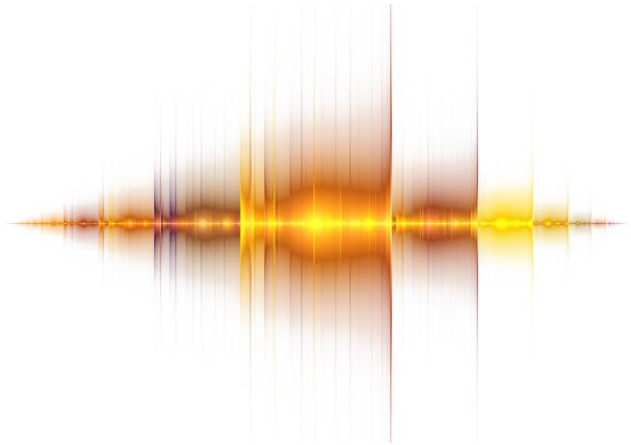
Cambridge Secondary 2

Example Candidate Responses

Cambridge IGCSE®

Physics **0625**

Paper 3



CAMBRIDGE
International Examinations

In order to help us develop the highest quality Curriculum Support resources, we are undertaking a continuous programme of review; not only to measure the success of our resources but also to highlight areas for improvement and to identify new development needs.

We invite you to complete our survey by visiting the website below. Your comments on the quality and relevance of Cambridge Curriculum Support resources are very important to us.

https://surveymonkey.co.uk/r/GL6ZNJB

Do you want to become a Cambridge consultant and help us develop support materials?

Please follow the link below to register your interest.

http://cie.org.uk/cambridge-for/teachers/teacherconsultants/

Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching IGCSE Physics (0625), and to show how different levels of candidates' performance (middle and low) relate to the subject's curriculum and assessment objectives.

In this booklet candidate responses have been chosen to exemplify a range of answers. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

For each question, response is annotated with clear explanation of where and why marks were awarded or omitted. This, in turn, followed by examiner comments on how the answer could have been improved. In this way it is possible for you to understand what candidates have done to gain their marks and what they will have to do to improve their marks. At the end there is a list of common mistakes candidates made in their answers for each question.

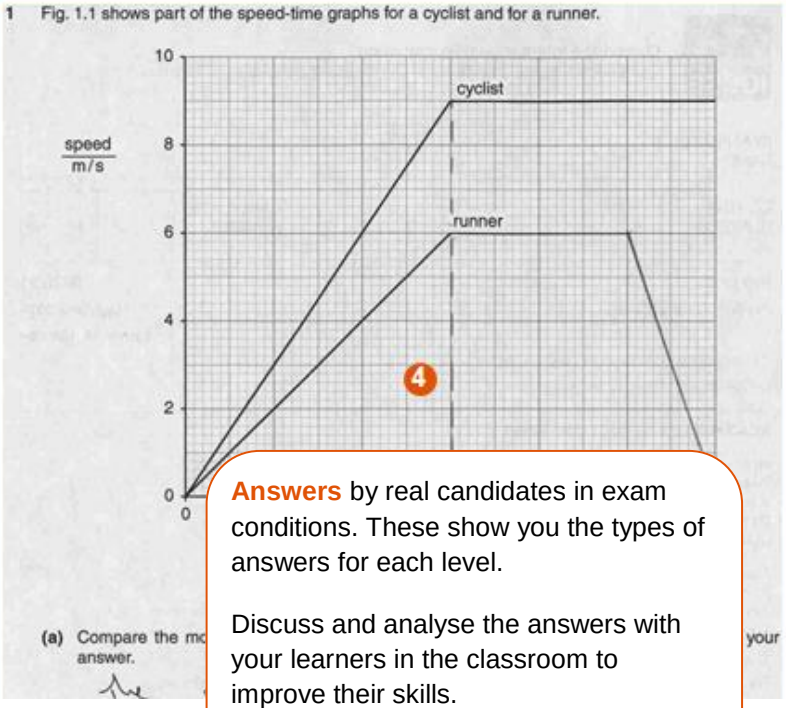
This document provides illustrative examples of candidate work. These help teachers to assess the standard required to achieve marks, beyond the guidance of the mark scheme. Some question types where the answer is clear from the mark scheme, such as short answers and multiple choice, have therefore been omitted.

The questions, mark schemes and pre-release material used here are available to download from Teacher Support. These files are:

Question Paper 3, June 2016	
Question paper	0625_s16_qp_31.pdf
Mark scheme	0625_s16_ms_31.pdf
Question Paper 4, June 2016	
Question paper	0625_s16_qp_41.pdf
Mark scheme	0625_s16_ms_41.pdf
Question Paper 6, June 2016	
Question paper	0625_s16_qp_61.pdf
Mark scheme	0625_s16_ms_61.pdf

Other past papers, Examiner Reports and other teacher support materials are available on Teacher Support at **https://teachers.cie.org.uk**

How to use this booklet

Example Candidate Response – middle	Examiner comments
1 Fig. 1.1 shows part of the speed-time graphs for a cyclist and for a runner.  (a) Compare the mo… answer.	1 This response indicates that the cyclist is gaining speed but does not give details of the motion of the runner. A mark is scored for identifying correctly the faster speed of the cyclist. Mark awarded for (a) = 1 out of 3

Answers by real candidates in exam conditions. These show you the types of answers for each level.

Discuss and analyse the answers with your learners in the classroom to improve their skills.

Examiner annotations: Each response is annotated with clear explanation of where and why marks were awarded or omitted. In this way it is possible for you to understand what candidates have done to gain their marks.

How the candidate could have improved the answer

(a) To achieve full marks candidate should have …

(c) The candidate should have calculated the are… 81m having to gain full marks.

Examiner comments This explains how the candidate could have improved the answer. This helps you to interpret the standard of Cambridge exams and helps your learners to refine exam technique.

Common mistakes candidates made in this question

(b) A common misconception was that the cycli…

(c) A common incorrect value was 108m. Candid… the maximum speed by the total time. They did n…

Common mistakes a list of common mistakes candidates made in their answers for each question.

Assessment at a glance

All candidates take must enter for three papers.

Core candidates take:	
Paper 1	45 minutes
Multiple Choice	30%
40 marks	
40 four-choice multiple-choice questions	
Questions will be based on the Core subject content	
Assessing grades C–G	
Externally assessed	
and:	
Paper 3	1 hour 15 minutes
Theory	50%
80 marks	
Short-answer and structured questions	
Questions will be based on the Core subject content	
Assessing grades C–G	
Externally assessed	
All candidates take either:	
Paper 5	1 hour 15 minutes
Practical Test	20%
40 marks	
Questions will be based on the experimental skills in Section 4	
Assessing grades A*–G	
Externally assessed	

Extended candidates take:	
Paper 2	45 minutes
Multiple Choice	30%
40 marks	
40 four-choice multiple-choice questions	
Questions will be based on the Extended subject content (Core and Supplement)	
Assessing grades A*–G	
Externally assessed	
and:	
Paper 4	1 hour 15 minutes
Theory	50%
80 marks	
Short-answer and structured questions	
Questions will be based on the Extended subject content (Core and Supplement)	
Assessing grades A*–G	
Externally assessed	
or:	
Paper 6	1 hour
Alternative to Practical	20%
40 marks	
Questions will be based on the experimental skills in Section 4	
Assessing grades A*–G	
Externally assessed	

Teachers are reminded that the latest syllabus is available on our public website at **www.cie.org.uk** and Teacher Support at **https://teachers.cie.org.uk**

Paper 3 – Theory (Core)

Question 1

Example Candidate Response – middle	Examiner comments

1 Fig. 1.1 shows part of the speed-time graphs for a cyclist and for a runner.

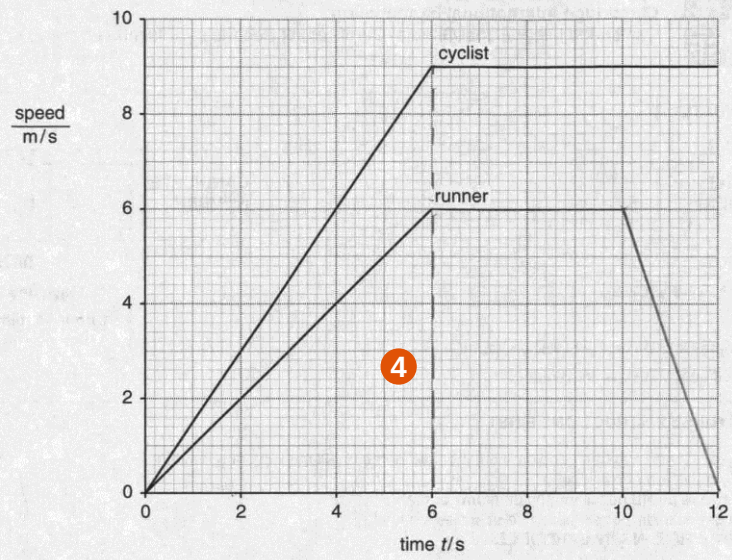


Fig. 1.1

(a) Compare the motion of the cyclist and the runner during the first 6 seconds. Explain your answer.

The cyclist picks up speed leaving the runner at 6m/s while the cyclist is 9m/s & with a gap of 3m/s. 1 [3]

(b) Describe the motion of the cyclist between time $t = 6.0$ s and time $t = 12.0$ s.

Its constant 2 [1]

(c) Calculate the total distance travelled by the cyclist between $t = 0$ and $t = 12.0$ s.

D = S × T

½ × 6 × 9 = 29

6 × 9 = 54

83

distance travelled = 83 3 m [4]

(d) After the first 6.0 seconds, the runner moves at constant speed for 4.0 seconds. He then slows down uniformly and stops in a further 2.0 seconds.

On Fig. 1.1, complete the graph for the runner's motion. [2]

[Total: 10]

1 This response indicates that the cyclist is gaining speed but does not give details of the motion of the runner. A mark is scored for identifying correctly the faster speed of the cyclist.

Mark awarded for (a) = 1 out of 3

2 Constant speed is the required answer.

Mark awarded for (b) = 1 out of 1

3 The graph gives an indication of the areas of a triangle and a rectangle. The candidate has calculated the area of the triangle incorrectly. The final mark is a quality mark awarded to candidates who obtain the value of 81m having completed correctly all parts of the calculation.

Mark awarded for (c) = 2 out of 4

4 The graph completed correctly.

Mark awarded for (d) = 2 out of 2

Total mark awarded = 6 out of 10

How the candidate could have improved the answer

(a) To achieve full marks candidate should have given details of the motion of the runner.

(c) The candidate should have calculated the area of the triangle correctly and reached the final value of 81m to gain full marks.

Example Candidate Response – low

1 Fig. 1.1 shows part of the speed-time graphs for a cyclist and for a runner.

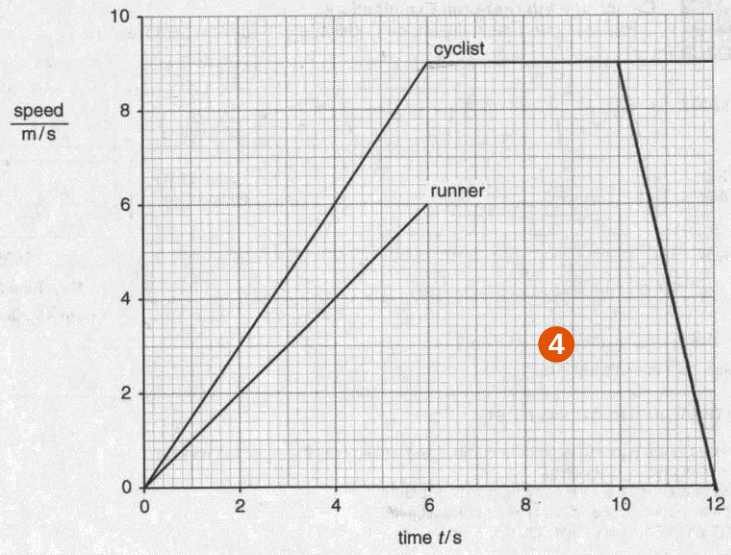


Fig. 1.1

(a) Compare the motion of the cyclist and the runner during the first 6 seconds. Explain your answer.

During the first 6 second the cyclist was having more speed than the runner and that is because a cyclist is machine and the runner is human so there is a huge difference between them. [3]

1

(b) Describe the motion of the cyclist between time $t = 6.0$ s and time $t = 12.0$ s.

9 m/s and it moves in constant speed. [1]

2

(c) Calculate the total distance travelled by the cyclist between $t = 0$ and $t = 12.0$ s.

Total distance = Total speed x Total time.

= 9 x 12 = 108m

=

distance travelled = 108 m [4]

3

(d) After the first 6.0 seconds, the runner moves at constant speed for 4.0 seconds. He then slows down uniformly and stops in a further 2.0 seconds.

On Fig. 1.1, complete the graph for the runner's motion. (decelerates) [2]

[Total: 10]

Examiner comments

1 Although the cyclist is moving faster there is no indication that the initial motion is acceleration. The higher acceleration of the cyclist has not been linked with the steeper gradient shown on the graph.

Mark awarded for (a) = 1 out of 3

2 The value of the cyclist's speed is not required. The candidate obtains the mark for "constant speed".

Mark awarded for (b) = 1 out of 1

3 The candidate has not taken into account the acceleration takes place during the first six seconds of the journey.

Mark awarded for (c) = 1 out of 4

4 The question is about the runner but the response given uses the cyclist's graph. As an error has been carried forward the second mark has been awarded for the correct interpretation of the deceleration.

Mark awarded for (d) = 1 out of 2

Total mark awarded = 4 out of 10

How the candidate could have improved the answer

(a) The candidate has given no indication that the initial motion is acceleration. The higher acceleration of the cyclist should have been linked with the steeper gradient shown on the graph.

(c) The use of distance = speed x time does not take into account the acceleration taking place during the first six seconds of the journey. Subtracting 27m would have given a correct response.

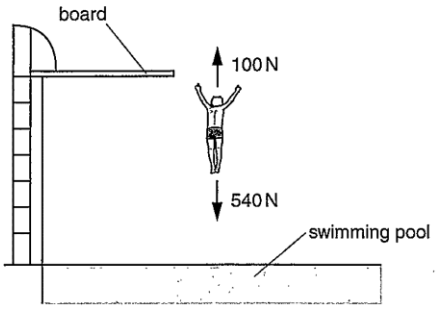
(d) The question is about the runner. To gain full credit the candidate needs to complete the runner's motion rather than the cyclist's.

Common mistakes candidates made in this question

(b) A common misconception was that the cyclist had stopped moving.

(c) A common incorrect value was 108m. Candidates used the equation distance = speed x time, multiplying the maximum speed by the total time. They did not account for the initial acceleration.

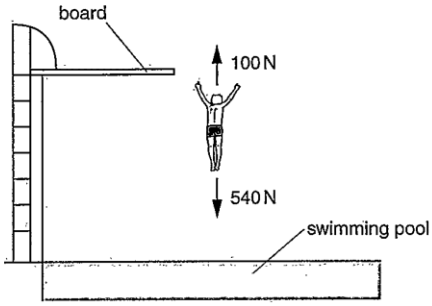
Question 2

Example Candidate Response – middle	Examiner comments
2 A boy steps off a high board into a swimming pool. Fig. 2.1 shows the forces acting on the boy at one point in his fall.  **Fig. 2.1** **(a)** The 540 N force is caused by gravitational attraction. State the cause of the 100 N force. air resistance 1 .....[1] **(b)** Calculate the mass of the boy. m = 540 ÷ 10 = 54 mass of boy = 54 2 kg [2] **(c)** Calculate the resultant force on the boy. State its direction. 100 ÷ 10 ~~540 ÷ 100 = 5.4~~ ~~100~~ resultant force = 5.4 10 3 N direction = Downwards [2] [Total: 5]	1 Correct response. Mark awarded for (a) = 1 out of 1 2 Although the equation is not stated, the calculation shows correct use of the equation and a correct value. Mark awarded for (b) = 2 out of 2 3 There is an appreciation that the resultant force acts downwards but the value of the force has been calculated incorrectly. Mark awarded for (c) = 1 out of 2 **Total mark awarded = 4 out of 5**

How the candidate could have improved the answer

(b) To improve the answer, the candidate should have stated the equation.

(c) The candidate should have stated the correct value for resultant force which was (540-100) = 440(N).

Example Candidate Response – low	Examiner comments
2 A boy steps off a high board into a swimming pool. Fig. 2.1 shows the forces acting on the boy at one point in his fall.  **Fig. 2.1** **(a)** The 540 N force is caused by gravitational attraction. State the cause of the 100 N force. Energy force 1 ..... [1] **(b)** Calculate the mass of the boy. 540 − 100 440 10 mass of boy = 44 2 ..... kg [2] **(c)** Calculate the resultant force on the boy. State its direction. resultant force = 640 ..... N direction = Down 3 ..... [2] [Total: 5]	1 The candidate is not aware that a frictional force, air resistance or drag, acts against the boy. Mark awarded for (a) = 0 out of 1 2 The candidate is aware that there is a link between mass and weight. However, this response suggests that the boy has a lower mass as he falls. Mark awarded for (b) = 0 out of 2 3 The value of the resultant force is incorrectly calculated. It is not appreciated that the forces act in opposite directions. The direction, in which the resultant force acts, is correct. Mark awarded for (c) = 1 out of 2 **Total mark awarded = 1 out of 5**

How the candidate could have improved the answer

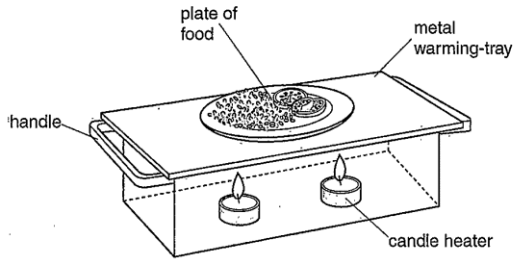
(a) The candidate should have indicated that a frictional force, air resistance or drag, acts against the boy.

(b) This response suggests that the boy has a lower mass as he falls. The correct response for resultant force was (540-100) = 440(N)

Common mistakes candidates made in this question

A variety of responses in the range of 44 to 640 was seen. Candidates used the numbers provided in a variety of ways to obtain incorrect values.

Question 3

Example Candidate Response – middle	Examiner comments
3 Fig. 3.1 shows a metal plate-warmer.  **Fig. 3.1** The plate-warmer contains two small candle heaters. Plates of food are placed on top of the warming-tray. **(a) (i)** State the name of a process by which the thermal energy from the candles passes to the warming-tray. radiation 1 .....[1] **(ii)** State the name of the process by which thermal energy moves through the warming-tray. Convection 2 .....[1] **(b)** The outside of the plate-warmer is shiny. Suggest how this helps the plate-warmer to stay hot. ~~It conducts heat and prevents heat from~~ being lost [1] 3 **(c)** The handles of the plate-warmer are made from metal. Identify a problem with this, and suggest how the problem could be solved. problem: ~~metal conducts heat hence the handles will be too hot~~ too hot to touch. action: make the handles out of something that does not conduct alot of heat. 4 [2] [Total: 5]	1 Correct response. 2 The response suggests confusion between convection and conduction. Mark awarded for (a) = 1 out of 2 3 This is a vague response that is just repeating the question. Mark awarded for (b) = 0 out of 1 4 Correct response Mark awarded for (c) = 2 out of 2 **Total mark awarded = 3 out of 5**

How the candidate could have improved the answer

(a) (ii) The candidate should have stated the correct answer which was ‘conduction’.

(b) The candidate should have answered in terms of shiny surfaces being poor emitters of thermal radiation.

Example Candidate Response – low	Examiner comments

3 Fig. 3.1 shows a metal plate-warmer.

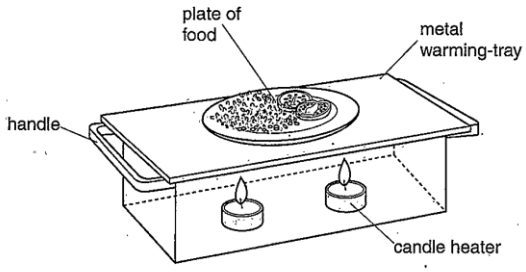


Fig. 3.1

The plate-warmer contains two small candle heaters. Plates of food are placed on top of the warming-tray.

(a) (i) State the name of a process by which the thermal energy from the candles passes to the warming-tray.

thermal energy 1 [1]

(ii) State the name of the process by which thermal energy moves through the warming-tray.

it moves the smoke up to the tray 2 [1]

(b) The outside of the plate-warmer is shiny.

Suggest how this helps the plate-warmer to stay hot.

get reflection 3 [1]

(c) The handles of the plate-warmer are made from metal.

Identify a problem with this, and suggest how the problem could be solved.

problem: The handle could be heated and difficult to touch. 4

action: using a product that is against heat or use gloves [2]

[Total: 5]

1 The response just repeats part of the question.

2 The process is not named.

Mark awarded for (a) = 0 out of 2

3 "Reflection" is too vague to be credited worthy.

Mark awarded for (b) = 0 out of 1

4 The problem (hot handles) and a suitable action (gloves) are identified.

Mark awarded for (c) = 2 out of 2

Total mark awarded = 2 out of 5

How the candidate could have improved the answer

(a) (i) The response repeated part of the question. The name of the process by which thermal energy is transferred was required.

(a) (ii) The name of the correct thermal process was required.

(b) To gain credit the candidate must have indicated that it was reflection of thermal radiation. 'Reflection' on its own is too vague.

Common mistakes candidates made in this question

(a) Few candidates confused the terms conduction, convection and radiation.

(b) There were many responses given in terms of light rather than thermal energy being reflected.

Question 4

Example Candidate Response – middle	Examiner comments

4 Fig. 4.1 is a simplified diagram of a geothermal power station.

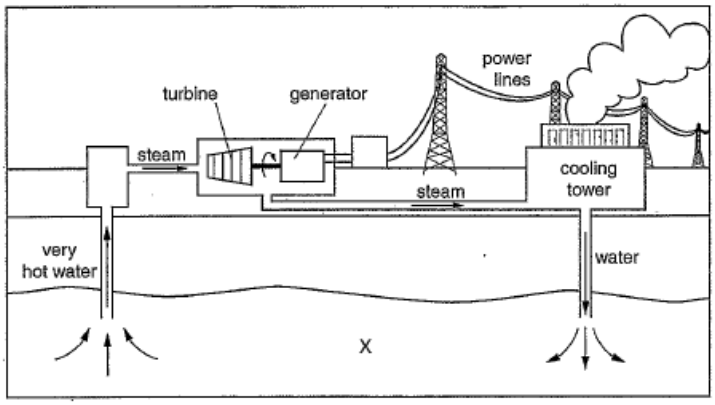


Fig. 4.1

(a) Describe the energy resource labelled X in Fig. 4.1.

Renewable [1]

1 The response does not answer the question. The correct answer is 'hot rocks'.

Mark awarded for (a) = 0 out of 1

(b) Identify the useful energy transformation that takes place in the geothermal power station. Tick **one** box in each column.

input energy		output energy	
chemical	☐	chemical	☐
electrical	☐	electrical	☑
gravitational	☐	gravitational	☐
sound	☐	sound	☐
thermal	☑	thermal	☐

[2]

2 Correct response.

Mark awarded for (b) = 2 out of 2

(c) State **two** disadvantages of obtaining energy from fossil fuels.

1. It is ~~bbbx~~ pollutant.

2. It is non-renewable.

[2]

3 The first point is too vague. The second point scores a mark for non-renewable energy source.

Mark awarded for (c) = 1 out of 2

[Total: 5]

Total mark awarded = 3 out of 5

How the candidate could have improved the answer

(a) The candidate needed to identify what caused the water to become very hot.

(c) To obtain full marks the candidate must have identified atmospheric pollution or the pollution of air.

Example Candidate Response – low	Examiner comments

4 Fig. 4.1 is a simplified diagram of a geothermal power station.

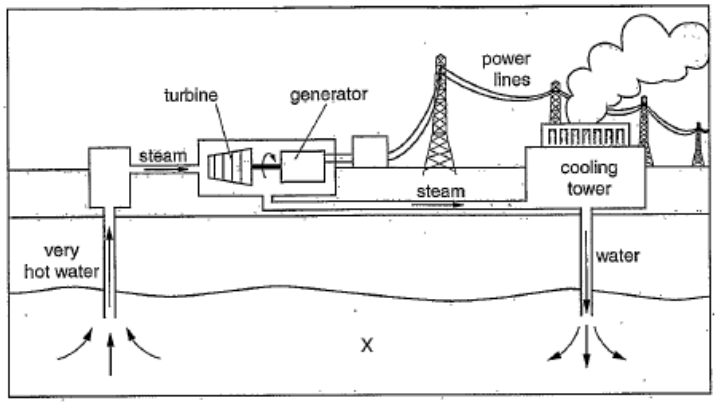


Fig. 4.1

(a) Describe the energy resource labelled X in Fig. 4.1. 1

hydro electric energy [1]

(b) Identify the useful energy transformation that takes place in the geothermal power station. Tick **one** box in each column.

	input energy	output energy
chemical		✓
electrical		
gravitational		
sound		
thermal	✓	

3 2

[2]

(c) State **two** disadvantages of obtaining energy from fossil fuels.

1. air Pollution from the power station

2. Noisy from the Power Station 4

[2]

[Total: 5]

1 The candidate does not appreciate that water becomes hot as a result of passing through hot rocks.

Mark awarded for (a) = 0 out of 1

2 Only one of the boxes has been ticked correctly. The output energy is electrical.

3 Input energy has been identified correctly. The output energy is electrical.

Mark awarded for (b) = 1 out of 2

4 Noisy is a general term and does not score a mark.

Mark awarded for (c) = 1 out of 2

Total mark awarded = 2 out of 5

How the candidate could have improved the answer

(a) The candidate needed to identify what causes the water to become very hot.

(b) The candidate should have ticked electrical for output energy.

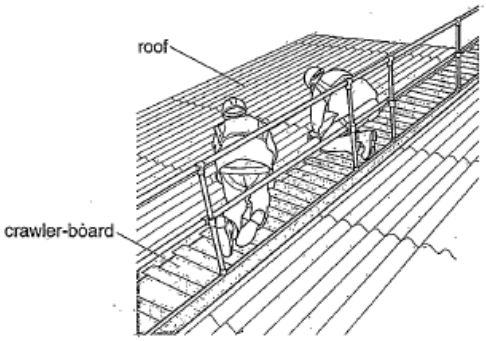
(c) Noisy is a general term and did not gain credit. There is a range of specific disadvantages e.g. global warming or non-renewable that could have been used to gain credit.

Common mistakes candidates made in this question

(a) A variety of wrong responses was seen linked to renewable sources of energy, e.g. wave, tidal and hydroelectric.

(b) A small number of candidates had reversed the input and output energies.

Question 5

Example Candidate Response – middle	Examiner comments
5 Fig. 5.1 shows two men repairing a weak roof using a crawler-board.  Fig. 5.1 (a) Explain why use of the crawler-board prevents the men from falling through the roof. They have support by It has a large surface area which will prevent from the roof to collapse when pressure is added. [2] (b) The crawler-board has a weight of 400 N. The total weight of the two men is 1600 N. The area of the crawler-board in contact with the roof is 0.8 m². Calculate the pressure on the roof when the men are on the crawler-board. Include the unit. 1600 − 400 = 1200 1200 ÷ 0.8 pressure = 960 N/m² [5] [Total: 7]	1 Large surface area is identified but no indication of how this affects the pressure exerted by the workers. Mark awarded for (a) = 1 out of 2 2 The calculation of the total force is incorrect. P=F/A is not stated. An error carried forward is allowed for candidate's force divided by the area. The value obtained for the pressure is incorrect, but credit is given for the nit that is stated correctly. Mark awarded for (b) = 2 out of 5 **Total mark awarded = 3 out of 7**

How the candidate could have improved the answer

(a) The candidate should have indicated how large surface are affects the pressure exerted by the workers.

(b) The candidate should have calculated the total force correctly by adding the forces. Pressure = force/area should have been stated.

Example Candidate Response – low	Examiner comments

5 Fig. 5.1 shows two men repairing a weak roof using a crawler-board.

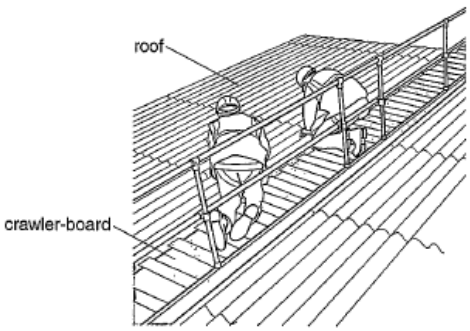


Fig. 5.1

(a) Explain why use of the crawler-board prevents the men from falling through the roof.

To reduce friction because that helps him to balance while walking and not slippery. and also to be able to walk properly. 1 [2]

(b) The crawler-board has a weight of 400 N. The total weight of the two men is 1600 N. The area of the crawler-board in contact with the roof is 0.8 m².

Calculate the pressure on the roof when the men are on the crawler-board. Include the unit.

$\frac{400}{1600} \times 0.64$

pressure = 0.16 2 [5]

[Total: 7]

1 The response here indicates a misconception that the crawler board is for safety and to prevent the workers from slipping.

Mark awarded for (a) = 0 out of 2

2 There is no indication that the candidate is aware of the need to use the equation P=F/A. The numbers appear to have been randomly applied to an equation.

Mark awarded for (b) = 0 out of 5

Total mark awarded = 0 out of 7

How the candidate could have improved the answer

(a) The candidate should have explained that the crawler has a large surface and prevents the roof from collapsing by spreading the men's weight.

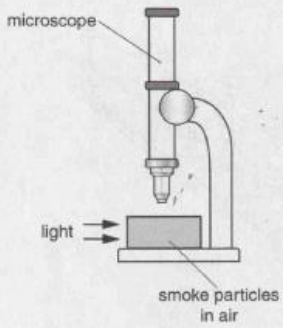
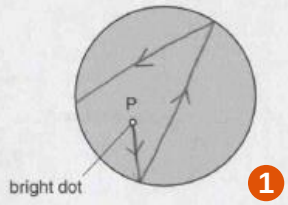
(b) The candidate should have used the correct formula P=F/A . The numbers appear to have been randomly applied to an equation.

Common mistakes candidates made in this question

(a) A common misconception was answers that suggested the crawler board is for safety and to prevent the workers from slipping.

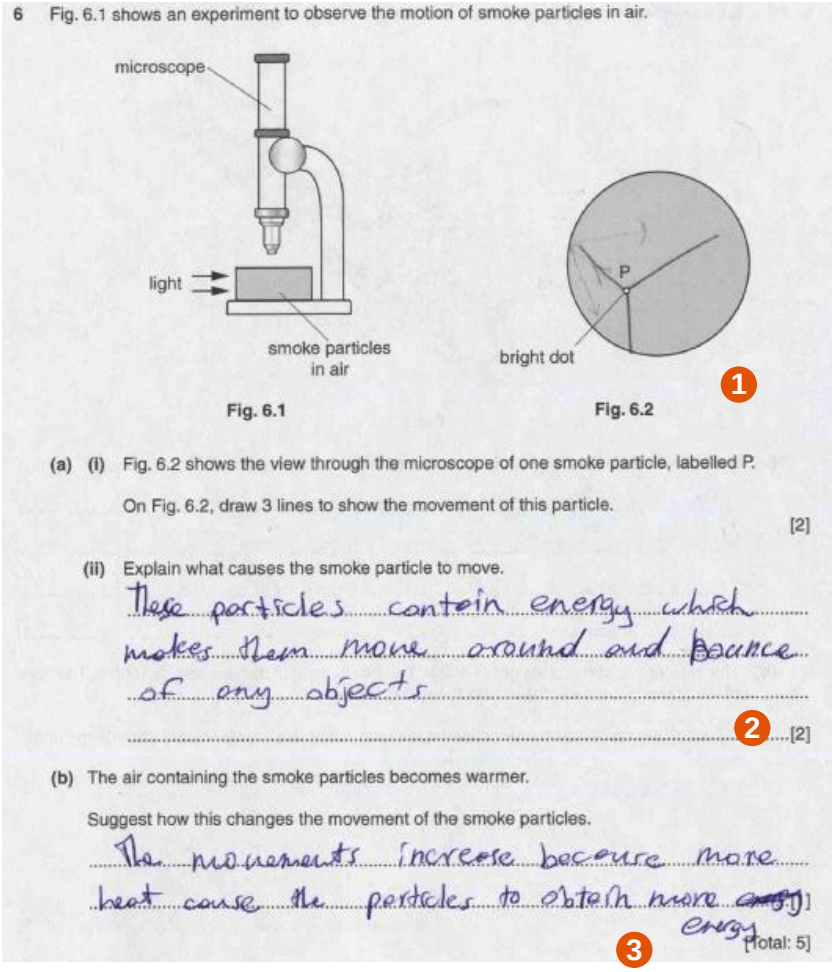
(b) Stating the equation incorrectly: pressure = force x area.

Question 6

Example Candidate Response – middle	Examiner comments
6 Fig. 6.1 shows an experiment to observe the motion of smoke particles in air.  Fig. 6.1  Fig. 6.2 (a) (i) Fig. 6.2 shows the view through the microscope of one smoke particle, labelled P. On Fig. 6.2, draw 3 lines to show the movement of this particle. [2] (ii) Explain what causes the smoke particle to move. gas particles move about freely in whatever container they are in. The more space a particle has, the more energy it has so the more it moves. [2] (b) The air containing the smoke particles becomes warmer. Suggest how this changes the movement of the smoke particles. They move more because they have more energy. move faster [1] [Total: 5]	1 Correct response. Mark awarded for (a) = 2 out of 2 2 The response is not answering the question. Mark awarded for (b) = 0 out of 2 3 Correct response. Mark awarded for (b) = 1 out of 1 **Total mark awarded = 3 out of 5**

How the candidate could have improved the answer

(a) (ii) The candidate must have referred to collisions of smoke particles with air molecules.

Example Candidate Response – low	Examiner comments
	1 There is no appreciation of particles moving in straight lines until deflected by collisions. Mark awarded for (a) = 0 out of 2 2 The idea of collisions between objects gains partial credit. Mark awarded for (b) = 1 out of 2 3 Increased movement is too vague and does not indicate an increase in speed or an increase in collisions. Mark awarded for (c) = 0 out of 1 **Total mark awarded = 1 out of 5**

How the candidate could have improved the answer

(a) (i) The candidate must have clearly indicated the movement of one particle.

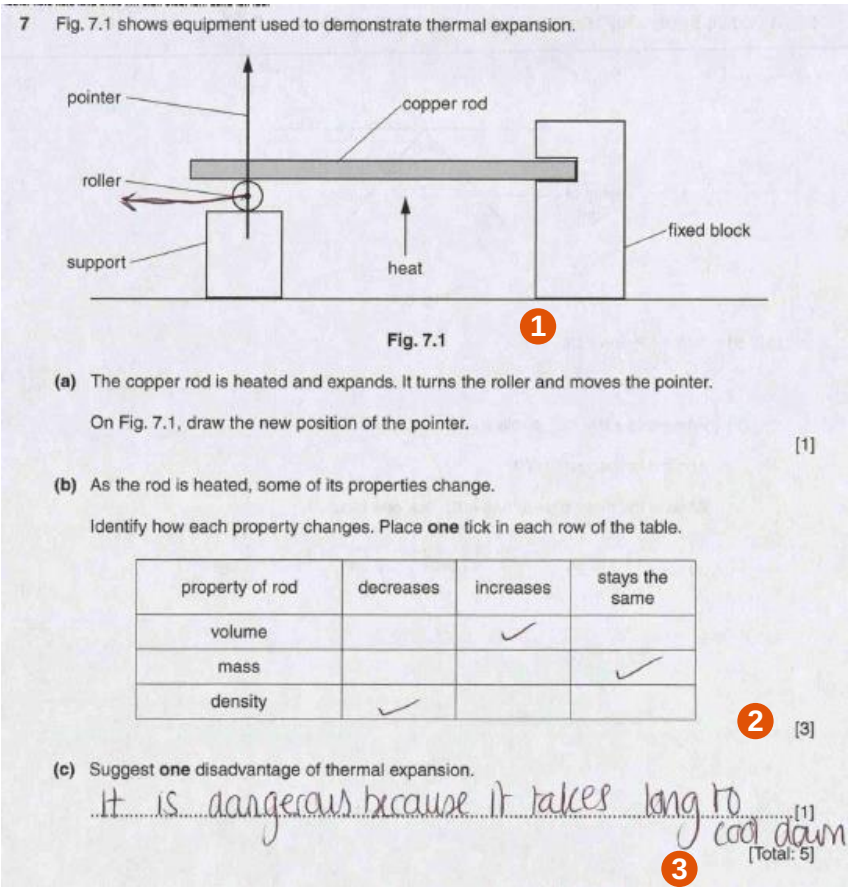
(a) (ii) For full credit the candidate must have stated that the collisions occurred between smoke particles and air molecules.

(b) The candidate should have indicated that smoke particles would change directions or there would be an increase in collisions.

Common mistakes candidates made in this question

(a) Candidates did not give a response in terms of the movement of a single particle.

Question 7

Example Candidate Response – middle	Examiner comments
	1 Candidate correctly identifies that, as the rod expands, the pointer rotates in an anti-clockwise direction. Mark awarded for (a) = 1 out of 1 2 A correct response. The candidate recognises that a volume increases and mass remains constant density decreases. Mark awarded for (b) = 3 out of 3 3 A vague response that did not address the question asked. Mark awarded for (c) = 0 out of 1 **Total mark awarded = 4 out of 5**

How the candidate could have improved the answer

(c) The candidate should have indicated that electrical cables would be lower to the ground.

Example Candidate Response – low	Examiner comments

7 Fig. 7.1 shows equipment used to demonstrate thermal expansion.

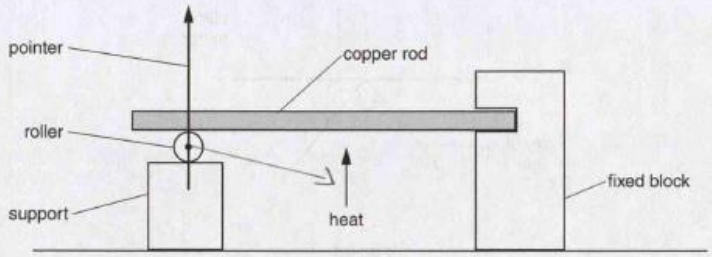


Fig. 7.1

1

(a) The copper rod is heated and expands. It turns the roller and moves the pointer.

On Fig. 7.1, draw the new position of the pointer.

[1]

(b) As the rod is heated, some of its properties change.

Identify how each property changes. Place **one** tick in each row of the table.

property of rod	decreases	increases	stays the same
volume		✓	
mass			✓
density			✓

2

[3]

(c) Suggest **one** disadvantage of thermal expansion.

Because of thermal expansion metals can melt and ~~these~~ come out of the place that they're fixed into. e.g A fixed block.

3

[1]

[Total: 5]

1 The candidate realises that the pointer moves but indicates the wrong direction.

Mark awarded for (a) = 0 out of 1

2 The candidate correctly identifies that volume increases and mass stays the same. There is a misconception that density is also constant as the rod is heated.

Mark awarded for (b) = 2 out of 3

3 An incorrect response that did not address the question.

Mark awarded for (c) = 0 out of 1

Total mark awarded = 2 out of 5

How the candidate could have improved the answer

(a) The candidate should have indicated the correct direction which was 'to the left' or 'anticlockwise'.

(b) The candidate needed to follow through the correct responses to identify that density would decrease.

(c) An example of a disadvantage of thermal expansion was required, e.g. buckling of railway lines.

Common mistakes candidates made in this question

(b) There were a range of misconceptions about mass, volume and density changing when a material is heated.

(c) There were many vague responses in terms of buildings, bridges and railways that were not given credit.

Question 8

Example Candidate Response – middle

8 A student directs a ray of light towards a plane mirror, as shown in Fig. 8.1.

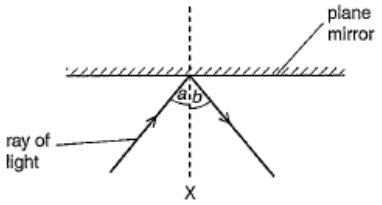


Fig. 8.1

(a) (i) Name the line labelled X. 1

Line of incidence reflection symmetry [1]

(ii) When angle *a* is 45°, angle *b* is also 45°.

Angle *a* is changed to 20°.

What is the new value of angle *b*? Tick **one** box. 2

20° ☑ 25° ☐ 45° ☐ 65° ☐ 80° ☐ [1]

(b) The student now makes the ray of light from Fig. 8.1 pass into a glass block, as shown in Fig. 8.2.

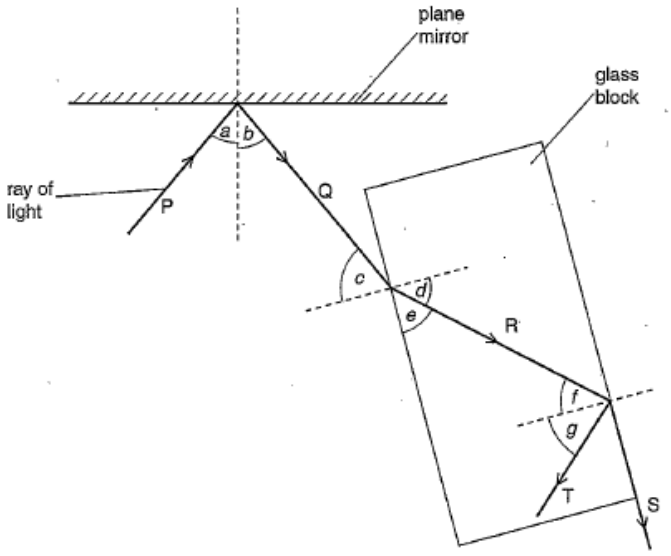


Fig. 8.2

Complete the table, using the labels from Fig. 8.2. The first label is done for you.

description	label
an angle of incidence	a
an angle of refraction	d
an internally reflected angle	g
a critical angle	f
a refracted ray	R

3

[4]

Examiner comments

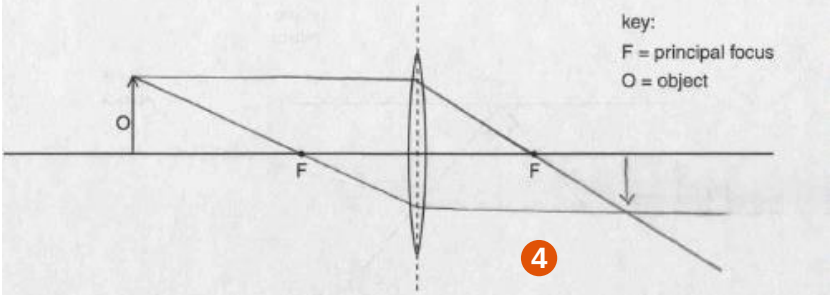
1 An incorrect response that did not use Physics terminology.

2 The correct box is ticked.

Mark awarded for (a) = 1 out of 2

3 Here the candidate correctly identifies all items. Note that the final label could have been R or S.

Mark awarded for (b) = 4 out of 4

Example Candidate Response – middle, continued	Examiner comments
(c) The student uses a converging lens to produce an image of an object. Fig. 8.3 shows the arrangement.  Fig. 8.3 On Fig. 8.3, using a ruler, carefully draw two rays from the object O to locate the position of the image. Use an arrow to represent the image. [3] [Total: 9]	4 A good ray diagram is drawn by the candidate to gain two marks. The image inverted but does not meet the intersection of two rays. The third mark is not awarded. Mark awarded for (c) = 2 out of 3 **Total mark awarded = 7 out of 9**

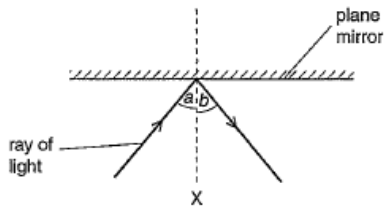
How the candidate could have improved the answer

(a) (i) Candidate was required to use the correct terminology; the correct response was ‘normal’.

(c) The candidate should have shown that the image is inverted but does not meet the intersection of the two rays.

Example Candidate Response – low

8 A student directs a ray of light towards a plane mirror, as shown in Fig. 8.1.



1

Fig. 8.1

(a) (i) Name the line labelled X.

Angle of reflection. [1]

(ii) When angle *a* is 45°, angle *b* is also 45°.

Angle *a* is changed to 20°.

What is the new value of angle *b*? Tick **one** box.

2

20° ✓ 25° ☐ 45° ☐ 65° ☐ 80° ☐

[1]

(b) The student now makes the ray of light from Fig. 8.1 pass into a glass block, as shown in Fig. 8.2.

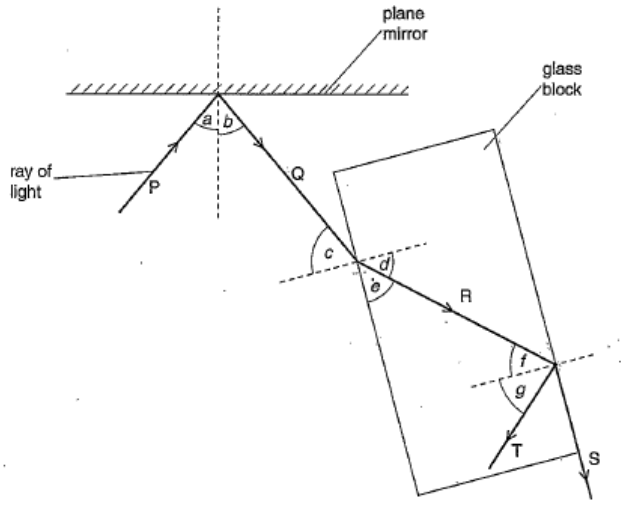


Fig. 8.2

Complete the table, using the labels from Fig. 8.2. The first label is done for you.

description	label
an angle of incidence	*a*
an angle of refraction	c
an internally reflected angle	e
a critical angle	~~X~~ f.
a refracted ray	g

3

[4]

Examiner comments

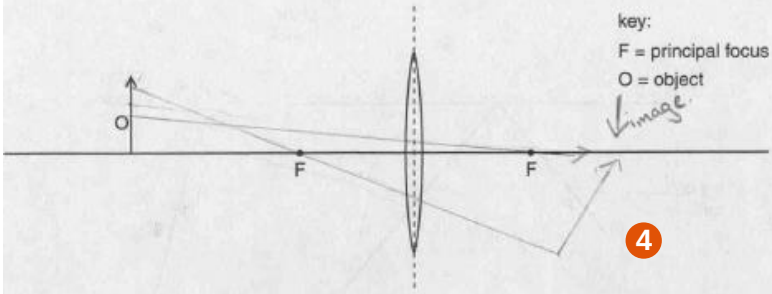
1 The candidate correctly identifies one of the angles shown but gives an incorrect response for the name of the line at right angles to the mirror

2 The correct box is ticked.

Mark awarded for (a) = 2 out of 2

3 In this question the candidate is required to identify various labels from a ray diagram. Only one is correct; the critical angle f.

Mark awarded for (b) = 1 out of 4

Example Candidate Response – low, continued	Examiner comments
(c) The student uses a converging lens to produce an image of an object. Fig. 8.3 shows the arrangement.  Fig. 8.3 On Fig. 8.3, using a ruler, carefully draw two rays from the object O to locate the position of the image. Use an arrow to represent the image. [3] [Total: 9]	4 The candidate is aware that rays need to pass through F but is unable to complete the ray diagram to obtain an inverted image. Mark awarded for (c) = 0 out of 3 **Total mark awarded = 2 out of 9**

How the candidate could have improved the answer

(a) (i) The correct response was normal.

(b) Only one of the labels was correct: critical angle – f. The candidate needed to have a clear understanding of the use of terms reflection and refraction to complete the table correctly.

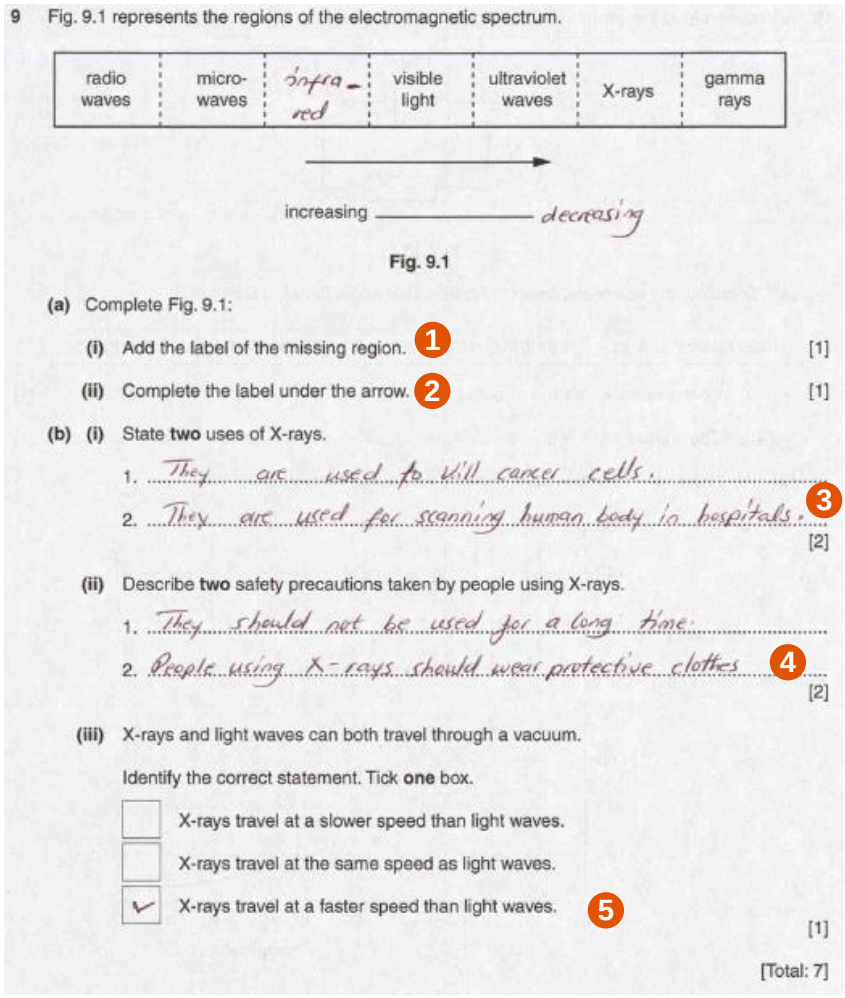
(c) The candidate should have constructed the ray diagram correctly to obtain an inverted image.

Common mistakes candidates made in this question

(b) Less well prepared candidates gave a variety of labels when completing the table.

(c) A common misconception was the lack of refraction of a ray passing through the lens.

Question 9

Example Candidate Response – middle	Examiner comments
	1 Correct response. 2 An incorrect response that did not address the question asked. Mark awarded for (a) = 1 out of 2 3 Candidate gives two correct responses. 4 A correct response in terms of restricting exposure is given along with a vague response about protective clothing that is not given any credit. 5 The candidate has ticked the wrong box indicating that X-ray travels faster than light waves. Mark awarded for (b) = 3 out of 5 **Total mark awarded = 4 out of 7**

How the candidate could have improved the answer

(a) (ii) The candidate should have recognised that the electromagnetic spectrum showed increasing frequency (decreasing wavelength) from left to right.

(b) (ii) A correct response in terms of restricting the user's exposure to X-rays gains credit. A vague second response about protective clothing did not gain any further credit. The candidate should have mentioned wearing 'lead apron' or 'standing behind a screen' to gain full marks.

(b) (iii) The candidate should have indicated that X-rays travel at the same speed as light waves.
.

Example Candidate Response – low	Examiner comments

9 Fig. 9.1 represents the regions of the electromagnetic spectrum.

radio waves	micro-waves	light waves	visible light	ultraviolet waves	X-rays	gamma rays

increasing Speed

Fig. 9.1

(a) Complete Fig. 9.1:

(i) Add the label of the missing region. [1]

(ii) Complete the label under the arrow. [1]

(b) (i) State **two** uses of X-rays.

1. To check your skeleton. (~~Medicine~~ Hospital use.)

2. ..... [2]

(ii) Describe **two** safety precautions taken by people using X-rays.

1. Safety goggles

2. gloves [2]

(iii) X-rays and light waves can both travel through a vacuum.

Identify the correct statement. Tick **one** box.

- ☐ X-rays travel at a slower speed than light waves.
- ☑ X-rays travel at the same speed as light waves.
- ☐ X-rays travel at a faster speed than light waves.

[1]

[Total: 7]

1 An incorrect response repeating information already included in the electromagnetic spectrum.

2 The candidate has not appreciated that all elements of the electromagnetic spectrum travel at the same speed.

Mark awarded for (a) = 0 out of 2

3 Hospital use is too vague but the candidate has indicated a particular area that can be given benefit of doubt.

4 Vague responses such as goggles and gloves do not gain marks.

5 A correct response identifying x-ray travel at the same speed as light waves.

Mark awarded for (b) = 2 out of 5

Total mark awarded = 2 out of 7

How the candidate could have improved the answer

(a) (i) The candidate should have indicated the correct response which was ‘infra-red’.

(a) (ii) The candidate should have appreciated that all elements of the electromagnetic spectrum travel at the same speed and gives an incorrect response.

(b) (i) Only one use was given. Hospital use was too vague to gain full marks, the candidate should have clearly stated where or for what purpose in hospitals.

(b) (ii) Vague responses such as goggles and gloves do not gain any credit. Screening from X-rays and limiting exposure would have gained full credit.

Common mistakes candidates made in this question

(a) (i) Incorrect responses included sound and ultra-sound.

(a) (ii) Wavelength and speed were common misconceptions.

(b) (i) Some very vague responses were seen, e.g. “use in pipes”.

(b) (ii) Goggles and gloves were common responses that did not gain any credit.

(b) (iii) There was a lack of appreciation that X-rays travelled at the same speed as light waves and consequently the top and bottom statements received equal numbers of incorrect responses.

Question 10

Example Candidate Response – middle

10 A student makes the circuit shown in Fig. 10.1 using a 12V battery.

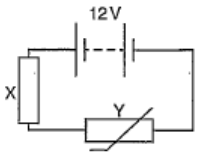


Fig. 10.1

(a) Complete the sentences about the circuit. Use words from the box.

fixed resistor	lamp	light-dependent resistor	parallel	series	thermistor

(i) Components X and Y are connected in ...Series... [1]

(ii) The component Y is a ...fixed resistor... [1]

(b) Fig. 10.2 shows how the resistance of Y varies with temperature.

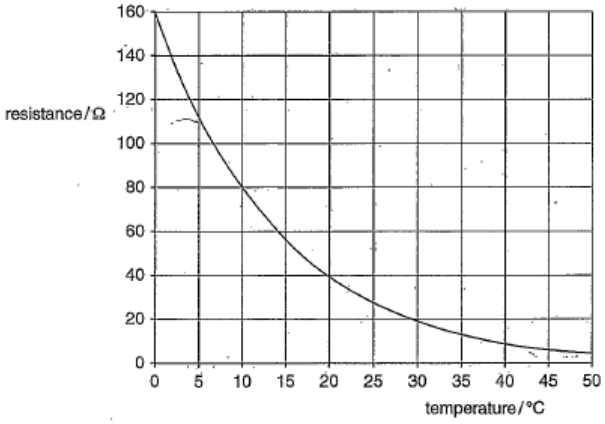


Fig. 10.2

(i) Describe how the resistance of Y varies with temperature.

The lesser the temperature the ... the higher the resistance ... [2]

(ii) The temperature of Y is 10°C. The resistance of X is 20Ω.

Calculate the combined resistance of Y and X.

80+20=16

resistance = ...100... Ω [3]

(iii) Calculate the current in the circuit.

$I = \frac{V}{R}$

120/10

160+140+120+100+80+60+40+20

current = ...0·02... A [3]

10

[Total: 10]

I = 12

160+140+120+100+80+60+40+20 = 12/220

Examiner comments

1 Correct response.

2 The candidate identifies X rather than Y.

Mark awarded for (a) = 1 out of 2

3 A partially correct response is given that gains 1 mark.

4 A correct response. The candidate used the graph to determine the value of the resistance of Y and then added the value of X to obtain the correct value for the total resistance.

5 The candidate states correctly the V=IR equation to gain 1 mark. A further calculation is then undertaken to determine the value of R instead of using the R value form part (b) (ii).

Mark awarded for (b) = 5 out of 8

Total mark awarded = 6 out of 10

How the candidate could have improved the answer

(a) (ii) The candidate needed to identify Y (thermistor) rather than X.

(b) (i) A partially correct response was given. The candidate should have the curve to explain the rate of change.

(b) (iii) The candidate should have made use of the R value from part (b)(ii) rather than incorrectly calculating the value of R.

Example Candidate Response – low

10 A student makes the circuit shown in Fig. 10.1 using a 12V battery.

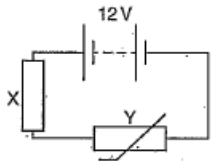


Fig. 10.1

(a) Complete the sentences about the circuit. Use words from the box.

fixed resistor	lamp	light-dependent resistor	parallel	series	thermistor

(i) Components X and Y are connected in parallel [1]

(ii) The component Y is a fixed resistor. [1]

(b) Fig. 10.2 shows how the resistance of Y varies with temperature.

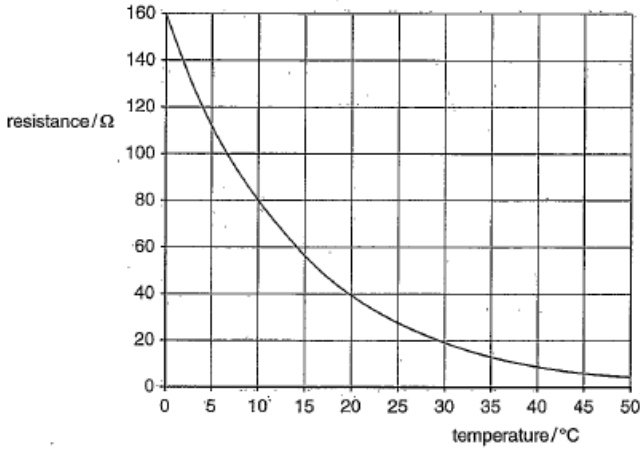


Fig. 10.2

(i) Describe how the resistance of Y varies with temperature.

As the resistance of y decreases the temperature of y increases.

[2]

(ii) The temperature of Y is 10 °C. The resistance of X is 20 Ω.

Calculate the combined resistance of Y and X.

r = y x x Ω

r = 80Ω x 20 Ω = 1600Ω

resistance = 1600 Ω [3]

(iii) Calculate the current in the circuit.

Current = $\frac{r}{V} = \frac{1600\Omega}{12V} = 133.3A$

current = 133.3 A [3]

[Total: 10]

Examiner comments

1 The candidate is unclear about series and parallel circuits.

2 The candidate identifies X rather than Y.

Mark awarded for (a) = 0 out of 2

3 A partially correct response is given that gains 1 mark.

4 The candidate correctly uses the graph to obtain a resistance value for Y of 80 Ω, obtaining 1 mark. The calculation is incorrect, the candidate multiplies the rather than adding them together.

5 The question requires the use of V=IR. The candidate uses an incorrect equation and therefore reaches an incorrect value.

Mark awarded for (b) = 2 out of 8

Total mark awarded = 2 out of 10

How the candidate could have improved the answer

(a) (i) The candidate did not understand the difference between a series and a parallel circuit.

(a) (ii) The candidate needed to identify Y (thermistor) rather than X.

(b) (i) The candidate should have linked the curve to explain the rate of change.

(b) (ii) To calculate the combined resistance, the candidate should have added two resistances to each other rather than multiply them together.

(b) (iii) The candidate should have used the correct formula: V= IR. The equation was incorrectly stated and an incorrect value was obtained.

Common mistakes candidates made in this question

(b) (ii) A common misconception was a value for the combined resistance of 30 ohm.

(b) (iii) There were the full range of incorrect variations of the V = IR equation.

Question 11

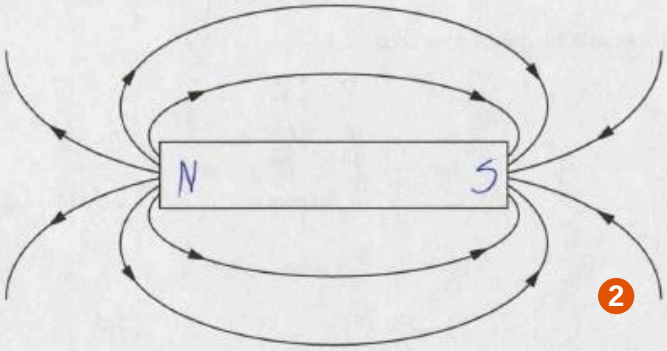
Example Candidate Response – middle	Examiner comments

11 (a) Put a ring around the names of the metals which are attracted to magnets.

aluminium copper iron mercury magnesium steel tin **1**

(b) Fig. 11.1 and Fig. 11.2 show magnetic field patterns for bar magnets.

On each diagram, correctly label the poles. Write **N** or **S**.



2

Fig. 11.1

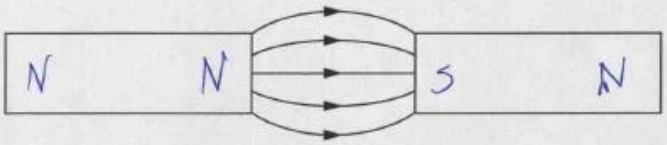
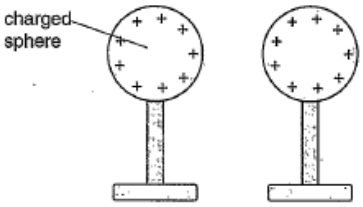
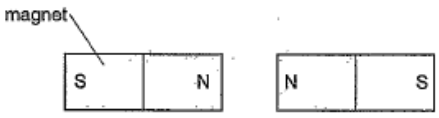


Fig. 11.2

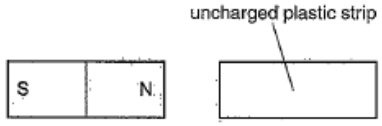
(c) For each diagram in Fig. 11.3, describe the force acting, if any. Use the words *attraction*, *repulsion*, or *no force*.



Repulsion No force **3**



Repulsion



No force

Fig. 11.3

[3]

1 Three metals ringed. Two are correct and one (copper) is incorrect.

Mark awarded for (a) = 1 out of 2

2 The candidate gives correct responses but on the bottom diagram includes a contradiction with the magnet being labelled with two north poles.

Mark awarded for (b) = 1 out of 2

3 Correct responses.

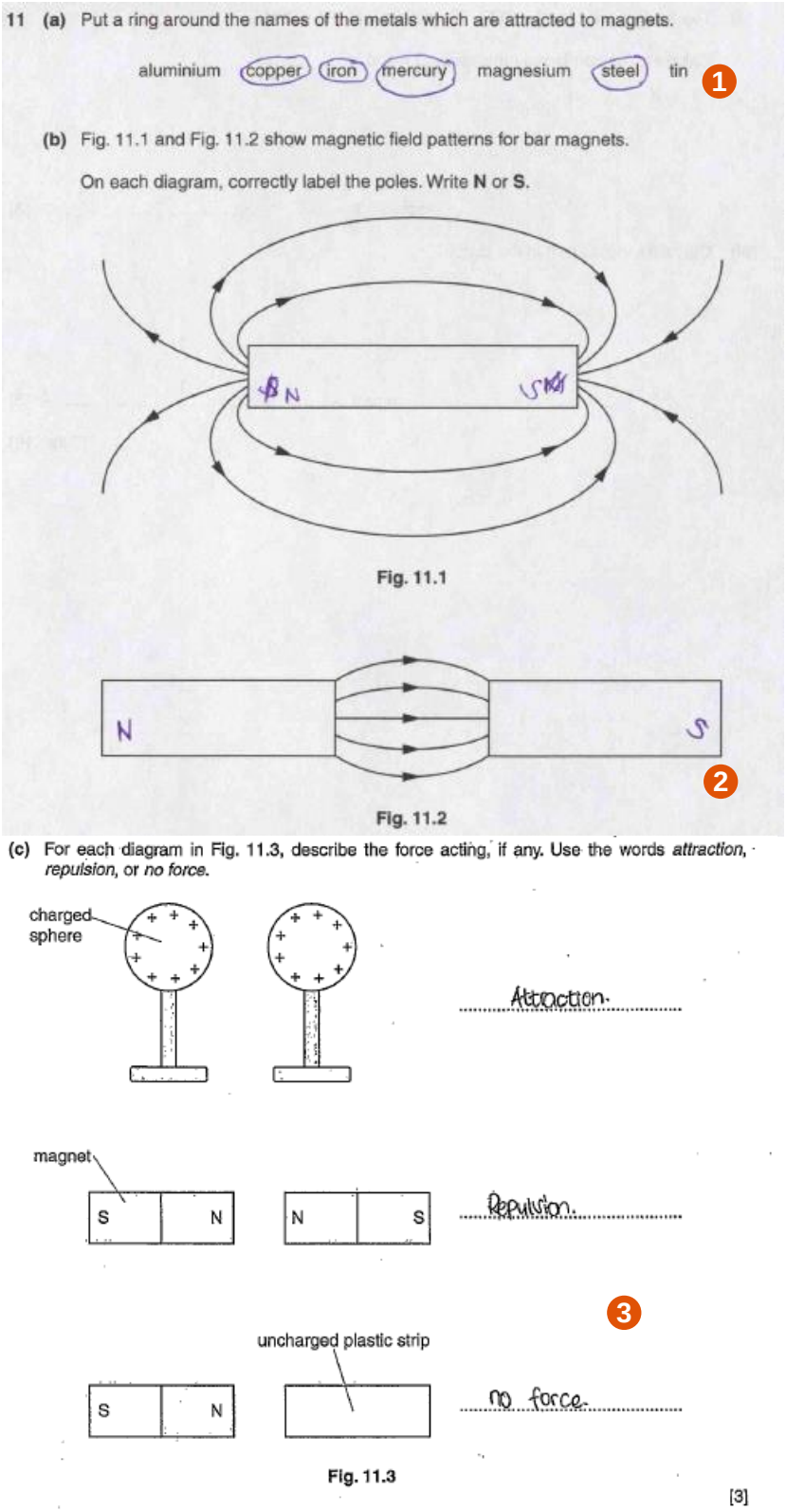
Mark awarded for (c) = 3 out of 3

Total mark awarded = 5 out of 7

How the candidate could have improved the answer

(a) The candidate should have ringed two correct answers and not three.

(b) The candidate should have labelled the magnet with one South and one North pole to gain full marks.

Example Candidate Response – low	Examiner comments
	1 Two marks available for two metals correctly identified. The candidate has ringed four metals two are correct and two are incorrect. No credit is given. Mark awarded for (a) = 0 out of 2 2 The candidate identifies the poles correctly in the top diagram 1 mark. However on the figures 11.2 the poles are incorrectly marked. Mark awarded for (b) = 1 out of 2 3 The first answer is incorrect. Mark awarded for (c) = 2 out of 3 **Total mark awarded = 3 out of 7**

How the candidate could have improved the answer

(a) The candidate should have ringed two correct answers and not four.

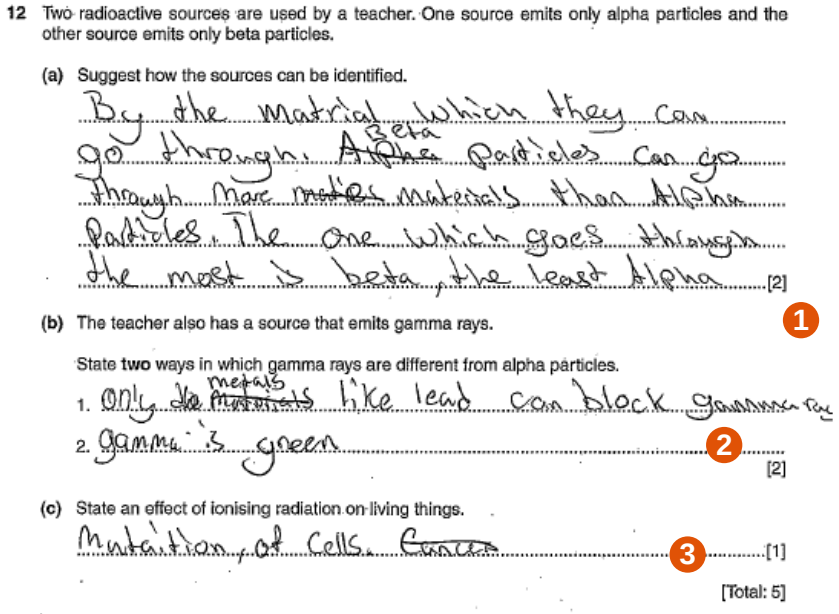
(b) The candidate should have identified the poles correctly in the bottom diagram to gain full credit.

(c) To gain full marks the candidate should have stated 'repulsion' for the first answer.

Common mistakes candidates made in this question

(a) Many candidates put a ring around more than two metals. Copper was a frequent incorrect response.

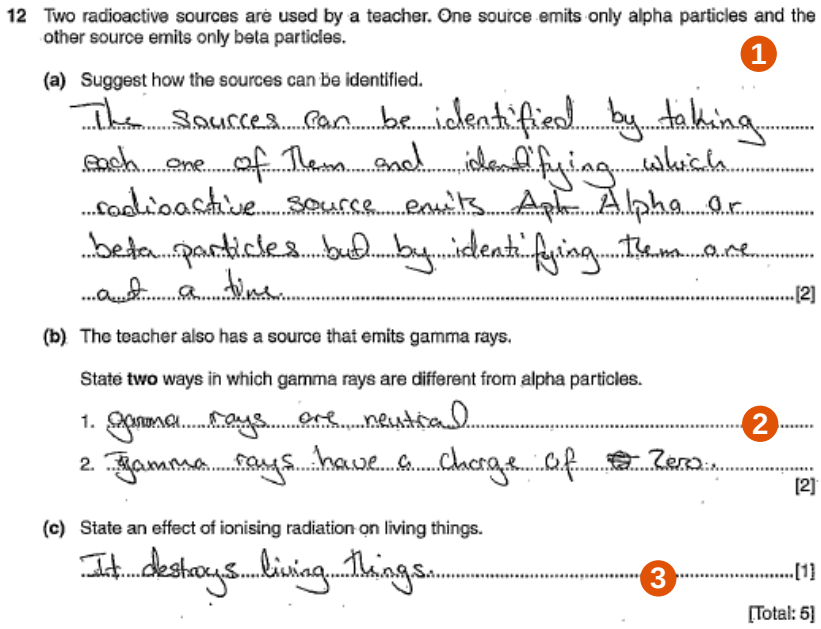
Question 12

Example Candidate Response – middle	Examiner comments
	1 The candidate identifies the differing penetrating properties of alpha and beta particles but the response is too vague to be given any credit. Mark awarded for (a) = 0 out of 2 2 The difference in the penetrating properties gains 1 of the two available marks. Mark awarded for (b) = 1 out of 2 3 Correct response is given. Mark awarded for (c) = 1 out of 1 **Total mark awarded = 2 out of 5**

How the candidate could have improved the answer

(a) The candidate identifies the differing penetrating properties of alpha and beta particles but the response is too vague to gain any credit. The candidate should have included the materials used for determining the sources.

(b) The difference in the penetrating properties gains 1 of the two available marks. Other acceptable responses that could have been given included speed of travel and levels of ionisation.

Example Candidate Response – low	Examiner comments
	1 The candidate responds by repeating the question. No credit is given. Mark awarded for (a) = 0 out of 2 2 Both responses are the same indicating that gamma rays do not have a charge. Mark awarded for (b) = 1 out of 2 3 A vague response that is not credit worthy. Mark awarded for (c) = 0 out of 1 **Total mark awarded = 1 out of 5**

How the candidate could have improved the answer

(a) The candidate should have identified a particular method such as 'idea of paper between source and detector'.

(b) Both responses are the same indicating that gamma rays do not have a charge. The candidate should have given two ways in which gamma rays are different from alpha.

(c) 'Damages cells' or 'tissues' would have gained credit.

Common mistakes candidates made in this question

(a) Many candidates gained partial credit giving details about alpha being stopped by paper but did not include the use of a detector to gain full credit.

Cambridge International Examinations
1 Hills Road, Cambridge, CB1 2EU, United Kingdom
t: +44 1223 553554 f: +44 1223 553558
e: **info@cie.org.uk** **www.cie.org.uk**

Version 1.0

Cambridge Assessment