IGCSE · PHYSICS 0625 · FOR EXAMINATION IN 2026, 2027 AND 2028

Cambridge IGCSE Physics

One practice paper for each of the six topics of Cambridge IGCSE Physics 0625, written in the format the board actually sets: four-option multiple choice, structured questions with lettered parts, and a practical-skills question — with the Core and Supplement split drawn where the syllabus draws it.

PAPERS	QUESTIONS	TOTAL MARKS	FIGURES
6	**60**	**233**	**30**

EVERY PAPER IN THIS FILE

ASSESSMENT
Every candidate sits two theory papers and one practical-skills paper. Core takes Papers 1 and 3 and is capped at grade C; Extended takes Papers 2 and 4 and reaches A*. Both then take either Paper 5 (practical test) or Paper 6 (alternative to practical), which carries 20% either way. Theory papers give you no formula sheet.

DEMAND
Pitched at the board's own level, not above it. Multiple choice is mostly one step, with a couple of two-step items and one that rewards the candidate who does not take the obvious route. Structured questions open on a 1-mark recall and close on an explanation or a suggestion worth two marks — the marks real candidates most often drop.

> *Written by GioPhysics from the published syllabus. These are practice papers in the style of Cambridge IGCSE Physics 0625; they are not Cambridge papers, contain no past-paper questions, and the official syllabus and specimen materials remain the authority.*
>
> Cambridge IGCSE Physics 0625 syllabus — https://www.cambridgeinternational.org/Images/697209-2026-2028-syllabus.pdf

Topic 1 · Motion, forces and energy

The largest topic on the syllabus and the one that carries the most marks in the real papers. Measurement, motion graphs, Newton's laws, moments, momentum, energy and pressure.

SUGGESTED TIME	TOTAL MARKS	QUESTIONS	MULTIPLE CHOICE
50 minutes	**41**	**10**	**6**

SECTION	**1 · Motion, forces and energy**
IN THE FORMAT OF	Papers 1 and 2 (multiple choice), Papers 3 and 4 (theory), Paper 6 (alternative to practical)
ROUTES	Core only — 5 questions, 13 marks. Core and Supp. — the whole paper, 10 questions, 41 marks. Every question is tagged in the left margin.
DEMAND	**Recall 1 · Routine 5 · Demanding 3 · Discriminating 1**
	Pitched at the board's own level, not above it. Multiple choice is mostly one step, with a couple of two-step items and one that rewards the candidate who does not take the obvious route. Structured questions open on a 1-mark recall and close on an explanation or a suggestion worth two marks — the marks real candidates most often drop.
SYLLABUS POINTS	1.1 · 1.2 · 1.3 · 1.4 · 1.5.1 · 1.5.2 · 1.5.3 · 1.6 · 1.7.1 · 1.7.2 · 1.7.3 · 1.7.4 · 1.8

INSTRUCTIONS

- Answer all questions in the spaces provided.
- Show your working. Method marks are awarded even where the final answer is wrong.
- Give your answers to a sensible number of significant figures, with a unit.
- The mark scheme for this paper follows the last question.

THE PAPER

Topic 1 · Motion, forces and energy

Answer all questions. 41 marks in 50 minutes.

1 CORE

MULTIPLE CHOICE · RECALL · 1.1 **[1]**

Which pair contains only vector quantities?

A distance and displacement

B energy and power

C mass and weight

D velocity and weight

Answer

2 CORE

MULTIPLE CHOICE · ROUTINE · 1.2 **[1]**

A cyclist travels 100 m in a straight line in 20 s, then stops at traffic lights for 10 s. What is the average speed over the whole 30 s?

A 0 m/s

B 3.3 m/s

C 5.0 m/s

D 10 m/s

Answer

3 CORE

MULTIPLE CHOICE · ROUTINE · 1.4 **[1]**

A rectangular metal block measures 2.0 cm × 3.0 cm × 5.0 cm and has a mass of 240 g. What is its density?

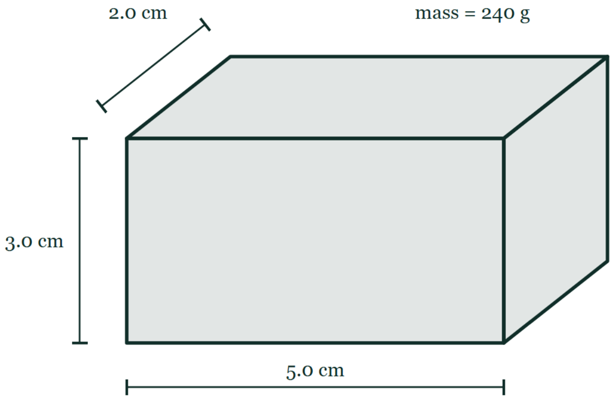

Fig. 3.1 *An oblique drawing of a solid rectangular metal block. The front face is marked 5.0 cm along its lower edge and 3.0 cm up its left-hand edge, and the edge receding into the page is marked 2.0 cm. The block carries the label mass = 240 g.*

A 0.13 g/cm^3

B 8.0 g/cm^3

C 24 g/cm^3

D 7200 g/cm^3

Answer

4 CORE

MULTIPLE CHOICE · ROUTINE · 1.5.2

[1]

A uniform beam is pivoted at its centre. A weight of 4.0 N hangs 0.80 m from the pivot on the left-hand side. A weight of 8.0 N is hung on the right-hand side so that the beam balances. How far from the pivot is the 8.0 N weight?

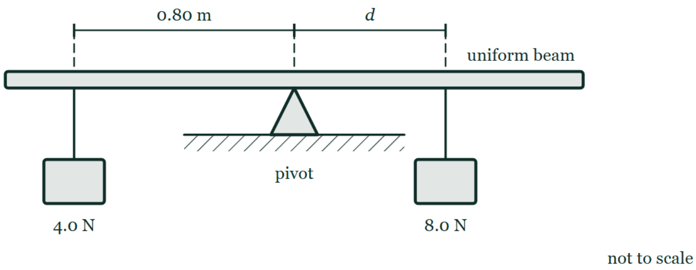

Fig. 4.1 *A uniform beam rests on a pivot standing on the ground, the pivot placed at the centre of the beam. A 4.0 N weight hangs from the beam at a point 0.80 m to the left of the pivot, and an 8.0 N weight hangs to the right of the pivot at a distance marked d. Both distances are measured along the beam from the pivot. The drawing is not to scale.*

A 0.20 m

B 0.40 m

C 0.80 m

D 1.6 m

Answer

5 MULTIPLE CHOICE · DEMANDING · 1.7.1 **[1]**

SUPP.

A ball of mass 0.50 kg is dropped from a height of 1.8 m and rebounds to a height of 1.2 m. How much energy is transferred away from the ball during the bounce?

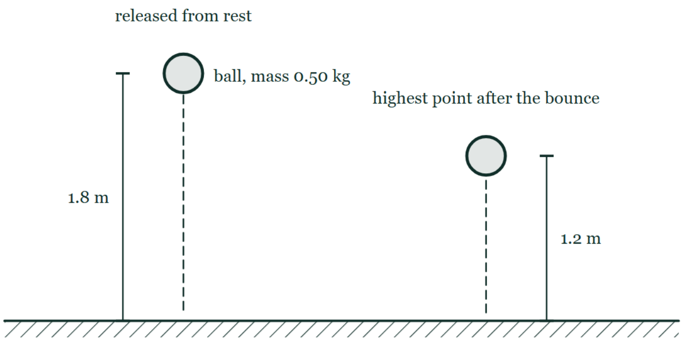

Fig. 5.1 *A ball of mass 0.50 kg is drawn twice above level ground. On the left it is at the point of release, with a dimension line marking 1.8 m from the ground up to the ball. On the right it is at the highest point reached after the bounce, with 1.2 m marked in the same way. Dashed vertical lines show the path down and the path back up.*

A 0.60 J

B 2.9 J

C 5.9 J

D 8.8 J

Answer

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6 MULTIPLE CHOICE · ROUTINE · 1.8 **[1]**

SUPP.

A diver is 15 m below the surface of a lake. The density of the water is 1000 kg/m³. What is the increase in pressure on the diver caused by the water above her?

A 1.5×10^3 Pa

B 1.5×10^4 Pa

C 1.5×10^5 Pa

D 1.5×10^6 Pa

Answer

7 STRUCTURED · DEMANDING · 1.2 · 1.5.1 **[9]**

SUPP.

A car of mass 1200 kg starts from rest on a straight, level road. It reaches a speed of 24 m/s in 8.0 s. The forward force produced by the engine during this time is 4500 N.

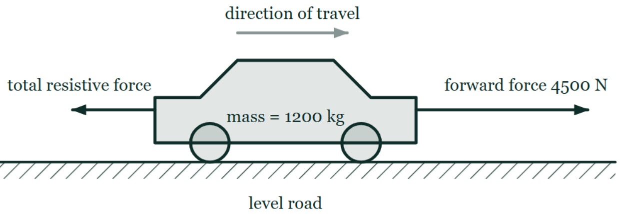

Fig. 7.1 *A car on a straight, level road, labelled mass = 1200 kg, with a faint arrow above it showing the direction of travel to the right. A long horizontal arrow points forwards from the front of the car and is labelled forward force 4500 N. A shorter horizontal arrow points backwards from the rear of the car and is labelled total resistive force, with no value given.*

(a) STATE **[1]**

State the equation linking acceleration, change in velocity and time taken.

(b) CALCULATE **[2]**

Calculate the acceleration of the car.

(c) CALCULATE **[2]**

Calculate the resultant force acting on the car.

(d) DETERMINE **[2]**

Determine the total resistive force acting on the car during this time.

(e) EXPLAIN **[2]**

The car later travels along the same road at a constant speed of 30 m/s. Explain, in terms of the forces acting, why the speed is constant.

8 SUPP. STRUCTURED · DISCRIMINATING · 1.6 · 1.7.1 **[9]**

Trolley A has a mass of 0.80 kg and moves along a straight, level track at 2.5 m/s. It collides with trolley B, of mass 1.2 kg, which is stationary. After the collision the two trolleys move off joined together. Friction is negligible.

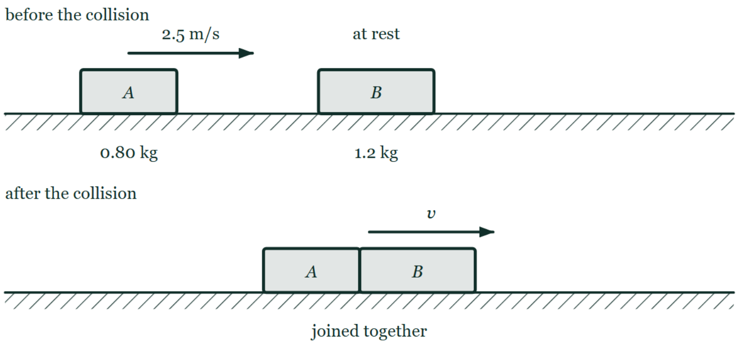

Fig. 8.1 *Two panels, one above the other. In the upper panel, labelled before the collision, trolley A of mass 0.80 kg stands on a level track with an arrow showing it moving to the right at 2.5 m/s towards trolley B of mass 1.2 kg, which is at rest. In the lower panel, labelled after the collision, the two trolleys are drawn joined together and moving to the right with a speed marked v.*

(a) STATE **[2]**

State the principle of conservation of momentum.

(b) CALCULATE **[3]**

Calculate the speed of the joined trolleys immediately after the collision.

(c) SHOW (THAT) **[3]**

Show that kinetic energy is not conserved in this collision, and determine how much kinetic energy is transferred to other stores.

(d) SUGGEST **[1]**

Suggest what happens to the kinetic energy that is not accounted for after the collision.

9 SUPP.

STRUCTURED · ROUTINE · 1.7.3 · 1.7.4 **[8]**

A wind turbine generates electricity for a school. Over a period of 60 s, the moving air delivers 900 kJ of energy to the turbine blades. The electrical output of the turbine during this time is 9.0 kW.

(a) STATE **[2]**

State two renewable energy resources other than wind.

(b) CALCULATE **[2]**

Calculate the input power delivered to the blades by the moving air.

(c) CALCULATE **[2]**

Calculate the efficiency of the turbine.

(d) EXPLAIN **[2]**

Explain why the efficiency of the turbine can never reach 100%.

10 PRACTICAL SKILLS · DEMANDING · 1.1 · 1.4 **[9]**

CORE

A student determines the density of a small irregularly shaped stone. She has an electronic balance, a measuring cylinder, water and a length of thread. The stone fits easily inside the measuring cylinder.

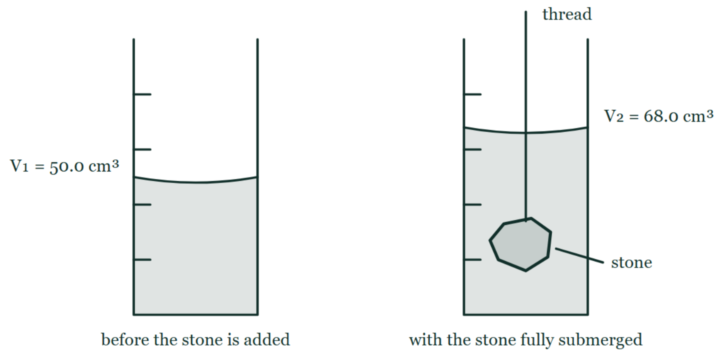

Fig. 10.1 *Two measuring cylinders drawn side by side, each with graduations up the wall and a curved meniscus. The first holds water alone, its surface at the 50.0 cm³ mark. The second holds the same water with the stone lowered in on a thread that runs up and out of the cylinder; the stone lies fully submerged near the base and the surface now stands at the 68.0 cm³ mark.*

The student's readings

Quantity	Reading
mass of stone m	47.6 g
volume of water alone V_1	50.0 cm³
volume of water and stone V_2	68.0 cm³

(a) DESCRIBE **[3]**

Describe how the student should use the measuring cylinder and thread to obtain the readings V_1 and V_2 accurately.

(b) CALCULATE **[3]**

Calculate the density of the stone. Give your answer to an appropriate number of significant figures.

(c) SUGGEST **[3]**

The stone is porous and slowly absorbs water. Suggest how this affects the value obtained for the density, and suggest one improvement to the method.

MARK SCHEME

Topic 1 · Motion, forces and energy — mark scheme

One line per mark, as an examiner would award them. A note under a part is the error that part is set to catch.

1 CORE — MULTIPLE CHOICE · RECALL · 1.1 **[1]**

Which pair contains only vector quantities?

KEY **D** **velocity and weight**

A and C each pair a scalar with a vector, which is the trap: distance and mass have no direction. B is two scalars. Only D is a vector twice over.

AO1

2 CORE — MULTIPLE CHOICE · ROUTINE · 1.2 **[1]**

A cyclist travels 100 m in a straight line in 20 s, then stops at traffic lights for 10 s. What is the average speed over the whole 30 s?

KEY **B** **3.3 m/s**

C is the speed while moving — the commonest wrong answer, because it ignores that average speed is total distance over total time. D halves the time as well as reading only the first stage.

AO2

3 CORE — MULTIPLE CHOICE · ROUTINE · 1.4 **[1]**

A rectangular metal block measures 2.0 cm × 3.0 cm × 5.0 cm and has a mass of 240 g. What is its density?

KEY **B** **8.0 g/cm^3**

A inverts the formula. C divides by only one dimension. D multiplies mass by volume instead of dividing, which is the slip a candidate working too fast makes.

AO2

4 CORE — MULTIPLE CHOICE · ROUTINE · 1.5.2 **[1]**

A uniform beam is pivoted at its centre. A weight of 4.0 N hangs 0.80 m from the pivot on the left-hand side. A weight of 8.0 N is hung on the right-hand side so that the beam balances. How far from the pivot is the 8.0 N weight?

KEY **B** **0.40 m**

D doubles the distance instead of halving it — the error of a candidate who has memorised that the moments are equal but not thought about which way the ratio runs.

AO2

5 SUPP. — MULTIPLE CHOICE · DEMANDING · 1.7.1 **[1]**

A ball of mass 0.50 kg is dropped from a height of 1.8 m and rebounds to a height of 1.2 m. How much energy is transferred away from the ball during the bounce?

KEY **B** **2.9 J**

C and D are mgh for the full drop and for the two heights added together. The question is about the difference in height, 0.60 m, and only B uses it. A is the height itself, not an energy.

AO2

6 SUPP.

MULTIPLE CHOICE · ROUTINE · 1.8 **[1]**

A diver is 15 m below the surface of a lake. The density of the water is 1000 kg/m³. What is the increase in pressure on the diver caused by the water above her?

KEY **C** **1.5×10^5 Pa**

All four are the same digits, so the item tests whether the candidate can carry a power of ten through ρgh rather than whether they know the formula. B drops the factor of g.

AO2

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7 SUPP.

STRUCTURED · DEMANDING · 1.2 · 1.5.1 **[9]**

A car of mass 1200 kg starts from rest on a straight, level road. It reaches a speed of 24 m/s in 8.0 s. The forward force produced by the engine during this time is 4500 N.

(a) STATE · AO1 **[1]**

State the equation linking acceleration, change in velocity and time taken.

1. $a = \Delta v / \Delta t$, in words or symbols, with symbols defined or standard

(b) CALCULATE · AO2 **[2]**

Calculate the acceleration of the car.

1. $a = 24 / 8.0$
2. $a = 3.0$ m/s² (unit required)

(c) CALCULATE · AO2 **[2]**

Calculate the resultant force acting on the car.

1. $F = ma = 1200 \times 3.0$
2. $F = 3600$ N (unit required)

(d) DETERMINE · AO2 **[2]**

Determine the total resistive force acting on the car during this time.

1. recognises resistive force = forward force − resultant force
2. 4500 − 3600 = 900 N

The part that separates grades. Candidates who have treated 4500 N as the resultant in (c) cannot recover here, which is exactly what the structure is testing.

(e) EXPLAIN · AO1 **[2]**

The car later travels along the same road at a constant speed of 30 m/s. Explain, in terms of the forces acting, why the speed is constant.

1. the resultant force on the car is zero
2. because the forward force from the engine is equal in size to the total resistive force (and opposite in direction)

"There is no force" earns nothing. The marks are for a resultant of zero produced by two forces that balance.

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8 STRUCTURED · DISCRIMINATING · 1.6 · 1.7.1 **[9]**

SUPP.

Trolley A has a mass of 0.80 kg and moves along a straight, level track at 2.5 m/s. It collides with trolley B, of mass 1.2 kg, which is stationary. After the collision the two trolleys move off joined together. Friction is negligible.

(a) STATE · AO1 **[2]**

State the principle of conservation of momentum.

1. the total momentum of a system (of interacting bodies) before an event equals the total momentum after it
2. provided no external resultant force acts

(b) CALCULATE · AO2 **[3]**

Calculate the speed of the joined trolleys immediately after the collision.

1. momentum before = $0.80 \times 2.5 = 2.0$ kg m/s
2. total mass after = $0.80 + 1.2 = 2.0$ kg
3. $v = 2.0 / 2.0 = 1.0$ m/s

(c) SHOW (THAT) · AO2 **[3]**

Show that kinetic energy is not conserved in this collision, and determine how much kinetic energy is transferred to other stores.

1. E_k before = $\frac{1}{2} \times 0.80 \times 2.5^2 = 2.5$ J
2. E_k after = $\frac{1}{2} \times 2.0 \times 1.0^2 = 1.0$ J
3. 1.5 J transferred away, so kinetic energy is not conserved

Momentum is conserved and kinetic energy is not: the pairing is the whole point of the question, and candidates who assume both are conserved lose all three marks.

(d) SUGGEST · AO1 **[1]**

Suggest what happens to the kinetic energy that is not accounted for after the collision.

1. transferred to the internal (thermal) energy store of the trolleys and surroundings, and/or emitted as sound

9 SUPP.

STRUCTURED · ROUTINE · 1.7.3 · 1.7.4 **[8]**

A wind turbine generates electricity for a school. Over a period of 60 s, the moving air delivers 900 kJ of energy to the turbine blades. The electrical output of the turbine during this time is 9.0 kW.

(a) STATE · AO1 **[2]**

State two renewable energy resources other than wind.

1. any one of: solar / hydroelectric / tidal / wave / geothermal / biofuel
2. a second, different one from the same list

Named fuels such as "gas" or "nuclear" score zero — both are non-renewable.

(b) CALCULATE · AO2 **[2]**

Calculate the input power delivered to the blades by the moving air.

1. P = E / t = 900 000 / 60
2. P = 15 000 W = 15 kW

(c) CALCULATE · AO2 **[2]**

Calculate the efficiency of the turbine.

1. efficiency = useful output power / total input power = 9.0 / 15
2. = 0.60 or 60%

(d) EXPLAIN · AO1 **[2]**

Explain why the efficiency of the turbine can never reach 100%.

1. some energy is always transferred to non-useful stores — friction in the bearings and gearbox heats the surroundings, and sound is emitted
2. and the air must still be moving after it passes the blades, so it keeps some kinetic energy

The second marking point is the one that separates a good answer. "Energy is lost" alone is not creditworthy: energy is not destroyed, it is transferred to a store that is not useful.

10 PRACTICAL SKILLS · DEMANDING · 1.1 · 1.4 **[9]**

CORE

A student determines the density of a small irregularly shaped stone. She has an electronic balance, a measuring cylinder, water and a length of thread. The stone fits easily inside the measuring cylinder.

(a) DESCRIBE · AO3 **[3]**

Describe how the student should use the measuring cylinder and thread to obtain the readings V_1 and V_2 accurately.

1 part-fill the cylinder with water and record the level V_1, reading the bottom of the meniscus with the eye level with the surface

2 lower the stone in gently on the thread so that no water splashes out and the stone is fully submerged

3 record the new level V_2 once the water is still

"Eye level with the meniscus" is the mark examiners report as most often missed, and it is worth as much as the method itself.

(b) CALCULATE · AO2 **[3]**

Calculate the density of the stone. Give your answer to an appropriate number of significant figures.

1 $V = V_2 - V_1 = 68.0 - 50.0 = 18.0\ cm^3$

2 $\rho = m / V = 47.6 / 18.0$

3 $\rho = 2.64\ g/cm^3$ ($2.6\ g/cm^3$ also accepted; unit required)

(c) SUGGEST · AO3 **[3]**

The stone is porous and slowly absorbs water. Suggest how this affects the value obtained for the density, and suggest one improvement to the method.

1 water enters the stone, so the rise in level $V_2 - V_1$ is smaller than the true volume of the stone

2 the calculated density is therefore too high

3 improvement: read V_2 immediately on submerging, or seal the stone first, or use a displacement can

Two marks are for the direction of the error, not just its existence. Answering "it makes it inaccurate" scores one at most.

Topic 2 · Thermal physics

The kinetic particle model and what it explains: gas pressure, thermal expansion, specific heat capacity, change of state, and the three ways energy moves.

SUGGESTED TIME	TOTAL MARKS	QUESTIONS	MULTIPLE CHOICE
45 minutes	**38**	**10**	**6**

SECTION	**2 · Thermal physics**
IN THE FORMAT OF	Papers 1 and 2 (multiple choice), Papers 3 and 4 (theory), Paper 6 (alternative to practical)
ROUTES	Core only — 6 questions, 13 marks. Core and Supp. — the whole paper, 10 questions, 38 marks. Every question is tagged in the left margin.
DEMAND	**Recall 1 · Routine 4 · Demanding 4 · Discriminating 1**
	Pitched at the board's own level, not above it. Multiple choice is mostly one step, with a couple of two-step items and one that rewards the candidate who does not take the obvious route. Structured questions open on a 1-mark recall and close on an explanation or a suggestion worth two marks — the marks real candidates most often drop.
SYLLABUS POINTS	2.1 · 2.2 · 2.3

INSTRUCTIONS

- Answer all questions in the spaces provided.
- Show your working. Method marks are awarded even where the final answer is wrong.
- Give your answers to a sensible number of significant figures, with a unit.
- The mark scheme for this paper follows the last question.

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THE PAPER

Topic 2 · Thermal physics

Answer all questions. 38 marks in 45 minutes.

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1 MULTIPLE CHOICE · RECALL · 2.1 **[1]**

CORE

Which row describes the molecules of a gas?

	separation	arrangement	motion
A	close together	regular	vibrating about fixed positions
B	close together	random	moving past one another
C	far apart	random	moving rapidly in all directions
D	far apart	regular	vibrating about fixed positions

A close together · regular · vibrating about fixed positions

B close together · random · moving past one another

C far apart · random · moving rapidly in all directions

D far apart · regular · vibrating about fixed positions

Answer

2
SUPP.

MULTIPLE CHOICE · ROUTINE · 2.1

[1]

A fixed mass of gas has a volume of 300 cm³ at a pressure of 1.0×10^5 Pa. The gas is compressed to a volume of 120 cm³ at constant temperature. What is the new pressure?

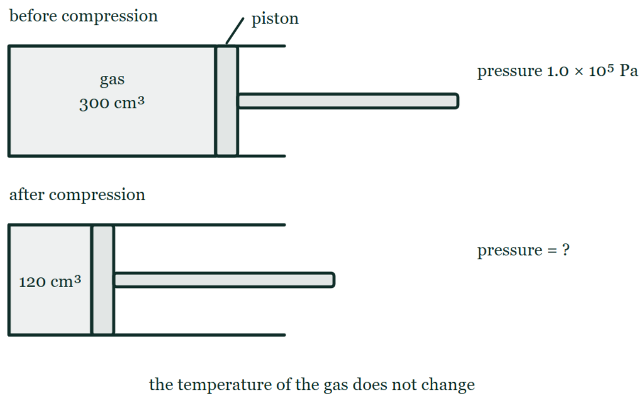

Fig. 2.1 *Two horizontal cylinders are drawn one above the other, each closed at the left-hand end and fitted with a piston on a rod that comes out through the open right-hand end. In the upper cylinder, labelled before compression, the trapped gas fills a column marked 300 cm³ and the pressure beside it is given as 1.0×10^5 Pa. In the lower cylinder, labelled after compression, the piston has been pushed further in so that the gas column is marked 120 cm³, and the pressure beside it is left as a question mark. A note below states that the temperature of the gas does not change.*

A 0.40×10^5 Pa

B 1.2×10^5 Pa

C 2.5×10^5 Pa

D 3.6×10^5 Pa

Answer

3
CORE

MULTIPLE CHOICE · ROUTINE · 2.2

[1]

The specific heat capacity of water is 4200 J/(kg °C). How much energy is needed to raise the temperature of 2.0 kg of water by 15 °C?

A 560 J

B 8400 J

C 63 000 J

D 126 000 J

Answer

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4 CORE

MULTIPLE CHOICE · DEMANDING · 2.2

[1]

Which statement about evaporation is correct?

A It happens throughout the liquid, at one fixed temperature.

B It happens only at the surface, at any temperature below the boiling point.

C It raises the temperature of the liquid that is left behind.

D It happens faster when the air above the liquid is still and humid.

Answer

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5 CORE

MULTIPLE CHOICE · ROUTINE · 2.3

[1]

An electric heating element is fitted at the bottom of a tank of water. Why is this the best position?

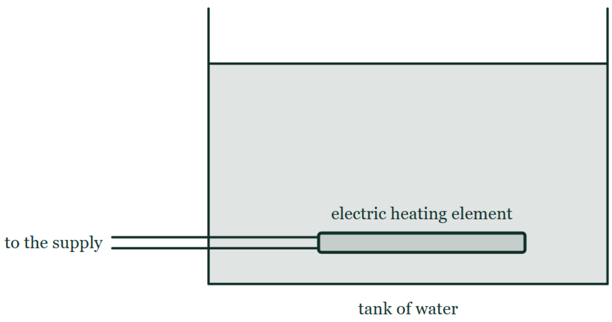

Fig. 5.1 *A rectangular open-topped tank holds water to about four-fifths of its depth. A flat electric heating element lies horizontally inside the tank, well below the water surface and a short distance above the tank floor, spanning about half the width of the tank. Two leads run from the left-hand end of the element out through the side wall of the tank to the electricity supply.*

A Water conducts thermal energy well downwards but not upwards.

B Warm water is less dense, so it rises and a convection current circulates through the tank.

C Thermal radiation travels upwards more easily than downwards.

D The pressure is greatest at the bottom, so energy transfers faster there.

Answer

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6 CORE

MULTIPLE CHOICE · ROUTINE · 2.3

[1]

Four identical cans are filled with water at 80 °C and left to cool in the same room. Which can cools fastest?

A a can with a shiny silver surface

B a can with a shiny white surface

C a can with a dull black surface

D all four cool at the same rate

Answer

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7 STRUCTURED · DISCRIMINATING · 2.1 **[8]**

SUPP.

Smoke particles are placed in a small glass cell containing air and viewed through a microscope with a bright light shining from the side. The smoke particles are seen as tiny bright specks.

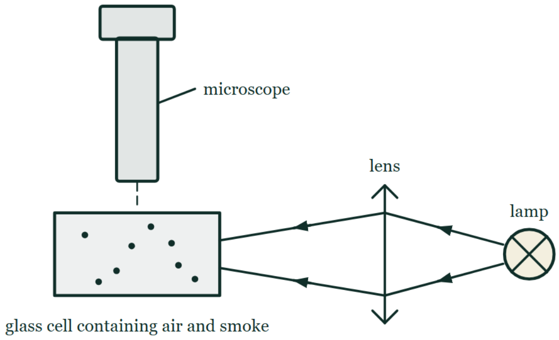


Fig. 7.1 *The apparatus is seen from the side. A small glass cell containing air and a scattering of smoke particles stands in the middle of the drawing. To the right, a lamp shines light through a converging lens, which brings the beam together inside the cell. Directly above the cell stands a microscope, its tube vertical and its lower end pointing straight down into the cell, so that the illuminated particles are viewed from above.*

(a) DESCRIBE **[2]**

Describe what is seen when the smoke particles are observed through the microscope.

(b) EXPLAIN **[3]**

Explain this motion in terms of the molecules of the air.

(c) EXPLAIN **[3]**

The air in a sealed metal container is heated. The volume of the container does not change. Explain, in terms of molecules, why the pressure of the air increases.

8 STRUCTURED · DEMANDING · 2.2 **[9]**

SUPP.

A 2.0 kW electric kettle contains 0.50 kg of water at 20 °C. The specific heat capacity of water is 4200 J/(kg °C) and the specific latent heat of vaporisation of water is 2.3×10^6 J/kg.

(a) DEFINE **[2]**

Define specific latent heat of vaporisation.

(b) CALCULATE **[2]**

Calculate the energy needed to raise the water from 20 °C to its boiling point of 100 °C.

(c) CALCULATE **[2]**

Assuming no energy is transferred to the surroundings, calculate the time taken for the water to reach its boiling point.

(d) DETERMINE **[3]**

The kettle is left switched on after the water boils. Determine the mass of water that boils away in the next 60 s.

9 STRUCTURED · DEMANDING · 2.3 **[7]**

SUPP.

A vacuum flask keeps a hot drink warm. It has a double-walled glass container with a vacuum between the walls, both facing surfaces of the glass are silvered, the flask has an insulating plastic stopper, and the glass container rests on soft insulating supports inside an outer case.

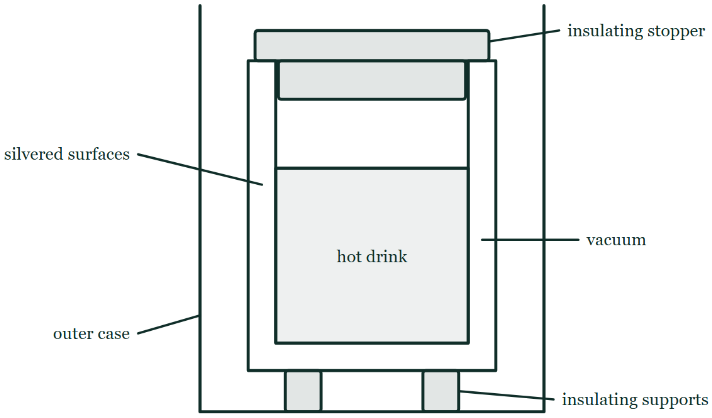


Fig. 9.1 *A cut-away view of a vacuum flask. Inside an outer case stands a double-walled glass container, sealed at the neck, with a narrow gap between the two walls that runs down both sides and under the base; the gap is labelled vacuum and the two facing glass surfaces are labelled silvered. Hot drink fills most of the inner container, an insulating stopper closes the neck at the top, and the glass container rests on small insulating supports standing on the floor of the outer case.*

(a) EXPLAIN **[2]**

Explain how the vacuum between the two walls reduces the transfer of thermal energy.

(b) EXPLAIN **[2]**

Explain why both facing surfaces of the glass are silvered.

(c) EXPLAIN **[3]**

Explain, in terms of the particles in a metal, why a metal spoon left in the drink becomes hot along its whole length far more quickly than a plastic one.

10 CORE

PRACTICAL SKILLS · DEMANDING · 2.2 **[8]**

A student determines the specific heat capacity of aluminium. She uses a 1.0 kg aluminium block with two narrow holes drilled in it, one holding a 48 W electric immersion heater and the other a thermometer. She switches on the heater and records the temperature every 2 minutes.

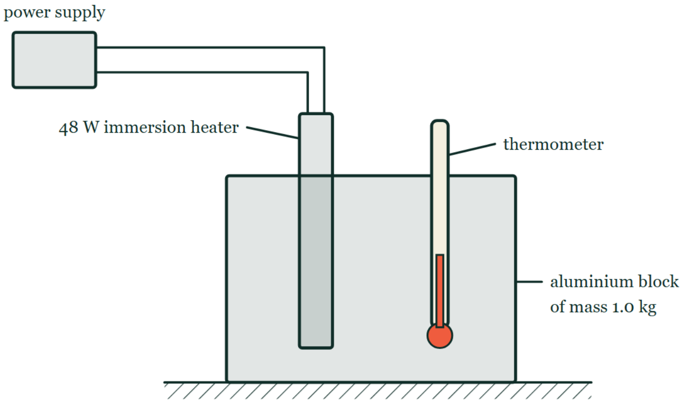


Fig. 10.1 *The apparatus is seen from the side. A rectangular aluminium block of mass 1.0 kg stands on the bench. A 48 W electric immersion heater is pushed down into a narrow hole drilled near one side of the block, and a thermometer is pushed down into a second narrow hole near the other side, its bulb reaching well inside the block. Two leads run from the top of the heater across to a power supply standing beside the apparatus.*

The student's results

time / minutes	**0**	**2**	**4**	**6**	**8**
temperature / °C	19.0	24.5	30.0	35.5	41.0

(a) DETERMINE **[4]**

Determine the temperature rise over the 8 minutes, and hence determine a value for the specific heat capacity of aluminium.

(b) SUGGEST **[2]**

The accepted value for the specific heat capacity of aluminium is 900 J/(kg °C). Suggest why the student's value is higher than this.

(c) SUGGEST **[2]**

Suggest two improvements to the student's method that would give a more accurate value.

Topic 2 · Thermal physics — mark scheme

One line per mark, as an examiner would award them. A note under a part is the error that part is set to catch.

1 CORE

MULTIPLE CHOICE · RECALL · 2.1 **[1]**

Which row describes the molecules of a gas?

KEY **C** **far apart · random · moving rapidly in all directions**

A is a solid — close together, regular, vibrating in place. B is a liquid: close together but disordered and able to move past one another. D is the trap, pairing a gas separation with solid motion, and it catches candidates who have learned that gas molecules are far apart without learning what they then do.

AO1

---

2 SUPP.

MULTIPLE CHOICE · ROUTINE · 2.1 **[1]**

A fixed mass of gas has a volume of 300 cm^3 at a pressure of 1.0×10^5 Pa. The gas is compressed to a volume of 120 cm^3 at constant temperature. What is the new pressure?

KEY **C** **2.5×10^5 Pa**

A applies the ratio the wrong way round — the answer must be larger, because squeezing a gas raises its pressure. D multiplies the volumes instead of taking their ratio.

AO2

---

3 CORE

MULTIPLE CHOICE · ROUTINE · 2.2 **[1]**

The specific heat capacity of water is 4200 J/(kg °C). How much energy is needed to raise the temperature of 2.0 kg of water by 15 °C?

KEY **D** **126 000 J**

C forgets the mass. B forgets the temperature rise. A divides where the candidate should multiply.

AO2

---

4 CORE

MULTIPLE CHOICE · DEMANDING · 2.2 **[1]**

Which statement about evaporation is correct?

KEY **B** **It happens only at the surface, at any temperature below the boiling point.**

A describes boiling, which is the distinction the item is set on. C reverses the cooling effect — the fastest molecules leave, so the mean energy of those remaining falls. D reverses the effect of a draught.

AO1

---

5 CORE

MULTIPLE CHOICE · ROUTINE · 2.3 **[1]**

An electric heating element is fitted at the bottom of a tank of water. Why is this the best position?

KEY **B** **Warm water is less dense, so it rises and a convection current circulates through the tank.**

A is wrong twice over — water is a poor conductor and conduction has no preferred direction. D confuses pressure with energy transfer.

AO1

---

6 MULTIPLE CHOICE · ROUTINE · 2.3 **[1]**

CORE

Four identical cans are filled with water at 80 °C and left to cool in the same room. Which can cools fastest?

KEY **C** **a can with a dull black surface**

D tempts candidates who remember that the water and temperature are identical but forget that the surface controls the rate of emission. A dull black surface is the best emitter as well as the best absorber.

AO2

---

7 STRUCTURED · DISCRIMINATING · 2.1 **[8]**

SUPP.

Smoke particles are placed in a small glass cell containing air and viewed through a microscope with a bright light shining from the side. The smoke particles are seen as tiny bright specks.

(a) DESCRIBE · AO1 **[2]**

Describe what is seen when the smoke particles are observed through the microscope.

1 the bright specks move continuously

2 in random directions / on jerky, unpredictable paths

(b) EXPLAIN · AO1 **[3]**

Explain this motion in terms of the molecules of the air.

1 the air molecules are in constant random motion and collide with the smoke particle

2 the molecules are much smaller than the smoke particle but move much faster, so each collision transfers a noticeable momentum

3 at any instant the collisions on one side outnumber those on the other, so the resultant force on the particle changes direction randomly

The mark most often lost is the second: candidates say the molecules "hit" the particle without saying why an object too small to see can move something visible.

(c) EXPLAIN · AO2 **[3]**

The air in a sealed metal container is heated. The volume of the container does not change. Explain, in terms of molecules, why the pressure of the air increases.

1 heating increases the average kinetic energy, so the molecules move faster on average

2 so they strike the walls more often

3 and each collision produces a greater change of momentum, so the average force on unit area of the wall increases

Both reasons are needed. "They hit the walls harder" on its own is one mark; a candidate who also mentions frequency of collisions earns the second.

---

8 STRUCTURED · DEMANDING · 2.2 **[9]**

SUPP.

A 2.0 kW electric kettle contains 0.50 kg of water at 20 °C. The specific heat capacity of water is 4200 J/(kg °C) and the specific latent heat of vaporisation of water is 2.3×10^6 J/kg.

(a) DEFINE · AO1 **[2]**

Define specific latent heat of vaporisation.

1 the energy required to change unit mass of a substance from liquid to gas

2 without a change in temperature

The second half is the mark: no temperature change is what distinguishes latent from specific heat capacity.

(b) CALCULATE · AO2 **[2]**

Calculate the energy needed to raise the water from 20 °C to its boiling point of 100 °C.

1 $E = mc\Delta\theta = 0.50 \times 4200 \times 80$

2 $E = 168\,000$ J $= 1.7 \times 10^5$ J

(c) CALCULATE · AO2 **[2]**

Assuming no energy is transferred to the surroundings, calculate the time taken for the water to reach its boiling point.

1 $t = E / P = 168\,000 / 2000$

2 $t = 84$ s

(d) DETERMINE · AO2 **[3]**

The kettle is left switched on after the water boils. Determine the mass of water that boils away in the next 60 s.

1 energy supplied $= 2000 \times 60 = 120\,000$ J

2 $m = E / L = 120\,000 / 2.3 \times 10^6$

3 $m = 0.052$ kg (52 g)

Candidates who add an $mc\Delta\theta$ term here have not noticed that the water is already at 100 °C and stays there. That is the discrimination the part is built on.

9 STRUCTURED · DEMANDING · 2.3 **[7]**

SUPP.

A vacuum flask keeps a hot drink warm. It has a double-walled glass container with a vacuum between the walls, both facing surfaces of the glass are silvered, the flask has an insulating plastic stopper, and the glass container rests on soft insulating supports inside an outer case.

(a) EXPLAIN · AO1 **[2]**

Explain how the vacuum between the two walls reduces the transfer of thermal energy.

1. there are (almost) no molecules between the walls
2. so energy cannot be transferred by conduction or convection, both of which need a medium

(b) EXPLAIN · AO1 **[2]**

Explain why both facing surfaces of the glass are silvered.

1. a shiny silvered surface is a poor emitter of infrared radiation, so the inner wall radiates less energy away
2. and a shiny surface is a good reflector, so radiation crossing the gap is reflected back rather than absorbed

(c) EXPLAIN · AO1 **[3]**

Explain, in terms of the particles in a metal, why a metal spoon left in the drink becomes hot along its whole length far more quickly than a plastic one.

1. in both, particles at the hot end vibrate more and pass energy on by colliding with neighbouring particles
2. a metal also contains free (delocalised) electrons
3. these gain kinetic energy at the hot end, move rapidly through the metal, and transfer energy by collision far along the spoon, so conduction is much faster

The Supplement mark is the free-electron mechanism. A candidate who describes only vibrating particles has described the process that happens in plastic too, and has not answered the question asked.

10 CORE

PRACTICAL SKILLS · DEMANDING · 2.2 **[8]**

A student determines the specific heat capacity of aluminium. She uses a 1.0 kg aluminium block with two narrow holes drilled in it, one holding a 48 W electric immersion heater and the other a thermometer. She switches on the heater and records the temperature every 2 minutes.

(a) DETERMINE · AO2 **[4]**

Determine the temperature rise over the 8 minutes, and hence determine a value for the specific heat capacity of aluminium.

1. $\Delta\theta = 41.0 - 19.0 = 22.0$ °C
2. energy supplied $E = Pt = 48 \times 480 = 23\,040$ J
3. $c = E / (m\Delta\theta) = 23\,040 / (1.0 \times 22.0)$
4. $c = 1050$ J/(kg °C) (accept 1000–1100)

Converting 8 minutes to 480 s is worth a mark on its own in the real mark scheme, and is the commonest single reason a candidate's answer is out by a factor of 60.

(b) SUGGEST · AO3 **[2]**

The accepted value for the specific heat capacity of aluminium is 900 J/(kg °C). Suggest why the student's value is higher than this.

1. thermal energy is transferred from the block to the surroundings, so not all of the 23 040 J raises the temperature of the block
2. the measured $\Delta\theta$ is therefore smaller than it should be for that energy, making the calculated c too large

Two marks, and the second is the reasoning. Saying "heat was lost" identifies the cause but does not explain the direction of the error, which is what is being marked.

(c) SUGGEST · AO3 **[2]**

Suggest two improvements to the student's method that would give a more accurate value.

1. lag the block with insulation / place it in an insulated container
2. any one of: put oil in the holes to improve thermal contact; start below and finish above room temperature; take readings more frequently and plot a graph; use a datalogger

Topic 3 · Waves

General wave properties, reflection and refraction, thin lenses, dispersion, the electromagnetic spectrum, and sound.

SUGGESTED TIME	TOTAL MARKS	QUESTIONS	MULTIPLE CHOICE
45 minutes	**38**	**10**	**6**

SECTION	**3 · Waves**
IN THE FORMAT OF	Papers 1 and 2 (multiple choice), Papers 3 and 4 (theory), Paper 6 (alternative to practical)
ROUTES	Core only — 6 questions, 13 marks. Core and Supp. — the whole paper, 10 questions, 38 marks. Every question is tagged in the left margin.
DEMAND	**Recall 3 · Routine 4 · Demanding 2 · Discriminating 1**
	Pitched at the board's own level, not above it. Multiple choice is mostly one step, with a couple of two-step items and one that rewards the candidate who does not take the obvious route. Structured questions open on a 1-mark recall and close on an explanation or a suggestion worth two marks — the marks real candidates most often drop.
SYLLABUS POINTS	3.1 · 3.2 · 3.3 · 3.4

INSTRUCTIONS

- Answer all questions in the spaces provided.
- Show your working. Method marks are awarded even where the final answer is wrong.
- Give your answers to a sensible number of significant figures, with a unit.
- The mark scheme for this paper follows the last question.

> *Written by GioPhysics from the published syllabus. These are practice papers in the style of Cambridge IGCSE Physics 0625; they are not Cambridge papers, contain no past-paper questions, and the official syllabus and specimen materials remain the authority.*
>
> Cambridge IGCSE Physics 0625 syllabus — https://www.cambridgeinternational.org/Images/697209-2026-2028-syllabus.pdf

Topic 3 · Waves

Answer all questions. 38 marks in 45 minutes.

1 CORE

MULTIPLE CHOICE · RECALL · 3.1 **[1]**

Which statement describes a longitudinal wave?

A The particles vibrate at right angles to the direction of energy transfer.

B The particles vibrate along the direction of energy transfer.

C The particles travel with the wave from one place to another.

D The wave cannot travel through a solid.

Answer

2 CORE

MULTIPLE CHOICE · ROUTINE · 3.1 **[1]**

Water waves in a ripple tank have a wavelength of 2.5 cm. 12 complete waves pass a fixed point in 4.0 s. What is the speed of the waves?

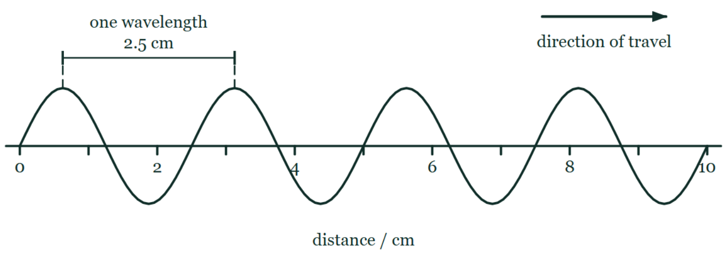


Fig. 2.1 *A snapshot of the water surface in the ripple tank at one instant, drawn as a side view. Four complete waves run left to right above a horizontal distance scale that is marked in centimetres from 0 to 10, the scale line itself being the undisturbed water level. A dimension line drawn between two neighbouring crests is labelled one wavelength, 2.5 cm, and a separate arrow above the wave shows the direction in which the waves are travelling.*

A 0.83 cm/s

B 7.5 cm/s

C 30 cm/s

D 120 cm/s

Answer

3 SUPP.

MULTIPLE CHOICE · ROUTINE · 3.2 **[1]**

A ray of light travels from air into a transparent block of refractive index 1.5. The angle of incidence in air is 40°. What is the angle of refraction in the block? (sin 40° = 0.643)

A 17°

B 25°

C 40°

D 74°

Answer

---

4 CORE

MULTIPLE CHOICE · RECALL · 3.3 **[1]**

Which list places these electromagnetic waves in order of increasing frequency?

A infrared, microwaves, ultraviolet, X-rays

B microwaves, infrared, ultraviolet, X-rays

C X-rays, ultraviolet, infrared, microwaves

D ultraviolet, X-rays, microwaves, infrared

Answer

---

5 CORE

MULTIPLE CHOICE · ROUTINE · 3.4 **[1]**

A student stands 165 m from a large wall and claps once. She hears the echo 1.0 s later. What is the speed of sound in air from her measurement?

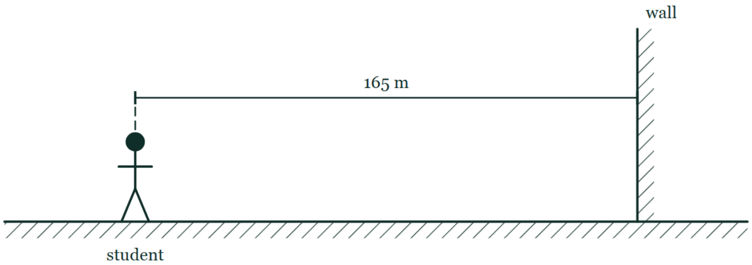


Fig. 5.1 *A side view of the arrangement. The student stands on level hatched ground on the left, facing a tall wall drawn as a hatched vertical slab standing on the same ground well to her right. A dimension line above her head runs horizontally from the student across to the face of the wall and is labelled 165 m. No sound path is drawn on the figure.*

A 165 m/s

B 247 m/s

C 330 m/s

D 660 m/s

Answer

6
CORE

MULTIPLE CHOICE · RECALL · 3.4

[1]

In which material does sound travel fastest?

A air

B a vacuum

C water

D steel

Answer

7 STRUCTURED · DEMANDING · 3.1 **[7]**

SUPP.

Straight water waves in a ripple tank travel from a deep region into a shallow region. The boundary between the regions is a straight line, and the wavefronts meet it at 30° to the boundary. In the deep region the waves have a wavelength of 1.8 cm and a frequency of 8.0 Hz. In the shallow region the wavelength is 1.2 cm.

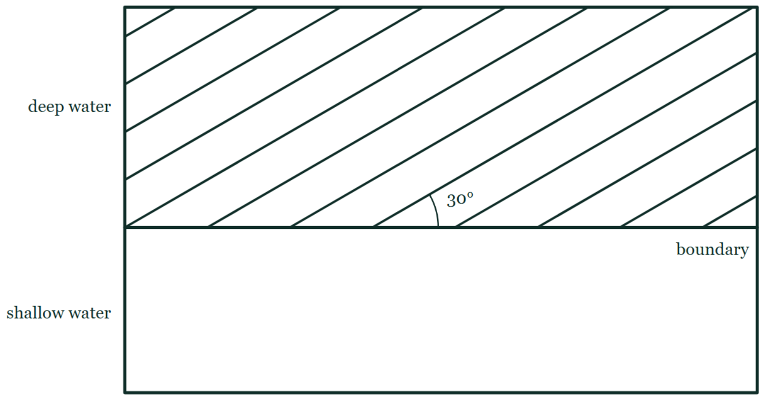


Fig. 7.1 *Plan view of the ripple tank, seen from above. A straight boundary runs right across the tank, dividing it into deep water in the upper part and shallow water in the lower part, each region labelled. Twelve straight parallel wavefronts, evenly spaced, fill the deep water and slope up to the right so that each one makes an angle of 30° with the boundary; that angle is marked with an arc where one front meets the boundary. The shallow region is drawn empty.*

(a) CALCULATE **[2]**

Calculate the speed of the waves in the deep region.

(b) DETERMINE **[2]**

Determine the speed of the waves in the shallow region.

(c) DESCRIBE **[3]**

The wavefronts meet the boundary at an angle. Describe and explain what happens to the direction in which the waves travel as they cross into the shallow region.

8 [9]

SUPP.

STRUCTURED · DISCRIMINATING · 3.2

An optical fibre has a glass core of refractive index 1.50. Light entering one end of the fibre travels along it by repeated total internal reflection at the core boundary, even where the fibre is gently curved.

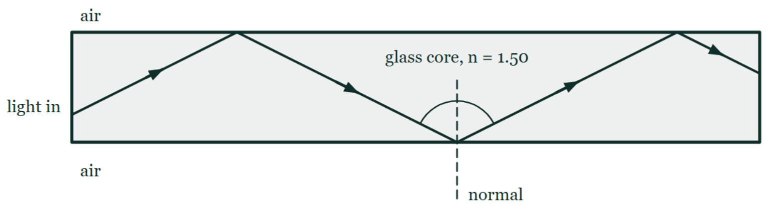


Fig. 8.1 *A straight length of optical fibre drawn in section as a long horizontal band with parallel walls, shaded to show glass and labelled glass core, n = 1.50, with air labelled outside it. Light entering the flat left-hand end travels up to the upper wall, reflects down to the lower wall, reflects again up to the upper wall and reaches the far end, giving a zig-zag path along the fibre. At one reflection a dashed normal is drawn perpendicular to the wall, and the angle on each side of it is marked with an arc; no angle is given a numerical value.*

(a) STATE [2]

State the two conditions necessary for total internal reflection to occur.

(b) CALCULATE [3]

Calculate the critical angle for the glass core.

(c) EXPLAIN [3]

A student suggests that bending the fibre very sharply would make no difference, because total internal reflection always happens. Explain why the student is wrong.

(d) GIVE [1]

Give one use of optical fibres other than in medicine.

9 STRUCTURED · ROUTINE · 3.3 **[8]**

CORE

The electromagnetic spectrum is a family of transverse waves that all travel at the same speed in a vacuum, 3.0×10^8 m/s.

(a) STATE **[1]**

State one property, other than their speed in a vacuum, that all electromagnetic waves share.

(b) IDENTIFY **[2]**

Identify the region of the electromagnetic spectrum used for each of the following, and give one different region for each: (i) cooking food in an oven that heats from the outside; (ii) sterilising medical equipment.

(c) CALCULATE **[3]**

A radio station broadcasts at a frequency of 95.8 MHz. Calculate the wavelength of the waves it emits.

(d) DESCRIBE **[2]**

Describe one harmful effect of excessive exposure to ultraviolet radiation, and state one way of reducing the risk.

[8]

A student determines the refractive index of a glass block using optical pins. She places the block on a sheet of paper, draws round it, and shines a ray at the top face at an angle of incidence i, marking the ray in and the ray out with pins. She repeats this for several values of i and measures the angle of refraction r inside the block.

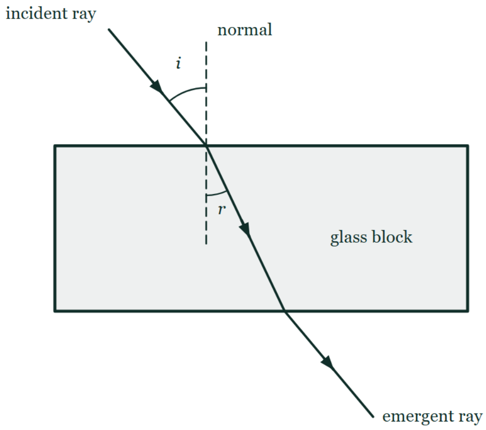


Fig. 10.1 *The rectangular glass block drawn on the paper, seen from above. A ray labelled incident ray comes down from the upper left and meets the top face of the block; a dashed normal is drawn perpendicular to that face at the point where the ray strikes it. The angle between the incident ray and the normal is labelled i, and the angle between the normal and the ray travelling inside the glass is labelled r. The ray crosses the block, leaves through the bottom face and continues as the emergent ray. The optical pins are not shown.*

The student's results

i / degrees	**20**	**30**	**40**	**50**	**60**
r / degrees	13.2	19.5	25.4	30.7	35.3
sin i	0.342	0.500	0.643	0.766	0.866
sin r	0.228	0.334	0.429	0.511	0.578

(a) DESCRIBE **[3]**

Describe how the student should place and use the optical pins so that the path of the ray is marked accurately.

(b) EXPLAIN **[3]**

Explain why plotting a graph of sin i against sin r gives a more reliable value for the refractive index than calculating sin i / sin r for a single pair of readings.

(c) DETERMINE **[2]**

Use the first and last results to determine a value for the refractive index of the glass.

MARK SCHEME

Topic 3 · Waves — mark scheme

One line per mark, as an examiner would award them. A note under a part is the error that part is set to catch.

1 CORE

MULTIPLE CHOICE · RECALL · 3.1 **[1]**

Which statement describes a longitudinal wave?

KEY **B** **The particles vibrate along the direction of energy transfer.**

C is the misconception the whole topic is set against: a wave transfers energy without transferring matter. A describes a transverse wave.

AO1

2 CORE

MULTIPLE CHOICE · ROUTINE · 3.1 **[1]**

Water waves in a ripple tank have a wavelength of 2.5 cm. 12 complete waves pass a fixed point in 4.0 s. What is the speed of the waves?

KEY **B** **7.5 cm/s**

C multiplies by the number of waves instead of the frequency — the error of a candidate who never works out that f = 12 / 4.0 = 3.0 Hz.

AO2

3 SUPP.

MULTIPLE CHOICE · ROUTINE · 3.2 **[1]**

A ray of light travels from air into a transparent block of refractive index 1.5. The angle of incidence in air is 40°. What is the angle of refraction in the block? (sin 40° = 0.643)

KEY **B** **25°**

D applies the ratio the wrong way round. Light entering a denser medium bends towards the normal, so any answer larger than 40° can be rejected before a calculation is done.

AO2

4 CORE

MULTIPLE CHOICE · RECALL · 3.3 **[1]**

Which list places these electromagnetic waves in order of increasing frequency?

KEY **B** **microwaves, infrared, ultraviolet, X-rays**

A swaps the first pair, which is the pair candidates most often reverse. C is the correct order of decreasing frequency, offered for anyone who reads the question too quickly.

AO1

5 CORE

MULTIPLE CHOICE · ROUTINE · 3.4 **[1]**

A student stands 165 m from a large wall and claps once. She hears the echo 1.0 s later. What is the speed of sound in air from her measurement?

KEY **C** **330 m/s**

A is the trap and takes about half of all candidates: the sound travels to the wall and back, so the distance is 330 m, not 165 m.

AO2

6 CORE

MULTIPLE CHOICE · RECALL · 3.4

[1]

In which material does sound travel fastest?

KEY **D** **steel**

B is set for the candidate who confuses sound with light: sound needs a medium and does not travel through a vacuum at all.

AO1

---

7 SUPP.

STRUCTURED · DEMANDING · 3.1

[7]

Straight water waves in a ripple tank travel from a deep region into a shallow region. The boundary between the regions is a straight line, and the wavefronts meet it at 30° to the boundary. In the deep region the waves have a wavelength of 1.8 cm and a frequency of 8.0 Hz. In the shallow region the wavelength is 1.2 cm.

(a) CALCULATE · AO2 **[2]**

Calculate the speed of the waves in the deep region.

1. $v = f\lambda = 8.0 \times 1.8$
2. $v = 14.4$ cm/s

(b) DETERMINE · AO2 **[2]**

Determine the speed of the waves in the shallow region.

1. the frequency is unchanged at 8.0 Hz as the waves cross the boundary
2. $v = 8.0 \times 1.2 = 9.6$ cm/s

The first marking point is the physics. Frequency is set by the source and does not change at a boundary; wavelength and speed do.

(c) DESCRIBE · AO2 **[3]**

The wavefronts meet the boundary at an angle. Describe and explain what happens to the direction in which the waves travel as they cross into the shallow region.

1. the direction of travel changes — the waves bend towards the normal to the boundary
2. because the part of each wavefront that reaches the shallow water first slows down before the rest of it does
3. so the wavefront pivots, and refraction has occurred

---

8 SUPP.

STRUCTURED · DISCRIMINATING · 3.2 **[9]**

An optical fibre has a glass core of refractive index 1.50. Light entering one end of the fibre travels along it by repeated total internal reflection at the core boundary, even where the fibre is gently curved.

(a) STATE · AO1 **[2]**

State the two conditions necessary for total internal reflection to occur.

1. the light must be travelling in the optically denser medium, towards a boundary with a less dense medium
2. the angle of incidence at the boundary must be greater than the critical angle

(b) CALCULATE · AO2 **[3]**

Calculate the critical angle for the glass core.

1. $\sin c = 1 / n$
2. $\sin c = 1 / 1.50 = 0.667$
3. $c = 41.8°$ (accept 42°)

(c) EXPLAIN · AO2 **[3]**

A student suggests that bending the fibre very sharply would make no difference, because total internal reflection always happens. Explain why the student is wrong.

1. bending the fibre sharply reduces the angle of incidence at the outer wall of the bend
2. if that angle falls below the critical angle of 41.8°, the light is no longer totally internally reflected
3. some light refracts out through the boundary and the signal is weakened or lost

The discriminating part of the paper. It requires the candidate to see that the angle of incidence is a property of the geometry, not a fixed feature of the fibre.

(d) GIVE · AO1 **[1]**

Give one use of optical fibres other than in medicine.

1. telephone / cable television / internet communication — any high-speed data transmission

9 CORE

STRUCTURED · ROUTINE · 3.3 **[8]**

The electromagnetic spectrum is a family of transverse waves that all travel at the same speed in a vacuum, 3.0×10^8 m/s.

(a) STATE · AO1 **[1]**

State one property, other than their speed in a vacuum, that all electromagnetic waves share.

1 any one of: they are transverse; they transfer energy; they can travel through a vacuum; they can be reflected and refracted

(b) IDENTIFY · AO1 **[2]**

Identify the region of the electromagnetic spectrum used for each of the following, and give one different region for each: (i) cooking food in an oven that heats from the outside; (ii) sterilising medical equipment.

1 (i) infrared

2 (ii) gamma rays (accept ultraviolet for surface sterilisation)

(c) CALCULATE · AO2 **[3]**

A radio station broadcasts at a frequency of 95.8 MHz. Calculate the wavelength of the waves it emits.

1 $\lambda = v / f$

2 $\lambda = 3.0 \times 10^8 / 95.8 \times 10^6$

3 $\lambda = 3.1$ m

(d) DESCRIBE · AO1 **[2]**

Describe one harmful effect of excessive exposure to ultraviolet radiation, and state one way of reducing the risk.

1 damage to surface cells / skin ageing / skin cancer / eye damage such as cataracts

2 wear sunscreen, sunglasses or protective clothing; limit exposure at midday

10 PRACTICAL SKILLS · DEMANDING · 3.2 **[8]**

SUPP.

A student determines the refractive index of a glass block using optical pins. She places the block on a sheet of paper, draws round it, and shines a ray at the top face at an angle of incidence i, marking the ray in and the ray out with pins. She repeats this for several values of i and measures the angle of refraction r inside the block.

(a) DESCRIBE · AO3 **[3]**

Describe how the student should place and use the optical pins so that the path of the ray is marked accurately.

1. place two pins in the incident ray, as far apart as possible
2. view from the far side of the block and place two more pins so that all four appear in line, one behind another
3. remove the block and draw a straight line through each pair to find the ray in and the ray out

"As far apart as possible" is a marking point in its own right: it reduces the effect of the uncertainty in each pin's position on the direction of the line.

(b) EXPLAIN · AO3 **[3]**

Explain why plotting a graph of sin i against sin r gives a more reliable value for the refractive index than calculating sin i / sin r for a single pair of readings.

1. n = sin i / sin r, so a graph of sin i against sin r should be a straight line through the origin of gradient n
2. the gradient uses all of the readings rather than one, so random errors in individual measurements average out
3. an anomalous result is visible as a point off the line and can be identified rather than silently included

(c) DETERMINE · AO2 **[2]**

Use the first and last results to determine a value for the refractive index of the glass.

1. gradient = (0.866 − 0.342) / (0.578 − 0.228) = 0.524 / 0.350
2. n = 1.50 (accept 1.5)

Topic 4 · Electricity and magnetism

Magnetism, charge and current, circuit calculations, electrical safety in the home, the motor effect, induction and transformers.

SUGGESTED TIME	TOTAL MARKS	QUESTIONS	MULTIPLE CHOICE
50 minutes	**41**	**10**	**6**

SECTION	**4 · Electricity and magnetism**
IN THE FORMAT OF	Papers 1 and 2 (multiple choice), Papers 3 and 4 (theory), Paper 6 (alternative to practical)
ROUTES	Core only — 5 questions, 19 marks. Core and Supp. — the whole paper, 10 questions, 41 marks. Every question is tagged in the left margin.
DEMAND	**Recall 2 · Routine 4 · Demanding 3 · Discriminating 1**
	Pitched at the board's own level, not above it. Multiple choice is mostly one step, with a couple of two-step items and one that rewards the candidate who does not take the obvious route. Structured questions open on a 1-mark recall and close on an explanation or a suggestion worth two marks — the marks real candidates most often drop.
SYLLABUS POINTS	4.1 · 4.2 · 4.3 · 4.4 · 4.5

INSTRUCTIONS

- Answer all questions in the spaces provided.
- Show your working. Method marks are awarded even where the final answer is wrong.
- Give your answers to a sensible number of significant figures, with a unit.
- The mark scheme for this paper follows the last question.

> *Written by GioPhysics from the published syllabus. These are practice papers in the style of Cambridge IGCSE Physics 0625; they are not Cambridge papers, contain no past-paper questions, and the official syllabus and specimen materials remain the authority.*
>
> Cambridge IGCSE Physics 0625 syllabus — https://www.cambridgeinternational.org/Images/697209-2026-2028-syllabus.pdf

THE PAPER

Topic 4 · Electricity and magnetism

Answer all questions. 41 marks in 50 minutes.

---

1 CORE

MULTIPLE CHOICE · RECALL · 4.1 **[1]**

Which statement about a permanent magnet and a piece of unmagnetised iron is correct?

A The magnet attracts the iron, and the iron attracts the magnet.

B The magnet attracts the iron, but the iron has no effect on the magnet.

C The magnet repels the iron if the south pole is brought close.

D The iron must first be magnetised before any force acts.

Answer

---

2 SUPP.

MULTIPLE CHOICE · ROUTINE · 4.2 **[1]**

A current of 250 mA flows in a lamp for 4.0 minutes. How much charge passes through the lamp?

A 1.0 C

B 60 C

C 1000 C

D 60 000 C

Answer

---

3 SUPP.

MULTIPLE CHOICE · ROUTINE · 4.3 **[1]**

Two resistors of 6.0 Ω and 3.0 Ω are connected in parallel. What is their combined resistance?

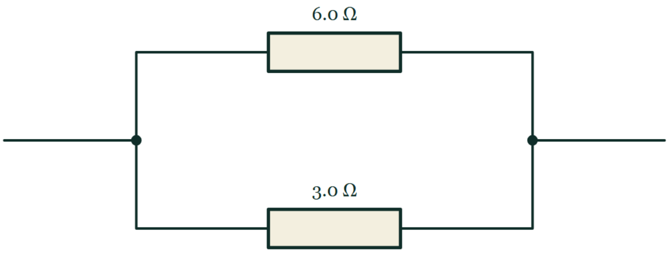


Fig. 3.1 *A circuit diagram of two resistors connected side by side between the same pair of points. A wire arrives from the left and reaches a junction, marked with a dot, where it divides into two branches. The upper branch contains a resistor labelled 6.0 ohm and the lower branch a resistor labelled 3.0 ohm. The two branches rejoin at a second junction dot on the right, from which a single wire continues away to the right.*

A 0.50 Ω

B 2.0 Ω

C 4.5 Ω

D 9.0 Ω

Answer

---

4 CORE

MULTIPLE CHOICE · DEMANDING · 4.4 **[1]**

An electric heater is rated at 230 V, 2.0 kW. Fuses of 3 A, 5 A, 10 A and 13 A are available. Which is the most suitable fuse for the heater?

A 3 A

B 5 A

C 10 A

D 13 A

Answer

---

5 MULTIPLE CHOICE · RECALL · 4.5 **[1]**

CORE

A straight wire carrying a current is placed at right angles to a magnetic field. In which direction does the force on the wire act?

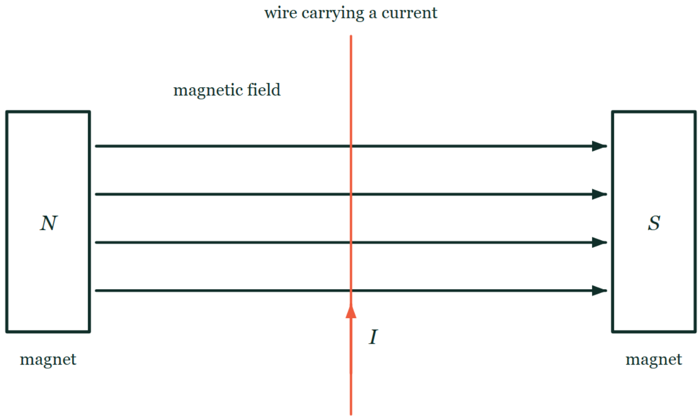


Fig. 5.1 *Two magnets face each other across a gap, the left one presenting its north pole and the right one its south pole, with the flat pole faces vertical and parallel. Four horizontal arrows drawn across the gap from the north pole to the south pole represent the magnetic field. A straight wire runs vertically down the page through the middle of the gap, so that it crosses the field lines at right angles, and a short arrow on the wire labelled I shows the current flowing up the page.*

A along the wire, in the direction of the current

B along the magnetic field lines

C at right angles to both the current and the field

D there is no force unless the wire moves

Answer

6 SUPP.

MULTIPLE CHOICE · ROUTINE · 4.5 **[1]**

A transformer has 200 turns on the primary coil and 5000 turns on the secondary coil. The primary is connected to a 12 V a.c. supply. What is the output voltage?

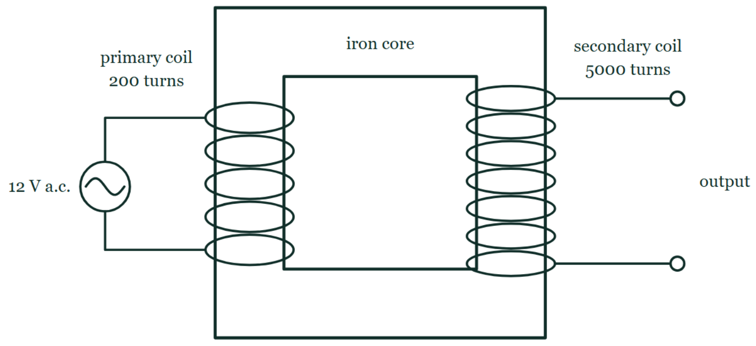


Fig. 6.1 *A transformer drawn as a rectangular iron core with a hollow centre. Wound around the left limb is the primary coil, labelled 200 turns and drawn as five loops encircling the limb; its two ends run out to the left to a 12 V a.c. supply, drawn as a circle containing one cycle of a sine wave. Wound around the right limb is the secondary coil, labelled 5000 turns and drawn as seven closer-spaced loops; its two ends run out to the right to a pair of open output terminals.*

A 0.48 V

B 12 V

C 300 V

D 1200 V

Answer

---

7 SUPP.

STRUCTURED · DEMANDING · 4.2 · 4.3 **[10]**

A 12 V battery of negligible internal resistance is connected to a 40 Ω resistor in series with a parallel combination of a 30 Ω resistor and a 60 Ω resistor.

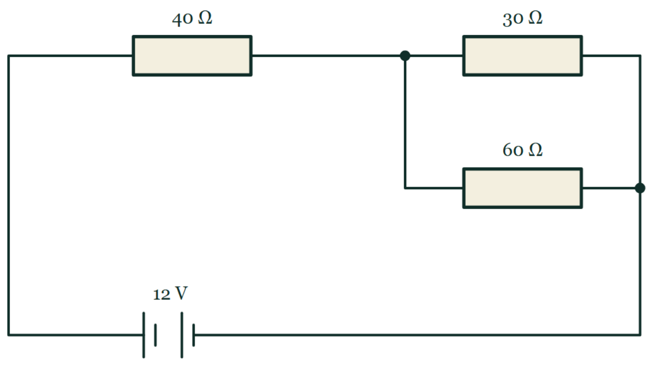


Fig. 7.1 *Circuit diagram. From the positive terminal of the 12 V battery, drawn at the foot of the circuit with its long plate on the left, the wire runs round to a resistor labelled 40 ohm. Beyond that resistor the circuit reaches a junction and divides into two parallel branches, the upper one containing a resistor labelled 30 ohm and the lower one a resistor labelled 60 ohm. The branches rejoin at a second junction, and a single wire returns from there to the negative terminal of the battery.*

(a) CALCULATE **[2]**

Calculate the combined resistance of the parallel pair.

(b) CALCULATE **[2]**

Calculate the current drawn from the battery.

(c) DETERMINE **[2]**

Determine the potential difference across the parallel pair.

(d) DETERMINE **[2]**

Determine the current in the 60 Ω resistor.

(e) EXPLAIN **[2]**

The 60 Ω resistor is now removed from the circuit, leaving a break in that branch. Explain what happens to the current drawn from the battery.

8 SUPP. STRUCTURED · DISCRIMINATING · 4.5 **[9]**

A bar magnet is pushed, north pole first, into a coil of insulated wire connected to a sensitive centre-zero ammeter. The ammeter needle deflects to the right while the magnet is moving in.

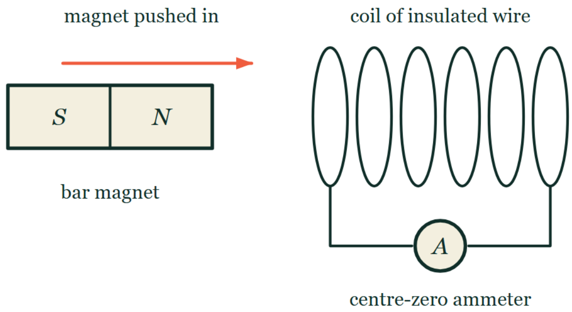


Fig. 8.1 *A bar magnet lies to the left of a coil of insulated wire, on the same horizontal axis as the coil. The magnet's south pole is at its left-hand end and its north pole at the right-hand end, so the north pole faces the coil. An arrow above the magnet points towards the coil, showing the direction in which the magnet is pushed. The coil is drawn as six loops, and wires from its two ends run down and join a centre-zero ammeter, whose face is shown as a circle marked A with no needle drawn on it.*

(a) STATE **[1]**

State what happens to the ammeter reading while the magnet is held stationary inside the coil.

(b) EXPLAIN **[3]**

Explain, in terms of magnetic field lines, why a current is produced only while the magnet is moving.

(c) STATE **[2]**

State two changes to the experiment that would each increase the size of the deflection.

(d) EXPLAIN **[3]**

The magnet is now pulled out of the coil, south pole first, at the same speed. Explain what is observed on the ammeter, and why.

9 CORE

STRUCTURED · ROUTINE · 4.4 [8]

A household electric shower is connected to the 230 V mains supply through a fuse and an earth wire. The shower has a metal case and is marked 8.5 kW.

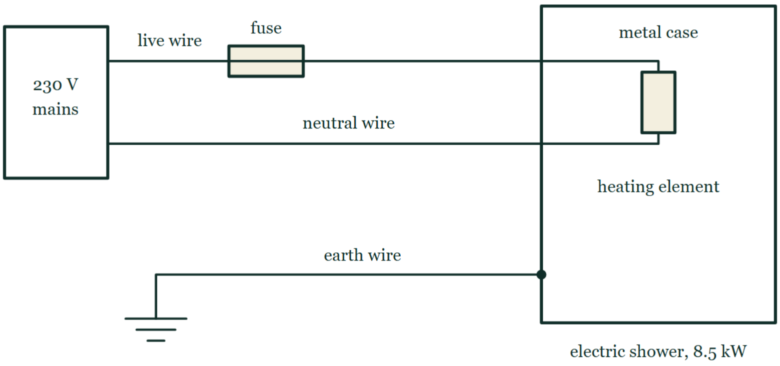


Fig. 9.1 *A wiring diagram of the electric shower. A box on the left marked 230 V mains has two wires leaving it: the live wire, which passes through a fuse drawn as a small rectangle with a line through it, and the neutral wire, which runs straight across. Both enter the outline of the shower, where they are joined to each other by the heating element. The shower's outline is labelled metal case and the appliance is marked 8.5 kW. A third wire, the earth wire, runs from an earth symbol of three shortening horizontal bars across to the metal case, meeting it at a solid connecting dot.*

(a) CALCULATE [2]

Calculate the current in the shower when it is operating normally.

(b) EXPLAIN [3]

Explain how the earth wire and the fuse together protect a person who touches the metal case if a live wire comes loose inside the shower.

(c) CALCULATE [3]

The shower is used for a total of 30 minutes each day. Electrical energy costs 24 cents per kilowatt-hour. Calculate the cost of using the shower for 30 days.

10 CORE

PRACTICAL SKILLS · DEMANDING · 4.3 **[8]**

A student investigates how the current in a filament lamp depends on the potential difference across it. She connects the lamp to a variable power supply, with an ammeter in series and a voltmeter across the lamp.

The student's results

V / V	0.0	1.0	2.0	3.0	4.0	5.0	6.0
I / A	0.00	0.17	0.28	0.36	0.42	0.47	0.51

(a) STATE **[2]**

State how the ammeter and the voltmeter must each be connected in the circuit.

(b) DETERMINE **[3]**

Determine the resistance of the lamp when the potential difference across it is 1.0 V, and again when it is 6.0 V.

(c) EXPLAIN **[3]**

Explain, in terms of the filament, why the resistance changes in the way your answers to (b) show.

MARK SCHEME

Topic 4 · Electricity and magnetism — mark scheme

One line per mark, as an examiner would award them. A note under a part is the error that part is set to catch.

---

1 CORE

MULTIPLE CHOICE · RECALL · 4.1 **[1]**

Which statement about a permanent magnet and a piece of unmagnetised iron is correct?

KEY **A** **The magnet attracts the iron, and the iron attracts the magnet.**

C is the item's real target: an unmagnetised magnetic material is always attracted, whichever pole approaches. Repulsion is the only sure test for a magnet.

AO1

---

2 SUPP.

MULTIPLE CHOICE · ROUTINE · 4.2 **[1]**

A current of 250 mA flows in a lamp for 4.0 minutes. How much charge passes through the lamp?

KEY **B** **60 C**

A converts the minutes but not the milliamps. C converts the milliamps but not the minutes. Both unit conversions have to be done, which is the point of the item.

AO2

---

3 SUPP.

MULTIPLE CHOICE · ROUTINE · 4.3 **[1]**

Two resistors of 6.0 Ω and 3.0 Ω are connected in parallel. What is their combined resistance?

KEY **B** **2.0 Ω**

D is the series total and C is the mean — both offered to candidates who reach for an average. A stops at 1/R without inverting. Any parallel answer must be smaller than the smaller resistor, which rules out C and D at a glance.

AO2

---

4 CORE

MULTIPLE CHOICE · DEMANDING · 4.4 **[1]**

An electric heater is rated at 230 V, 2.0 kW. Fuses of 3 A, 5 A, 10 A and 13 A are available. Which is the most suitable fuse for the heater?

KEY **C** **10 A**

The working current is 2000 / 230 = 8.7 A, so the fuse must be the smallest standard rating above it. A and B are below the working current and would melt every time the heater was switched on. D would carry the working current safely but is so far above it that a fault current of 12 A — enough to overheat the flex — would flow without ever blowing the fuse.

AO2

---

5 CORE

MULTIPLE CHOICE · RECALL · 4.5 **[1]**

A straight wire carrying a current is placed at right angles to a magnetic field. In which direction does the force on the wire act?

KEY **C** **at right angles to both the current and the field**

D confuses the motor effect with electromagnetic induction — a current-carrying wire in a field experiences a force whether or not it is moving.

AO1

---

6 MULTIPLE CHOICE · ROUTINE · 4.5 **[1]**

SUPP.

A transformer has 200 turns on the primary coil and 5000 turns on the secondary coil. The primary is connected to a 12 V a.c. supply. What is the output voltage?

KEY **C** **300 V**

A inverts the turns ratio. With more turns on the secondary this is a step-up transformer, so any answer at or below 12 V can be discarded before the arithmetic.

AO2

---

7 STRUCTURED · DEMANDING · 4.2 · 4.3 **[10]**

SUPP.

A 12 V battery of negligible internal resistance is connected to a 40 Ω resistor in series with a parallel combination of a 30 Ω resistor and a 60 Ω resistor.

(a) CALCULATE · AO2 **[2]**

Calculate the combined resistance of the parallel pair.

1 1/R = 1/30 + 1/60 = 3/60

2 R = 20 Ω

(b) CALCULATE · AO2 **[2]**

Calculate the current drawn from the battery.

1 total resistance = 40 + 20 = 60 Ω

2 I = V / R = 12 / 60 = 0.20 A

(c) DETERMINE · AO2 **[2]**

Determine the potential difference across the parallel pair.

1 p.d. across the 40 Ω resistor = 0.20 × 40 = 8.0 V

2 p.d. across the pair = 12 − 8.0 = 4.0 V (or 0.20 × 20 = 4.0 V)

(d) DETERMINE · AO2 **[2]**

Determine the current in the 60 Ω resistor.

1 I = V / R = 4.0 / 60

2 I = 0.067 A (67 mA)

(e) EXPLAIN · AO2 **[2]**

The 60 Ω resistor is now removed from the circuit, leaving a break in that branch. Explain what happens to the current drawn from the battery.

1 the total resistance increases, because the parallel pair is replaced by the 30 Ω resistor alone, giving 70 Ω instead of 60 Ω

2 so the current from the battery decreases (to about 0.17 A)

Candidates routinely say removing a resistor lowers the resistance. Removing one branch of a parallel pair raises it, and this part is set precisely on that.

---

8 STRUCTURED · DISCRIMINATING · 4.5 **[9]**

SUPP.

A bar magnet is pushed, north pole first, into a coil of insulated wire connected to a sensitive centre-zero ammeter. The ammeter needle deflects to the right while the magnet is moving in.

(a) STATE · AO1 **[1]**

State what happens to the ammeter reading while the magnet is held stationary inside the coil.

1 the reading returns to (and stays at) zero

(b) EXPLAIN · AO1 **[3]**

Explain, in terms of magnetic field lines, why a current is produced only while the magnet is moving.

1 an e.m.f. is induced when the magnetic field lines linking the coil change

2 moving the magnet changes the number of field lines through the coil, cutting the turns of wire

3 a stationary magnet gives an unchanging field through the coil, so no e.m.f. and no current

(c) STATE · AO1 **[2]**

State two changes to the experiment that would each increase the size of the deflection.

1 move the magnet faster

2 any one of: use a stronger magnet; use a coil with more turns; use a coil of smaller cross-sectional area wound closer to the magnet

(d) EXPLAIN · AO2 **[3]**

The magnet is now pulled out of the coil, south pole first, at the same speed. Explain what is observed on the ammeter, and why.

1 the needle deflects to the left — the current is in the opposite direction

2 because the field through the coil is changing in the opposite sense as the magnet is withdrawn

3 the size of the deflection is the same, because the rate of change of the field is the same

Three marks and three separate ideas: direction, cause and size. Most answers get the reversal and stop, and stop at one mark.

9 CORE

STRUCTURED · ROUTINE · 4.4 **[8]**

A household electric shower is connected to the 230 V mains supply through a fuse and an earth wire. The shower has a metal case and is marked 8.5 kW.

(a) CALCULATE · AO2 **[2]**

Calculate the current in the shower when it is operating normally.

1. I = P / V = 8500 / 230
2. I = 37 A

(b) EXPLAIN · AO1 **[3]**

Explain how the earth wire and the fuse together protect a person who touches the metal case if a live wire comes loose inside the shower.

1. the earth wire connects the metal case to earth through a very low resistance path
2. if the live wire touches the case, a very large current flows to earth rather than through the person
3. this current melts the fuse, breaking the live wire and isolating the appliance

The fuse must be described as being in the live wire. A fuse in the neutral would blow but leave the case live, and mark schemes withhold the mark for exactly that reason.

(c) CALCULATE · AO2 **[3]**

The shower is used for a total of 30 minutes each day. Electrical energy costs 24 cents per kilowatt-hour. Calculate the cost of using the shower for 30 days.

1. energy per day = 8.5 kW × 0.50 h = 4.25 kWh
2. energy in 30 days = 127.5 kWh
3. cost = 127.5 × 24 = 3060 cents = $30.60

---

10 CORE

PRACTICAL SKILLS · DEMANDING · 4.3 **[8]**

A student investigates how the current in a filament lamp depends on the potential difference across it. She connects the lamp to a variable power supply, with an ammeter in series and a voltmeter across the lamp.

(a) STATE · AO3 **[2]**

State how the ammeter and the voltmeter must each be connected in the circuit.

1. the ammeter is connected in series with the lamp
2. the voltmeter is connected in parallel with (across) the lamp

(b) DETERMINE · AO2 **[3]**

Determine the resistance of the lamp when the potential difference across it is 1.0 V, and again when it is 6.0 V.

1. R = V / I used at both points
2. at 1.0 V: R = 1.0 / 0.17 = 5.9 Ω
3. at 6.0 V: R = 6.0 / 0.51 = 11.8 Ω (accept 12 Ω)

(c) EXPLAIN · AO2 **[3]**

Explain, in terms of the filament, why the resistance changes in the way your answers to (b) show.

1. as the current increases the filament gets hotter
2. the metal ions in the filament vibrate with greater amplitude
3. so the electrons collide with them more often and the resistance increases

A graph of I against V for a filament lamp curves towards the V axis. Candidates who say the lamp "does not obey Ohm's law" have named the observation, not explained it, and the marks here are for the mechanism.

Topic 5 · Nuclear physics

The nuclear model of the atom, nuclide notation and isotopes, the three radiations and what stops them, decay equations, half-life and safety.

SUGGESTED TIME	TOTAL MARKS	QUESTIONS	MULTIPLE CHOICE
40 minutes	**36**	**10**	**6**

SECTION	**5 · Nuclear physics**
IN THE FORMAT OF	Papers 1 and 2 (multiple choice), Papers 3 and 4 (theory), Paper 6 (alternative to practical)
ROUTES	Core only — 6 questions, 12 marks. Core and Supp. — the whole paper, 10 questions, 36 marks. Every question is tagged in the left margin.
DEMAND	**Recall 3 · Routine 3 · Demanding 2 · Discriminating 2**
	Pitched at the board's own level, not above it. Multiple choice is mostly one step, with a couple of two-step items and one that rewards the candidate who does not take the obvious route. Structured questions open on a 1-mark recall and close on an explanation or a suggestion worth two marks — the marks real candidates most often drop.
SYLLABUS POINTS	5.1 · 5.2

INSTRUCTIONS

— Answer all questions in the spaces provided.

— Show your working. Method marks are awarded even where the final answer is wrong.

— Give your answers to a sensible number of significant figures, with a unit.

— The mark scheme for this paper follows the last question.

> *Written by GioPhysics from the published syllabus. These are practice papers in the style of Cambridge IGCSE Physics 0625; they are not Cambridge papers, contain no past-paper questions, and the official syllabus and specimen materials remain the authority.*
>
> Cambridge IGCSE Physics 0625 syllabus — https://www.cambridgeinternational.org/Images/697209-2026-2028-syllabus.pdf

Topic 5 · Nuclear physics

Answer all questions. 36 marks in 40 minutes.

1 CORE

MULTIPLE CHOICE · RECALL · 5.1 **[1]**

How many neutrons are there in a nucleus of ${}^{235}_{92}U$?

A 92

B 143

C 235

D 327

Answer

2 CORE

MULTIPLE CHOICE · RECALL · 5.2 **[1]**

A radioactive source is placed near a detector. A sheet of paper does not reduce the count rate, but a 5 mm sheet of aluminium reduces it almost to background. What does the source emit?

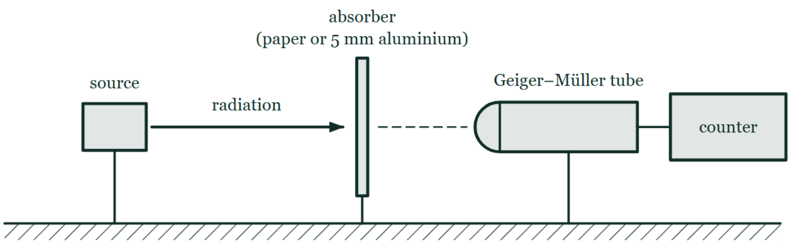


Fig. 2.1 *A radioactive source in a holder stands on the bench facing a Geiger–Müller tube that is joined by a lead to a counter. Between them an absorber is held upright in the path of the radiation: either a sheet of paper or a 5 mm sheet of aluminium. The source, the absorber and the window of the tube all lie on the same horizontal line, and the distance between the source and the tube is not changed when the absorber is put in place.*

A α-particles only

B β-particles only

C γ-rays only

D α-particles and γ-rays

Answer

3 CORE

MULTIPLE CHOICE · ROUTINE · 5.2

[1]

A sample of a radioactive isotope has an activity of 800 Bq. The half-life of the isotope is 6.0 hours. What is the activity after 24 hours?

A 0 Bq

B 50 Bq

C 200 Bq

D 400 Bq

Answer

---

4 SUPP.

MULTIPLE CHOICE · ROUTINE · 5.2

[1]

A nucleus of $^{226}_{88}Ra$ decays by emitting an α-particle. What is the nuclide produced?

A $^{222}_{86}Rn$

B $^{222}_{88}Ra$

C $^{226}_{86}Rn$

D $^{226}_{89}Ac$

Answer

---

5 CORE

MULTIPLE CHOICE · RECALL · 5.2

[1]

Which is not a source of background radiation?

A cosmic rays reaching the Earth from space

B radon gas seeping from rocks and soil

C the Earth's magnetic field

D naturally occurring isotopes in food and drink

Answer

---

6 MULTIPLE CHOICE · DEMANDING · 5.2 **[1]**

CORE

A smoke alarm contains a source that ionises the air in a small gap, allowing a tiny current to flow. Smoke entering the gap reduces the current and sets off the alarm. Which source is most suitable?

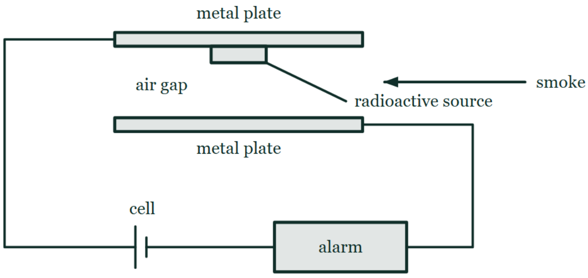


Fig. 6.1 *A cut-through view of the ionisation chamber of a smoke alarm. Two horizontal metal plates face each other across a small air gap, and a radioactive source is fixed to the underside of the upper plate so that it irradiates the gap. A wire from the upper plate leads to a cell and a wire from the lower plate leads to the alarm, so the two plates and the air gap between them form part of one complete series circuit. An arrow shows smoke drifting sideways into the gap.*

A an α-emitter with a half-life of several hundred years

B an α-emitter with a half-life of a few hours

C a γ-emitter with a half-life of several hundred years

D a β-emitter with a half-life of a few days

Answer

7 SUPP. STRUCTURED · DISCRIMINATING · 5.1 **[7]**

In the α-particle scattering experiment, a beam of α-particles was directed at a very thin sheet of gold foil in an evacuated container. Most α-particles passed straight through with little or no deviation. A small number were deflected through large angles, and about one in 8000 was deflected through more than 90°.

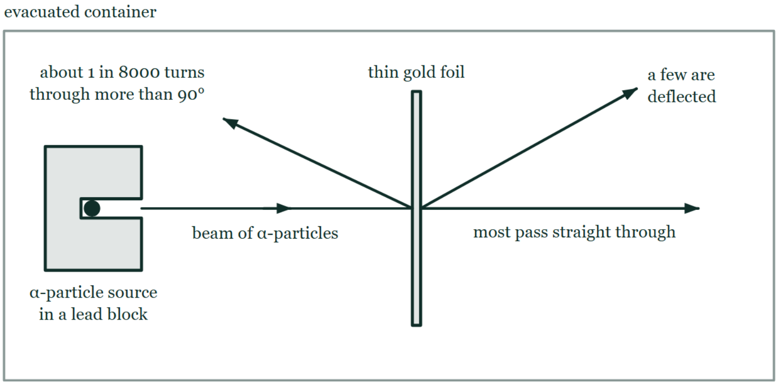


Fig. 7.1 *The scattering apparatus, drawn inside an evacuated container. A source of α-particles sits in a lead block with a narrow channel cut through it, so a fine beam travels horizontally to a very thin vertical sheet of gold foil. Three paths are drawn from the point where the beam meets the foil: one carrying straight on in the original direction and labelled as the path of most of the particles, one deflected upwards through a moderate angle, and one turned back towards the source side of the foil through more than 90°.*

(a) EXPLAIN **[2]**

Explain what the observation that most α-particles passed straight through tells us about the structure of the atom.

....

....

....

(b) EXPLAIN **[3]**

Explain what the small number of α-particles deflected through more than 90° tells us about the nucleus.

....

....

....

....

....

(c) SUGGEST **[2]**

Suggest why the container had to be evacuated and the gold foil had to be very thin.

....

....

....

8 SUPP.

STRUCTURED · DEMANDING · 5.1 · 5.2 **[8]**

Carbon has two naturally occurring stable isotopes, $^{12}_{6}C$ and $^{13}_{6}C$, and one radioactive isotope, $^{14}_{6}C$, which decays by β-emission to nitrogen.

(a) DEFINE **[2]**

Define the term isotope.

(b) EXPLAIN **[2]**

Explain why the three isotopes of carbon all behave identically in chemical reactions.

(c) STATE **[2]**

Complete the decay equation for carbon-14, giving the nucleon and proton numbers of the nitrogen nucleus produced: $^{14}_{6}C \rightarrow {}^{A}\_Z\ N + {}^{0}_{-1}\beta$

(d) EXPLAIN **[2]**

A β-particle is an electron, yet there are no electrons in a nucleus. Explain where the emitted β-particle comes from.

9 STRUCTURED · ROUTINE · 5.2 **[7]**

CORE

A hospital uses a radioactive tracer to study a patient's kidneys. The tracer is a γ-emitter with a half-life of 6 hours and is injected into the bloodstream.

(a) DEFINE **[2]**

Define half-life.

(b) EXPLAIN **[3]**

Explain why a γ-emitter is chosen for this use rather than an α-emitter.

(c) SUGGEST **[2]**

Suggest why an isotope with a half-life of 6 hours is more suitable than one with a half-life of 6 years.

10 SUPP.

PRACTICAL SKILLS · DISCRIMINATING · 5.2

[8]

A student determines the half-life of a radioactive source using a Geiger–Müller tube and a counter. Before bringing out the source, she records the count over 10 minutes with no source present and obtains 240 counts. She then places the source at a fixed distance from the tube and records the count rate every 20 minutes.

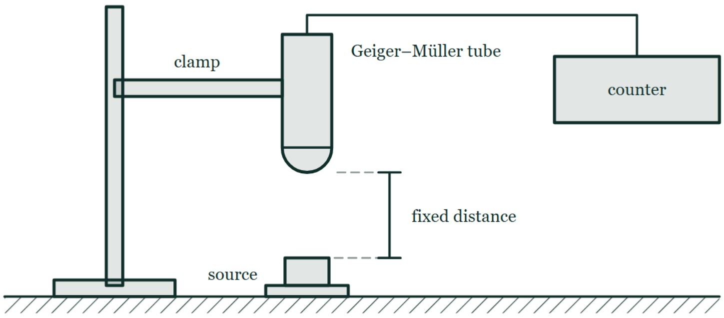


Fig. 10.1 *The arrangement used for the measurements. A Geiger–Müller tube is held vertically in a clamp on a retort stand with its window facing downwards, and is joined by a lead to a counter standing on the bench. The radioactive source sits on the bench directly beneath the tube, and the vertical gap between the tube window and the source is marked as a fixed distance which is kept the same for every reading.*

The student's readings, each a measured count rate in counts/minute

time / minutes	0	20	40	60	80
measured count rate / counts per minute	404	214	119	72	48

(a) DETERMINE **[2]**

Determine the background count rate, and explain why it must be measured.

(b) DETERMINE **[4]**

Correct the readings for background and hence determine the half-life of the source.

(c) SUGGEST **[2]**

The student's corrected values do not halve over exactly equal intervals. Suggest why, and suggest one improvement to the experiment.

MARK SCHEME

Topic 5 · Nuclear physics — mark scheme

One line per mark, as an examiner would award them. A note under a part is the error that part is set to catch.

---

1 CORE

MULTIPLE CHOICE · RECALL · 5.1 **[1]**

How many neutrons are there in a nucleus of $^{235}_{92}U$?

KEY **B** **143**

A gives the proton number and C the nucleon number. The neutron number is the difference, 235 − 92 = 143, and D adds them instead.

AO1

---

2 CORE

MULTIPLE CHOICE · RECALL · 5.2 **[1]**

A radioactive source is placed near a detector. A sheet of paper does not reduce the count rate, but a 5 mm sheet of aluminium reduces it almost to background. What does the source emit?

KEY **B** **β-particles only**

The paper result rules out alpha, and the aluminium result rules out gamma. Both pieces of evidence have to be used, which is what makes this a two-step item rather than recall.

AO1

---

3 CORE

MULTIPLE CHOICE · ROUTINE · 5.2 **[1]**

A sample of a radioactive isotope has an activity of 800 Bq. The half-life of the isotope is 6.0 hours. What is the activity after 24 hours?

KEY **B** **50 Bq**

24 hours is four half-lives, so the activity is halved four times: 800 → 400 → 200 → 100 → 50. C and D are the answers of candidates who stop after one or two halvings.

AO2

---

4 SUPP.

MULTIPLE CHOICE · ROUTINE · 5.2 **[1]**

A nucleus of $^{226}_{88}Ra$ decays by emitting an α-particle. What is the nuclide produced?

KEY **A** $^{222}_{86}Rn$

B changes only the nucleon number and C only the proton number. D is a beta decay. An α-particle carries away two protons and two neutrons, so both numbers must fall — by 2 and by 4.

AO2

---

5 CORE

MULTIPLE CHOICE · RECALL · 5.2 **[1]**

Which is not a source of background radiation?

KEY **C** **the Earth's magnetic field**

A magnetic field is not ionising radiation. The other three are the standard components of background, and candidates who have only learned that background is "from rocks" miss B or D.

AO1

---

6 CORE

MULTIPLE CHOICE · DEMANDING · 5.2 **[1]**

A smoke alarm contains a source that ionises the air in a small gap, allowing a tiny current to flow. Smoke entering the gap reduces the current and sets off the alarm. Which source is most suitable?

KEY **A** **an α-emitter with a half-life of several hundred years**

Two properties have to be right at once. Alpha is by far the most strongly ionising and is stopped by the alarm's own casing, so it is both effective and safe; and a long half-life means the alarm keeps working for years. B has the right radiation but would stop working almost immediately.

AO2

---

7 SUPP.

STRUCTURED · DISCRIMINATING · 5.1 **[7]**

In the α-particle scattering experiment, a beam of α-particles was directed at a very thin sheet of gold foil in an evacuated container. Most α-particles passed straight through with little or no deviation. A small number were deflected through large angles, and about one in 8000 was deflected through more than 90°.

(a) EXPLAIN · AO2 **[2]**

Explain what the observation that most α-particles passed straight through tells us about the structure of the atom.

1. most of the atom is empty space
2. so most α-particles pass through the foil without coming close to anything that can deflect them

(b) EXPLAIN · AO2 **[3]**

Explain what the small number of α-particles deflected through more than 90° tells us about the nucleus.

1. the positive charge and almost all the mass of the atom are concentrated in a very small volume — the nucleus
2. the α-particle is positive, so it is repelled strongly when it passes very close to a nucleus
3. such a close approach is rare, which is why so few particles are deflected through large angles

All three ideas — concentration, repulsion, rarity — are needed. Candidates who describe only the repulsion have not explained why the effect is so uncommon.

(c) SUGGEST · AO2 **[2]**

Suggest why the container had to be evacuated and the gold foil had to be very thin.

1. α-particles are absorbed by only a few centimetres of air, so air in the container would stop them before they reached the foil or the detector
2. a thin foil ensures each α-particle is scattered by at most one nucleus, so the deflections can be interpreted

---

8 STRUCTURED · DEMANDING · 5.1 · 5.2 **[8]**

SUPP.

Carbon has two naturally occurring stable isotopes, ${}^{12}_{6}C$ and ${}^{13}_{6}C$, and one radioactive isotope, ${}^{14}_{6}C$, which decays by β-emission to nitrogen.

(a) DEFINE · AO1 **[2]**

Define the term isotope.

1 atoms of the same element, with the same number of protons (same proton number)

2 but different numbers of neutrons (different nucleon number)

(b) EXPLAIN · AO2 **[2]**

Explain why the three isotopes of carbon all behave identically in chemical reactions.

1 chemical behaviour is determined by the electrons, particularly the outer electrons

2 all three isotopes have 6 protons and therefore the same number and arrangement of electrons

(c) STATE · AO2 **[2]**

Complete the decay equation for carbon-14, giving the nucleon and proton numbers of the nitrogen nucleus produced: ${}^{14}_{6}C \rightarrow {}^{A}\_Z\ N + {}^{0}_{-1}\beta$

1 A = 14

2 Z = 7

(d) EXPLAIN · AO1 **[2]**

A β-particle is an electron, yet there are no electrons in a nucleus. Explain where the emitted β-particle comes from.

1 a neutron in the nucleus changes into a proton

2 and an electron is created and emitted at that moment, which is why the proton number rises by one while the nucleon number is unchanged

The part that separates the strongest candidates. It is the only place in the topic where the bookkeeping of the decay equation has to be justified rather than performed.

9 CORE

STRUCTURED · ROUTINE · 5.2 **[7]**

A hospital uses a radioactive tracer to study a patient's kidneys. The tracer is a γ-emitter with a half-life of 6 hours and is injected into the bloodstream.

(a) DEFINE · AO1 **[2]**

Define half-life.

1. the time taken for half the nuclei of the radioactive isotope in a sample to decay
2. or, equivalently, for the activity (count rate) of the sample to fall to half its original value

(b) EXPLAIN · AO2 **[3]**

Explain why a γ-emitter is chosen for this use rather than an α-emitter.

1. γ-rays are the most penetrating of the three, so they pass out through the body and can be detected outside it
2. α-particles would be absorbed within a few centimetres of tissue and never reach the detector
3. α is the most strongly ionising, so it would do far more damage to the surrounding cells

(c) SUGGEST · AO2 **[2]**

Suggest why an isotope with a half-life of 6 hours is more suitable than one with a half-life of 6 years.

1. the activity falls quickly once the measurement is finished, so the patient's total exposure is small
2. an isotope with a half-life of years would keep irradiating the patient long after the scan, with no benefit

10 PRACTICAL SKILLS · DISCRIMINATING · 5.2 **[8]**

SUPP.

A student determines the half-life of a radioactive source using a Geiger–Müller tube and a counter. Before bringing out the source, she records the count over 10 minutes with no source present and obtains 240 counts. She then places the source at a fixed distance from the tube and records the count rate every 20 minutes.

(a) DETERMINE · AO3 **[2]**

Determine the background count rate, and explain why it must be measured.

1. background count rate = 240 / 10 = 24 counts per minute
2. radiation from cosmic rays, rocks, and other natural sources is detected as well as the source, so it must be subtracted from every reading to obtain the count rate due to the source alone

(b) DETERMINE · AO2 **[4]**

Correct the readings for background and hence determine the half-life of the source.

1. subtracts 24 from every reading: corrected rates 380, 190, 95, 48, 24 counts per minute
2. identifies that the corrected rate halves from 380 to 190 between 0 and 20 minutes
3. checks a second interval — 190 falls to 95 over the next 20 minutes, and 95 to 48 over the next
4. half-life = 20 minutes

The whole question turns on the correction. Using the raw readings gives an apparent half-life of about 22 minutes, and the error is systematic rather than random — background does not average away with more readings, it has to be subtracted.

(c) SUGGEST · AO3 **[2]**

The student's corrected values do not halve over exactly equal intervals. Suggest why, and suggest one improvement to the experiment.

1. radioactive decay is a random process, so the count in any fixed interval fluctuates
2. improvement: count over a longer interval at each time, take repeat readings, or plot all the corrected values on a graph and take the half-life from a smooth curve

Topic 6 · Space physics

The Earth and the Solar System, orbits and gravitational field strength, the life cycle of stars, and the evidence for an expanding Universe.

SUGGESTED TIME	TOTAL MARKS	QUESTIONS	MULTIPLE CHOICE
40 minutes	**39**	**10**	**6**

SECTION	**6 · Space physics**
IN THE FORMAT OF	Papers 1 and 2 (multiple choice), Papers 3 and 4 (theory), with a data-handling question in place of a practical
ROUTES	Core only — 5 questions, 10 marks. Core and Supp. — the whole paper, 10 questions, 39 marks. Every question is tagged in the left margin.
DEMAND	**Recall 4 · Routine 2 · Demanding 3 · Discriminating 1**
	Pitched at the board's own level, not above it. Multiple choice is mostly one step, with a couple of two-step items and one that rewards the candidate who does not take the obvious route. Structured questions open on a 1-mark recall and close on an explanation or a suggestion worth two marks — the marks real candidates most often drop.
SYLLABUS POINTS	6.1 · 6.2

INSTRUCTIONS

- Answer all questions in the spaces provided.
- Show your working. Method marks are awarded even where the final answer is wrong.
- Give your answers to a sensible number of significant figures, with a unit.
- The mark scheme for this paper follows the last question.

> *Written by GioPhysics from the published syllabus. These are practice papers in the style of Cambridge IGCSE Physics 0625; they are not Cambridge papers, contain no past-paper questions, and the official syllabus and specimen materials remain the authority.*
>
> Cambridge IGCSE Physics 0625 syllabus — https://www.cambridgeinternational.org/Images/697209-2026-2028-syllabus.pdf

Topic 6 · Space physics

Answer all questions. 39 marks in 40 minutes.

1 CORE

MULTIPLE CHOICE · RECALL · 6.1 **[1]**

What causes the seasons on Earth?

A The Earth's distance from the Sun changes during the year.

B The Earth's axis is tilted relative to the plane of its orbit.

C The Earth spins on its axis once every 24 hours.

D The Sun's output of energy varies during the year.

Answer

2 CORE

MULTIPLE CHOICE · RECALL · 6.1 **[1]**

Which list gives four planets in order of increasing distance from the Sun?

A Mercury, Venus, Mars, Earth

B Venus, Earth, Mars, Jupiter

C Earth, Venus, Jupiter, Saturn

D Mars, Earth, Saturn, Jupiter

Answer

3
SUPP.

MULTIPLE CHOICE · ROUTINE · 6.1

[1]

A planet orbits its star in a nearly circular path of radius 1.1×10^{11} m, taking 1.9×10^{7} s to complete one orbit. What is its average orbital speed?

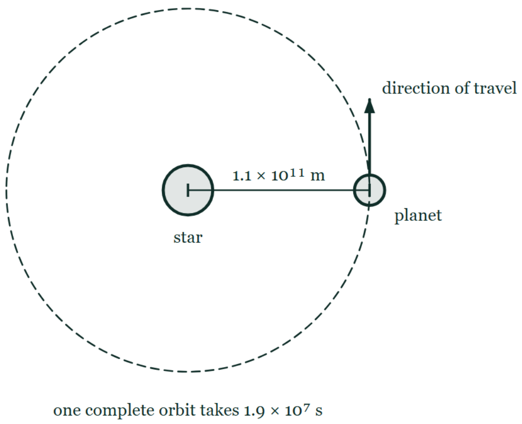


Fig. 3.1 *A planet moving on a nearly circular orbit around its star. The star is a disc at the centre of a dashed circle and the planet is a smaller disc on that circle, level with the star and to its right. The distance from the centre of the star out to the planet is marked 1.1×10^{11} m, an arrow at the planet points along the orbit to show the direction in which it travels, and a note beneath states that one complete orbit takes 1.9×10^{7} s.*

A 5.8×10^{3} m/s

B 1.8×10^{4} m/s

C 3.6×10^{4} m/s

D 5.8×10^{4} m/s

Answer

4
CORE

MULTIPLE CHOICE · RECALL · 6.2

[1]

What is a light-year?

A the time taken for light to travel across the Milky Way

B the distance travelled by light in one year

C the time taken for light from the Sun to reach the Earth

D the age of the light emitted by a distant galaxy

Answer

---

5 CORE

MULTIPLE CHOICE · RECALL · 6.2

[1]

A star with a mass much greater than that of the Sun reaches the end of its life. Which sequence of stages is correct?

A red giant → planetary nebula → white dwarf

B red supergiant → supernova → neutron star or black hole

C white dwarf → supernova → red supergiant

D protostar → white dwarf → black hole

Answer

---

6 SUPP.

MULTIPLE CHOICE · DEMANDING · 6.2

[1]

Light from a distant galaxy shows a spectral line at a wavelength longer than the wavelength of the same line measured in a laboratory on Earth. What does this show?

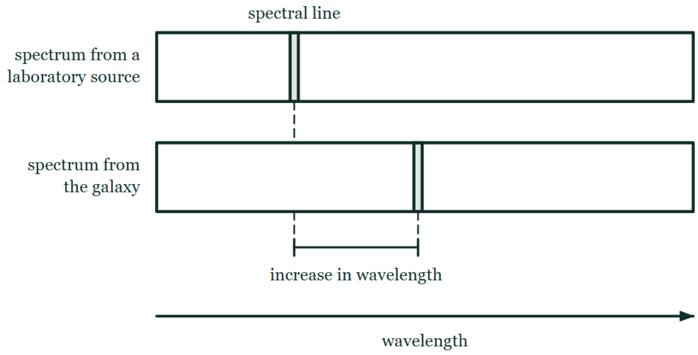


Fig. 6.1 *Two spectra drawn one above the other against a common horizontal wavelength scale that increases to the right. The upper strip is the spectrum of a source in the laboratory on Earth, with one spectral line marked in it. The lower strip is the spectrum of light received from the distant galaxy, in which the same line appears further to the right. A dashed line dropped from each line marks its position on the scale, and the gap between the two positions is labelled as the increase in wavelength.*

A The galaxy is moving towards the Earth.

B The galaxy is moving away from the Earth.

C The galaxy is hotter than the laboratory source.

D Light slows down as it travels across space.

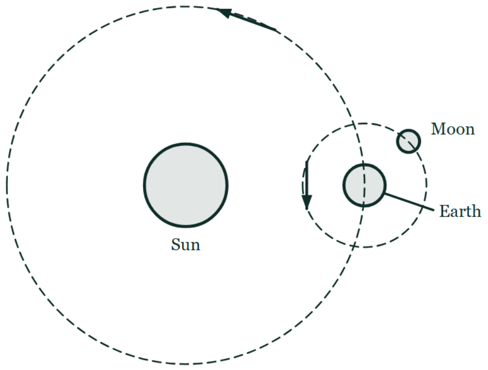
Answer

---

7 STRUCTURED · ROUTINE · 6.1 **[6]**

CORE

The Earth spins on its own axis and also orbits the Sun. The Moon orbits the Earth, taking about one month to complete an orbit.



dashed lines show the orbits — not to scale

Fig. 7.1 *A not-to-scale plan view of the Sun, the Earth and the Moon. The Sun is a disc at the centre of a large dashed circle, and the Earth is a smaller disc sitting on that circle to the right of the Sun. A second, much smaller dashed circle is drawn around the Earth with the Moon on it, up and to the right of the Earth. A short arrow on each dashed circle shows the direction in which the Earth travels around the Sun and the Moon around the Earth.*

(a) STATE **[2]**

State the approximate time taken for one rotation of the Earth on its axis, and for one orbit of the Earth around the Sun.

(b) EXPLAIN **[2]**

Explain why the Moon can be seen from Earth even though it produces no light of its own.

(c) EXPLAIN **[2]**

The Sun is much further from the Earth than the Moon is, yet the Sun and the Moon appear almost the same size in the sky. Explain how this is possible.

8 STRUCTURED · DEMANDING · 6.1 **[7]**

SUPP.

The table gives the orbital radius and the orbital period of four planets in the Solar System.

planet	orbital radius / 10^{11} m	orbital period / 10^{7} s
Earth	1.50	3.16
Mars	2.28	5.94
Jupiter	7.78	37.4
Saturn	14.3	92.9

(a) CALCULATE **[3]**

Calculate the average orbital speed of Jupiter.

(b) DETERMINE **[2]**

Without further calculation, determine whether Saturn's orbital speed is greater or smaller than Jupiter's, and justify your answer using the table.

(c) EXPLAIN **[2]**

Explain, in terms of gravitational field strength, why planets further from the Sun move more slowly.

9 SUPP.

STRUCTURED · DEMANDING · 6.2 **[8]**

A star forms from a cloud of dust and gas that is pulled together by gravitational attraction. The Sun is a stable star roughly halfway through its life.

(a) EXPLAIN **[2]**

Explain why the Sun is stable at present, in terms of the forces acting within it.

(b) DESCRIBE **[3]**

Describe the process by which energy is released in the core of the Sun.

(c) DESCRIBE **[3]**

Describe what will happen to the Sun once the hydrogen in its core has been used up.

[12]

Astronomers measure the speed at which distant galaxies are moving away from the Earth and the distance to each galaxy. The table gives values for four galaxies.

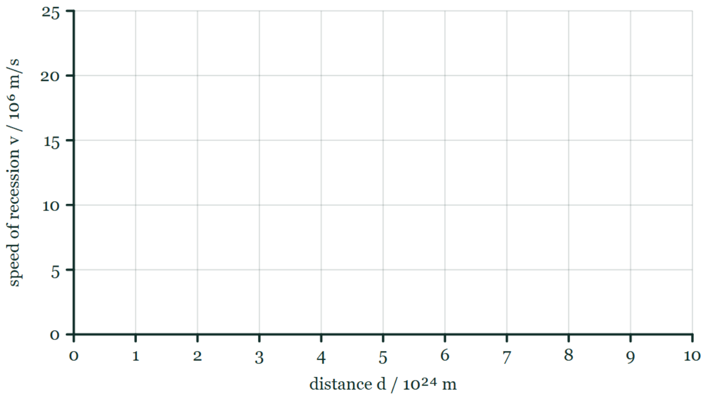


Fig. 10.1 *An empty graph grid on which the readings in the table can be plotted. The horizontal axis is labelled distance d / 10^{24} m and runs from 0 to 10 with a numbered gridline at every unit; the vertical axis is labelled speed of recession v / 10^{6} m/s and runs from 0 to 25 with a numbered gridline every 5. No points are plotted on the grid.*

galaxy	distance d / 10^{24} m	speed of recession v / 10^{6} m/s
P	1.2	2.6
Q	3.5	7.7
R	6.0	13.2
S	9.4	20.7

(a) DESCRIBE **[2]**

Describe the relationship between the speed of recession and the distance shown by the table.

(b) DETERMINE **[3]**

Determine a value for the Hubble constant H_0 from these data, and give its unit.

(c) ESTIMATE **[2]**

Use your value of H_0 to estimate the age of the Universe. Give your answer in seconds.

(d) EXPLAIN **[3]**

Explain how the relationship in (a) supports the idea that the Universe began with the Big Bang.

(e) SUGGEST **[2]**

The astronomers measured only four galaxies. Suggest two reasons why a value of H_0 obtained this way is less reliable than one obtained from several hundred galaxies.

MARK SCHEME

Topic 6 · Space physics — mark scheme

One line per mark, as an examiner would award them. A note under a part is the error that part is set to catch.

1 CORE

MULTIPLE CHOICE · RECALL · 6.1 **[1]**

What causes the seasons on Earth?

KEY **B** **The Earth's axis is tilted relative to the plane of its orbit.**

A is the near-universal misconception, and it is testable against the fact that the northern and southern hemispheres have opposite seasons at the same moment. C gives day and night, not the seasons.

AO1

2 CORE

MULTIPLE CHOICE · RECALL · 6.1 **[1]**

Which list gives four planets in order of increasing distance from the Sun?

KEY **B** **Venus, Earth, Mars, Jupiter**

A, C and D each swap one neighbouring pair, so none can be eliminated by a rough sense of the order alone — the candidate has to know the actual sequence. The four rocky planets run Mercury, Venus, Earth, Mars, and Jupiter is the first of the gas giants beyond them.

AO1

3 SUPP.

MULTIPLE CHOICE · ROUTINE · 6.1 **[1]**

A planet orbits its star in a nearly circular path of radius 1.1×10^{11} m, taking 1.9×10^{7} s to complete one orbit. What is its average orbital speed?

KEY **C** **3.6×10^{4} m/s**

A divides the radius by the time and forgets the circumference entirely. B uses πr rather than $2\pi r$, which is the commonest slip once the candidate has remembered that a circumference is involved.

AO2

4 CORE

MULTIPLE CHOICE · RECALL · 6.2 **[1]**

What is a light-year?

KEY **B** **the distance travelled by light in one year**

A, C and D are all times. The name misleads, which is why this item appears on real papers so often: a light-year is a distance.

AO1

5 CORE

MULTIPLE CHOICE · RECALL · 6.2 **[1]**

A star with a mass much greater than that of the Sun reaches the end of its life. Which sequence of stages is correct?

KEY **B** **red supergiant → supernova → neutron star or black hole**

A is the route for a star of about the Sun's mass, and is the answer of a candidate who has learned one life cycle rather than two.

AO1

6 SUPP.

MULTIPLE CHOICE · DEMANDING · 6.2 **[1]**

Light from a distant galaxy shows a spectral line at a wavelength longer than the wavelength of the same line measured in a laboratory on Earth. What does this show?

KEY **B** **The galaxy is moving away from the Earth.**

A is the answer of a candidate who knows the term redshift but not which way it runs. D contradicts the constancy of the speed of light in a vacuum, on which the whole method depends.

AO2

---

7 CORE

STRUCTURED · ROUTINE · 6.1 **[6]**

The Earth spins on its own axis and also orbits the Sun. The Moon orbits the Earth, taking about one month to complete an orbit.

(a) STATE · AO1 **[2]**

State the approximate time taken for one rotation of the Earth on its axis, and for one orbit of the Earth around the Sun.

1 rotation: 24 hours (1 day)

2 orbit: 365 days (1 year)

(b) EXPLAIN · AO1 **[2]**

Explain why the Moon can be seen from Earth even though it produces no light of its own.

1 light from the Sun falls on the Moon

2 and is reflected from the Moon's surface to the Earth

(c) EXPLAIN · AO2 **[2]**

The Sun is much further from the Earth than the Moon is, yet the Sun and the Moon appear almost the same size in the sky. Explain how this is possible.

1 the Sun's diameter is very much larger than the Moon's — about 400 times larger

2 and the Sun is about 400 times further away, so the two subtend almost the same angle at the Earth

---

8 SUPP.

STRUCTURED · DEMANDING · 6.1 **[7]**

The table gives the orbital radius and the orbital period of four planets in the Solar System.

(a) CALCULATE · AO2 **[3]**

Calculate the average orbital speed of Jupiter.

1 $v = 2\pi r / T$

2 $v = 2\pi \times 7.78 \times 10^{11} / 37.4 \times 10^{7}$

3 $v = 1.31 \times 10^{4}$ m/s

(b) DETERMINE · AO2 **[2]**

Without further calculation, determine whether Saturn's orbital speed is greater or smaller than Jupiter's, and justify your answer using the table.

1 Saturn's radius is about 1.8 times Jupiter's, but its period is about 2.5 times Jupiter's

2 the period grows by the larger factor, so $2\pi r/T$ is smaller — Saturn moves more slowly

(c) EXPLAIN · AO1 **[2]**

Explain, in terms of gravitational field strength, why planets further from the Sun move more slowly.

1 the Sun's gravitational field strength decreases with distance from the Sun

2 so a more distant planet is held by a weaker force and a smaller speed is enough to maintain its orbit

---

9 SUPP.

STRUCTURED · DEMANDING · 6.2 **[8]**

A star forms from a cloud of dust and gas that is pulled together by gravitational attraction. The Sun is a stable star roughly halfway through its life.

(a) EXPLAIN · AO1 **[2]**

Explain why the Sun is stable at present, in terms of the forces acting within it.

1. the inward gravitational attraction of the Sun's own mass
2. is balanced by the outward pressure produced by the energy released in the core, so the Sun neither collapses nor expands

(b) DESCRIBE · AO1 **[3]**

Describe the process by which energy is released in the core of the Sun.

1. hydrogen nuclei fuse together at the very high temperature and pressure of the core
2. forming helium nuclei
3. the mass of the products is slightly less than that of the reactants, and the difference is released as energy

(c) DESCRIBE · AO1 **[3]**

Describe what will happen to the Sun once the hydrogen in its core has been used up.

1. the core contracts and the outer layers expand — the Sun becomes a red giant
2. helium and heavier nuclei fuse in the core, up to the mass of iron
3. the outer layers are then thrown off as a planetary nebula, leaving the hot dense core as a white dwarf

10 DATA ANALYSIS · DISCRIMINATING · 6.2 **[12]**

SUPP.

Astronomers measure the speed at which distant galaxies are moving away from the Earth and the distance to each galaxy. The table gives values for four galaxies.

(a) DESCRIBE · AO2 **[2]**

Describe the relationship between the speed of recession and the distance shown by the table.

1. the speed of recession increases as the distance increases
2. and the increase is proportional — v/d is the same for all four galaxies

(b) DETERMINE · AO2 **[3]**

Determine a value for the Hubble constant H_0 from these data, and give its unit.

1. $H_0 = v / d$
2. using galaxy S: $H_0 = 20.7 \times 10^6 / 9.4 \times 10^{24}$
3. $H_0 = 2.2 \times 10^{-18}$, unit s^{-1} (per second)

Working from a single well-separated point, or from the gradient of a v–d graph, both earn full marks. Taking the mean of the four ratios is also accepted.

(c) ESTIMATE · AO2 **[2]**

Use your value of H_0 to estimate the age of the Universe. Give your answer in seconds.

1. age $\approx 1 / H_0$
2. age $\approx 1 / 2.2 \times 10^{-18} = 4.5 \times 10^{17}$ s

(d) EXPLAIN · AO2 **[3]**

Explain how the relationship in (a) supports the idea that the Universe began with the Big Bang.

1. every distant galaxy is moving away from us, and the further away it is the faster it recedes, so the Universe is expanding
2. tracing the motion backwards, all the galaxies were once much closer together
3. so the expansion began from a single point at a definite time in the past

The last mark is the one that closes the argument. Candidates who describe the expansion but never run it backwards have given evidence for expansion, not for a beginning.

(e) SUGGEST · AO3 **[2]**

The astronomers measured only four galaxies. Suggest two reasons why a value of H_0 obtained this way is less reliable than one obtained from several hundred galaxies.

1. the distance to a galaxy is very difficult to measure and carries a large uncertainty, so a value from four galaxies depends heavily on whether those four happen to be well measured
2. galaxies also have their own motion within their local cluster on top of the expansion, and averaging over many galaxies is what reduces that additional scatter

The only place on this paper where the marks are for judging data rather than using it — which is what Topic 6 offers in place of a practical, since space physics is not examined on Paper 5 or Paper 6.

THE CHEAPEST MARKS ON ANY PAPER

What the command words are asking for

Every board publishes these and marks to them. A candidate who explains where the question said state has spent four minutes earning one mark; one who states where it said explain has earned none.

Calculate	Work out from given facts, figures or information.
Define	Give the precise meaning.
Describe	State the points of a topic; give characteristics and main features.
Determine	Establish an answer using the information available.
Estimate	Suggest an approximate value.
Explain	Set out purposes or reasons; make relationships evident; give why and/or how.
Give	Produce an answer from a given source or recall.
Identify	Name, select or recognise.
Show (that)	Provide structured evidence that leads to a given result.
State	Express in clear terms.
Suggest	Apply knowledge and understanding to situations where there is a range of valid responses in order to make proposals.

WHAT IS BEING TESTED

IGCSE assessment objectives

Every candidate sits two theory papers and one practical-skills paper. Core takes Papers 1 and 3 and is capped at grade C; Extended takes Papers 2 and 4 and reaches A*. Both then take either Paper 5 (practical test) or Paper 6 (alternative to practical), which carries 20% either way. Theory papers give you no formula sheet.

AO1 77 MARKS · 33% QUALIFICATION 50%	**Knowledge with understanding** Recall, describe, explain and use physics ideas, terminology, instruments and conventions.
AO2 132 MARKS · 57% QUALIFICATION 30%	**Handling information and problem-solving** Locate and interpret information, translate between forms, calculate, reason, and apply physics to unfamiliar situations.
AO3 24 MARKS · 10% QUALIFICATION 20%	**Experimental skills and investigations** Plan, use apparatus, record and present observations, analyse, evaluate, and suggest improvements.

> *Written by GioPhysics from the published syllabus. These are practice papers in the style of Cambridge IGCSE Physics 0625; they are not Cambridge papers, contain no past-paper questions, and the official syllabus and specimen materials remain the authority.*
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> Cambridge IGCSE Physics 0625 syllabus — https://www.cambridgeinternational.org/Images/697209-2026-2028-syllabus.pdf