.4×10^5 Pa.

The temperature of the gas remains constant.

Calculate the volume of the gas when the piston is in its new position.

volume = ... cm^3 [3]

(ii) The area of the piston in contact with the gas is 1.9×10^{-3} m^2.

Calculate the force exerted on the piston by the gas when the piston is held in its new position.

force = ... [2]

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(iii) The distance moved by the piston is 0.036 m. The average force exerted by the piston as it moves is 220 N.

Calculate the mechanical work done by the piston. State the equation you use.

work done = ... [2]

(b) Explain, in terms of particles, why gases can be compressed but liquids cannot.

.....

.....

..... [1]

[Total: 8]

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5 **(a)** There is a large puddle of water on a road. The water in the puddle evaporates.

(i) Describe how evaporation from the puddle occurs. Use ideas about particles in your answer.

.....

.....

..... [2]

(ii) State and explain **one** change in the weather that causes a faster rate of evaporation.

Statement .....

Explanation .....

.....

.....

[2]

(b) A car travels on a dry road. The driver presses the brakes. The car travels a distance before it comes to rest. This distance is called the braking distance.

State and explain how the braking distance changes when the road is wet.

.....

.....

..... [1]

[Total: 5]

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6 **(a)** Fig. 6.1 shows successive crests of a water wave approaching a boundary.

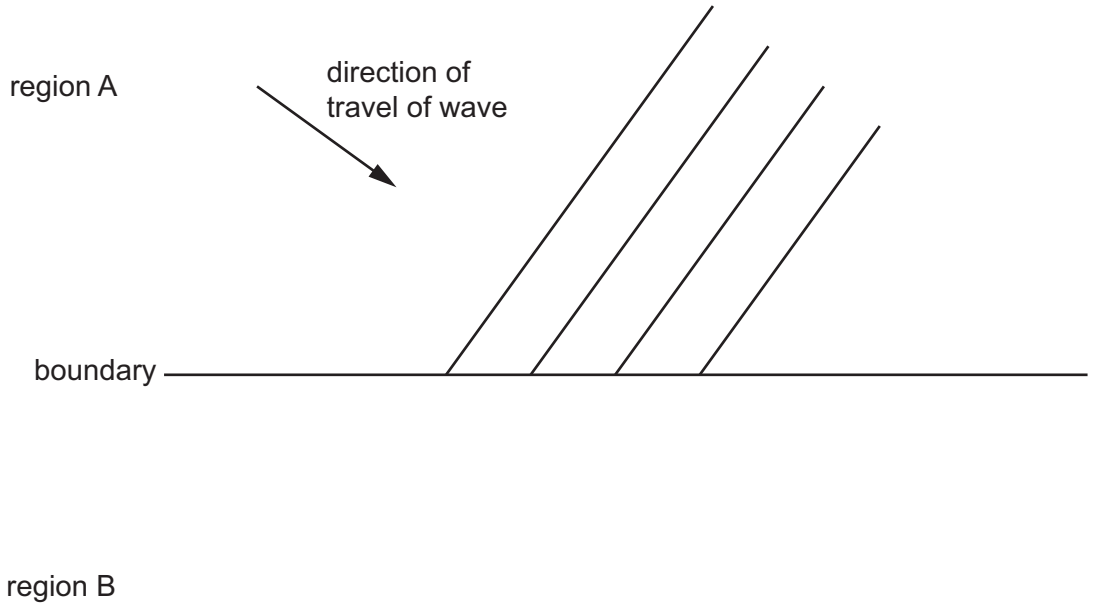


Fig. 6.1

(i) The speed of the waves in region B is lower than the speed of the waves in region A.

On Fig. 6.1, draw the crests of the waves in region B. [3]

(ii) State the wave effect that occurs as the wave crosses the boundary between region A and region B.

..... [1]

(b) **(i)** Light can be totally internally reflected when striking the boundary between two different regions.

State **two** conditions that are necessary for total internal reflection to occur.

1 .....

.....

2 .....

.....

[2]

(ii) State **two** advantages of using optical fibres for transmitting high speed broadband.

1 .....

2 .....

[2]

[Total: 8]

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7 A circuit consists of an a.c. supply and two lamps. The lamps are connected in parallel.

(a) Draw the circuit diagram.

[2]

(b) The electromotive force (e.m.f.) of the a.c. supply is 230 V. When connected to the 230 V supply, the resistance of one lamp is 1200 Ω and the resistance of the other lamp is 800 Ω.

(i) Calculate the current in the 800 Ω lamp.

current = ... [2]

(ii) Calculate the energy used by the 800 Ω lamp in 5.0 hours.

Give your answer in kWh.

energy = ... kWh [3]

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(iii) Calculate the combined resistance of the two lamps in this circuit.

resistance = ... [2]

[Total: 9]

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8 **(a)** State what is meant by a magnetic field.

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..... [1]

(b) Fig. 8.1 shows an ammeter connected to a coil wound on a thin plastic cylinder. A small trolley is placed on a curved track which passes through the cylinder.

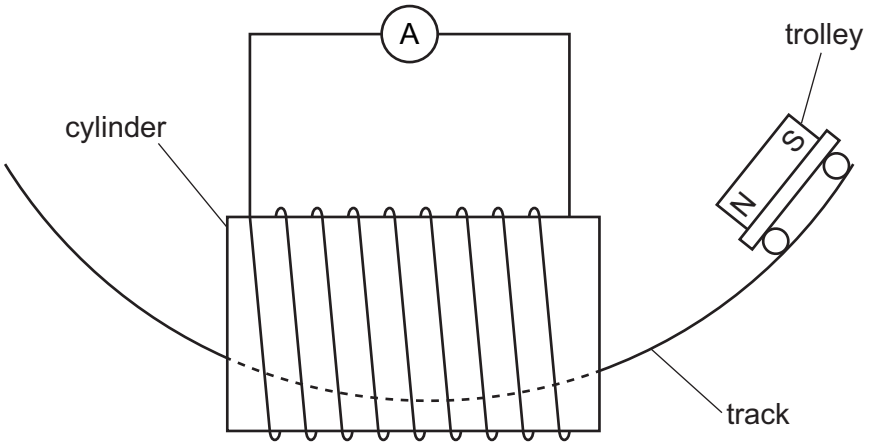


Fig. 8.1

The trolley is released from the position shown in Fig. 8.1. It travels through the coil from right to left. The trolley travels back from left to right. It has a lower maximum speed when it travels from left to right.

The plastic cylinder does not affect any magnetic field. A magnet is fixed to the trolley.

(i) State why there is a lower maximum speed when the trolley travels back from left to right.

.....

..... [1]

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(ii) Fig. 8.2 shows a close-up view of the ammeter.

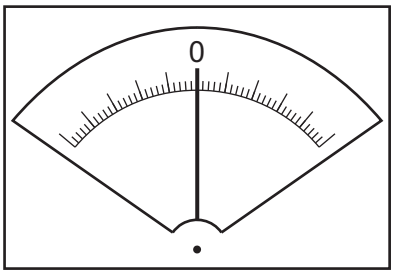


Fig. 8.2

As the trolley enters the coil moving from right to left, the ammeter needle deflects to the left and then returns to zero.

State and explain any changes to the deflection on the ammeter as the trolley enters the coil when moving back from left to right.

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.....

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..... [3]

[Total: 5]

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9 **(a)** Fig. 9.1 shows a beam of radiation in a vacuum. The beam contains α-particles, β-particles and γ-radiation.

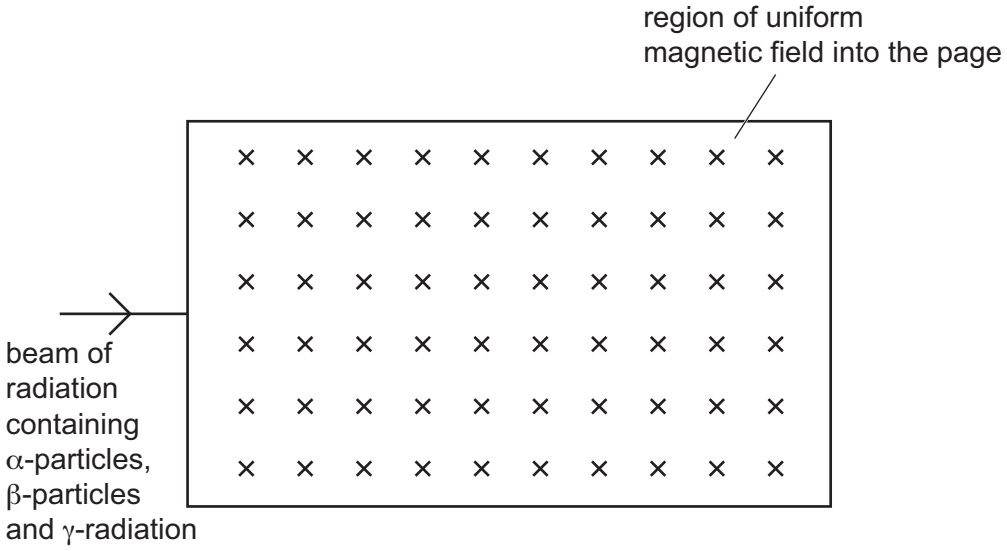


Fig. 9.1

The beam enters a region where there is a strong, uniform magnetic field. The direction of the magnetic field is into the page.

On Fig. 9.1 draw and label the paths within the magnetic field of:

(i) α-particles (label this path α) [1]

(ii) β-particles (label this path β) [2]

(iii) γ-radiation (label this path γ) [1]

(b) Table 9.1 shows five radioactive sources, the main type of radiation emitted by each source and the half-life of each source.

Table 9.1

radioactive source	type of radiation emitted	half-life
P	alpha	460 years
Q	alpha	10 days
R	beta	29 years
S	beta	14 days
T	gamma	30 years

(i) Define half-life of a radioactive isotope.

.....

..... [1]

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(ii) Fig. 9.2 shows a simplified diagram of a machine that produces thin sheets of aluminium of constant thickness.

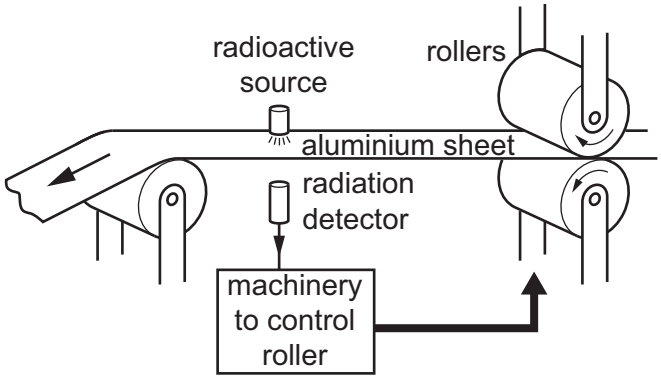


Fig. 9.2

The radiation detector is used to measure the thickness of the aluminium sheets and control the gap between the rollers.

State the most suitable radioactive source in Table 9.1 for the machine in Fig. 9.2.

Explain why this radioactive source is the most suitable and why the other sources are unsuitable.

most suitable source .....

explanation .....

.....

.....

.....

.....

.....

.....

[4]

[Total: 9]

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10 (a) Fill in the gaps in the description of how an accretion model explains the formation of the Solar System.

The planets nearest the Sun are small and .....

The planets furthest from the Sun are large and .....

All the planets were formed when a cloud of gas and dust collapsed due to

.....

The rotation of material in the cloud forms an .....

[4]

(b) The time taken for light to travel from the Moon to the Earth is 1.3 s.

Calculate the distance of the Moon from the Earth. Give your answer in m.

distance = ... m [3]

(c) The Whirlpool galaxy is 2.3×10^{7} light-years from the Earth. The current value of the Hubble constant is 2.2×10^{-18} per second.

Calculate the speed at which the Whirlpool galaxy is moving away from the Earth.

speed = ... [3]

[Total: 10]

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