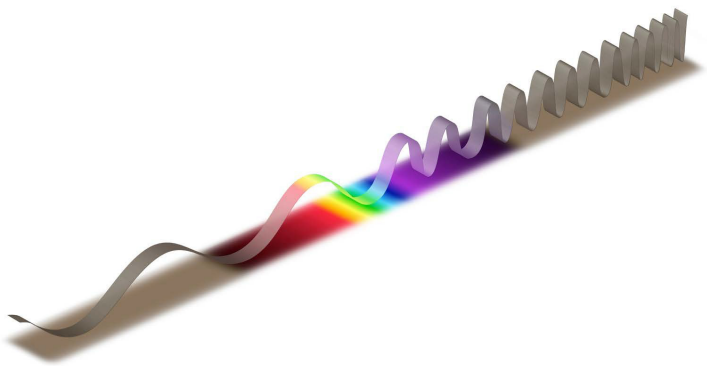
Cambridge Assessment International Education

# Specimen Paper Answers – Paper 4

## Cambridge IGCSE™ / IGCSE (9–1)

## Physics 0625 / 0972

For examination from 2023



Version 1

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# Contents

# Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge IGCSE / IGCSE (9-1) Physics 0625 / 0972, and to show different examples of answers within an overall good performance.

In this booklet, we have provided answers for all questions with examiner comments where relevant. This paper requires candidates to answer short-answer and structured questions and candidates are awarded maximum of 80 marks for this paper and the mark scheme provides the answers required to gain the marks.

In some cases, the question and answer is followed by an examiner comment on the candidates answer. Additionally, the examiner has set out a number of common mistakes that occur when candidates answer the questions. In this way, it is possible to understand what candidates have done to gain their marks and how they could improve their answers and avoid errors.

The mark schemes for the Specimen Papers are available to download from the School Support Hub at www.cambridgeinternational.org/support

**2023 Specimen Paper 4 Mark Scheme**

Past exam resources and other teaching and learning resources are available on the School Support Hub www.cambridgeinternational.org/support

# Assessment at a glance

The syllabus for Cambridge IGCSE Physics 0625 is available at www.cambridgeinternational.org

All candidates take three papers. Candidates who have studied the Core syllabus content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G.

Candidates who have studied the Extended syllabus content (Core and Supplement), and who are expected to achieve a grade C or above, should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A* to G.

## Core assessment

Core candidates take Paper 1 and Paper 3. The questions are based on the Core subject content only:

| Paper 1: Multiple Choice (Core) | |
|---|---|
| 45 minutes | |
| 40 marks | 30% |
| 40 four-option multiple-choice questions | |
| Externally assessed | |

| Paper 3: Theory (Core) | |
|---|---|
| 1 hour 15 minutes | |
| 80 marks | 50% |
| Short-answer and structured questions | |
| Externally assessed | |

## Extended assessment

Extended candidates take Paper 2 and Paper 4. The questions are based on the Core and Supplement subject content:

| Paper 2: Multiple Choice (Extended) | |
|---|---|
| 45 minutes | |
| 40 marks | 30% |
| 40 four-option multiple-choice questions | |
| Externally assessed | |

| Paper 4: Theory (Extended) | |
|---|---|
| 1 hour 15 minutes | |
| 80 marks | 50% |
| Short-answer and structured questions | |
| Externally assessed | |

## Practical assessment

All candidates take one practical paper from a choice of two:

| Paper 5: Practical Test | |
|---|---|
| 1 hour 15 minutes | |
| 40 marks | 20% |
| Questions will be based on the experimental skills in Section 4 | |
| Externally assessed | |

| Paper 6: Alternative to Practical | |
|---|---|
| 1 hour | |
| 40 marks | 20% |
| Questions will be based on the experimental skills in Section 4 | |
| Externally assessed | |

# Question 1

## Question 1(a)

**1** Fig. 1.1 shows the speed-time graph for a vehicle accelerating from rest.

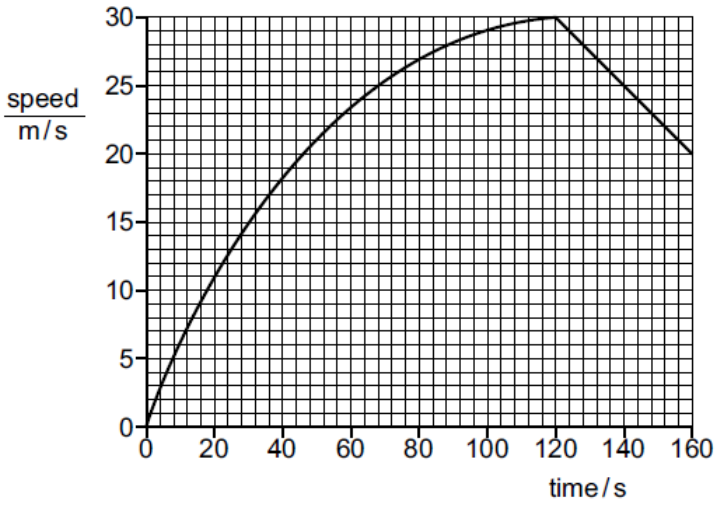


**Fig. 1.1**

**(a)** Calculate the acceleration of the vehicle at time $t$ = 30 s.

*acceleration = gradient of graph*

*= (30 – 4) / (72 – 0)*

*Tangent drawn at 30 s*

*triangle clear or end-points labelled e.g. (72,30) and (0,4)*

acceleration = ..... *0.36 m/s²* ..... [3]

**Mark awarded = 3 out of 3**

### Examiner comment

No working needs be shown for full credit. Values in range 0.30 – 0.45 are allowed without any working.

The unit is not given so 1 mark is awarded for correct unit stated.

### Common mistakes

'Tangent' is often clearly a chord.

## Question 1(b)

**(b)** Without further calculation, state how the acceleration at time $t$ = 100 s compares to the acceleration at time $t$ = 10 s.
Using ideas about forces, explain why any change in the acceleration has occurred.

.....

*Acceleration will be less because the driving force is smaller.*

..... [2]

**Mark awarded = 2 out of 2**

## Examiner comment

Allow reference to greater resistive force / friction force / air resistance / drag, or smaller resultant force.

## Question 1(c)

**(c)** Determine the distance travelled by the vehicle between time $t$ = 120 s and time $t$ = 160 s.

*Distance given by area under graph*
*distance = 25 × 40*

distance = *1000 m* ..... [3]

**Mark awarded = 3 out of 3**

## Examiner comment

The correct answer alone scores 3 marks. If the incorrect answer is given and no working is shown, then no credit can be awarded. The unit is required for full marks to be awarded.

**Total mark awarded = 8 out of 8**

# Question 2

## Question 2(a)

**2 (a)** Complete the definitions by giving the name of each quantity.

mass × acceleration = ....force....

force × time = ....impulse....

[2]

**Mark awarded = 2 out of 2**

## Question 2(b)(i)

**(b)** Fig. 2.2 shows a man using a golf club to hit a ball.

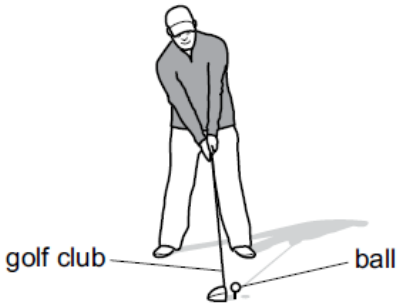


**Fig. 2.2**

The ball has a mass of 0.046 kg. The golf club is in contact with the ball for a duration of $5.0 \times 10^{-4}$ s and the ball leaves the golf club at a speed of 65 m / s.

**(i)** Calculate the momentum of the ball as it leaves the golf club.

Momentum = $m \times v$

= $0.046 \times 65$

momentum = ....3.0 kg m / s.... [2]

**Mark awarded = 2 out of 2**

## Examiner comment

Accept conventional symbols. The answer alone scores 2/2 marks. If incorrect answer is given and no working out is shown, then no credit can be awarded. The unit is required for full credit.

## Question 2(b)(ii)

**(ii)** Calculate the average resultant force acting on the ball while it is in contact with the golf club.

Force × time = change in momentum

force = 3.0 / (5.0 × $10^{-4}$)

average force = 6000 N [2]

**Mark awarded = 2 out of 2**

## Examiner comment

The answer alone scores 2 marks. If incorrect answer is given and no working out is shown, then no credit can be awarded. The unit is required for full credit.

## Question 2(b)(iii)

**(iii)** While the golf club is in contact with the ball, the ball becomes compressed and changes shape.

State the type of energy stored in the ball during its contact with the golf club.

Strain energy [1]

**Mark awarded = 1 out of 1**

## Examiner comment

Allow elastic energy.

**Total mark awarded = 7 out of 7**

# Question 3

## Question 3(a)(i)

3 Fig. 3.1 shows solar cells that use radiation from the Sun to generate electrical power.

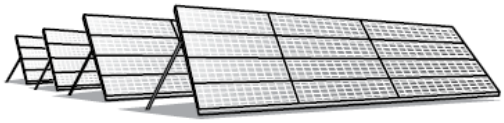

**Fig. 3.1**

**(a) (i)** State the name of the process which releases energy in the Sun.

*Nuclear fusion* [1]

**Mark awarded = 1 out of 1**

## Examiner comment

'Nuclear' must be stated.

## Question 3(a)(ii)

**(ii)** Describe what happens in this process.

*Two light nuclei combine to form a heavier nucleus with the release of energy.* [2]

**Mark awarded = 2 out of 2**

## Examiner comment

Could state 'loss of mass' too.

## Question 3(b)

**(b)** Apart from solar cells, there are other energy resources used on Earth for which the radiation from the Sun is the main source.

State the name of **one** of these energy resources and explain whether it is renewable.

name of energy resource *hydroelectric*

explanation *Solar energy continuously evaporates water and water vapour rises*

[2]

**Mark awarded = 2 out of 2**

## Question 3(c)

**(c)** State **two** advantages and **two** disadvantages of using solar cells to generate electrical power.

advantage 1 no pollution .....

.....

advantage 2 low maintenance .....

.....

disadvantage 1 depends on weather conditions .....

.....

disadvantage 2 small scale unless large area used .....

.....

[4]

**Mark awarded = 3 out of 4**

## Examiner comment

For credit, 'atmospheric' must be specified. Accept any reasonable statements.

**Total mark awarded = 8 out of 9**

# Question 4

## Question 4(a)

**4** Fig. 4.1 shows a balloon filled with helium that is used to lift measuring instruments to a great height above the Earth's surface.

**Fig. 4.1**

**(a)** Using ideas about momentum, explain how the atoms of helium produce a force on the wall of the balloon.

.....

*Atoms collide with wall and suffer a change in momentum.*

*This change gives a force on the wall.*

..... [3]

**Mark awarded = 2 out of 3**

### Examiner comment

No mention of rate of change of momentum.

### Common mistakes

Any reference to averaging over time is frequently omitted.

## Question 4(b)(i)

**(b)** At ground level, the pressure of the helium in the balloon is $1.0 \times 10^5$ Pa. The volume of the helium is 9.6 $m^3$.

The balloon is released and it rises quickly through the atmosphere. The volume of the helium increases. The temperature of the helium remains constant.

**(i)** Explain why the pressure in the balloon decreases as the balloon rises.
You should refer to helium atoms in your answer.

.....

*Fewer atoms per unit volume so there are fewer collisions per unit*

*area of the walls*

..... [2]

**Mark awarded = 2 out of 2**

## Question 4(b)(ii)

**(ii)** Calculate the pressure of the helium when its volume is 12 $m^3$.

$p \times V = \text{constant}$

$1.0 \times 10^5 \times 9.6 = p \times 12$

pressure = ..$p = 8.0 \times 10^4$ Pa..... [2]

**Mark awarded = 2 out of 2**

## Examiner comment

Accept conventional symbols. The answer alone scores 2 marks. If the incorrect answer is given and no working is shown, then no credit can be awarded. Unit required for full credit – allow N / $m^2$.

**Total mark awarded = 6 out of 7**

# Question 5

## Question 5(a)

**5 (a)** Compare the arrangement and motion of the particles in ice and in liquid water.

arrangement ..In ice, particles are in fixed lattice but in water they move.....
.....randomly.....

motion ....In ice, particles vibrate and in water they move randomly.....

.....
[2]

**Mark awarded = 2 out of 2**

### Examiner comment

It implies random positioning.

## Question 5(b)(i)

**(b)** A lake has a layer of ice on its surface. The area of the lake is 1800 $m^2$. The ice has a thickness of 0.025 m. The density of ice is 920 kg / $m^3$.

**(i)** Calculate the mass of ice on the lake.

Density = $m / V$
$m = 920 \times 1800 \times 0.025$

mass = 41400 kg [2]

**Mark awarded = 2 out of 2**

### Examiner comment

Accept conventional symbols and more than 2 significant figures. The answer alone scores 2/2 marks. If the incorrect answer is given and no working is shown, then no credit can be awarded. The unit is required for full credit.

## Question 5(b)(ii)

**(ii)** At night, the temperature of the ice on the lake falls by 3.5 °C.
The specific heat capacity of ice is 2.1 × $10^3$ J / kg °C.
Calculate the change in energy as the temperature falls.

Energy = $c \times m \times \Delta\theta$
$= 2.1 \times 10^3 \times 41000 \times 3.5$

energy = $3.0 \times 10^8$ J [2]

**Mark awarded = 2 out of 2**

## Examiner comment

Accept conventional symbols and more than 2 significant figures. The answer alone scores 2 marks. If the incorrect answer is given and no working is shown, then no credit can be awarded. The unit is given so there is no need to quote it.

**Total mark awarded = 6 out of 6**

# Question 6

## Question 6(a)(i)

**6** **(a)** Fig. 6.1 shows a converging lens and its principal axis. The points $F_1$ and $F_2$ are each a principal focus of the lens.

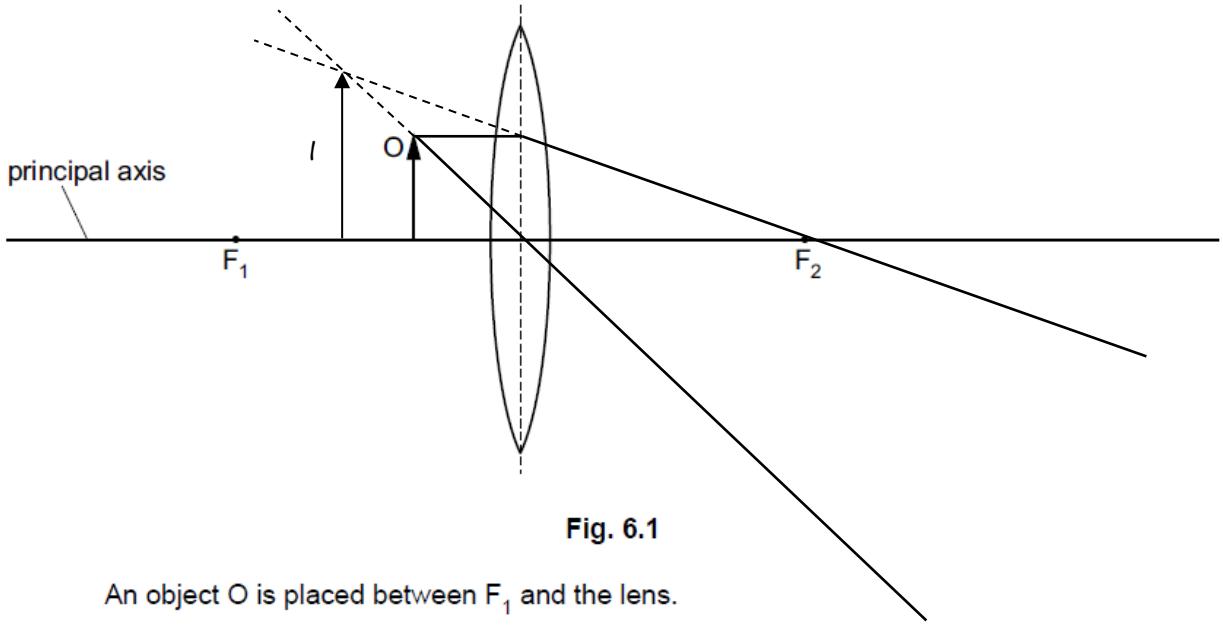


**Fig. 6.1**

An object O is placed between $F_1$ and the lens.

**(i)** On Fig. 6.1, draw two rays from the top of the object O to locate the image. Label the image I. [3]

**Mark awarded = 3 out of 3**

## Question 6(a)(ii)

**(ii)** The object O is moved to the left along the principal axis so that it is further from the lens than $F_1$.

Fig. 6.2 is a diagram of the new arrangement with the new image shown.

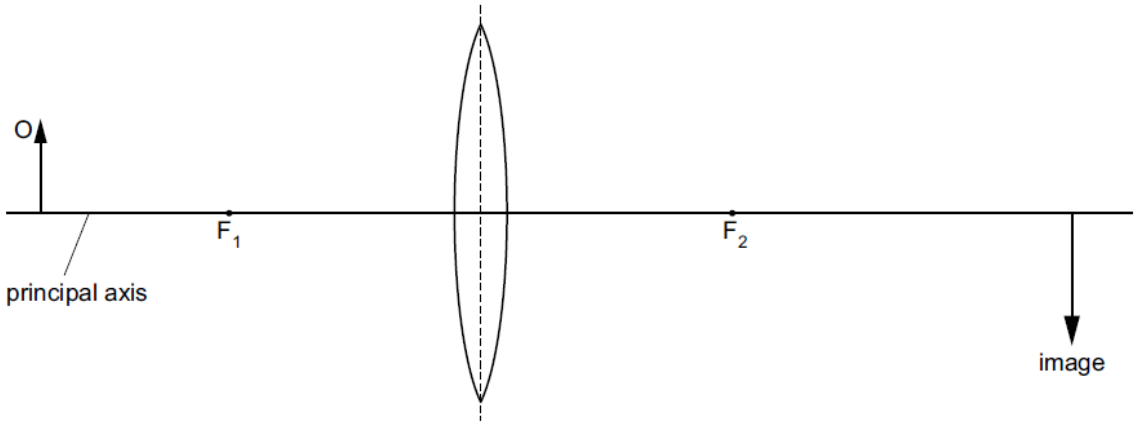


**Fig. 6.2**

Underline **three** of the terms below that describe the image shown in Fig. 6.2.

**diminished** **enlarged** **inverted** **real** **same size** **upright** **virtual**

[2]

**Mark awarded = 2 out of 2**

## Question 6(b)

**(b)** Fig. 6.3 shows yellow light passing through a glass prism.

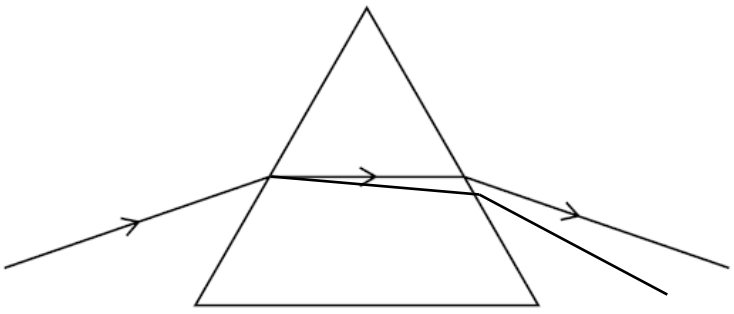

**Fig. 6.3**

Blue light enters the prism along the same path as the yellow light.

On Fig. 6.3, draw the path of the blue light as it enters, passes through and leaves the prism.

[2]

**Mark awarded = 2 out of 2**

**Total mark awarded = 7 out of 7**

# Question 7

## Question 7(a)

**7** **(a)** State a typical value for the speed of sound in air.

speed = 340 m/s ..... [1]

**Mark awarded = 1 out of 1**

### Examiner comment

Unit is required.

## Question 7(b)

**(b)** A sound wave in air has a wavelength of 22 mm.

Using your value for the speed of sound in **(a)**, calculate the frequency of the sound wave.

Speed = frequency × wavelength

$340 = f \times 22 \times 10^{-3}$

frequency = $f = 15.5$ kHz ..... [2]

**Mark awarded = 2 out of 2**

### Examiner comment

Accept conventional symbols and more than 2 significant figures. The answer alone scores 2/2 marks. If the incorrect answer is given and no working is shown, then no credit can be awarded. The unit is required for full credit.

## Question 7(c)

**(c)** Fig. 7.1 shows a solid block made from hot liquid metal. As the liquid cooled, a bubble formed **inside** the block. The bubble is **not** visible from outside the block.

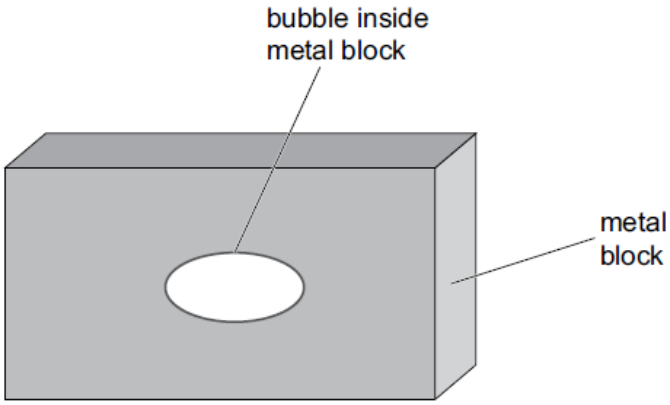


**Fig. 7.1**

Describe and explain how to use ultrasound to determine the size and position of the bubble inside the metal block. You may draw on the diagram.

.....

*Time found for echo to return from both sides of bubble.*

*Thickness of bubble found using speed × time*

.....

.....

.....

..... [4]

**Mark awarded = 3 out of 4**

## Examiner comment

No mention of transducer to produce and detect pulses of ultrasound.

**Total mark awarded = 6 out of 7**

# Question 8

## Question 8(a)

**8** Fig. 8.1 is a circuit diagram.

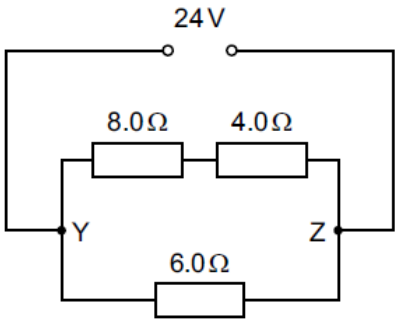


**Fig. 8.1**

**(a)** Calculate the combined resistance between Y and Z.

$1/R_T = 1/R + 1/R_S$

$R_S = 8 + 4$

$1/R_T = 1/6 + 1/12$

resistance = $R_T = 4.0\ \Omega$ [4]

**Mark awarded = 4 out of 4**

### Examiner comment

The correct answer and unit is needed to be awarded full marks. If an incorrect answer is given and no working out is shown then no credit can be awarded.

## Question 8(b)

**(b)** Calculate the potential difference (p.d.) across the 8.0 Ω resistor.

$V = 24 \times (8/12)$

p.d. = 16 V [2]

**Mark awarded = 2 out of 2**

### Examiner comment

The correct answer and unit is needed to be awarded full marks. If an incorrect answer is given and no working out is shown then no credit can be awarded.

**Total mark awarded = 6 out of 6**

# Question 9

## Question 9(a)

**9** Fig. 9.1 shows a conducting ball that oscillates between two charged plates.

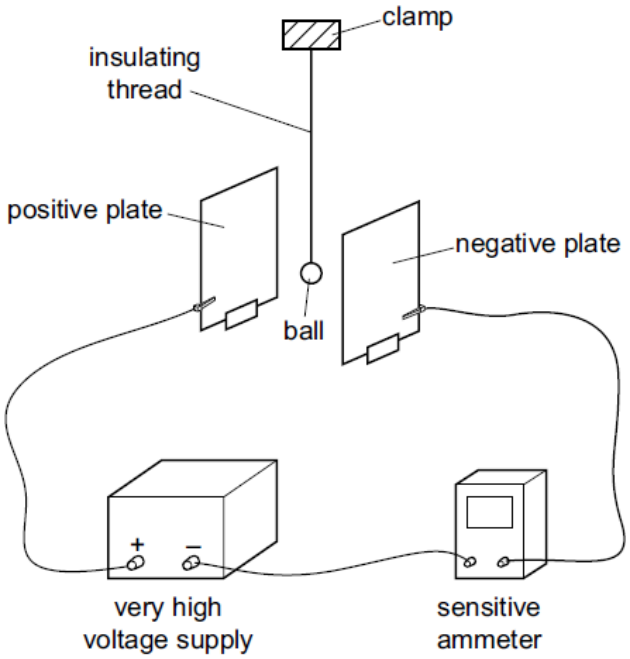


**Fig. 9.1**

As the ball oscillates, it touches each plate in turn.

**(a)** Referring to the charge on the ball, explain why the ball moves to the positive plate after touching the negative plate.

.....

*The ball collects negative charge from the negative plate. It is*

*attracted to the positive plate.*

..... [2]

**Mark awarded = 2 out of 2**

## Examiner comment

The answer must refer to negative and positive plates.

## Question 9(b)

**(b)** State which particles move when there is a current and state the direction in which they move through the sensitive ammeter.

particles: ....electrons.....

direction: ....From left to right through ammeter.....

[2]

**Mark awarded = 2 out of 2**

## Question 9(c)

**(c)** For each complete oscillation of the ball moving between the plates, a charge of $8.5 \times 10^{-10}$ C is transferred from one plate to the other. The frequency of oscillation is 4.0 Hz.

Calculate the current shown on the sensitive ammeter.

Charge = current × time

time = 1/4 s

current = $(8.5 \times 10^{-10}) / 4$

current = ....$2.1 \times 10^{-10}$ A..... [3]

**Mark awarded = 2 out of 3**

## Examiner comment

Working shows clearly that there is an arithmetic error for substitution of the time so this response is awarded 2 out of 3 marks. If no working is shown, then no marks would be awarded.

**Total mark awarded = 6 out of 7**

# Question 10

## Question 10(a)(i)

**10 (a) (i)** An americium (Am) nucleus decays by the emission of an α-particle into a neptunium (Np) nucleus.

Complete the nuclear equation for this decay.

$^{241}_{95}Am \rightarrow$ $^{237}_{93}Np + ^{4}_{2}He$

[2]

**Mark awarded = 2 out of 2**

## Examiner comment

Allow $^{4}_{2}\alpha$.

## Question 10(a)(ii)

**(ii)** Americium is used in smoke detectors.
Explain why beta (β) emitters or gamma (γ) emitters are **not** used in smoke detectors.

.....

They do not produce sufficient ionisation ..... [1]

**Mark awarded = 0 out of 1**

## Examiner comment

The answer should make reference to density of ionisation.

## Question 10(b)

**(b)** The half-life of this americium nuclide is 470 years. A sample of this nuclide contains $8.0 \times 10^{14}$ atoms. After some time, $6.0 \times 10^{14}$ americium atoms have decayed.

Calculate the time required for this decay.

$2 \times 10^{6}$ remain

$8 \times 10^{6}$ to $4 \times 10^{6}$ to $2 \times 10^{6}$ is 2 half lives

time = 940 years [3]

**Mark awarded = 3 out of 3**

## Examiner comment

Answer alone scores 3/3 marks. If the incorrect answer is given and no working is shown then no credit can be awarded. The unit is required for full credit.

**Total mark awarded = 5 out of 6**

# Question 11

## Question 11(a)

**11 (a)** Describe and explain how a stable star is formed.

Low temperature hydrogen gas drawn together by gravitation.

The temperature of gas increases as density increases creating a protostar.

When hot enough, nuclear fusion begins and no more contraction takes place.

[3]

**Mark awarded = 2 out of 3**

### Examiner comment

There is no mention of hydrogen in nebula, but this is allowed. The response does not include balancing of forces so only 2 of the 3 marks is awarded.

## Question 11(b)

**(b)** Describe and explain what can be deduced from cosmic microwave background radiation (CMBR).

CMBR was produced when the Universe was formed and the radiation is continuously being redshifted.

So, this indicates that the Universe is expanding.

[3]

**Mark awarded = 3 out of 3**

### Examiner comment

No mention that CMBR is observed in all directions but there are three relevant points given so 3 marks are awarded.

**Total mark awarded = 5 out of 6**

# Question 12

## Question 12(a)

**12** Fig. 12.1 shows a transformer.

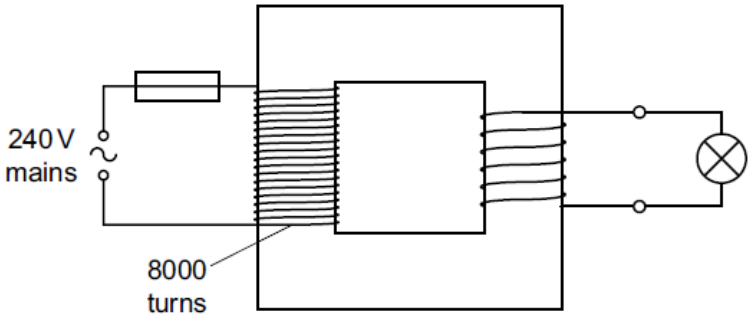


**Fig. 12.1**

There are 8000 turns in the primary coil of the transformer. The primary coil is connected to a 240 V mains supply. A 6.0 V lamp connected to the secondary coil operates at full brightness.

**(a)** Calculate the number of turns in the secondary coil.

$N = 8000 \times (6/240)$

number of turns = 200 [2]

**Mark awarded = 2 out of 2**

### Examiner comment

A wrong answer with no explanation will be awarded 0 out of 2 marks. Inverted ratio would score 0/2.

### Common mistakes

Inverted ratio is a common error where an initial expression is not written out.

## Question 12(b)

**(b)** The current in the lamp is 2.0 A. The transformer operates with 100% efficiency.

Calculate the current in the primary circuit.

$I = 2.0 \times (6/240)$

current = 0.05A [2]

**Mark awarded = 2 out of 2**

## Examiner comment

Allow 1 significant figure. A wrong answer with no explanation will be awarded 0 out of 2 marks. The unit required in order to be awarded 2 out of 2 marks.

## Common mistakes

Inverted ratio is a common error.

**Total mark awarded = 4 out of 4**

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