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Examiners' Report
June 2023

GCSE Physics 1PH0 2F

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June 2023

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Introduction

This was the sixth year of examining this specification, being paper 2 of Physics, foundation tier. Questions were set to test students' knowledge, application and understanding from nine topics in the specification:

- Topic 1 – Key concepts of physics
- Topic 8 – Energy – Forces doing work
- Topic 9 – Forces and their effects
- Topic 10 – Electricity and circuits
- Topic 11 – Static electricity
- Topic 12 – Magnetism and the motor effect
- Topic 13 – Electromagnetic induction
- Topic 14 – Particle model
- Topic 15 – Forces and matter

It was intended that the examination paper would allow every candidate to show what they knew, understood and were able to do. Within the question paper, a variety of question types were included, such as objective questions, short answer questions worth one or two marks each and longer questions worth three, four or six marks each. Several questions assessed candidates' knowledge of practical procedures, notably Q02(a) electrical circuits, Q03(a)(i), (ii) and (b) concerning an investigation on melting ice, Q06(b) and (d) about energy transfers and Q08 (c)–(d) about measuring resistance varying with length, 9(b) concerning specific heat capacity final temperature measurement and Q010 (a) about electromagnetic induction. The two 6 markers were Q07(c) about moments applied to a crowbar and Q09(d) about choices of building insulation material, with candidates being provided with information to base their choices upon.

Successful candidates were:

- well-acquainted with the content of the specification
- skilled as a result of having been engaged with practical work during their course
- competent in quantitative work, especially in using equations
- well-focused in their comprehension of the question-at-hand
- willing to apply physics principles to the novel situations presented to them

Less successful candidates:

- had gaps in their conceptual knowledge of the topics of this paper
- had gaps in their procedural knowledge, relating to their practical work
- misread and / or misunderstood the symbols used in equations
- did not focus sufficiently on what the question was asking
- found difficulty in applying their knowledge to new situations

This report will provide exemplification of candidates' work, together with comments and tips, for a selection of questions. The exemplification will come from responses which highlight successes and pitfalls, with the aim of aiding future teaching of these topics.

Question 1 (b)(i)

Many students obtained one mark by talking about charge travelling through the body – see 'if no other mark' in additional guidance.

Very few students associated diverging with same charges and so like charges repel each other.

(b) Figure 2 shows a person touching a charged dome.

The person's hair is standing on end.

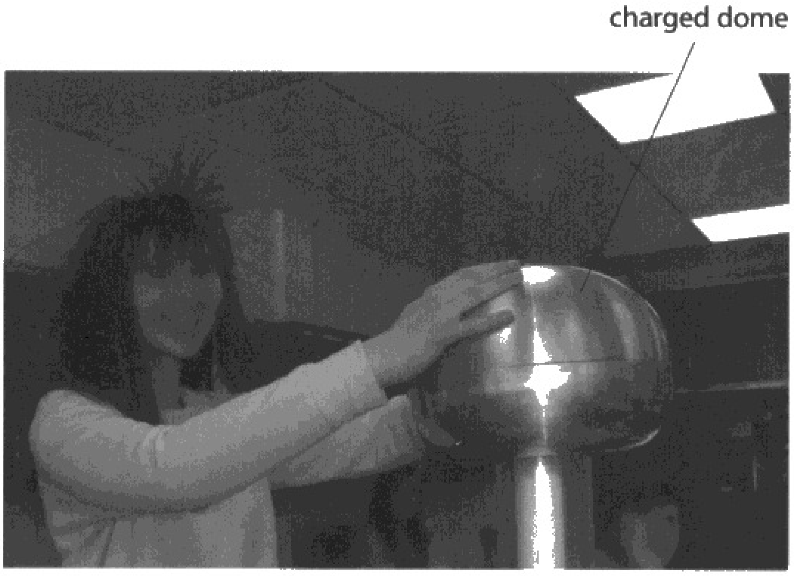


Figure 2

(i) Explain how electric charge causes the hair to spread out, as shown in Figure 2.

(2)

The electrons charge the hair and repel away from each other because they will all be negatively charged and 2 negative forces repel

ResultsPlus Examiner Comments

Identifies negative charges (electrons) on the hair repelling each other.

Well thought out and expressed.

(b) Figure 2 shows a person touching a charged dome.

The person's hair is standing on end.

Figure 2

(i) Explain how electric charge causes the hair to spread out, as shown in Figure 2.

(2)

same charge repel therefore the hairs stand up and move away from each other.

ResultsPlus
Examiner Comments

Full marks.

The two essential mark points are matched very well.

'move away from each other' taken as being equivalent to repel.

ResultsPlus
Examiner Tip

Think about charges and the science / physics behind: what causes the 'spreading out'?

A classic case of the result of like charges repelling each other.

(b) Figure 2 shows a person touching a charged dome.

The person's hair is standing on end.

Figure 2

(i) Explain how electric charge causes the hair to spread out, as shown in Figure 2.

(2)

Because the electric charge ~~sho~~ gets sent through your body which causes your hair to spread out

ResultsPlus
Examiner Comments

This represents a typical response earning one mark through talking about charge passing through the body.

This was the compensatory mark 'if no other mark scored'.

(b) Figure 2 shows a person touching a charged dome.

The person's hair is standing on end.

Figure 2

(i) Explain how electric charge causes the hair to spread out, as shown in Figure 2.

(2)

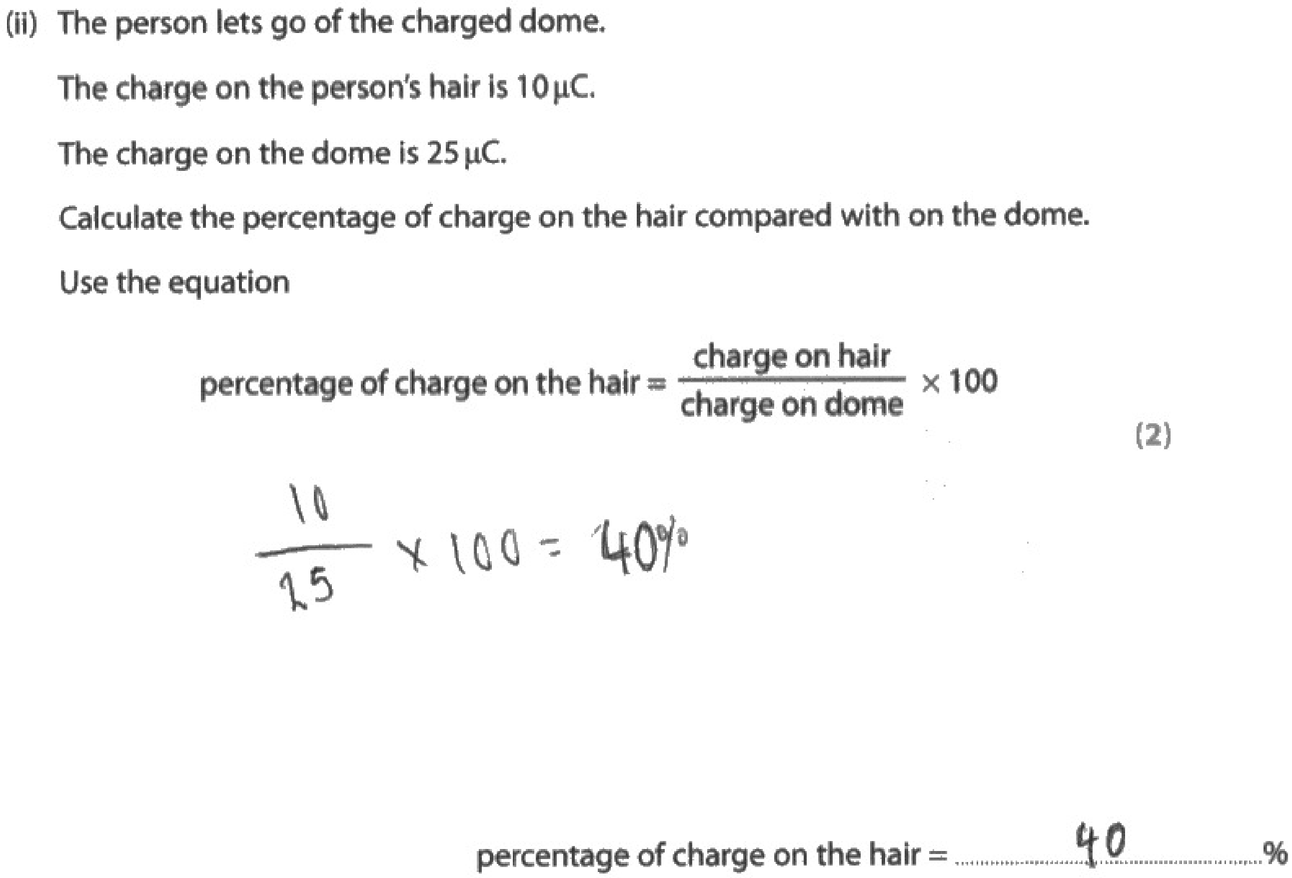
- gives energy charge to the girl
- hair goes Static and spreads out.

ResultsPlus
Examiner Comments

Note needs to be taken that the mark scheme says ignore 'static'.

Question 1 (b)(ii)

This was very high scoring with most candidates accessing this opening math question with confidence.



(ii) The person lets go of the charged dome.

The charge on the person's hair is 10 µC.

The charge on the dome is 25 µC.

Calculate the percentage of charge on the hair compared with on the dome.

Use the equation

$$\text{percentage of charge on the hair} = \frac{\text{charge on hair}}{\text{charge on dome}} \times 100$$

(2)

$$\frac{10}{25} \times 100 = 40\%$$

percentage of charge on the hair = 40 %

ResultsPlus
Examiner Comments

Well set out, perfectly evaluated.

ResultsPlus
Examiner Tip

Physics exams test mathematical skills. You should prepare for this with practice, using your basic skills.

(ii) The person lets go of the charged dome.

The charge on the person's hair is 10 μC.

The charge on the dome is 25 μC.

Calculate the percentage of charge on the hair compared with on the dome.

Use the equation

$$\text{percentage of charge on the hair} = \frac{\overset{10}{\text{charge on hair}}}{\underset{25}{\text{charge on dome}}} \times 100$$

(2)

percentage of charge on the hair = ... %

ResultsPlus
Examiner Comments

The candidate gains a mark for substitution, taking the numbers written next to the numerator and denominator of the stated equation.

No calculation followed.

(ii) The person lets go of the charged dome.

The charge on the person's hair is 10 μC.

The charge on the dome is 25 μC.

Calculate the percentage of charge on the hair compared with on the dome.

Use the equation

$$\text{percentage of charge on the hair} = \frac{\text{charge on hair}}{\text{charge on dome}} \times 100$$

(2)

$$\frac{10}{25} \times 100$$

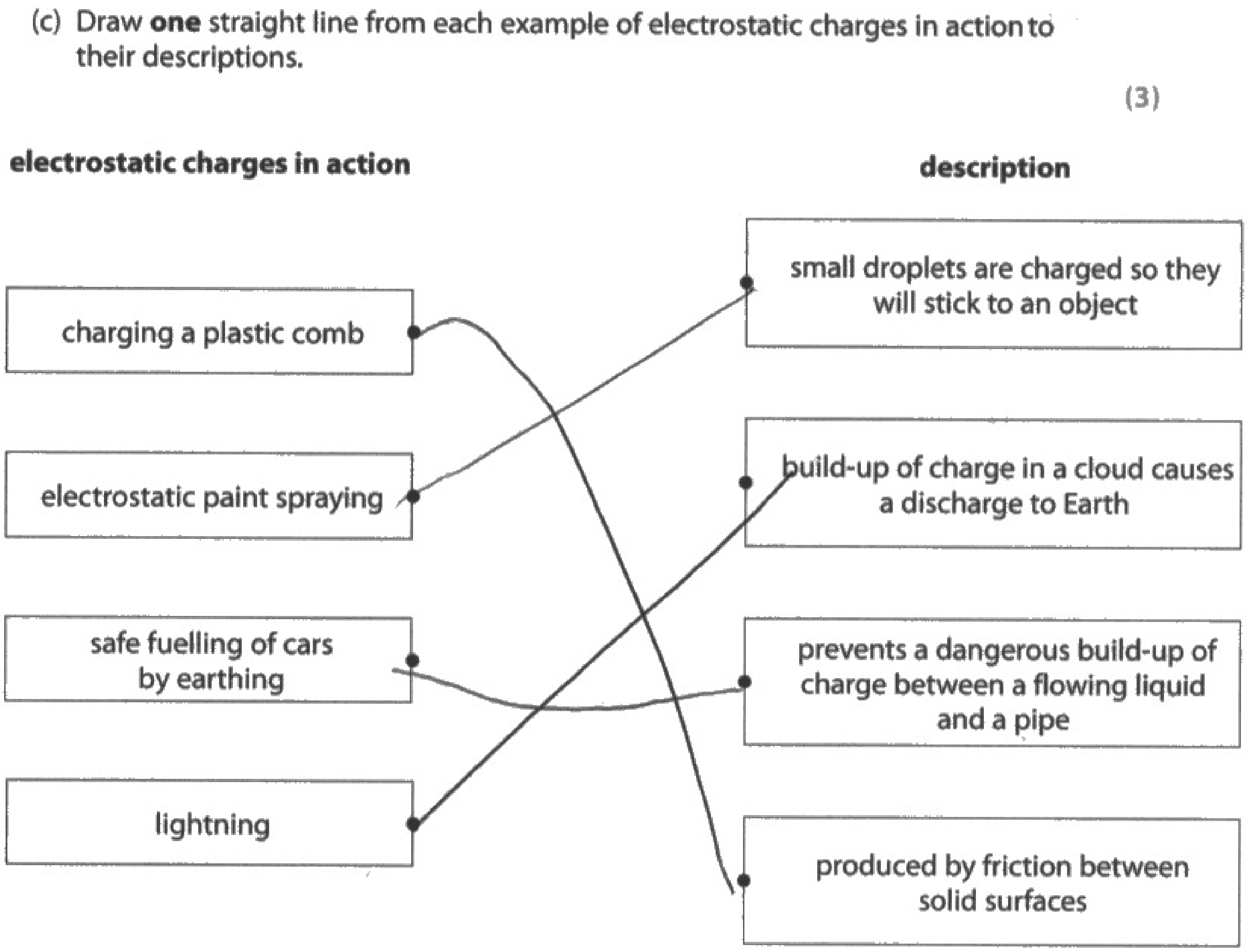
percentage of charge on the hair = 400 %

ResultsPlus Examiner Comments

Substitution mark awarded but then there is an arithmetical mistake in evaluating.

Question 1 (c)

Most candidates scored maximum marks with this item about everyday electrostatic phenomena.



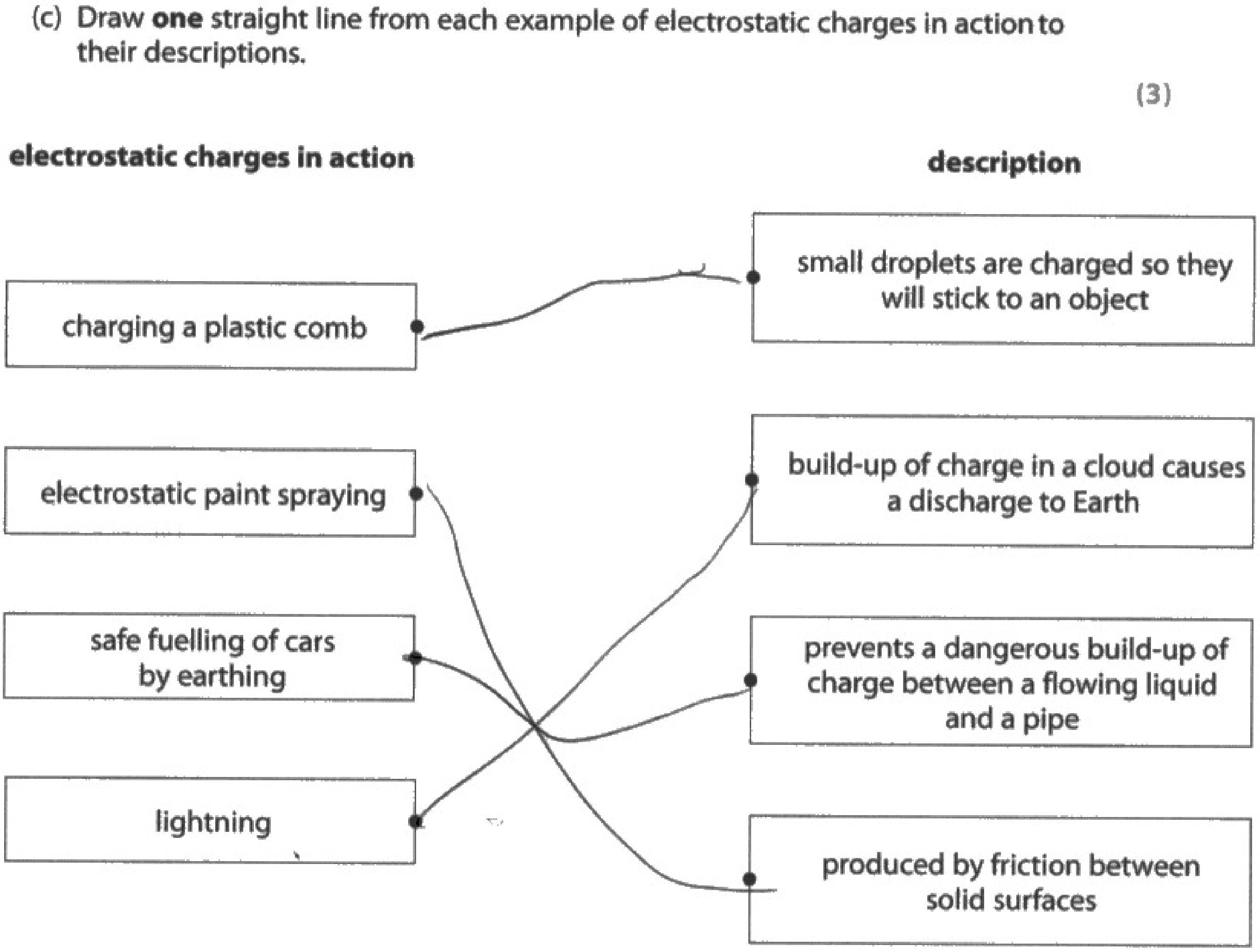
(c) Draw **one** straight line from each example of electrostatic charges in action to their descriptions.

(3)

electrostatic charges in action	description
charging a plastic comb	small droplets are charged so they will stick to an object
electrostatic paint spraying	build-up of charge in a cloud causes a discharge to Earth
safe fuelling of cars by earthing	prevents a dangerous build-up of charge between a flowing liquid and a pipe
lightning	produced by friction between solid surfaces

ResultsPlus
Examiner Comments

Fully correct for 3 marks. There are lots of clues in the descriptions.



(c) Draw **one** straight line from each example of electrostatic charges in action to their descriptions.

(3)

electrostatic charges in action

charging a plastic comb

electrostatic paint spraying

safe fuelling of cars by earthing

lightning

description

small droplets are charged so they will stick to an object

build-up of charge in a cloud causes a discharge to Earth

prevents a dangerous build-up of charge between a flowing liquid and a pipe

produced by friction between solid surfaces

ResultsPlus
Examiner Comments

Fuelling of cars and lightning associations correct.

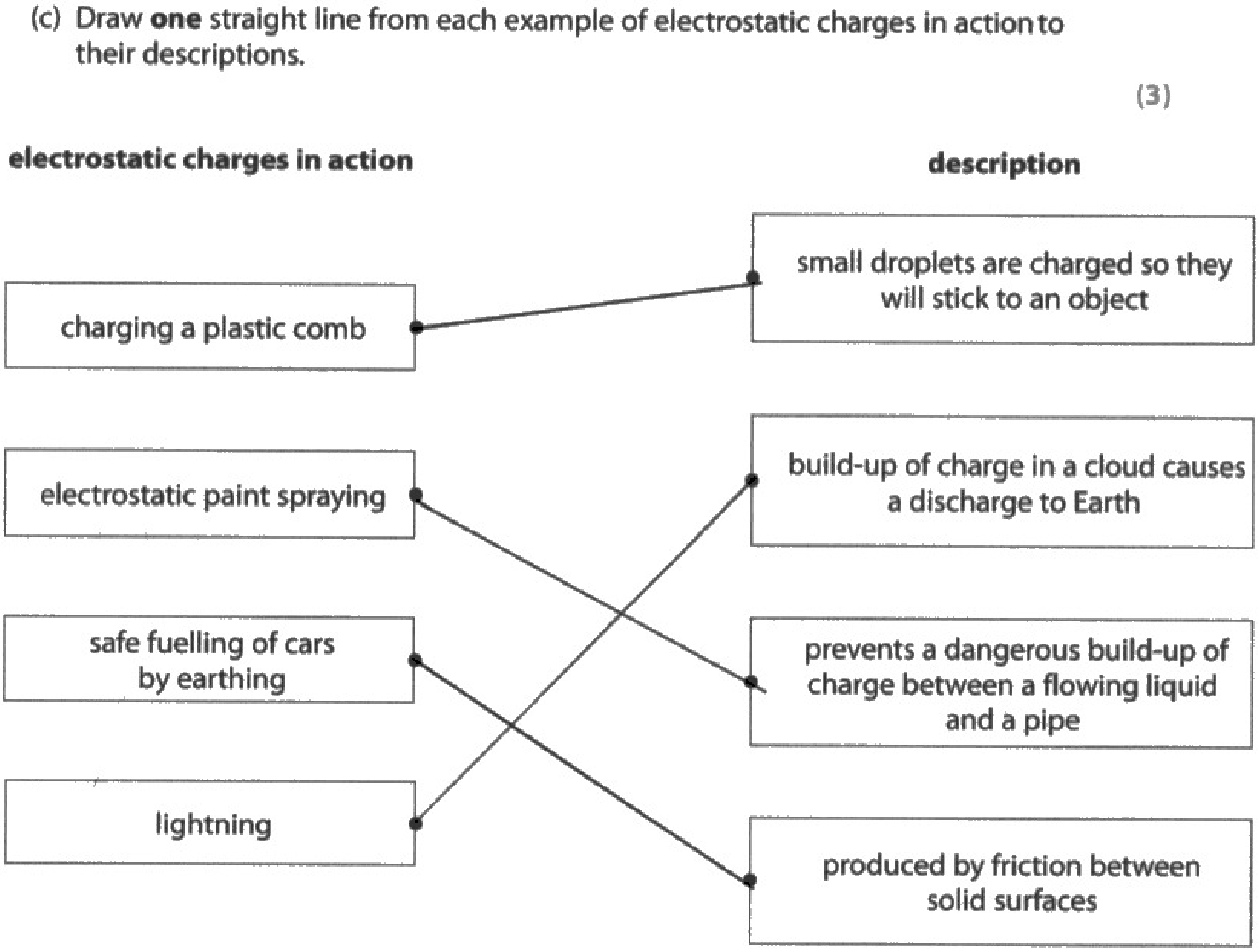
Two marks.

ResultsPlus
Examiner Tip

Don't bother looking for patterns in the way the lines are drawn.

The associations need to be read carefully and thought about, e.g. is charging a comb likely to be associated with small droplets getting charged? What small droplets?

Asking such questions should rule that top link out.



(c) Draw **one** straight line from each example of electrostatic charges in action to their descriptions.

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electrostatic charges in action	**description**
charging a plastic comb	small droplets are charged so they will stick to an object
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safe fuelling of cars by earthing	prevents a dangerous build-up of charge between a flowing liquid and a pipe
lightning	produced by friction between solid surfaces

ResultsPlus
Examiner Comments

Only the lightning link is correctly associated with charge in a cloud.

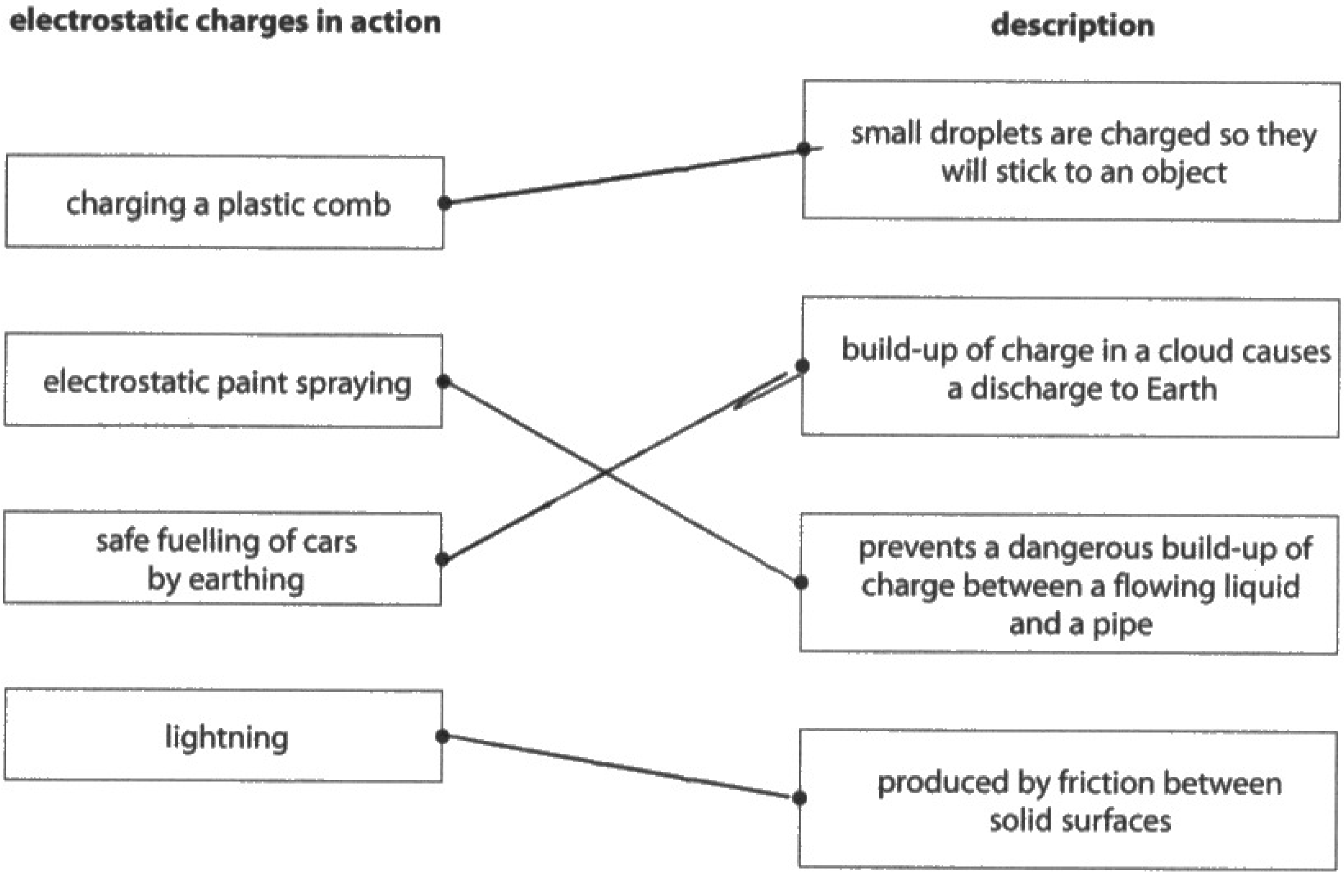
ResultsPlus
Examiner Tip

Think: where and when does lightning occur?

The cloud association should become obvious.

(c) Draw **one** straight line from each example of electrostatic charges in action to their descriptions.

(3)



electrostatic charges in action

charging a plastic comb

electrostatic paint spraying

safe fuelling of cars by earthing

lightning

description

small droplets are charged so they will stick to an object

build-up of charge in a cloud causes a discharge to Earth

prevents a dangerous build-up of charge between a flowing liquid and a pipe

produced by friction between solid surfaces

ResultsPlus
Examiner Comments

Maybe a symmetric pattern in the lines is seen, but no correct link.

ResultsPlus
Examiner Tip

Think: is safe fuelling of cars anything to do with charged clouds?

Question 2 (a)

This question involved translating a line drawing of a circuit into a circuit diagram. It was a test of circuit symbols and recognising that a simple series circuit was present.

Many candidates scored highly on this question.

2 (a) Figure 3 shows the parts in an electrical circuit.

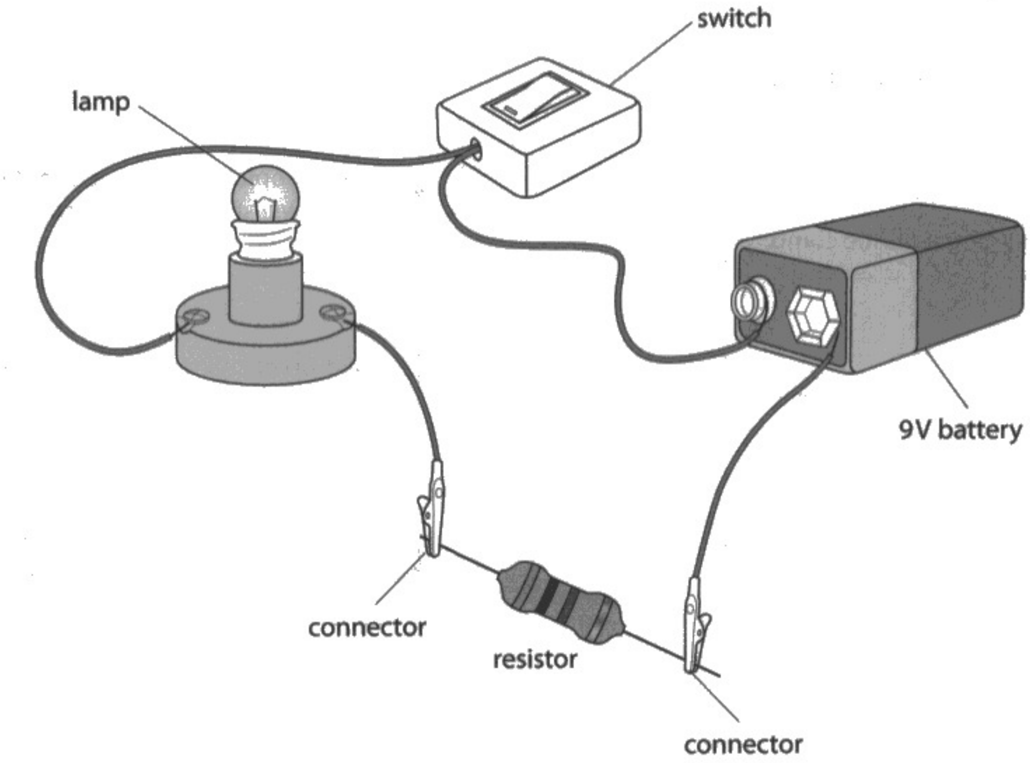
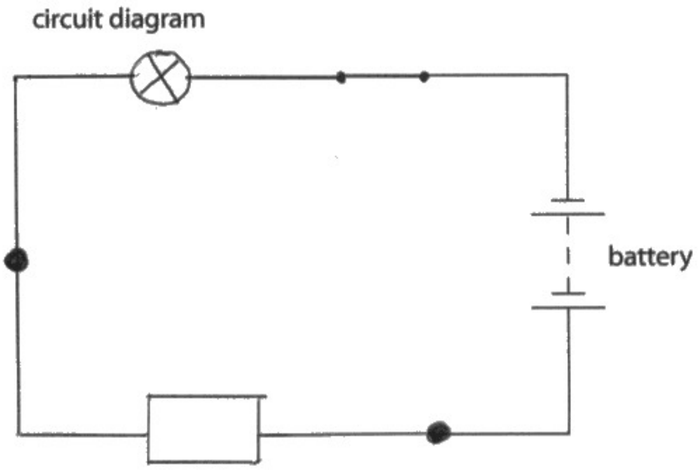


Figure 3

Draw the circuit diagram of this electrical circuit in the space provided.

The battery symbol and some of the connecting wires have been drawn for you.

(4)



ResultsPlus
Examiner Comments

Skilfully and carefully drawn using a ruler.

All symbols correct. The switch could be drawn open or closed like this.

ResultsPlus
Examiner Tip

Putting a circuit together in practice requires neat methodical working.

Commit the circuit symbols to memory and aim for as clear presentation as you can.

2 (a) Figure 3 shows the parts in an electrical circuit.

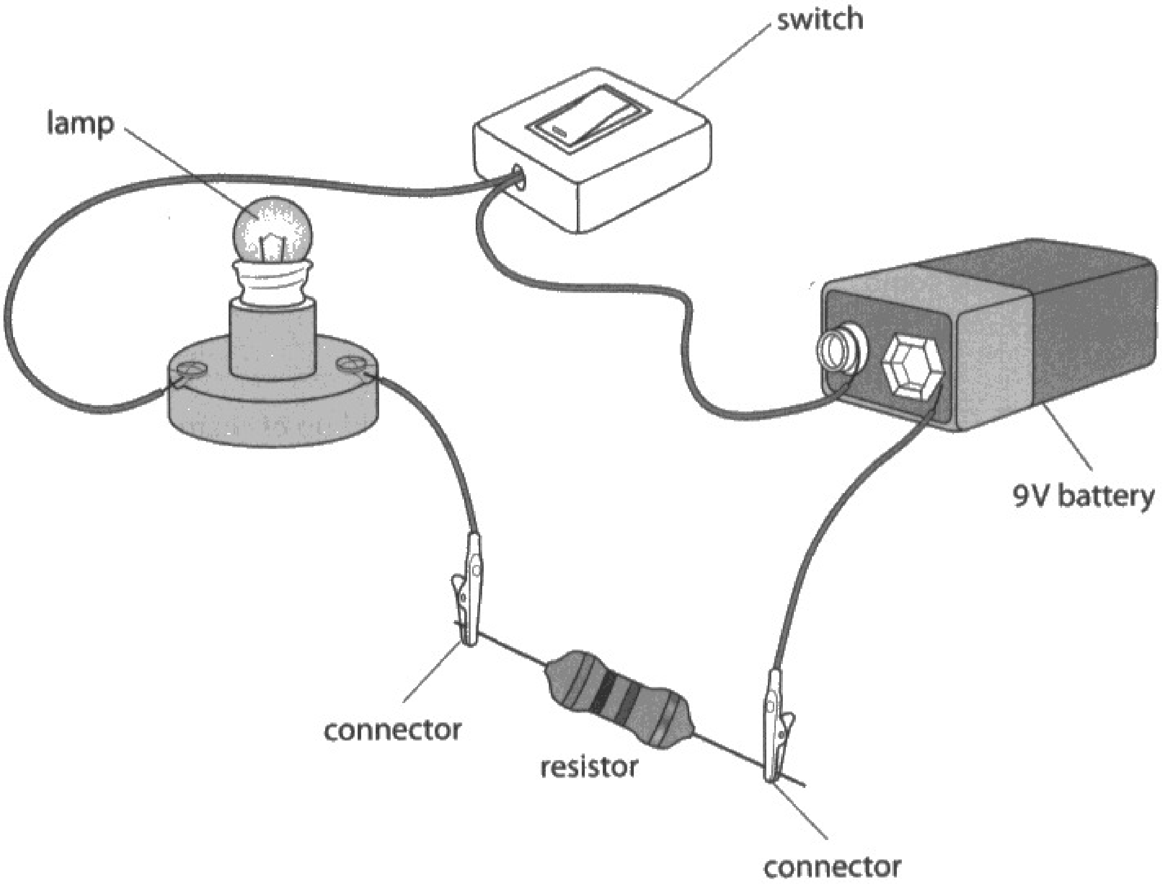


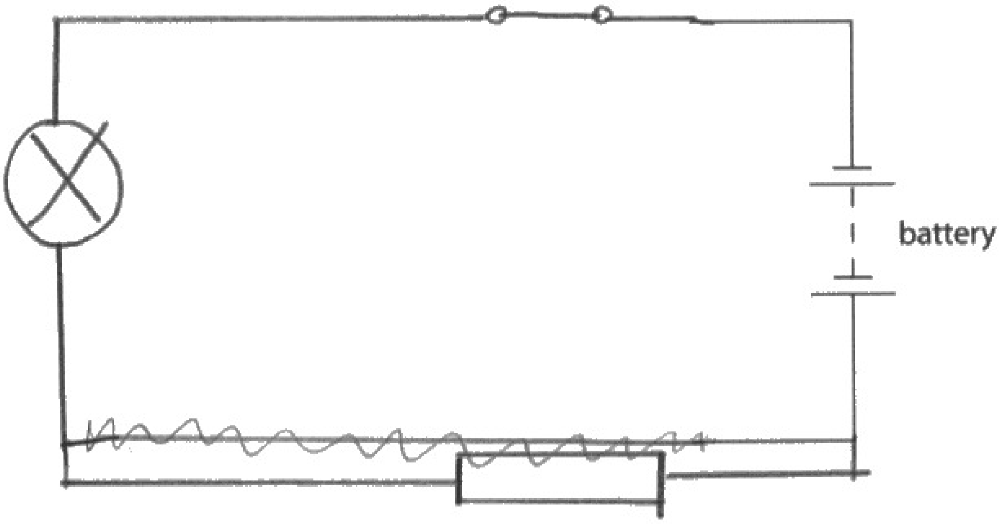
Figure 3

Draw the circuit diagram of this electrical circuit in the space provided.

The battery symbol and some of the connecting wires have been drawn for you.

(4)

circuit diagram



ResultsPlus
Examiner Comments

Fully correct, with that extra connecting line clearly crossed out.

Full marks.

ResultsPlus
Examiner Tip

If you make a mistake make any corrections clear that are not likely to confuse the examiner marking your work.

2 (a) Figure 3 shows the parts in an electrical circuit.

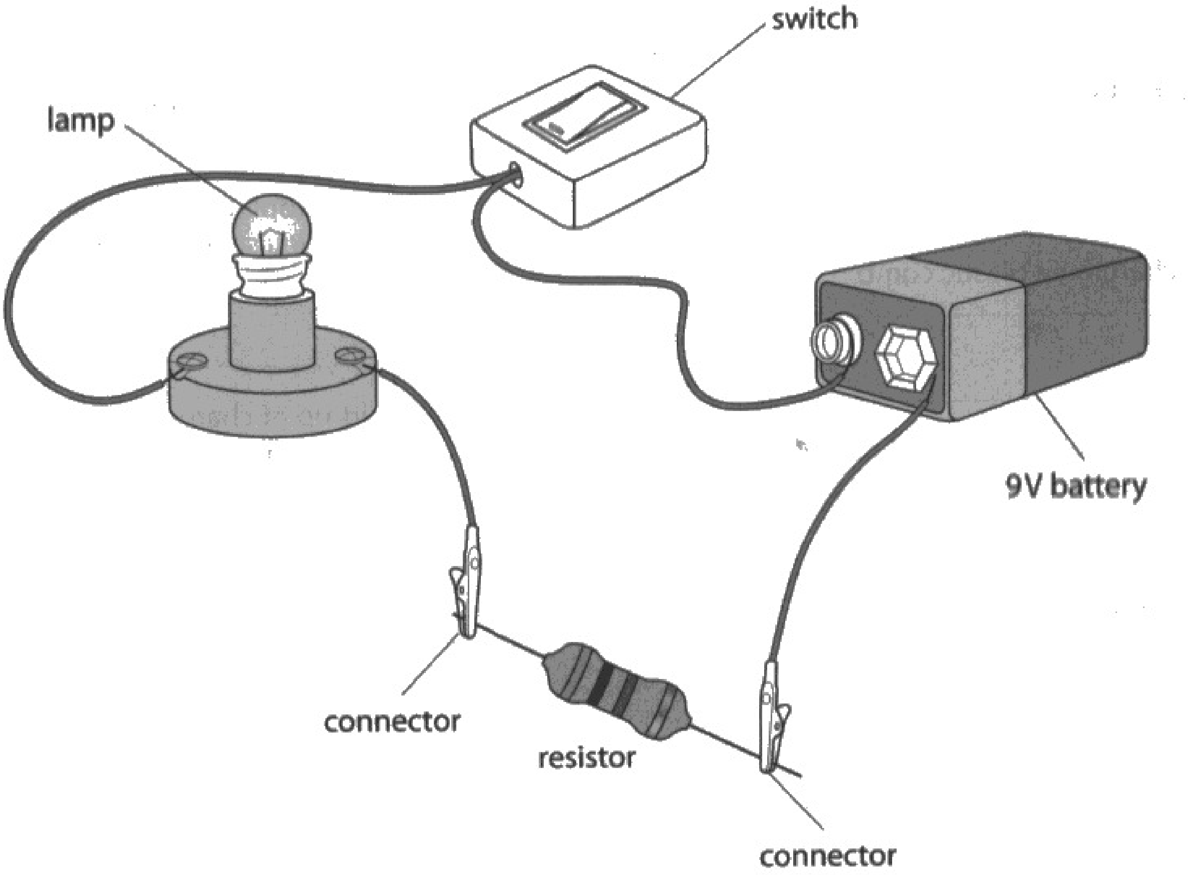
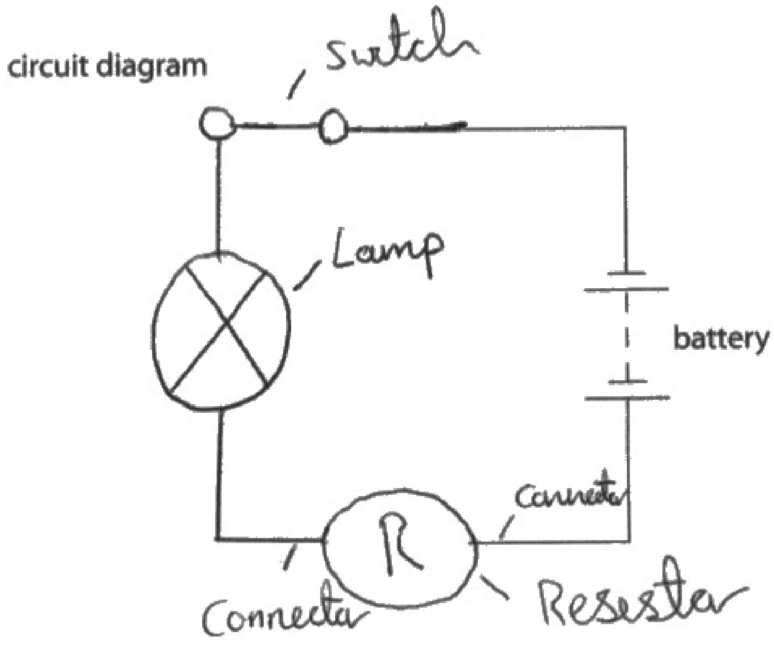


Figure 3

Draw the circuit diagram of this electrical circuit in the space provided.

The battery symbol and some of the connecting wires have been drawn for you.

(4)



ResultsPlus Examiner Comments

Resistor symbol not accepted. The rest are good, and a complete series circuit is shown.

3 marks.

ResultsPlus Examiner Tip

The correct symbol for a resistor is a rectangle.

Circles are used for meters and lamps.

2 (a) Figure 3 shows the parts in an electrical circuit.

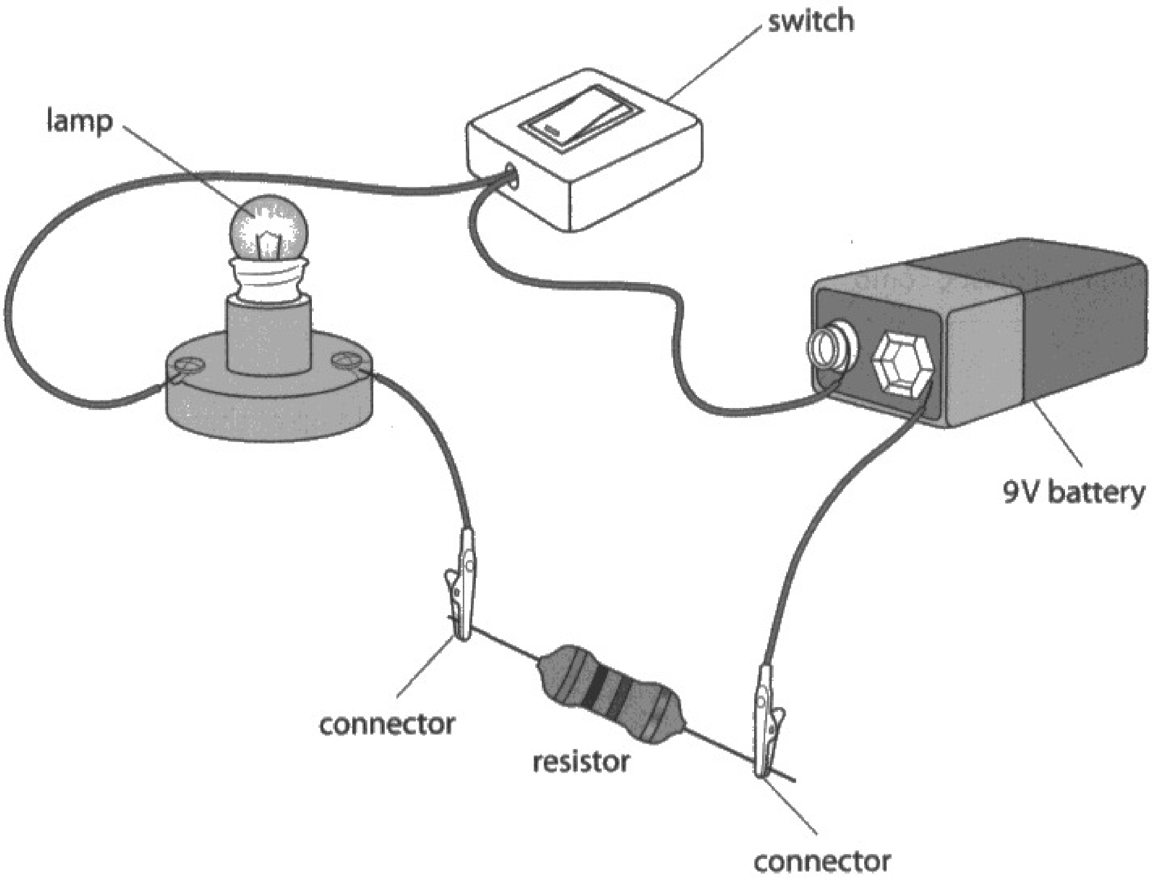
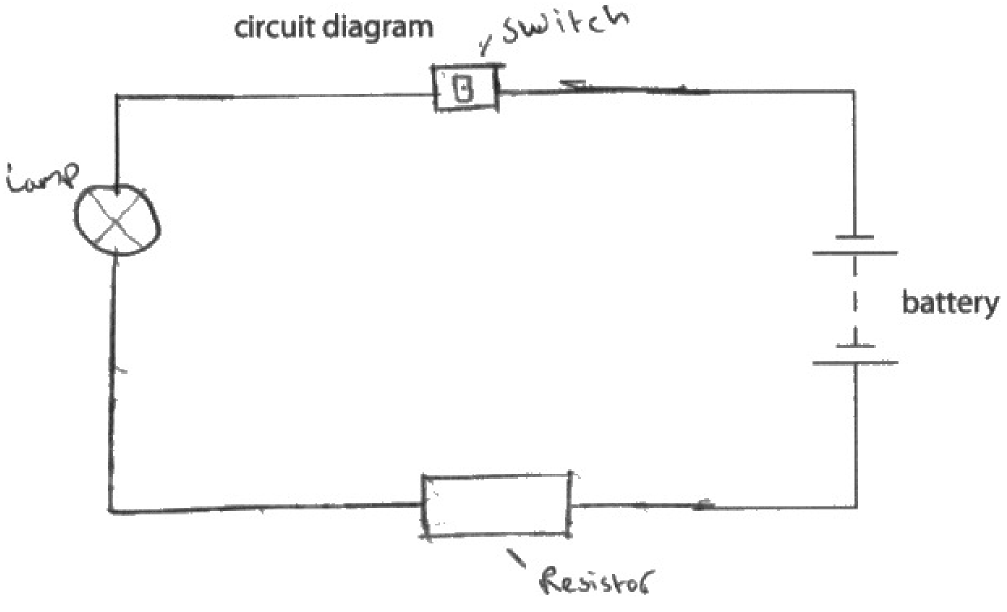


Figure 3

Draw the circuit diagram of this electrical circuit in the space provided.

The battery symbol and some of the connecting wires have been drawn for you.

(4)



ResultsPlus
Examiner Comments

Now all is correct apart from the switch symbol.

Maybe the candidate thinks of a push button switch.

At any rate it is not a correct circuit symbol.

2 (a) Figure 3 shows the parts in an electrical circuit.

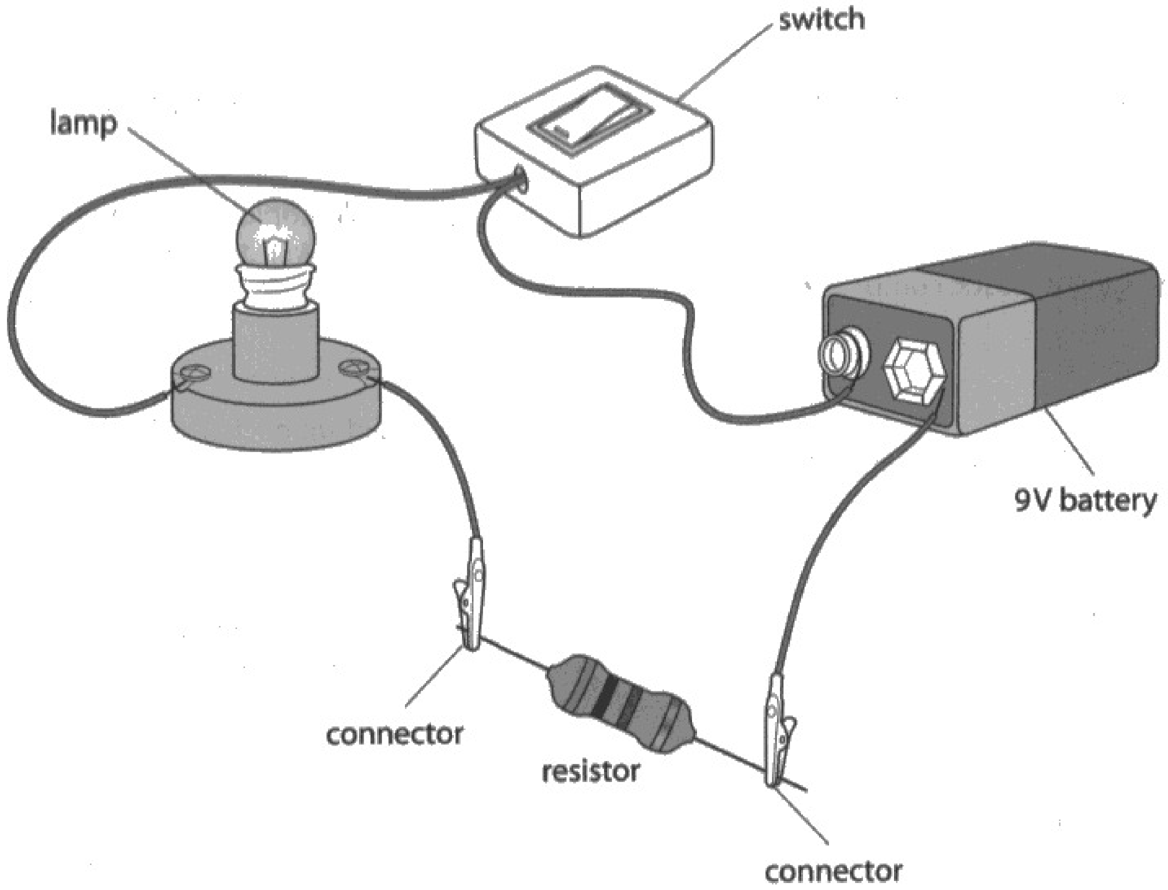


Figure 3

Draw the circuit diagram of this electrical circuit in the space provided.

The battery symbol and some of the connecting wires have been drawn for you.

(4)

circuit diagram

ResultsPlus
Examiner Comments

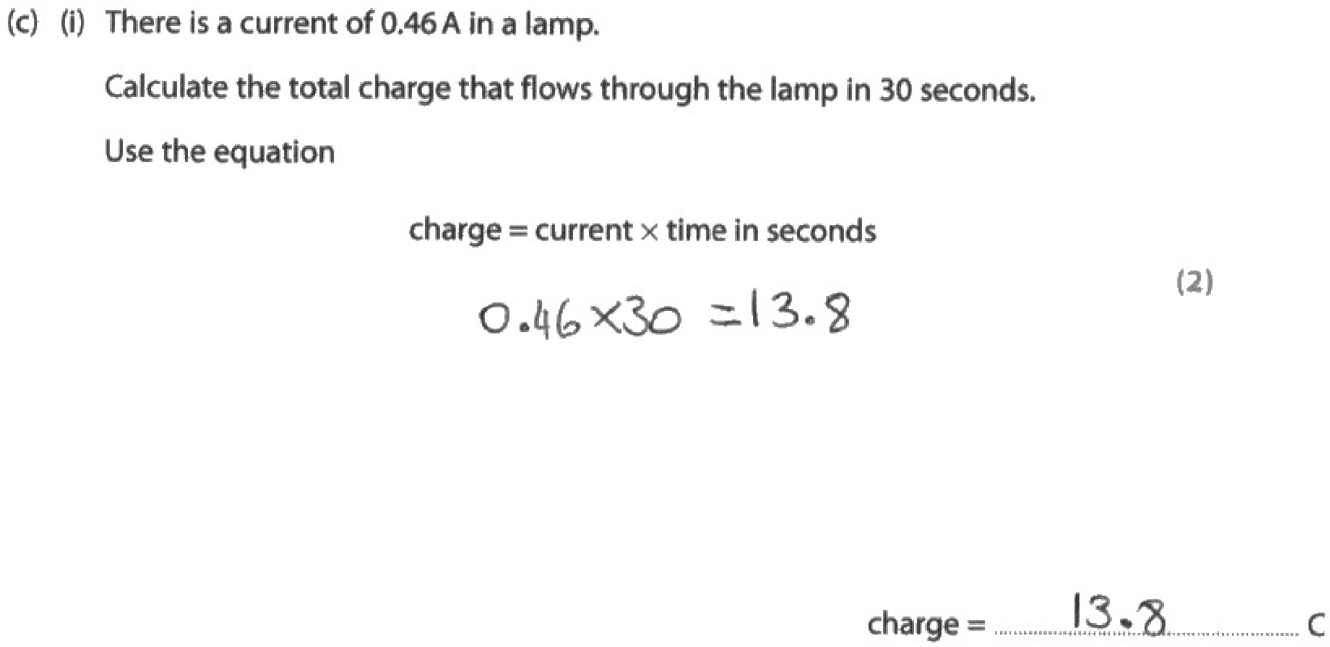
The lamp symbol earns the mark.

ResultsPlus
Examiner Tip

If the candidate had connected up this to the battery, showing a complete circuit, they could have got a second mark. It is always worth trying to complete the circuit.

Question 2 (c)(i)

This was a very high scoring item, calculating charge from current x time.



(c) (i) There is a current of 0.46 A in a lamp.

Calculate the total charge that flows through the lamp in 30 seconds.

Use the equation

$$\text{charge} = \text{current} \times \text{time in seconds}$$

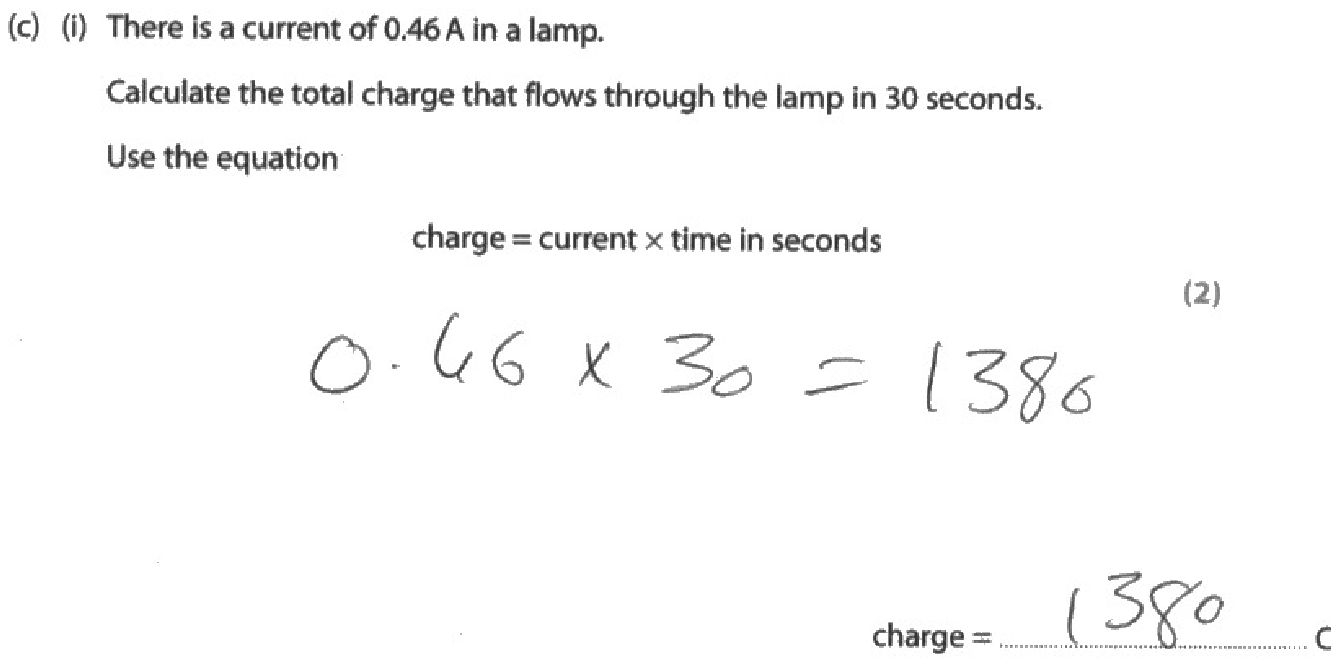
(2)

$0.46 \times 30 = 13.8$

charge = 13.8 C

ResultsPlus
Examiner Comments

This response shows clear working, with a correct evaluation of the charge.



(c) (i) There is a current of 0.46 A in a lamp.

Calculate the total charge that flows through the lamp in 30 seconds.

Use the equation

charge = current × time in seconds

(2)

0.46 x 30 = 1380

charge = 1380 C

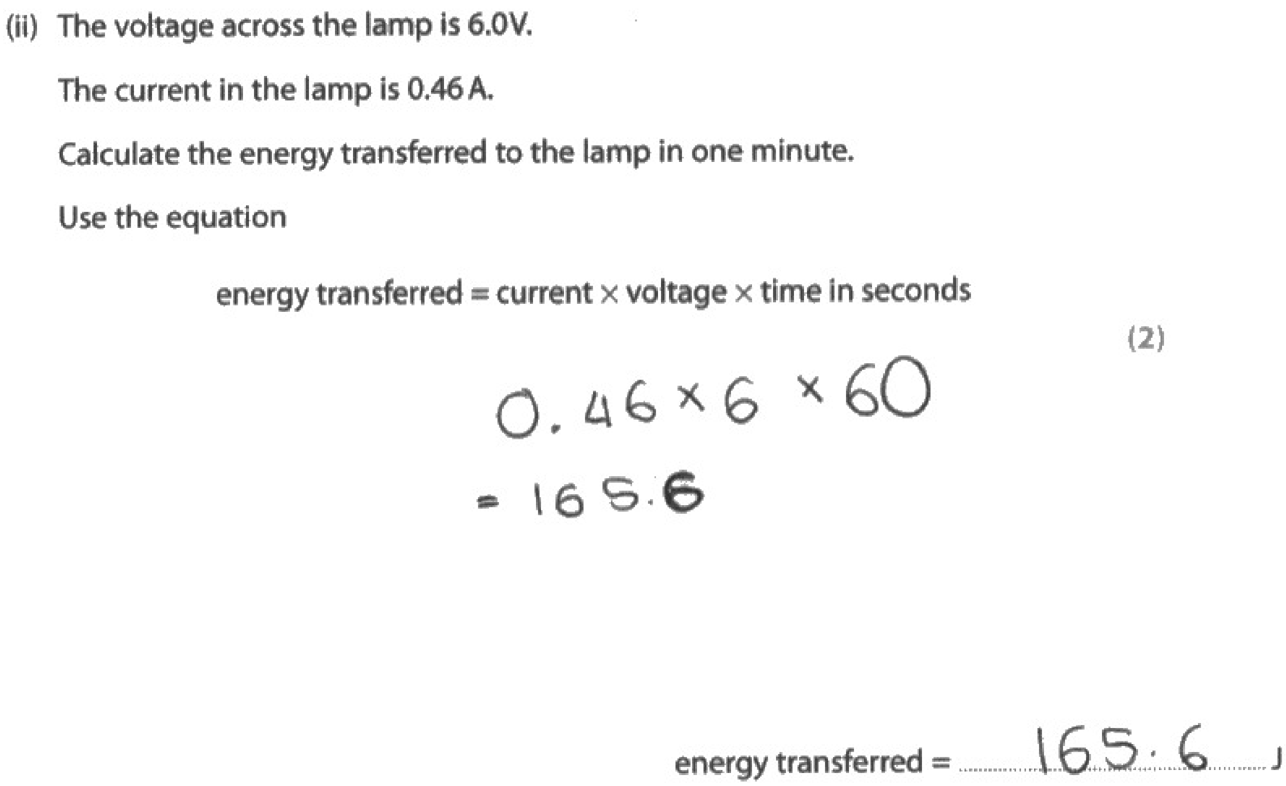
ResultsPlus
Examiner Comments

1 mark was awarded for the substitution of values into "charge = current × time in seconds".

The candidate then had a very flawed calculation result.

Question 2 (c)(ii)

This was high scoring, asking candidates to calculate energy transferred from current × voltage × time in seconds. The slight snag involved a conversion from minutes to seconds. That did not deter the vast majority of candidates.



(ii) The voltage across the lamp is 6.0V.

The current in the lamp is 0.46 A.

Calculate the energy transferred to the lamp in one minute.

Use the equation

energy transferred = current × voltage × time in seconds

(2)

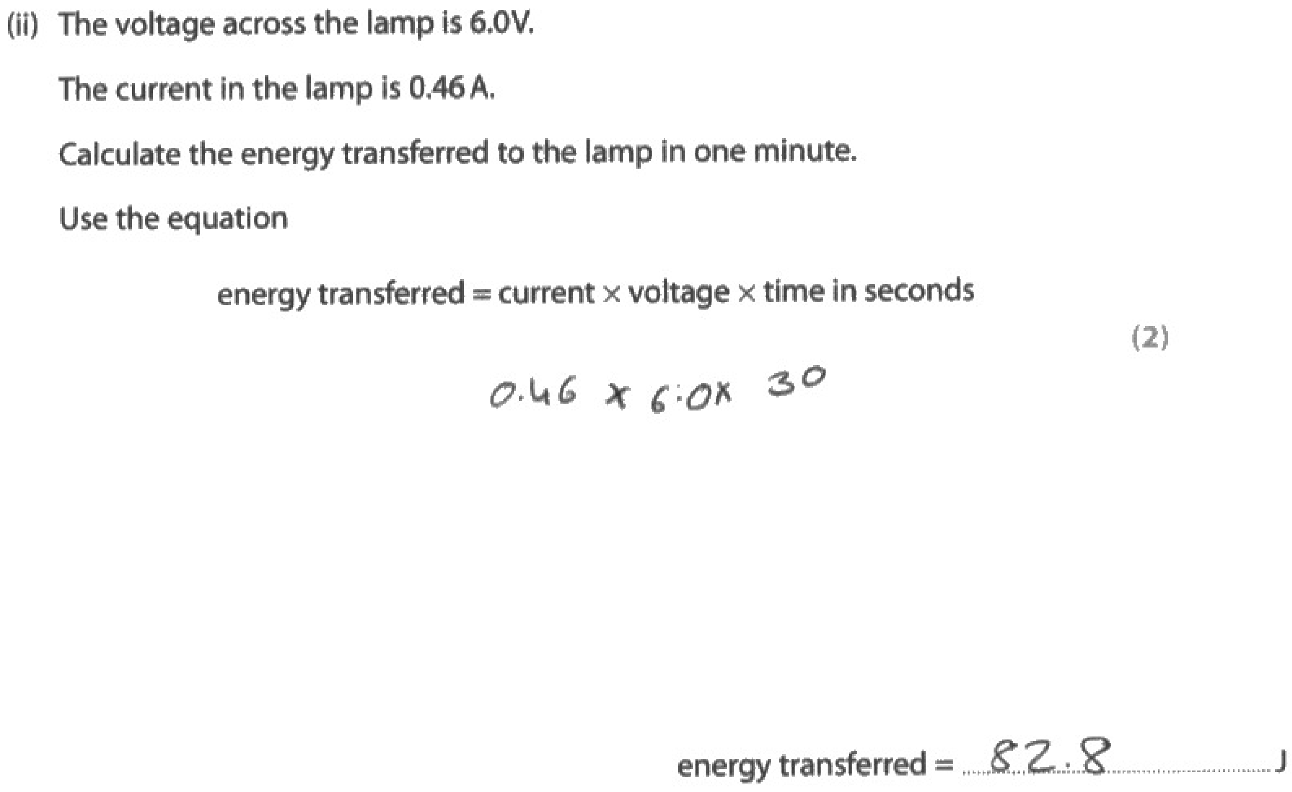
0.46 × 6 × 60

= 165.6

energy transferred = 165.6 J

ResultsPlus
Examiner Comments

This response is ideal, showing how the final answer was arrived at very clearly.



(ii) The voltage across the lamp is 6.0V.

The current in the lamp is 0.46 A.

Calculate the energy transferred to the lamp in one minute.

Use the equation

energy transferred = current × voltage × time in seconds

(2)

0.46 x 6:0x 30

energy transferred = 82.8 J

ResultsPlus
Examiner Comments

The additional guidance allows for an answer like this for one mark only. The candidate has used the 30s from the previous item rather than the 60s (one minute) given in this question.

Question 3 (a)(i)

This was not as high scoring as expected.

There were quite a lot of answers which were not specific enough for the question at hand, e.g. 'gloves', 'goggles', 'electrocution', 'electricity and water'.

Most correct answers related to not touching the heater.

3 (a) Figure 5 shows the apparatus used to investigate the melting of some crushed ice.

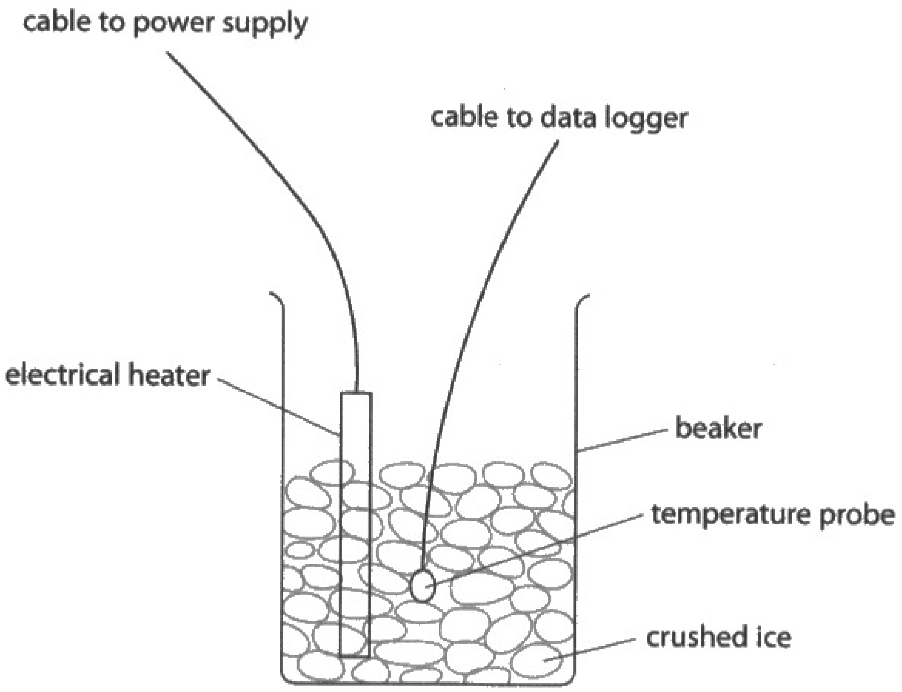


Figure 5

(i) Suggest **one** safety precaution needed when using the electrical heater.

(1)

~~gloves so you~~ thick gloves so that you don't burn your hands.

ResultsPlus Examiner Comments

The mark scheme says 'use gloves' must be qualified with a purpose in using them, e.g. use gloves to prevent burns. This candidate does that well.

1 mark

3 (a) Figure 5 shows the apparatus used to investigate the melting of some crushed ice.

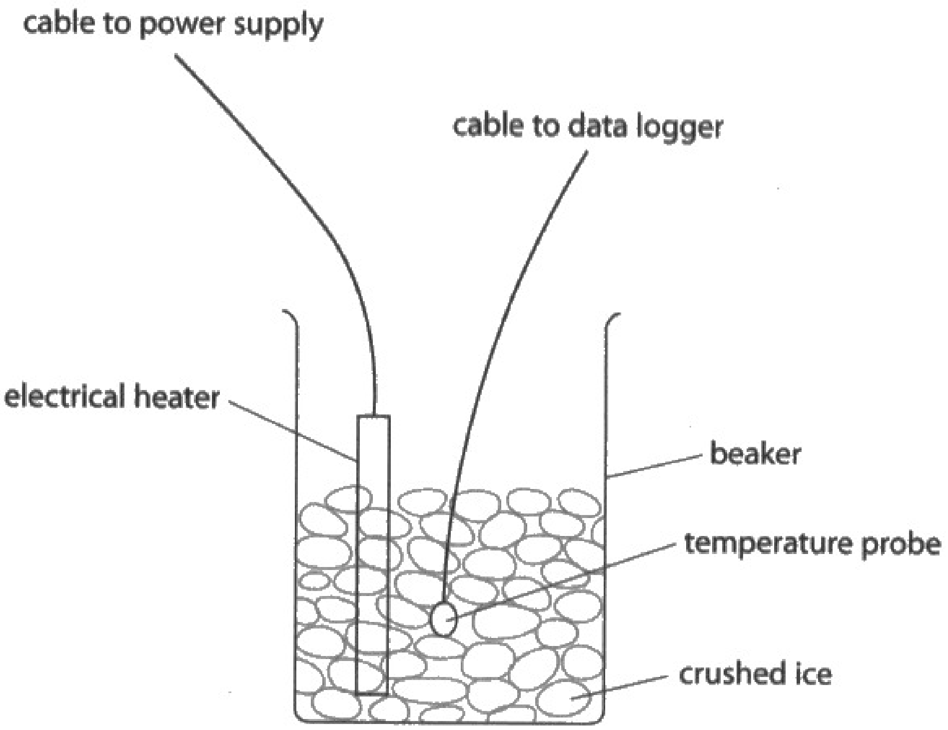


Figure 5

(i) Suggest **one** safety precaution needed when using the electrical heater.

(1)

don't touch it.

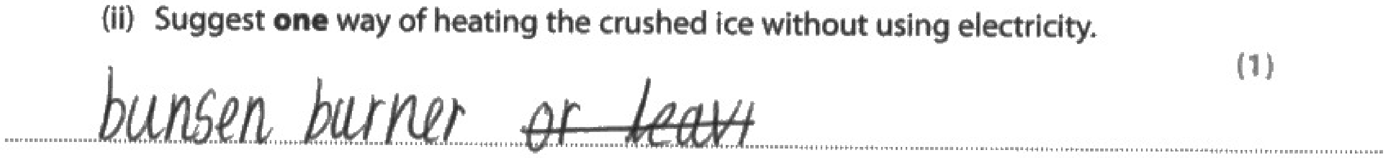
ResultsPlus Examiner Comments

This addressed the first mark point. It is a key common sense safety precaution when performing this investigation.

1 mark awarded

Question 3 (a)(ii)

A majority of candidates scored this mark suggesting heating using a bunsen burner, the most common answer. Placing in sunlight was the second most popular answer.



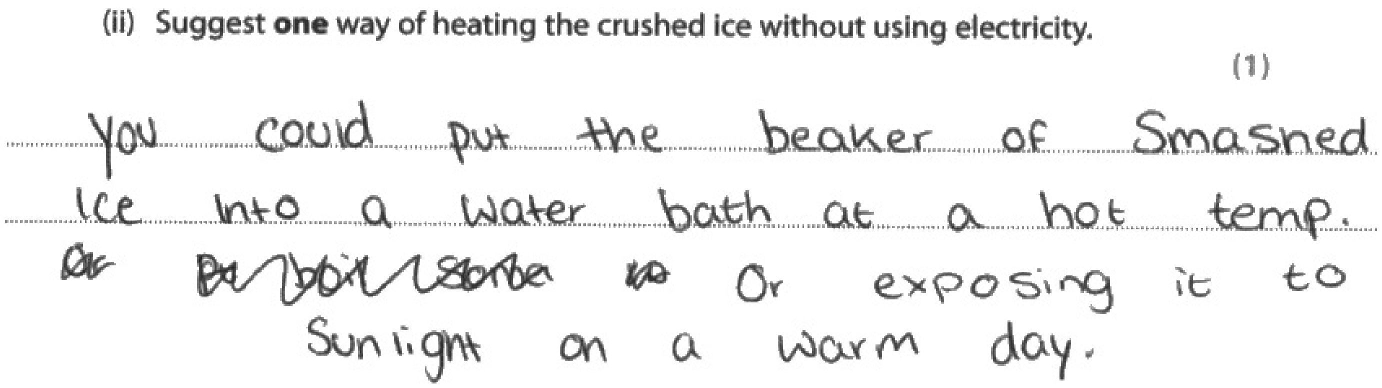
(ii) Suggest **one** way of heating the crushed ice without using electricity.

(1)

bunsen burner ~~or leav+~~

ResultsPlus Examiner Comments

This was the most common correct answer.



(ii) Suggest **one** way of heating the crushed ice without using electricity.

(1)

You could put the beaker of Smashed ice into a water bath at a hot temp. ~~Or~~ [illegible] Or exposing it to Sunlight on a warm day.

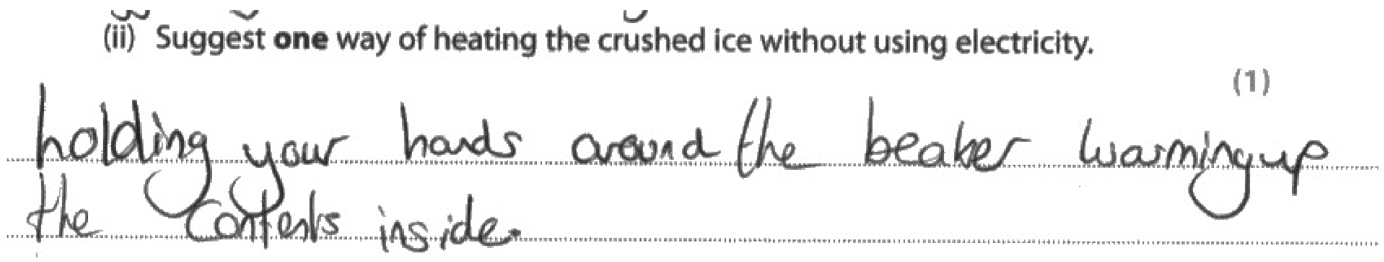
ResultsPlus Examiner Comments

'Exposing it to sunlight' is mark point 2 and 'water bath' is mark point 3.

Scores the mark – see tip on this.

ResultsPlus Examiner Tip

If the question asks for **one** way, **one** being emboldened for a reason, you should not give two answers. That jeopardises the mark. Hedging your bets will often lead to losing marks.



(ii) Suggest **one** way of heating the crushed ice without using electricity.

(1)

holding your hands around the beaker warming up the Contents inside.

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Examiner Comments

This forms an example of another accepted answer – see additional guidance in the mark scheme.

Question 3 (b)

This question elicited a variety of responses. The mark scheme was deliberately set widely, with eight alternative marking points from which the 3 marks could be earned.

(b) Figure 6 shows a graph produced from the data collected by the data logger in Figure 5.

Labels P, Q, R and S have been added.

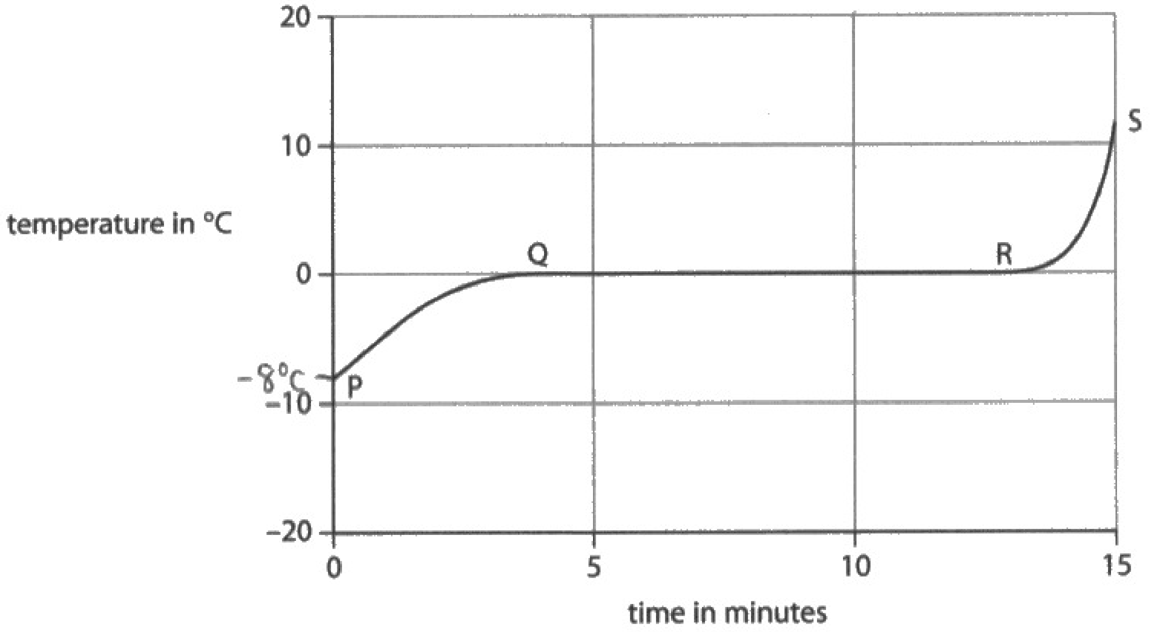

Figure 6

At the start, P, the beaker contains crushed ice at −8 °C.

Describe what happens to the crushed ice during the next 15 minutes.

You may use labels P, Q, R and S to help your answer.

(3)

From points P to Q, the ~~s~~ temperature increases by 8°C ~~so~~ and the ice starts to melt. From Points Q to R, the temperature doesn't change because all the ice is melting. From point R to S, the temperature increases again by 11°C and the melted ice would start to evaporate.

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Examiner Comments

Mark points 1, 2, 3, 4 and 5 are all matched here.

The candidate gets full marks, 3 awarded.

(b) Figure 6 shows a graph produced from the data collected by the data logger in Figure 5.

Labels P, Q, R and S have been added.

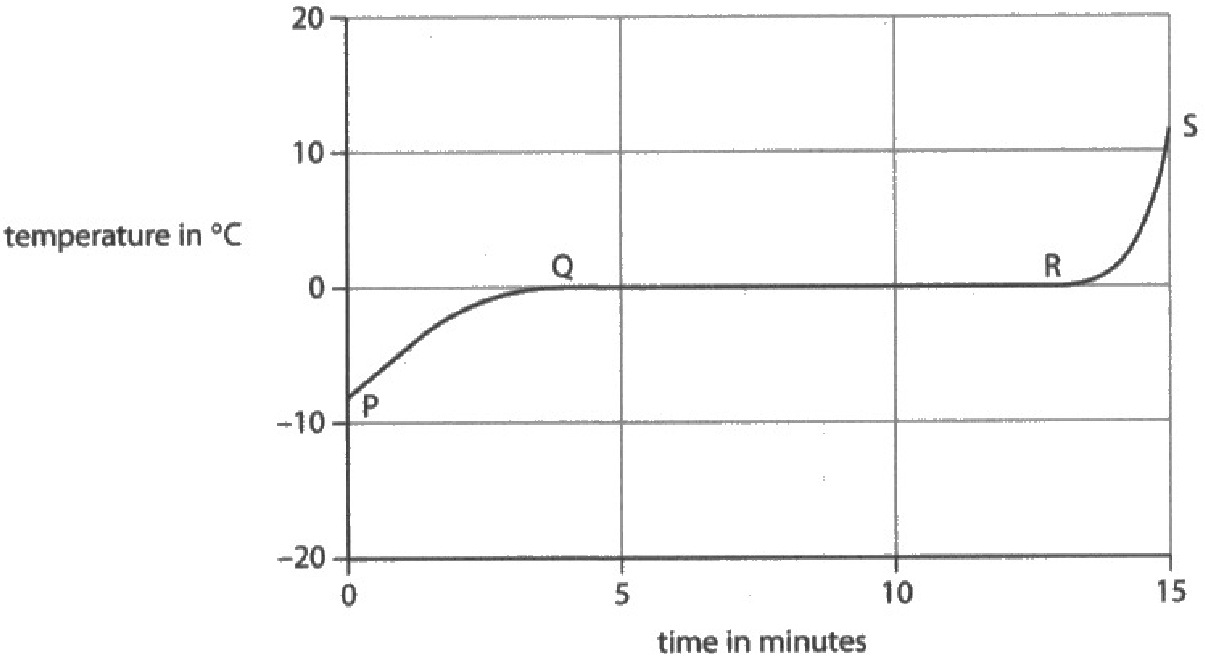


Figure 6

At the start, P, the beaker contains crushed ice at –8 °C.

Describe what happens to the crushed ice during the next 15 minutes.

You may use labels P, Q, R and S to help your answer.

(3)

From Point P to Point Q the temperature increased from -8°c to 0°c. Points Q and R the temperature Stayed the Same at 0°c over a 5 Minute span and from Point R to S it incraesed to 11°c.

ResultsPlus
Examiner Comments

This scores 3 marks, awarded for the basic descriptions of temperature changes in each of the three sections (mark points 1, 2 and 3).

(b) Figure 6 shows a graph produced from the data collected by the data logger in Figure 5.

Labels P, Q, R and S have been added.

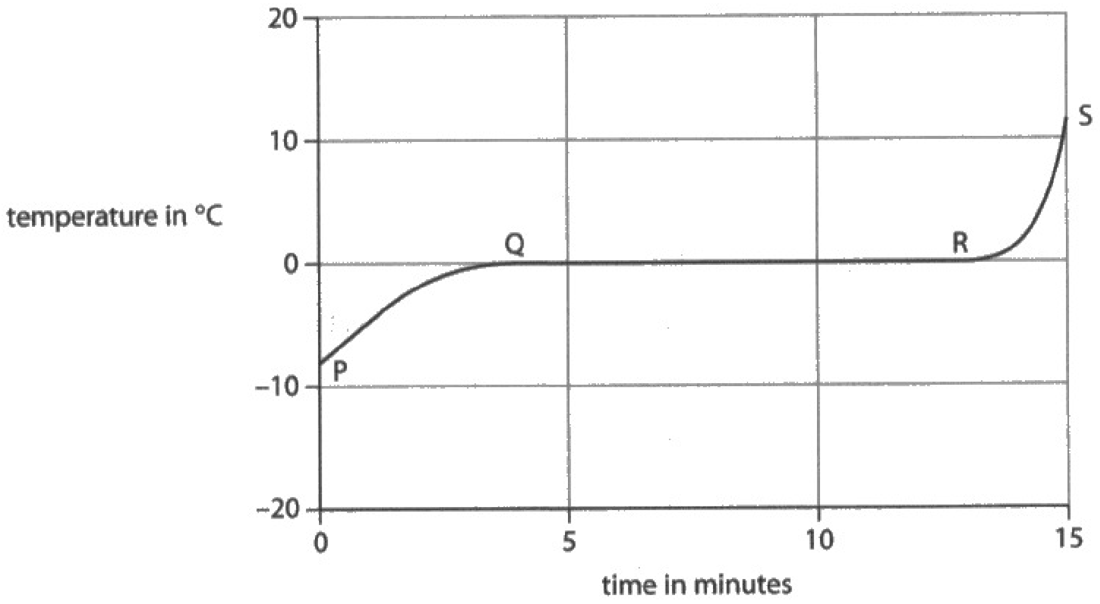


Figure 6

At the start, P, the beaker contains crushed ice at −8 °C.

Describe what happens to the crushed ice during the next 15 minutes.

You may use labels P, Q, R and S to help your answer.

(3)

~~From~~ from P to Q the tempature rises then from Q to R the Temperture is the same and R to S, it rises again

ResultsPlus
Examiner Comments

Brief answers for PQ, QR and RS temperature changes are given. They do match mark points 1, 2 and 3.

3 marks

(b) Figure 6 shows a graph produced from the data collected by the data logger in Figure 5.

Labels P, Q, R and S have been added.

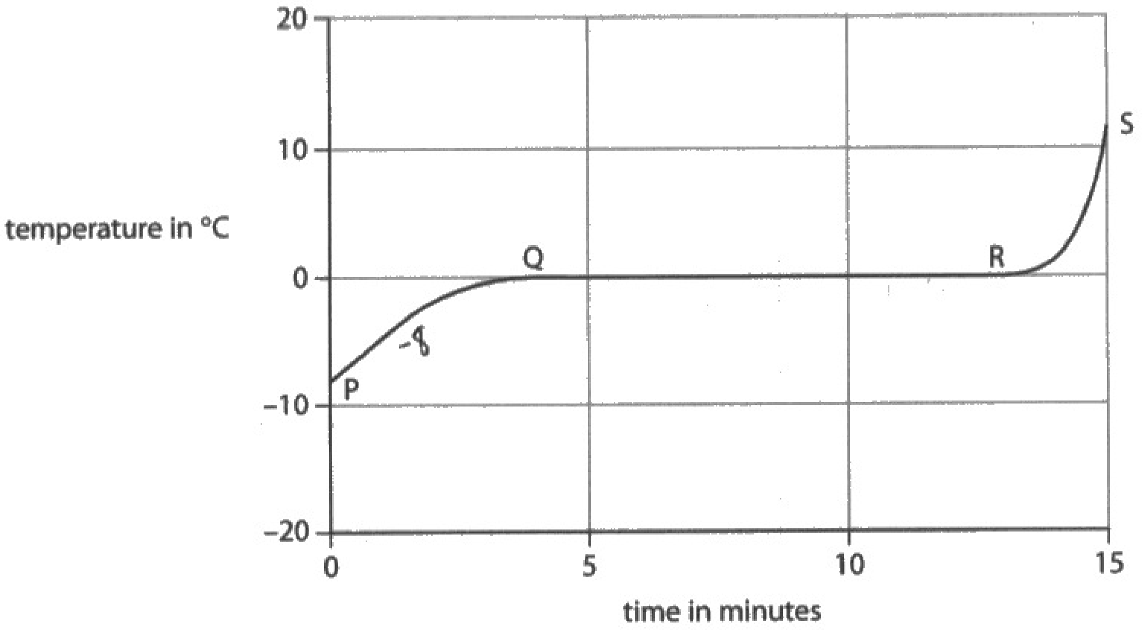


Figure 6

At the start, P, the beaker contains crushed ice at −8 °C.

Describe what happens to the crushed ice during the next 15 minutes.

You may use labels P, Q, R and S to help your answer.

(3)

~~after the beaker~~ At the start as said P is at -8 it then starts to increase at around 3mins(4)to a tenperature of 0(zero)until at R it starts to increase at around 13mins until S at 15 and looks as though its still increasing.

ResultsPlus
Examiner Comments

This matches mark points 1 and 3 for two marks. The intermediate 'temperature stays constant from Q to R' is missing.

(b) Figure 6 shows a graph produced from the data collected by the data logger in Figure 5.

Labels P, Q, R and S have been added.

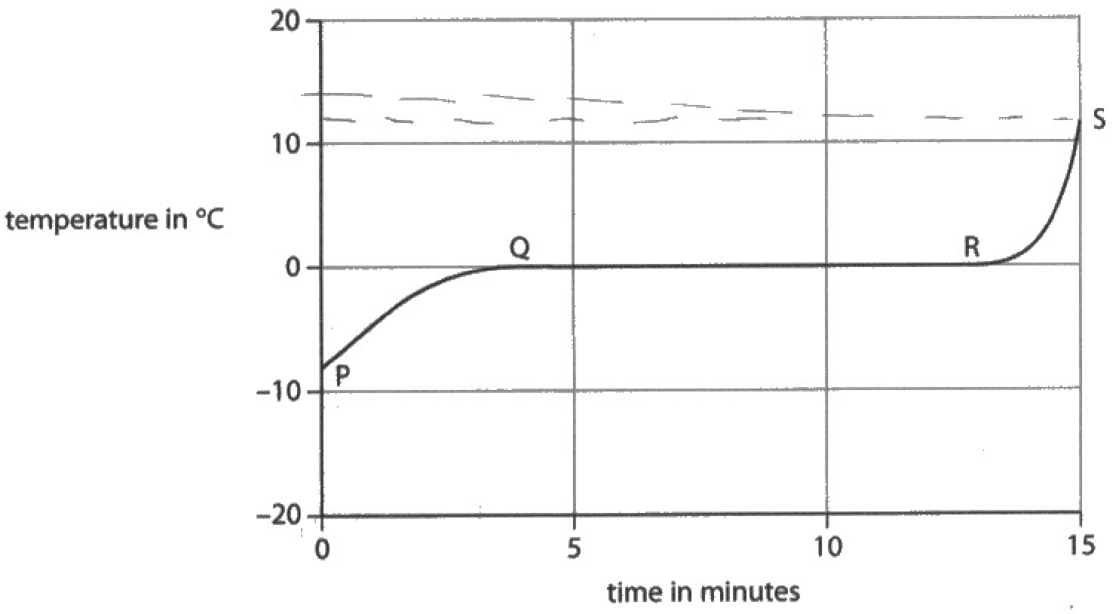


Figure 6

At the start, P, the beaker contains crushed ice at −8 °C.

Describe what happens to the crushed ice during the next 15 minutes.

You may use labels P, Q, R and S to help your answer.

(3)

In 15 minutes point P went up to 13°C It rapidly increased by 21°C in a short amount of time. The ice most likely would of melted

ResultsPlus
Examiner Comments

Mark point 4 was awarded here for the last sentence of the candidate's response.

The student describes the overall change in temperature but does not give any details of what's going on in the individual sections of time.

1 mark

(b) Figure 6 shows a graph produced from the data collected by the data logger in Figure 5.

Labels P, Q, R and S have been added.

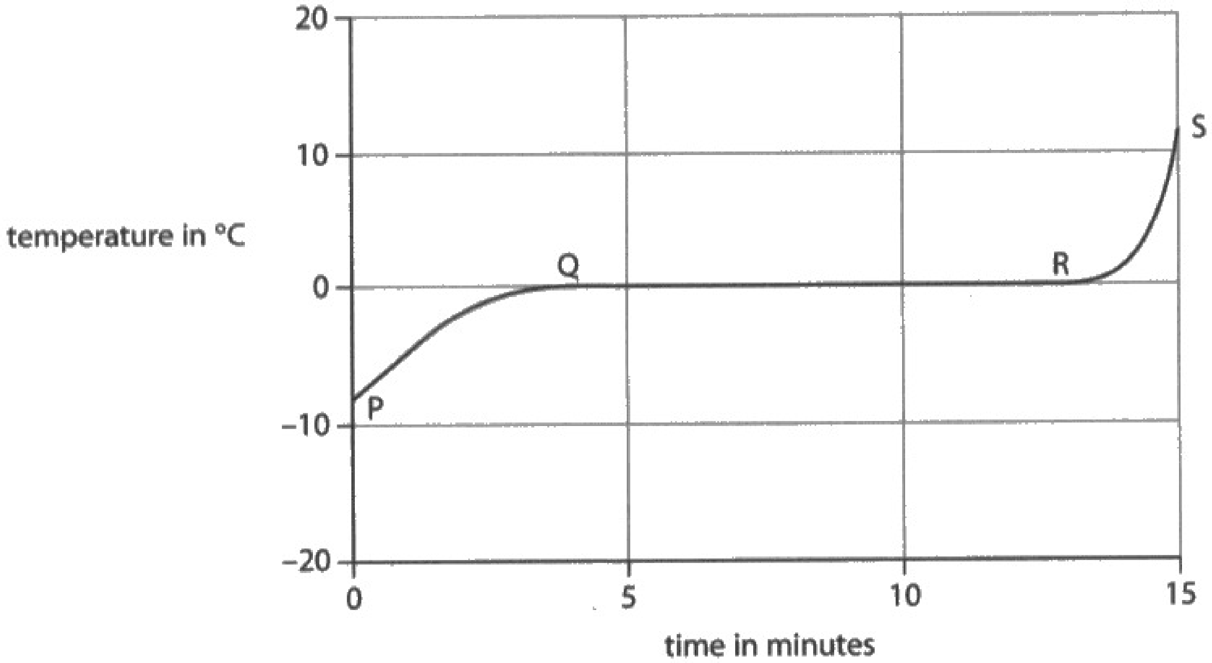


Figure 6

At the start, P, the beaker contains crushed ice at −8 °C.

Describe what happens to the crushed ice during the next 15 minutes.

You may use labels P, Q, R and S to help your answer.

(3)

At Q the temperature goes to 0° and for 10 minutes until R it stays 0°. Then at S the temperature increased and is now 12°,

ResultsPlus
Examiner Comments

This gains one mark for the middle section. Mark point 2 applies.

There's too much of 'at Q' and at 'at S', when it is time intervals that need spelling out, with their accompanying temperature changes.

ResultsPlus
Examiner Tip

When marking your work examiners cannot piece things together to make sense of what's missing.

Talking about what happened at a point leaves too much unsaid which phrases such as 'between P and Q... such and such a temperature change occurred' avoid.

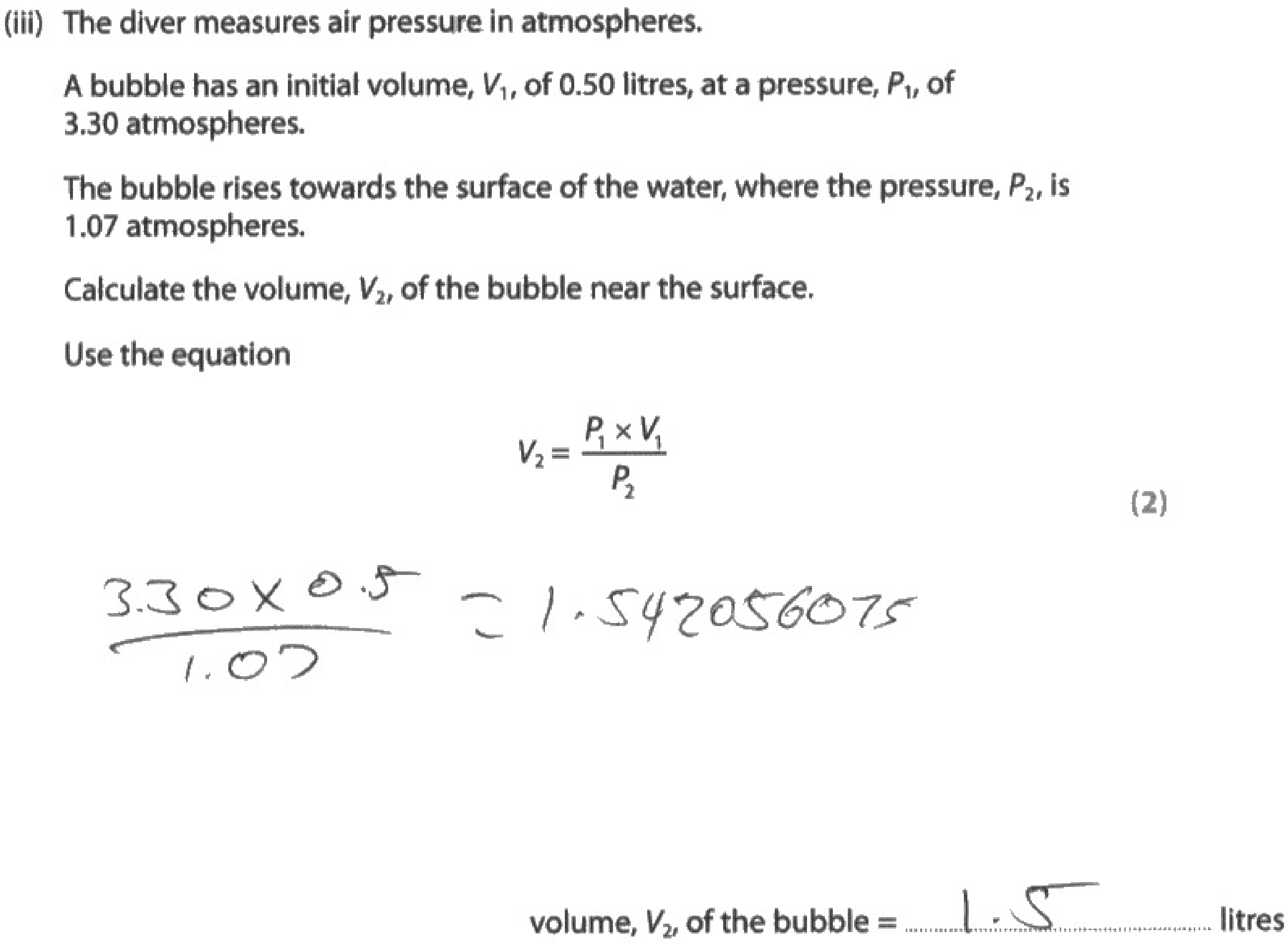
It is in your own interests to spell things out clearly.

Question 3 (c)(iii)

This involved substituting 3 values into

$$V_2 = \frac{P_1 \times V_1}{P_2}$$

Candidates often did very well with this, extracting the values from the descriptions in the text.



(iii) The diver measures air pressure in atmospheres.

A bubble has an initial volume, V_1, of 0.50 litres, at a pressure, P_1, of 3.30 atmospheres.

The bubble rises towards the surface of the water, where the pressure, P_2, is 1.07 atmospheres.

Calculate the volume, V_2, of the bubble near the surface.

Use the equation

$$V_2 = \frac{P_1 \times V_1}{P_2}$$

(2)

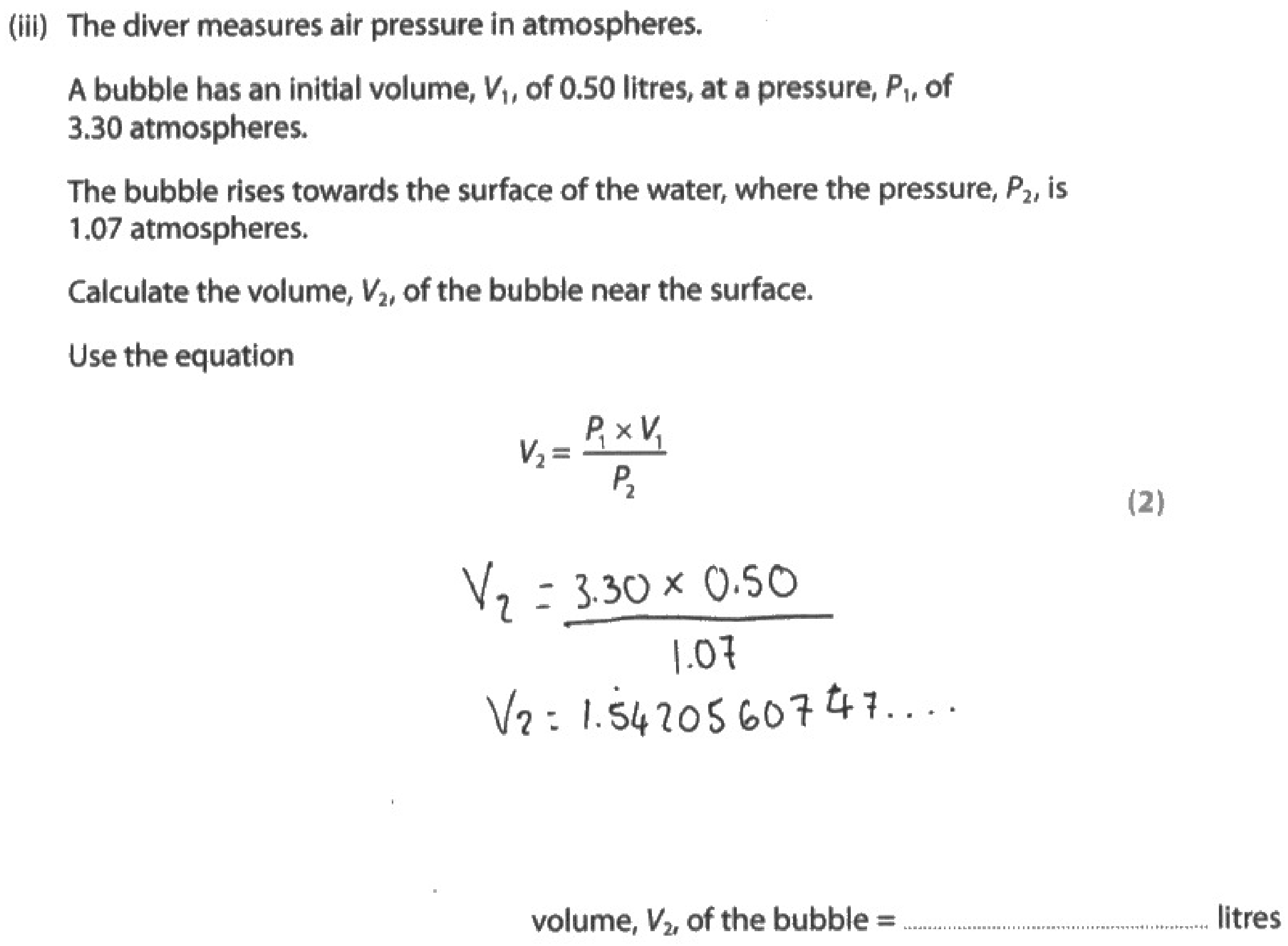
$$\frac{3.30 \times 0.5}{1.07} = 1.542056075$$

volume, V_2, of the bubble = 1.5 litres

ResultsPlus
Examiner Comments

The substitution and evaluation are both done very well.

This is an exemplary answer.



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Calculate the volume, V_2, of the bubble near the surface.

Use the equation

$$V_2 = \frac{P_1 \times V_1}{P_2}$$

(2)

$$V_2 = \frac{3.30 \times 0.50}{1.07}$$

$$V_2 = 1.5420560747....$$

volume, V_2, of the bubble = ... litres

ResultsPlus
Examiner Comments

Full marks given.

Clearly set out.

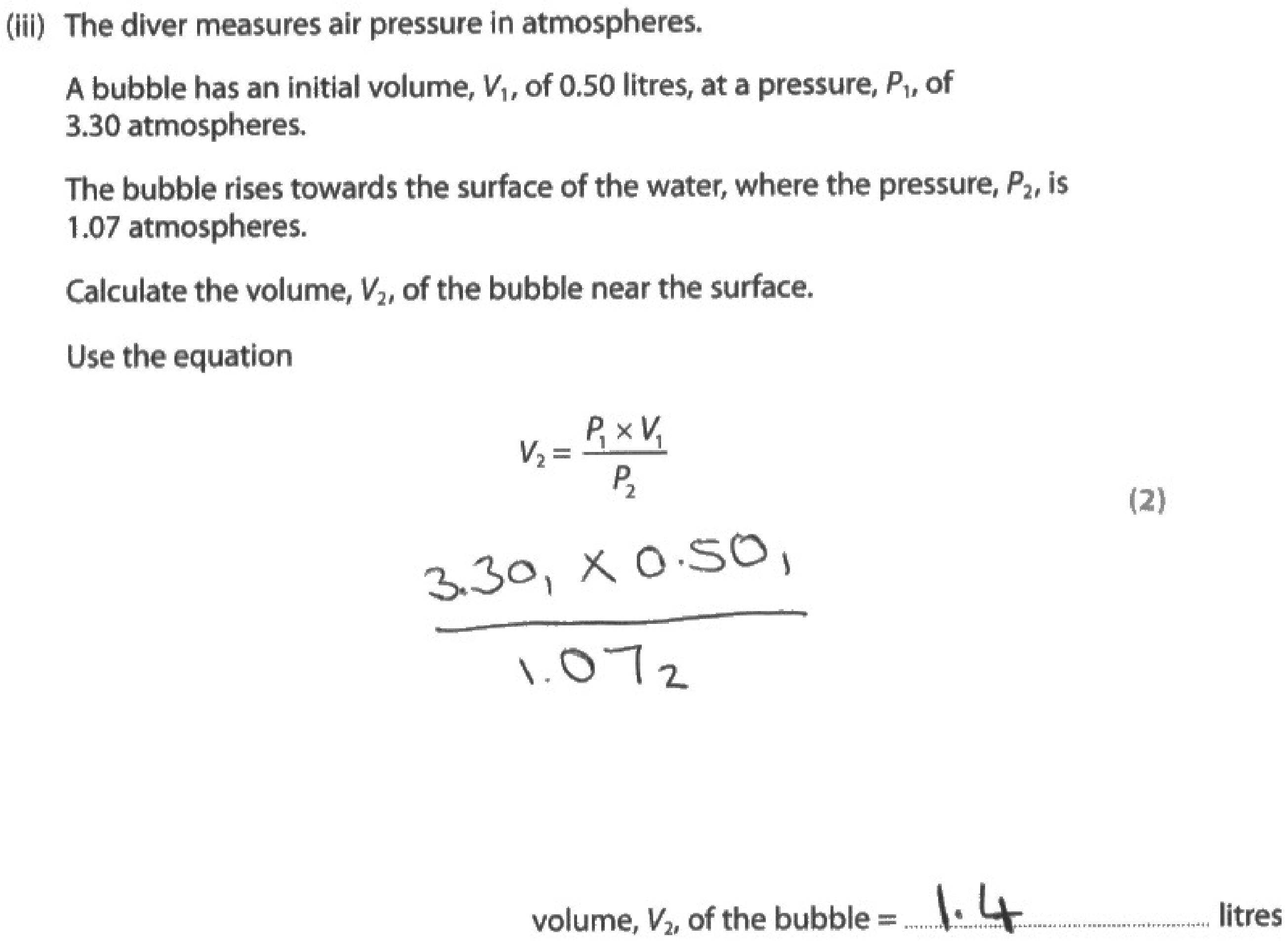
For this question there was no penalty for too many decimal places – significant figures were not asked for.

The mark is given, even though the final fill-in line was not completed. The candidate has done all that was absolutely necessary.

ResultsPlus
Examiner Tip

It makes sense to round numbers off and to see that as vital if a certain number of significant figures are asked for.

It helps to put an answer in the final answer line to draw attention to it and avoid any ambiguity about what you intended to be the final answer.



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A bubble has an initial volume, V_1, of 0.50 litres, at a pressure, P_1, of 3.30 atmospheres.

The bubble rises towards the surface of the water, where the pressure, P_2, is 1.07 atmospheres.

Calculate the volume, V_2, of the bubble near the surface.

Use the equation

$$V_2 = \frac{P_1 \times V_1}{P_2}$$

(2)

$$\frac{3.30_1 \times 0.50_1}{1.07_2}$$

volume, V_2, of the bubble = 1.4 litres

ResultsPlus
Examiner Comments

1 mark for substitution.

The mark scheme stipulates 'any number that rounds to 1.5' for the evaluation mark. This clearly doesn't.

The candidate could have squared 1.07 in the denominator; that yields 1.4(4) as an answer.

ResultsPlus
Examiner Tip

With V_1, P_2 symbols the numbers are called subscripts, referring to volume at first$_1$ and pressure at the end$_2$.

They shouldn't be put with the substitutions and certainly not squared in the case of P_2.

Question 4 (a)(i)

The great majority of candidates did well with this question, identifying the two poles of each of the two paperclips.

They did have to be shown at the ends of each paperclip. A few students with untidy placing of the poles made for difficult judgement calls from examiners.

4 This question is about magnets and magnetism.

(a) Figure 8 shows a magnet that has picked up three paper clips.

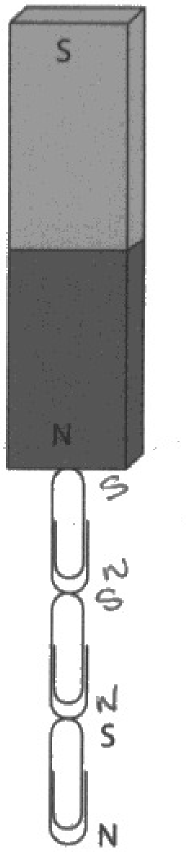


Figure 8

(i) The poles of the lowest paper clip are labelled.

Label the poles of the other two paper clips in Figure 8.

ResultsPlus
Examiner Comments

Full marks. Well annotated N and S poles at appropriate places.

ResultsPlus
Examiner Tip

Label poles carefully at the ends of the objects involved (the paperclips).

4 This question is about magnets and magnetism.

(a) Figure 8 shows a magnet that has picked up three paper clips.

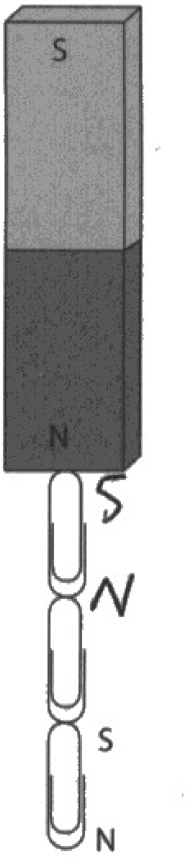


Figure 8

(i) The poles of the lowest paper clip are labelled.

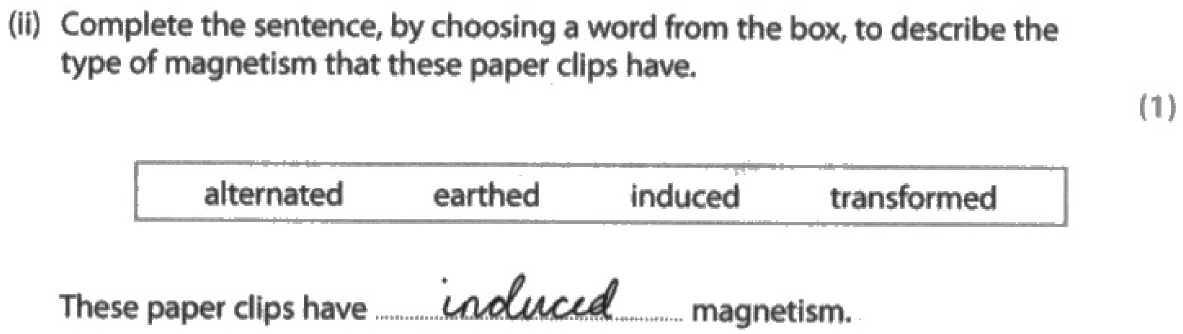
Label the poles of the other two paper clips in Figure 8.

ResultsPlus
Examiner Comments

This student labels the top paperclip with their correct poles but fails to label the one underneath.

Question 4 (a)(ii)

The majority of candidates recognised that this was a situation where ***induced*** magnetism was playing its part.



(ii) Complete the sentence, by choosing a word from the box, to describe the type of magnetism that these paper clips have.

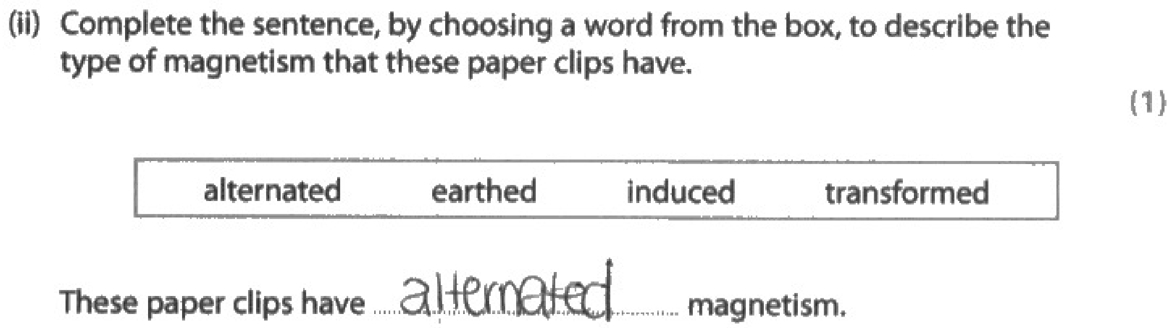
(1)

alternated	earthed	induced	transformed

These paper clips have induced magnetism.

ResultsPlus
Examiner Comments

Correct response, one mark awarded.



(ii) Complete the sentence, by choosing a word from the box, to describe the type of magnetism that these paper clips have.

(1)

alternated	earthed	induced	transformed

These paper clips have alternated magnetism.

ResultsPlus
Examiner Comments

See below.

ResultsPlus
Examiner Tip

This was the most regular (and wrong) adjective to use in this case.

Question 4 (a)(iii)

Many candidates chose iron as their chosen magnetic material, with a few choosing steel. Even less chose nickel and one or two chose cobalt.

Many also chose an incorrect metal, especially aluminium.

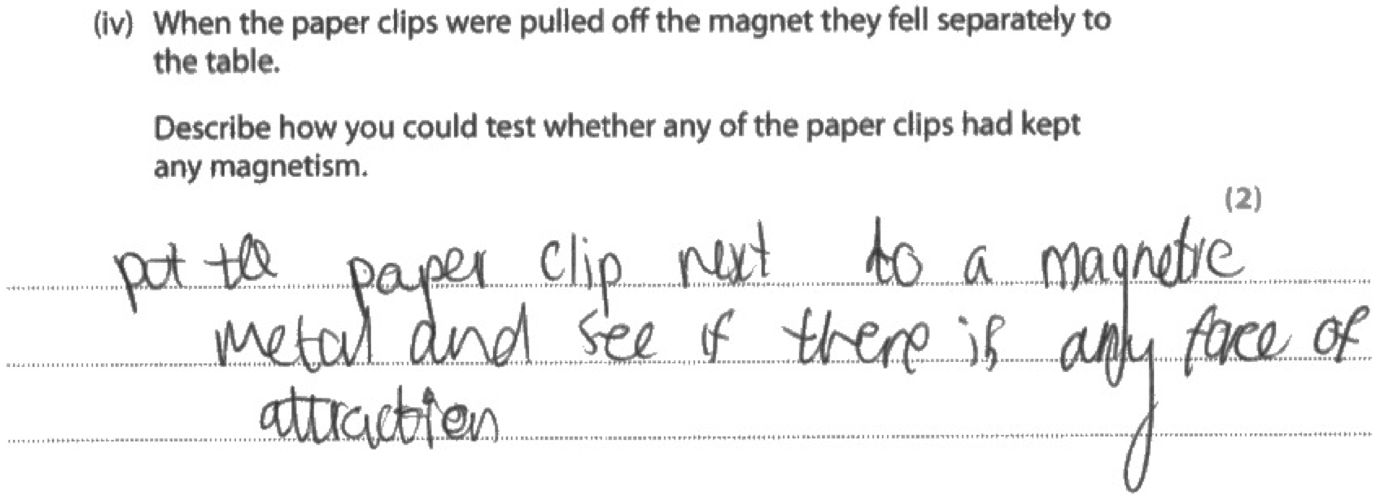
Question 4 (a)(iv)

There were six possible marking points available for this two marks question.

These were listed as possible pairs, e.g. first pair use a plotting compass (mark point – mp1) – needle (of compass) moves (mp2).

The second pair focused on bringing the paperclips together after they had been released from the main magnet. The third pair involved iron filings – using them to look for a pattern.

The second pair proved the most popular.



(iv) When the paper clips were pulled off the magnet they fell separately to the table.

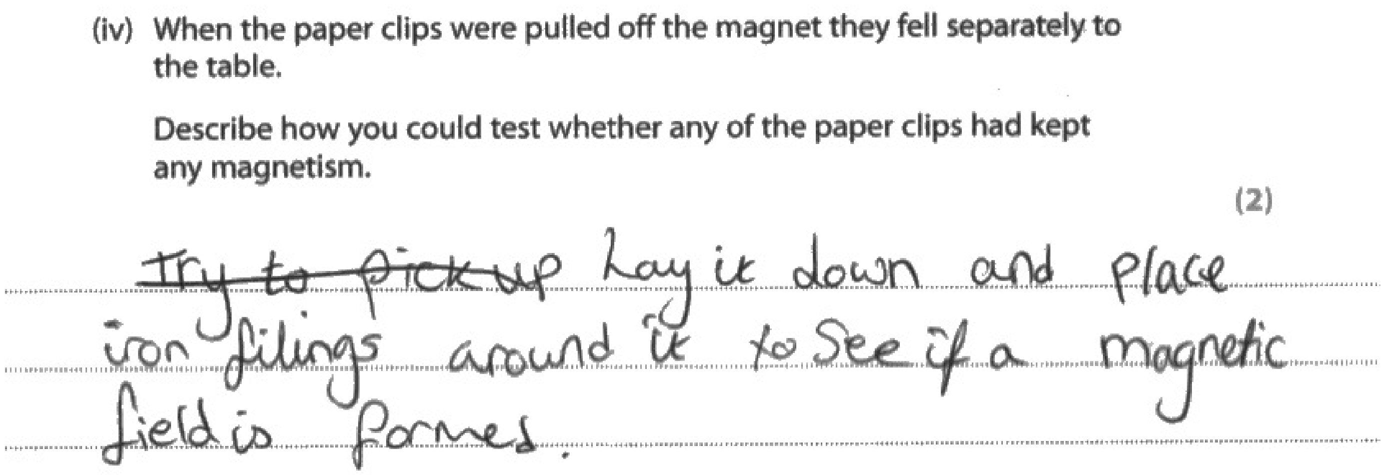
Describe how you could test whether any of the paper clips had kept any magnetism.

(2)

put the paper clip next to a magnetic metal and see if there is any force of attraction

ResultsPlus
Examiner Comments

This matches mark point 3 (additional guidance – bring near to a magnetic material) and mark point 4 'see if they attract'.



(iv) When the paper clips were pulled off the magnet they fell separately to the table.

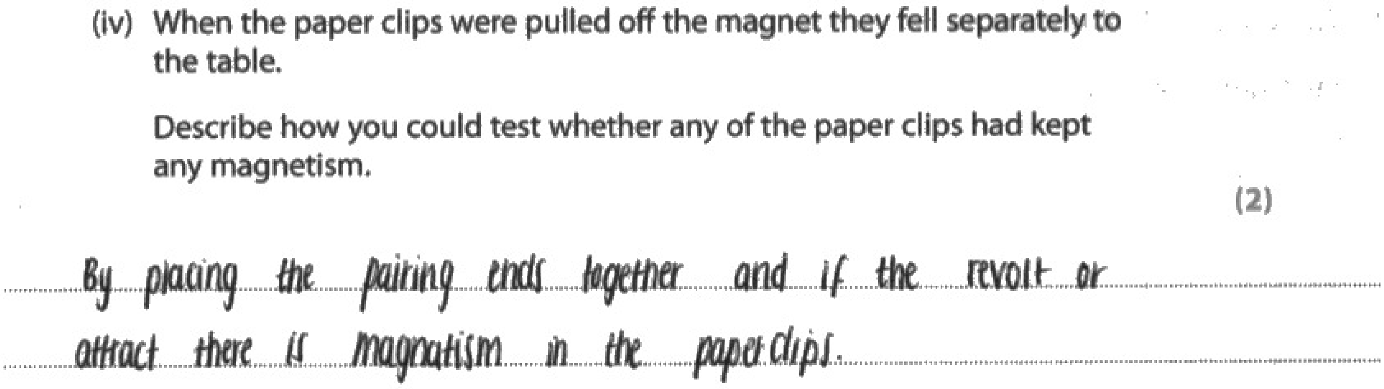
Describe how you could test whether any of the paper clips had kept any magnetism.

(2)

~~Try to pick up~~ Lay it down and place iron filings around it to See if a magnetic field is formes.

ResultsPlus
Examiner Comments

This matches mark point 5 and mark point 6. Some slight benefit of doubt is given to the phrase 'see if a magnetic field is formed (from the iron filings)'. That was taken as being equivalent to looking for a pattern.



(iv) When the paper clips were pulled off the magnet they fell separately to the table.

Describe how you could test whether any of the paper clips had kept any magnetism.

(2)

By placing the pairing ends together and if the revolt or attract there is magnatism in the paper clips.

ResultsPlus
Examiner Comments

The candidate is talking about bringing paperclips together and seeing if they attract – mark points 3 and 3.

2 marks awarded

(iv) When the paper clips were pulled off the magnet they fell separately to the table.

Describe how you could test whether any of the paper clips had kept any magnetism.

(2)

Use a plotting compass to
test the magnetic sield

ResultsPlus
Examiner Comments

Mark point 1 was matched but the candidate did not then effectively say how it would accomplish that test.

ResultsPlus
Examiner Tip

With practical questions always try and spell out exactly what you would do. How would it test what you wanted testing?

Question 4 (b)(i)

A minority of candidates recognised that the way to tell where a stronger magnetic field was through observing how close the (field) lines were to each other.

This was testing specification reference 12.4, 'relate the strength of the field to the concentration of lines'.

Only a minority of candidates responded that way.

The clips illustrate this.

(b) Figure 9 shows the magnetic field around a wire carrying a current.

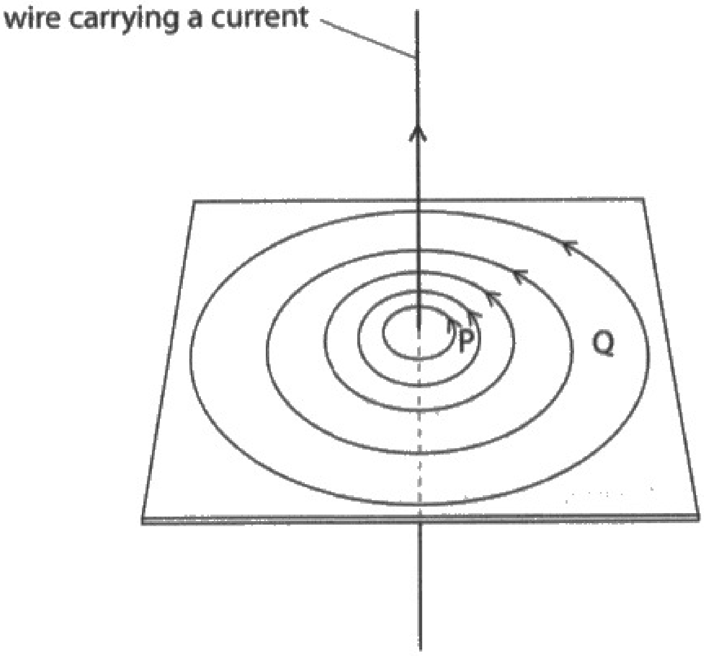


Figure 9

(i) State how you can tell from Figure 9 that the strength of the field is greater at P than at Q.

(1)

The Lines are closer together

ResultsPlus
Examiner Comments

See below.

ResultsPlus
Examiner Tip

This is exactly what was needed for the single mark available.

The key evidence from figure 9 is that the closer together lines are means the field is stronger there.

(b) Figure 9 shows the magnetic field around a wire carrying a current.

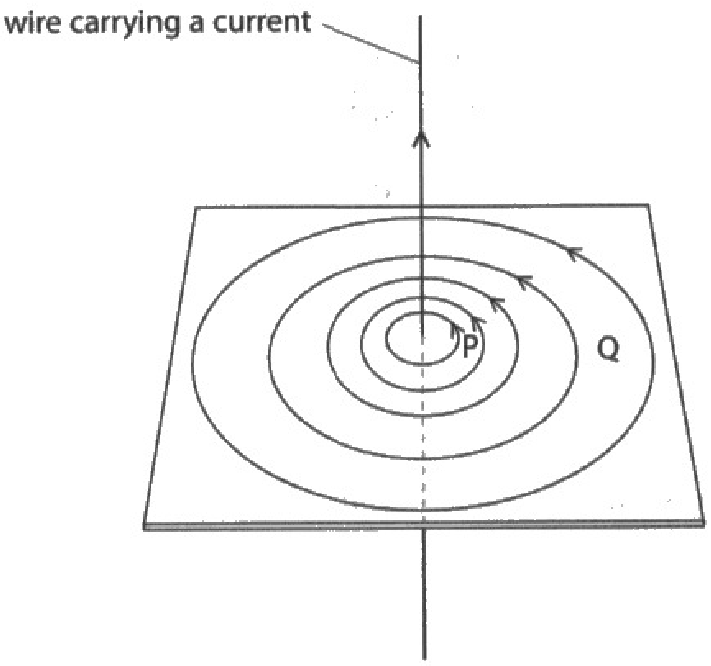


Figure 9

(i) State how you can tell from Figure 9 that the strength of the field is greater at P than at Q.

(1)

P is closer to the wire carrying a current

ResultsPlus
Examiner Comments

Unfortunately 'being closer to the wire' was not what was being asked for.

Question 4 (b)(ii)

A large majority of candidates scored one mark for identifying the basic trend.

A minority went on to the more refined point of linearity / direct proportionality.

(ii) The magnetic field strength is measured at P for different values of current in the wire.

The results of this investigation are shown in Figure 10.

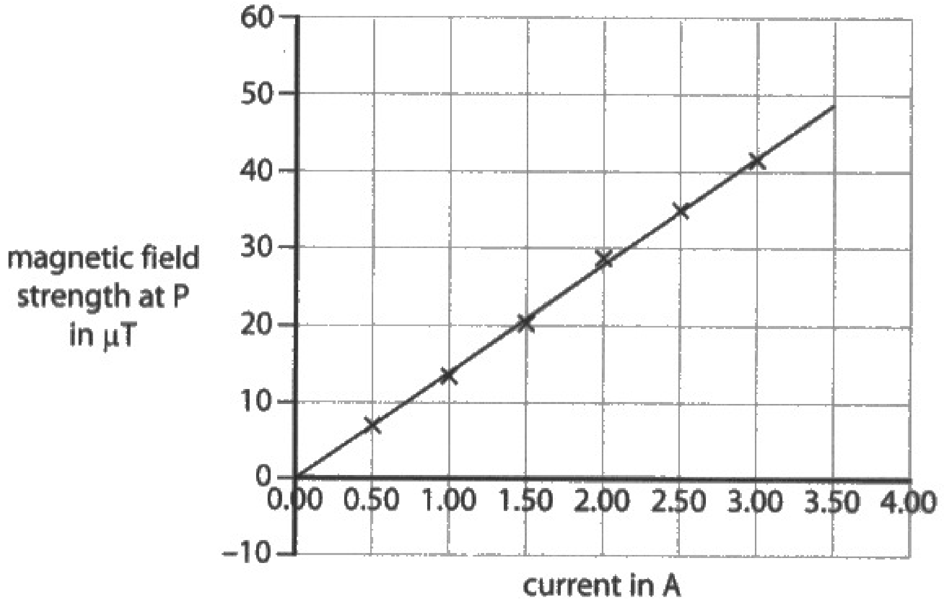


Figure 10

Describe the relationship between magnetic field strength and current.

(2)

the ~~relatiship~~ relationship between magnetic feild strength is directly proportional. As Mg increases, current increases.

ResultsPlus
Examiner Comments

As the mark scheme stipulates 'directly proportional' scores two marks.

(ii) The magnetic field strength is measured at P for different values of current in the wire.

The results of this investigation are shown in Figure 10.

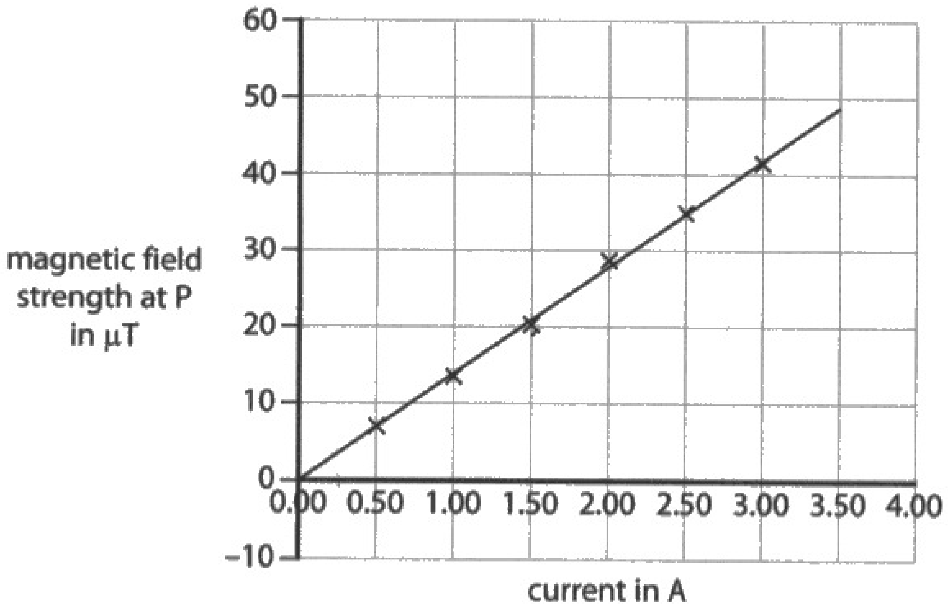


Figure 10

Describe the relationship between magnetic field strength and current.

(2)

- As the current increases, the strength of the magnetic field also increases. The ~~grad~~ magnetic field increases proportionally to the current. X

![ResultsPlus Examiner Comments]

ResultsPlus
Examiner Comments

Two marks awarded.

The proportional idea, correctly stated, was sufficient to gain the second mark.

(ii) The magnetic field strength is measured at P for different values of current in the wire.

The results of this investigation are shown in Figure 10.

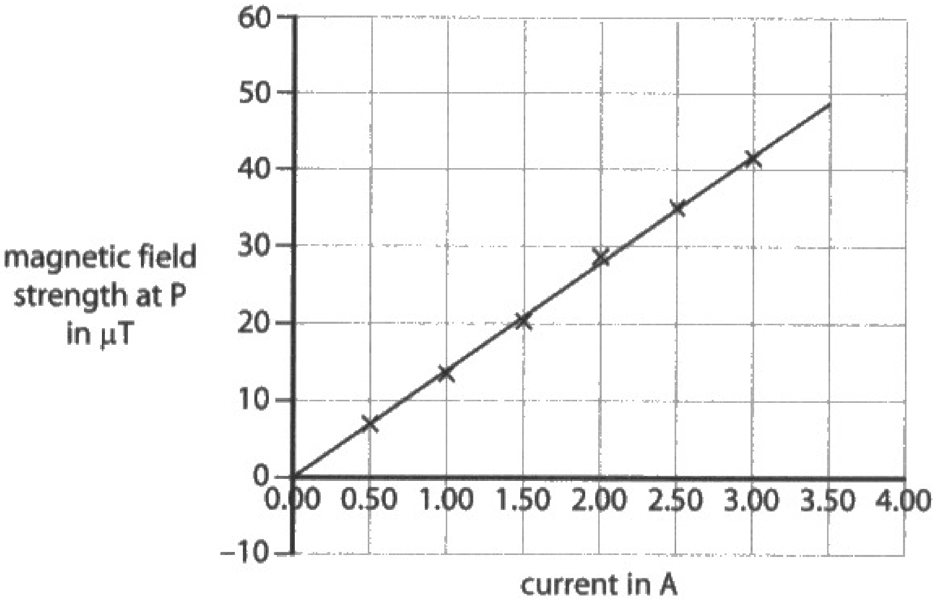


Figure 10

Describe the relationship between magnetic field strength and current.

(2)

As the magnetic field increase the current does also. In every 20 of magnetic field strength the current increases by 1.5.

ResultsPlus
Examiner Comments

Two marks awarded.

Another way of getting the second mark was the even steps idea, achieved here by this candidate through quoting numerical increments.

(ii) The magnetic field strength is measured at P for different values of current in the wire.

The results of this investigation are shown in Figure 10.

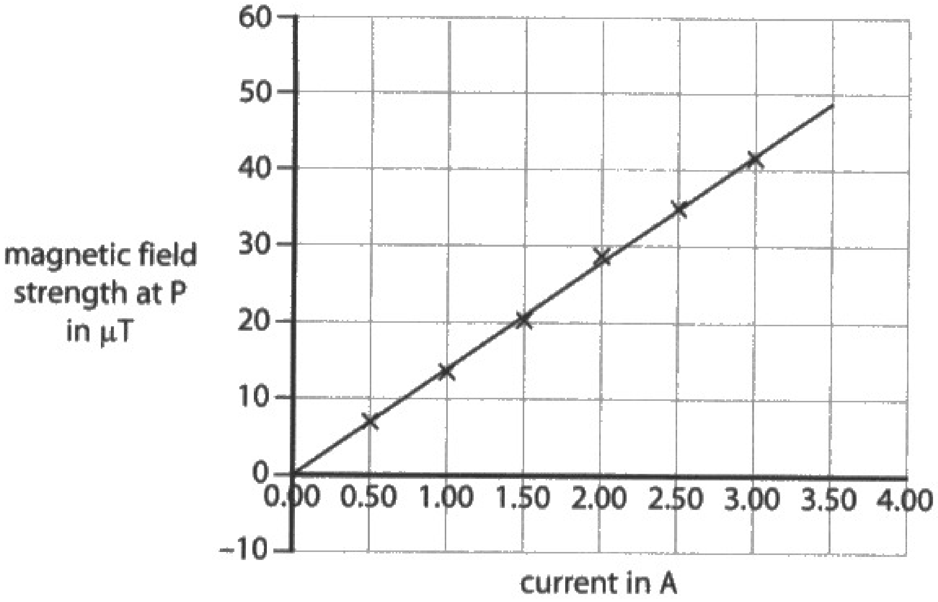


Figure 10

Describe the relationship between magnetic field strength and current.

(2)

As the magnetic field strength levels increase, as does the current.

ResultsPlus
Examiner Comments

This was the most common answer seen.

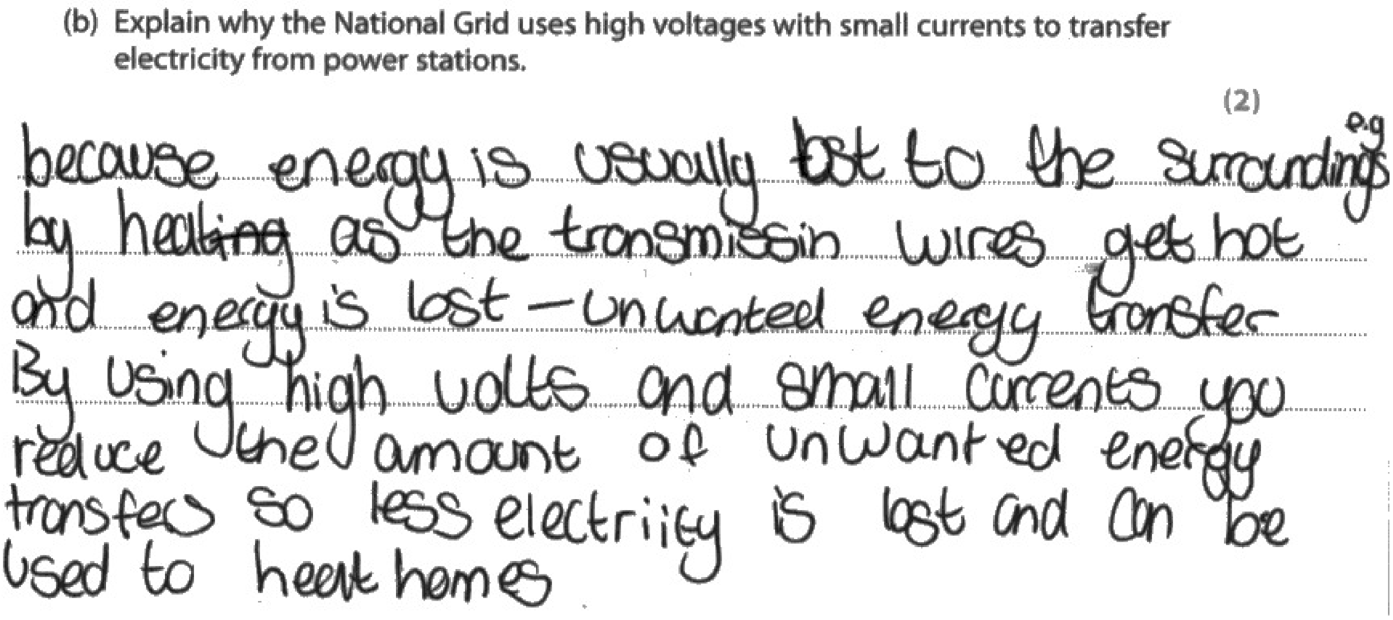
ResultsPlus
Examiner Tip

With graphical questions asking for a relationship between variables the answer almost always has two mark points. The easiest way of getting the second mark point, therefore, is to go on to comment upon whether the graph is linear or non-linear (straight line or curve).

Question 5 (b)

Most candidates incorrectly based their answers around contending that transmitting at high voltage and low current was safer or faster.

The key point is rather efficiency (mark point mp3) with less power wasted (mp2). This is achieved by minimising the current in the transmission lines. Otherwise the heating effect of current (mp1) causes that energy loss / inefficiency.



(b) Explain why the National Grid uses high voltages with small currents to transfer electricity from power stations.

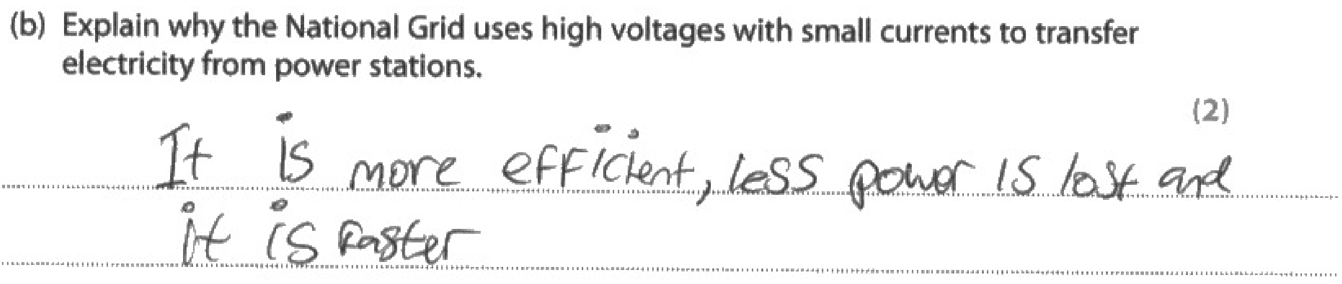
(2)

because energy is usually lost to the surroundings e.g by heating as the transmissin wires get hot and energy is lost – unwanted energy transfer By using high volts and small currents you reduce the amount of unwanted energy transfers so less electriity is lost and can be used to heat homes

ResultsPlus
Examiner Comments

This is an excellent answer, beginning with mark point 2, about energy lost / wasted, going on to cover mark point 1 about the heating effect in wires carrying current.

The less electricity is lost final comment may be ignored.



(b) Explain why the National Grid uses high voltages with small currents to transfer electricity from power stations.

(2)

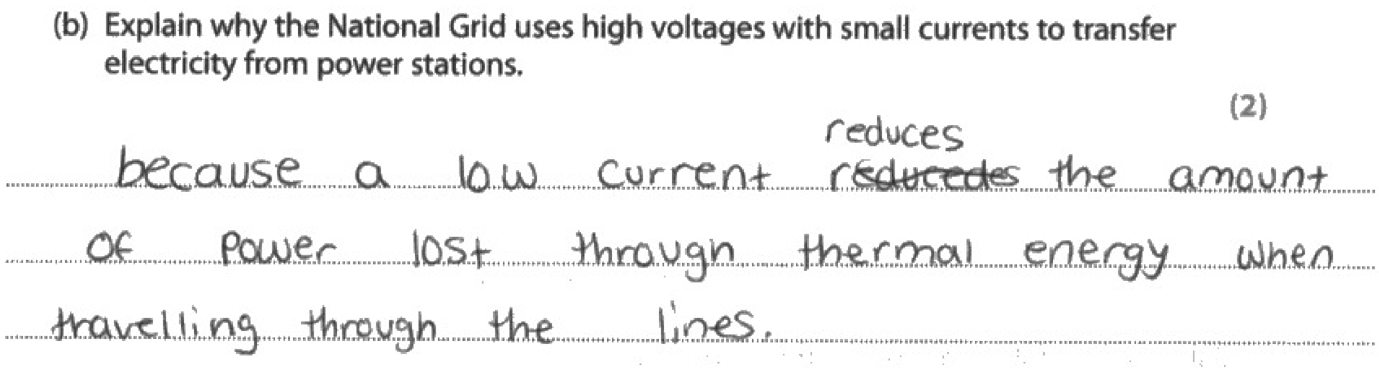
It is more efficient, less power is lost and it is faster

ResultsPlus Examiner Comments

See below.

ResultsPlus Examiner Tip

This matches mark points 2 and 3 in the first line of the candidate's answer.



(b) Explain why the National Grid uses high voltages with small currents to transfer electricity from power stations.

(2)

because a low current ~~reducedes~~ reduces the amount of power lost through thermal energy when travelling through the lines.

ResultsPlus Examiner Comments

This also expresses the ideas of power losses and the thermal effect through current travelling 'though the lines'.

2 marks

(b) Explain why the National Grid uses high voltages with small currents to transfer electricity from power stations.

(2)

To prevent waste of energy and electricity. ~~To prevent~~ Transfomer decreases or increeses the voltage. To provide enough electricity for houses etc. current increases in transfomer

ResultsPlus
Examiner Comments

This gets one mark through the comment about preventing 'waste of energy' matching mark point 2.

Question 5 (c)(i)

This question required inspecting the diagram to retrieve information, which was then fed into the equation for power.

It was a high scoring item.

(c) Figure 12 shows details of a transformer.

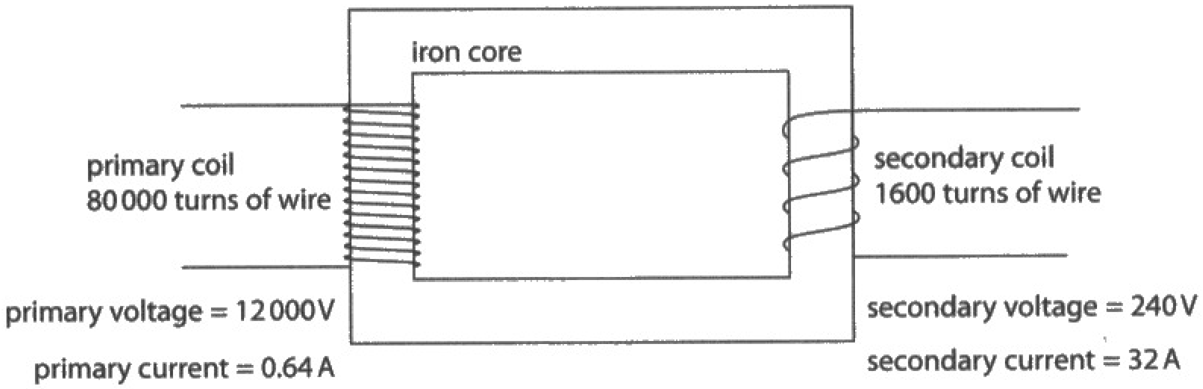


Figure 12

(i) Calculate the power in the primary coil.

Use the equation

0.64

$$P = V \times I$$

(2)

0.64 X 12000

~~12000x~~

power in the primary coil = 7680 W

ResultsPlus
Examiner Comments

A correct evaluation, with working shown.

Most candidates achieved this.

2 marks

(c) Figure 12 shows details of a transformer.

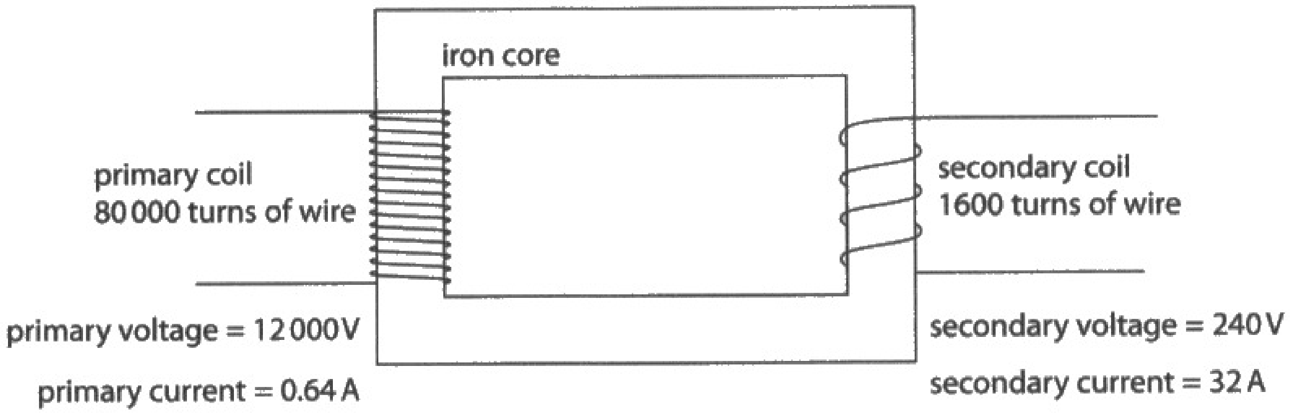


Figure 12

(i) Calculate the power in the primary coil.

Use the equation

$$P = V \times I$$

(2)

P = 12000 × 0.64

P = 7.680

power in the primary coil = 7.680 W

ResultsPlus
Examiner Comments

The candidate interprets and extracts correct data from the diagram.

The substitution earned one mark.

The evaluation clearly has a decimal point after the '7'. That mark is missed with the candidate's answer being a factor of 1000 out from the correct answer.

ResultsPlus Examiner Tip

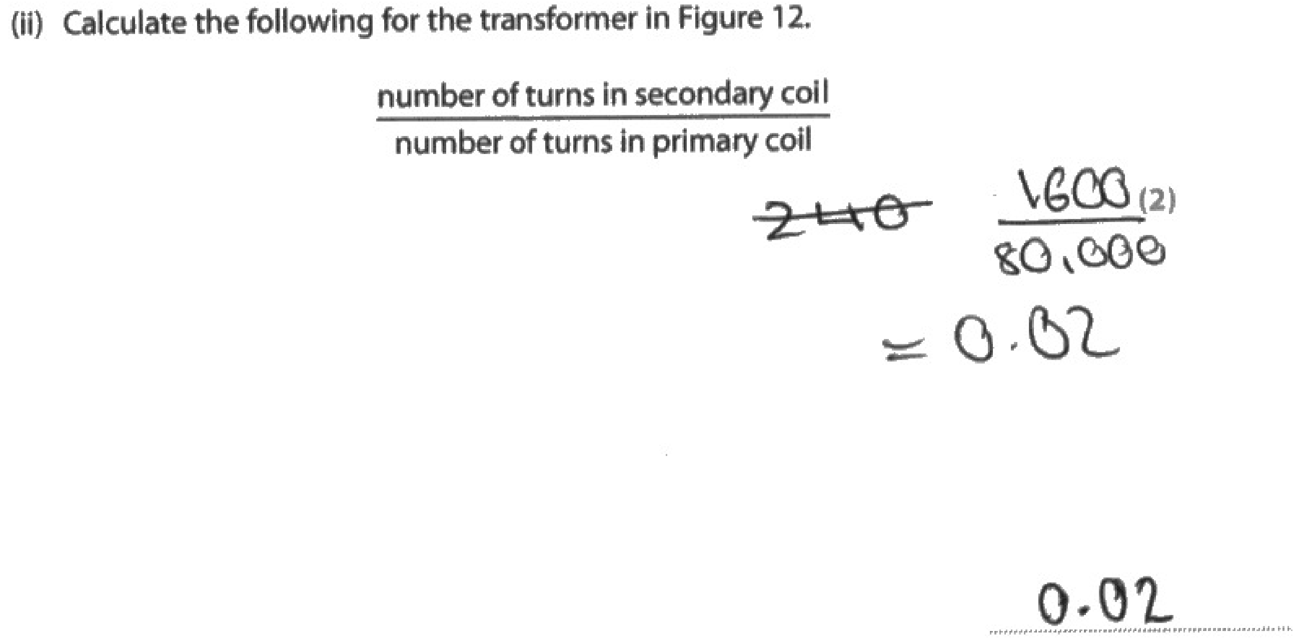
Careful calculator use is always needed.

Some common sense reflection would help avoid mistakes, e.g. here, in your head is 12000 x 0.64 likely to be 7.68?

Question 5 (c)(ii)

This was a very high scoring item, again requiring obtaining the relevant data from the table.

If the student counted coils seen on the schematic diagram that was allowed some credit. However since the number of coils on the transformer were clearly stated in the diagram those numbers were expected to be used.



(ii) Calculate the following for the transformer in Figure 12.

$$\frac{\text{number of turns in secondary coil}}{\text{number of turns in primary coil}}$$

~~240~~ $\frac{1600}{80{,}000}$ (2)

$= 0.02$

0.02

ResultsPlus
Examiner Comments

A very large majority of students scored both marks on this item, as this candidate has done.

(ii) Calculate the following for the transformer in Figure 12.

$$\frac{\text{number of turns in secondary coil}}{\text{number of turns in primary coil}}$$

(2)

80 000 ÷ 1600 = 50

50

ResultsPlus
Examiner Comments

One mark was given to candidates who mistakenly inverted the two numbers.

(ii) Calculate the following for the transformer in Figure 12.

$$\frac{\text{number of turns in secondary coil}}{\text{number of turns in primary coil}}$$

(2)

$$\frac{\cancel{3}4}{15}$$

$= 0.26$

0.26

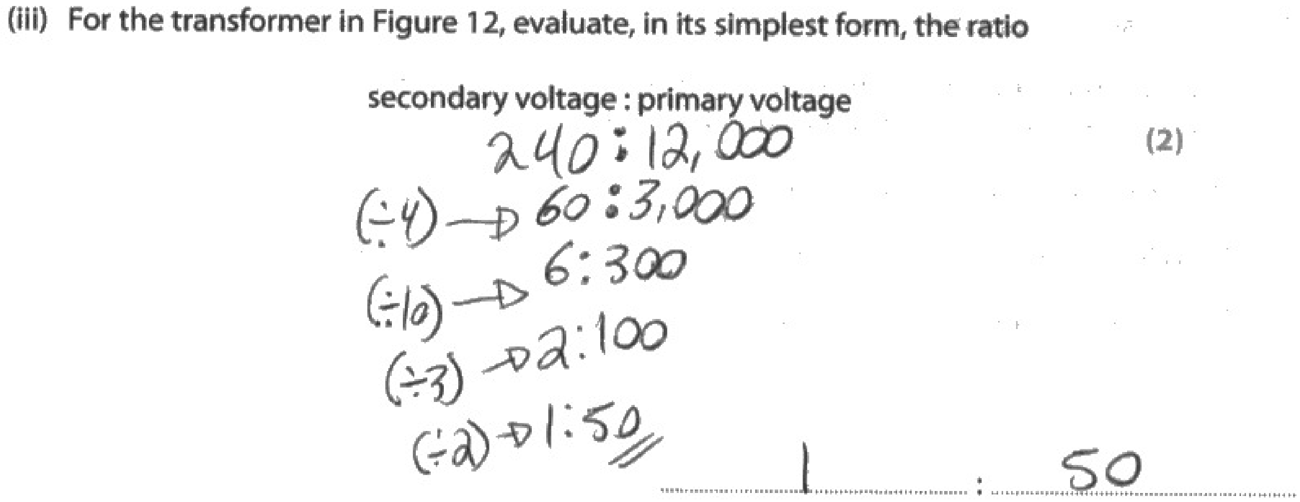
ResultsPlus
Examiner Comments

One mark was awarded for candidates who counted coils in the diagram, as opposed to taking the real data, which was labelled in the diagram.

Question 5 (c)(iii)

This ratio should be the same as the fractional answer given in Q05(c)ii (for a 100% efficient transformer).

With ramping of degree of difficulty within this question, no credit was now given for inverse ratios.



(iii) For the transformer in Figure 12, evaluate, in its simplest form, the ratio

secondary voltage : primary voltage

240 : 12,000

(÷4) → 60 : 3,000

(÷10) → 6 : 300

(÷3) → 2 : 100

(÷2) → 1 : 50

(2)

1 : 50

ResultsPlus
Examiner Comments

This candidate carefully simplifies the ratio.

They also explain each step in the brackets.

This is commendable, helping them to focus on accurate working.

(iii) For the transformer in Figure 12, evaluate, in its simplest form, the ratio

secondary voltage : primary voltage

(2)

240 : 12000

24 : 1200

: 600

12 : 100

2

240 : 12000

120 : 6000

60 : 3000

~~2~~ 30 : 1500

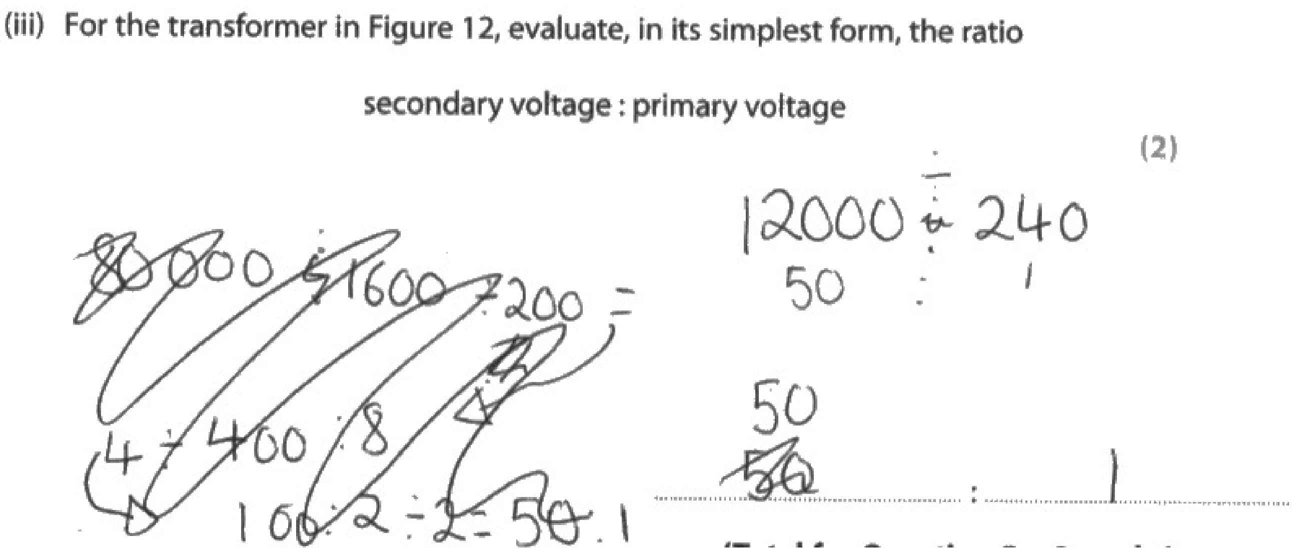
10 : 300

1 : 3

ResultsPlus
Examiner Comments

This candidate substitutes the correct values from the diagram, so gets one mark.

Unfortunately they then make a mistake two thirds of the way down their chosen simplification route, getting the wrong answer.



(iii) For the transformer in Figure 12, evaluate, in its simplest form, the ratio

secondary voltage : primary voltage

(2)

~~80000 ÷ 1600 ÷ 200 =~~

~~4 ÷ 400 ÷ 8 ÷ 4~~

~~100 ÷ 2 ÷ 2 = 50 : 1~~

12000 ÷ 240

50 : 1

50

~~56~~ : 1

ResultsPlus
Examiner Comments

It is a pity the candidate gets the ratio the wrong way round.

ResultsPlus
Examiner Tip

Make a check on which is which voltage from the diagram, to avoid this mistake.

Question 6 (a)

A large majority scored full marks on this item.

Finding 'arithmetic means' is a mathematical skill candidates are expected to have.

This was the case with a very large majority of candidates, scoring full marks on this question.

6 This question is about energy transfers.

Figure 13 shows the apparatus used for investigating the transfer between gravitational potential energy and kinetic energy.

A metal ball is attached to a thread.

The ball is released from a starting position and swings on the thread.

The ball cuts a light beam at the bottom of its swing.

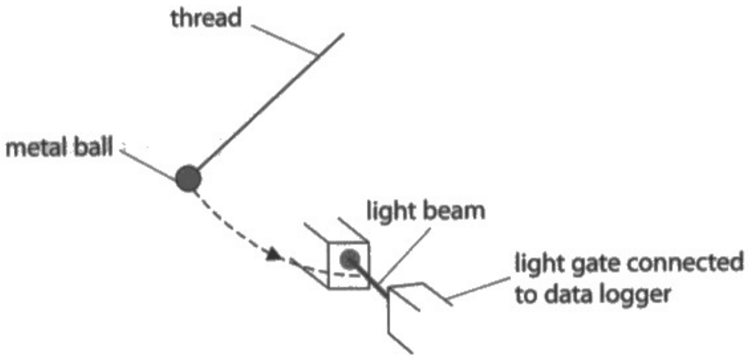


Figure 13

When the ball cuts the light beam, the speed of the ball is recorded by the data logger.

The ball was released 3 times from the same height and the speed measured each time.

The measurements of speed are given in Figure 14.

speed in m/s	1.31	1.27	1.16

Figure 14

(a) Calculate the mean speed.

(2)

1.31
1.27
1.16 +

3.74 ÷ 3 = 1.25

mean speed = 1.25 m/s

ResultsPlus
Examiner Comments

The mark scheme stipulates 'any answer that rounds to 1.25 (m/s)' for the two marks.

This response achieves that perfectly.

6 This question is about energy transfers.

Figure 13 shows the apparatus used for investigating the transfer between gravitational potential energy and kinetic energy.

A metal ball is attached to a thread.

The ball is released from a starting position and swings on the thread.

The ball cuts a light beam at the bottom of its swing.

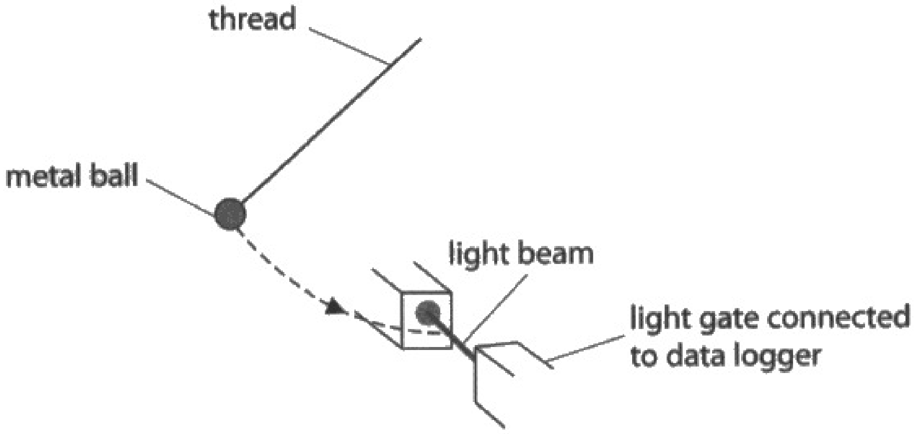


Figure 13

When the ball cuts the light beam, the speed of the ball is recorded by the data logger.

The ball was released 3 times from the same height and the speed measured each time.

The measurements of speed are given in Figure 14.

speed in m/s	1.31	1.27	1.16

Figure 14

(a) Calculate the mean speed.

(2)

$$\frac{1.31 + 1.27 + 1.16}{3}$$

mean speed = 1.246 m/s

ResultsPlus
Examiner Comments

Fully correct, two marks.

There is no significant figures demand for this question.

The candidate sets out their working in a clear and methodical manner.

6 This question is about energy transfers.

Figure 13 shows the apparatus used for investigating the transfer between gravitational potential energy and kinetic energy.

A metal ball is attached to a thread.

The ball is released from a starting position and swings on the thread.

The ball cuts a light beam at the bottom of its swing.

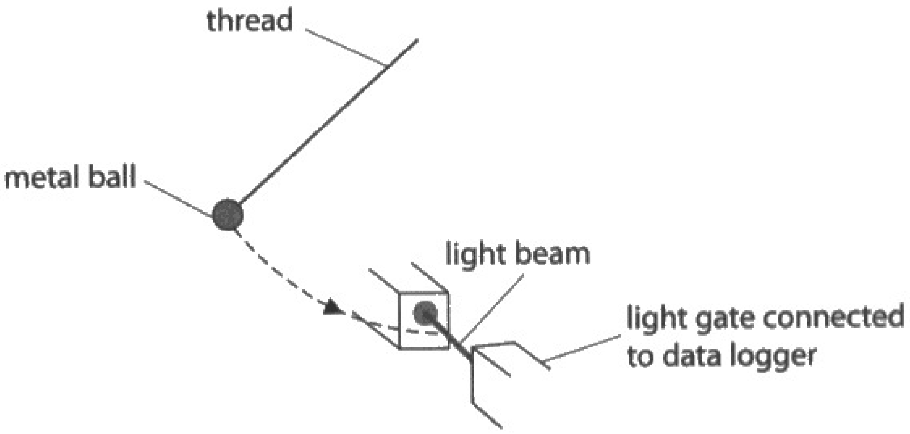


Figure 13

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The ball was released 3 times from the same height and the speed measured each time.

The measurements of speed are given in Figure 14.

speed in m/s	1.31	1.27	1.16

Figure 14

(a) Calculate the mean speed. **(2)**

1.31
1·16 +
1·27 +
3·74 ÷ 3 = 1.216
1

mean speed = 1.216 m/s

ResultsPlus
Examiner Comments

The substitution of values into the mean speed calculation gives the first mark.

Then a mistake is made in the arithmetic.

ResultsPlus
Examiner Tip

This type of question really does require a calculator.

It would be a pity to miss out on marks if you forgot to have it with you . . . .

6 This question is about energy transfers.

Figure 13 shows the apparatus used for investigating the transfer between gravitational potential energy and kinetic energy.

A metal ball is attached to a thread.

The ball is released from a starting position and swings on the thread.

The ball cuts a light beam at the bottom of its swing.

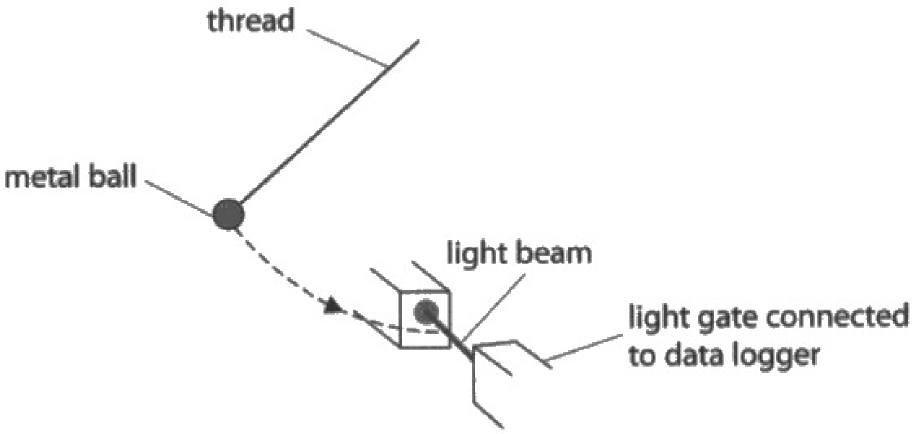


Figure 13

When the ball cuts the light beam, the speed of the ball is recorded by the data logger.

The ball was released 3 times from the same height and the speed measured each time.

The measurements of speed are given in Figure 14.

speed in m/s	1.31	1.27	1.16

Figure 14

(a) Calculate the mean speed. **(2)**

$$\frac{1{\cdot}31+1{\cdot}27+1{\cdot}16}{3} = 3{\cdot}74$$

mean speed = 3·74 m/s

ResultsPlus Examiner Comments

First mark point achieved via substituting into an equation for the mean.

Then the candidate fails to write down the result of the division, just quoting the numerator of the fraction as the answer.

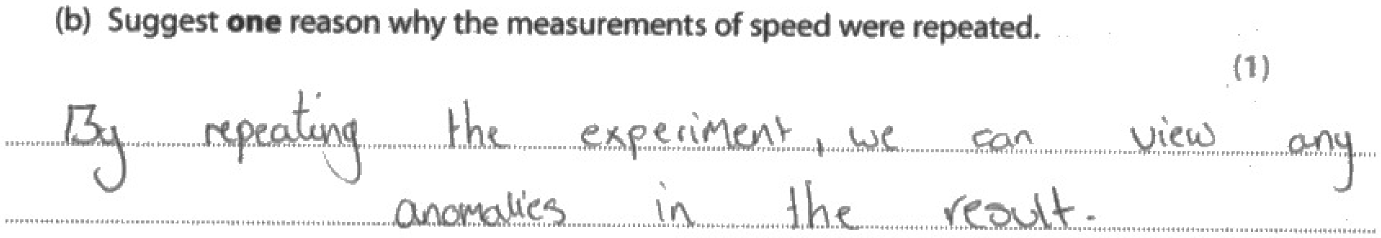
Question 6 (b)

The question asked for 'one reason why the measurements of speed were repeated'.

Familiarity with experimental methods was tested.

Unfortunately many candidates did not have an adequate answer. Most students stated “accuracy” incorrectly for their reason.

Later in this question, in part d(ii), a compensatory mark was allowed for using that word. "Accuracy" is used far too indiscriminately by students as a catch-all explanation in reasons behind experimental practice.



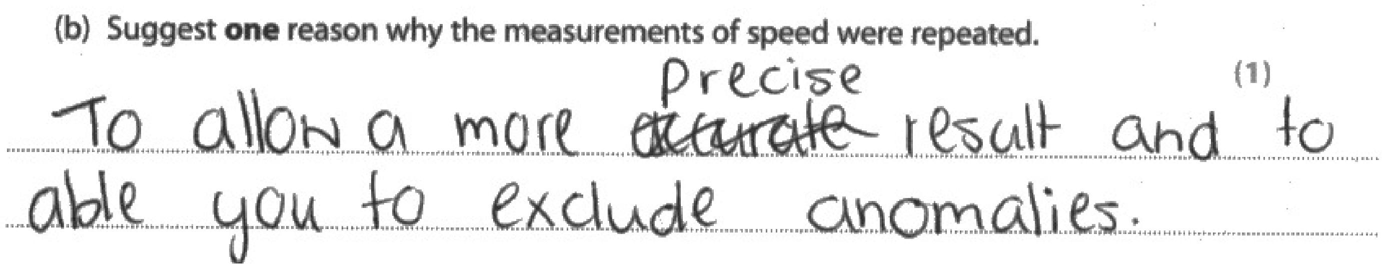
(b) Suggest **one** reason why the measurements of speed were repeated.

(1)

By repeating the experiment, we can view any anomalies in the result.

ResultsPlus
Examiner Comments

This matches mark point 1 in the mark scheme.



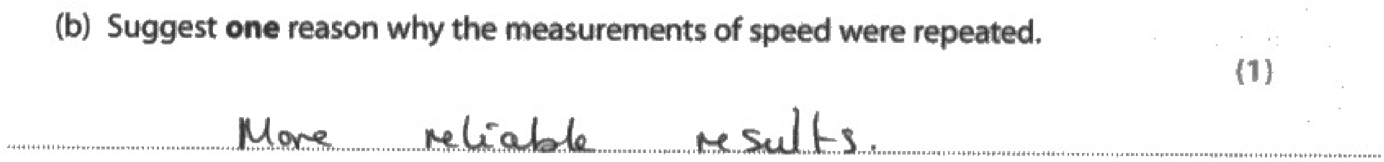
(b) Suggest **one** reason why the measurements of speed were repeated.

(1)

To allow a more ~~accurate~~ precise result and to able you to exclude anomalies.

ResultsPlus
Examiner Comments

This matches mark point 1, and the mark scheme allowed 'more precise' as an alternative as well.



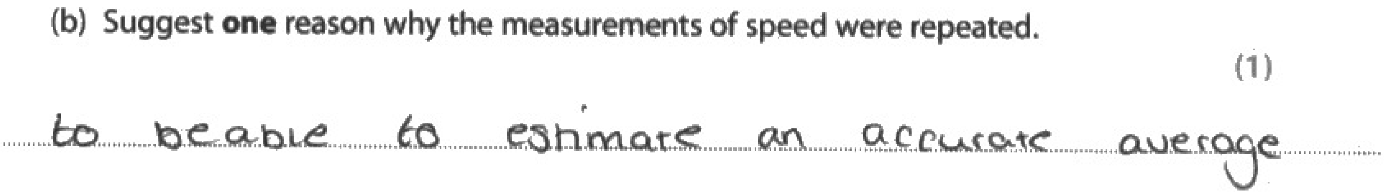
(b) Suggest **one** reason why the measurements of speed were repeated.

(1)

More reliable results.

ResultsPlus
Examiner Comments

This matches mark point 2 of the mark scheme.



(b) Suggest **one** reason why the measurements of speed were repeated.

(1)

to be able to estimate an accurate average

ResultsPlus
Examiner Comments

Mark scheme stipulates 'ignore accuracy'.

ResultsPlus
Examiner Tip

Repeat checks to show up anomalies and to show whether a measurement is reliable or not.

What does accuracy mean?

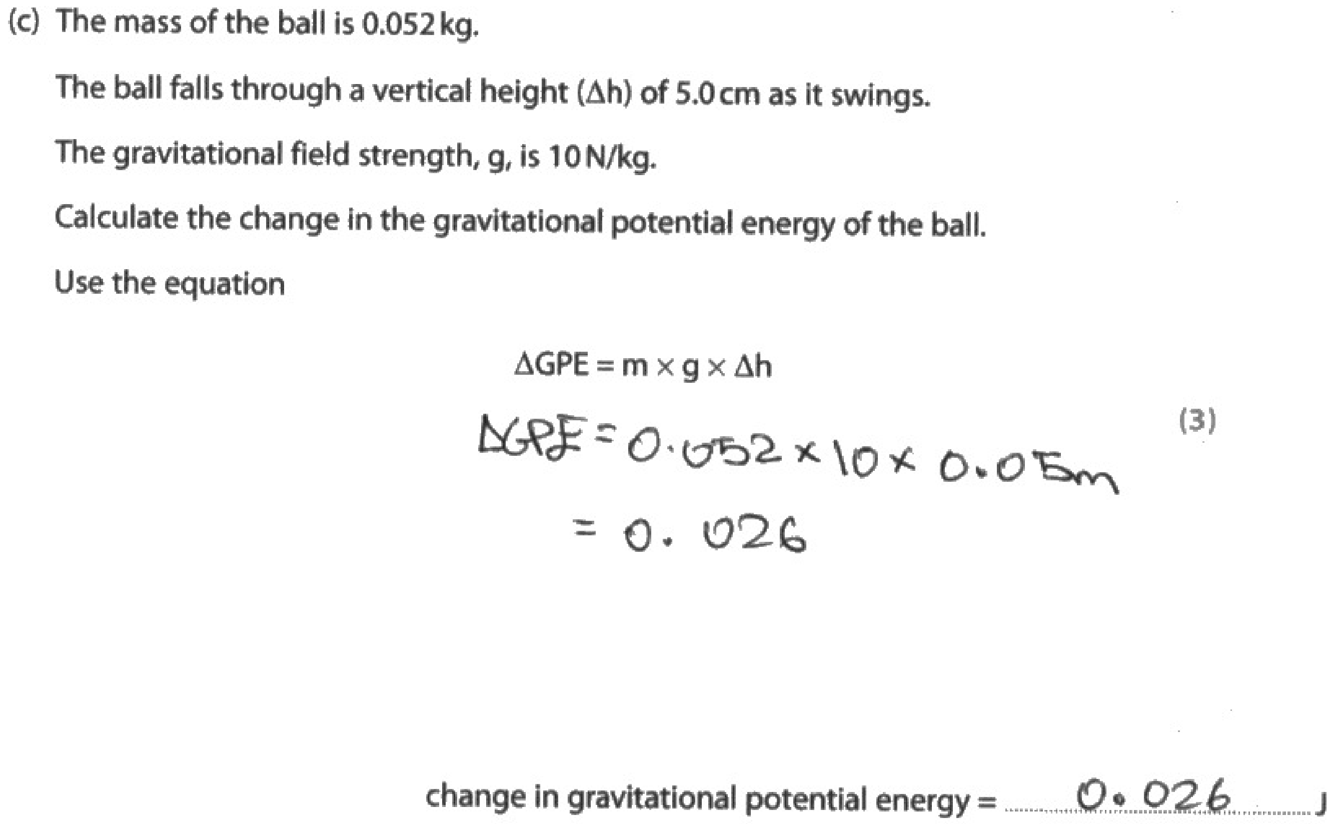
"Accuracy: a result is accurate if it is close to the true value."

Repeating, however, won't help you to get closer to a true value if there is some built-in bias to your measurement.

Question 6 (c)

The vast majority of candidates scored 2/3 on this question.

The reason for not getting full marks was largely due to a failure to convert centimetres to metres or simple powers of ten errors creeping in.



(c) The mass of the ball is 0.052 kg.

The ball falls through a vertical height (Δh) of 5.0 cm as it swings.

The gravitational field strength, g, is 10 N/kg.

Calculate the change in the gravitational potential energy of the ball.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(3)

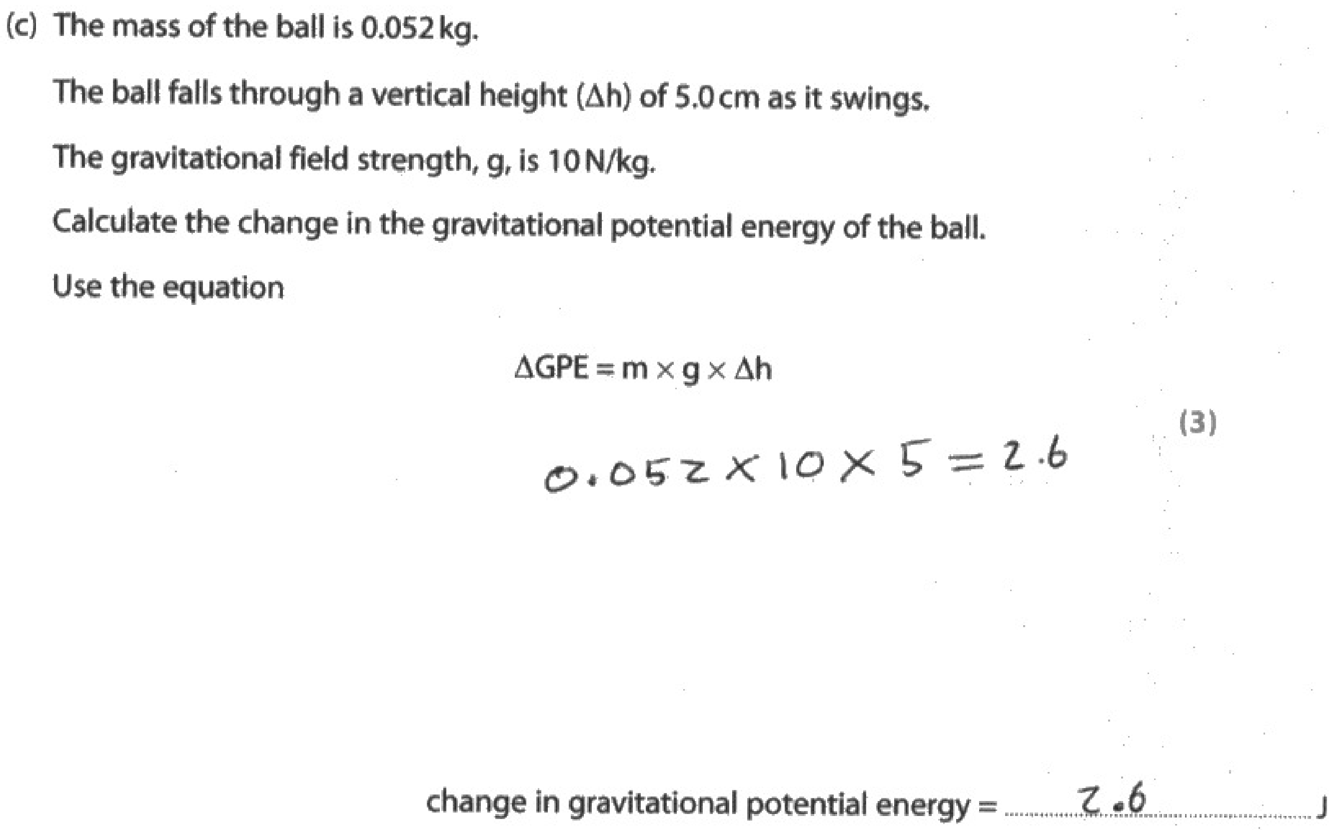
$\Delta GPE = 0.052 \times 10 \times 0.05m$

$= 0.026$

change in gravitational potential energy = 0.026 J

ResultsPlus
Examiner Comments

This is a perfect response, notably converting cm to m to obtain an answer in joules.



(c) The mass of the ball is 0.052 kg.

The ball falls through a vertical height (Δh) of 5.0 cm as it swings.

The gravitational field strength, g, is 10 N/kg.

Calculate the change in the gravitational potential energy of the ball.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(3)

$0.052 \times 10 \times 5 = 2.6$

change in gravitational potential energy = 2.6 J

ResultsPlus
Examiner Comments

This was a typical response, neglecting to convert cm to m.

ResultsPlus
Examiner Tip

Get used to working in S.I. units which include metres, kilograms, seconds and other units such as newtons or joules.

We work in S.I. units which require converting centimetres to metres to calculate energy in joules. Change in gravitational potential energy (joule, J) = mass (kilogram, kg) × gravitational field strength (newton per kilogram, N/kg) × change in vertical height (metre, m).

(c) The mass of the ball is 0.052 kg. affect

The ball falls through a vertical height (Δh) of 5.0 cm as it swings.

The gravitational field strength, g, is 10 N/kg.

Calculate the change in the gravitational potential energy of the ball.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(3)

GPE = 0.052 X 10 X 5 = 2.8

~~43~~

change in gravitational potential energy = 2.8 J

ResultsPlus
Examiner Comments

This gets the first substitution mark but then has an arithmetical mistake.

2.6 would have scored two marks, with the mark scheme saying '0.026 to any other power of ten scores two marks'.

Question 6 (d)(i)

Over half of candidates scored this mark, placing a ruler aptly alongside the apparatus in a vertical position.

The mark scheme stipulated a minimum vertical distance that had to be covered to gain the mark.

(d) Figure 15 shows an end-on view of the ball's swing from its starting position.

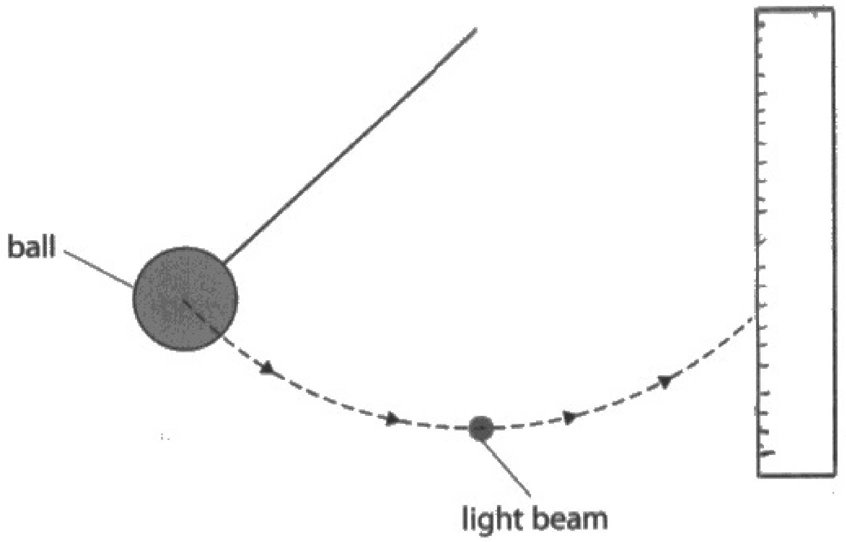


Figure 15

(i) To measure the change in vertical height, Δh, through which the ball moves, a ruler could be used.

Draw a ruler on Figure 15, placed in a position to measure the change in vertical height Δh.

ResultsPlus Examiner Comments

This is a perfect response for the mark.

ResultsPlus Examiner Tip

Experimental familiarity should help you with such questions when novel investigations are put to test your application. Imagining having the apparatus in front of you and then asking 'What would I do?' may help.

(d) Figure 15 shows an end-on view of the ball's swing from its starting position.

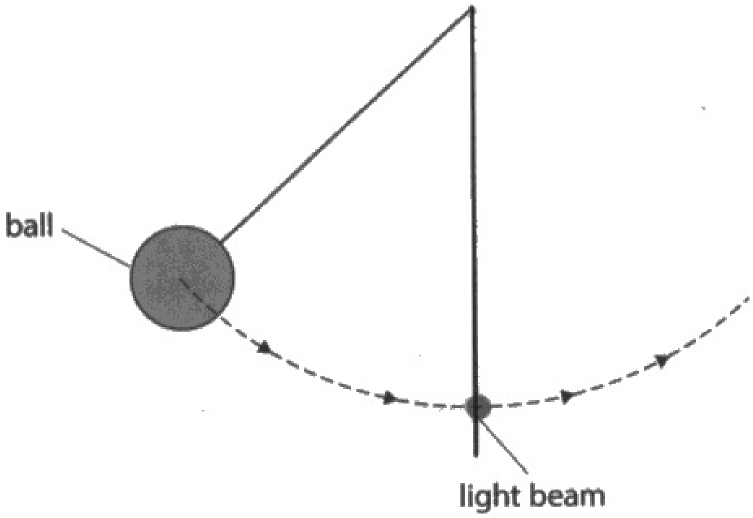


Figure 15

(i) To measure the change in vertical height, Δh, through which the ball moves, a ruler could be used.

Draw a ruler on Figure 15, placed in a position to measure the change in vertical height Δh.

ResultsPlus
Examiner Comments

The mark scheme stated 'accept any vertical line covering the minimum vertical distance'. So a line, rather than drawing a ruler, would be enough.

ResultsPlus
Examiner Tip

Don't take this acceptance of a line alternative for granted.

We would never expect you to draw painstaking and time-consuming detailed representations, but reasonable portrayals of apparatus are generally expected.

(d) Figure 15 shows an end-on view of the ball's swing from its starting position.

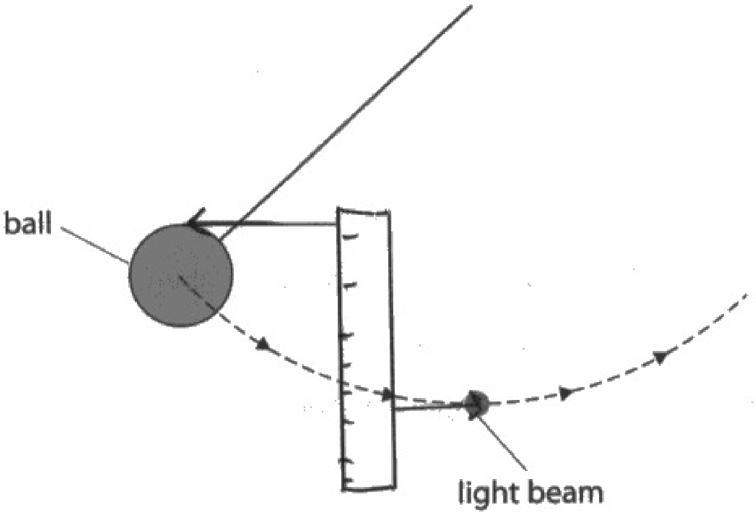


Figure 15

(i) To measure the change in vertical height, Δh, through which the ball moves, a ruler could be used.

Draw a ruler on Figure 15, placed in a position to measure the change in vertical height Δh.

ResultsPlus
Examiner Comments

This scores the mark for ruler placement.

The extra horizontal lines may have been intended to help with part d (ii).

Question 6 (d)(ii)

This asked for how you might improve the investigation using a set square.

It was poorly answered.

It seems as though most students do not imagine themselves with the apparatus in front of them or maybe they have not gained a sufficient range of experimental practice to be able to do such in an informed way.

The mark scheme talks of using the set square to establish the vertical or used to measure a vertical height. 2 marks were awarded for any horizontal line (set square use) on the diagram drawn through / touching a vertical ruler.

(d) Figure 15 shows an end-on view of the ball's swing from its starting position.

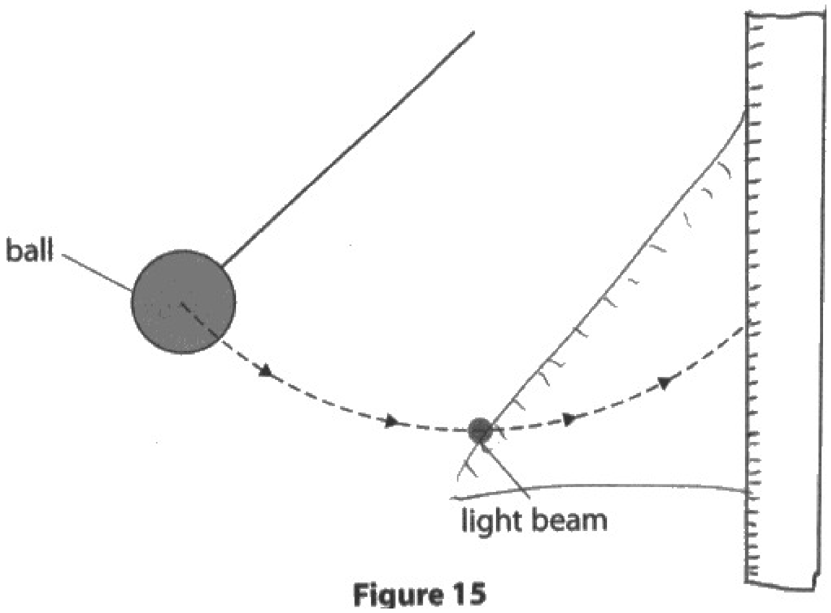


Figure 15

(ii) Figure 16 shows a set square.

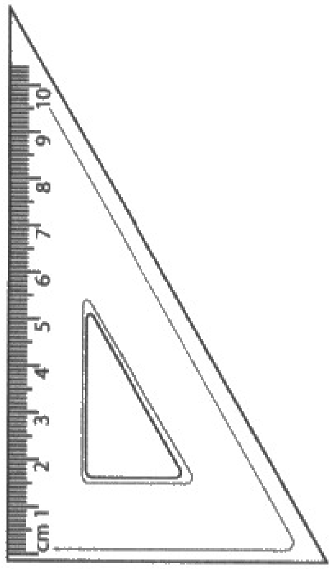


Figure 16

Describe how the measurement of the change in vertical height, Δh, could be improved using the set square.

You may add to Figure 15 or Figure 16 to help your description.

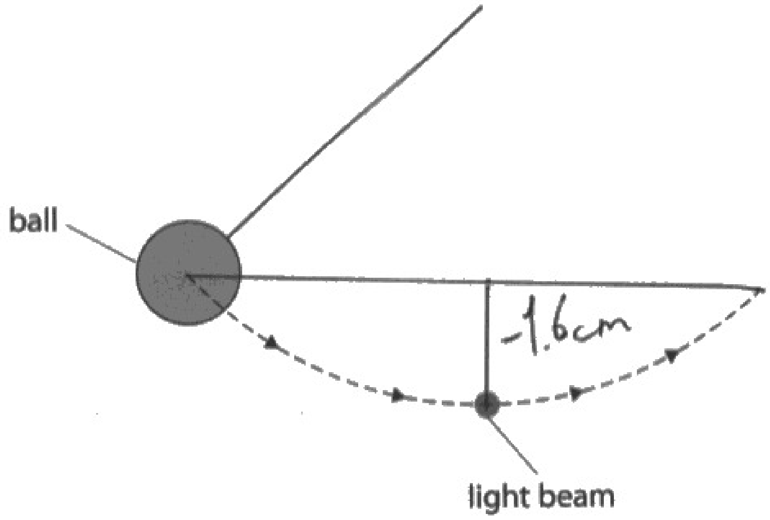
(2)

Could be used as shown in figure 15 to get a more accurate answer.

ResultsPlus
Examiner Comments

This shows a very acceptable use of the set square to establish the vertical and horizontal enabling the vertical heights to be measured.

(d) Figure 15 shows an end-on view of the ball's swing from its starting position.



(ii) Figure 16 shows a set square.

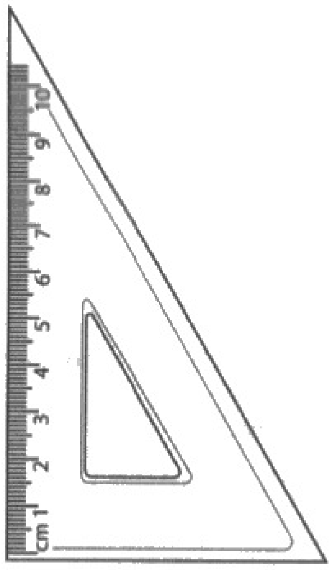


Figure 16

Describe how the measurement of the change in vertical height, Δh, could be improved using the set square.

You may add to Figure 15 or Figure 16 to help your description.

(2)

it would be asier to get an accurate straight down reading as it has a 90° angle.

ResultsPlus

Examiner Comments

See below.

ResultsPlus

Examiner Tip

This establishes the vertical and horizontal, and as the mark scheme states was accepted for two marks – allow 2 marks for any horizontal line (set square use) on the diagram drawn through / touching a vertical ruler.

Remember a vertical line like that was taken as representing where the ruler was.

The script from the candidate talks of the 90^{o} angle use as well.

2 marks awarded.

(d) Figure 15 shows an end-on view of the ball's swing from its starting position.

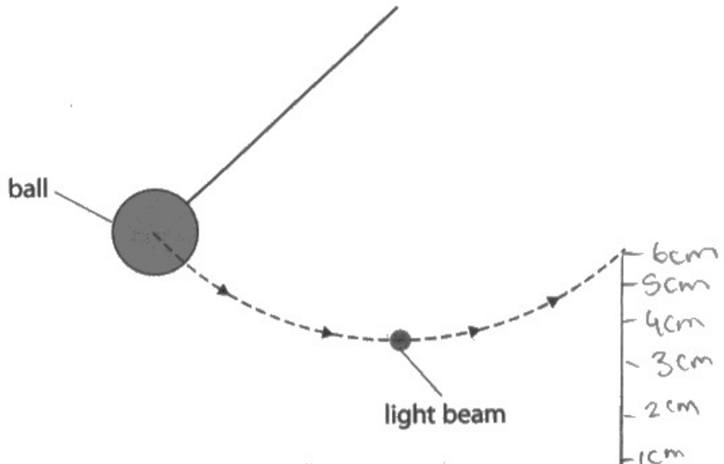


Figure 15

(ii) Figure 16 shows a set square.

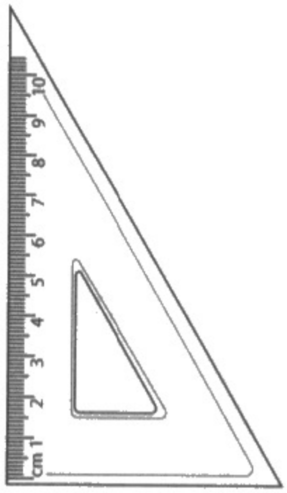


Figure 16

Describe how the measurement of the change in vertical height, Δh, could be improved using the set square.

You may add to Figure 15 or Figure 16 to help your description.

(2)

a Setting Square ~~uses~~ allows a person to get an accurate reading.

ResultsPlus
Examiner Comments

This gets 1 mark on the basis of the additional guidance 'if no other mark scored allow 1 mark for improving accuracy'.

Question 7 (b)(i-ii)

The great majority of candidates scored between 2 and 5 on this question.

Almost everyone got 2 marks on (b)(i), then (b)(ii) discriminated well. Having to rearrange the equation played a part in that.

(b) Figure 17 shows a balanced seesaw with two children on it.

The pivot is at the centre of the seesaw.

The seesaw is balanced with no children sitting on it.

Child P has a weight of 150 N.

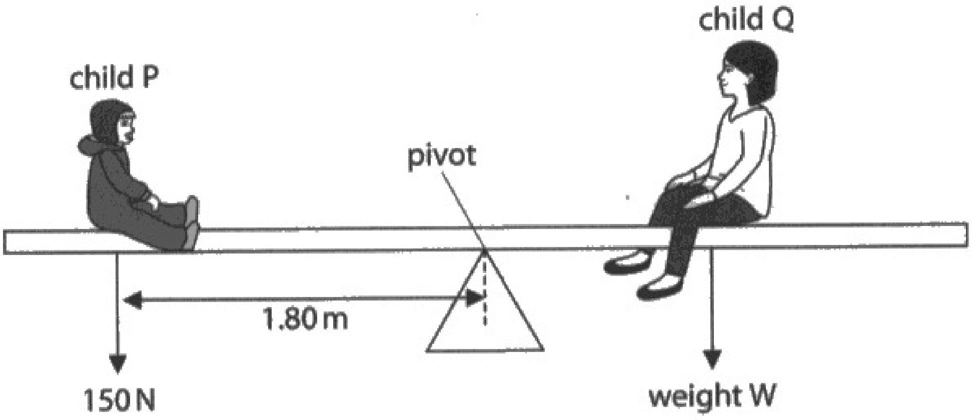


Figure 17

(i) Calculate the moment of the weight of child P about the pivot in N m.

Use the equation

moment of a force = force × distance to pivot

(2)

150N × 1.80m = 270

moment = 270 N m

(ii) Figure 18 shows the same balanced seesaw, with the distance of child Q to the pivot labelled as well.

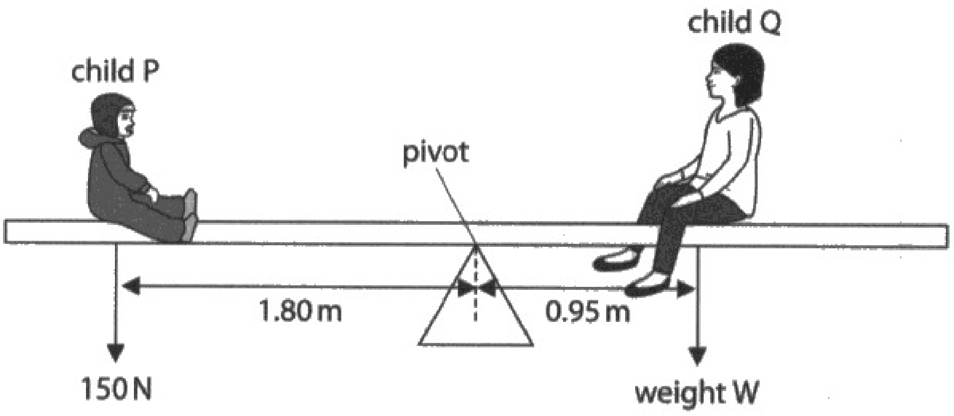


Figure 18

Calculate the value of W, the weight of child Q.

Use the idea of moments and the equation

the moment of W = the moment of the weight of child P

Give your answer to 2 significant figures.

(3)

~~270 × 0.95 = 256.5~~

270 ÷ 0.95 = 284.21

~~284.21 × 0.95 = 270~~

W = 280 N

ResultsPlus
Examiner Comments

This scored maximum marks with both evaluations correct, and the b(ii) answer given to 2 decimal places.

The student's working is easy to follow allowing a safety net in case any miscalculation should occur.

(b) Figure 17 shows a balanced seesaw with two children on it.

The pivot is at the centre of the seesaw.

The seesaw is balanced with no children sitting on it.

Child P has a weight of 150 N.

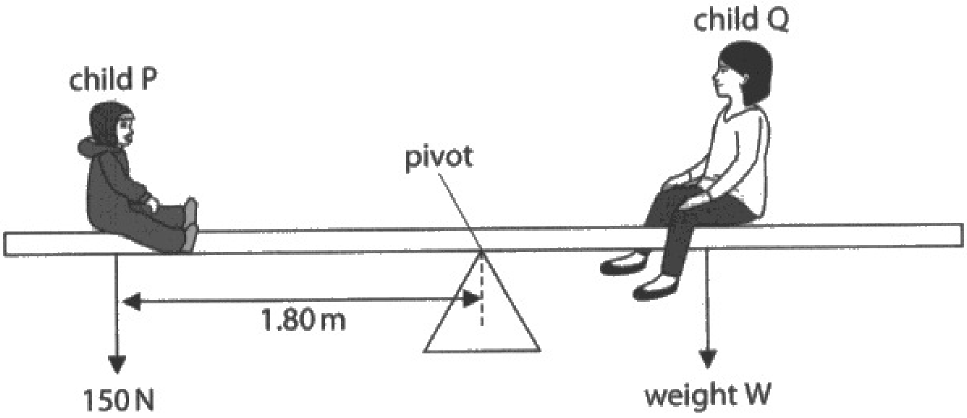


Figure 17

(i) Calculate the moment of the weight of child P about the pivot in N m.

Use the equation

moment of a force = force × distance to pivot

150 x 1.80 = 270

(2)

moment = 270 N m

(ii) Figure 18 shows the same balanced seesaw, with the distance of child Q to the pivot labelled as well.

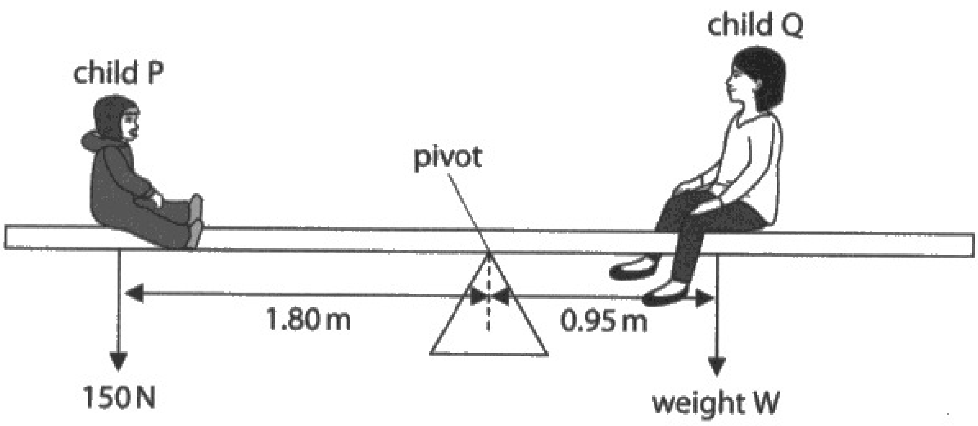


Figure 18

Calculate the value of W, the weight of child Q.

Use the idea of moments and the equation

the moment of W = the moment of the weight of child P

Give your answer to 2 significant figures.

(3)

child p = $\boxed{270}$

270 ÷ 0.98 = 284.21

W = 284.21 N

ResultsPlus
Examiner Comments

This scored 2 for b(i) and 2 for b(ii).

It just lacked the significant figure aspect for that final mark.

The working is again set out to be easy to follow.

ResultsPlus
Examiner Tip

Make sure you highlight / think about significant figure marks.

(b) Figure 17 shows a balanced seesaw with two children on it.

The pivot is at the centre of the seesaw.

The seesaw is balanced with no children sitting on it.

Child P has a weight of 150 N.

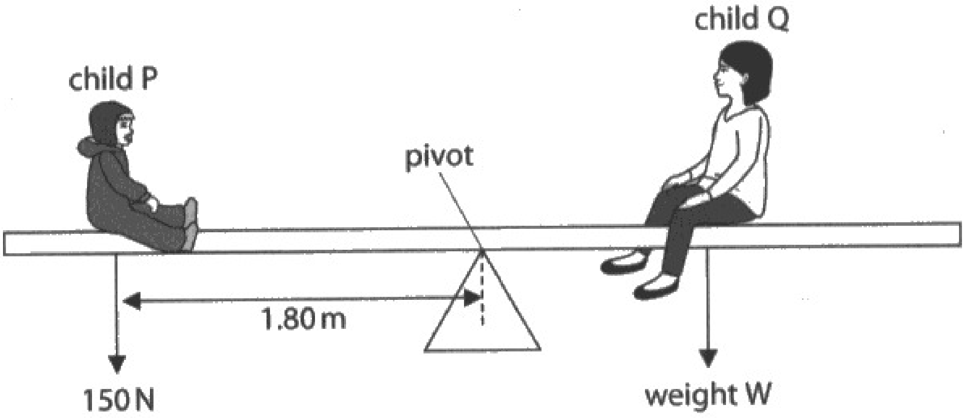


Figure 17

(i) Calculate the moment of the weight of child P about the pivot in N m.

Use the equation

moment of a force = force × distance to pivot

(2)

150N × 1.8 = 270

moment = 270 N m

(ii) Figure 18 shows the same balanced seesaw, with the distance of child Q to the pivot labelled as well.

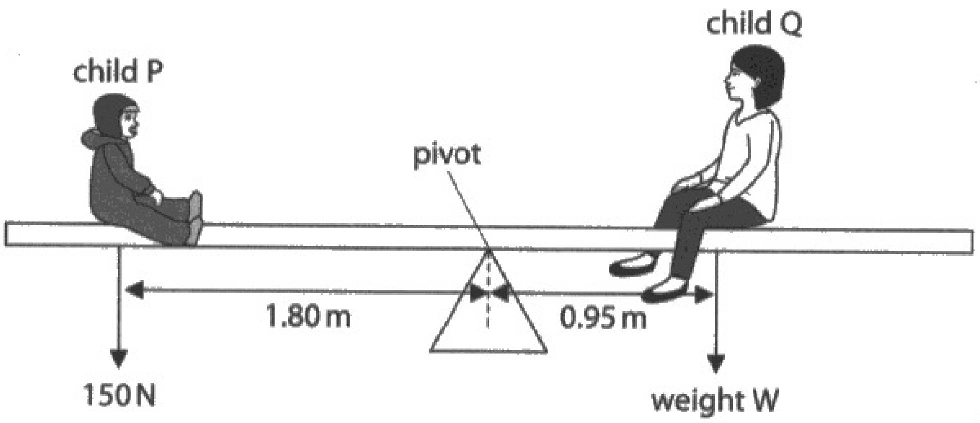


Figure 18

Calculate the value of W, the weight of child Q.

Use the idea of moments and the equation

the moment of W = the moment of the weight of child P

Give your answer to 2 significant figures.

150 × 1.8 = 270

(3)

Moment of force = F × DTP

190N = 200 × 0.95

W = 190 N

ResultsPlus
Examiner Comments

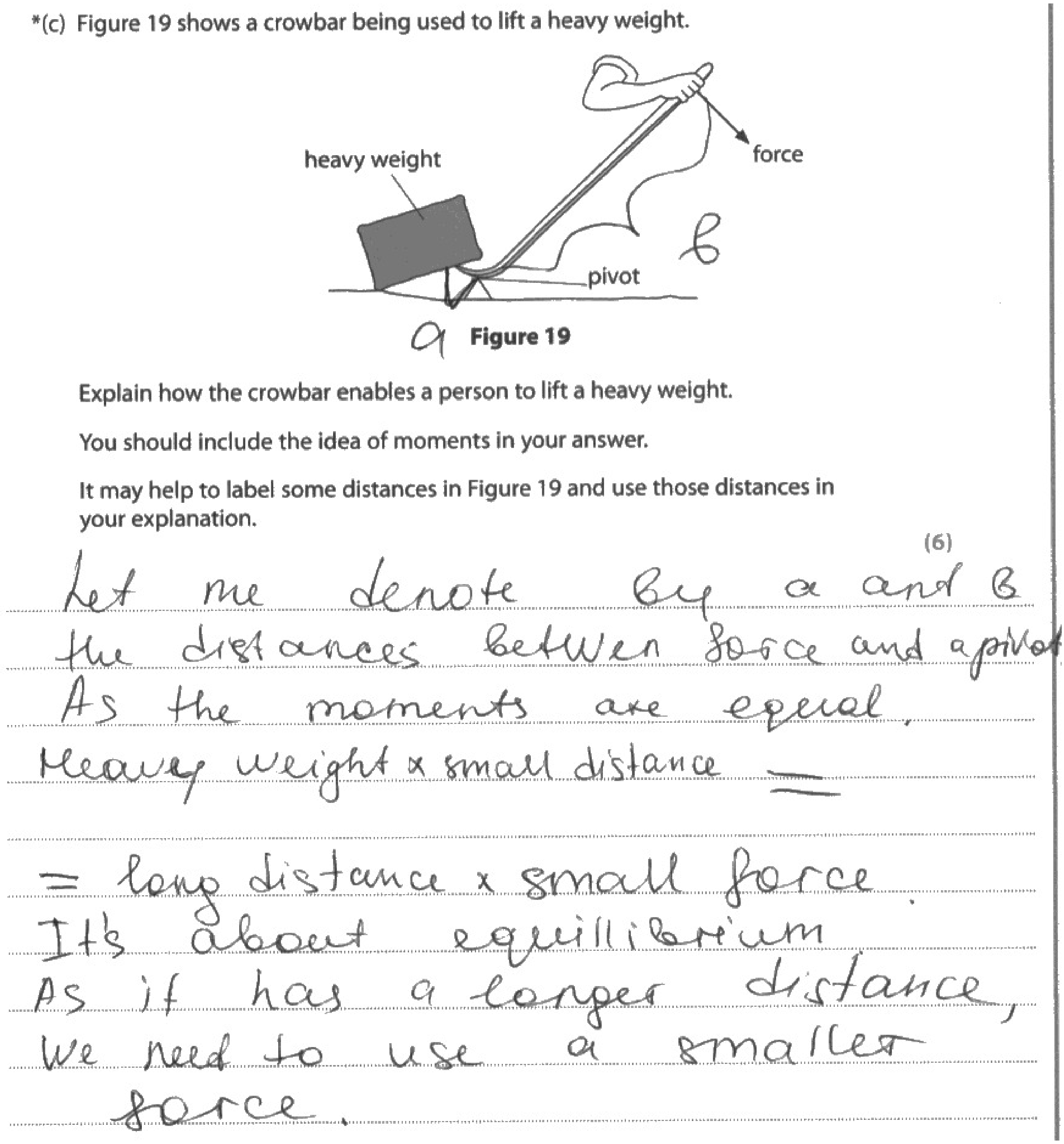
Full marks for b(i).

270 N should have been used directly in b(ii), dividing by 0.95.

The candidate gets a mark for '**any** answer to 2 sf'.

Question 7 (c)

Q07(c) was the first 6 marks question concerning a crowbar. There was a steep tail off of marks after level 1. It was the more demanding of the two 6 marks questions in terms of physics concepts needed. The illustration provided clearly enabled many candidates to access those level 1 marks and to enable those that wanted to, at level 3, to utilise that diagram in using labelled distances.



*(c) Figure 19 shows a crowbar being used to lift a heavy weight.

Figure 19

Explain how the crowbar enables a person to lift a heavy weight.

You should include the idea of moments in your answer.

It may help to label some distances in Figure 19 and use those distances in your explanation.

(6)

Let me denote by a and b
the distances between force and a pivot
As the moments are equal,
Heavy weight x small distance =

= long distance x small force.
It's about equillibrium
As if has a longer distance,
We need to use a smaller
force.

ResultsPlus
Examiner Comments

This is a level 3 answer making a link between force and distance and also refers to moments.

The candidate manages to do that in a very succinct way, utilising the diagram expertly.

The student clearly understands the physics ideas very well.

ResultsPlus
Examiner Tip

You don't have to write reams to get 6 marks. It's the quality of knowledge and understanding that counts.

Ask yourself 'What physics ideas are involved here?'

*(c) Figure 19 shows a crowbar being used to lift a heavy weight.

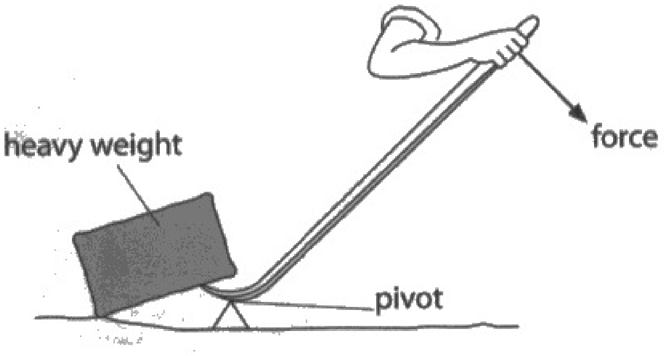


Figure 19

Explain how the crowbar enables a person to lift a heavy weight.

You should include the idea of moments in your answer.

It may help to label some distances in Figure 19 and use those distances in your explanation.

(6)

The crowbar allows a person to lift a heavy weight as it increases the moment of the person and the force that they are applying. The force is being applied at the end of the crowbar and therefore ~~and~~ far away from the pivot. By being further away from the pivot it increases the moment of the force and therefore means a greater amount of newton meters are being used to lift the heavy weight. If the person did not have the crowbar or they had a shorter one it would mean that they ~~to~~ would be nearer to the pivot point which would therefore decrease the moment of the force, this would mean that if the exact same force was being applied but from closer the weight will not be lifting as much. Therefore the crowbar increases the moment of the person's force which allows them to lift the heavy weights.

(Total for Question 7 = 12 marks)

ResultsPlus
Examiner Comments

This is a level 3 answer linking force and distance and referring to moments relevantly.

The candidate presents an argument well that if the force was applied closer to the pivot it would be less effective. It is a somewhat convoluted argument but it still matches what is required for a level 3 answer.

*(c) Figure 19 shows a crowbar being used to lift a heavy weight.

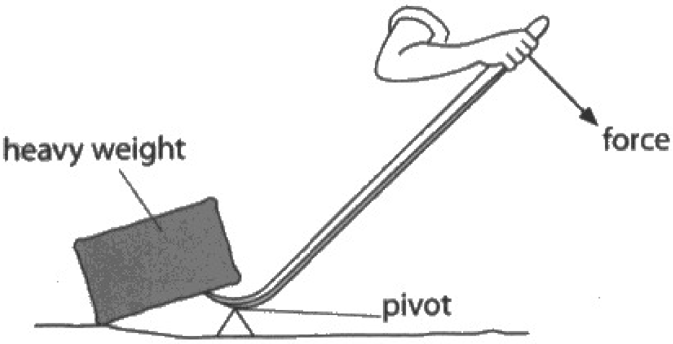


Figure 19

Explain how the crowbar enables a person to lift a heavy weight.

You should include the idea of moments in your answer.

It may help to label some distances in Figure 19 and use those distances in your explanation.

(6)

Since the pivot is so much closer to weight then the persons hand is to the pivot, the person has to Move the crowbar much further to move the weight then the weight actually moves. This means though that less force is needed to move the weight then there would be otherwise. The further away from the pivot, the less force needed to apply the same amount of force on the weight on the other end of the lever.

ResultsPlus
Examiner Comments

This is a level 2 answer awarded 4 marks.

There is excellent reference to the distances and the force required with the candidate noting that less force is required as a result of choosing a further distance from the pivot. There is no mention of moments, which is what limits this to a level 2.

*(c) Figure 19 shows a crowbar being used to lift a heavy weight.

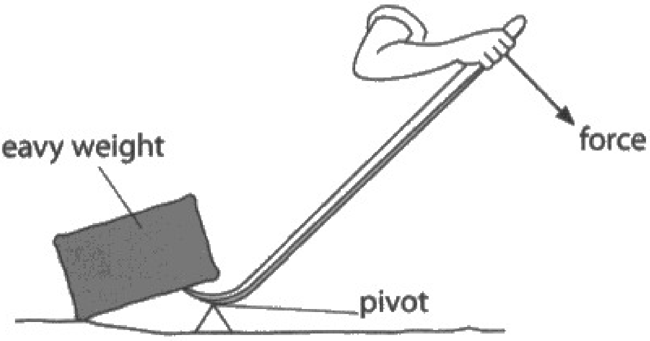


Figure 19

Explain how the crowbar enables a person to lift a heavy weight.

You should include the idea of moments in your answer.

It may help to label some distances in Figure 19 and use those distances in your explanation.

(6)

he is able to get the leverage to lift a heavy weight without alot of force because of the Length of the crowbar ~~bushing~~ pushing againt the pivot lifts it because all the weight goes to the pivot point

ResultsPlus
Examiner Comments

Level 1, two marks

Elements of physics but insufficient link between force and distance to yield a level 2 mark.

Holistic view makes this at the top of level 1, not quite enough to convince a lower level 2 mark might be appropriate.

*(c) Figure 19 shows a crowbar being used to lift a heavy weight.

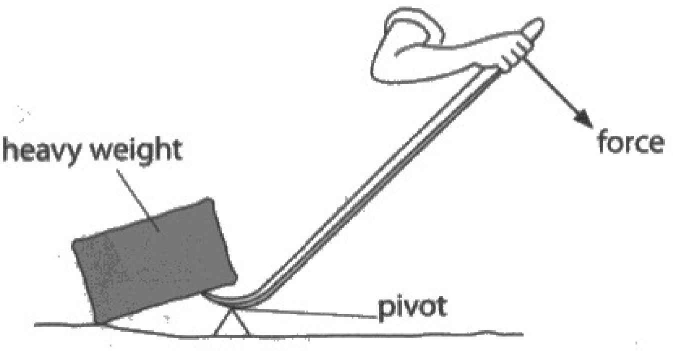


Figure 19

Explain how the crowbar enables a person to lift a heavy weight.

You should include the idea of moments in your answer.

It may help to label some distances in Figure 19 and use those distances in your explanation.

(6)

It is acting as a lever. The force is going down while a pivot is there to get the force going down, to go up the ~~to~~ heavy weight. The heavy weight has upthrust due to the ~~g~~ crowbar being pushed down while the head of the crowbar is under the heavy weight.

ResultsPlus
Examiner Comments

Level 1 answer. 2 marks awarded.

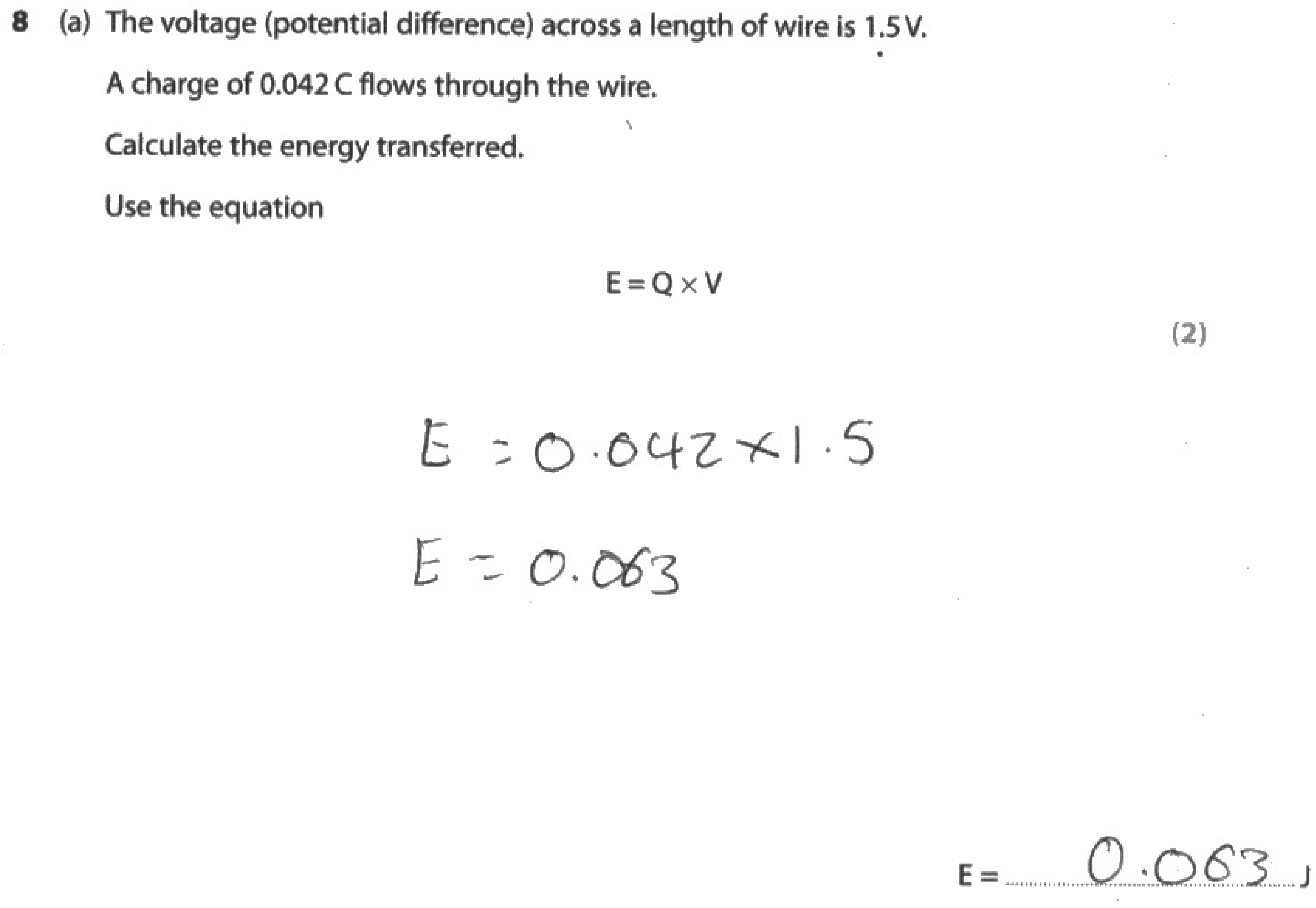
Mention of the level and force directions constitute the elements of physics seen here,

No link between force and distance, so not level 2.

Question 8 (a)

This was a very high scoring item.

It required direct substitution into E = Q × V.



8 (a) The voltage (potential difference) across a length of wire is 1.5 V.

A charge of 0.042 C flows through the wire.

Calculate the energy transferred.

Use the equation

$$E = Q \times V$$

(2)

$E = 0.042 \times 1.5$

$E = 0.063$

E = 0.063 J

ResultsPlus
Examiner Comments

This shows the correct clear substitution and correct evaluation.

2 marks

8 (a) The voltage (potential difference) across a length of wire is 1.5 V.

A charge of 0.042 C flows through the wire.

Calculate the energy transferred.

Use the equation

$$E = Q \times V$$

(2)

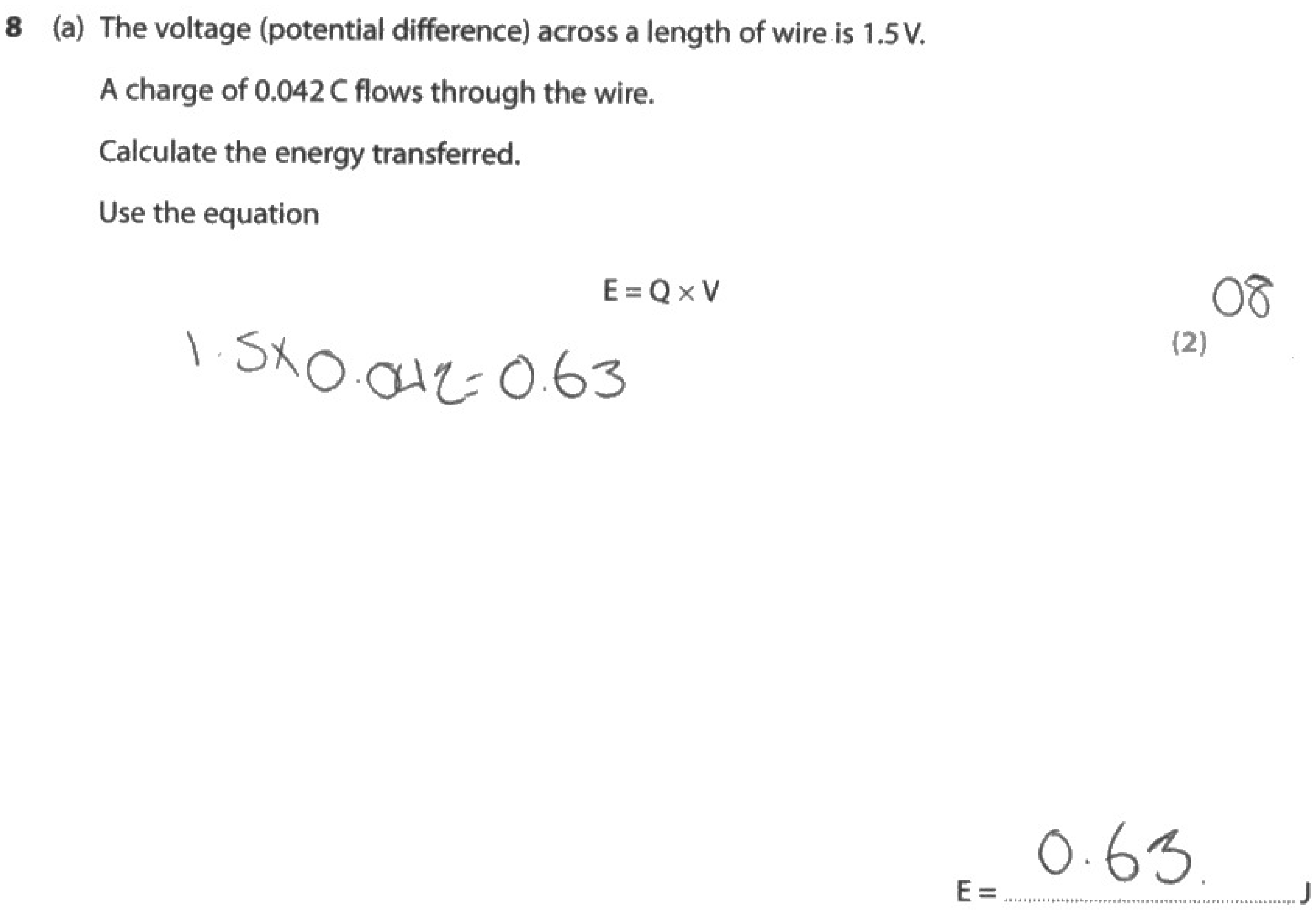
E = 0.063 J

ResultsPlus
Examiner Comments

The rule, as ever, is 'award 2 marks for the correct answer without working'.

ResultsPlus
Examiner Tip

Runs the risk of yielding nothing if an arithmetical mistake occurs or the numbers not entered correctly into a calculator. If you show your working it may give an intermediate mark in the presence of such mistakes.



8 (a) The voltage (potential difference) across a length of wire is 1.5 V.

A charge of 0.042 C flows through the wire.

Calculate the energy transferred.

Use the equation

$$E = Q \times V$$

08

1.5x0.042=0.63

(2)

E = 0.63 J

ResultsPlus
Examiner Comments

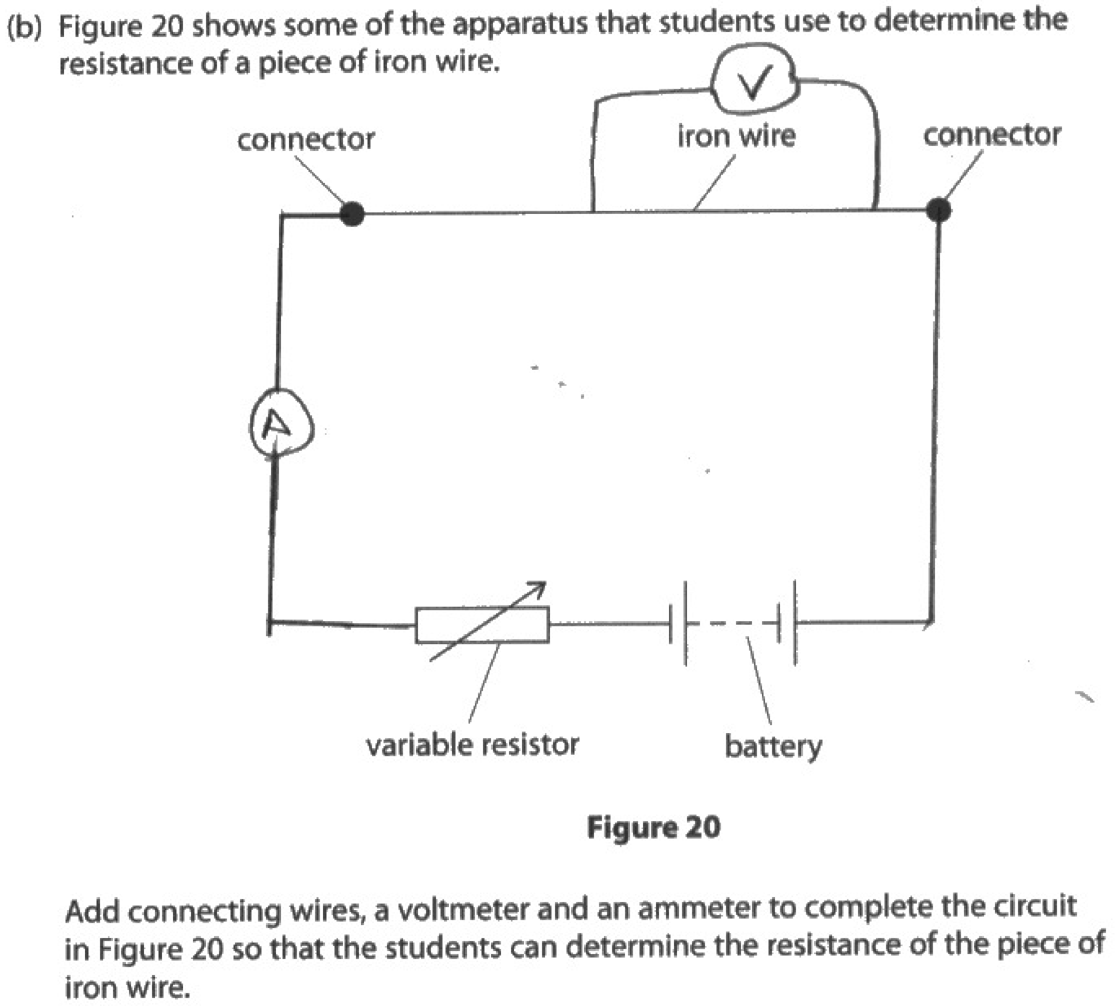
A mistake occurs in calculating the final answer.

One substitution mark is still given for 1.5 x 0.042.

0.63, a factor of 10 out, was seen a number of times with this item.

Question 8 (b)

This item required adding an ammeter and a voltmeter to a half drawn circuit to determine the resistance of a length of iron wire. Ammeters were often added in series but hardly any candidates added a voltmeter across the wire, most opting to place the voltmeter in series, on the opposite side to their ammeter.



(b) Figure 20 shows some of the apparatus that students use to determine the resistance of a piece of iron wire.

Figure 20

Add connecting wires, a voltmeter and an ammeter to complete the circuit in Figure 20 so that the students can determine the resistance of the piece of iron wire.

ResultsPlus
Examiner Comments

This is an example of an answer that scored 2 marks.

2 marks answers were few and far between.

The voltmeter was shown across part of the wire, which the mark scheme says is fine.

ResultsPlus
Examiner Tip

Ammeters are put in series with what you are measuring.

Voltmeter are **always** put in parallel – across something you are investigating.

(b) Figure 20 shows some of the apparatus that students use to determine the resistance of a piece of iron wire.

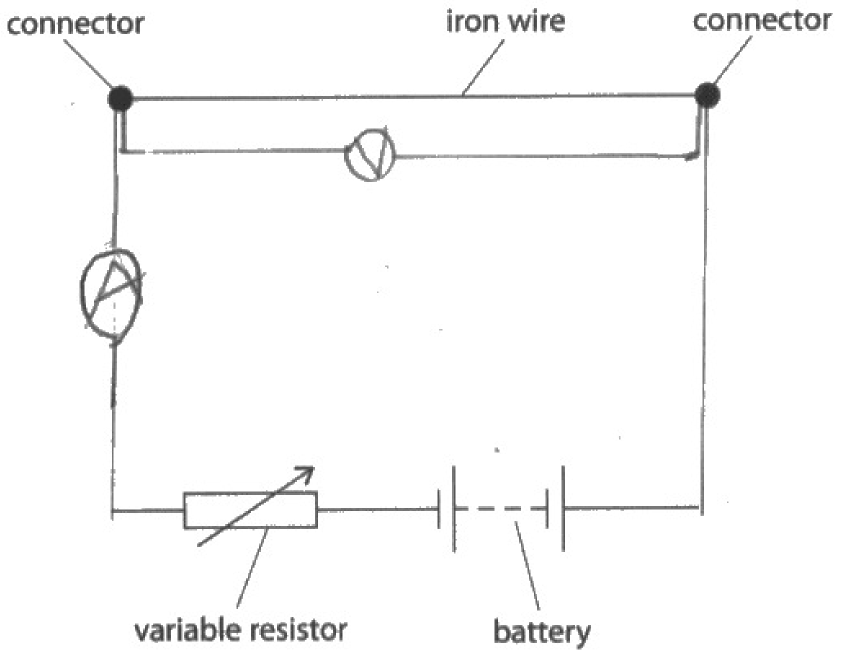


Figure 20

Add connecting wires, a voltmeter and an ammeter to complete the circuit in Figure 20 so that the students can determine the resistance of the piece of iron wire.

ResultsPlus
Examiner Comments

Full marks for this one with the voltmeter shown in parallel – across the whole wire.

(b) Figure 20 shows some of the apparatus that students use to determine the resistance of a piece of iron wire.

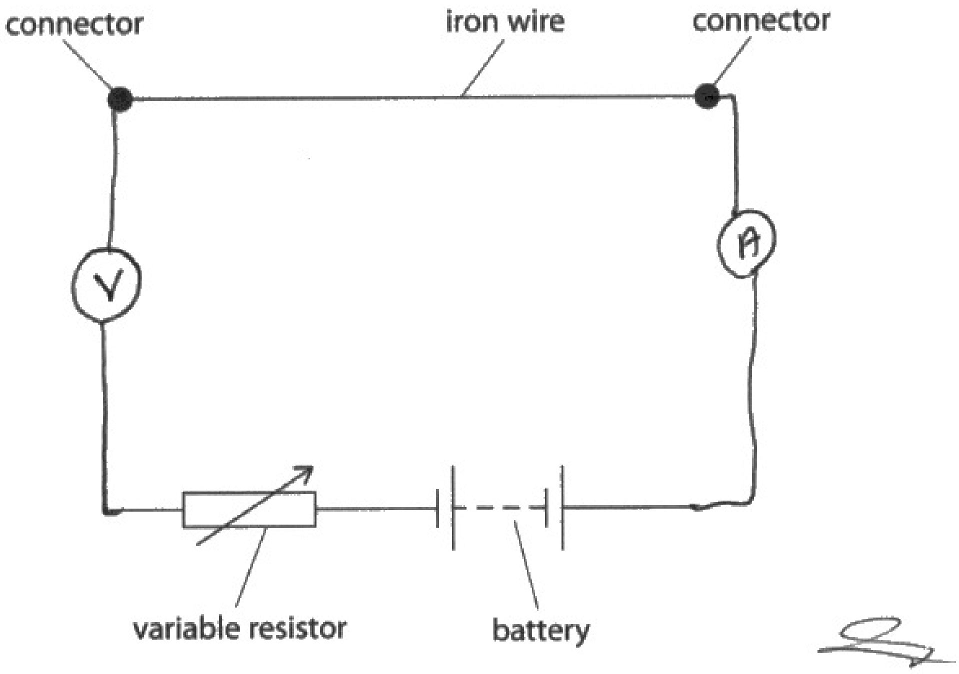


Figure 20

Add connecting wires, a voltmeter and an ammeter to complete the circuit in Figure 20 so that the students can determine the resistance of the piece of iron wire.

ResultsPlus
Examiner Comments

This was by far the most popular way of answering the question, so losing the voltmeter placement mark every time. Hence 1 mark was awarded for the ammeter placement.

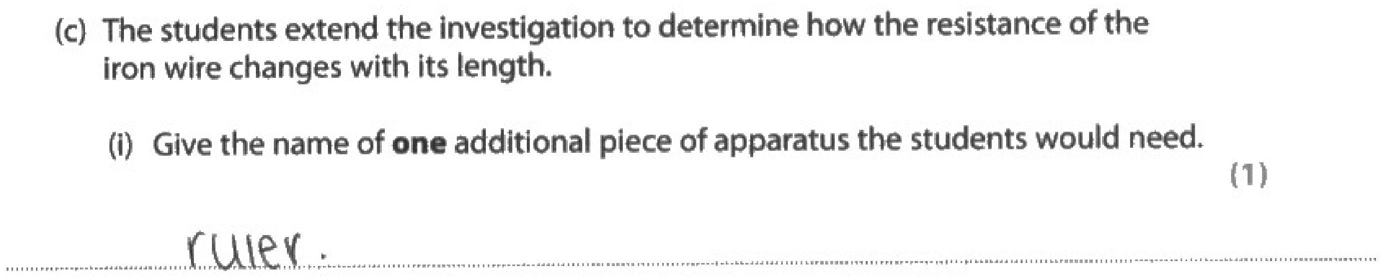
ResultsPlus
Examiner Tip

Ammeters are put in series with what you are measuring.

Voltmeter are **always** put in parallel – across something you are investigating.

Question 8 (c)(i)

The question asked candidates to name one extra piece of apparatus needed to find how the resistance of the iron wire **changes with its length**. Only a minority of students suggested using a ruler / metre rule / tape measure to measure a varying length of wire.



(c) The students extend the investigation to determine how the resistance of the iron wire changes with its length.

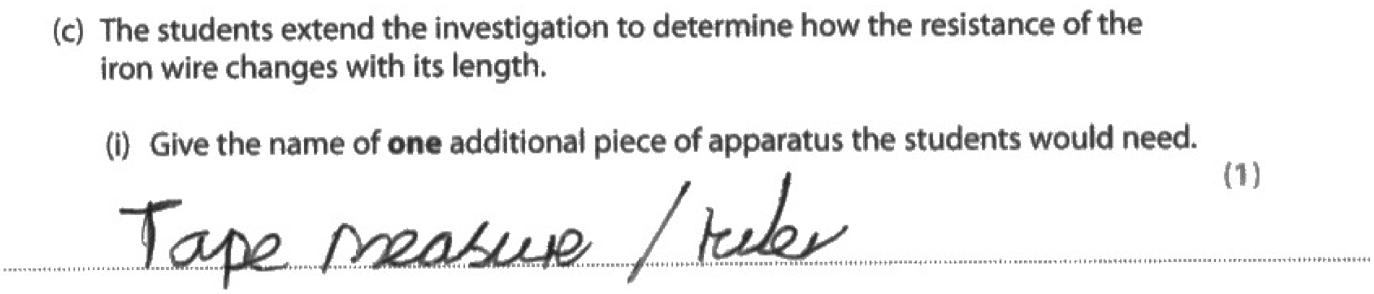
(i) Give the name of **one** additional piece of apparatus the students would need.

(1)

ruler.

ResultsPlus
Examiner Comments

This candidate writes the simplest most direct correct answer to the question.



(c) The students extend the investigation to determine how the resistance of the iron wire changes with its length.

(i) Give the name of **one** additional piece of apparatus the students would need.

(1)

Tape measure / ruler

ResultsPlus
Examiner Comments

Tape measure / ruler correctly stated in order to measure that varying length.

Question 8 (c)(ii-iii)

Q08(c)(ii)–(iii) was high scoring for most candidates, with lots of good lines of best fit and reading off the 100 cm value off the graph.

(ii) Figure 21 shows a graph of the results.

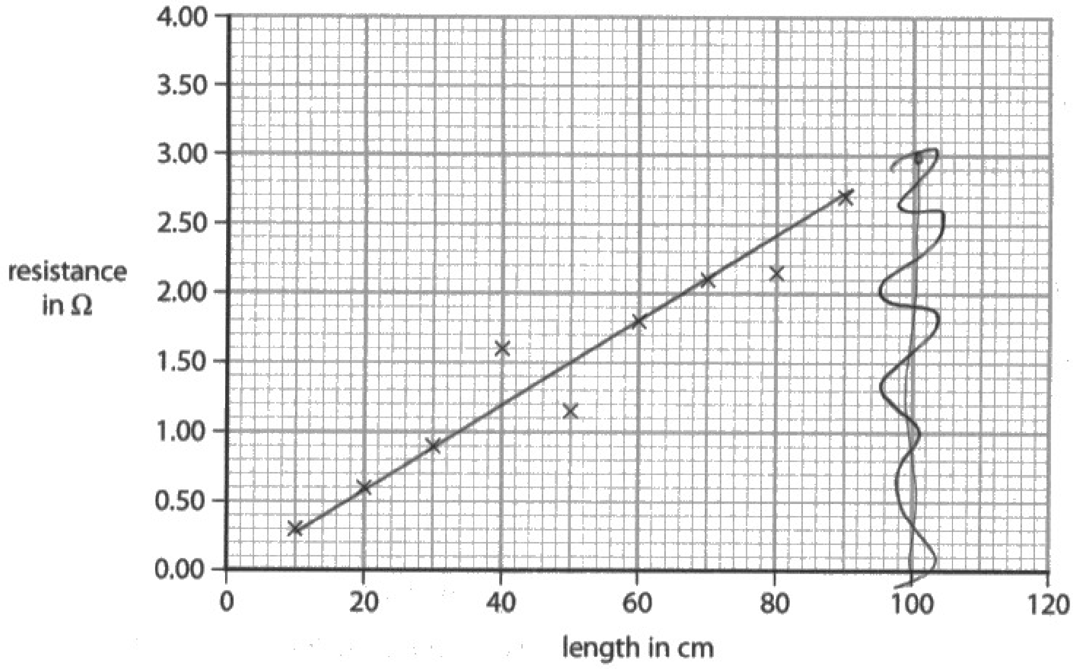


Figure 21

Draw a straight line of best fit on Figure 21.

(1)

(iii) Use Figure 21 to estimate the resistance of a 100 cm length of the iron wire.

(1)

resistance = 3 Ω

ResultsPlus
Examiner Comments

The first mark point is matched. It does not require extrapolation at either end.

Extrapolation diagonally upwards would have helped accurately finding the resistance of 100 cm of wire. However '3' is accepted, within our tolerance band.

Significant figures are not an issue here.

(ii) Figure 21 shows a graph of the results.

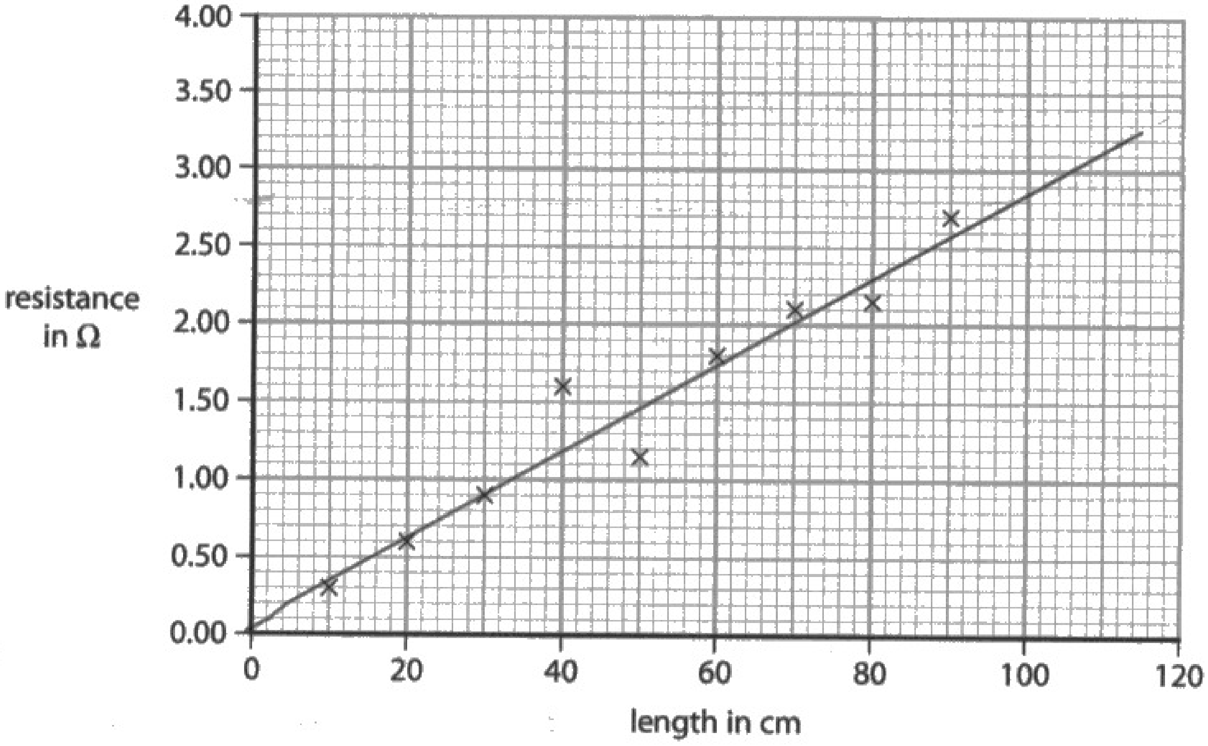


Figure 21

Draw a straight line of best fit on Figure 21.

(1)

(iii) Use Figure 21 to estimate the resistance of a 100 cm length of the iron wire.

(1)

resistance = 2,56 Ω

ResultsPlus
Examiner Comments

The best fit line on the graph was within the bounds set in the mark scheme, earning a mark.

The candidate then misread the value of resistance for 100cm from the graph so didn't get the second mark.

ResultsPlus
Examiner Tip

Always ask yourself what does 1 small square represent on the graph, for both axes.

Here it seems the candidate was counting 0.02 Ω for each square on the y axis to get 2.56.

One square on the y-axis actually represents 0.10 Ω.

(ii) Figure 21 shows a graph of the results.

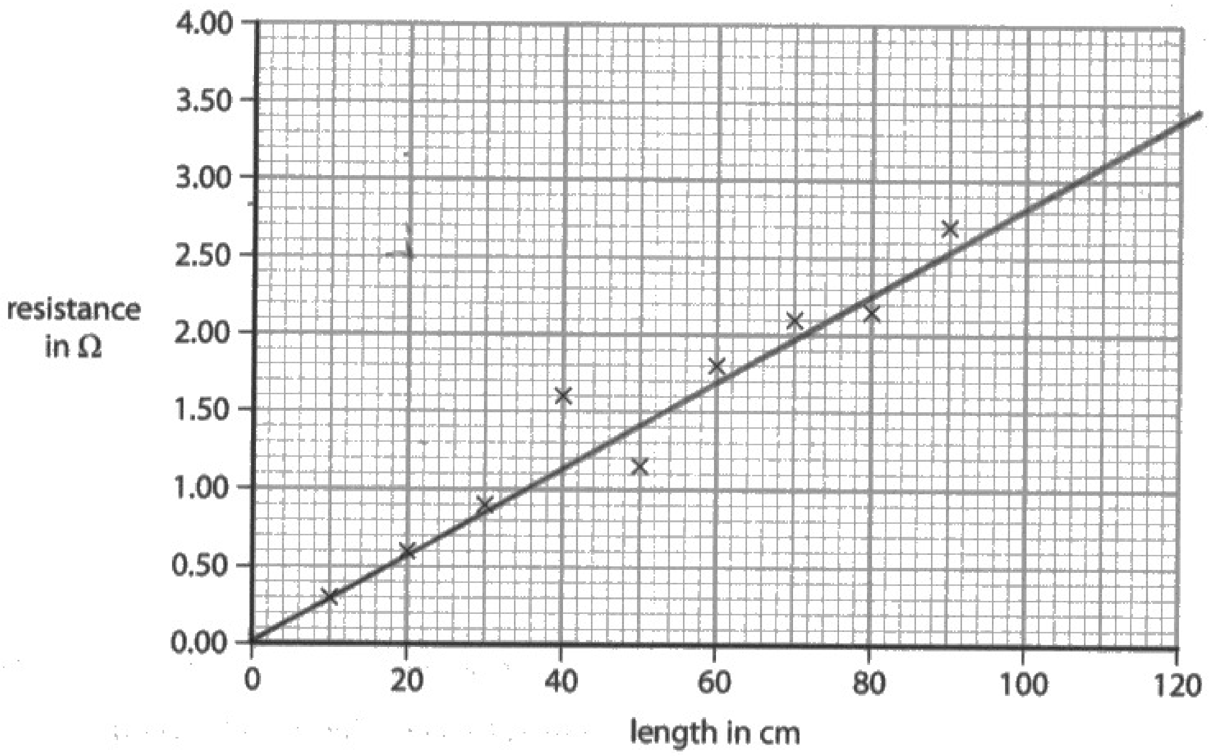


Figure 21

Draw a straight line of best fit on Figure 21.

(1)

(iii) Use Figure 21 to estimate the resistance of a 100 cm length of the iron wire.

(1)

resistance = 2.80 Ω

ResultsPlus
Examiner Comments

The line drawn and the resistance of 100cm of wire are both within the accepted limits of the mark scheme.

2 marks awarded

(ii) Figure 21 shows a graph of the results.

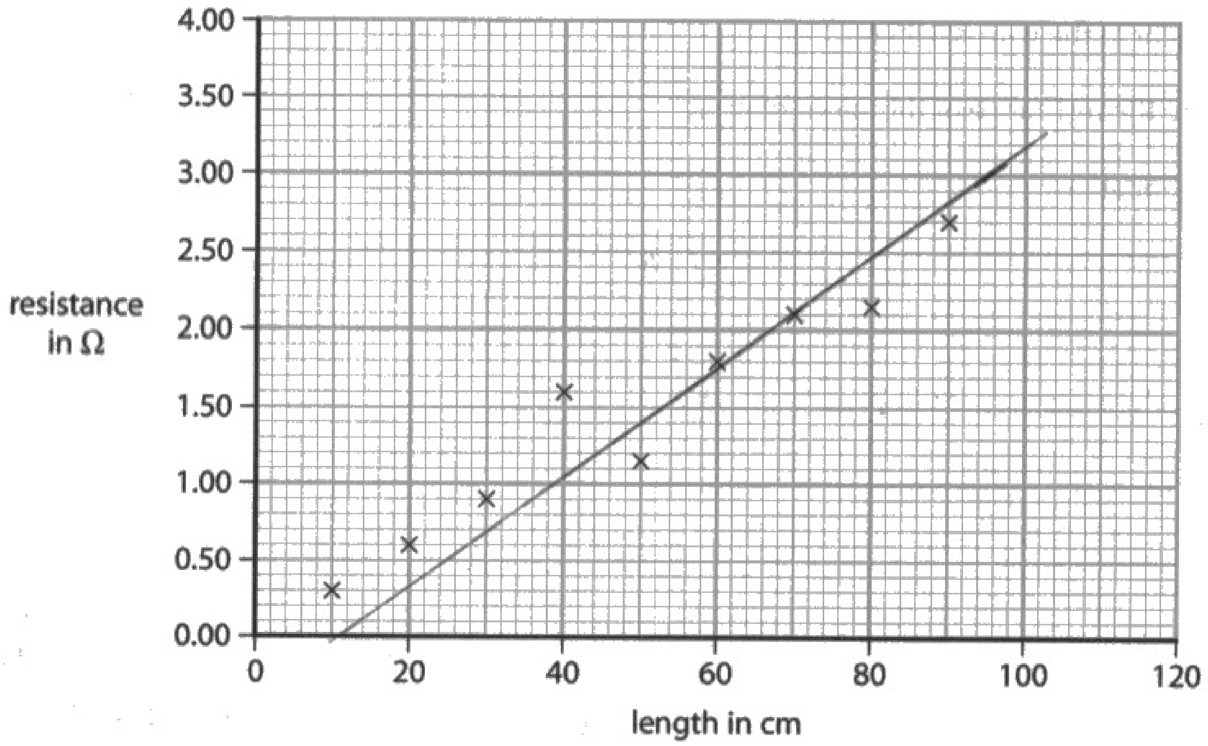


Figure 21

Draw a straight line of best fit on Figure 21.

(1)

(iii) Use Figure 21 to estimate the resistance of a 100 cm length of the iron wire.

(1)

resistance = 3.20 Ω

ResultsPlus
Examiner Comments

The line drawn on the graph is out of the acceptable bounds – especially the intercept on the x-axis (up to 6cm accepted – this is ≈12cm)

The 100 cm resistance is within the bounds set, so the second mark is awarded.

(ii) Figure 21 shows a graph of the results.

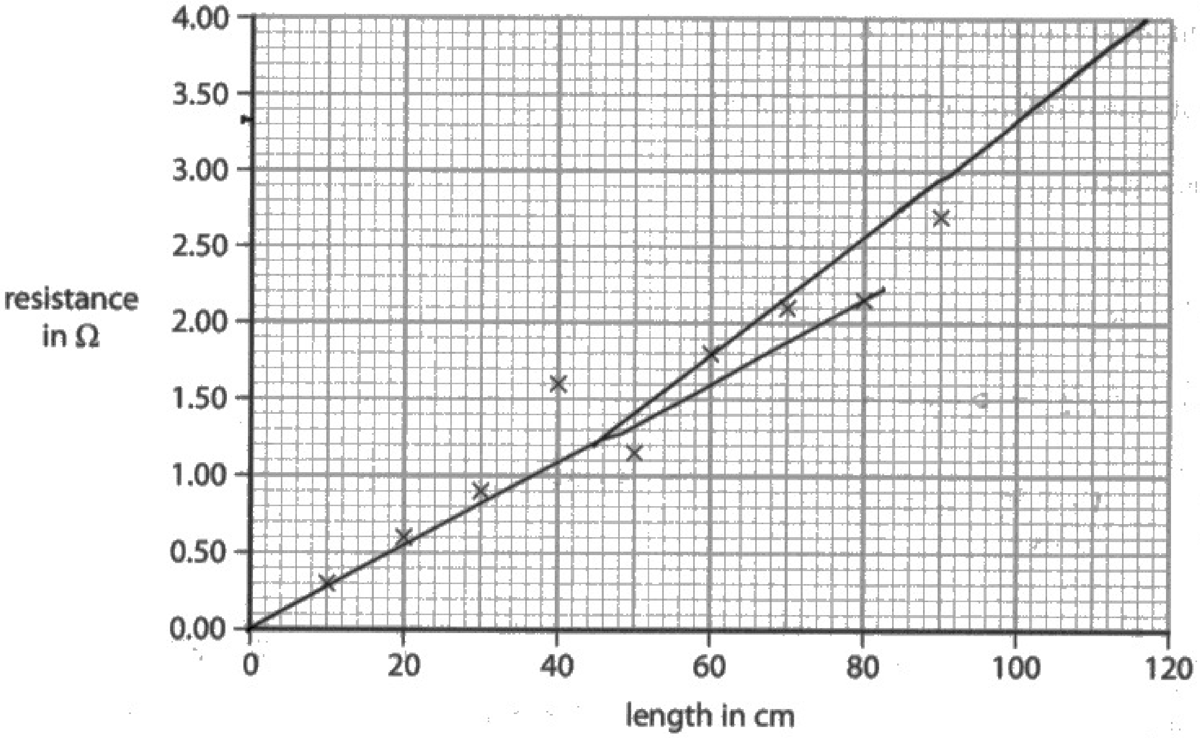


Figure 21

Draw a straight line of best fit on Figure 21.

(1)

(iii) Use Figure 21 to estimate the resistance of a 100 cm length of the iron wire.

(1)

resistance = 3.35 Ω

ResultsPlus
Examiner Comments

A single best fit line is expected, not two separate ones.

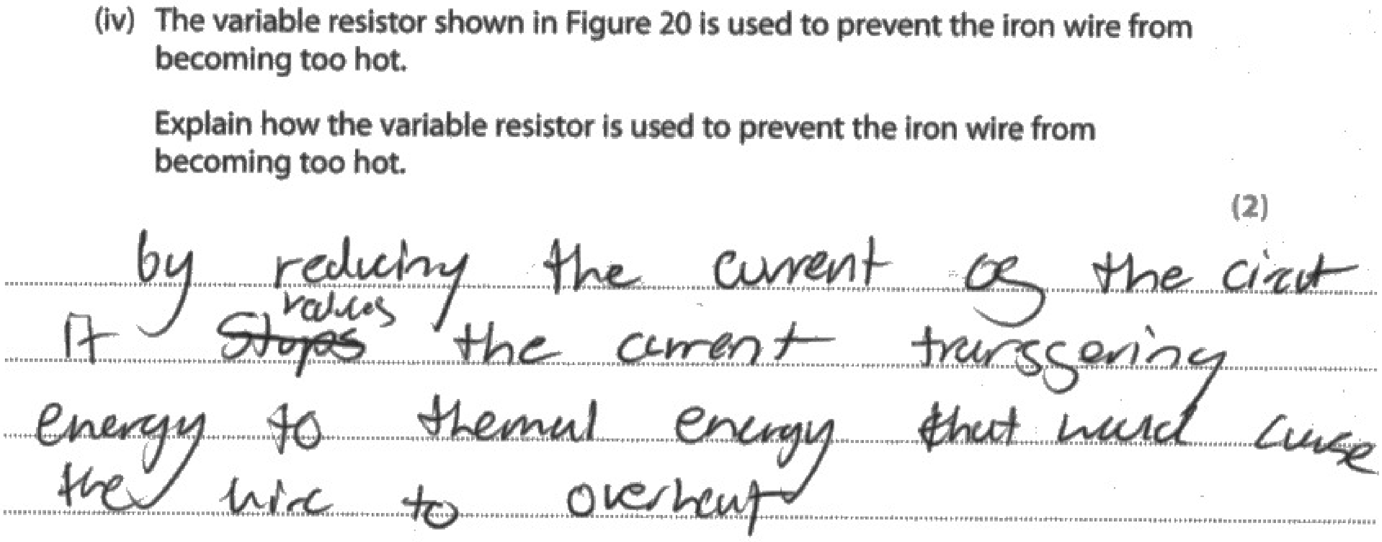
The question says 'Draw **a** straight line of best fit on Figure 21'

Because ecf is allowed in (iii) a second mark is, however, awarded.

The candidate has read off 3.35 Ω off their graph well.

Question 8 (c)(iv)

Q08(c)(iv) was not well done. The ideas / conceptual demands of Joule heating proved too much for most.



(iv) The variable resistor shown in Figure 20 is used to prevent the iron wire from becoming too hot.

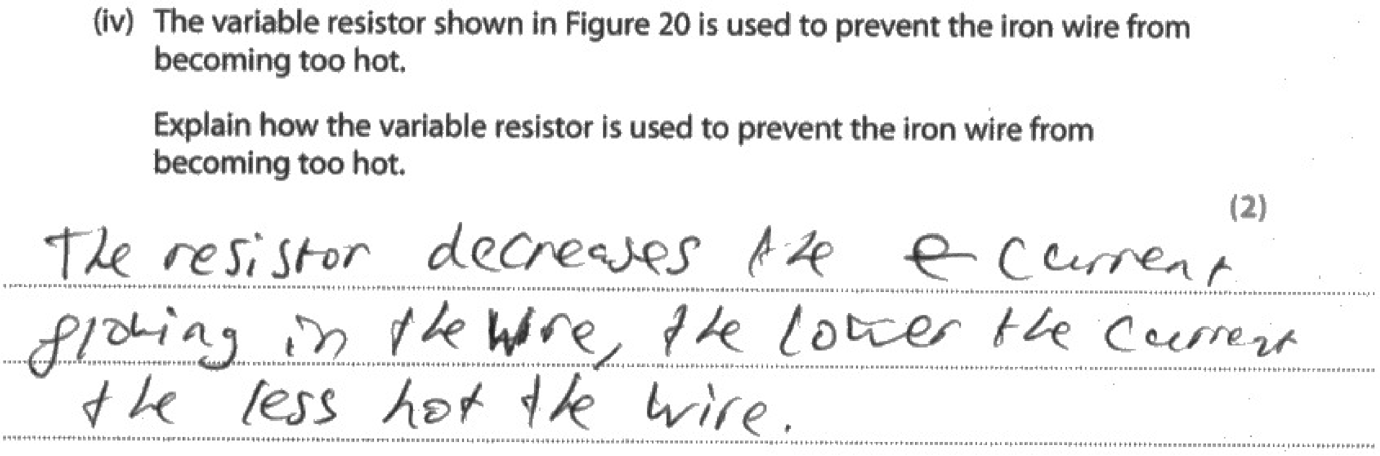
Explain how the variable resistor is used to prevent the iron wire from becoming too hot.

(2)

by reducing the current of the circuit It ~~Stops~~ reduces the current transferring energy to thermal energy that would cause the wire to overheat

ResultsPlus
Examiner Comments

This does have sufficient reference to reducing the current (mp2) affecting a reduction in thermal energy (mp3) 'that would cause...'



(iv) The variable resistor shown in Figure 20 is used to prevent the iron wire from becoming too hot.

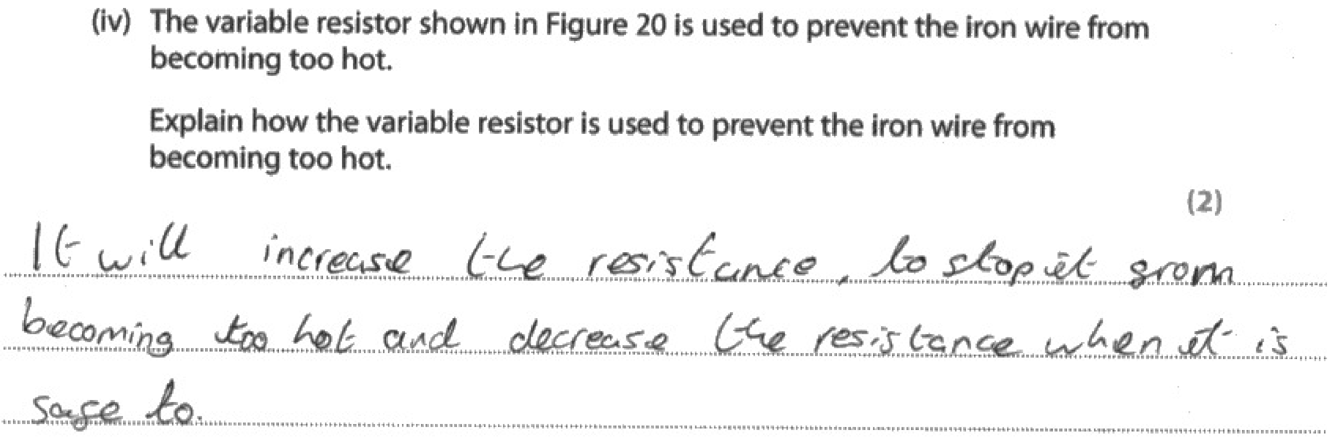
Explain how the variable resistor is used to prevent the iron wire from becoming too hot.

(2)

The resistor decreases the ~~e~~ current flowing in the wire, the lower the current the less hot the wire.

ResultsPlus
Examiner Comments

Mark point 2 matched, then the association between 'less current the less hot the wire' is accepted for mark point 3.



(iv) The variable resistor shown in Figure 20 is used to prevent the iron wire from becoming too hot.

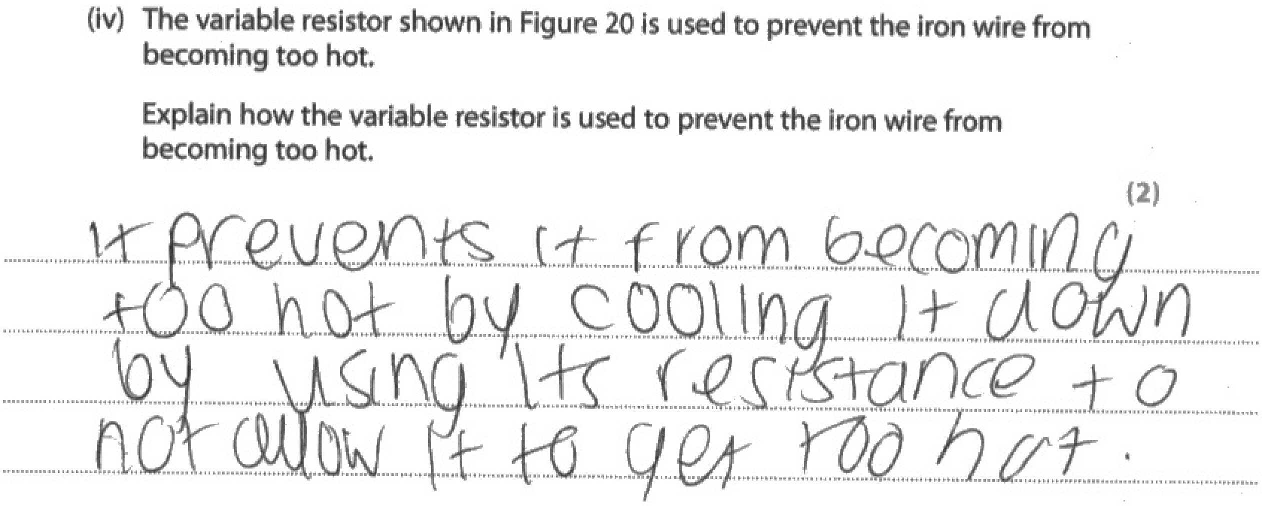
Explain how the variable resistor is used to prevent the iron wire from becoming too hot.

(2)

It will increase the resistance, to stop it from becoming too hot and decrease the resistance when it is safe to.

ResultsPlus Examiner Comments

1 mark awarded for mark point 1 being addressed regarding the increase in resistance.



(iv) The variable resistor shown in Figure 20 is used to prevent the iron wire from becoming too hot.

Explain how the variable resistor is used to prevent the iron wire from becoming too hot.

(2)

It prevents it from becoming too hot by cooling it down by using its resistance to not allow it to get too hot.

ResultsPlus Examiner Comments

See below.

ResultsPlus Examiner Tip

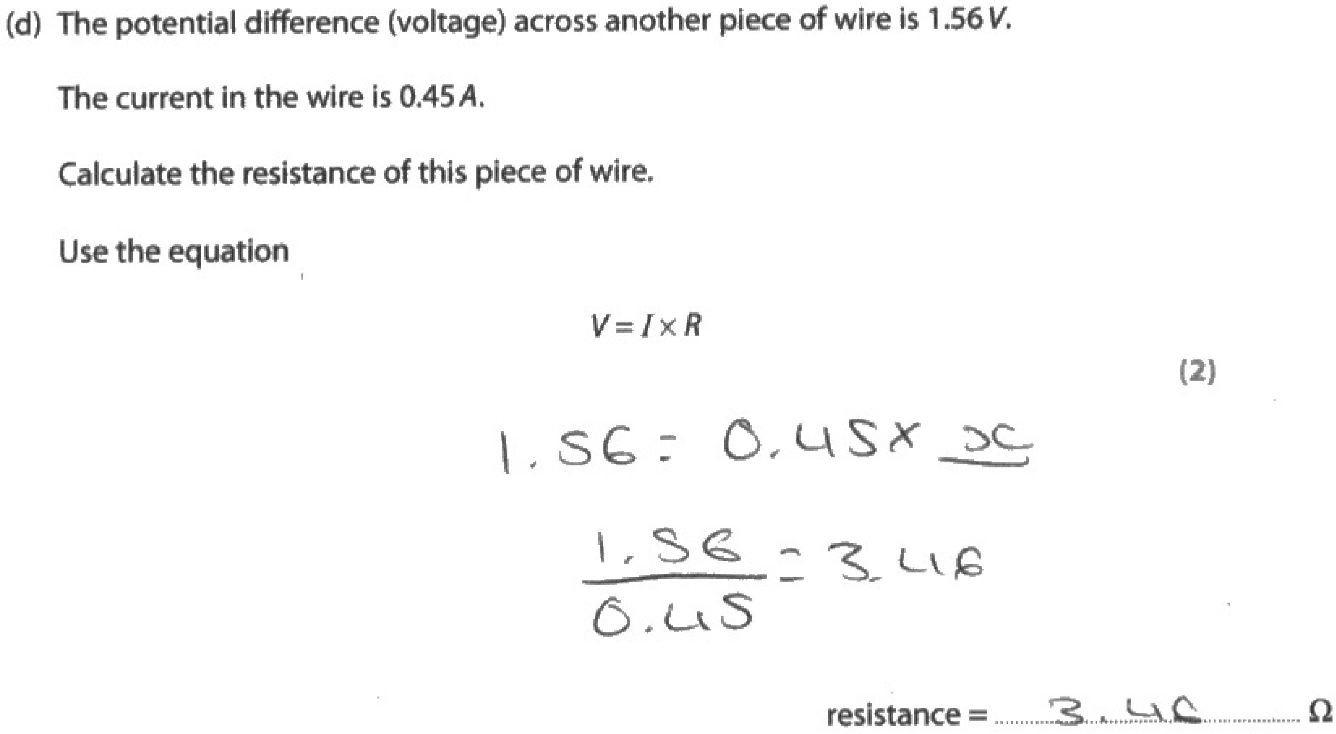
No mark scheme points were met in this answer.

The argument ('cooling it down') is weak.

Question 8 (d)

Once again the comfort zone of calculations enables most to score the two marks here.

The rearrangement of the equation did not cause as much problem as it did in other questions on this paper.



(d) The potential difference (voltage) across another piece of wire is 1.56 *V*.

The current in the wire is 0.45 *A*.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

(2)

$1.56 = 0.45 \times \underline{x}$

$\frac{1.56}{0.45} = 3.46$

resistance = 3.46 Ω

ResultsPlus
Examiner Comments

This candidate sets out the equation substituted into (1 mark), then rearranges and evaluates accurately (1 mark).

(d) The potential difference (voltage) across another piece of wire is 1.56 *V*.

The current in the wire is 0.45 *A*.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

$y = \frac{0.45}{1.56}$ **(2)**

$1.56 = y \times 0.45$

resistance = 0.28 Ω

ResultsPlus
Examiner Comments

This candidate gets the substitution mark but rearranges wrongly thus limiting their mark to 1 mark altogether.

(d) The potential difference (voltage) across another piece of wire is 1.56 *V*.

The current in the wire is 0.45 *A*.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

(2)

1.56 ÷ 0.45

resistance = 346.6 Ω

ResultsPlus
Examiner Comments

This candidate has a good substitution into a rearranged equation, but then falls down on the final evaluation ending up a factor of 100x too great.

(d) The potential difference (voltage) across another piece of wire is 1.56 *V*.

The current in the wire is 0.45 *A*.

Calculate the resistance of this piece of wire.

Use the equation

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

$$V = I \times R$$

(2)

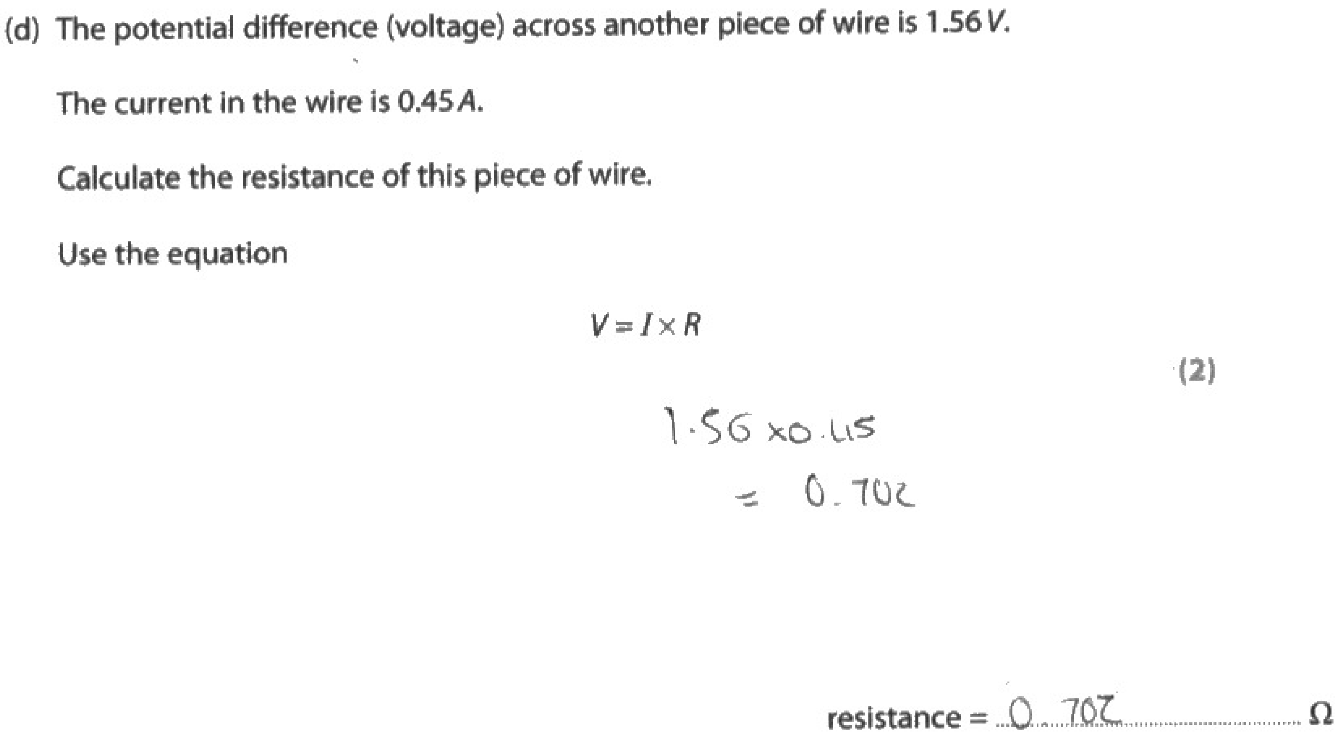
$$R = \frac{V}{I}$$

$$= \frac{1 \cdot 56}{0 \cdot 45} = 0 \cdot 702$$

resistance = 0·70 Ω

ResultsPlus
Examiner Comments

Correct rearrangement and substitution, then performs a wrong calculation – multiplying.



(d) The potential difference (voltage) across another piece of wire is 1.56 V.

The current in the wire is 0.45 A.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

(2)

1·56 x 0.45

= 0.702

resistance = 0.702 Ω

ResultsPlus
Examiner Comments

The candidate appears to just want to multiply the two values, which are not 'I' and 'R'.

So wholly wrong, unfortunately.

(d) The potential difference (voltage) across another piece of wire is 1.56 *V*.

The current in the wire is 0.45 *A*.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

(2)

$$\frac{1.56}{0.45} = 3.46$$

resistance = 3.[illegible]46 Ω

ResultsPlus
Examiner Comments

The candidate rearranges and then substitutes with accuracy.

Full marks – 2 awarded

(d) The potential difference (voltage) across another piece of wire is 1.56 V.

The current in the wire is 0.45 A.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

(2)

$R = \frac{1}{V}$ $\frac{0.45}{1.56}$

resistance = ~~0.28~~ 0.29 Ω

ResultsPlus

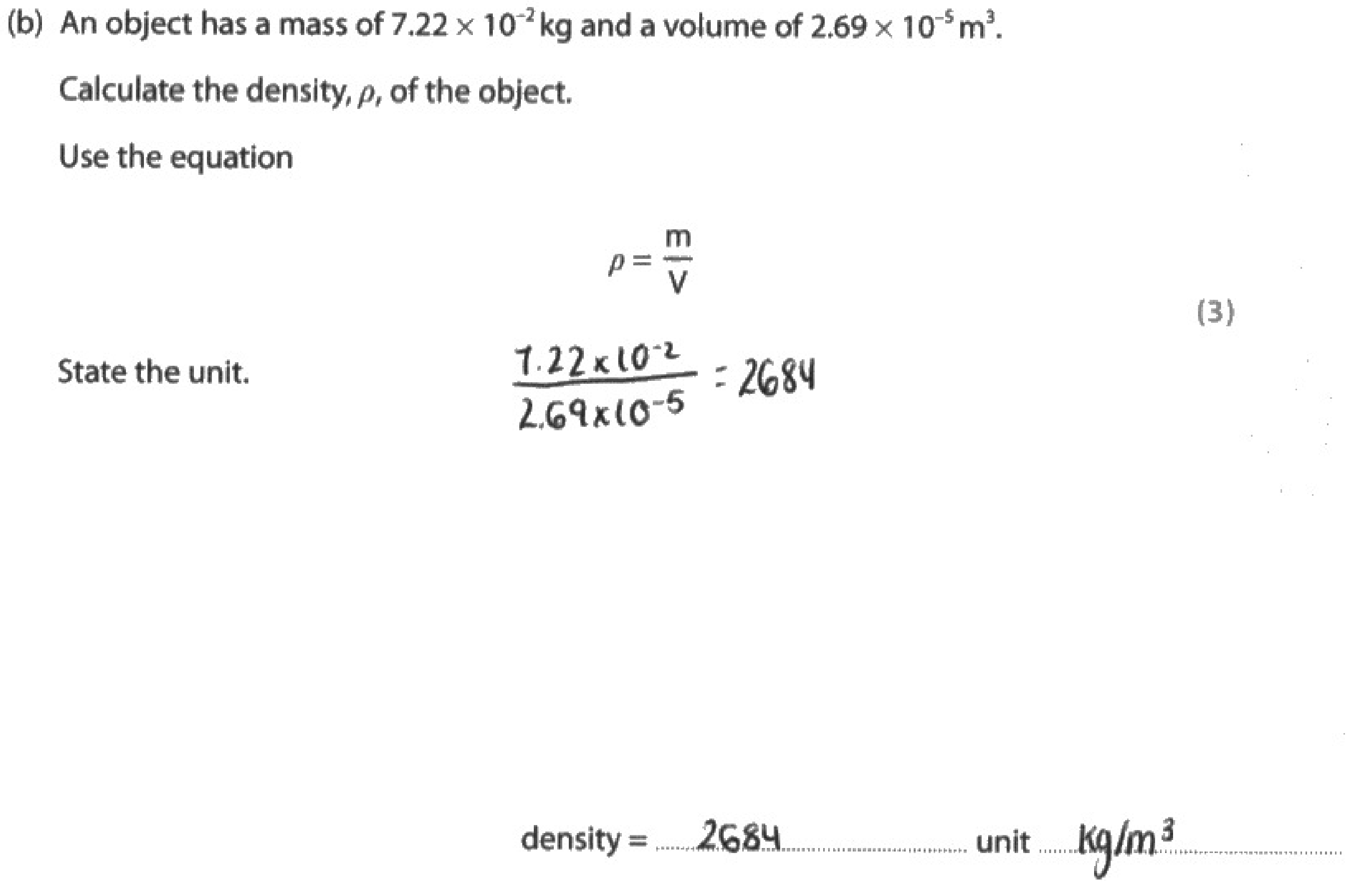
Examiner Comments

The candidate takes I/V, so misinterprets their formula triangle.

No marks are creditable here.

Question 9 (b)

There were many good calculations seen in 9(b), with not so many students knowing the unit of density however.



(b) An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m^3.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

State the unit.

(3)

$$\frac{7.22 \times 10^{-2}}{2.69 \times 10^{-5}} = 2684$$

density = 2684 unit kg/m^3

ResultsPlus
Examiner Comments

A perfect answer was seen from this candidate.

Correct substitution.

Correct evaluation.

Correct associated unit.

3 marks awarded.

(b) An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m^3.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

(3)

State the unit.

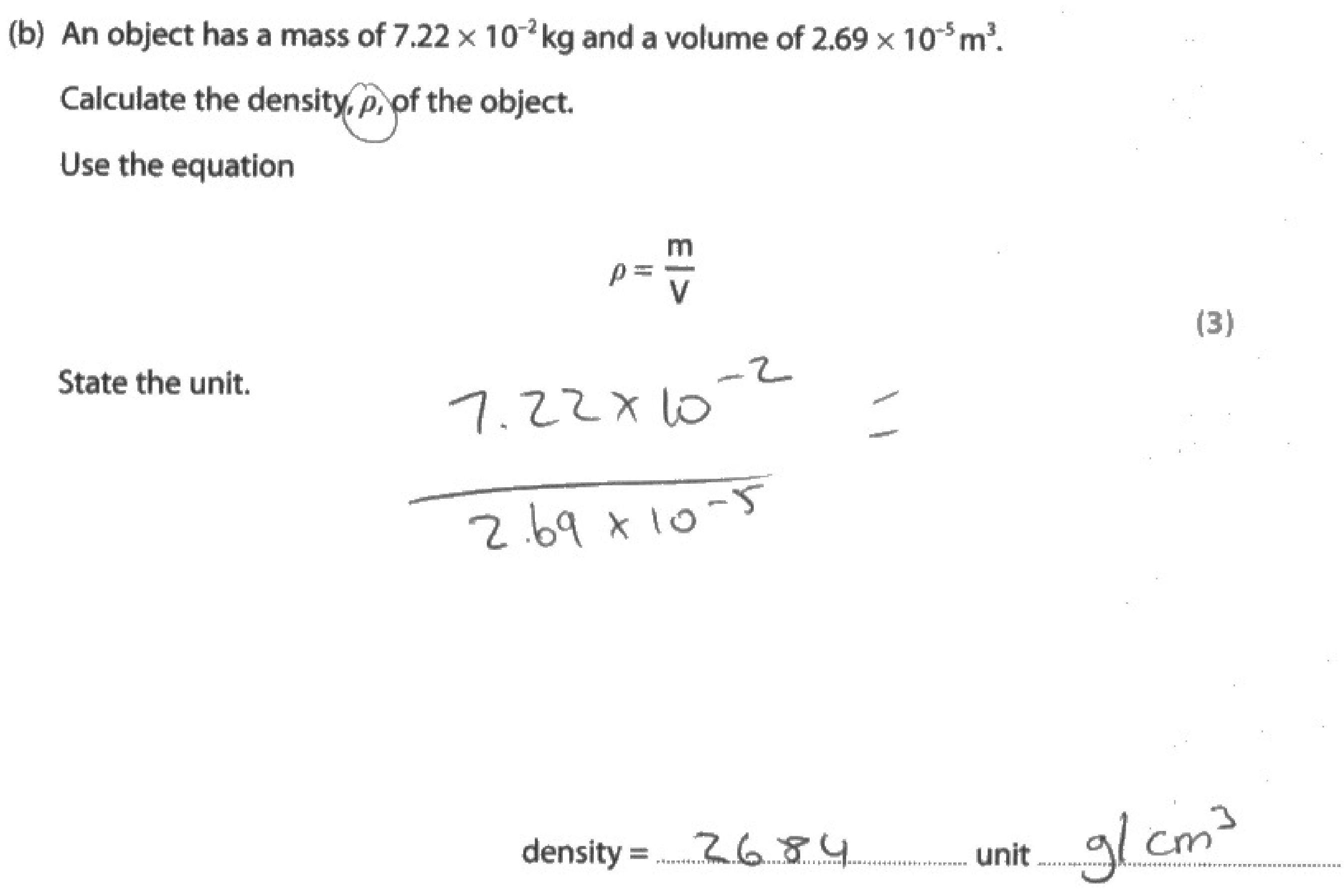
$$\frac{7.22\times10^{-2}}{2.69\times10^{-5}} = \frac{0.0722}{0.0000.269} = 2684.0187 = 2684.02$$

density = 2684.02 unit p

ResultsPlus Examiner Comments

Mark scheme stipulates:

Allow for one mark: 2680 to any other power of ten with no or incorrect unit.



(b) An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m³.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

(3)

State the unit.

$$\frac{7.22 \times 10^{-2}}{2.69 \times 10^{-5}} =$$

density = 2684 unit g/cm³

ResultsPlus Examiner Comments

"Allow for one mark: 2680 to any other power of ten with no or incorrect unit".

Here, although the associated unit is incorrect, 2 marks are awarded.

(b) An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m³.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

State the unit.

(3)

$$\frac{7.22 \times 10^{-2}}{2.69 \times 10^{-5}} = 2684.01487$$

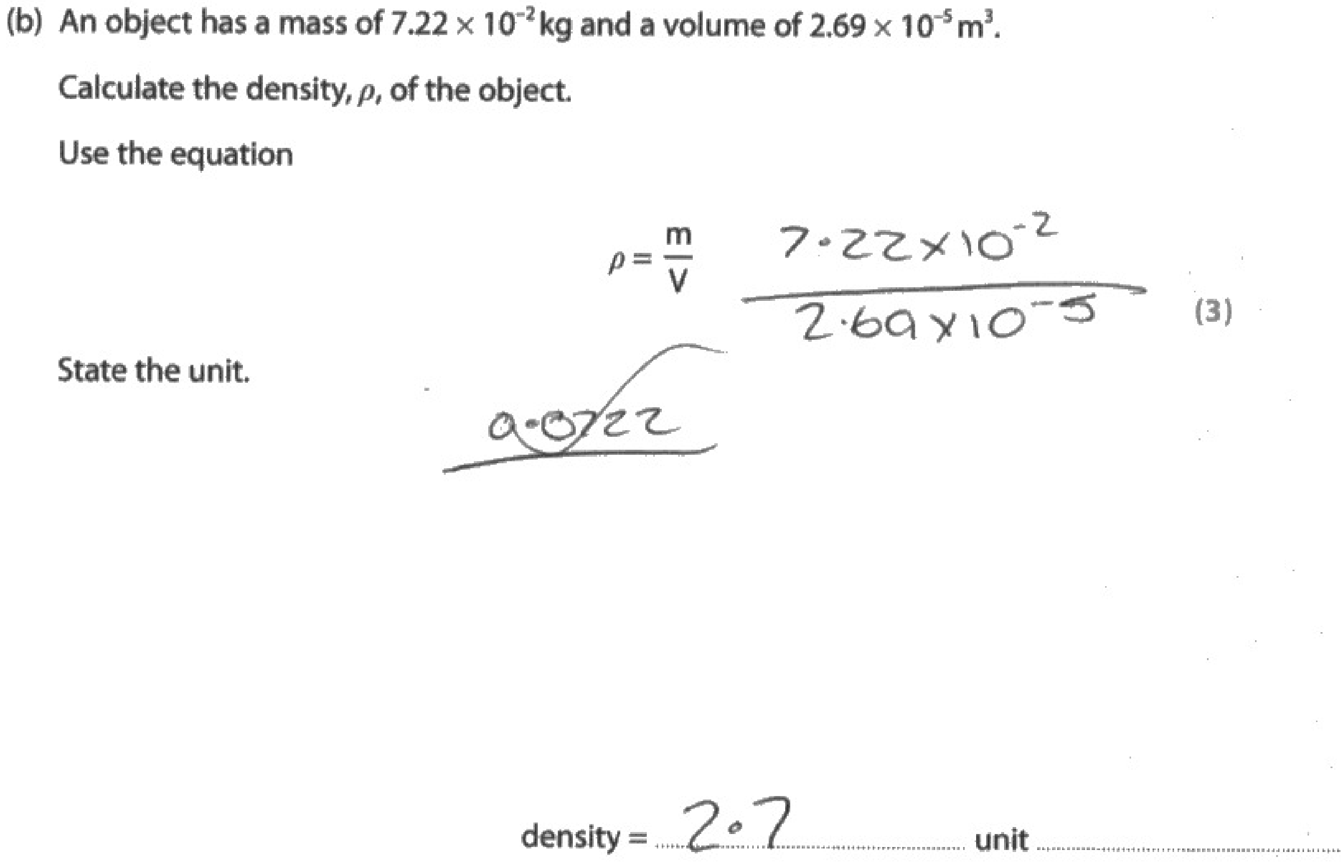
density = 2684.01487 unit ....

ResultsPlus
Examiner Comments

See below.

ResultsPlus
Examiner Tip

Correct substitution and evaluation for 2 marks. No units.



(b) An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m³.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V} \qquad \frac{7{\cdot}22\times10^{-2}}{2{\cdot}69\times10^{-5}}$$

(3)

State the unit.

0·0722

density = 2·7 unit ....

ResultsPlus
Examiner Comments

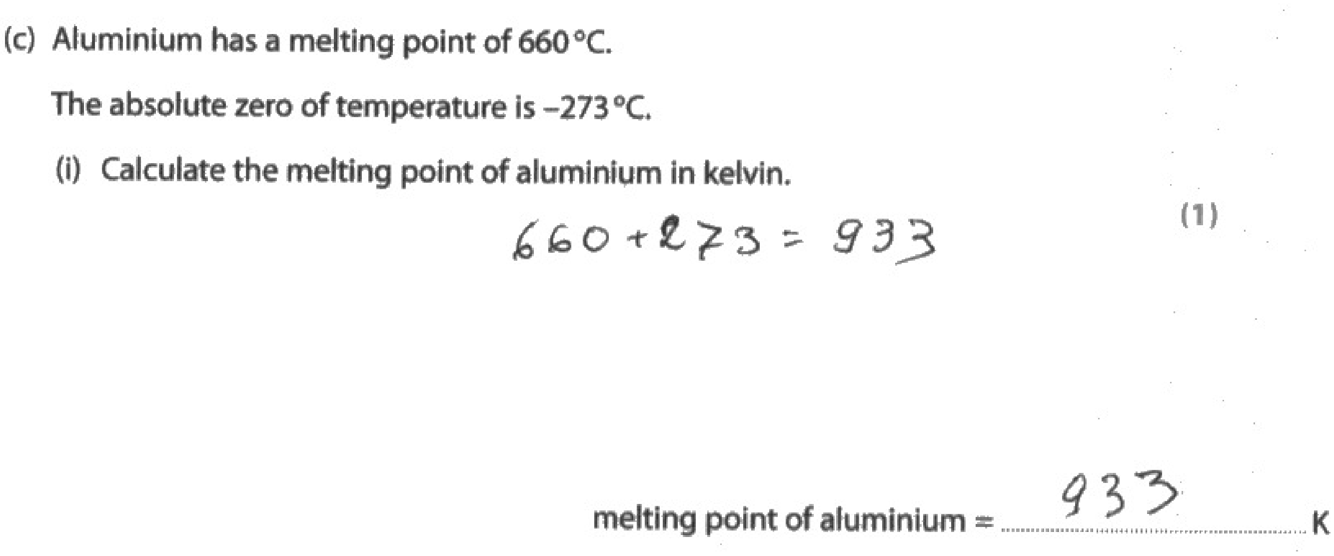
One mark for the initial substitution line.

Only one mark due with no unit (see additional guidance).

Question 9 (c)(i)

The vast majority of candidates did not know how to convert Celsius to kelvin.

The specification says students should be able 'to convert between the kelvin and Celsius scales' (14.15)



(c) Aluminium has a melting point of 660 °C.

The absolute zero of temperature is −273 °C.

(i) Calculate the melting point of aluminium in kelvin.

(1)

660 + 273 = 933

melting point of aluminium = 933 K

ResultsPlus Examiner Comments

Correct calculation, adding 273 to the Celsius temperature.

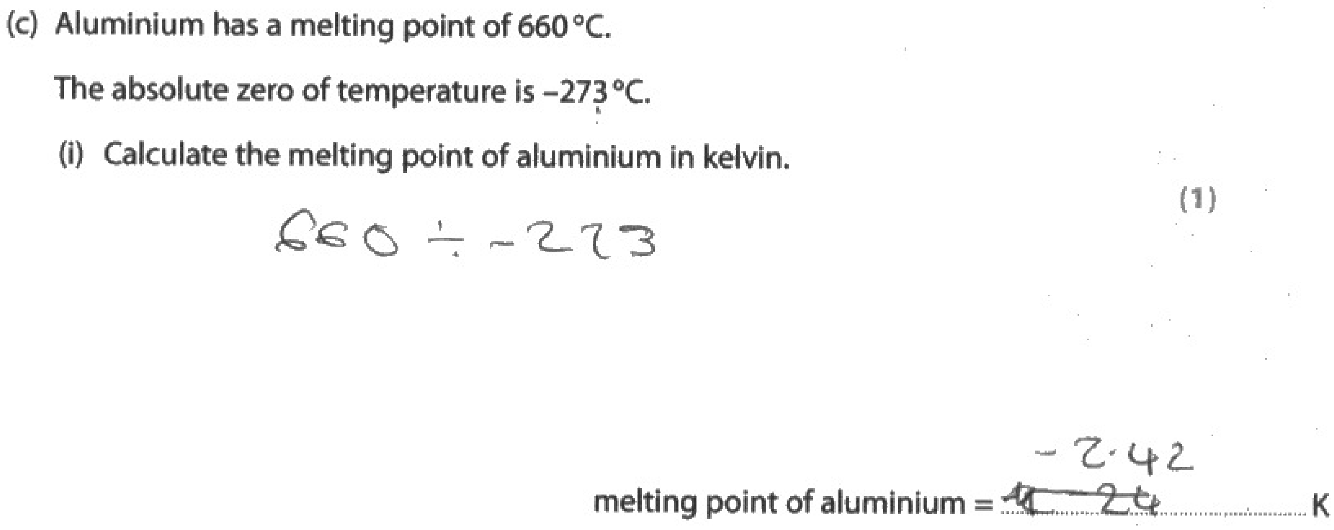
ResultsPlus Examiner Tip

This is how it works:

Add 273 to the Celsius temperature to get kelvin.

Subtract 273 to a kelvin temperature to get Celsius.

You will be told 'The absolute zero of temperature is –273 °C'. Then you just have to remember what to do with the '273'.



(c) Aluminium has a melting point of 660 °C.

The absolute zero of temperature is –273 °C.

(i) Calculate the melting point of aluminium in kelvin.

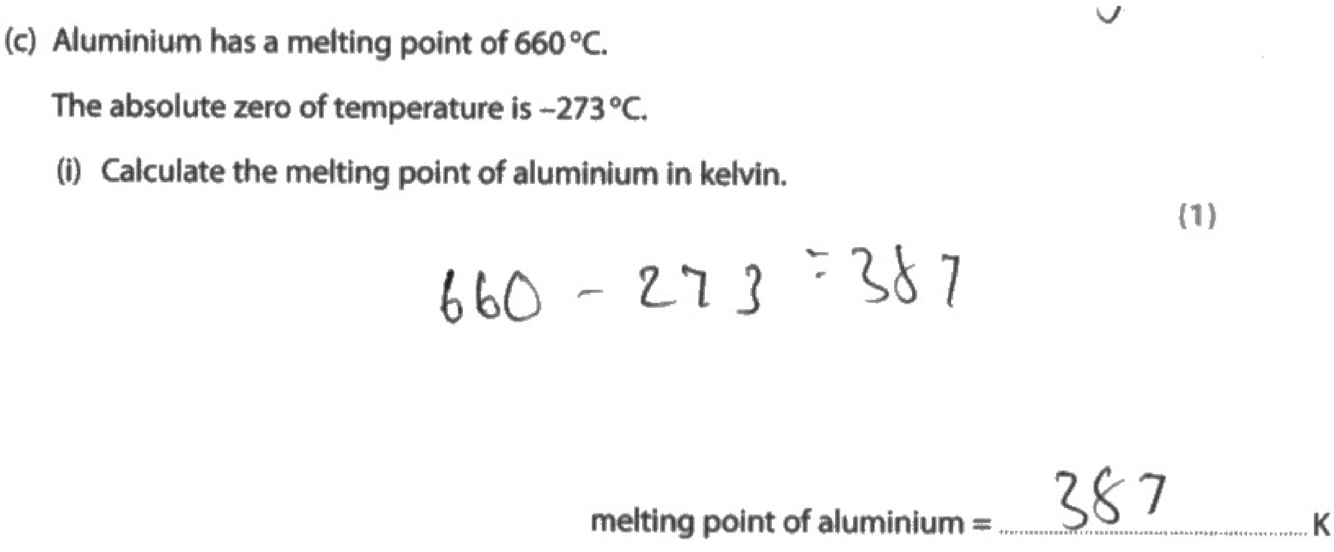
(1)

660 ÷ -273

melting point of aluminium = ~~4 24~~ -2.42 K

ResultsPlus
Examiner Comments

One of many other false attempts at conversion.



(c) Aluminium has a melting point of 660 °C.

The absolute zero of temperature is –273 °C.

(i) Calculate the melting point of aluminium in kelvin.

(1)

660 - 273 = 387

melting point of aluminium = 387 K

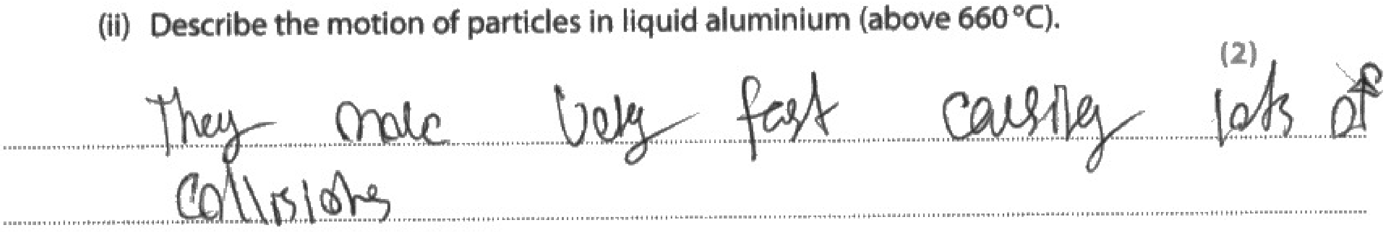
ResultsPlus
Examiner Comments

This was a very common misapplication. Understandable on seeing –273 °C, but incorrect.

Question 9 (c)(ii)

Most students scored at least one mark on this question.

Describing the arrangement of particles could not be credited since the question asked 'Describe **the motion** of particles'.



(ii) Describe the motion of particles in liquid aluminium (above 660 °C).

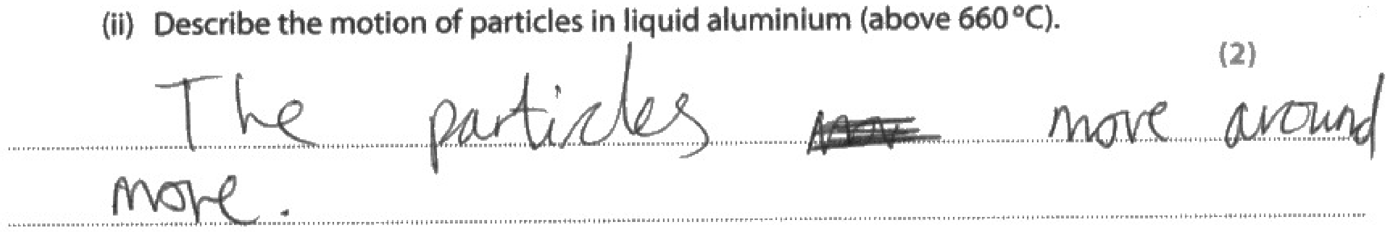
(2)

They move very fast causing lots of collisions

ResultsPlus
Examiner Comments

'fast' scores mp4 and 'collisions' scores mp3.

2 marks in total



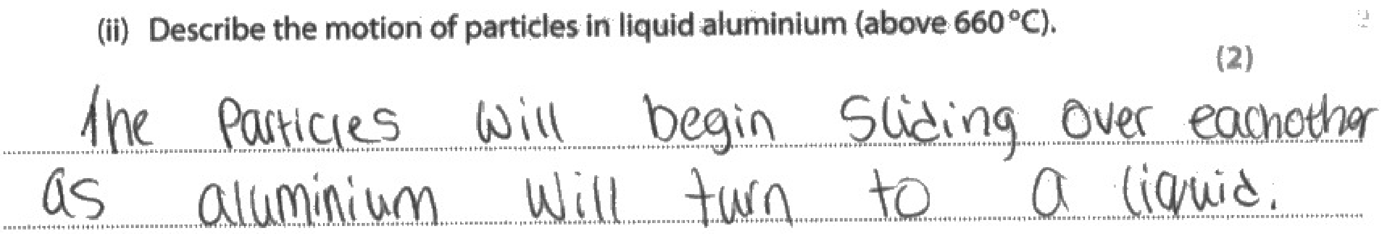
(ii) Describe the motion of particles in liquid aluminium (above 660 °C).

(2)

The particles move around more.

ResultsPlus
Examiner Comments

'Move around' scores 1 mark, as per the additional guidance for mp1.



(ii) Describe the motion of particles in liquid aluminium (above 660 °C).

(2)

The Particles will begin Sliding over eachother as aluminium will turn to a liquid.

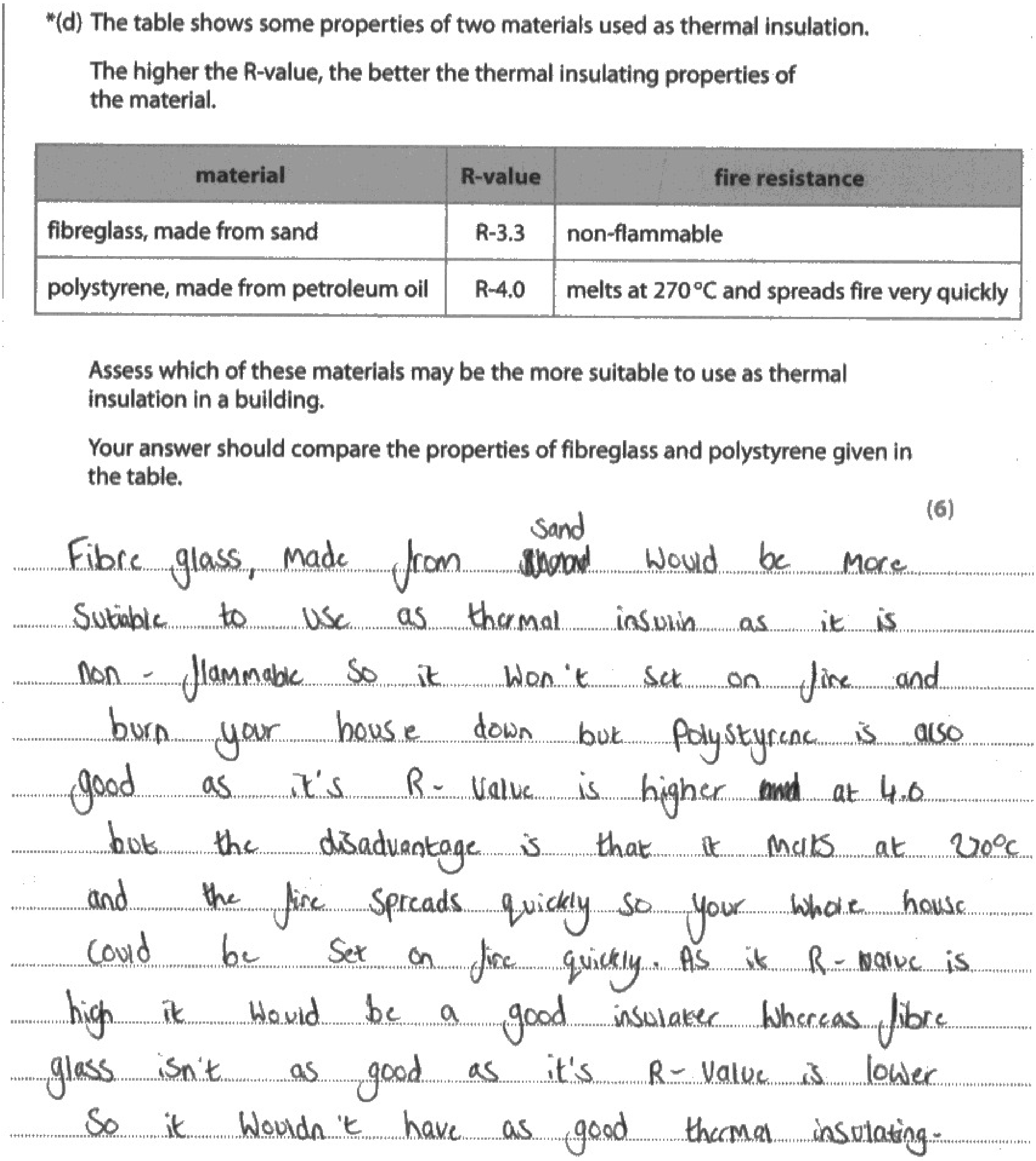
ResultsPlus

Examiner Comments

'Particles sliding over each' other scores mp 3 (additional guidance).

Question 9 (d)

9(d) was a 6 marks question asking candidates to assess which of two potential building materials to use as thermal insulator. With a half of all candidates achieving level 3 this was better facilitating than the earlier 6 marks question 7(c).



*(d) The table shows some properties of two materials used as thermal insulation.

The higher the R-value, the better the thermal insulating properties of the material.

material	R-value	fire resistance
fibreglass, made from sand	R-3.3	non-flammable
polystyrene, made from petroleum oil	R-4.0	melts at 270 °C and spreads fire very quickly

Assess which of these materials may be the more suitable to use as thermal insulation in a building.

Your answer should compare the properties of fibreglass and polystyrene given in the table.

(6)

Fibre glass, made from ~~[illegible]~~ sand would be more suitable to use as thermal insulin as it is non-flammable so it won't set on fire and burn your house down but Polystyrene is also good as it's R-value is higher ~~and~~ at 4.0 but the disadvantage is that it melts at 270°c and the fire spreads quickly so your whole house could be set on fire quickly. As it R-value is high it would be a good insulater whereas fibre glass isn't as good as it's R-value is lower so it wouldn't have as good thermal insulating.

ResultsPlus
Examiner Comments

This script concludes that fibre glass would be the better choice, weighing the evidence carefully.

This answer 'compares at least two properties AND gives a conclusion' – the criteria for a level 3 answer.

6 marks awarded

*(d) The table shows some properties of two materials used as thermal insulation.

The higher the R-value, the better the thermal insulating properties of the material.

material	R-value	fire resistance
fibreglass, made from sand	R-3.3	non-flammable
polystyrene, made from petroleum oil	R-4.0	melts at 270 °C and spreads fire very quickly

Assess which of these materials may be the more suitable to use as thermal insulation in a building.

Your answer should compare the properties of fibreglass and polystyrene given in the table.

(6)

Fibreglass should be used because it is non-flammable which is very useful when insulating a building. on the ~~other~~ other hand polystyrene is an oil which would spread fire very quickly which is not suitable for insulating a building and if it gets above 270°c the polystyrene will melt, meaning the building will be left with no insulation.

ResultsPlus
Examiner Comments

This is a level 2 answer – 'compares one property and gives a conclusion about suitability'.

It is wholly focused on flammability and melting at 270^{o}C, ignoring R-values.

4 marks awarded.

*(d) The table shows some properties of two materials used as thermal insulation.

The higher the R-value, the better the thermal insulating properties of the material.

material	R-value	fire resistance
fibreglass, made from sand	R-3.3	non-flammable
polystyrene, made from petroleum oil	R-4.0	melts at 270 °C and spreads fire very quickly

Assess which of these materials may be the more suitable to use as thermal insulation in a building.

Your answer should compare the properties of fibreglass and polystyrene given in the table.

(6)

Fibreglass is a much safer option for an insulator as it is made from sand meaning it is non-flammable. It also means it is long lasting and safer for the environment. polystyrene which is made from petroleum oil, is very flammable and could pose a potential serious threat to life. Even though the insulation gained from the polystyrene is greater, does not mean it is safer. Fibreglass would be a much more suitable option as it does not pose harm to people and the process of making is healthier and safer. Even though the R-value is smaller, it's properties show that the insulation is still very good without a risk of danger.

ResultsPlus
Examiner Comments

This candidate weighs up and compares the evidence in a sophisticated manner.

They take into account many factors, including what the material is made from.

Viewed holistically this is certainly a level 3 answer fulfilling the level 3 criteria and worthy of 6 marks.

*(d) The table shows some properties of two materials used as thermal insulation.

The higher the R-value, the better the thermal insulating properties of the material.

material	R-value	fire resistance
fibreglass, made from sand	R-3.3	non-flammable
polystyrene, made from petroleum oil	R-4.0	melts at 270 °C and spreads fire very quickly

Assess which of these materials may be the more suitable to use as thermal insulation in a building.

Your answer should compare the properties of fibreglass and polystyrene given in the table.

(6)

Overall, fibreglass is the better material to use as a thermal insulator in a building. The reason for this is because it is none-flammable which means it is not a danger hazard or risk when discussing fire Safety. The polystyrene however, is not good to use as a insilator in a building. This is because it is a fire hazard ~~and its~~ Since it spreads fire quickly and also has a melting point of 270°. This would not be useful since its job would be to contain heat.

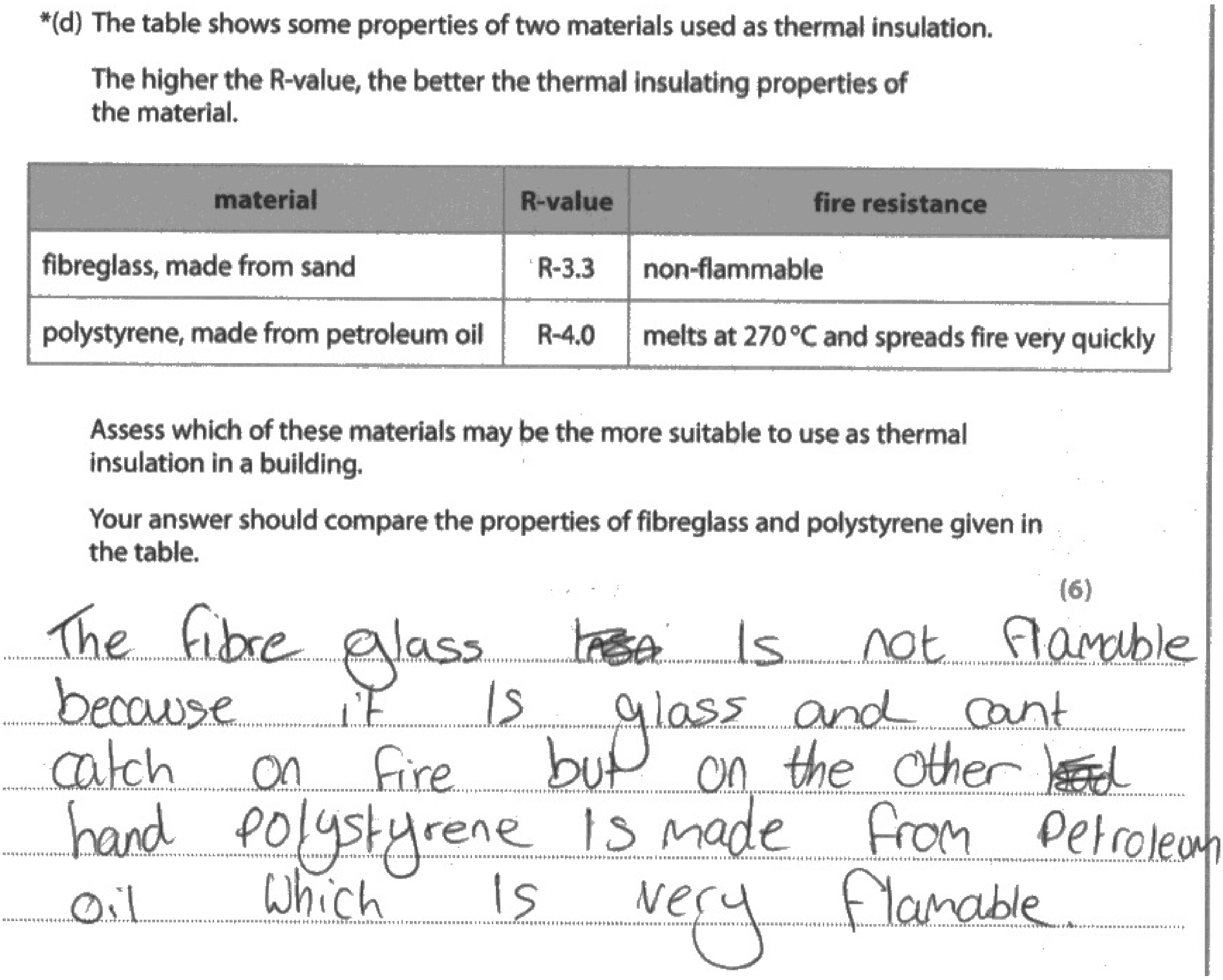
ResultsPlus
Examiner Comments

The quality of this answer is judged holistically to be level 2.

Does not bring R-values into consideration.

With a focus on flammability it really only fulfils the level 2 criteria of considering one property with a conclusion.

4 marks



*(d) The table shows some properties of two materials used as thermal insulation.

The higher the R-value, the better the thermal insulating properties of the material.

material	R-value	fire resistance
fibreglass, made from sand	R-3.3	non-flammable
polystyrene, made from petroleum oil	R-4.0	melts at 270 °C and spreads fire very quickly

Assess which of these materials may be the more suitable to use as thermal insulation in a building.

Your answer should compare the properties of fibreglass and polystyrene given in the table.

(6)

The fibre glass [illegible] Is not Flamable because it Is glass and cant catch on Fire but on the other [illegible] hand polystyrene Is made From Petroleum oil Which Is very Flamable.

ResultsPlus
Examiner Comments

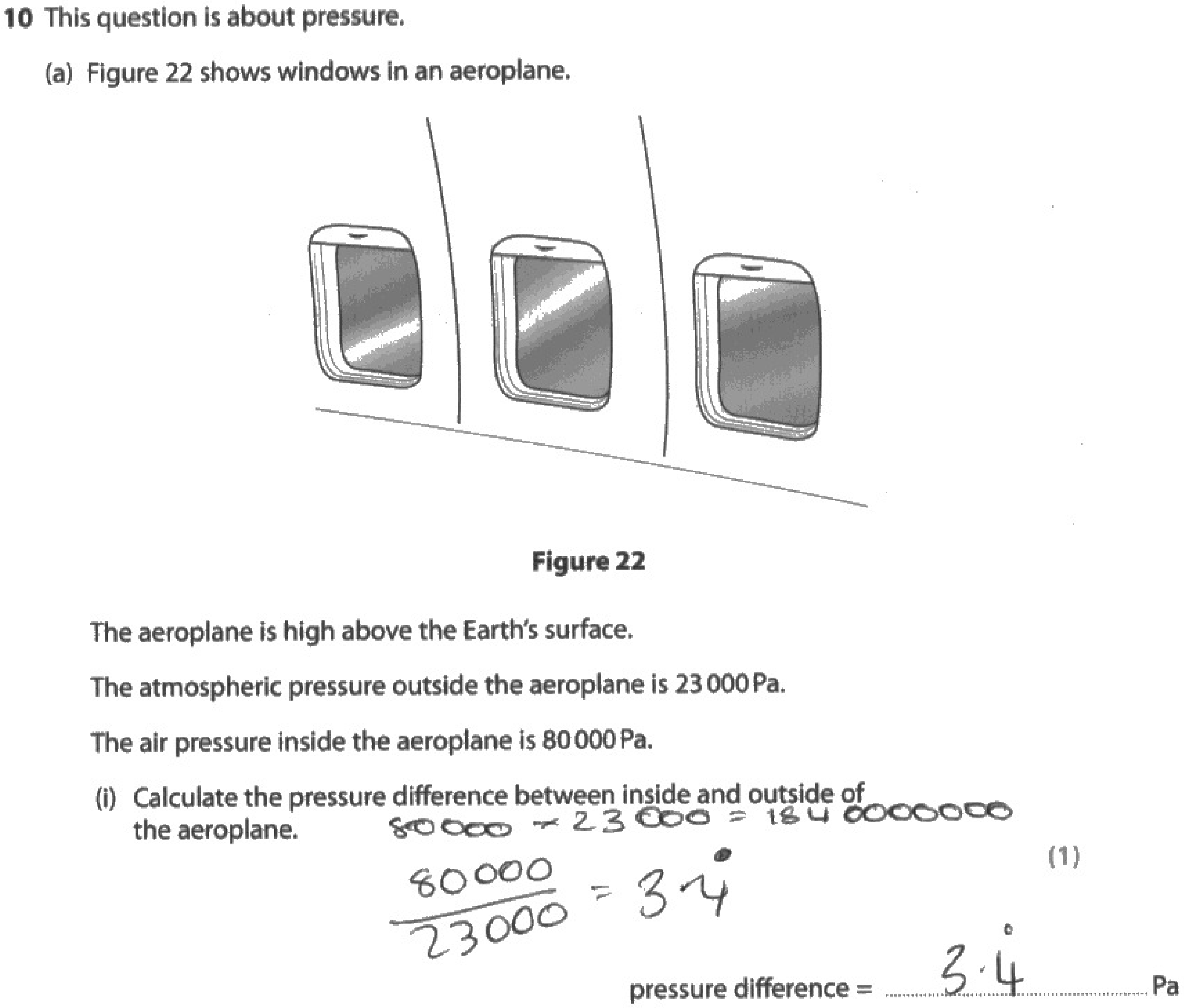
Level 1 answer – 'at least two pieces of information from the table used'.

Focuses on flammability but does not come to a stated conclusion, so this may not access level 2.

Question 10 (a)(i)

Q10(a) i begins with an easy opener, just calculating a difference.

A very large majority scored this mark.



10 This question is about pressure.

(a) Figure 22 shows windows in an aeroplane.

Figure 22

The aeroplane is high above the Earth's surface.

The atmospheric pressure outside the aeroplane is 23 000 Pa.

The air pressure inside the aeroplane is 80 000 Pa.

(i) Calculate the pressure difference between inside and outside of the aeroplane.

$80000 \times 23000 = 184\,0000000$

$\frac{80000}{23000} = 3.\dot{4}$

(1)

pressure difference = $3.\dot{4}$ Pa

ResultsPlus
Examiner Comments

There were always other things that could be done instead of calculating the simple difference asked for.

No marks for not finding the simple difference.

10 This question is about pressure.

(a) Figure 22 shows windows in an aeroplane.

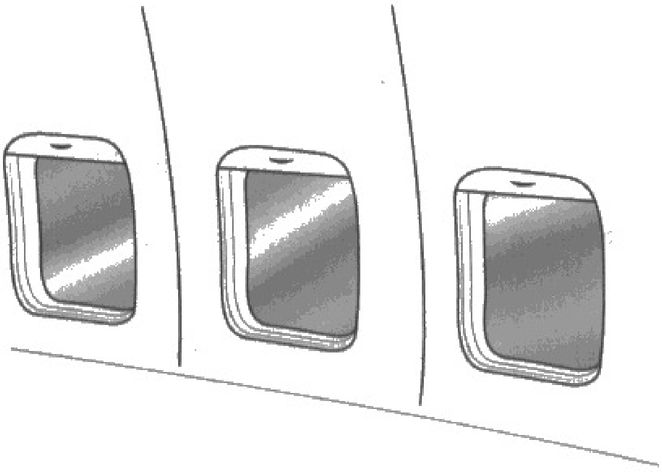


Figure 22

The aeroplane is high above the Earth's surface.

The atmospheric pressure outside the aeroplane is 23 000 Pa.

The air pressure inside the aeroplane is 80 000 Pa.

(i) Calculate the pressure difference between inside and outside of the aeroplane.

$\frac{23000}{80000} = 0.2875$ **(1)**

pressure difference = 0.2875 Pa

ResultsPlus
Examiner Comments

Another variation of avoiding the simple difference calculation.

0 marks

10 This question is about pressure.

(a) Figure 22 shows windows in an aeroplane.

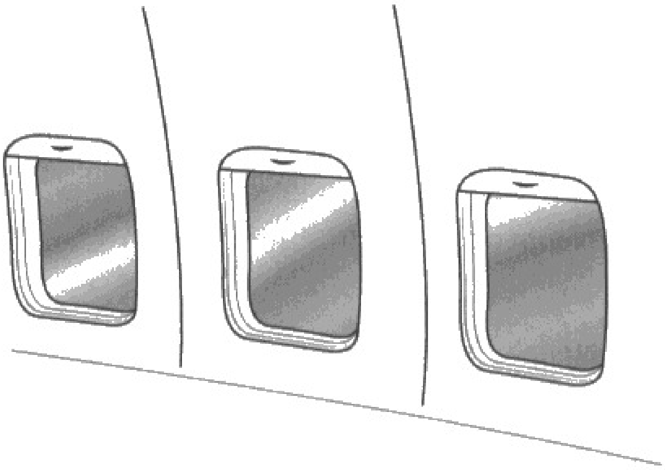


Figure 22

The aeroplane is high above the Earth's surface.

The atmospheric pressure outside the aeroplane is 23 000 Pa.

The air pressure inside the aeroplane is 80 000 Pa.

(i) Calculate the pressure difference between inside and outside of the aeroplane.

(1)

80000 − 23000

pressure difference = 57,000 Pa

ResultsPlus
Examiner Comments

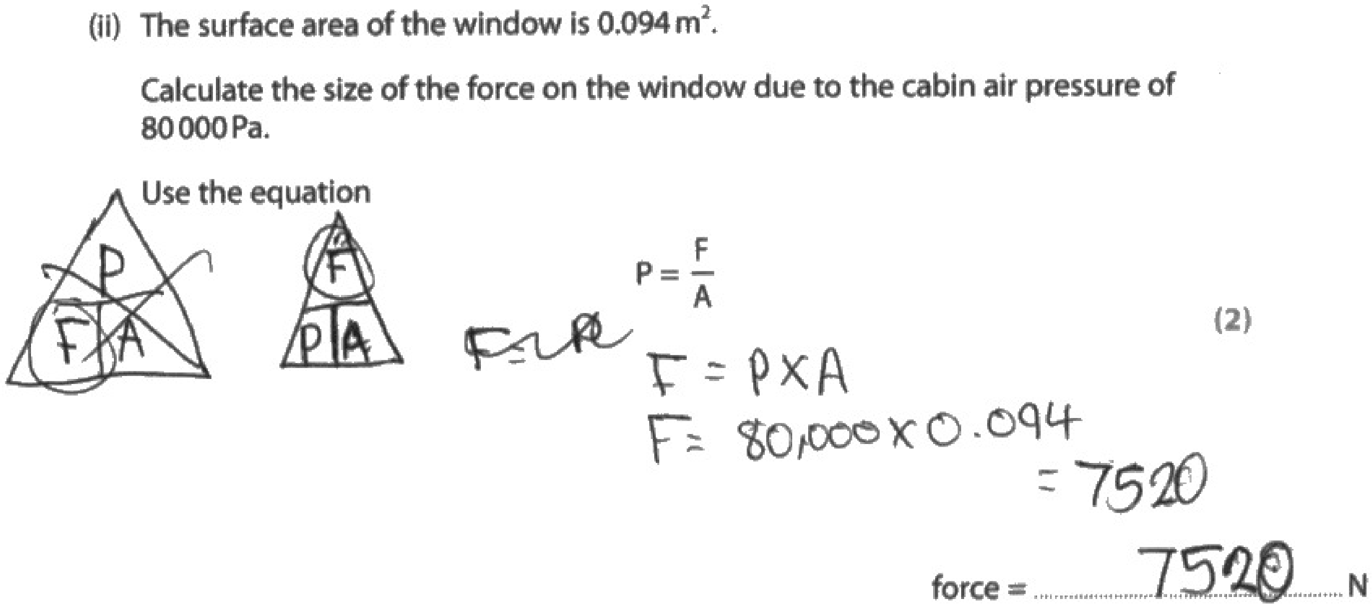
As executed by the vast majority of candidates, this one having clarity in giving the simple working.

Question 10 (a)(ii)

Many candidates scored 2/2 for this calculation of force requiring a rearrangement of the pressure = force / area formula to achieve this.

Not quite as many made no progress when they had a wrong substitution or wrong rearrangement or both.

Extremely few scored 1/2.



(ii) The surface area of the window is 0.094 m^2.

Calculate the size of the force on the window due to the cabin air pressure of 80 000 Pa.

Use the equation

$$P = \frac{F}{A}$$

(2)

F=PA

F = P×A

F= 80,000×0.094

= 7520

force = 7520 N

ResultsPlus
Examiner Comments

Correct substitution, rearrangement and evaluation.

2 marks

(ii) The surface area of the window is 0.094 m^2.

Calculate the size of the force on the window due to the cabin air pressure of 80 000 Pa.

Use the equation

$$P = \frac{F}{A}$$

(2)

$$P = \frac{80,000}{0.094}$$

$$P = 851063.8298$$

force = 850,000 N

ResultsPlus
Examiner Comments

Wrong substitution with confusion over the subject of the formula given.

0 marks

(ii) The surface area of the window is $0.094\,m^2$.

Calculate the size of the force on the window due to the cabin air pressure of 80 000 Pa.

Use the equation

$$P = \frac{F}{A}$$

(2)

$$\frac{0.094}{80.000} = 1.175$$

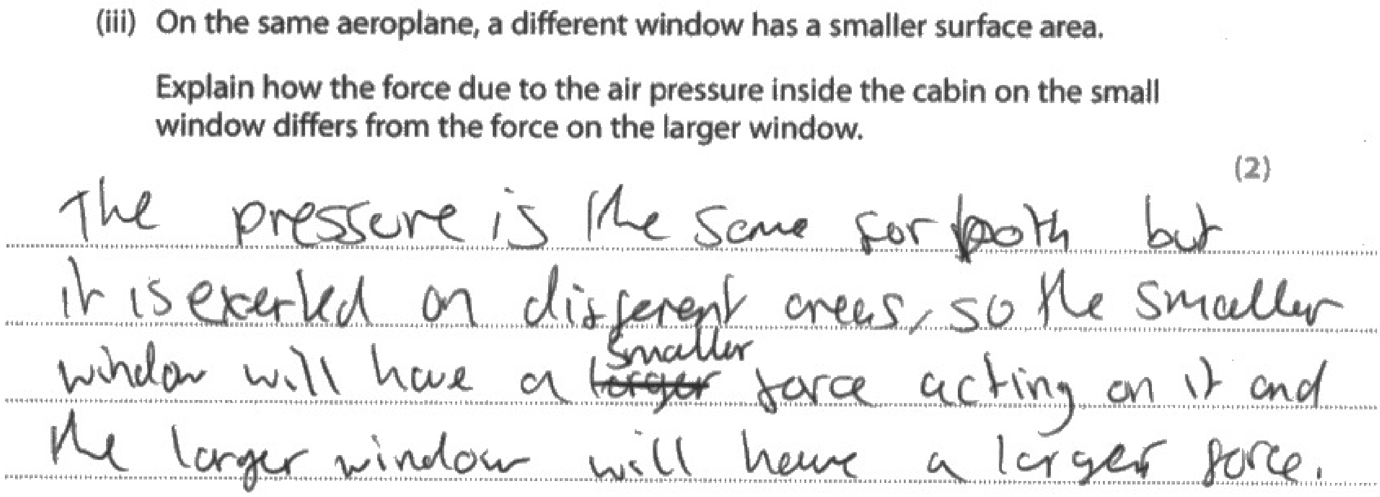
force = 1.175 N

ResultsPlus
Examiner Comments

This candidate takes area divided by pressure: 0 marks.

Question 10 (a)(iii)

Candidates struggled to suggest, let alone explain, that a smaller window inside the plane, should have a smaller force acting on it. Hardly any candidates went on to apply the idea of constancy of pressure between the larger and smaller windows.



(iii) On the same aeroplane, a different window has a smaller surface area.

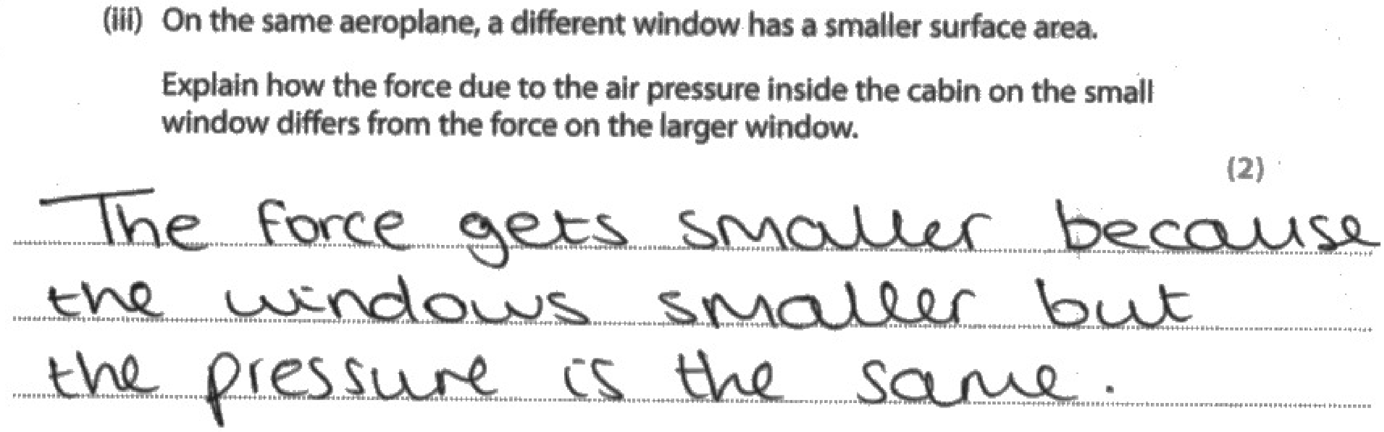
Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.

(2)

The pressure is the same for both but it is exerted on different areas, so the smaller window will have a ~~larger~~ smaller force acting on it and the larger window will have a larger force.

ResultsPlus
Examiner Comments

Perfectly argued, scoring both mark points.



(iii) On the same aeroplane, a different window has a smaller surface area.

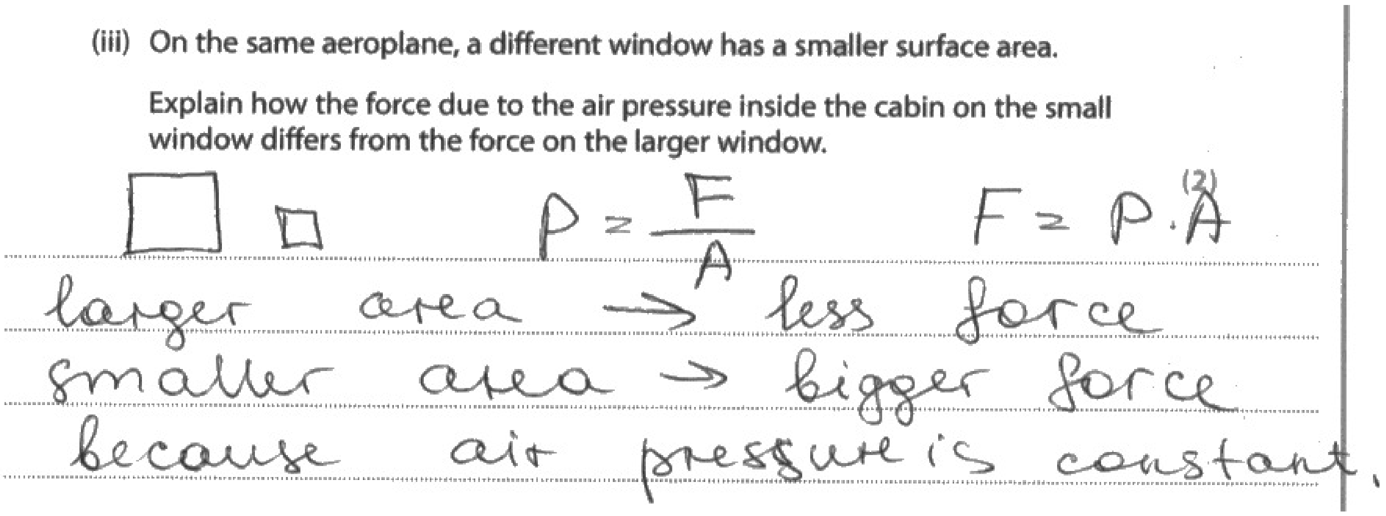
Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.

(2)

The force gets smaller because the windows smaller but the pressure is the same.

ResultsPlus
Examiner Comments

Succinctly put, matching both mark points.



(iii) On the same aeroplane, a different window has a smaller surface area.

Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.

(2)

□ □ $p = \frac{F}{A}$ $F = p \cdot A$

larger area → less force

smaller area → bigger force

because air pressure is constant.

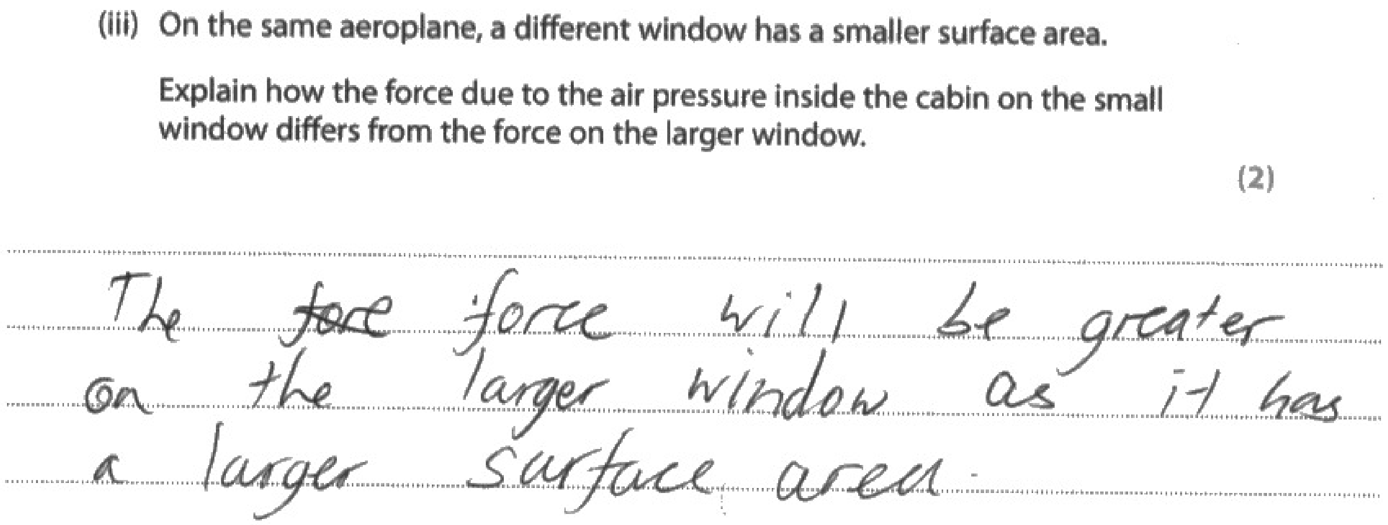
ResultsPlus
Examiner Comments

One mark awarded for constancy of force.

Overall conclusion wrong regarding area and force.

ResultsPlus
Examiner Tip

Having worked out F = p A and talked about constancy of pressure, it is a pity the candidate did not extrapolate 'smaller area smaller force' from that equation.



(iii) On the same aeroplane, a different window has a smaller surface area.

Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.

(2)

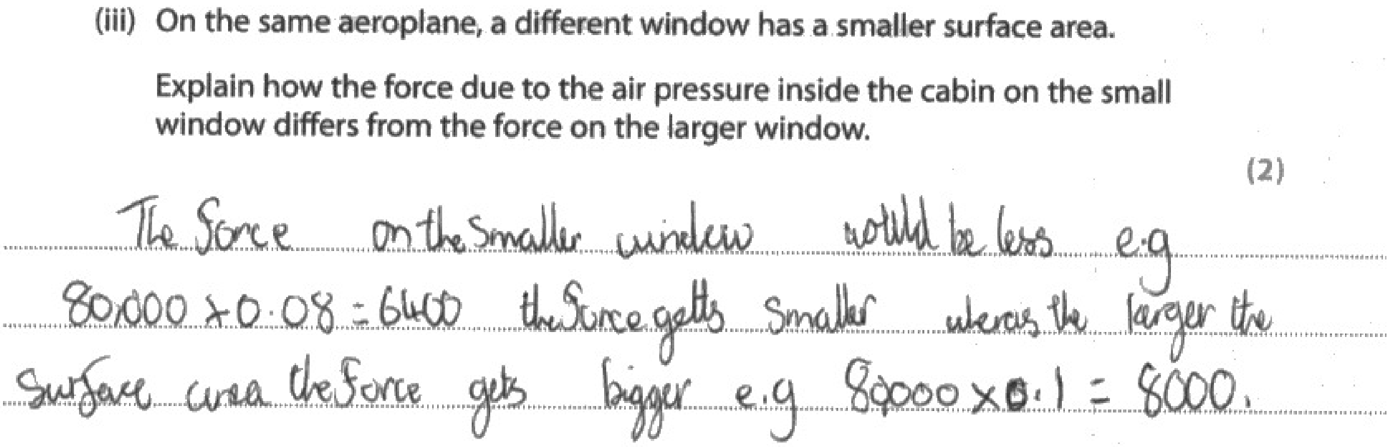
The ~~fore~~ force will be greater on the larger window as it has a larger surface area.

ResultsPlus
Examiner Comments

Additional guidance, first mark point, credits this.

Second mark point not seen here.

1 mark awarded



(iii) On the same aeroplane, a different window has a smaller surface area.

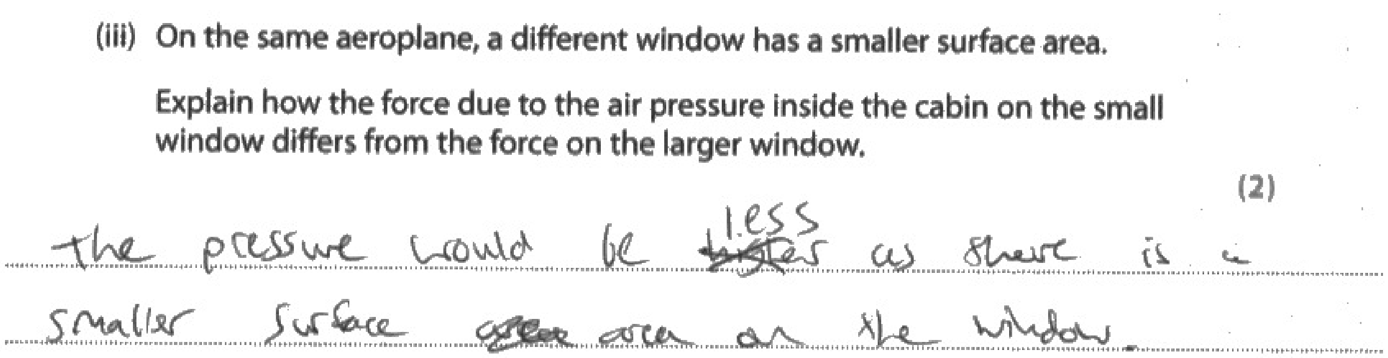
Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.

(2)

The Force on the Smaller window would be less e.g 80,000 × 0.08 = 6400 the Force gets Smaller whereas the larger the Surface area the Force gets bigger e.g 80000 × 0.1 = 8000.

ResultsPlus
Examiner Comments

2 marks for a well-organised answer using data and keeping pressure constant for that illustrative calculation.



(iii) On the same aeroplane, a different window has a smaller surface area.

Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.

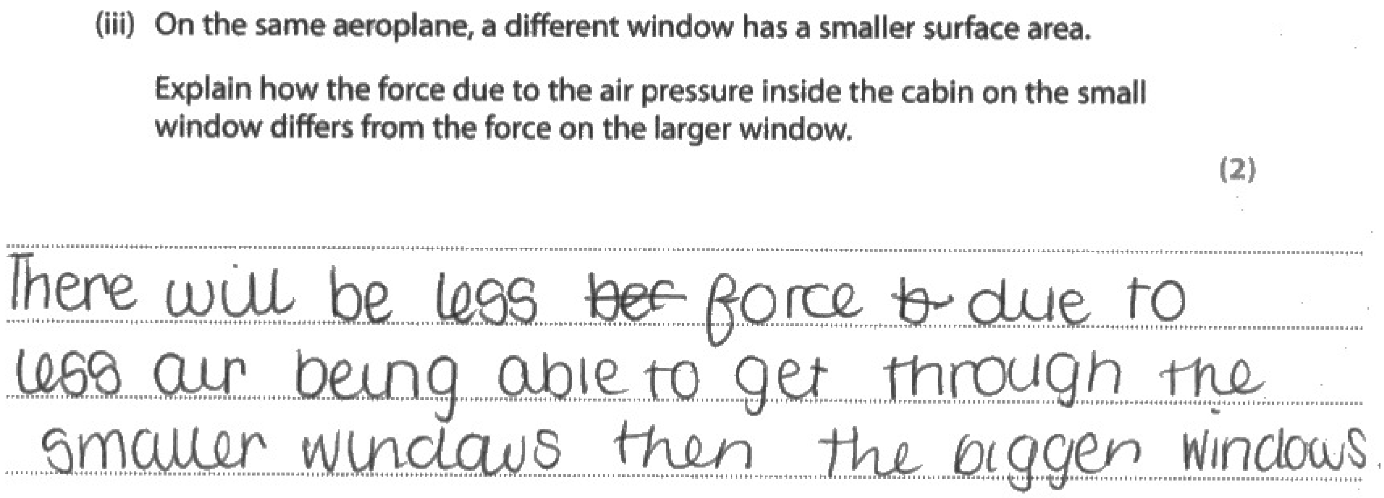
(2)

the pressure would be ~~bigger~~ less as there is a smaller surface [illegible] area on the window.

ResultsPlus
Examiner Comments

The candidate is not talking of the force, as required by the question. Many candidates did not mention the force.

0 marks



(iii) On the same aeroplane, a different window has a smaller surface area.

Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.

(2)

There will be less ~~bef~~ force ~~to~~ due to less air being able to get through the smaller windows then the bigger windows.

ResultsPlus
Examiner Comments

'Less force' give this first mark point.

Question 10 (a)(iv)

A significant number recognised that the resultant force was acting outwards.

The vast majority did not draw the force arrow acting at the point asked for.

(iv) Figure 23 shows a cross-section through the aeroplane including one window.

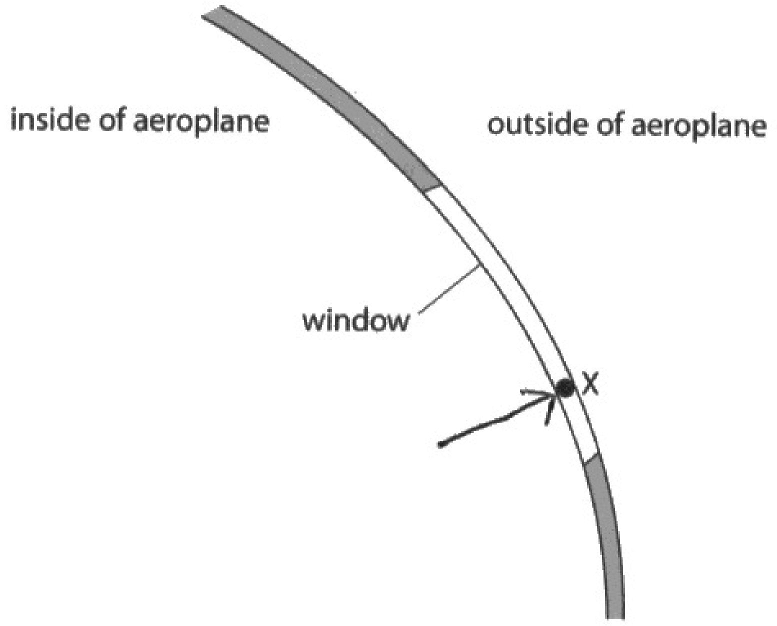


Figure 23

Draw an arrow on Figure 23 to show the direction of the resultant force due to the air pressure inside the cabin on the window at point X.

ResultsPlus
Examiner Comments

Both marks points scored:

- arrow pointing towards outside of aeroplane (1)
- arrow is normal to surface at X (judge by eye) (1)

(iv) Figure 23 shows a cross-section through the aeroplane including one window.

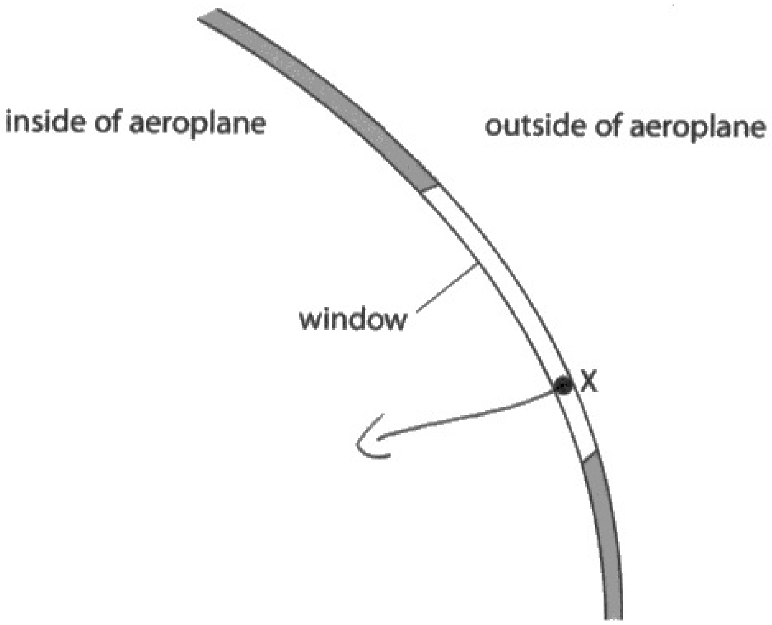


Figure 23

Draw an arrow on Figure 23 to show the direction of the resultant force due to the air pressure inside the cabin on the window at point X.

ResultsPlus
Examiner Comments

Gets one mark for mark point 2. It is near enough perpendicular.

Arrow in wrong direction, so no mp 1.

(iv) Figure 23 shows a cross-section through the aeroplane including one window.

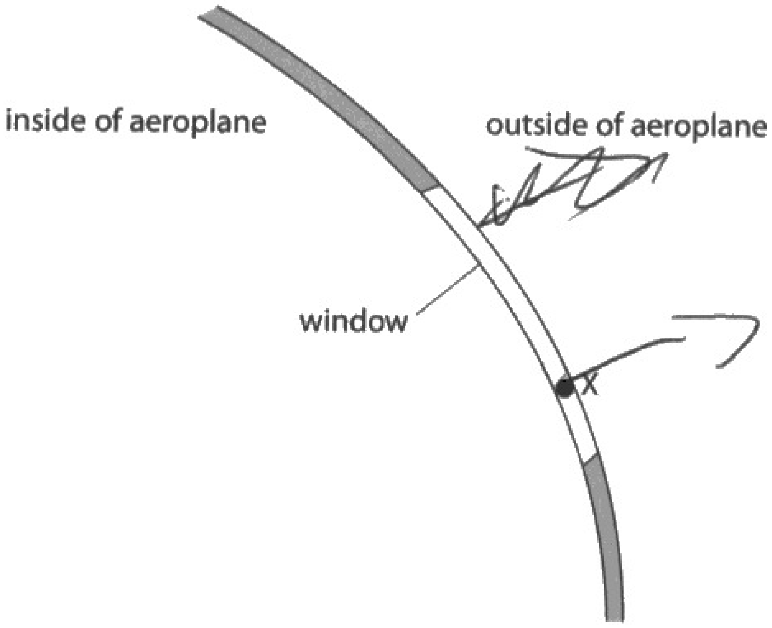


Figure 23

Draw an arrow on Figure 23 to show the direction of the resultant force due to the air pressure inside the cabin on the window at point X.

ResultsPlus
Examiner Comments

Both mark points scored.

Arrow a bit rough, but acceptable.

(iv) Figure 23 shows a cross-section through the aeroplane including one window.

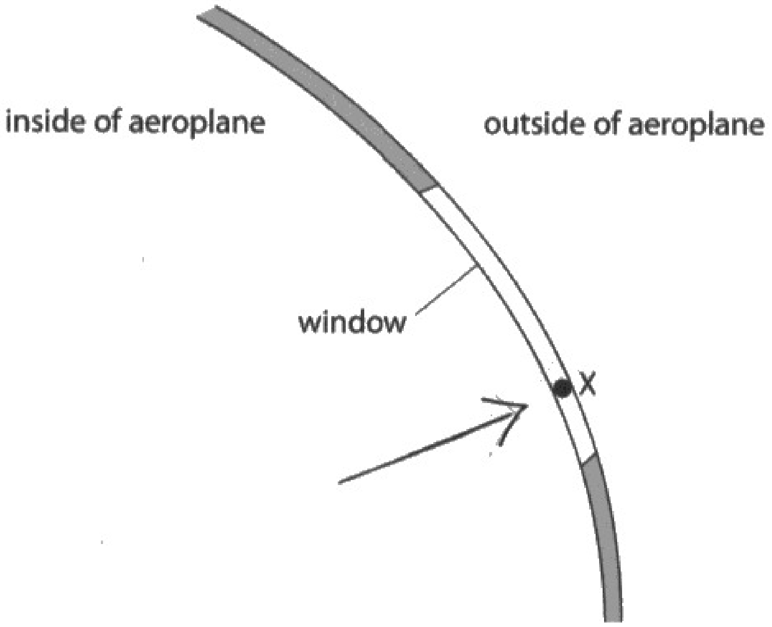


Figure 23

Draw an arrow on Figure 23 to show the direction of the resultant force due to the air pressure inside the cabin on the window at point X.

ResultsPlus
Examiner Comments

Arrow pointing to the outside of the aircraft – 1 mark.

For the arrow the mark scheme states 'must touch X or dot at X.

This arrow doesn't do that.

Question 10 (b)(i)

Asked to describe a trend from a graph in (b)i most identified that as height above the surface increased atmospheric pressure decreased, but there was little citing of non-linearity unfortunately. In comparison many more candidates did use numerical data (mp3) in the way expected.

(b) Figure 24 shows the atmospheric pressure at different heights above the Earth's surface.

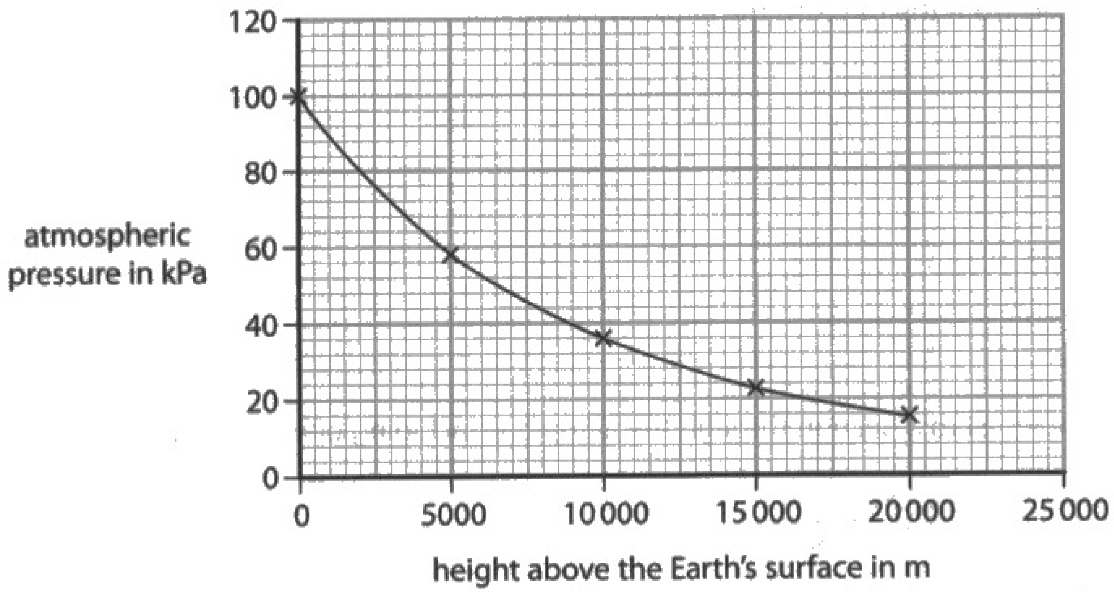


Figure 24

(i) Describe how the atmospheric pressure changes with height above the Earth's surface.

Use data from Figure 24 to support your answer.

(3)

As the distance from the ground increases, the atmospheric pressure decreases. ~~as~~ At 0m the pressure is 100kPa but at 15000 its around 22kPa. However it decreases by a diminishing amount as at 20,000m its around 16kPa.

ResultsPlus
Examiner Comments

In addition to mark points 1 and 3 being present the candidate also has 'decreases by a decreasing amount', matching mark point 2 – idea that pressure does not change evenly.

3 marks awarded

(b) Figure 24 shows the atmospheric pressure at different heights above the Earth's surface.

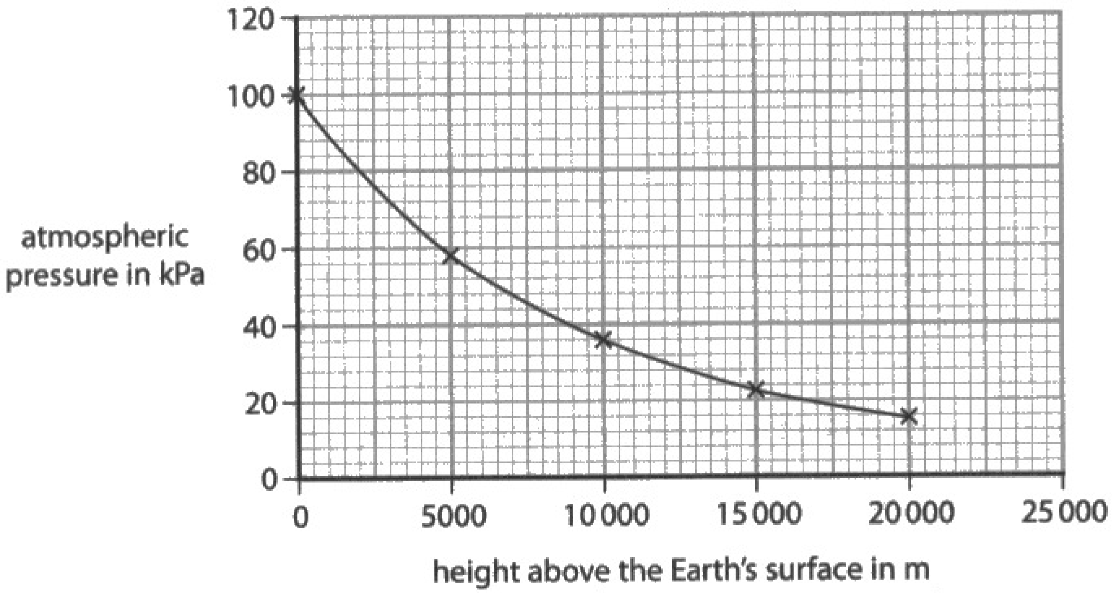


Figure 24

(i) Describe how the atmospheric pressure changes with height above the Earth's surface.

Use data from Figure 24 to support your answer.

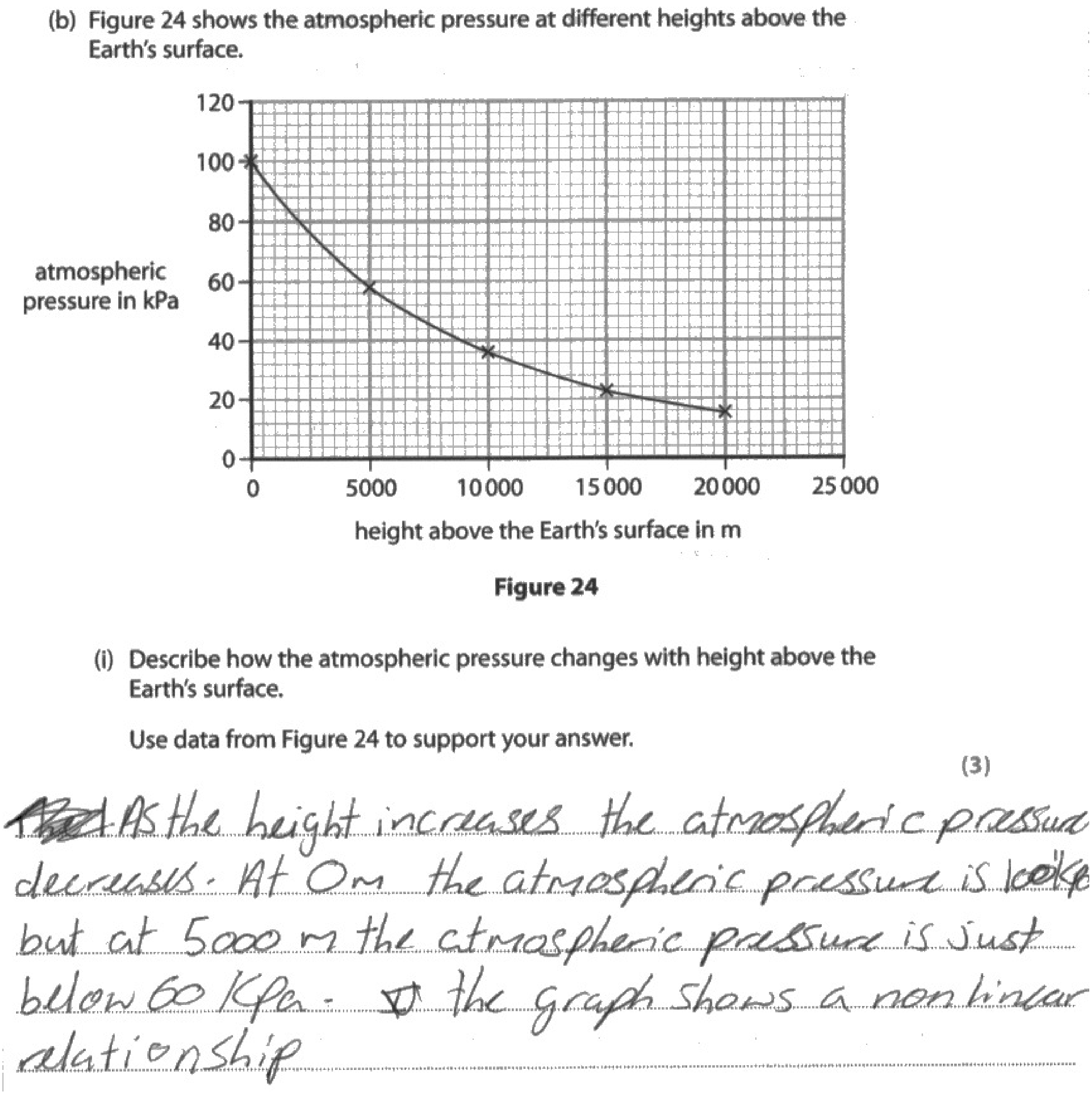
(3)

- ATMOSPHERIC PRESSURE SLOWLY DECREASE AS THE HEIGHT ABOVE THE EARTH'S SURFACE INCREASE
- AT 0m THE ~~PRE~~ ATMOSPHERIC PRESSURE IS 100 KPA
- AT 20000m THE ATMOSPHERIC PRESSURE IS LESS THAN 20 KPA
- BETWEEN 0m TO 10000m THE PRESSURE DECREASE FASTER

ResultsPlus
Examiner Comments

This is also awarded 3 marks.

The answer includes the idea that at lower quoted altitudes 'the pressure decreases faster' so gets mark point 2 again.



(b) Figure 24 shows the atmospheric pressure at different heights above the Earth's surface.

Figure 24

(i) Describe how the atmospheric pressure changes with height above the Earth's surface.

Use data from Figure 24 to support your answer.

(3)

As the height increases the atmospheric pressure decreases. At 0m the atmospheric pressure is 100kP but at 5000 m the atmospheric pressure is just below 60 KPa. the graph shows a non linear relationship

ResultsPlus
Examiner Comments

Matches all mark points, including the not-often seen quotation about non-linearity.

(b) Figure 24 shows the atmospheric pressure at different heights above the Earth's surface.

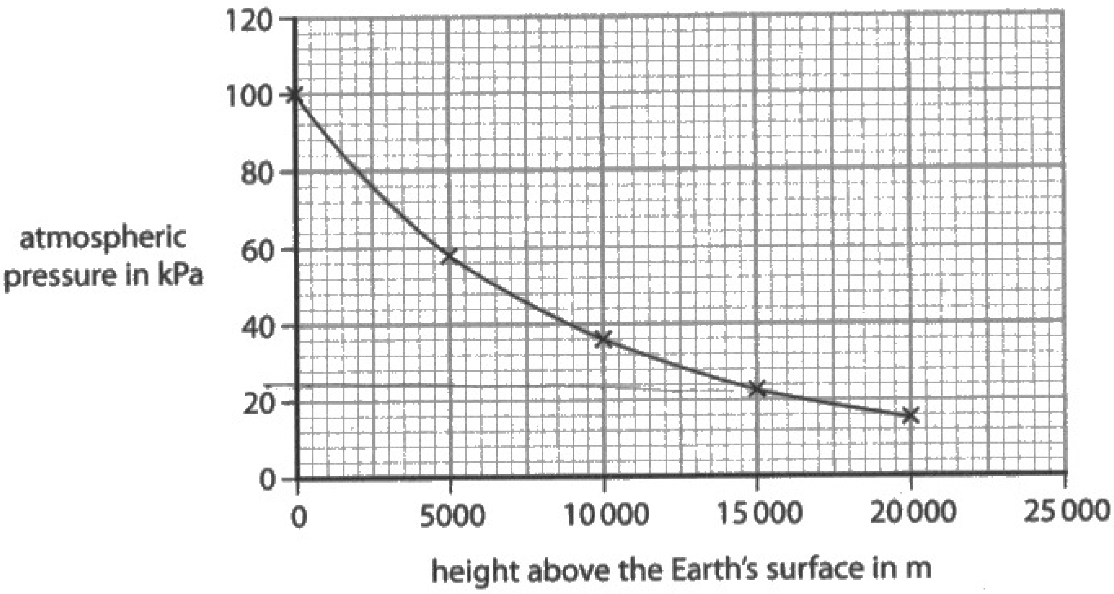


Figure 24

(i) Describe how the atmospheric pressure changes with height above the Earth's surface.

Use data from Figure 24 to support your answer.

(3)

the pressure decreases the higher above earth surface. At 0m the pressure is 100kPa but at 15000m, the pressure is 24kPa

ResultsPlus
Examiner Comments

Mark points 1 and 3 matched (two different pressure and height values used).

2 marks

(b) Figure 24 shows the atmospheric pressure at different heights above the Earth's surface.

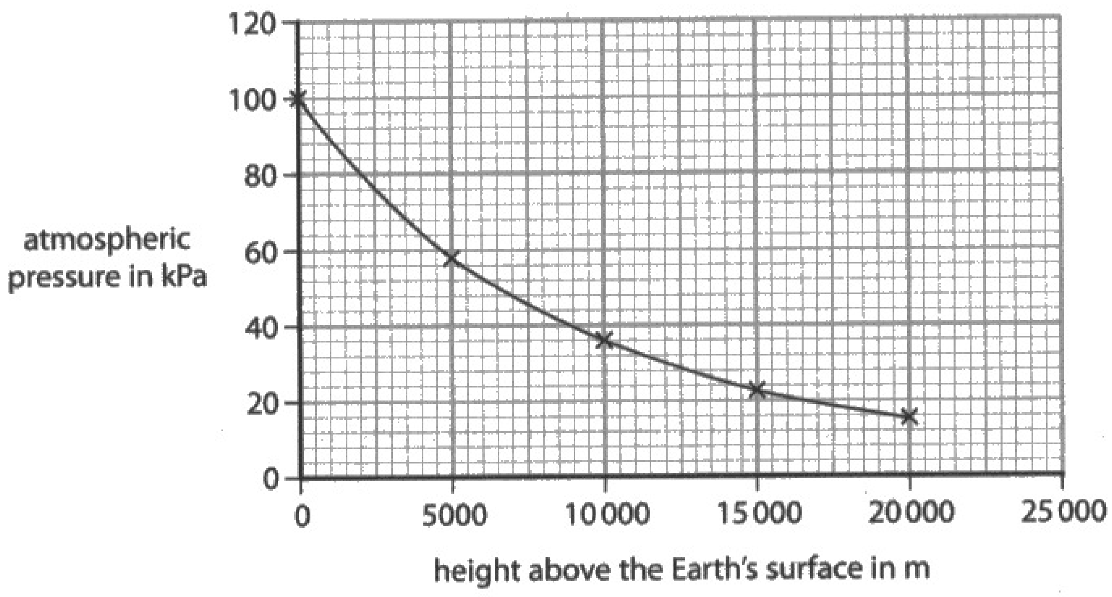


Figure 24

(i) Describe how the atmospheric pressure changes with height above the Earth's surface.

Use data from Figure 24 to support your answer.

(3)

The pressure changes with height above the earth's surface ~~was~~ because as the height increases, the atmospheric pressure decreases. This means that the GPE has converted into kinetic energy as the Earth isn't giving much gravity.

ResultsPlus
Examiner Comments

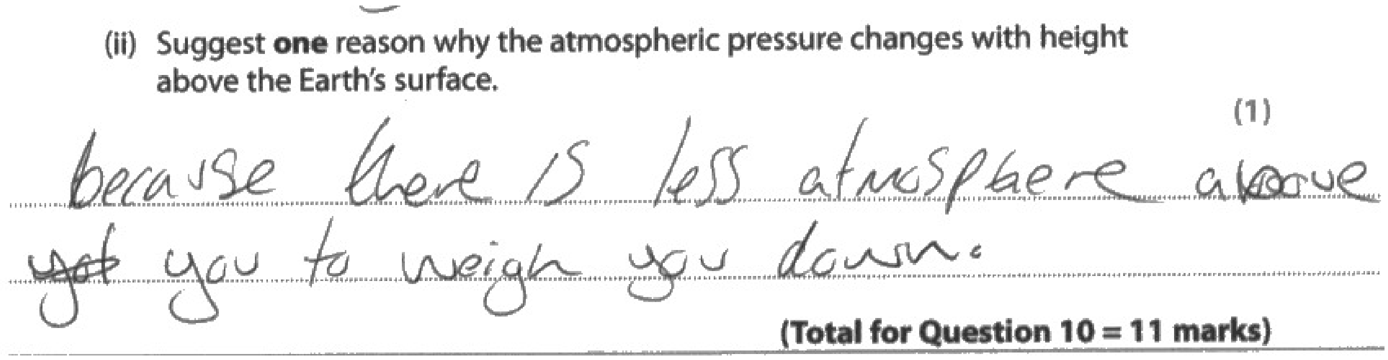
Mark point 1 scored for the basic trend.

Question 10 (b)(ii)

Most candidates did not score the mark with this question.

Very few candidates included the idea that the higher you go, the less the weight of the atmosphere is above you.

Many candidates focused on less oxygen being there at greater altitudes, mostly missing the point.



(ii) Suggest **one** reason why the atmospheric pressure changes with height above the Earth's surface.

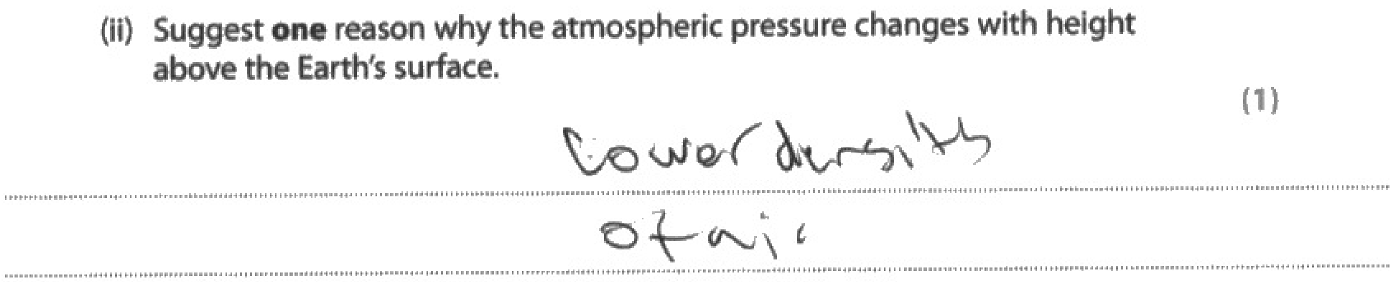
(1)

because there is less atmosphere above ~~yet~~ you to weigh you down.

(Total for Question 10 = 11 marks)

ResultsPlus
Examiner Comments

Awarded the mark for mark point 2 – less air above.



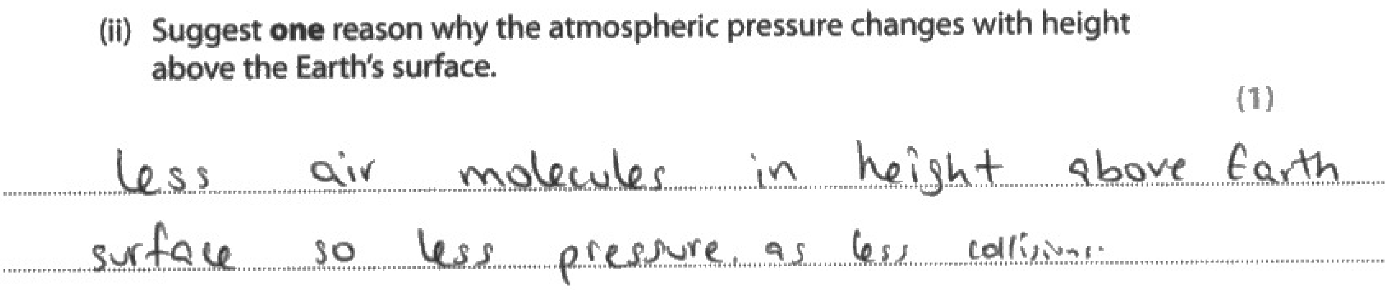
(ii) Suggest **one** reason why the atmospheric pressure changes with height above the Earth's surface.

(1)

lower density of air

ResultsPlus
Examiner Comments

This matches mark point 1 and is the most straightforward of explanations.



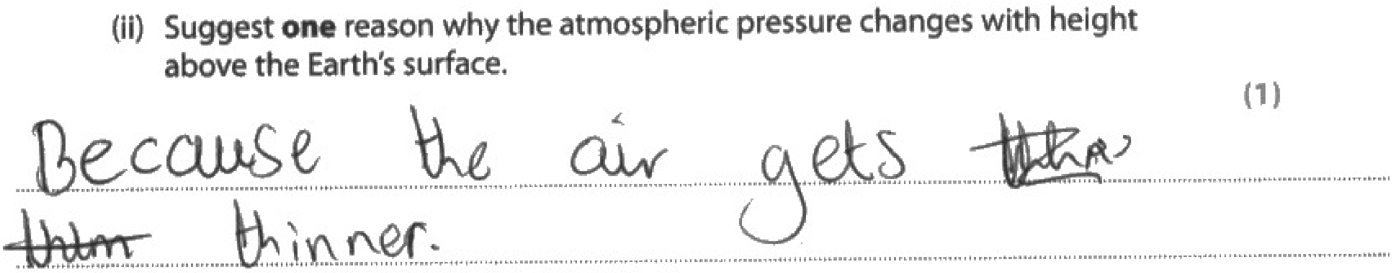
(ii) Suggest **one** reason why the atmospheric pressure changes with height above the Earth's surface.

(1)

less air molecules in height above Earth surface so less pressure, as less collisions

ResultsPlus
Examiner Comments

This gets mark point 1 (additional guidance). The added point about less collisions is also very worthy.



(ii) Suggest **one** reason why the atmospheric pressure changes with height above the Earth's surface.

(1)

Because the air gets ~~than~~ ~~thim~~ thinner.

ResultsPlus
Examiner Comments

Acceptable way of talking about the decrease in density, allowed for in the additional marking guidance.

Paper Summary

Overall this exam gave ample opportunity for candidates to display their knowledge and understanding at grades 1-5. A mean mark of 58/100 showed this was a decent scoring paper. It also enables good differentiation, helping towards the discrimination of grades from this component.

Candidates continued to do well with most calculation questions, although some didn't cope well with the rearrangement of equations and units involved, these being units of density and pressure.

Based on their performance on this paper, candidates are offered the following advice:

- Students should make the most of opportunities afforded in school laboratories where they become acquainted with practical work from the specification. This concerns both core practicals and the suggested practicals. It would benefit students to always question 'What is the purpose of this experiment?' making sure they are clear in their minds about it. After the event evaluations are also useful, especially when reflecting about how the experiment could have been improved. Such approaches would have reaped dividends in answering items Q02(a), Q03(a), Q06(b) and (d) and Q08(c)–(d).
- Students should be able to recall standard S.I. units and their compounds, e.g. kg / m^3 for density and Pa for pressure. Some students got these mixed up, putting Pa as the unit required for a question that asked for density. Students also need to have the mathematical skills of rearranging equations and of being able to round off results of calculations to a given number of significant figures.
- In constructing explanations students need to take note of the marks allocated to a particular question and respond with a corresponding number of points in their answer. Students should take opportunities, where they can, to use diagrammatic illustrations to aid and prompt their explanations.
- Of the two 6 marks questions Q09(d) was higher scoring and found to be more amenable to students than Q07(c). The former question matched more students' everyday knowledge – about house insulation – and gave them a novel situation to choose between two materials, based upon information given. The former question, about moments and a crowbar, was more elusive to many students, being more reliant upon students' knowledge and understanding of physics principles.

Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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