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Examiners' Report
June 2025

Int GCSE Physics 4PH1 1PR

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June 2025

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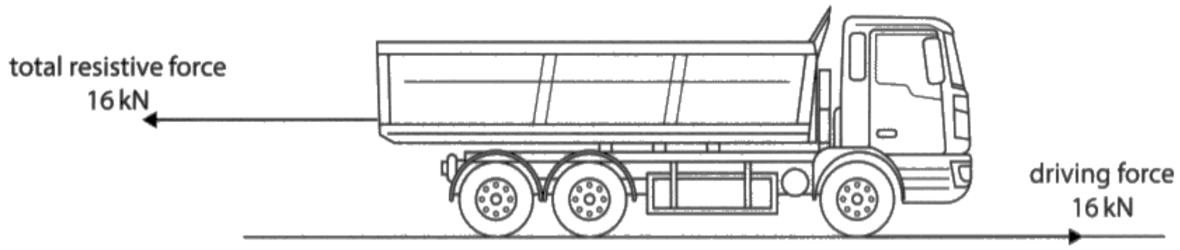
Introduction

As in examinations for previous sessions, most candidates handled the calculations well. Candidates who gave the best practical descriptions usually appeared to be writing from first-hand experience. Responses to the longer questions showed that the less able candidates tended to struggle when assembling a logical description or when asked to offer more than one idea. There were a wide range of responses and it was good to see that many candidates could give full and accurate answers.

Question 1(a)

Very straightforward opening item here – some candidates showed some working, which wasn't necessary but is good practice.

1 The diagram shows a truck travelling along a horizontal road.



(a) The diagram shows the horizontal forces acting on the truck.

Give the resultant horizontal force acting on the truck.

(1)

16-16 = 0

resultant horizontal force = ...0.......... kN

ResultsPlus
Examiner Comments

This candidate has clearly got the right answer.

ResultsPlus
Examiner Tip

This candidate has also shown their working, even though it was not necessary at this stage, for only one mark.

Question 1(b)i

Again, almost all candidates remembered that the stopping distance equals the sum of the braking distance and the thinking distance.

(b) The driver of the truck has to stop because a tree has fallen on the road.

(i) The thinking distance of the driver is 7 m.

The braking distance of the truck is 20 m.

Calculate the stopping distance of the truck.

(1)

$7 + 20 = 27$

stopping distance = 27 m

ResultsPlus
Examiner Comments

Just like in the previous item, the candidate has shown their working even for an otherwise low demand item.

Question 1(b)ii

The mark scheme shows a large range of acceptable responses, which meant many candidates could pick up both marks available. A small number of candidates confused thinking distance and braking distance, incorrectly suggesting that alcohol and tiredness can affect braking distance. These responses were limited to 1 mark maximum.

(ii) Give two factors that would affect the braking distance of the truck.

(2)

1 • The speed at which the truck is travelling before braking.

2 • The condition, that is the smoothness or roughness of the road.

ResultsPlus
Examiner Comments

Two marks here for clearly describing two of the acceptable factors.

(ii) Give two factors that would affect the braking distance of the truck.

(2)

1 The road condition

2 The reacnon time of the driver

ResultsPlus Examiner Comments

This candidate, however, has named one of the factors that affects thinking distance, limiting their response to 1 mark.

ResultsPlus Examiner Tip

During revision, be diligent about revising key facts.

Question 2(a)

Virtually all candidates correctly assigned opposite pole labels to the magnet pieces. Some candidates did not draw horizontal lines at all, or they didn't make sure that the lines touched the poles at both ends.

Lines outside the poles were ignored.

The minimum number of lines required to show that the field was uniform is three – giving two spaces between lines that should be the same.

Finally, candidates needed to make sure that any arrowheads drawn on their field lines were consistent with their labelling of the poles.

2 This question is about magnetic fields.

(a) Diagram 1 shows the poles of two strong bar magnets being held close together.

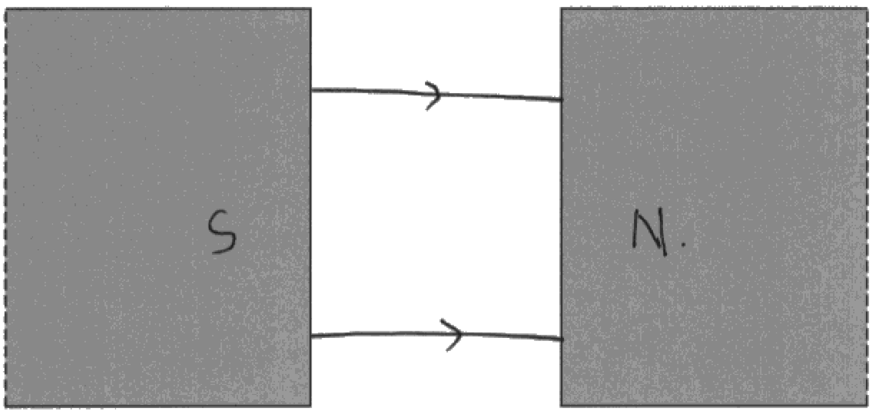


Diagram 1

There is a uniform magnetic field between the poles of the bar magnets.

Complete diagram 1 by drawing magnetic field lines to show the uniform magnetic field.

You should label the poles of the bar magnets.

(4)

ResultsPlus
Examiner Comments

Only 1 mark here, for drawing and labelling two opposing poles. The poles are not consistent with the direction of these lines, nor are there enough lines to show that the field is uniform. The lines are not acceptably horizontal.

ResultsPlus
Examiner Tip

Bring a straight edge or ideally a ruler to the examination.

2 This question is about magnetic fields.

(a) Diagram 1 shows the poles of two strong bar magnets being held close together.

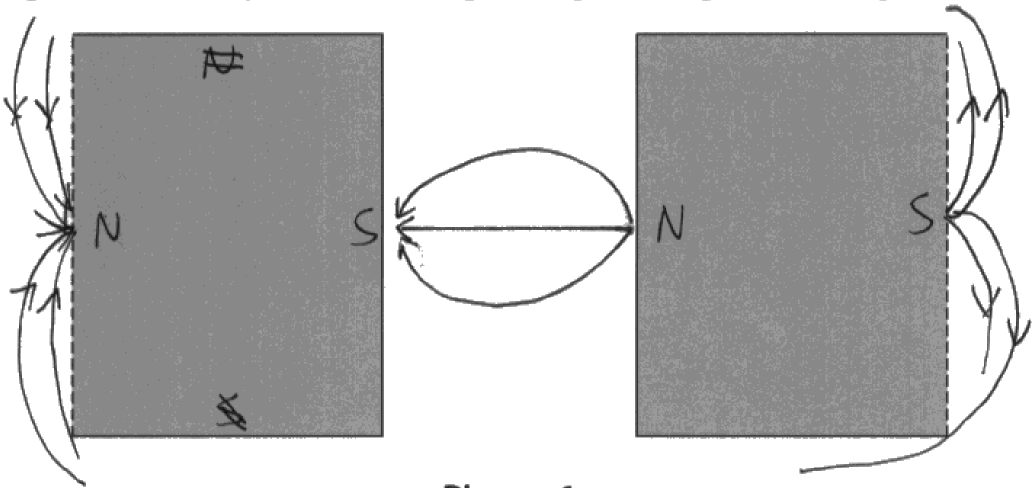


Diagram 1

There is a uniform magnetic field between the poles of the bar magnets.

Complete diagram 1 by drawing magnetic field lines to show the uniform magnetic field.

You should label the poles of the bar magnets.

(4)

ResultsPlus
Examiner Comments

Two marks here, for opposite poles labelled and lines with arrows that are consistent with those poles. The lines are definitely not horizontal nor are they equally spaced throughout their length.

ResultsPlus
Examiner Tip

The key term in the question is 'uniform'.

2 This question is about magnetic fields.

(a) Diagram 1 shows the poles of two strong bar magnets being held close together.

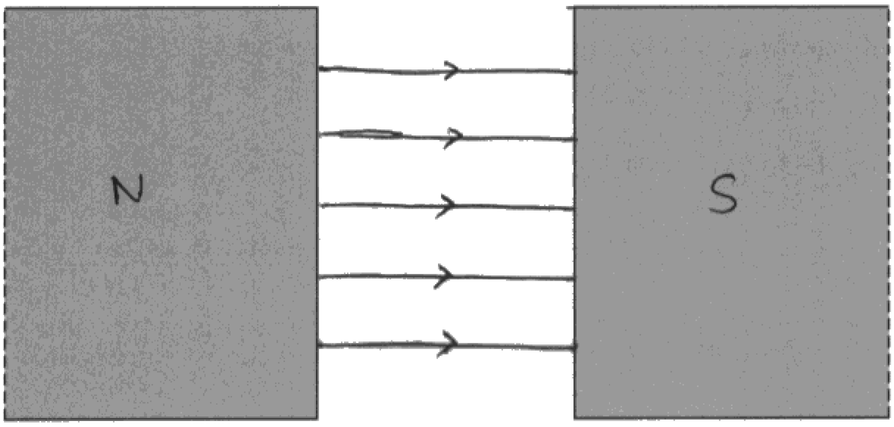


Diagram 1

There is a uniform magnetic field between the poles of the bar magnets.

Complete diagram 1 by drawing magnetic field lines to show the uniform magnetic field.

You should label the poles of the bar magnets.

(4)

ResultsPlus
Examiner Comments

All four marks here. The lines are straight and parallel. They also touch both poles and have arrows that show direction consistent with the choice of poles.

Question 2(b)i

Both poles of the iron block were required to score the mark here.

(b) Diagram 2 shows a strong magnet attracting an iron block.

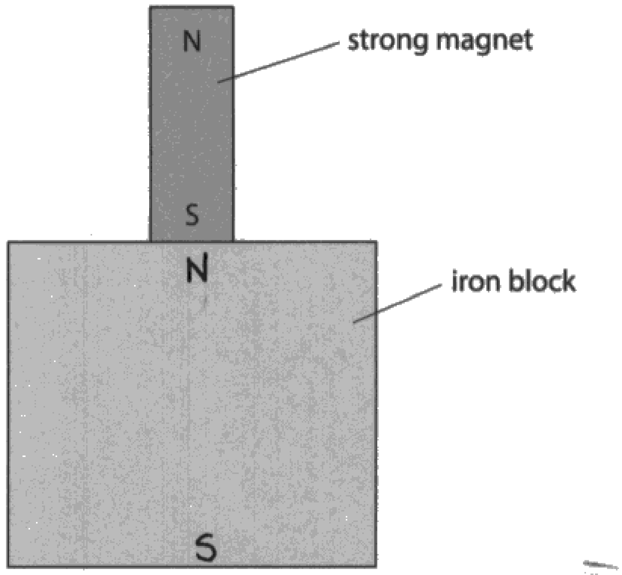


Diagram 2

(i) The iron block becomes magnetised when it is in the magnetic field of the strong magnet.

Label the magnetic poles on the magnetised iron block in diagram 2.

(1)

ResultsPlus
Examiner Comments

This candidate scored the available mark. It would still have been acceptable if the letters N and S were further away from the rectangle's shorter edges.

(b) Diagram 2 shows a strong magnet attracting an iron block.

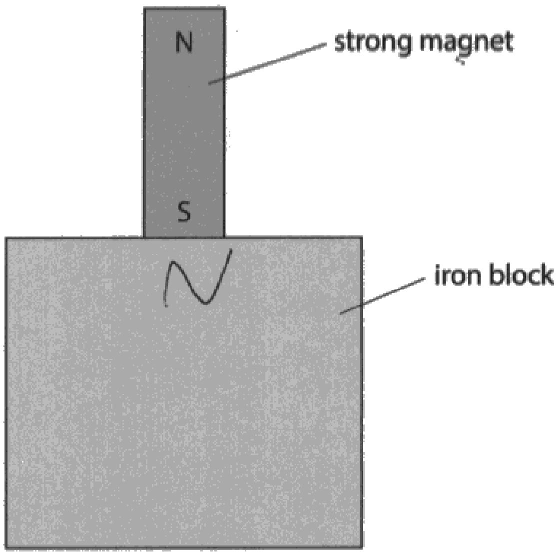


Diagram 2

(i) The iron block becomes magnetised when it is in the magnetic field of the strong magnet.

Label the magnetic poles on the magnetised iron block in diagram 2.

(1)

ResultsPlus
Examiner Comments

No mark here as the indication of a south pole on the iron block is not present. Anywhere below the halfway line would have been acceptable for the S at the bottom.

Question 2(b)ii

Recognising that iron is a magnetic material was insufficient for this item as it doesn't answer the question.

To score well here, candidates not only needed to show that they knew the term 'soft' (in a magnetic context) but also what that means.

(ii) A student takes the strong magnet away from the iron block.

The student suggests they can permanently use the iron block to attract small pieces of iron.

Explain whether the student's suggestion is correct.

(2)

Iron is magnetic which can attract the magnetic material.

ResultsPlus
Examiner Comments

Nothing here for stating that iron is a magnetic material.

(ii) A student takes the strong magnet away from the iron block.

The student suggests they can permanently use the iron block to attract small pieces of iron.

Explain whether the student's suggestion is correct.

(2)

~~Yes this is correct that Iron can be permanently converting into~~ No, Iron cannot be converted into a permanent ~~magnetic~~ magnetic material as it is soft ~~[illegible] magnetic mate~~ material.

ResultsPlus
Examiner Comments

The use of the term 'soft' here was taken to mean "soft" in the magnetic sense, so 1 mark here.

(ii) A student takes the strong magnet away from the iron block.

The student suggests they can permanently use the iron block to attract small pieces of iron.

Explain whether the student's suggestion is correct.

(2)

The student cannot use it ~~as~~ permenantly as iron is a magnetically soft material and loses it's ~~magnetism~~ magnetism once the strong magnet is taken away and the iron comes out of the magnetic field of the strong magnet. Therefore, it can't be use to attract small pieces of iron once the strong magnet has been taken away.

(Total for Question 2 = 7 marks)

ResultsPlus
Examiner Comments

An excellently crafted answer here for both marks.

ResultsPlus
Examiner Tip

Think carefully about being more concise, yet concise enough to score all available marks.

Question 3(a)

Current indicators are any device that will signify, visibly, the presence of a current, either by light or by some numerical signal.

In our specification, this gives an LED, a filament lamp and an ammeter as reasonable alternatives.

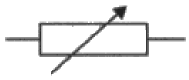
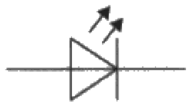
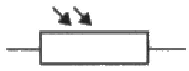
Candidates were penalised if they gave more options than the three expected ones.

3 This question is about electrical circuits.

(a) The table shows the circuit symbols for some electrical components.

Complete the table by placing ticks (✓) to show whether each component can visibly indicate the presence of a current in a circuit.

(3)

Electrical component	Can visibly indicate the presence of a current
	~~Insulator~~ ✓
	✓
	~~LED~~
	~~Conductor~~ ✓
	
	~~Ammeter~~ ✓

ResultsPlus
Examiner Comments

This candidate started off by naming the components, rather than answering the question that was asked. They have re-read the question and carefully crossed out their unwanted answer. In the end, they have selected two of the correct answers however also ticked two incorrect answers. Neither the variable resistor nor the thermistor can visibly indicate the presence of a current. Since there was a maximum of three answers, one of the incorrect answers has attracted a 1 mark penalty to give an overall score of 1 mark.

ResultsPlus
Examiner Tip

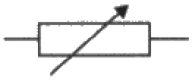
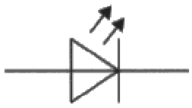
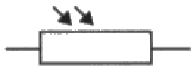
Make any amendments to your answers as clear as possible. Read the question carefully so that you know what is being asked. Consider how many marks are available and think about how many ideas are required.

3 This question is about electrical circuits.

(a) The table shows the circuit symbols for some electrical components.

Complete the table by placing ticks (✓) to show whether each component can visibly indicate the presence of a current in a circuit.

(3)

Electrical component	Can visibly indicate the presence of a current
	
	✓
	✓
	
	
	✓

ResultsPlus
Examiner Comments

All correct here. The candidate has considered the variable resistor but rejected it, crossing their original tick out carefully.

Question 3(b)i

The only acceptable response here was 'thermistor'.

Question 3(b)ii-iv

In (ii) almost all candidates read the resistance of the thermistor at the appropriate point.

In (iii) a small number of candidates either used the 50 degrees in the formula or rearranged the formula incorrectly.

In (iv) some candidates knew the formula for adding up resistors in series, even though it is not on the specification. This is why this marking point cannot be in the left-hand column of the mark scheme and can only be alternative to a marking point.

That said, a large proportion of candidates expressed some of the right ideas. There is still a misconception that 'series circuits have the same current' ie that the current of a circuit doesn’t change if you change the circuit. This is not true.

The factor that controls the current in a circuit, for a given voltage from a battery, for example, is the **total** resistance in a circuit.

(ii) Using the graph, determine the resistance of component X when its temperature is 50 °C.

(1)

resistance = 80 Ω

(iii) The cell in diagram 1 has a voltage of 9.0 V.

Calculate the current in component X when its temperature is 50 °C.

Use the formula

voltage = current × resistance

(3)

✓

$\frac{V}{I} = I \quad I \quad R \quad \frac{9.0}{50} = 0.18$

current = 0.18 A

(iv) The circuit in diagram 1 is modified by adding a second identical component X in series with the other components.

The temperatures of the first component X and second component X are reduced to 26 °C.

Explain how the resistance of the circuit is affected by these changes.

(4)

The resistance ~~de~~ increases as the temperature ~~in~~ decreases. The resistance is shared equally in a series circuit, and therefore all the resistance will be equal in the components

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Examiner Comments

(ii) – all fine here.

(iii) – the candidate has rearranged the formula correctly but unfortunately used the temperature rather than the resistance from part (ii). 1 mark only.

(iv) – "The resistance increases as the temperature decreases" is not specific enough to the thermistor or the circuit. The rest of the response is not creditworthy.

ResultsPlus
Examiner Tip

Always qualify simple statements when talking about electrical circuits. Refer to individual components or the circuit overall, especially when discussing resistance.

(ii) Using the graph, determine the resistance of component X when its temperature is 50 °C.

(1)

resistance = 80 Ω

(iii) The cell in diagram 1 has a voltage of 9.0 V.

Calculate the current in component X when its temperature is 50 °C.

Use the formula

voltage = current × resistance

(3)

$9V = I \times 80\Omega$

$I = 720$

current = 720 A

(iv) The circuit in diagram 1 is modified by adding a second identical component X in series with the other components.

* The temperatures of the first component X and second component X are reduced to 26 °C.

Explain how the resistance of the circuit is affected by these changes.

(4)

if the temperature is reduced the resistance will increase in the circuit meaning that less current will be flowing through especially if their are now two resistors in the circuit the current will greatly decrease causing the resistance to increase all across this shows temp & resistance inversely proportional relationship

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Examiner Comments

(ii) – all good.

(iii) – the substitution here is correct however the rearrangement and hence the evaluation is incorrect. 1 mark.

(iv) – here there's a qualified statement about which resistance is increasing due to a drop in temperature. The idea of two resistor in series having more resistance is present. 2 marks.

(ii) Using the graph, determine the resistance of component X when its temperature is 50 °C.

(1)

resistance = 80 Ω

(iii) The cell in diagram 1 has a voltage of 9.0 V.

Calculate the current in component X when its temperature is 50 °C.

Use the formula

voltage = current × resistance

(3)

$$\text{current} = \frac{\text{voltage}}{\text{resistance}} = \frac{9.0\,V}{80\,\Omega} = 0.1125\ A$$

$$\approx 0.11\ A$$

current = 0.11 A

(iv) The circuit in diagram 1 is modified by adding a second identical component X in series with the other components.

The temperatures of the first component X and second component X are reduced to 26 °C.

Explain how the resistance of the circuit is affected by these changes.

(4)

when temperature of the thermistor decreases to 26°C, its resistance is 160 Ω, from the graph double from the original ~~an~~ temp of 50°C. because the two thermistors are connected in ~~parallel~~ series, then $R_T = R_1 + R_2$. as a result, there will be double the amount of resistors with double amount of resistance meaning the resistance of the circuit is 4 times higher by these changes.

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Examiner Comments

An excellent answer here: items (ii) and (iii) are very clear and correct. Item (iv) is also very clear. The candidate has discussed the new resistance of the thermistor specifically and discussed the effects of resistors being in series. This has enabled them to discuss the total resistance quantitatively. It should be noted that R T = R 1 + R 2 for series circuits is not on the specification, although as stated, many candidates appear to know it.

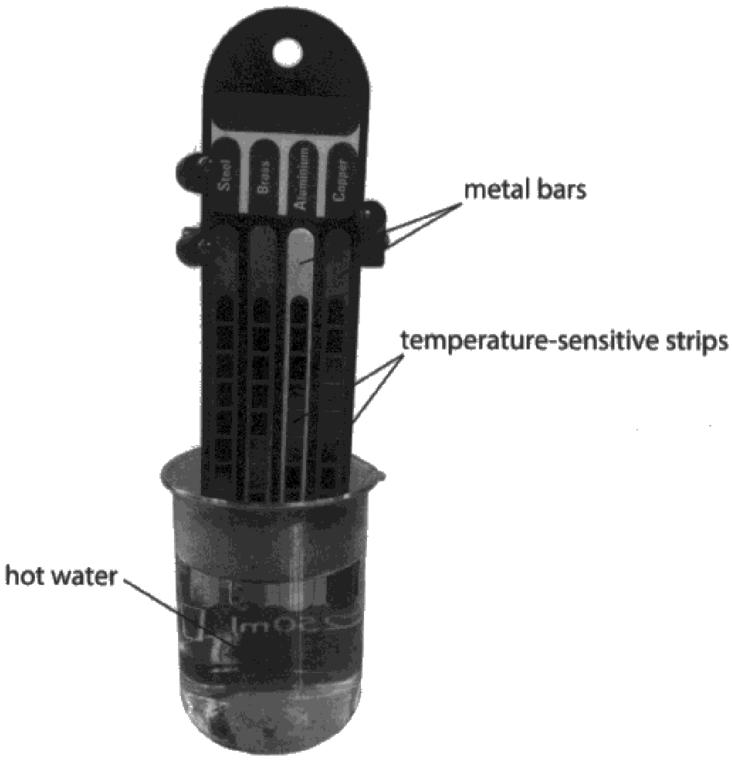
Question 4(a)i

The mark scheme includes a wide variety of variables that could reasonably be accepted as control variables for this investigation.

Factors which might be considered trivially true were not accepted. Examples of this were 'same beaker', 'same temperature sensitive strips' and so on.

4 A student does an experiment to investigate energy transfer by conduction.

(a) The student plans to use the piece of apparatus shown in the photograph.



The apparatus has four bars made from different metals.

When the apparatus is placed in hot water, energy is transferred from the bottom of the bar to the top of the bar. The temperature-sensitive strip on each bar changes colour as the temperature of the bar changes.

The time taken for the colour change to reach the top of the bar can be used to compare how effective each metal is at transferring energy by conduction.

(i) Give three control variables in the student's investigation.

(3)

1 bars are same length and thickness each time the practical is repeated

2 tempreature and volume of water each time the practical is repeated

3 Same beaker volume and material, similar external tempreature if possible.

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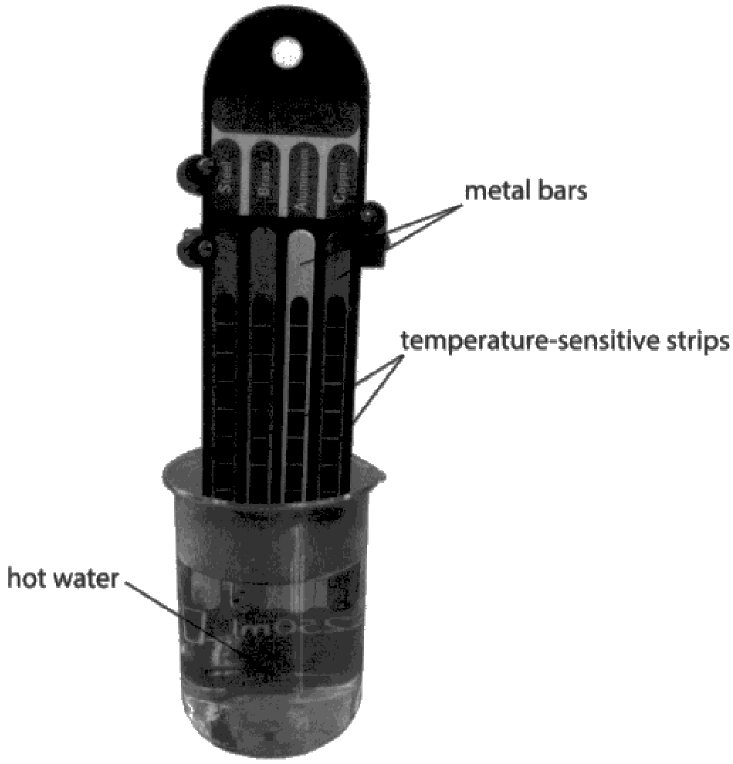
Examiner Comments

This candidate scored the marks for mentioning length, thickness and the idea of the same temperature of water. The other factors were ignored.

4 A student does an experiment to investigate energy transfer by conduction.

(a) The student plans to use the piece of apparatus shown in the photograph.



The apparatus has four bars made from different metals.

When the apparatus is placed in hot water, energy is transferred from the bottom of the bar to the top of the bar. The temperature-sensitive strip on each bar changes colour as the temperature of the bar changes.

The time taken for the colour change to reach the top of the bar can be used to compare how effective each metal is at transferring energy by conduction.

(i) Give three control variables in the student's investigation.

(3)

1 ~~Temperature of water~~ volume of water.

2 How deep the apparatus is inside the beaker ensuring the bottom of each metal strip is at the same height.

3 Starting temperature for each metal strip

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Examiner Comments

This candidate has mentioned a different factor 'that the bars should go in the same depth' and that the temperature should be the same. Volume of water was not deemed creditworthy.

Question 4(a)ii

Most candidates gave an excellent description of an appropriate method, even though they may never have seen the apparatus shown in the diagram.

Successful candidates did not merely repeat the apparatus list yet were very clear about what they were going to measure and how they would achieve that. Candidates scored maximum marks often by being explicit about when they would start timing, when they would stop timing and finally how to maintain a fair test across multiple repeats.

(ii) The student has this equipment.

- beaker
- hot water
- stopclock
- clamp and clamp stand

Design a method the student could use to compare the effectiveness of the metals at transferring energy by conduction.

You may draw a diagram to help your answer.

(5)

-> Place the metal bars with temperature - sensitive strips into the beaker of hot water so the same length is submerged.

-> use a clamp stand to hold the bars in place.

-> Start the stopwatch and record the time taken for the strip to change colour at the top of each bar.

-> Compare the times - the metal with the shortest time is the best conductor.

-> Repeat the experiment and take average.

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Examiner Comments

An excellent, clear response to this question which scored the first five marking points.

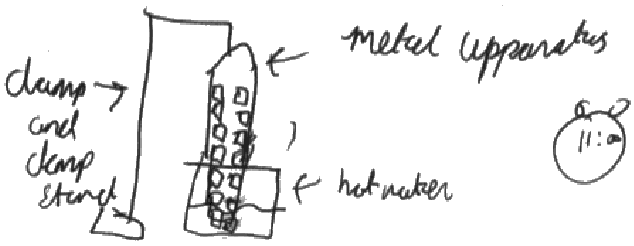
(ii) The student has this equipment.

- beaker
- hot water
- stopclock
- clamp and clamp stand

Design a method the student could use to compare the effectiveness of the metals at transferring energy by conduction.

You may draw a diagram to help your answer.

(5)



First ~~sto~~ the student can clamp the metal apparatus to the clamp stand. Next fill the ~~w~~ beaker with hot water and submerge the tips of the apparatus in it. The clamp stand allows all the tips to be at one height leading to a fair investigation. After the student should time using the stop watch how long it takes for each strip to change colour completely and plot a graph to display the results

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Examiner Comments

This candidate has drawn a diagram, which has been helpful and scored the first marking point. The second sentence gets marking point 6 (for the idea of the same depth). The next sentence scores marking point 3. We did not think there was sufficient evidence for marking points 2, 4 or 5.

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Examiner Tip

Keep responses concise. For this type of question, think carefully about how you would tell a younger student how to complete the investigation.

Question 4(b)i

Most candidates produced excellent bar charts that were appropriately scaled, labelled and plotted correctly.

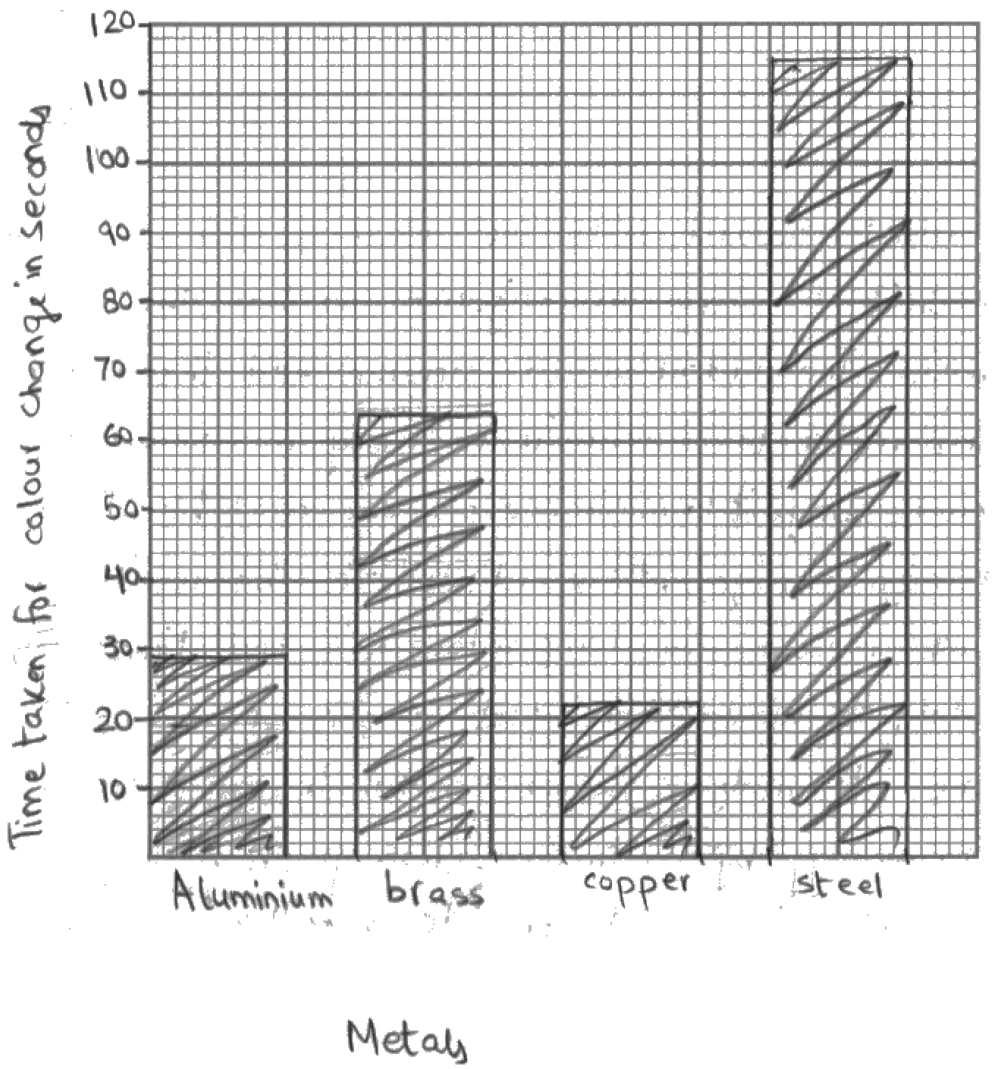
There were a minority of candidates that either misplotted at least one bar or forgot the unit for the time axis.

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

Metal	Time taken for colour change in seconds
aluminium	29
brass	64
copper	22
steel	115

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

(3)



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Examiner Comments

This is an excellent bar chart. Both axes are labelled, with a correct unit where appropriate. All of the bars are the correct size according to the scale.

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Examiner Tip

Always think of the axes, units and an appropriate scale that covers half of the available space. Check your plotting too.

Question 4(b)ii

Nearly all candidates arrived at a valid conclusion with an accompanying logical reason.

Some candidates did not make clear their reasoning, by not using a suitable comparative (shorter time) or ideally a superlative (shortest time).

(ii) Deduce which metal is the most effective at transferring energy by conduction.

(2)

Metals Bars is most effective at transforing energy by conduction Because, Electrons leave their atom by free electrons. ions are closely packed. ~~condu~~ Metals are good conductors of heat.

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Examiner Comments

This candidate has stated some great physics but has not answered the question. 0 marks.

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Examiner Tip

The exam will not expect you to reproduce physics that is not on the specification. Make sure you know what is on the specification and what is not.

(ii) Deduce which metal is the most effective at transferring energy by conduction.

(2)

Copper is the most effective at transferring energy. as the conduction increases the processes.

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Examiner Comments

A simple answer, for one mark. The candidate has got the right conclusion however has not told us how they came to that conclusion.

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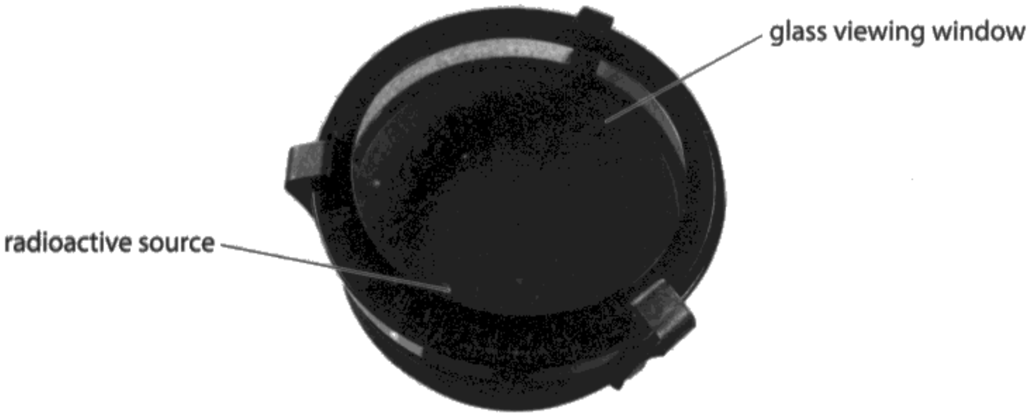
Examiner Tip

Sometimes really short answers are absolutely appropriate. Make sure your reasoning relates to the data you have been given in the question.

Question 5(a)

Candidates did well here. Many attempted to describe the structure by mentioning neutrons and protons. Reference to a helium nucleus was insufficient to do this.

5 The photograph shows a cloud chamber, used to observe alpha radiation produced by a radioactive source. The radioactive source is inside the cloud chamber, as shown in the photograph.



(a) Describe the structure of an alpha particle.

(2)

An alpha particle consists of two neutrons and two protons. It has a charge of +2 and is essentially a helium nucleas.

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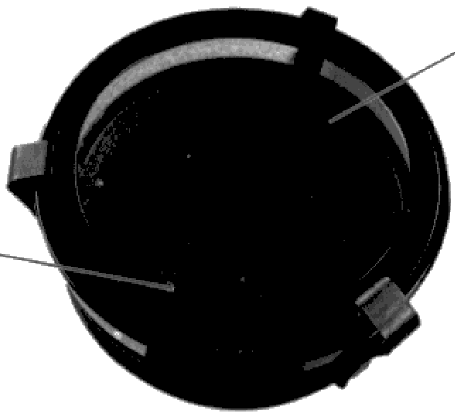
Examiner Comments

The candidate has scored both marks in the first sentence. The second sentence adds nothing and doesn't describe the structure of the alpha, although it does describe a property.

5 The photograph shows a cloud chamber, used to observe alpha radiation produced by a radioactive source. The radioactive source is inside the cloud chamber, as shown in the photograph.



(a) Describe the structure of an alpha particle.

(2)

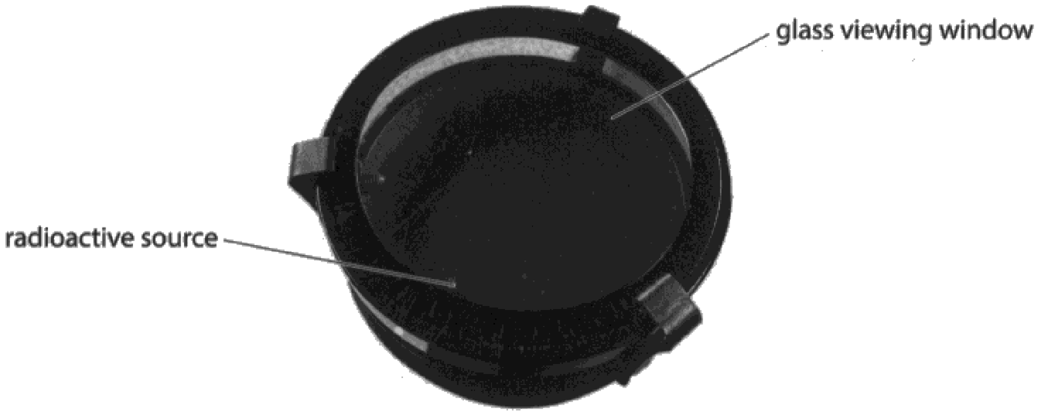
It has two protons and 4 neutrons

![ResultsPlus Examiner Comments]

ResultsPlus
Examiner Comments

An unfortunate slip here. The candidate has muddled the two numbers indicative of the alpha particle as a symbol.

5 The photograph shows a cloud chamber, used to observe alpha radiation produced by a radioactive source. The radioactive source is inside the cloud chamber, as shown in the photograph.



(a) Describe the structure of an alpha particle.

(2)

Alpha particle has mass number of 4 and atomic number of ~~two~~ 2.

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Examiner Comments

Again, the candidate has described two of the properties just not the structure of the alpha particle.

Question 5(b)

While some candidates guessed at this item, most candidates appreciated that the alpha particle needed to have 4 at the top and 2 at the bottom. The final check was that the upper numbers and the lower numbers balanced on either side of the equation.

(b) The source used in the cloud chamber contains the isotope radium-226.

The incomplete nuclear equation shows the decay of radium-226 into an isotope of radon.

Complete the nuclear equation by writing the correct numbers in the boxes.

(3)

$$^{226}_{88}\mathrm{Ra} \rightarrow\ ^{\boxed{222}}_{86}\mathrm{Rn} +\ ^{\boxed{4}}_{\boxed{2}}\alpha$$

ResultsPlus
Examiner Comments

The correct answer in full. The candidate has remembered the 4-2 nature of the alpha and correctly subtracted 4 from the 226 on the left-hand side of the equation to arrive at 222.

(b) The source used in the cloud chamber contains the isotope radium-226.

The incomplete nuclear equation shows the decay of radium-226 into an isotope of radon.

Complete the nuclear equation by writing the correct numbers in the boxes.

(3)

$$^{226}_{88}\mathrm{Ra} \rightarrow {}^{\boxed{140}}_{86}\mathrm{Rn} + {}^{\boxed{86}}_{\boxed{2}}\alpha$$

ResultsPlus
Examiner Comments

The proton number for the alpha is correct. The 86 for the alpha is clearly wrong, however the candidate has balanced the equation by subtracting 86 from 226 arriving at 140. This gained the third marking point 'error carried forward'.

Question 5(c)

At this point in the paper, candidates should be using more appropriate technical language. In this case, they should mention about penetration power or the ability of the alpha particles to be absorbed by the glass or the skin.

(c) The tracks in the cloud chamber can be seen through the glass viewing window.

Explain why the radioactive source is not a hazard to the person viewing the cloud chamber.

(2)

because alpha radiation has a low penetration power meaning the person behind the glass will not be affected by it as alpha can only pass through thin objects such as a sheet of paper

ResultsPlus
Examiner Comments

Just one mark here for being precise about the alpha having low penetration power. The rest of the response effectively repeats the question or reinforces the point already scored.

(c) The tracks in the cloud chamber can be seen through the glass viewing window.

Explain why the radioactive source is not a hazard to the person viewing the cloud chamber.

(2)

As alpha has a low penetration power so it cannot pass through the glass & will not irradiate the person.

ResultsPlus
Examiner Comments

This candidate has gone one step further than the previous candidate in explaining that the alpha cannot pass through the glass.

Question 5(d)

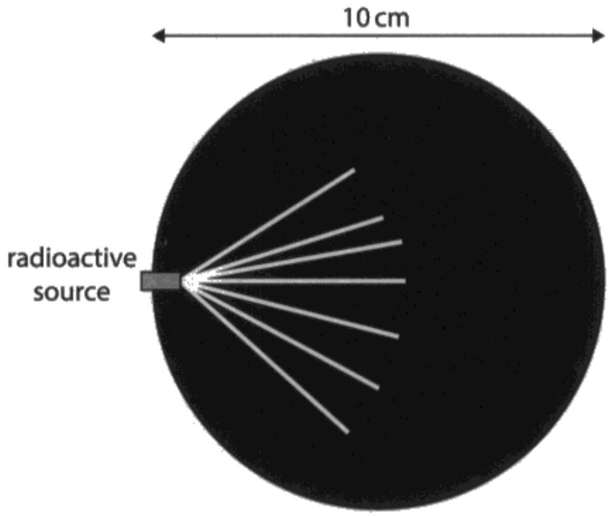
Most successful candidates mentioned that the tracks were short or gave a value for the track length. Many of those went on to infer what that meant about the penetration or ionising power of the alphas.

Very few candidates picked up that the tracks were all the same length and that this meant that all of the alphas have the same kinetic energy.

(d) When radiation is emitted from the source a white line is produced in the cloud chamber. The white line is known as a track.

The diagram shows the tracks produced by the radiation from the source.

The diameter of the cloud chamber is also shown.



Explain the properties of alpha radiation that can be deduced from the length of the tracks.

(3)

The length of tracks is short, because α radiation has the weak penetrating power, which means it can't cross the cloud chamber and all of them will be absorbed by this chamber.

ResultsPlus
Examiner Comments

This candidate has scored 2 marks for mentioning that the length of the tracks are short, which implies weak penetrating power. Any reference at all to the tracks being the same length would have scored the first marking point on the mark scheme.

Question 6(a)-(b)

Many candidates spotted that calculating the change of velocity was straightforward ie multiplying the acceleration by the time taken.

Following on from that, using that acceleration and this 'final' velocity was key to using the given formula linking final speed, initial speed, acceleration and distance travelled.

A small number of candidates drew the velocity-time graph in part (c) and worked out that the distance travelled = 0.5 x final velocity x time taken, to get to the same mathematically consistent answer.

The table gives some information about the motion of the rocket during the first 5.0 seconds of its launch.

Initial velocity	0.0 m/s
Acceleration	13 m/s^2
Time taken	5.0 s

(a) Calculate the final velocity of the rocket after 5.0 seconds.

Assume that the acceleration remains constant during this time.

(3)

$\cancel{v = \sqrt{u^2 + 2as}}$

$\cancel{= \sqrt{0^2 + (2 \times 13 \times 5)}}$

$\cancel{= \sqrt{130}}$

$\cancel{= 11.40}$

$a = \frac{(v-u)}{t}$

$v = u + at$

$0 + (13 \times 5)$

$v = 65$

final velocity = $\cancel{11.40}$ 65 m/s

(b) Calculate the distance the rocket travels during the 5.0 seconds.

Assume that the acceleration remains constant during this time.

(3)

$v^2 = u^2 + 2as$

$s = \frac{v^2 - u^2}{2a}$

$= \frac{65^2 - 0^2}{2 \times 13} = 162.5$

distance travelled = 162.5 m

ResultsPlus
Examiner Comments

This candidate's answer is clear and concise. They have thought about which equation to use and where each piece of data should go.

ResultsPlus
Examiner Tip

Notice that they have crossed out some work lightly so that it is still readable. This is also sensible – they may well have come back to this item after having had a think. If they did not replace their crossed out work, markers would check what they had previously written, even though it was crossed out.

Question 6(c)

Almost all candidates realised that the rocket started from rest and got faster, so that both graphs would start at (0,0) and then increase.

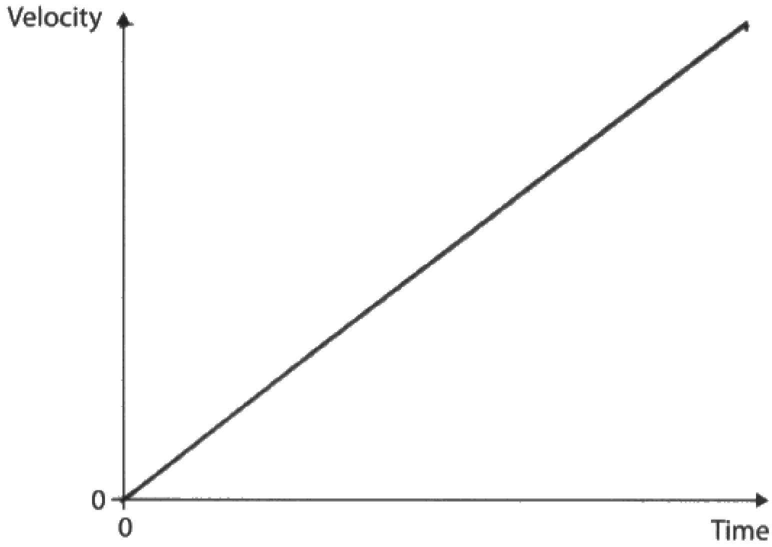
A large fraction of candidates forgot that air resistance was not a factor and so curved their velocity-time graphs unnecessarily. The question also mentioned that the acceleration was constant, which was a further reminder that this line should be straight.

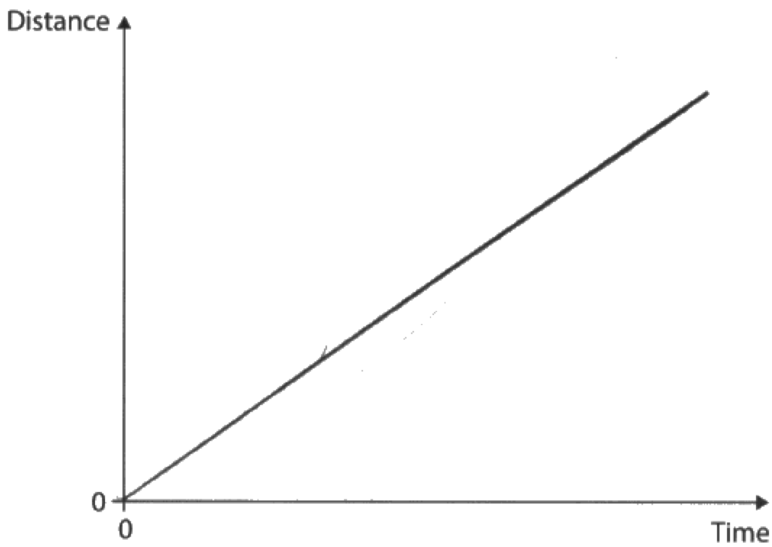
Far fewer candidates got the shape of the distance-time graph correct. This was a subtle item, requiring the knowledge that the gradient of a distance-time graph gives the velocity. As the rocket is getting faster, then the gradient must be getting steeper.

(c) Sketch a velocity-time graph and a distance-time graph showing how the motion of the rocket changes during the first 5.0 seconds of its launch.

You do not need to include values on the axes.

(4)





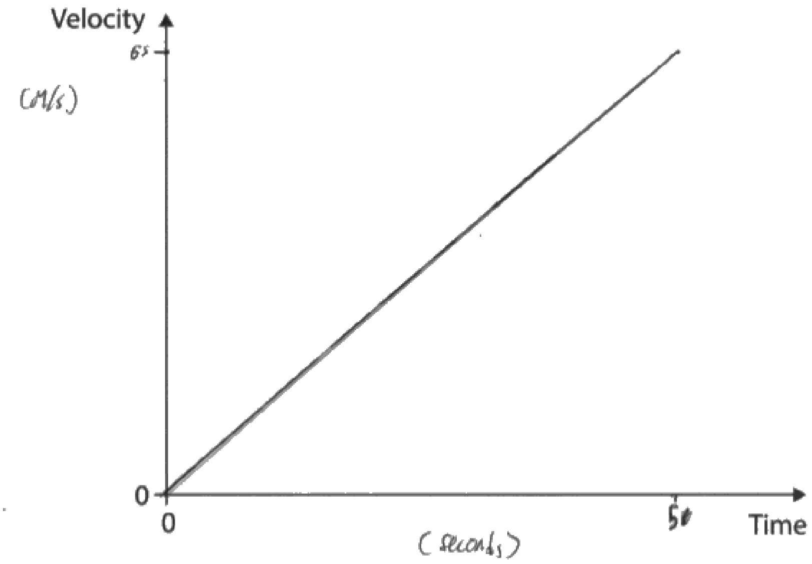
ResultsPlus
Examiner Comments

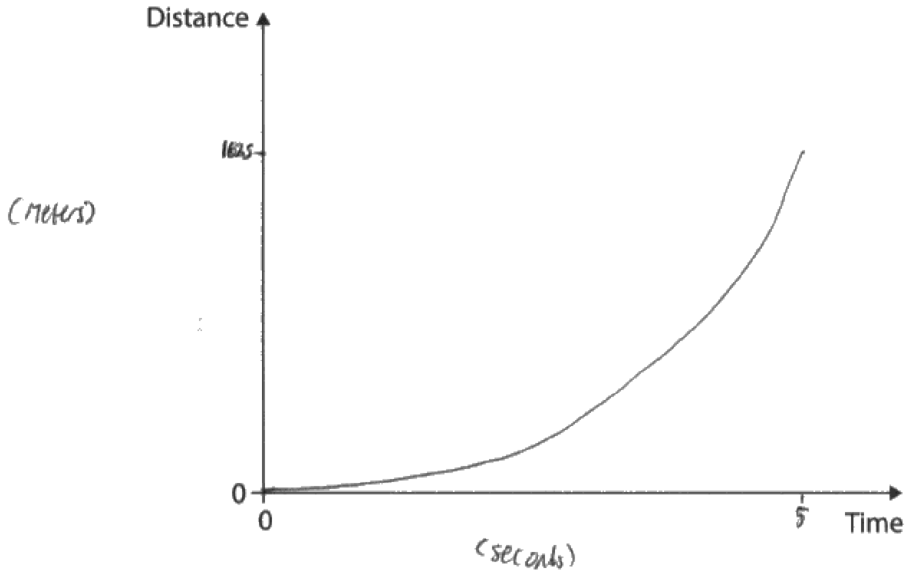
The first graph is correct. The second cannot be correct as it has constant velocity (which does not match the first graph).

(c) Sketch a velocity-time graph and a distance-time graph showing how the motion of the rocket changes during the first 5.0 seconds of its launch.

You do not need to include values on the axes.

(4)





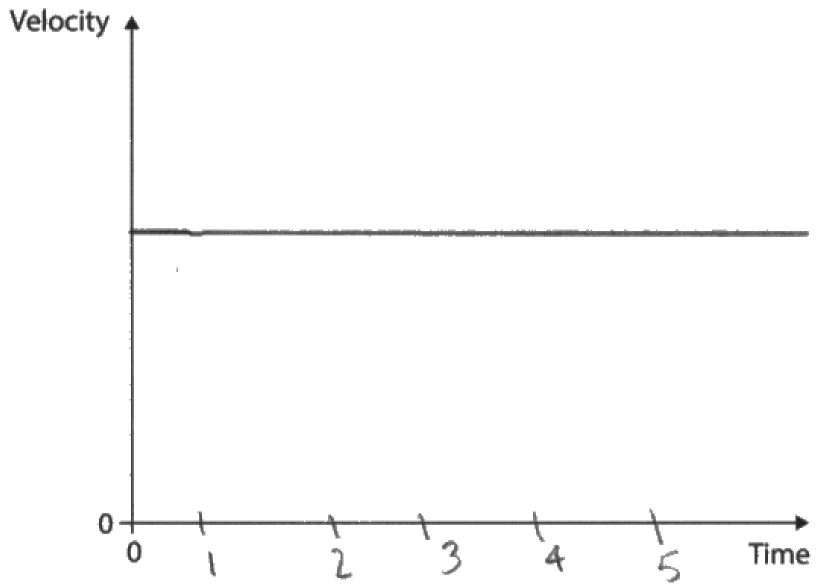
ResultsPlus
Examiner Comments

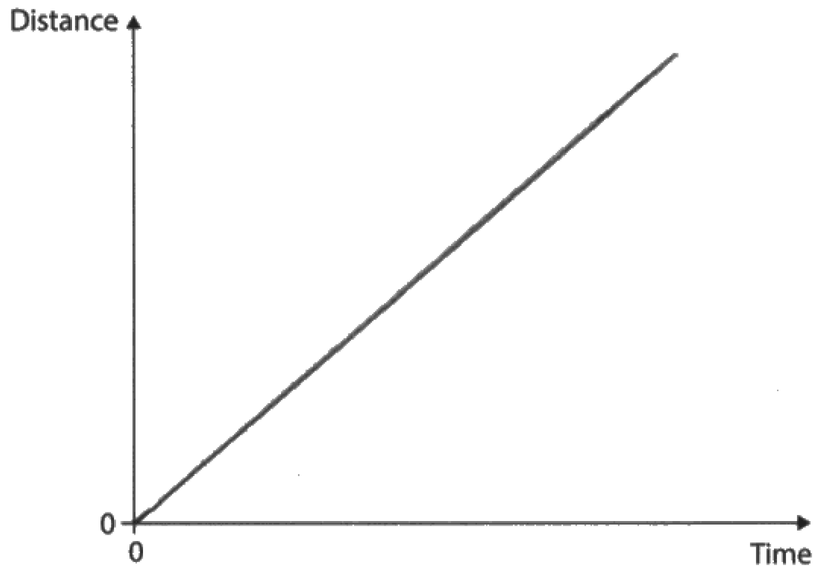
Both graphs here are fully acceptable. Note the addition of units, which may well have helped the candidate to decide what to draw.

(c) Sketch a velocity-time graph and a distance-time graph showing how the motion of the rocket changes during the first 5.0 seconds of its launch.

You do not need to include values on the axes.

(4)





ResultsPlus
Examiner Comments

Two marks here. One for the first graph for producing a straight line. One for the second for a line that starts at the origin and has positive gradient throughout. This candidate has confused acceleration for velocity in the first graph and velocity for distance in the second.

ResultsPlus
Examiner Tip

Check what you have drawn by trying to describe the motion your graph is telling you and seeing whether that matches the motion described in the question.

Question 7(a)

Many candidates have become well-practised at answering questions about definitions of transverse and longitudinal waves.

In this case, only knowledge of transverse waves is required. Some candidates drew diagrams without annotations or with incomplete annotations.

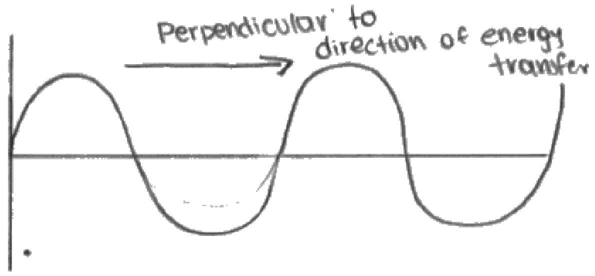
7 This question is about light.

(a) Light is an example of a transverse wave.

Describe a transverse wave.

You may draw a diagram to help your answer.

(2)



The particles in a transverse waves oscillate perpendicular to direction of energy transfer

ResultsPlus
Examiner Comments

The diagram does not make the candidate's answer any clearer. On that diagram they have not shown anything to do with the oscillation of any particles or the medium. The sentence on the answer line is absolutely perfect, however, so both marks were awarded.

7 This question is about light.

(a) Light is an example of a transverse wave.

Describe a transverse wave.

You may draw a diagram to help your answer.

(2)

(or) travel

particles in medium move perpendicular to the direction of energy transfer.

ResultsPlus
Examiner Comments

This response does not mention oscillations at all, so cannot score the first mark. The candidate has mentioned the idea of 'perpendicular to the direction of energy transfer' however so has gained the second mark of the two available.

Question 7(b)i

While some candidates drew a ray that refracted out of the fibre, most drew a ray that indeed reflected. There was a generous tolerance on the relative sizes of the angles of incidence and reflection. Most candidates, however, measured the angle of incidence and produced an angle of reflection that matched.

(b) Diagram 1 shows a ray of light in a section of optical fibre.

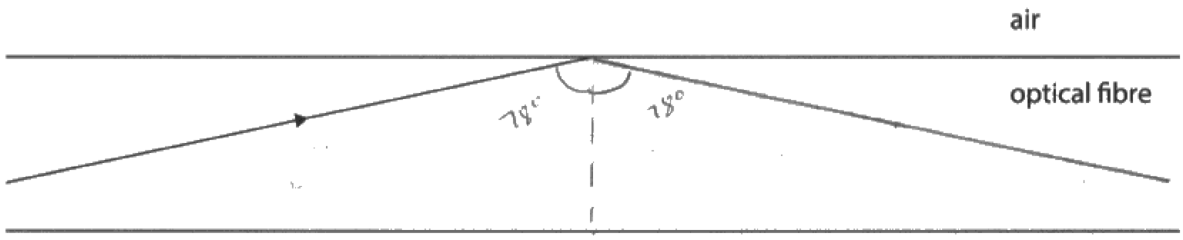


Diagram 1

(i) The ray of light is incident at the boundary between the optical fibre and air.

The ray of light reflects at the boundary.

Complete diagram 1 by drawing the reflected ray of light.

(2)

ResultsPlus
Examiner Comments

This candidate scored two marks with ease. They have measured and labelled the angle of incidence and taken care to make sure that the angle of reflection matched the angle of incidence.

ResultsPlus
Examiner Tip

Always draw in a normal for light diagrams.

(b) Diagram 1 shows a ray of light in a section of optical fibre.

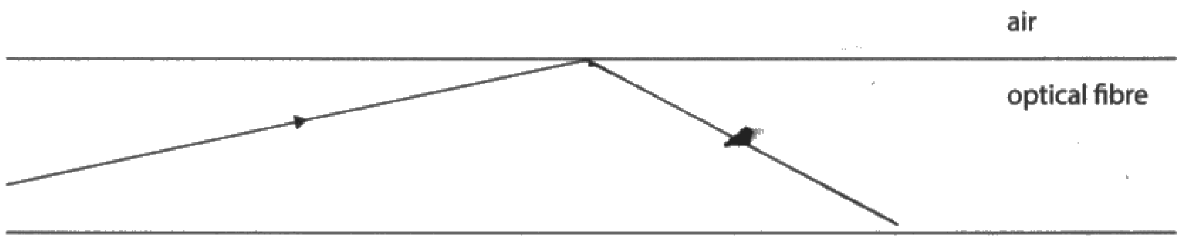


Diagram 1

(i) The ray of light is incident at the boundary between the optical fibre and air.

The ray of light reflects at the boundary.

Complete diagram 1 by drawing the reflected ray of light.

(2)

ResultsPlus
Examiner Comments

While there is definitely a reflected ray here, it is clearly in the wrong direction. 1 mark.

ResultsPlus
Examiner Tip

Remember that the law of reflection states that the angle of reflection = angle of incidence.

Question 7(b)ii

Candidates that did well on this item noticed that there were three marks available and so there were three different ideas to convey. There is no credit for repeating the question 'no light leaves...' however naming the phenomenon, ie Total Internal Reflection, was a good start for many.

The other two ideas are as important as each other, namely that the light is travelling from glass to air (and so there's a reduction in refractive index for the light, potentially) and that the angle of incidence is larger than the critical angle.

(ii) Explain why no light leaves the optical fibre when the light reflects at the boundary between the optical fibre and air.

(3)

No light leaves the ~~optitter~~ optical fibre because the optical fibre is significantly more dense ~~the~~ then air therefore stopping light from leaving to air.

ResultsPlus
Examiner Comments

Only one mark here, for the idea that the optical fibre is more dense than the air.

(ii) Explain why no light leaves the optical fibre when the light reflects at the boundary between the optical fibre and air.

(3)

Because the light is total internally reflected, as the incidence angle is bigger than the critical angle of the optic fibre. Therefore, all the light is reflected back.

ResultsPlus
Examiner Comments

It was common for candidates to mention Total Internal Reflection and that the angle of incidence was greater than the critical angle. The third idea, mentioned in the previous example, was the most common omission.

(ii) **Explain why no light leaves the optical fibre when the light reflects at the boundary between the optical fibre and air.**

(3)

Total internal reflection occurs because the light ~~ray~~ is travelling from a medium of higher refractive index to a ~~reg~~ medium of lower refractive index. And the ~~critical~~ angle of incidence is larger than the critical angle.

ResultsPlus
Examiner Comments

Here we have a very clear response that mentions all three of the required ideas.

Question 7(c)

This item is a 'show that' question – candidates should show their working and be clear about how they've arrived at their final evaluation.

This evaluation should be to more significant figures than the value quoted in the question; in this case, 3 significant figures.

Many candidates scored the first mark by annotating the diagram with the correct angle of incidence of 50 degrees.

The most straightforward way of completing this item is to use the formula linking critical angle and refractive index, although it isn't the only method.

Many candidates attempted using the formula linking angle of incidence, angle of refraction and refractive index. This is possible, although a significant fraction of those that did, made some error of physics even though they arrived at a refractive index of 1.305.

(c) Diagram 2 shows a different ray of light, incident on the boundary between water and air.

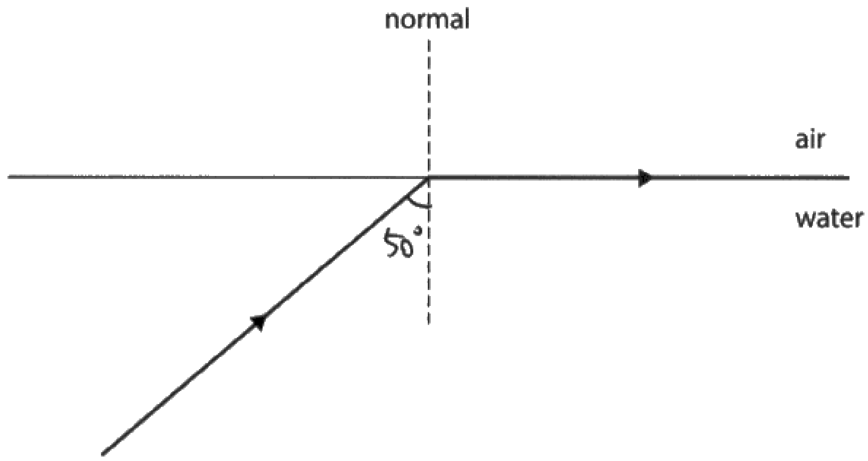


Diagram 2

Using diagram 2, show that the refractive index of water is approximately 1.3

(4)

$\sin C = \frac{1}{n}$

$\sin 50° = \frac{1}{n}$

$n = 1.305$

ResultsPlus Examiner Comments

This response has scored all four marks very simply – the candidate has labelled the angle of incidence and then substituted into the most appropriate formula. The working is clear and sufficient.

(c) Diagram 2 shows a different ray of light, incident on the boundary between water and air.

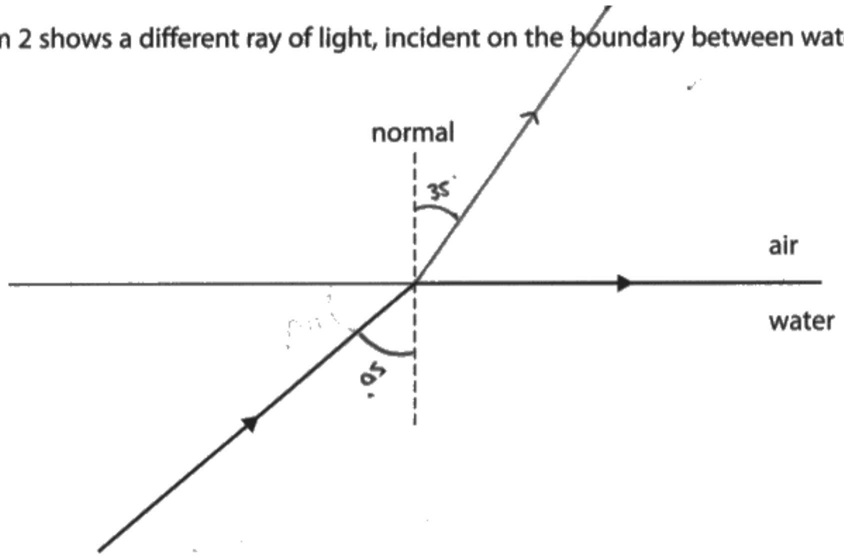


Diagram 2

Using diagram 2, show that the refractive index of water is approximately 1.3

(4)

$$n = \frac{\sin(i)}{\sin(r)}$$

$$\frac{\sin(50)}{\sin(35)} = 1.33557\ldots$$

$$= 1.3$$

ResultsPlus
Examiner Comments

This candidate, like a large number of others, ignored that the refracted ray lay along the boundary between the water and the air. They have constructed a refracted ray which has bent towards the normal, which is unphysical – the ray should bend away from the normal anyway going from glass to air. This meant that their working was wrong physics and so could not have scored. The candidate has scored the mark for showing evidence that they have measured the angle of incidence correctly.

Question 8(a)

Almost all candidates could name the Milky Way as the home galaxy of our Solar System.

Question 8(b)i

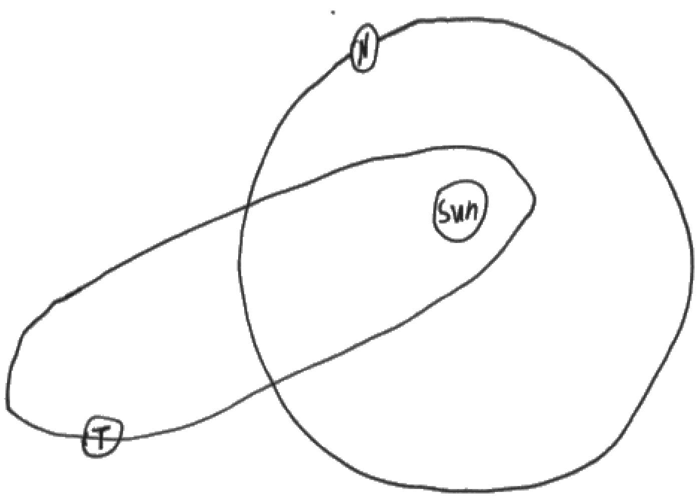
Many candidates correctly demonstrated their knowledge of which object orbits which in our Solar System. As long as their response was clear in showing that Neptune orbits the Sun and Triton orbits Neptune, then the response was accepted.

(b) Neptune is a planet in the Solar System.

(i) Triton is a moon that orbits the planet, Neptune.

Draw a diagram to show the orbit of Neptune and the orbit of Triton in the Solar System.

(2)



ResultsPlus
Examiner Comments

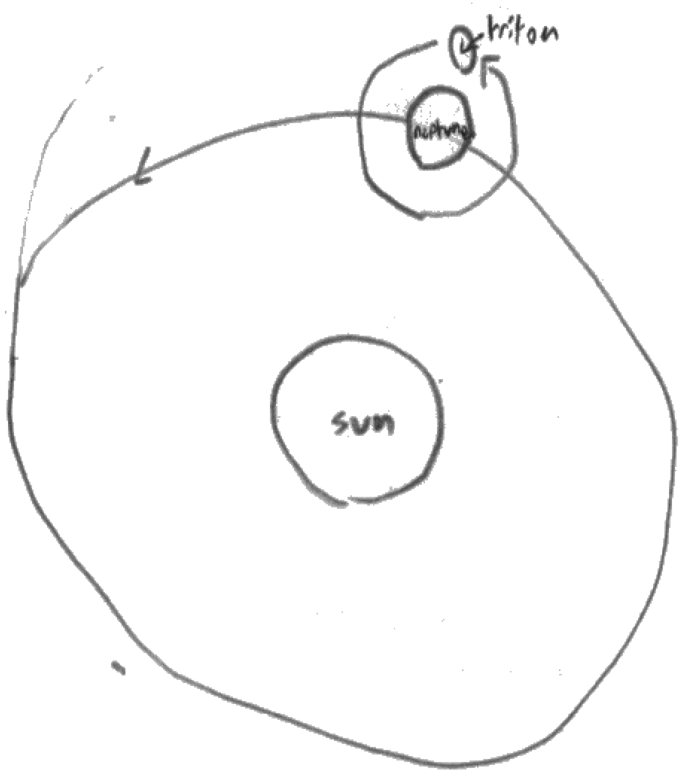
This candidate scored a mark for indicating that Neptune (N) orbits the Sun. Although Triton technically orbits the Sun (essentially by virtue of it orbiting Neptune), Triton's (T) orbit does not look like this. The candidate has guessed that Triton is a comet, or has guessed that the question requires the orbit of a comet.

(b) Neptune is a planet in the Solar System.

(i) Triton is a moon that orbits the planet, Neptune.

Draw a diagram to show the orbit of Neptune and the orbit of Triton in the Solar System.

(2)



ResultsPlus
Examiner Comments

This diagram expresses clearly enough that the candidate knows that Triton orbits Neptune and that Neptune orbits the Sun.

Question 8(b)ii

Another "show that" question. As there were two planets involved, it was important for candidates to be clear about which planet's data they were using and what they were trying to evaluate.

Many candidates correctly calculated the orbital period of Neptune. A significantly large fraction successfully demonstrated where the ratio of 2:3 came from.

Less successful candidates were unclear, used the wrong data or could not produce a convincing 'middle step' to demonstrate the 2:3 ratio.

(ii) Neptune orbits in the Solar System at an orbital speed of 5.4×10^3 m/s with an orbital radius of 4.5×10^{12} m.

Pluto is another object in the Solar System. Pluto orbits with a time period of 7.8×10^9 s.

Show that the ratio of the orbital time period of Neptune to the orbital time period of Pluto is 2 : 3

(4)

$$\text{orbital speed} = \frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$$

Neptune

$$5.4 \times 10^3 = \frac{2 \times \pi \times (4.5 \times 10^{12})}{\text{time}}$$

$$\text{time} = \frac{2\pi \times (4.5 \times 10^{12})}{5.4 \times 10^3}$$

orbital time = 5235987756

or 5.2×10^4

Pluto's orbital time = 7.8×10^9

Ratio

Neptune : Pluto

5.2×10^9 : 7.8×10^9

2 : 3

$$\left(\frac{7.8 \times 10^9}{3}\right) \times 2 = 5.2 \times 10^9$$

ResultsPlus
Examiner Comments

All four marks awarded here. The candidate could not have been clearer regarding each of the calculations they have completed. Notice the words at each stage rather than a field of numbers. There is no doubt what they are trying to communicate.

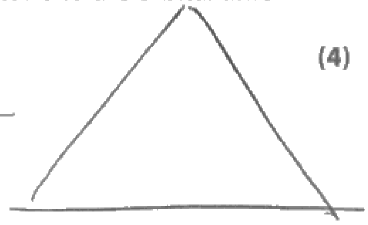
(ii) Neptune orbits in the Solar System at an orbital speed of 5.4×10^3 m/s with an orbital radius of 4.5×10^{12} m.

Pluto is another object in the Solar System. Pluto orbits with a time period of 7.8×10^9 s.

Show that the ratio of the orbital time period of Neptune to the orbital time period of Pluto is 2:3

(4)

orbital speed $= \dfrac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$.



~~Neptune $= 2 \times \pi \times 4.5 \times 10^{12}$~~

Neptune $= 5.4 \times 10^3 = \dfrac{2 \times \pi \times 4.5 \times 10^{12}}{\text{Time period}}$

$\dfrac{2 \times \pi \times 4.5 \times 10^{12}}{5.4 \times 10^3}$ = Time period $\quad \dfrac{2 \times \pi \times 4.5 \times 10^{12}}{}$

$= 5235987756$ $\quad$ = 5400 time period of Neptune

$2:3 = 5$

Pluto $= 7.8 \times 10^9$

(Total for Question 8 = 7 marks)

Neptune = 5235987756.

pluto = 3.12×10^7

Neptune · 3141592654

ResultsPlus
Examiner Comments

This candidate's work was a little less clear than the previous example although it is still clear enough to follow. Unfortunately, there is no attempt to construct a ratio between the orbital periods of Neptune and Pluto, hence the award of three marks.

Question 9(a)ii

Long answer items on the energy topic are challenging. The language used to describe energy stores and energy transfers is concise – there are eight energy stores and only four energy transfers.

This is slightly different to the description more prevalent in centres. The mark scheme has to reflect acceptable answers using either scheme. This is shown in the first three marking points and was relatively accessible to all.

The remaining marking points required some more detailed application of knowledge to how this system was developing in time.

(ii) The spring is released from the position shown in diagram 3.

Describe the energy transfers that take place until the spring stops vibrating.

(6)

As spring is released, elastic potential energy from spring is transfered into kinetic energy of spring and kinetic energy of weight, some of the energy is lost ~~through~~ to thermal energy store of the surrounding through conduction as there is friction with air. Gravitational potential energy of weight increased too. As the spring ~~stopped~~ stopped contracting, weigh of the weight couse the spring to be pulled back down, this couse the ~~weigh of~~ kinetic energy and elastic potential energy (KE of the) of the spring and weight to increase and GPE of the weight decrease. Some of the energy is again lost through conduction into thermal energy of the surrounding. In The process of ~~weight~~ spring vibrations, ~~energy transferred~~ energy are transferred mainly as mechanically. This process repeats until most of the energy is lost into thermal energy of the surrounding and there is no more energy ~~from~~ for movement of spring.

ResultsPlus
Examiner Comments

This description is excellent. The candidate has gone down the path of the alternate energy transfer scheme as described in the 'notes' column in the mark scheme. They have scored the first marking point, the seventh marking point and the eighth marking point in the first sentence. The second sentence, by extension, has got the idea of gravitational potential energy increasing at the same time (marking point two). In line seven of the response, the candidate goes on to mention what happens after the spring and mass have started moving back down again (marking point four). Mechanical energy transfer (marking point five) is mentioned in line thirteen of the candidate’s response.

Question 9(b)ii

Successful candidates made clear the three required ideas here. Firstly, that there was relative motion between the magnet and the coil. Next, they mentioned the idea of the coil cutting field lines. Finally, the end result of that was that a voltage was induced.

Candidates should avoid using non-technical language which has been given in the question. In this case 'generates electricity' would not score any marks, compared with the more technical 'induces a voltage'.

• (ii) Explain how this new type of shock absorber can generate electricity.

(3)

As the magnet slides inside the coil, the coil cuts ~~cuts~~ the magnetic field which induces a voltage & therefore, current

ResultsPlus
Examiner Comments

A wonderfully concise answer that conveys the three required ideas clearly.

(ii) Explain how this new type of shock absorber can generate electricity.

(3)

The coil cuts the uniform magnetic field produced by the permanent magnet. This generates voltage and current, and the voltage generates electricity.

ResultsPlus
Examiner Comments

Only one mark here, for the idea of cutting field lines. The candidate has not used the term 'induction' nor have they related the reason that field lines have been cut ie the idea of relative motion between the coil and the magnet.

(ii) Explain how this new type of shock absorber can generate electricity.

(3)

* as the shock absorbers are used, the coil goes into and out of the magnets, creating an Alternating current (A.C)
* An A.C will then generate electricity as it passes through the complete circuit

ResultsPlus
Examiner Comments

Conversely, this candidate has clearly described the relative motion of the coil and magnet yet has not been specific enough with their technical language to score either of the two remaining marking points. "Generate" is not sufficient for "induce/induction".

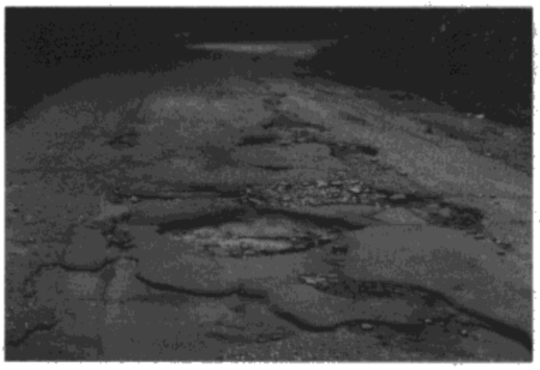
Question 9(b)iii

Most candidates could discuss the relative unevenness of the two road surfaces for the first mark. Many then went on to successfully explain that this would mean a greater current or voltage, or that the voltage would be induced for a longer time in total.

The second marking point was the most challenging for candidates to score, as it required a high degree of precise technical language.

(iii) Road X has a rough surface.

Road Y has a smooth surface.



(Source: © MikhailSh / Shutterstock)

Road X

(Source: © BearFotos / Shutterstock)

Road Y

A motorcycle travels at the same speed along road X and road Y.

Explain why the new type of shock absorber will generate more electricity for this motorcycle on road X than on road Y.

(3)

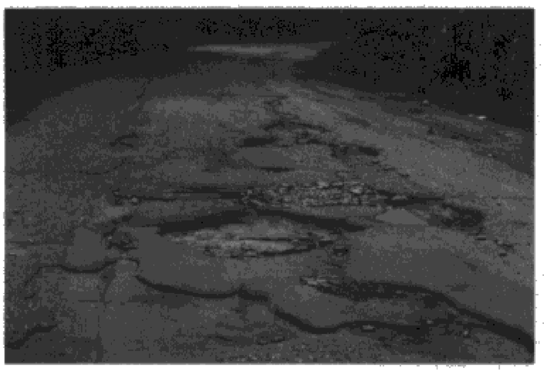
Because more energy is being used on road x as it has got more bumps this means ~~of~~ more energy will be stored so more electricity can be powered compared to road y which is flat defeating the whole purpose as theres no shock to absorb.

ResultsPlus
Examiner Comments

One mark here for communicating the difference in bumpiness between the two roads. The rest is uncreditworthy.

(iii) Road X has a rough surface.

Road Y has a smooth surface.



(Source: © MikhailSh / Shutterstock)

Road X

(Source: © BearFotos / Shutterstock)

Road Y

A motorcycle travels at the same speed along road X and road Y.

Explain why the new type of shock absorber will generate more electricity for this motorcycle on road X than on road Y.

(3)

On road X since it is more bumby, it will cause the magnet to slide inside the coil more frequently. This would allow for the coil to ~~cut~~ cut through the magnetic field more frequently therefore inducing more voltage and generate more electricity. Road Y is smooth so it won't cause the magnet to slide into the coil as frequently as road X.

ResultsPlus
Examiner Comments

This candidate has made the initial idea clear about a difference in road bumpiness and then linked that to an enhancement in the relative motion of the coil and magnet (lines two and three). Finally, there is two and a half lines explaining what effect that has on the induction process. The rest of the response merely says that the reverse is true for road Y. Full marks.

Question 10(a)i

Many candidates correctly identified a balance as the correct piece of apparatus for the task of measuring a mass. A "scale" without qualification has never been acceptable for this specification.

A large proportion of candidates also described making sure that the balance read zero before being used. Rather fewer mentioned that the balance should be on a level surface or that draughts may affect the reading.

Question 10(a)ii-iii

In part (ii), the candidates were told that there was an anomalous result and virtually all candidates identified the value of 6.426 correctly.

In part (iii), many candidates forgot to exclude that result from their evaluation of the mean mass, for a penalty of one mark.

The correct answer needed to be three decimal places / four significant figures to match those provided in the table.

(ii) The table shows the student's measurements of the mass of the ring.

Mass in g
6.411
6.408
6.410
6.426
6.412

One of the student's measurements is an anomaly.

Draw a circle around the anomalous result in the table.

(1)

(iii) Calculate the mean mass of the gold ring.

(3)

$$\frac{6.411+6.408+6.410+6.412}{4} = 6.41025$$

≈ 6.410

mean mass = 6.410 g

ResultsPlus
Examiner Comments

An excellent, clear answer. The anomalous point has been encircled and removed from the calculation of the mean. Finally, the mean has been rounded to three decimal places, as implied by the data in the data table.

(ii) The table shows the student's measurements of the mass of the ring.

Mass in g
6.411
6.408
6.410
6.426
6.412

One of the student's measurements is an anomaly.

Draw a circle around the anomalous result in the table.

(1)

(iii) Calculate the mean mass of the gold ring.

(3)

$$\frac{6.411 + 6.408 + 6.410 + 6.412 + 6.426}{5}$$

$= 6.4134$

mean mass = 6.4134 g

ResultsPlus
Examiner Comments

Again, the anomalous point has been identified. The candidate has forgotten that this means that the data point in question should not be included in the calculation for the mean. The mean value has also not been rounded as required.

Question 10(b)

Four-mark responses were rare for this item, even though the mark scheme included six possible creditworthy ideas.

Comparing the viability of two differing approaches is a sensible thing in terms of understanding and being able to evaluate an investigation critically.

There are plenty of ideas for classroom discussion in the practical guide for this specification: https://qualifications.pearson.com/content/dam/pdf/International%20GCSE/Biology/2017/teaching-and-learning-materials/biology-chemistry-physics-core-practical-guide.pdf

(b) The student does not know if the ring is made of pure gold.

The student suggests that they could also measure the volume of the ring using a displacement method.

Discuss which method (calculation method or displacement method) will give the most accurate volume measurement.

(4)

The calculation method could produce the more accurate volume measurement as the result of the calculation will be to a larger ~~##~~ number of decimal places, unlike the displacement method ~~wi~~ which only gives the value to the nearest $0.1 cm^3$. Furthermore, the calculation method removes the possibility of human errors due to things like the parallax error or a meniscus. However, the student doesn't know if the ring is made of pure gold, so the volume value will be incorrect if it is.

(Total for Question 10 = 11 marks)

ResultsPlus
Examiner Comments

An excellent response. Many candidates made the link between purity of the gold samples and the effect on the overall density. A few went on to describe the effect that would have on the calculated volume. This candidate has done that and mentioned which method is therefore more accurate. The difference between this response and those that scored three marks was the reference to the scale gradation of 0.1 cm^3 in line six.

Question 11(a)

A large proportion of candidates correctly substituted the values for mass and speed. Common errors included not converting the mass from grams into kilograms or forgetting the explicit instruction to round the energy to three significant figures.

11 A ball is moving through the air with a speed of 54.8 m/s. The ball has a mass of 159 g.

(a) Calculate the energy in the kinetic store of the ball.

Give your answer to 3 significant figures.

(4)

kinetic energy $= \frac{1}{2} \times m \times v^2$

$159g \rightarrow 0.159kg$

$= \frac{1}{2} \times 0.159 \times 54.8^2$

$= 239J$ (3 s.f)

energy in kinetic store = 239 J

ResultsPlus
Examiner Comments

This candidate has performed the conversion from grams to kilograms, evaluated the kinetic energy correctly and then rounded to 3 significant figures as required. Notice the conversion on the left-hand side of the page, ensuring that they made it clear what they were doing.

11 A ball is moving through the air with a speed of 54.8 m/s. The ball has a mass of 159 g.

(a) Calculate the energy in the kinetic store of the ball.

Give your answer to 3 significant figures.

(4)

$KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2} \times 159 \times (54.8)^2$

$KE = 238741.7$

energy in kinetic store = 238741.7 J

ResultsPlus
Examiner Comments

This candidate, however, has treated this calculation more simply than required. There is no conversion to kilograms and no rounding as required.

ResultsPlus
Examiner Tip

This candidate did, however, make it clear to themselves that they should square the speed. Often, candidates will write the squared symbol and not do so on their calculator or forget to include the squared symbol at all.

Question 11(b)i

There is an unseen formula to substitute into in this item, although it is closely related to the given formula for cosmological redshift.

As this is another "show that" item, candidates need to be clear about their working to arrive at an evaluation for the change in frequency to at least 3 significant figures.

The mark scheme suggests that the substitution and rearrangement can occur in either order: there is no evidence to suggest which of the two is more likely to result in a correct evaluation.

Many candidates achieved the right value, albeit with a possible power of ten error.

(i) The change in frequency can be calculated using this formula.

$$\text{speed of ball} = \frac{\text{change of frequency}}{\text{source frequency}} \times \frac{\text{speed of radio waves}}{2}$$

Show that the change in frequency of the radio waves is approximately 1.1×10^4 Hz.

[speed of radio waves = 3.00×10^8 m/s]

(3)

$$54.8 = \frac{\text{change of frequency}}{2.90 \times 10^{10}} \times \frac{3 \times 10^8}{2}$$

$$\frac{54.8}{\frac{3 \times 10^8}{2}} = \frac{\text{change of frequency}}{2.90 \times 10^{10}}$$

$$\frac{54.8}{3 \times 10^8 / 2} \times 2.90 \times 10^{10} = \text{change of frequency}$$

$= ~~1056~~$ $10594.66..$

≈ 10594

≈ 11000

$\approx \underline{1.1 \times 10^4 \text{Hz}}$

ResultsPlus
Examiner Comments

This candidate has made each stage of their algebra and working clear. There are no errors and they have shown how their evaluated change in frequency compares to the approximate value.

(i) The change in frequency can be calculated using this formula.

$$\text{speed of ball} = \frac{\text{change of frequency}}{\text{source frequency}} \times \frac{\text{speed of radio waves}}{2}$$

Show that the change in frequency of the radio waves is approximately 1.1×10^4 Hz.

[speed of radio waves = 3.00×10^8 m/s]

(3)

$$54.8 = \frac{x}{2.9 \times 10^{10}} \times \frac{3 \times 10^8}{2}$$

$$54.8 = \frac{(1.5 \times 10^4)x}{2.9 \times 10^{10}}$$

$$158.92 \times 10^{10} = 1.5 \times 10^4 x$$

$$\frac{158.92 \times 10^{10}}{1.5 \times 10^4} = x$$

$$x = 105.9 \times 10^6$$

$$x = 1.06 \times 10^4 \approx \underline{1.1 \times 10^4}$$

ResultsPlus
Examiner Comments

This candidate has also shown their working clearly and effectively. There is a slip in the second line of working, unfortunately. They have divided 3 x 10^8 by 2 to get 1.5 x 10^4 , ie halving the figure and the power of ten. At the end of their work, the evaluated answer is clearly not equal to the approximate value. This scored two marks, as the rearrangement and substitution were correct, yet the evaluation has gone wrong.

(i) The change in frequency can be calculated using this formula.

$$\text{speed of ball} = \frac{\text{change of frequency}}{\text{source frequency}} \times \frac{\text{speed of radio waves}}{2}$$

Show that the change in frequency of the radio waves is approximately 1.1×10^4 Hz.

[speed of radio waves = 3.00×10^8 m/s]

(3)

$$V = \frac{1.1 \times 10^4 \text{ Hz}}{2.9 \times 10^{10} \text{ Hz}} \times \frac{3.00 \times 10^8 \text{ m/s}}{2}$$

$$v = 56.90 (\text{m/s})$$

ResultsPlus
Examiner Comments

This candidate decided to substitute in the approximate value for the change of frequency to arrive at an approximate speed. Although this seems sensible, it does not answer the question. That said, the mark scheme allows a maximum of one mark for this approach.

Question 11(b)ii

The last item on the paper was relatively accessible. Successful candidates appreciated that this was about the Doppler effect, although no credit was allowed for stating this.

Many candidates had learned the explanation of the Doppler effect on frequency and correctly attributed the decrease in frequency to an increased wavelength and a constant wave speed.

Paper Summary

Based on their performance on this paper, candidates should:

- Take care when drawing diagrams to add correct labels for all apparatus and draw accurately.
- Ensure that they have either seen or performed the practicals named in the specification where possible. This might include either building or simulating circuits in which the number of components changes and noting the effect on the currents and voltages in or across those components.
- 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 and any additional instructions used in each question to determine how the examiner expects the question to be answered, for instance whether to give a description or an explanation. This includes using particular ideas (such as forces or energy) in your answer.
- Structure multi-step calculations as simply as possible, with words, ideally, to facilitate checking at each stage.
- Recall the units given in the specification and use them appropriately.
- Practise structuring and sequencing longer extended writing questions.
- Show all working so that some credit can still be given for answers that are only partly correct.
- Be ready to comment on data and suggest improvements to experimental methods.
- Allow time at the end of the examination to check answers carefully and correct basic slips in wording or calculation.

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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