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Examiners' Report
June 2025

Int GCSE Single Science 4SS0 1P

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June 2025

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Introduction

This was the fifth Summer series Physics examination for the International GCSE Single Award Science qualification. Questions were set to assess candidates' knowledge, understanding and application of Physics from all eight topics in the specification. This year, candidates were once again provided with a full formulae sheet for the examination, which removed the requirement to recall any of the formulae.

The examination was written to assess across the full range of grades from 1 to 9. Consequently, some questions were written to be challenging whilst others were designed to be more straightforward and accessible. A range of different question types were included in the examination such as objective and multiple choice, calculations and both short and long written responses. Approximately 20% of the marks available in the examination were for candidates' demonstration of experimental skills and understanding.

Successful candidates were well-acquainted with the content of the specification and could recall facts whilst applying their understanding to new and complex situations. They were competent in performing quantitative work and could rearrange formulae to obtain the correct answer. Successful candidates also showed evidence of undertaking all the required practicals themselves and could produce detailed, coherent methods whilst recalling the relevant results of these experiments.

Less successful candidates showed gaps in their knowledge of topics and either had limited experience or could not recall information from the required practical tasks. These candidates often did not address the demands of the question and overlooked the importance of the command words being used.

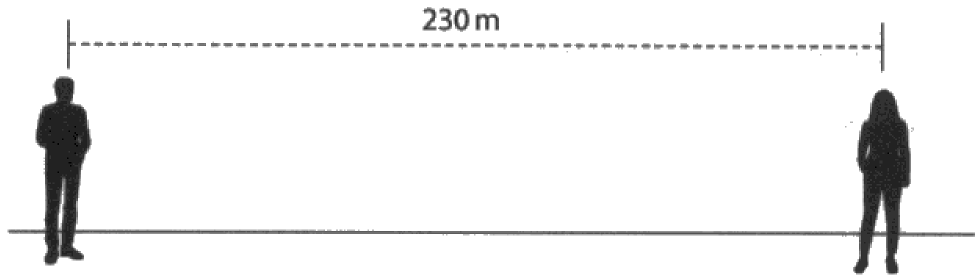
Question 1(b)

Most candidates scored highly in this question. Despite no rearrangement being necessary, some candidates did substitute correctly, but still managed to evaluate incorrectly, indicating issues with using their calculators correctly. Reasonably straightforward calculation with no errors out of the ordinary and most were scoring full marks. Those that lost marks did so on the unit. The most common incorrect units were m/s^2 or kps. Others were seen eg km/s, s, decibels, ms, J, m/s^2.

(b) The student makes the same sound in a large open space with no rocks.

The diagram shows the student and a teacher.

The teacher is 230 m away from the student.



(Source: © Chipmunk131 / Shutterstock)

(i) State the formula linking average speed, distance moved and time taken. **(1)**

$$\text{average speed} = \frac{\text{distance moved}}{\text{time taken}}$$

(ii) The time between the student making the sound and the teacher hearing the sound is 0.66 seconds.

Calculate the average speed of the sound.

Give an appropriate unit. **(3)**

- $\text{average speed} = \dfrac{\text{distance moved}}{\text{time taken}}$
- $\text{average speed} = \dfrac{230}{0.66}$

average speed = 348.48 unit s

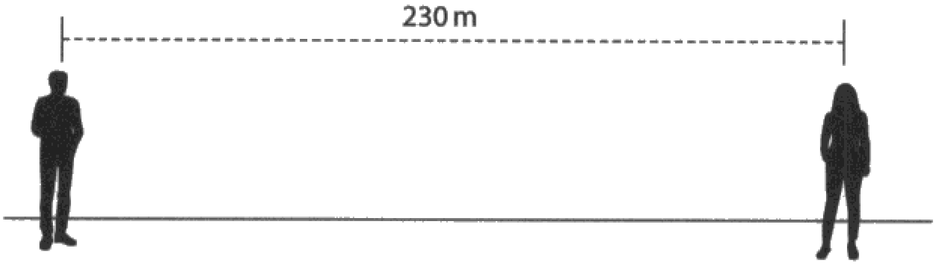
ResultsPlus
Examiner Comments

This response scored three marks. The right equation was given and the evaluation was correct. The unit used was incorrect.

(b) The student makes the same sound in a large open space with no rocks.

The diagram shows the student and a teacher.

The teacher is 230 m away from the student.



(Source: © Chipmunk131 / Shutterstock)

(i) State the formula linking average speed, distance moved and time taken.

(1)

$V = \frac{d}{t}$

(ii) The time between the student making the sound and the teacher hearing the sound is 0.66 seconds.

Calculate the average speed of the sound.

Give an appropriate unit.

(3)

$V = \frac{d}{t}$

$V = \frac{230}{0.66} =$

average speed = 348.48 unit m/s

ResultsPlus
Examiner Comments

This response scored four marks. Symbol equations are always accepted in place of word equations. The candidate got the correct answer and unit.

ResultsPlus
Examiner Tip

Candidates should learn all of the common physics units found in the specification.

Question 2(a)

This question was answered correctly by about a third of candidates. Red was the most common correct answer, followed by orange. The most common incorrect answer was white and blue. We would accept red, orange, red/orange and orange/yellow. An incorrect answer of blue may have been linked to colour objects being bluer in everyday life.

2 This question is about the Solar System.

(a) The Sun is a yellow star.

State a possible colour for a star that has a lower surface temperature than the Sun.

orange

ResultsPlus
Examiner Comments

This response scored one mark for the correct answer.

ResultsPlus
Examiner Tip

The question asks to state a possible colour. Writing more that one colour could cause a confliction, so no mark would be awarded.

Question 2(b)

Candidates tended to score a whole range of different marks in this question. Many candidates named the correct stages of the life cycle of the sun perfectly, but failed to get MP4 for getting them into the correct order. Some confused red giant with a red super giant, others got red dwarf mixed up with white dwarf so limited their response to three marks maximum. Others incorrectly mentioned supernova, neutron star and black hole, that are part of the life cycle of much larger stars. Main sequence star was the most missed stage in the life cycle of the sun. Some candidates mentioned the word 'star', but it had to refer to the main sequence stage of a star to gain credit.

(b) Describe the stages of evolution in the life cycle of the Sun.

(4)

nebula: ~~gas~~ gas and dust pulled by gravity

main sequence: hydrogen fusion ~~burn~~, balances the gravity

red gaint: hydrogen runs out, hellium fuision gain, stars cols and collapsed.

white dwarf: fusion ends, ~~heat~~ hot outer layer emlosts, the core callapsed

~~black what~~ black hole: white dwarf be cooler and darker.

ResultsPlus
Examiner Comments

This response scored three marks. They described the order correctly, but then mentioned black hole that is not part of our sun's life cycle. Therefore, only a maximum of three marks could be awarded.

ResultsPlus
Examiner Tip

Candidates should read questions carefully to ensure their answers are focused and do not include irrelevant physics that may detract from their answer.

(b) Describe the stages of evolution in the life cycle of the Sun.

(4)

- nebula is a form of gas and dust
- Protostar
- main sequence longest period of sun life
- then ~~white dwarf~~ Red giant
- then white dwarf

ResultsPlus
Examiner Comments

This response scored four marks. All stages were mentioned and were in the correct order for the fourth mark. Main sequence was allowed even though it did not mention star.

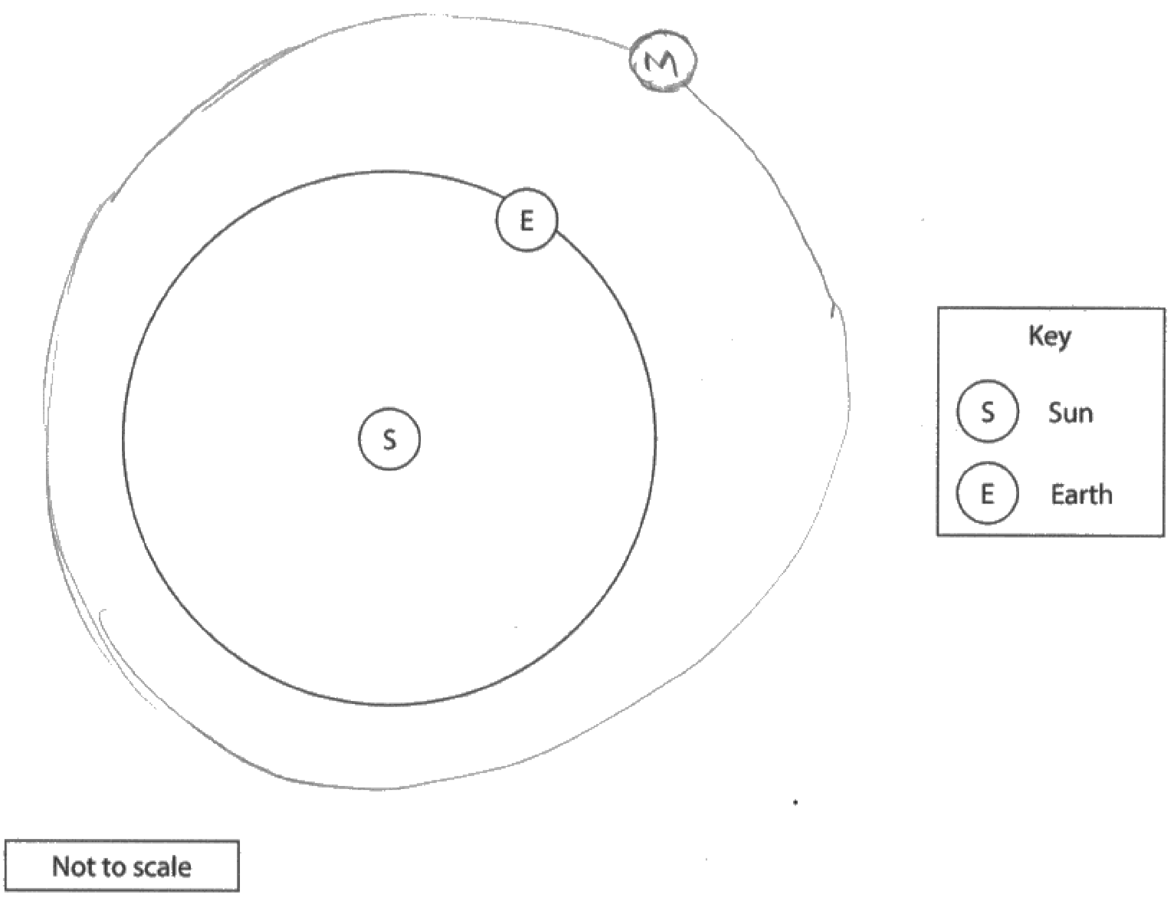
Question 2(c)

Most candidates scored the maximum of two marks in this question. The question asks candidates to draw the orbit of the Moon. Therefore, a full circle drawn around the Earth would score two marks even if they did not draw an M in a small circle, or if it is not perfectly circular. If a partial circular orbit was drawn, only one mark could be scored. A drawing of an orbit around the sun scored nothing. A common mistake was a drawing of the Moon orbiting the Sun.

(c) The diagram shows the Earth in its orbit around the Sun.

Draw the orbit of the Moon on the diagram.

(2)



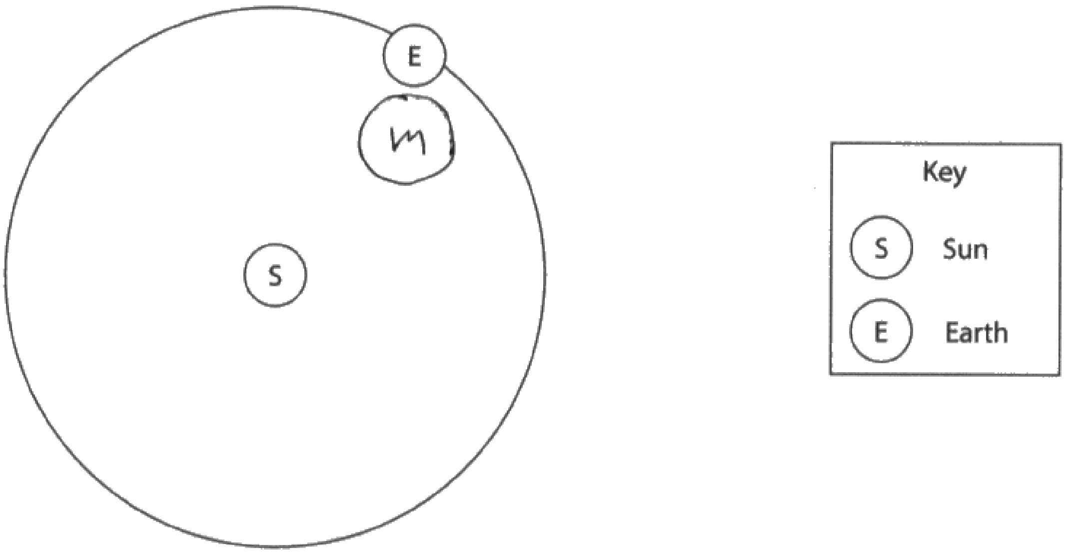
ResultsPlus Examiner Comments

This response scored no mark. Although circular, it needed to orbit the Earth.

(c) The diagram shows the Earth in its orbit around the Sun.

Draw the orbit of the Moon on the diagram.

(2)



Not to scale

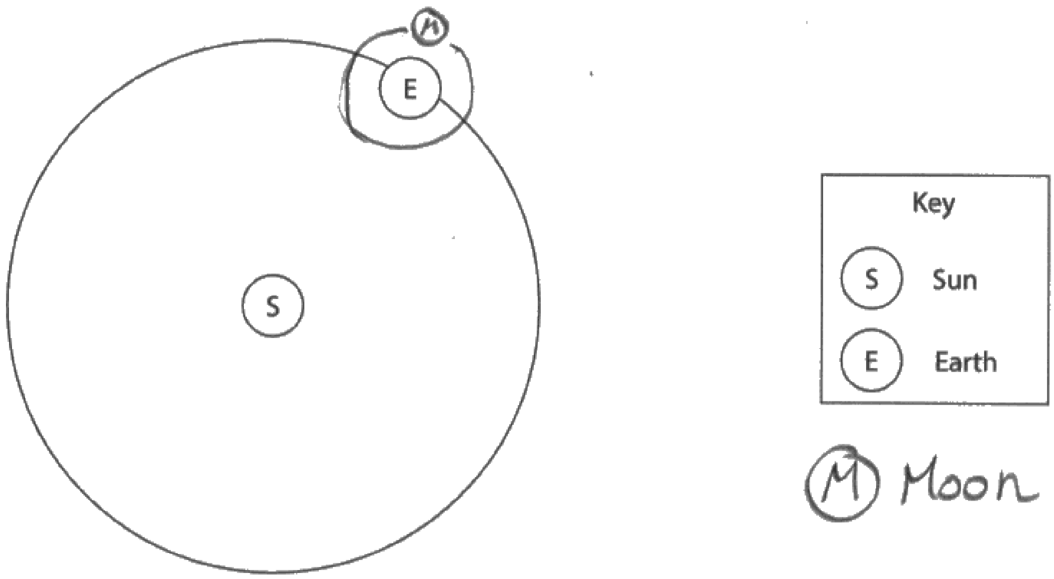
ResultsPlus
Examiner Comments

This response scored no mark. The question asked for a drawing of the orbit of the Moon. No orbit can be seen.

(c) The diagram shows the Earth in its orbit around the Sun.

Draw the orbit of the Moon on the diagram.

(2)



Not to scale

ResultsPlus
Examiner Comments

This response scored two marks. Although it is not a complete circle, it was thought that it showed enough to represent the Moon's orbit around the Earth.

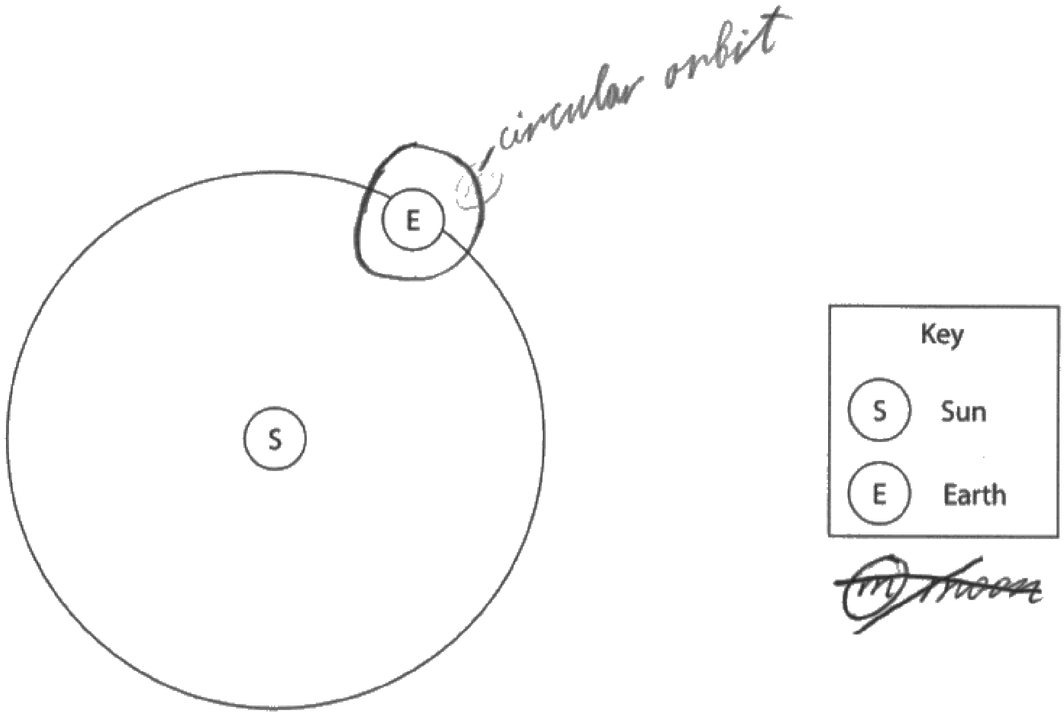
ResultsPlus
Examiner Tip

When candidates draw diagrams, they should usually draw them in plan view and ensure all objects are labelled as much as possible.

(c) The diagram shows the Earth in its orbit around the Sun.

Draw the orbit of the Moon on the diagram.

(2)



Not to scale

ResultsPlus
Examiner Comments

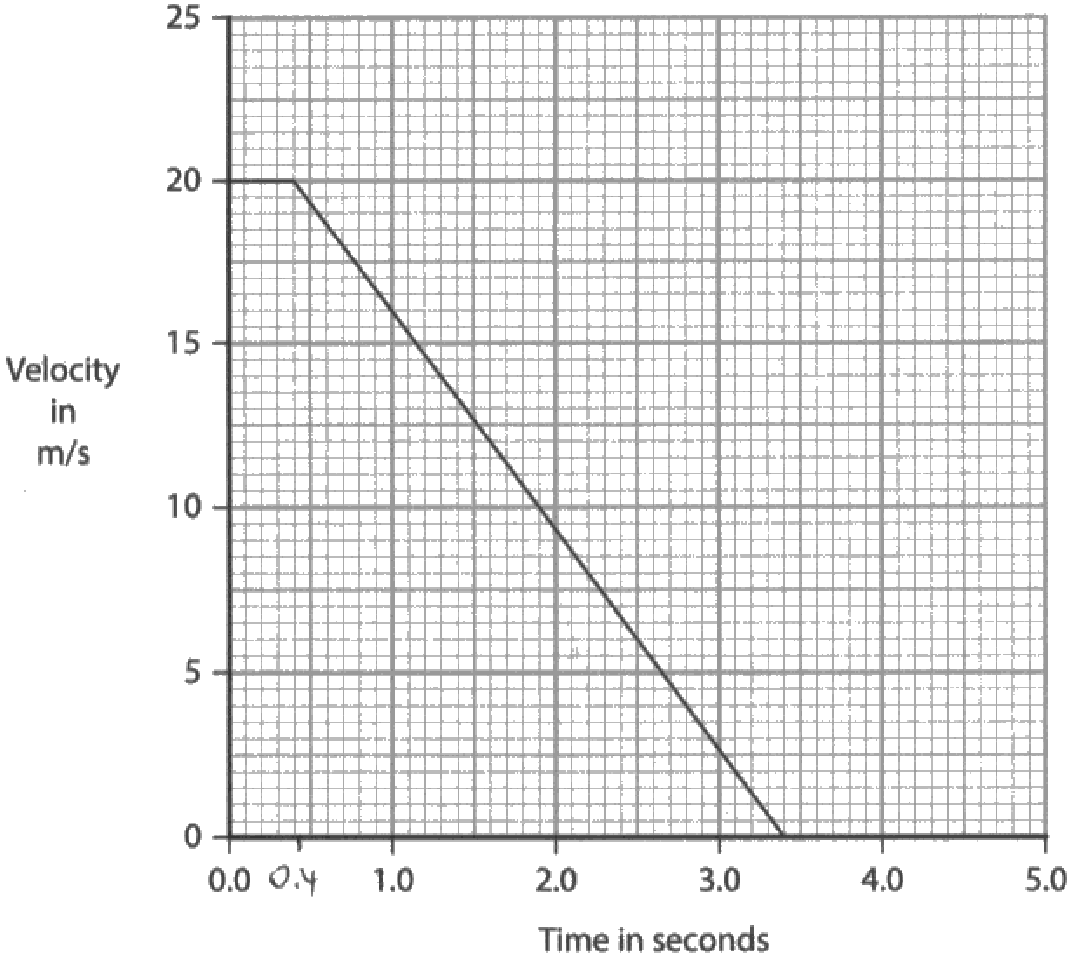
This response scored two marks. No Moon was drawn, but it answered the question wanting the orbit of the Moon drawing around the Earth on the diagram.

Question 3(b)

Most candidates scored either zero or one marks in this question. Any attempt at finding an area under the graph eg any velocity x any time, scored one mark. Any candidate correctly using the formula for the area of a triangle (1/2 base x height) gained two marks. A correct evaluation on the answer line scored three marks. Some candidates dividing by 2 rather than using half, which also gave a correct evaluation. A significant number of candidates scored one mark for identifying the correct values but used the formula velocity × time rather than calculating the area under the graph. Some misread the question and mistakenly calculated stopping distance.

3 A person is driving a car along a dry road. They see an obstruction and apply the brakes.

This is the velocity-time graph for the car.



(b) Determine the braking distance of the car.

(3)

Speed = distance ÷ time

distance = speed × time

= ~~20 × 3.4~~ =

= 20 × 3 = 60

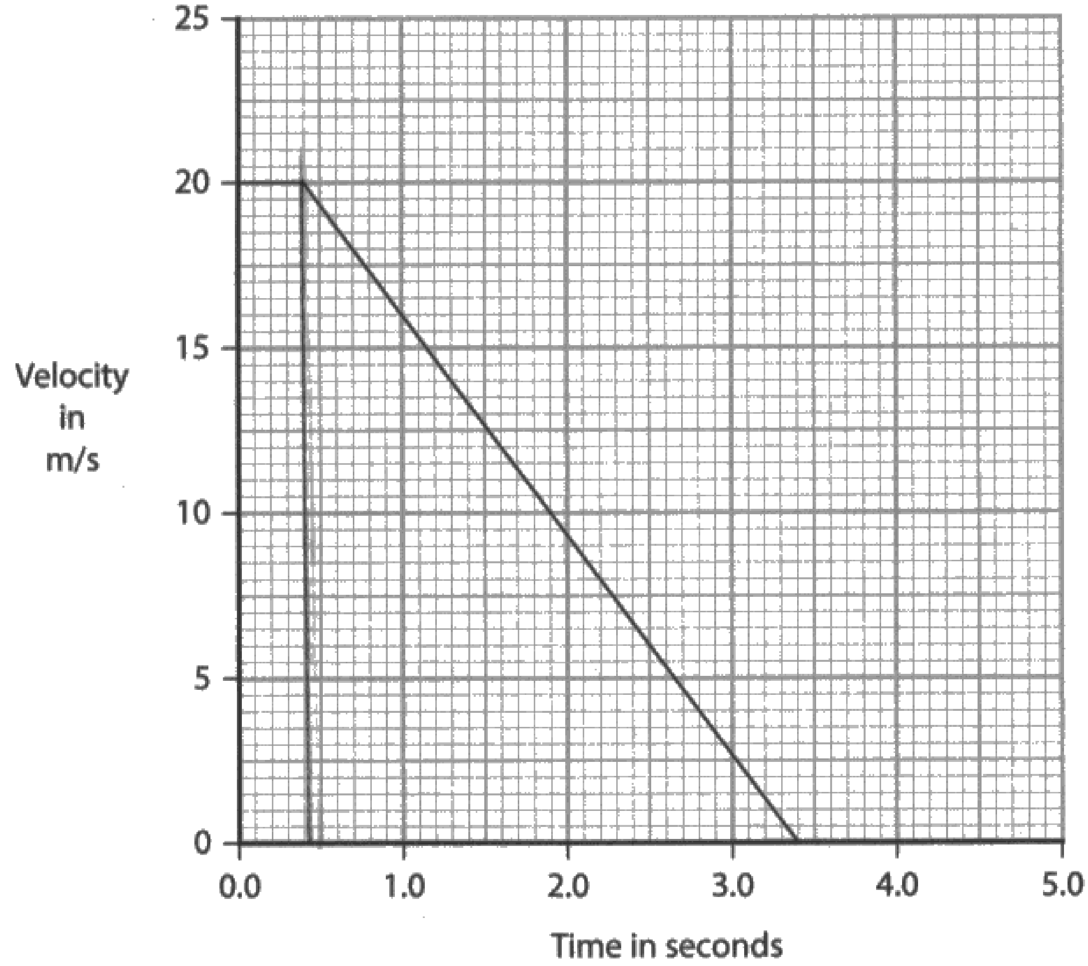
braking distance = 60 m

ResultsPlus
Examiner Comments

This response gained one mark. An attempt was made to find the area by multiplying any velocity by any time.

3 A person is driving a car along a dry road. They see an obstruction and apply the brakes.

This is the velocity-time graph for the car.



(b) Determine the braking distance of the car.

(3)

area of retangle = w × l
area of triangle = $\frac{1}{2}$ × b × h (d = v × t)

area of retangle = 0.4 × 20
area of retangle = 8 m (3.4 − 0.4 = 3)
area of triangle = $\frac{1}{2}$ × 3 × 20
area of triangle = 30 m
30 + 8 = 38 m

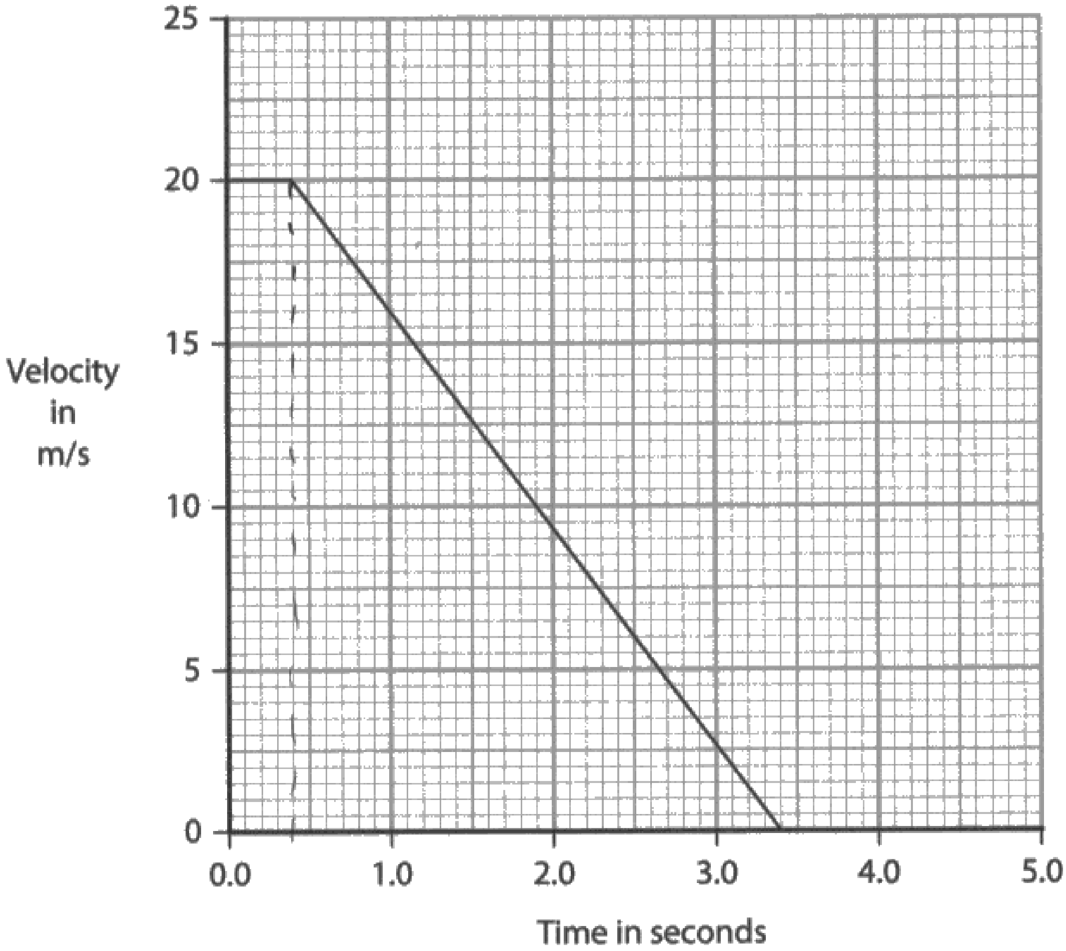
braking distance = 38 m

ResultsPlus
Examiner Comments

This response scored two marks. The candidate has the correct evaluation in their working, but the answer on the answer line takes precedence.

3 A person is driving a car along a dry road. They see an obstruction and apply the brakes.

This is the velocity-time graph for the car.



(b) Determine the braking distance of the car.

(3)

distance = $\frac{1}{2} \times 3 \times 20$ =

= 30 m

area of a triangle

braking distance = 30 m

ResultsPlus
Examiner Comments

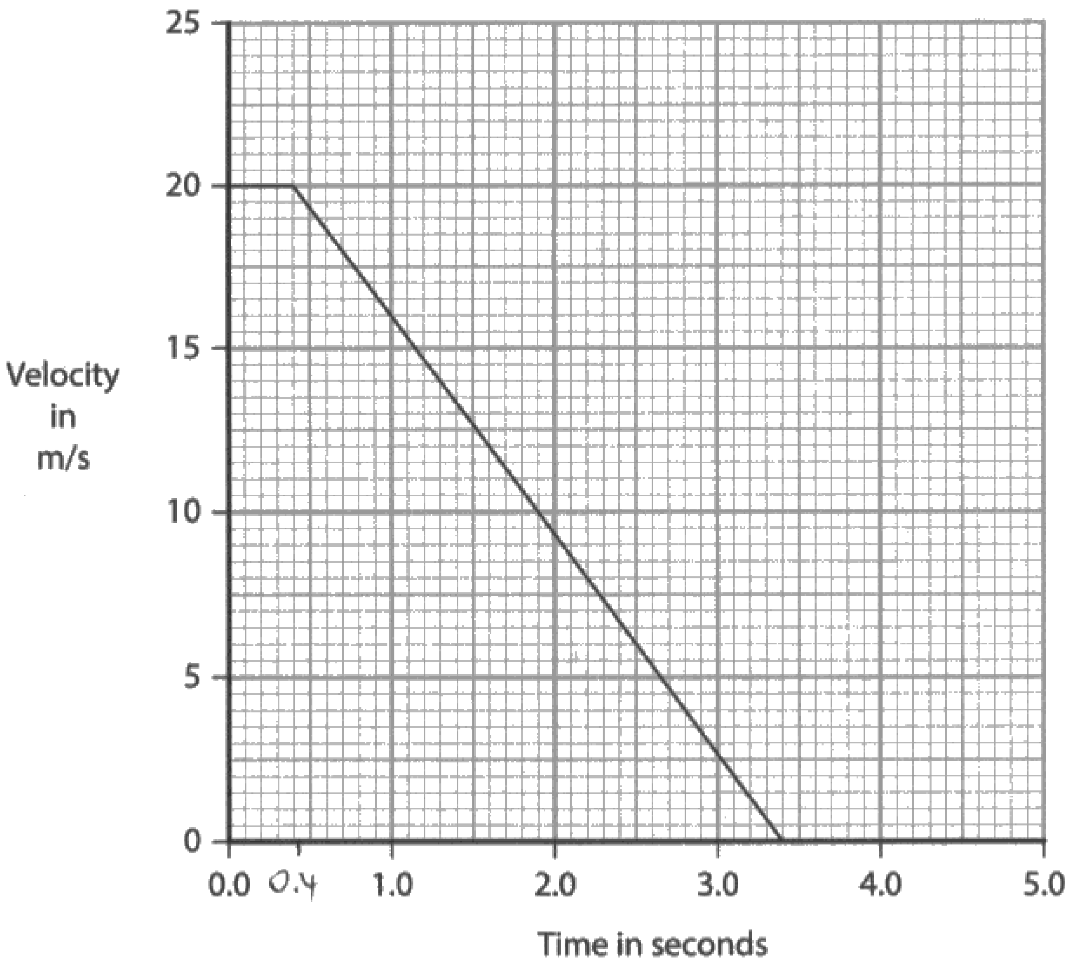
This response scored three marks. The candidate used the correct formula for finding the area of a triangle 1/2 x base x height.

Question 3(c)

Most candidates scored no marks on this question. This question proved to be a good discriminator as it really tested their understanding of the graph in context. There were a reasonable minority that related the answer to the gradient of the graph. Most were scoring for the alternative approach in describing the increase in braking time etc. There was some good terminology used for MP2, including less friction/traction. Some scored one mark for the idea of the line being less steep or mentioning that there would be less friction, or that it would be slippery. Very few candidates linked how the graph would be different to the reason why. Other candidates lost marks for mentioning braking distance or stopping distance when we were looking at the idea of time.

3 A person is driving a car along a dry road. They see an obstruction and apply the brakes.

This is the velocity-time graph for the car.



(c) Explain how the graph will be different after 0.4 seconds if the road is wet.

(2)

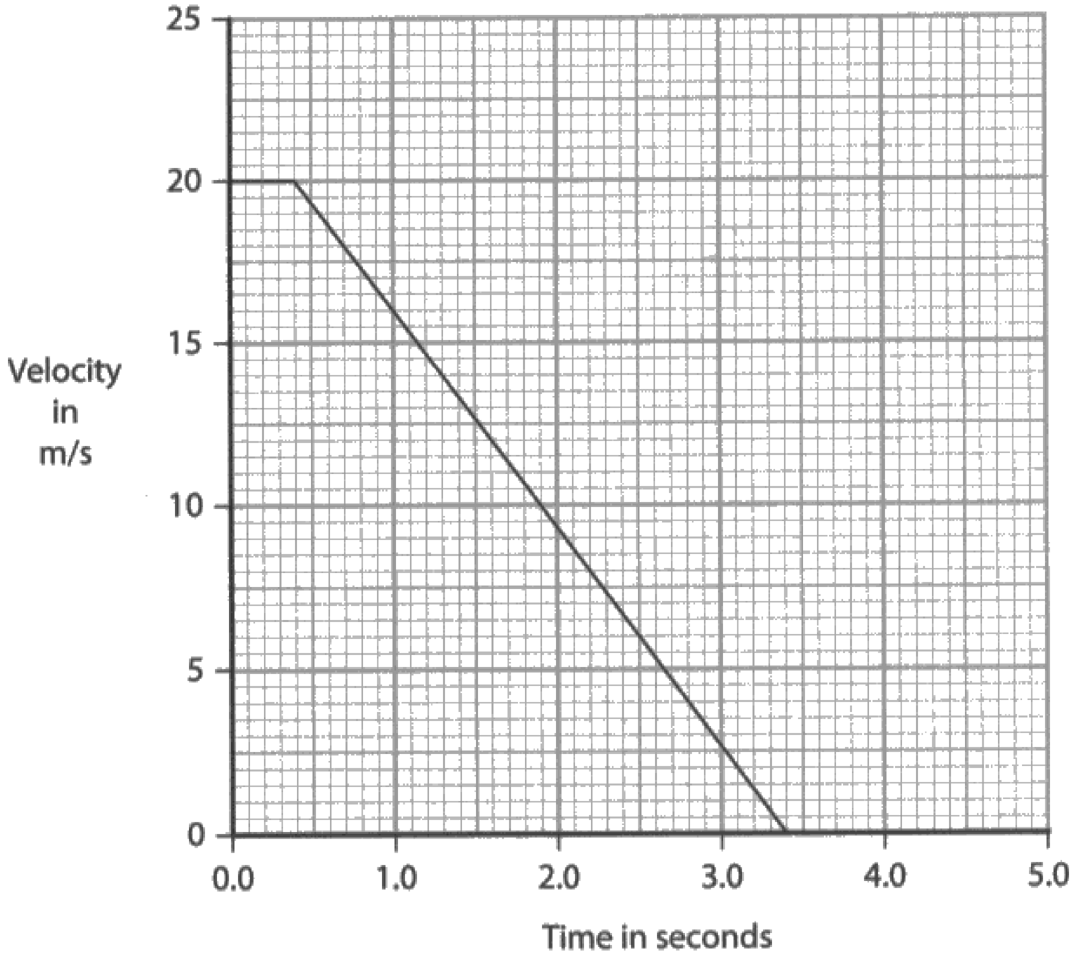
wet roads increase the thinking distance therefore driver will start thinking earlier

ResultsPlus
Examiner Comments

This response scored no mark. Many candidates incorrectly referenced braking and stopping distance, rather than the time.

3 A person is driving a car along a dry road. They see an obstruction and apply the brakes.

This is the velocity-time graph for the car.



(c) Explain how the graph will be different after 0.4 seconds if the road is wet.

(2)

~~T~~ the time of the car while breacking will be more.

ResultsPlus
Examiner Comments

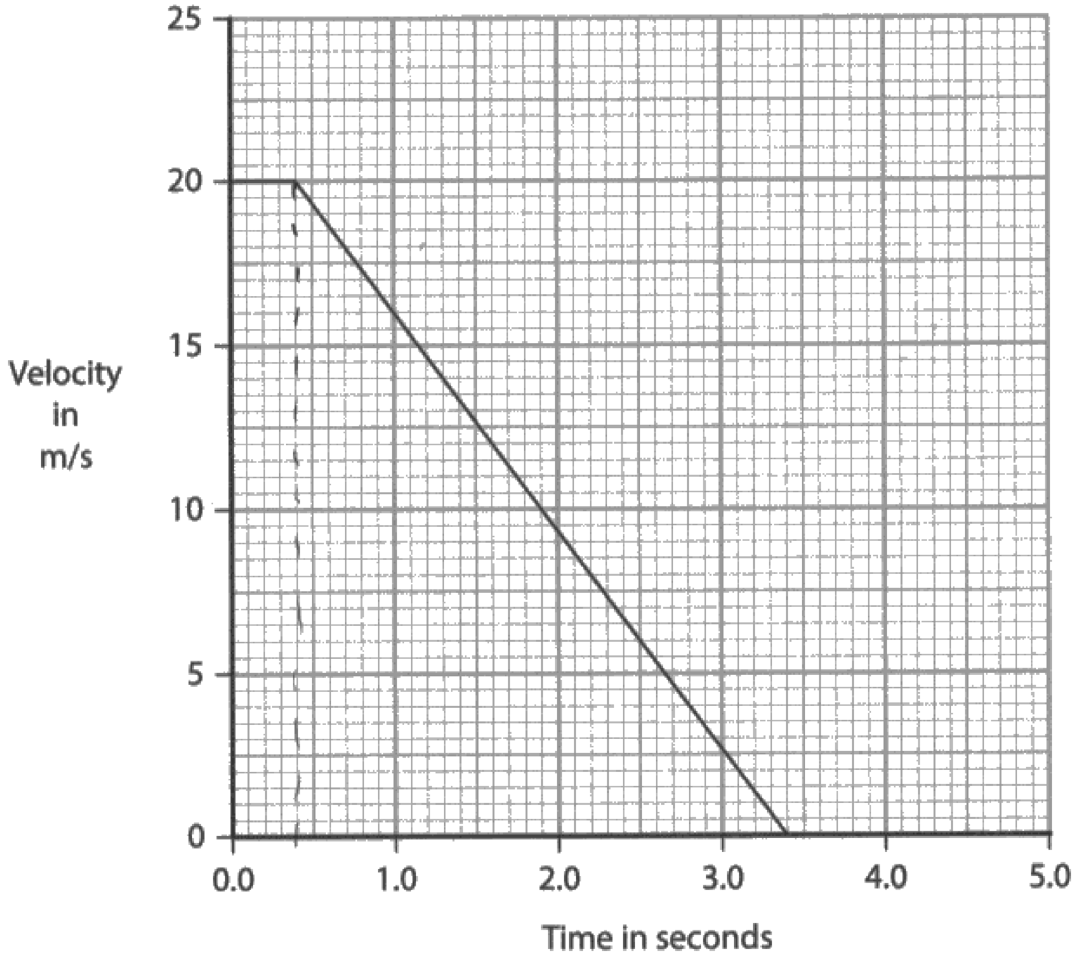
This response scores one mark for the idea of a longer time period to stop. Stating that the gradient is less steep would have scored the same marking point.

ResultsPlus
Examiner Tip

If a question asks to explain, the candidate has to provide a reason for their choice using knowledge and understanding.

3 A person is driving a car along a dry road. They see an obstruction and apply the brakes.

This is the velocity-time graph for the car.

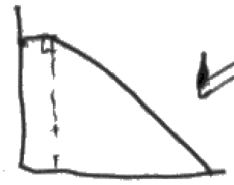


(c) Explain how the graph will be different after 0.4 seconds if the road is wet.

(2)

the velocity would decelerate slower because there is less friction with a wet road than with a dry road. therefore, it would take more time for car to stop and the graph would be longer.

(Total for Question 3 = 6 marks)



ResultsPlus
Examiner Comments

This response scores two marks. The idea of more time to stop with a diagram of a 'longer' graph. The candidate then moves on to explain that there is less friction with a wet road.

Question 4(a)

Very few candidates scored a mark for this question. To get the mark, candidates had to successfully remove 50 from -273.15. The correct unit was already given on the answer line. Some candidates forgot to include a minus so scored no mark for just 223.15. -223 was accepted as an alternative, rounded down to the nearest whole number.

Question 4(b)

Candidates scored a full range of marks in this question. Very few were awarded marks for the KE doubling because the temperature had doubled marking point. Some candidates mentioned that the KE of the particles increased or that particles moved around more for one mark. MP1 and MP6 were the most awarded MPs. Collisions of particles had to refer to 'with the walls' and that it had increased eg 'more frequent' or 'happened more often'. Therefore, not many getting MP4 in this question. The mention of Force=rate of change of momentum was scarcely seen. Many candidates knew that the pressure would increase, but they struggled to explain why.

(b) Explain what happens to the pressure of the gas when its temperature is increased from 50 K to 100 K.

Refer to particles in your answer.

~~more P~~ more ~~Pe~~ temperature lead more Pressur

So the particles ~~w~~ will have more kinetk energy

it will ~~coll~~ collapsed with the wall exerts Pressure

ResultsPlus
Examiner Comments

This response scored two marks. 'More pressure' answered the actual question. To gain further marks, they needed to refer to particles and how they actually increased the pressure. Particles having more KE scored the second mark.

ResultsPlus
Examiner Tip

When starting a long answer question, underline/highlight the key words to help focus attention on the most important parts of the question.

(b) Explain what happens to the pressure of the gas when its temperature is increased from 50 K to 100 K.

Refer to particles in your answer.

(4)

Particles gain more kinetic energy, causing more frequent collisions with the walls of the container. This causes a force to be exerted, as pressure = force / area.

ResultsPlus
Examiner Comments

This response scores three marks. The 'KE of the particles increasing' is the same marking point as the 'particles move around quicker'. This candidate correctly mentions 'more frequent' collisions with the walls. No mark for the force being exerted as it needed to state it increased/more/doubled as well. Linking the force increase to F=M/A also scored a mark.

ResultsPlus
Examiner Tip

In explain questions, ask candidates to think about what equations could link to that question topic. This could give them clues about what details to write in the space provided.

(b) Explain what happens to the pressure of the gas when its temperature is increased from 50 K to 100 K.

Refer to particles in your answer.

(4)

The particles are given more energy if heated up meaning that they will travel faster, bounce off the container's wall more often, pressure increases, because $P = \frac{F}{A}$. The area will stay the same but the lid might be blown off if too much heat was added.

ResultsPlus
Examiner Comments

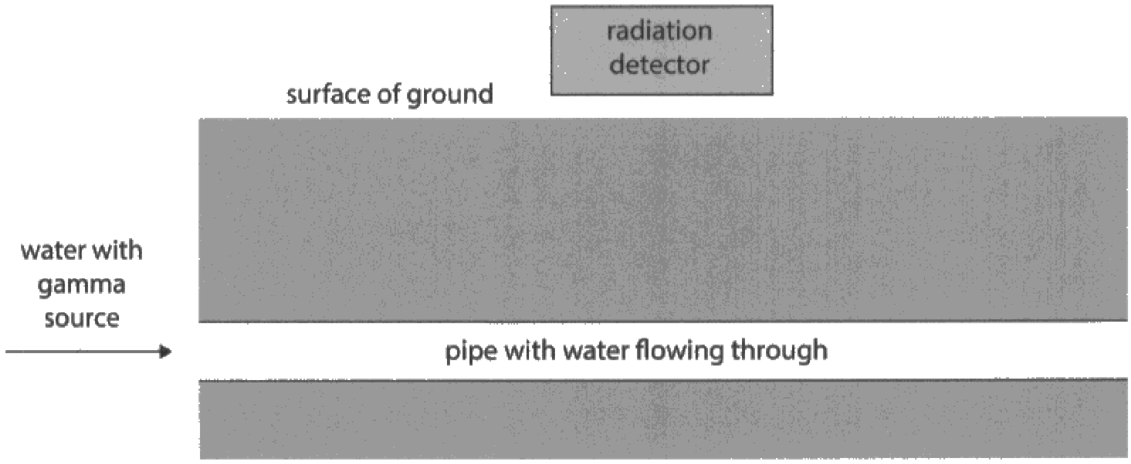
This response scores four marks. The candidate has fully explained what happens to the pressure when temperature doubles. A higher temperature gives the particles more energy, so they move around faster. They will bounce off the 'container walls' more often, so the pressure must increase. The equation P=F/A is used.

Question 5(a)(i)

Lots of candidates failed to score a mark on this question. Common incorrect answers were gamma radiation is more powerful/stronger, gamma radiation is less harmful to humans/the water, gamma radiation has less/low ionising power, so is not so damaging. Some candidates were successful and gained a mark for gamma being more penetrating, but then failed to talk about the gamma being able to pass through the ground to be detected. The range of alpha and beta being low/gamma having a long range was very rarely mentioned.

5 Gamma sources can be used to track the flow of liquids.

The diagram shows a gamma source being used to track the flow of water through an underground pipe.



The gamma source is added to water flowing through the pipe.

The detector can detect the gamma radiation on the surface of the ground.

A person moves the detector along the surface of the ground.

(a) (i) Explain why it is better to use a gamma source in the water, rather than a beta source or an alpha source.

(2)

Because gamma rays are able to travel for longer and futher than Beta and Alpha sources.

ResultsPlus
Examiner Comments

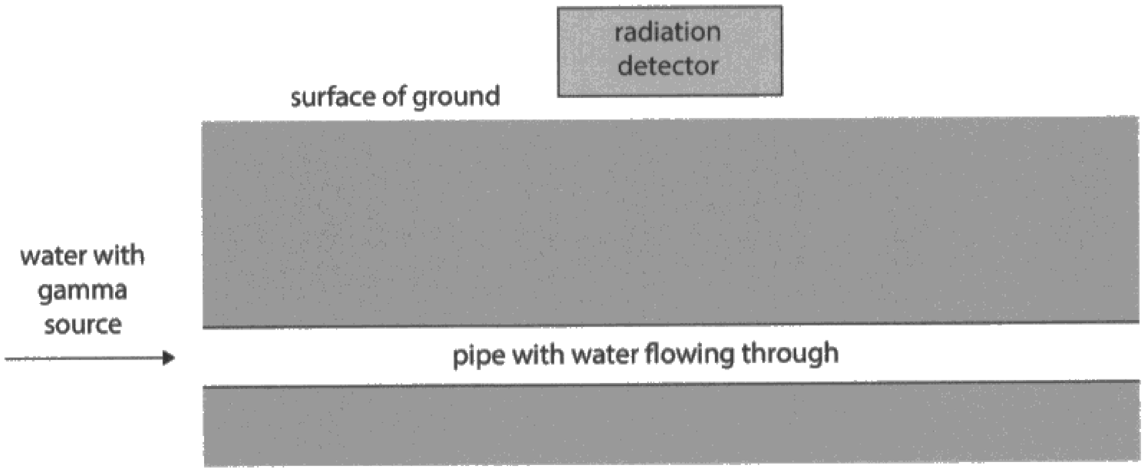
This response scores one mark. The idea that gamma has a bigger range and travels further is enough for one mark. If this candidate went on to say that gamma would reach the radiation detector, they would have scored the second mark.

ResultsPlus
Examiner Tip

Candidates should always study the diagram in the question to give them ideas on what details to include in their answers.

5 Gamma sources can be used to track the flow of liquids.

The diagram shows a gamma source being used to track the flow of water through an underground pipe.



The gamma source is added to water flowing through the pipe.

The detector can detect the gamma radiation on the surface of the ground.

A person moves the detector along the surface of the ground.

(a) (i) Explain why it is better to use a gamma source in the water, rather than a beta source or an alpha source.

(2)

Because gamma has a better penetration ability. Alpha and beta source can't penetrate through the ground while gamma can. This allows the water to be tracked more easily.

ResultsPlus
Examiner Comments

This response scored two marks. The candidate stated that gamma was the most penetrating. Then they moved on to say that the gamma would penetrate through the ground and beta/alpha would not.

Question 5(a)(ii)

About half of candidates could recall one of the possible answers to this question. A Geiger-Muller tube/GM tube/GM counter/Geiger counter were all acceptable. The most common reasons for scoring zero were for Gamma radiation detector/machine/meter or GM/Geiger-Muller without the word tube/counter/detector, which would have scored them the mark. A minority of candidates made multiple attempts at spelling 'Geiger-Muller' correctly. In the majority of cases the first attempt would have been accepted, even if spelt incorrectly eg Guy-ger Mullar Counter.

Question 5(b)(i)

Most candidates scored one mark out of two in this question. There was certainly a good understanding of time being involved, which scored the first marking point. For the second marking point, they had to refer to what was halving. Terms like halving the atoms life/halving the atom/halving the mass of the substance were often seen and did not score. Halving of the radioactivity/activity/nuclei/mass of isotope or isotope could score MP2. The understanding of the term half-life was generally poor. Those that tried to describe it in terms of changing numbers of nuclei/atoms found it much more difficult to express themselves satisfactorily.

(b) (i) Describe what is meant by the term **half-life**.

Time taken for the activity

ResultsPlus
Examiner Comments

This response scored one mark. Any reference to the time taken gains a mark. To get the second mark, the candidate has to explain along the lines of 'for halving off...'.

ResultsPlus
Examiner Tip

If a describe question has two marks, at least two individual points need to be made.

(b) (i) Describe what is meant by the term **half-life**.

Time taken for half of the radioactive nuclei to decay.

ResultsPlus
Examiner Comments

This response got two marks. They referenced the 'time taken' for one mark. 'Half the radioactive nuclei to decay' is correct for the second mark.

(b) (i) Describe what is meant by the term **half-life**.

(2)

the time it takes for radioactivity to halve

ResultsPlus
Examiner Comments

This response gained two marks. 'Time taken' scores the first mark. Anything about halving the radioactivity, the number of nuclei, the mass of the isotope or just the isotope, is enough for the second mark.

Question 5(b)(ii)

Many candidates did not score a mark in this question. They could either reference the way it affects the water, or reference the dangerous effect it would have on the body. Many candidates did realise the idea that gamma would cause some sort of contamination, or it would cause some sort of harm eg it causes cancer/mutations/damage cells. Others made incorrect references eg wavelength or being weak or it damages us. More precise use of terminology is needed in describing biological effects of ionisation. Some were discussing the effect of the half-life on the activity, but not very clearly, while others also discussed the properties of gamma, again not in clear detail.

(ii) Suggest why this gamma source should have a short half-life.

So it doesn't stay for long and affect the water.

ResultsPlus Examiner Comments

This response scored the mark for the idea of stopping or reducing water contamination.

(ii) Suggest why this gamma source should have a short half-life.

(1)

becouse it is harmful and causes cancer

ResultsPlus Examiner Comments

This response scored the mark for referencing how gamma would harm the body eg cancer.

ResultsPlus Examiner Tip

Comments stating that radiation would harm or cause damage rarely scores the mark. To gain credit, more specific examples need to be used eg cancer, DNA damage, mutations.

Question 5(c)

Many candidates gained credit in this question. Most could state the correct word equation, but dealing with standard form was a bit of a challenge for some. Error carried forwards was allowed if a candidate wrote the wrong equation in the first part. One mark could be awarded for a substitution into an incorrect but visible rearrangement. Rearrangement and substitution were allowed in either order. A number lost the final mark due to incorrect rounding error, eg 1.6 or a POT error. An answer of 1.6 recurring was fine. A power of 10 error could still score two marks.

(c) (i) State the formula linking speed, frequency and wavelength of a wave.

(1)

wavelength = speed x frequency

(ii) The gamma source emits gamma waves with a frequency of 1.8×10^{20} Hz.

Calculate the wavelength of the gamma waves.

Give your answer in standard form.

[speed of gamma waves = 3.0×10^{8} m/s]

(3)

$1.8 \times 10^{20} \times 3.0 \times 10^{8} = 5.4 \times 10^{28}$

wavelength = speed x frequency

wavelength = 5.4×10^{28} m

ResultsPlus
Examiner Comments

This response got one mark. They wrote down the incorrect word equation. Error was carried forward as they substituted into an incorrect but visible rearrangement. The evaluation was also incorrect.

ResultsPlus
Examiner Tip

Candidates should be advised to substitute data into formulae before attempting to rearrange them, especially if the candidate experiences difficulty when doing this. Once a formula has been incorrectly rearranged, no further marks will be awarded in the calculation.

(c) (i) State the formula linking speed, frequency and wavelength of a wave.

(1)

speed = frequency × wavelength

(ii) The gamma source emits gamma waves with a frequency of 1.8×10^{20} Hz.

Calculate the wavelength of the gamma waves.

Give your answer in standard form.

[speed of gamma waves = 3.0×10^{8} m/s]

(3)

$3.0 \times 10^{8} \div 1.8 \times 10^{20}$

wavelength = 1.66×10^{28} m

ResultsPlus
Examiner Comments

This response gained three marks. They stated the correct equation and substituted correctly into the rearranged equation. The evaluation was to the wrong power of 10, so only three marks scored in total.

ResultsPlus
Examiner Tip

Candidates need lots of practice calculating in standard form.

Question 6(a)(i)

Many candidates managed to score at least a mark in this question for drawing an ammeter in series with the piece of wire. Voltmeters were rarely drawn in parallel and if they were, they were drawn in the incorrect place eg around the battery. Many candidates could not draw the correct symbol for a variable resistor and many drew a thermistor symbol instead. An arrow head was needed on the variable resistor to score a mark. Some included bulbs and other unneeded components, which were ignored. Lines through components were also ignored. Responses that scored zero were most likely due to them drawing a single horizontal line through the wire and then including the incorrect circuit symbols on an incomplete circuit. A particular error seen was drawing an ammeter in the middle of the piece of wire being investigated. To do this you would have to split the wire in half, thus making the experiment unworkable.

6 A student investigates how the current in a piece of wire varies with the voltage across the wire. The temperature of the wire is constant.

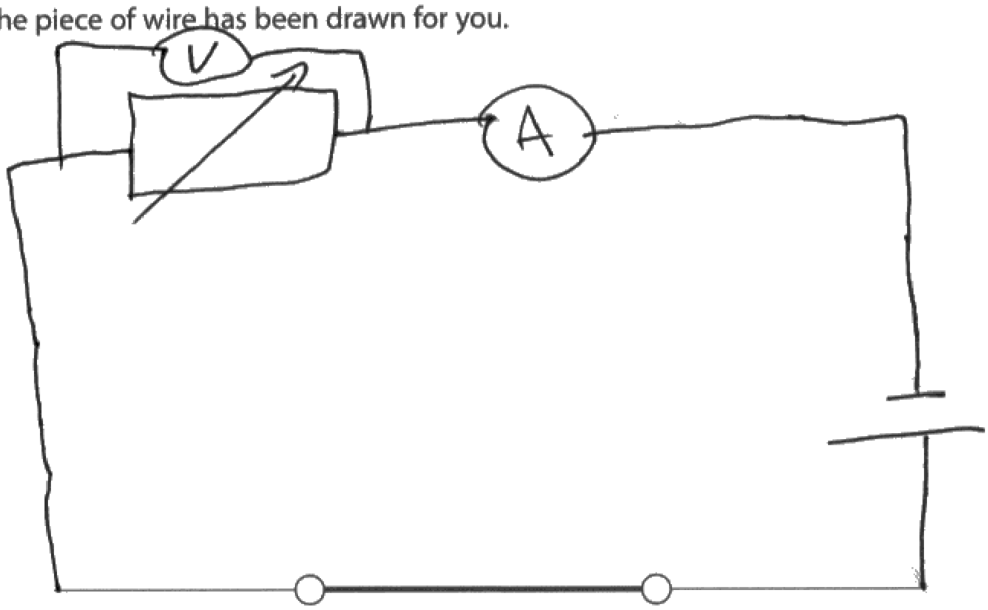
(a) (i) Draw a suitable circuit diagram the student could use for the investigation.

Include this equipment in your diagram.

- cell
- variable resistor
- ammeter
- voltmeter

The piece of wire has been drawn for you.

(3)



ResultsPlus Examiner Comments

This response was awarded two marks. A complete circuit, which includes an ammeter connected in series with the piece of wire. It also had the correct symbols drawn for an ammeter, voltmeter and variable resistor. No third mark was awarded as the voltmeter was connected across an incorrect part of the circuit.

ResultsPlus Examiner Tip

Learn all circuit symbols and practice drawing complete circuits with a pencil and a ruler.

6 A student investigates how the current in a piece of wire varies with the voltage across the wire. The temperature of the wire is constant.

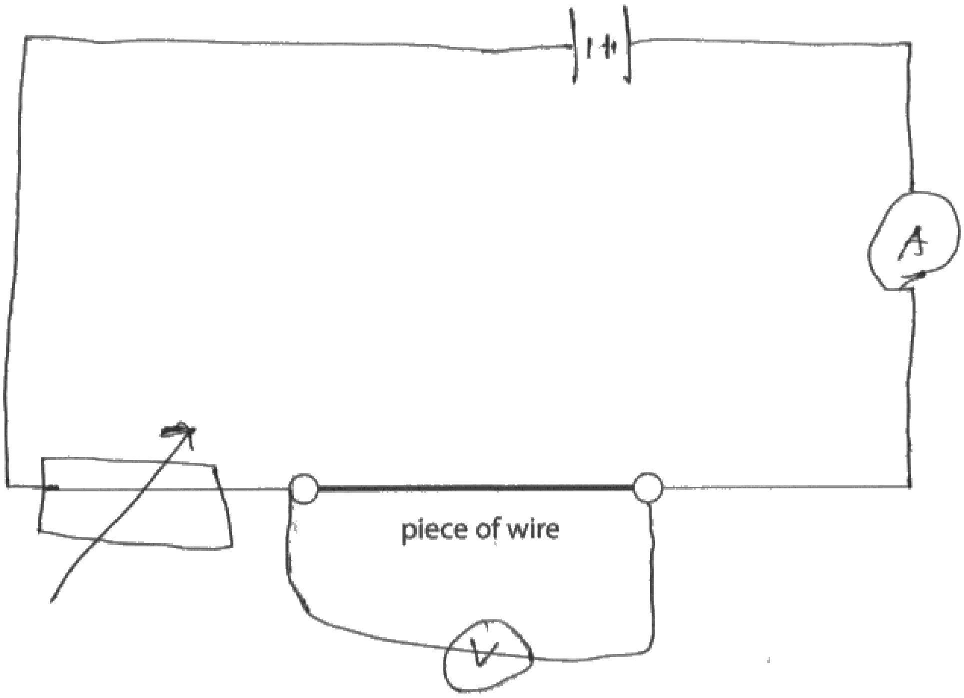
(a) (i) Draw a suitable circuit diagram the student could use for the investigation.

Include this equipment in your diagram.

- cell
- variable resistor
- ammeter
- voltmeter

The piece of wire has been drawn for you.

(3)



ResultsPlus
Examiner Comments

This response was given three marks. Although the battery is drawn incorrectly, the ammeter and voltmeter were drawn into the correct place to measure the current and voltage of the piece of wire. The three circuit symbols were all drawn correctly. Lines drawn through ammeter, voltmeters and variable resistors were ignored.

6 A student investigates how the current in a piece of wire varies with the voltage across the wire. The temperature of the wire is constant.

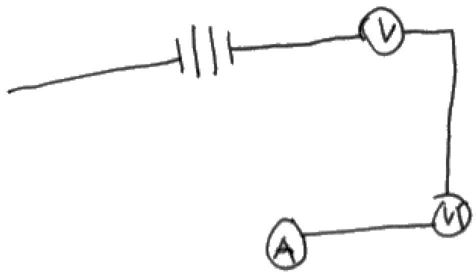
(a) (i) Draw a suitable circuit diagram the student could use for the investigation.

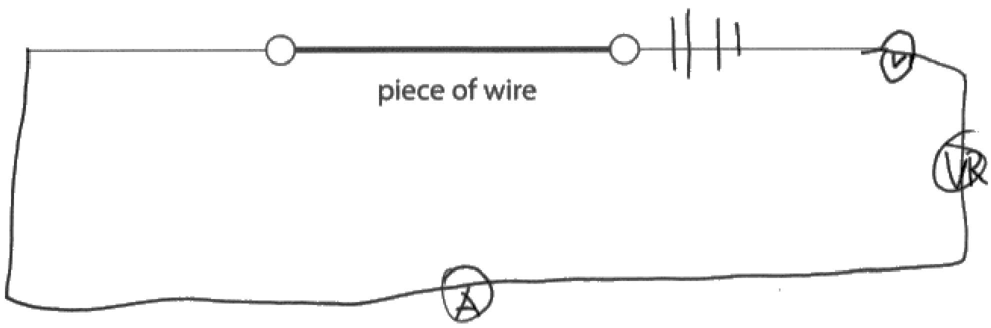
Include this equipment in your diagram.

- cell
- variable resistor
- ammeter
- voltmeter

The piece of wire has been drawn for you.

(3)





ResultsPlus
Examiner Comments

This response gained one mark for connecting an ammeter in series with the piece of wire. The voltmeter was incorrectly drawn in series and no variable resistor was included.

ResultsPlus
Examiner Tip

Candidates are expected to know how to correctly connect ammeters and voltmeters into circuits to read current and voltage successfully.

6 A student investigates how the current in a piece of wire varies with the voltage across the wire. The temperature of the wire is constant.

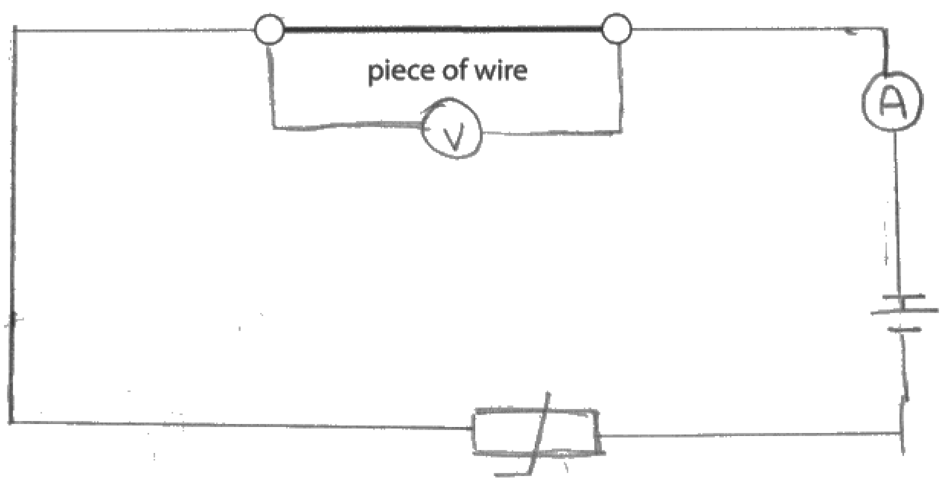
(a) (i) Draw a suitable circuit diagram the student could use for the investigation.

Include this equipment in your diagram.

- cell
- variable resistor
- ammeter
- voltmeter

The piece of wire has been drawn for you.

(3)



ResultsPlus
Examiner Comments

This response was awarded two marks. The candidate drew the ammeter and voltmeter into the correct places, but confused a thermistor for a variable resistor.

Question 6(a)(ii)

Many candidates struggled to gain any marks in this question. Some candidates scored one mark for stating that a lower current/voltage should be used. Very few mentioned the importance of turning off the circuit between readings to keep the temperature of the wire lower. The word 'resistance' was hardly ever used, yet many could use the equation for resistance = voltage/current. Misconceptions included talking about how the temperature of the room could be controlled or the wire could be 'kept under water'. Other misconceptions included describing how to monitor the temperature of the wire using thermometers, or wearing gloves to handle it etc. Some were close with temperature but did not specifically state that the temperature would increase, just change.

(ii) Explain the precautions the student should take to ensure that the temperature of the piece of wire is constant.

(3)

- mak sure the room tempetare isn't too hot
- not increase the voltage so much

ResultsPlus
Examiner Comments

This response gained one mark for the idea of keeping the voltage lower.

ResultsPlus
Examiner Tip

The link between voltage, current and resistance is tested regularly in written form, as well as in number form.

(ii) Explain the precautions the student should take to ensure that the temperature of the piece of wire is constant.

(3)

Ensure that the piece of wire does not have a very high resistance which could lead to overheating. Hence, avoid increasing or decreasing values in the variable resistor to extremes. Resistance increases, as voltage increases as temperature of the wire increases. Hence ensure that the different data values for voltage are of ~~a~~ smaller intervals. The same cell should be used. Do not add other components to the circuit.

ResultsPlus
Examiner Comments

This response scored three marks. The idea of keeping voltage/current lower using the variable resistor. They also linked resistance to temperature increase.

Question 6(b)

Most candidates tried to draw some sort of graph. Most were able to create some sort of axes scales, but if it was not linear, it limited the mark awarded to one. Lots of candidates could add labels but some of these candidates forgot to add the units. Axes could be drawn either way around. Misplotting of points were rather rare and lines of best fit were of a good quality from many candidates. Lower scoring candidates did not have linear scales and presented bar charts for the data. Tramlining was very rare and could be ignored after the last point if it did happen. The question asked for a curved line of best fit, therefore straight lines did not gain credit as they did not pass through the plotted points.

(b) The table shows the student's results.

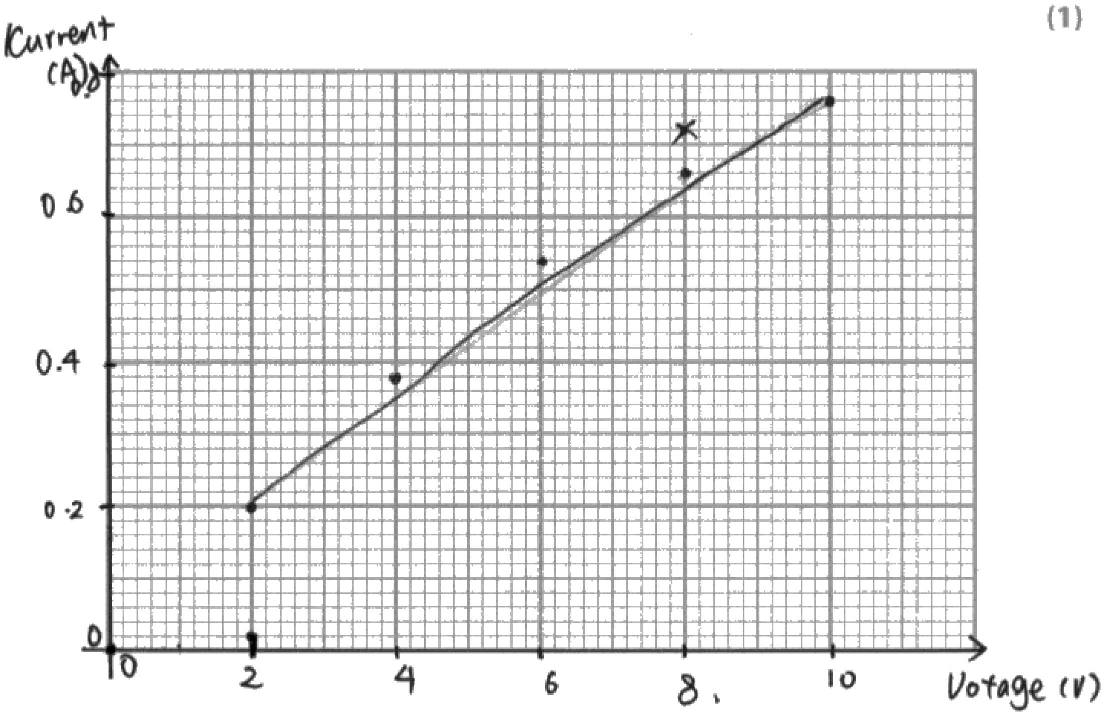
Voltage in V	Current in A
0.0	0.00
2.0	0.20
4.0	0.38
6.0	0.54
8.0	0.66
10.0	0.76

(i) Plot a graph of the student's results.

(3)

(ii) Draw a curve of best fit.

(1)



ResultsPlus
Examiner Comments

This response gained three marks in total. The candidate used a linear scale using most of the graph space. They added labels and units to the axes, and plotted all the points within 1/2 square. The curve of best fit was a straight line that did not go through most plots.

(b) The table shows the student's results.

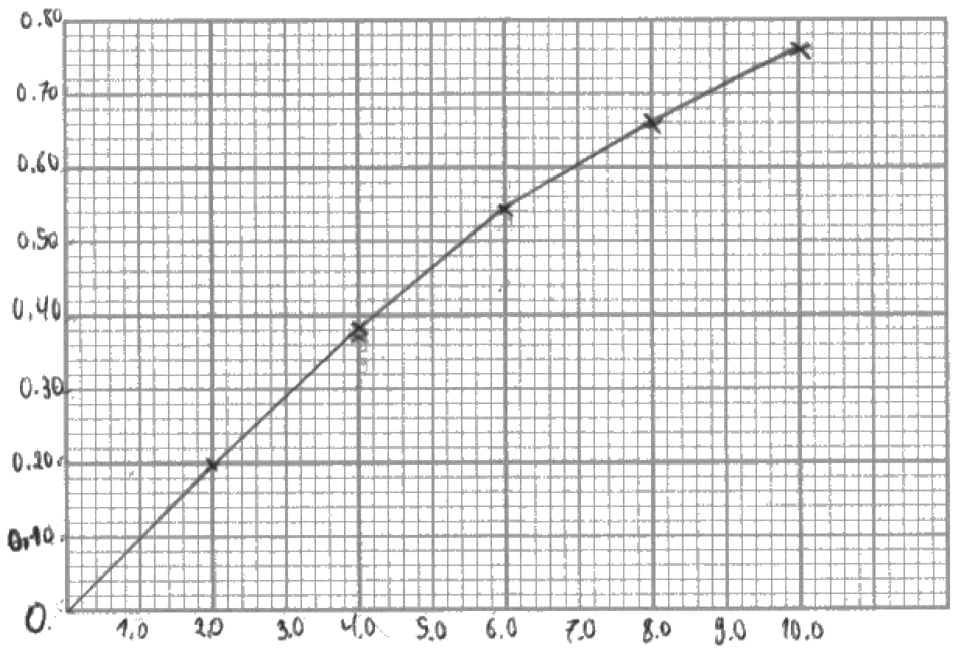
Voltage in V	Current in A
0.0	0.00
2.0	0.20
4.0	0.38
6.0	0.54
8.0	0.66
10.0	0.76

(i) Plot a graph of the student's results.

(3)

(ii) Draw a curve of best fit.

(1)



ResultsPlus
Examiner Comments

This response gained three marks in total. The candidate used a linear scale using most of the graph space, but did not add labels and units. All the plot points are within 1/2 square. The curve of best fit went through every plotted point.

ResultsPlus
Examiner Tip

Candidates need practice adding correct labels and units to different graph axes.

(b) The table shows the student's results.

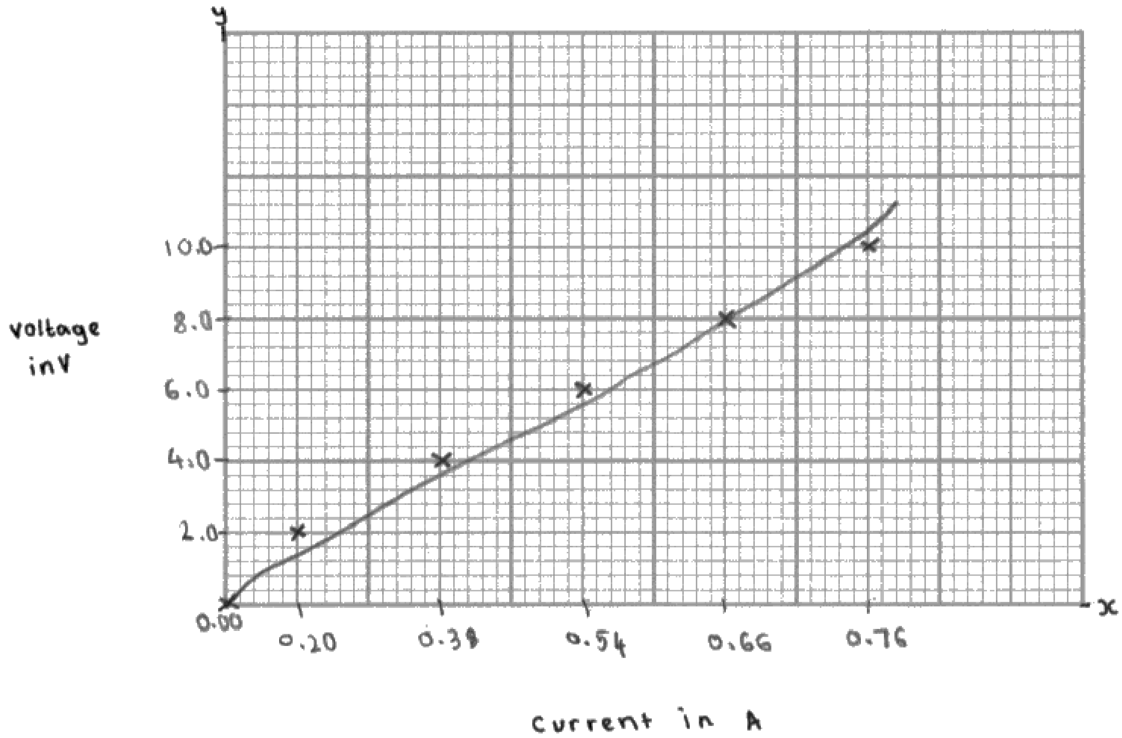
Voltage in V	Current in A
0.0	0.00
2.0	0.20
4.0	0.38
6.0	0.54
8.0	0.66
10.0	0.76

(i) Plot a graph of the student's results.

(3)

(ii) Draw a curve of best fit.

(1)



Examiner Comments

This response gained one mark. The candidate did not use a linear x-axis so this limited the marks that could be awarded in this question. The axes were labelled correctly with units.

(b) The table shows the student's results.

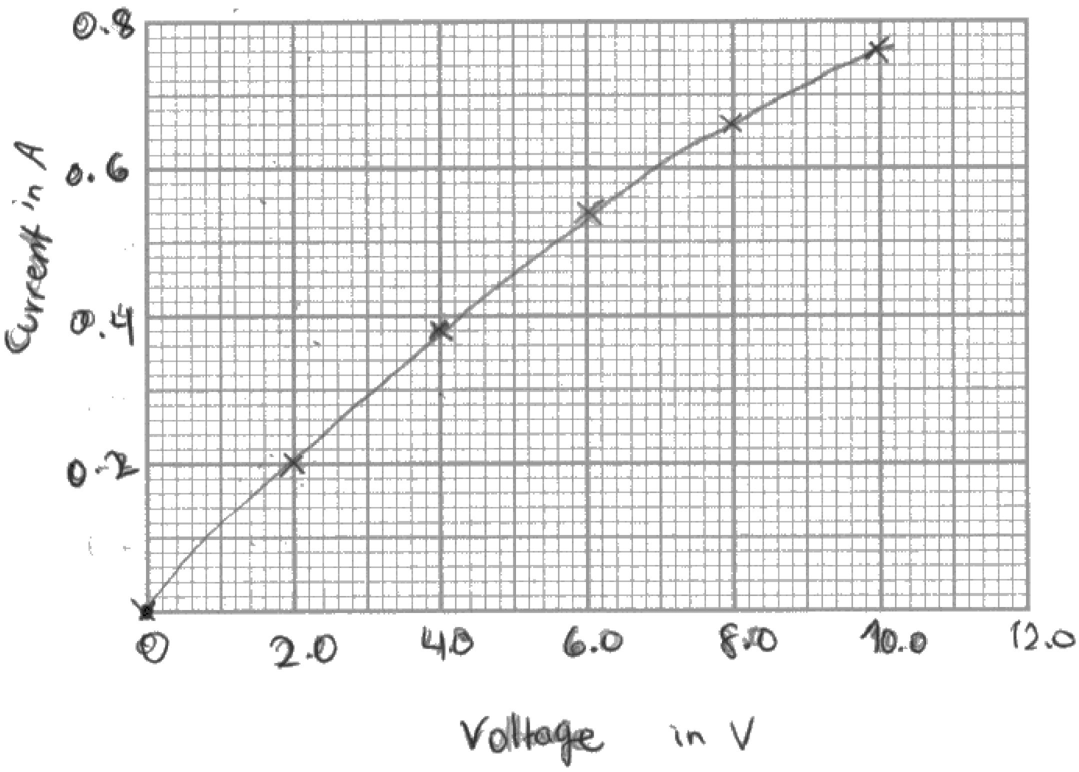
Voltage in V	Current in A
0.0	0.00
2.0	0.20
4.0	0.38
6.0	0.54
8.0	0.66
10.0	0.76

(i) Plot a graph of the student's results.

(3)

(ii) Draw a curve of best fit.

(1)



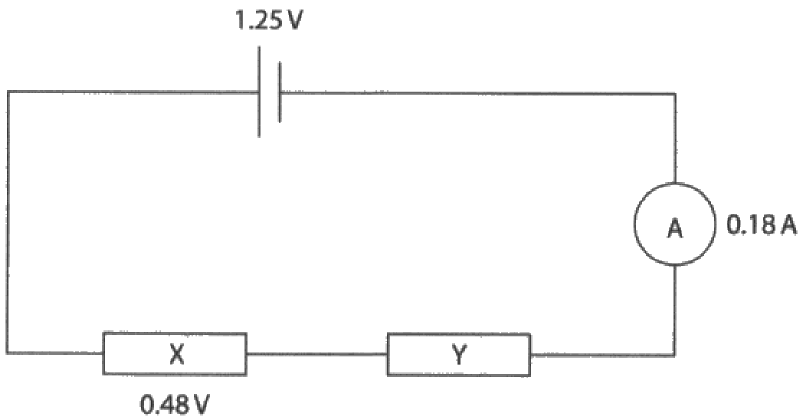
ResultsPlus
Examiner Comments

This response gained four marks in total. The candidate used a linear scale using most of the graph space and added appropriate labels and units. All the plot points are within 1/2 square. The curve of best fit went through every plotted point.

Question 6(c)

Many candidates failed to score marks on this question. The question wanted the resistance of resistor Y. This involved calculating the voltage across Y, by subtracting the voltage used by resistor X from the total voltage supplied by the battery. One mark could be awarded for the correct answer of 0.77, seen anywhere. Very few candidates moved on to calculate the correct resistance of resistor Y. Those that were incorrect and scored nothing did random addition of currents and voltages. Lots of candidates also incorrectly divided 0.18 by a mixture of other numbers. Common answers were 0.77, 2.67 or 6.94. Very few candidates followed the working through to the final answer and only did one calculation whether right or wrong.

(c) This diagram shows a circuit with two resistors, X and Y.



The current in the circuit is 0.18 A and the voltage across resistor X is 0.48 V.

Calculate the resistance of resistor Y.

(3)

~~voltage = current x resistor~~
~~= 0.18 x 0.48~~

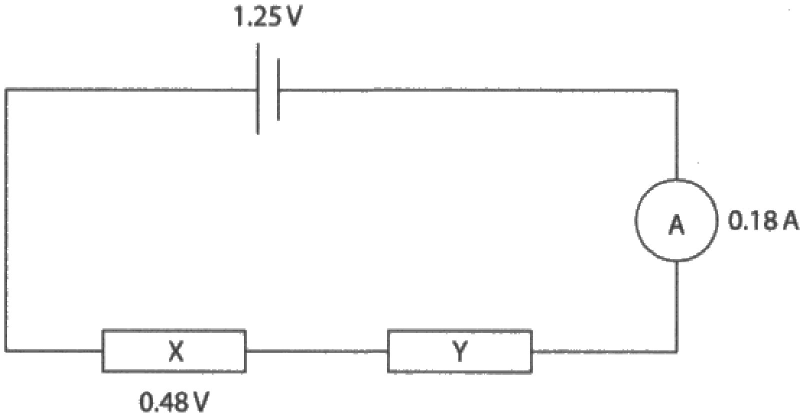
voltage = 1.25 − 0.48
= 0.77

resistance = 0.77 ohms

ResultsPlus
Examiner Comments

This response scored one mark. The candidate had the right idea that resistor Y must have an unequal share of the total voltage from the battery, therefore calculating 0.77 scored one mark. 0.77 seen anywhere would score.

(c) This diagram shows a circuit with two resistors, X and Y.



The current in the circuit is 0.18 A and the voltage across resistor X is 0.48 V.

Calculate the resistance of resistor Y.

(3)

$\boxed{V = I \times R \quad R = \frac{V}{I}}$

$R = \frac{1,25}{0,18}$

$R = 6,944$

Volts in $Y = 1,25 - 0,48$

$Y = 0,77$

$R_{in Y} = \frac{0,77}{0,18}$

$R_Y = 4,2\dot{7}\ \Omega$

resistance = $4,2\dot{7}$ ohms

ResultsPlus Examiner Comments

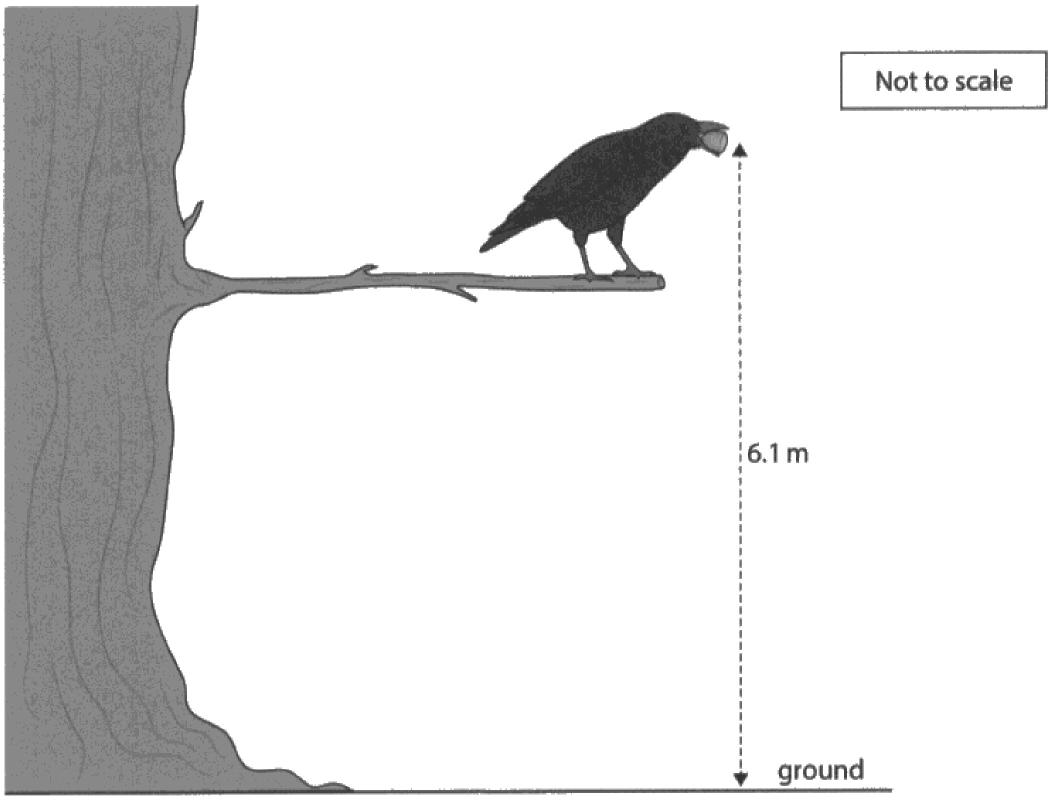
This response scored three marks. An evaluation that rounded to 4.3 was awarded three marks.

Question 7(a)

In this question, candidates scored a full range of different marks. Q07(a)(i) asks for the correct equation, which scored highly. Q07(a)(ii) did not need a rearrangement, just a substitution. Therefore, it should have scored highly, but many candidates could not recall what the number for 'g' was, as it was not given in the question. Candidates were expected to recall that 'g' was equal to 10, or 9.8. Any number that rounded to 0.17 or 0.18 could gain full credit. An incorrect answer of 0.017 was common, due to the fact that they had left 'g' out of their calculation, therefore, no power of 10 error was allowed. Q07(a)(iii) needed their answer from Q07(a)(ii), or just 0.2. Q07(a)(iv) scored poorly. Rearranging the KE equation and then using square root was rare. Many rearranged with v^2 being the final subject, but many did not know what to do with the v^2. We allowed ecf for this part of the question. There is a common error when doing “Show that” questions such as Q07(a)(ii) where a candidate will incorrectly work backwards from the approximate answer. In this case, it led to many candidates working out what the value of 'g' would be for the values given of GPE, mass and height, ending up with g = 11.3.

7 A bird tries to break open a nut by dropping it from a tree onto the ground.

The bird drops the nut from a height of 6.1 m.



(a) The nut has a mass of 0.0029 kg.

(i) State the formula linking gravitational potential energy (GPE), mass, gravitational field strength and height.

(1)

GPE = mass × gravitational field strength × height
(10)

(ii) Show that the GPE of the nut is approximately 0.2 J when it is 6.1 m above the ground.

(2)

0.0029 × 10 × 6.1 = 0.1769 = 0.2J

~~1g - 1.000g~~
~~0.0029~~
~~0.0029~~
~~1000~~

(iii) State the kinetic energy (KE) of the nut just before it hits the ground.

Assume that the nut is dropped from rest and that there is no air resistance.

(1)

KE = 0.2J J

(iv) Calculate the speed of the nut just before it hits the ground.

Assume that the nut is dropped from rest and that there is no air resistance.

[kinetic energy = ½ × mass × speed²]

(3)

$$\frac{0.2}{\frac{1}{2} \times 0.0029} = 137.9$$

speed = 137.9 m/s

ResultsPlus
Examiner Comments

Q07(a)(i) - Correct equation used.

Q07(a)(ii) - Correct substitution and evaluation.

Q07(a)(iii) - Correct, using their answer from part Q07(a)(ii), or stating 0.2.

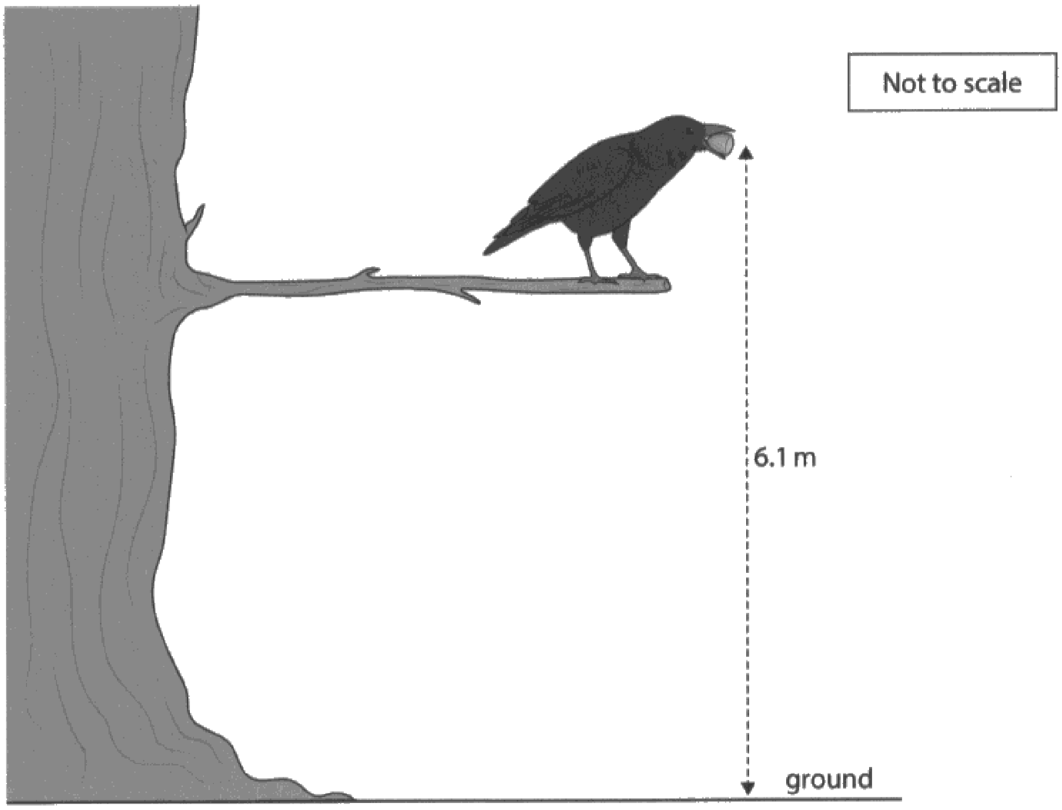
Q07(a)(iv) - This candidate substituted and rearranged correctly, but then did not square root their answer, so could only gain two marks.

ResultsPlus
Examiner Tip

Always include evidence of your working in calculations. Structure working with a new line for each step so that the examiner can easily see evidence of correct substitution of data and rearrangements of formulae.

7 A bird tries to break open a nut by dropping it from a tree onto the ground.

The bird drops the nut from a height of 6.1 m.



(a) The nut has a mass of 0.0029 kg.

(i) State the formula linking gravitational potential energy (GPE), mass, gravitational field strength and height.

(1)

GPE = m × g × H

(ii) Show that the GPE of the nut is approximately 0.2 J when it is 6.1 m above the ground.

(2)

0.0029 × 6.1
= 0.01769
round up
0.2

(iii) State the kinetic energy (KE) of the nut just before it hits the ground.

Assume that the nut is dropped from rest and that there is no air resistance.

(1)

$6.1 \times 0.0029 = 0.01769$

KE = ... J

(iv) Calculate the speed of the nut just before it hits the ground.

Assume that the nut is dropped from rest and that there is no air resistance.

[kinetic energy = ½ × mass × speed^2]

(3)

$0.01769 \times 0.0029 = 5.1301$

speed = 5.1301 m/s

ResultsPlus
Examiner Comments

Q07(a)(i) - Correct equation identified.

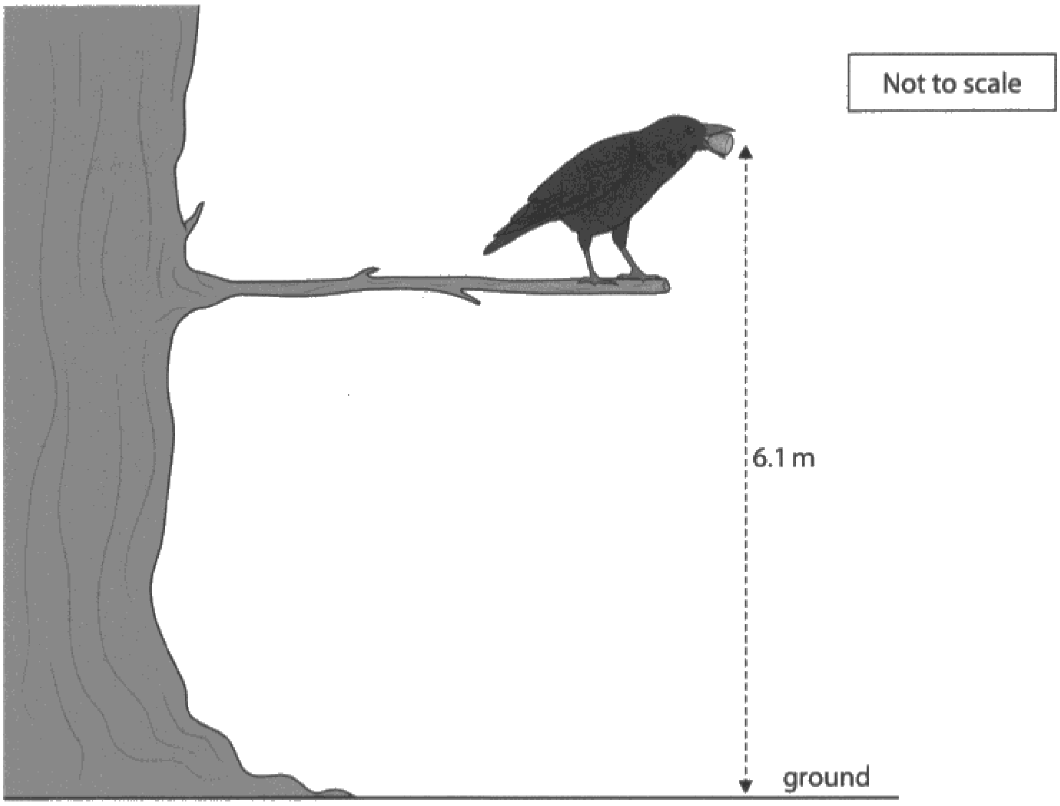
Q07(a)(ii) - The candidate did not recall 10 or 9.8 as the gravitational field strength. No power of 10 error was allowed, so no marks could be awarded for correct substitution.

Q07(a)(iii) - Error carried forward from Q07(a)(ii) for one mark.

Q07(a)(iv) - No mark awarded as it has an incorrect substitution and rearrangement.

7 A bird tries to break open a nut by dropping it from a tree onto the ground.

The bird drops the nut from a height of 6.1 m.



(a) The nut has a mass of 0.0029 kg.

(i) State the formula linking gravitational potential energy (GPE), mass, gravitational field strength and height.

(1)

gPE = m x g x h

(ii) Show that the GPE of the nut is approximately 0.2 J when it is 6.1 m above the ground.

(2)

gPE = 0.0029 x 10 x 6.1 = 0.17

(iii) State the kinetic energy (KE) of the nut just before it hits the ground.

Assume that the nut is dropped from rest and that there is no air resistance.

(1)

KE = 0.17 J

(iv) Calculate the speed of the nut just before it hits the ground.

Assume that the nut is dropped from rest and that there is no air resistance.

[kinetic energy = ½ × mass × speed²]

(3)

$KE = 0.5 \times m \times v^2$

$0.17 = 0.5 \times 0.0029 \times v^2$

$v = \frac{0.17}{0.5 \times 0.0029} = 117.24^2$

$\sqrt{117.24^2} = 10.8$

speed = 10.8 m/s

ResultsPlus
Examiner Comments

Q07(a)(i) - Correct equation identified, in symbols or words. We allowed gravitational field strength for 'g', but not just gravity.

Q07(a)(ii) - Correct answer seen for two marks.

Q07(a)(iii) - Answer for Q07(a)(ii) used to gain a mark. 0.2 would also score without the correct answer to Q07(a)(ii).

Q07(a)(iv) - Correct substitution, rearrangement and evaluation is correct for three marks.

Question 7(b)

This question was answered well by over half the candidates. The ideal answer of a bird having to do more work on the nut was very rarely mentioned. Answers like increasing the energy/force/acceleration/velocity/speed of the nut were more likely. If 'increased' was not mentioned, no credit could be given. Some were rephrasing the question, explaining that the bird needed to throw it because it did not have enough energy, but not stating that the bird did work etc. Many candidates simply stated it was not enough energy but did not say the bird could increase the energy/force by throwing. Many candidates had the idea that work had to increase, but were just not specific enough.

(b) The energy required for the nut to break is approximately 0.3 J.

Suggest why, at a height of 6.1 m, the bird has to throw the nut rather than just dropping it from rest.

To gain KE.

ResultsPlus
Examiner Comments

This response scores one mark. KE increased or energy increased was used a lot by candidates.

(b) The energy required for the nut to break is approximately 0.3 J.

Suggest why, at a height of 6.1 m, the bird has to throw the nut rather than just dropping it from rest.

(1)

• Because if you add force while throwing it will most likely break then dropping it
• like this there is more energy acting ~~with~~ on the nut

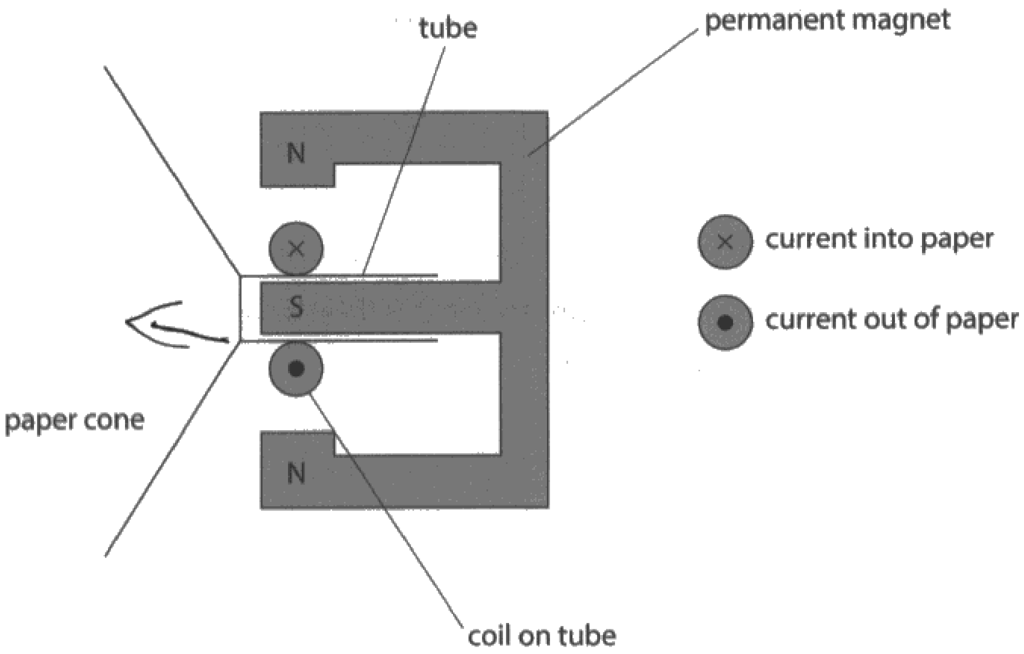
ResultsPlus
Examiner Comments

This response gains the mark. The candidate mentions more force and more energy on the nut.

Question 8(a)

About a third of candidates were able to gain credit for this question. An almost horizontal arrow, judged by eye, was needed that had an arrow head attached, to show its direction. The arrow could be seen anywhere on the diagram. If two arrows were drawn that were correct, a mark was awarded. If two arrows were drawn that conflicted each other, no mark was obviously awarded. It was rare to see conflicting arrow directions depicted in a response. Most common misconceptions were drawing an horizontal arrow to the right, arrow drawn pointing upwards or downwards or an arrow drawn pointing diagonally upwards or downwards. The question required knowledge and correct application of 'Fleming's left-hand rule'.

8 The diagram shows a cross-section of a loudspeaker.



The tube is attached to the paper cone.

(a) Draw an arrow on the diagram to show the direction of the force exerted on the paper cone from the coil.

(1)

ResultsPlus
Examiner Comments

This response was awarded a mark. The arrow was just about horizontal, but any further verticle would have scored no mark. The arrow could be shown anywhere on the diagram.

ResultsPlus
Examiner Tip

The questions asks for 'an arrow' to be drawn. Therefore, only draw a maximum of one arrow otherwise, any further arrows could contradict your answer.

Question 8(b)

This question was not answered well by the vast majority of candidates. Some candidates described what AC or DC current was for one mark, but very few went further to explain about how the force would increase. Only the most confident candidates could explain that the magnetic field produced would change direction and cause vibrations of the cone/air. A few described that the force produced would change direction. The most common combination was of MP1 and MP4. Whilst a few candidates mentioned vibrations, responses often lacked the specificity needed to achieve MP4.

(b) A student wants to produce a sound from the loudspeaker.

Explain why the student should use alternating current (a.c.) rather than direct current (d.c.).

(2)

Because alternating current can change directions to produce different vibrations to produe a range of different sounds whereas direct current is set to one direction and cannot produce different vibrations.

ResultsPlus
Examiner Comments

This response scores one mark. The description for AC and DC current was seen to be correct, but the candidate did not mention what would be vibrating to produce a sound eg the cone or the air particles.

(b) A student wants to produce a sound from the loudspeaker.

Explain why the student should use alternating current (a.c.) rather than direct current (d.c.).

(2)

Because alternating current changes directions continuously therefore ~~at~~ allowing the paper cone to vibrate. whereas direct current ~~f~~ travels in one direction therefore no sound is produces. Cone has to vibrate to produce sound waves.

ResultsPlus
Examiner Comments

This response scores two marks. The candidate described AC current and DC current, then went on to describe that the loudspeaker needed AC current to vibrate.

Question 8(c)

Most candidates gained credit in this question. There was a reasonable mix of answers from across the three marking points. Less successful candidates were able to score at least one mark for the idea of current increasing. Some went on to mention 'increasing' magnetic field or stronger magnet. References to larger/bigger/thicker magnets were rare and did not gain credit. Common misconceptions included longer coil, more coil, size of the coil and not the idea of 'number of coils' for MP2.

(c) Explain how the student could increase the force on the loudspeaker coil.

(2)

increasing the current will increase the force

ResultsPlus
Examiner Comments

This response scores one mark. Increasing current was the most common correct answer.

ResultsPlus
Examiner Tip

Always study the questions diagram because it is there for a reason. It will support the candidates thinking of the question.

(c) Explain how the student could increase the force on the loudspeaker coil.

more Coil.
Higher Current.
Larger ~~Magnite~~. magnet.

ResultsPlus
Examiner Comments

This response scored only one mark for stating, higher current. More coil was seen as too basic, we needed to see something along the lines of 'more turns' on the coil. Stating a larger magnet gains no credit as a larger magnet does not mean it has a larger magnetic field strength.

(c) Explain how the student could increase the force on the loudspeaker coil.

(2)

· By using a stronger magnet in order to increase the magnetic field strength.
· Increasing the current flowing by increasing the voltage of the power supply.
· Increasing the number of turns on the coil.

ResultsPlus
Examiner Comments

This response scored two marks. A stronger magnet, increasing current and increasing the number of turns gave 3 good points to this answer.

ResultsPlus
Examiner Tip

Look how many marks are available in the question to indicate how many points you should write to gain maximum credit.

Paper Summary

Based on their performance on this paper, candidates should:

- Take note of the number of marks given for each question and use this as a guide as to the amount of detail expected in the answer.
- Take note of the command word used in each question to determine how the examiner expects the question to be answered, for example, whether to give a description or an explanation.
- Be able to rearrange the formulae listed in the specification.
- Know the SI units for physical quantities and be able to convert from non-SI units to SI units when required.
- Show all working, so that some credit can still be given for answers that are only partly correct.
- Take advantage of opportunities to draw labelled diagrams as well as, or instead of, written answers.
- Take care when drawing diagrams to do so accurately and with labels.

Grade boundaries

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