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Examiners' Report June 2024

Int GCSE Physics 4PH1 1P

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June 2024

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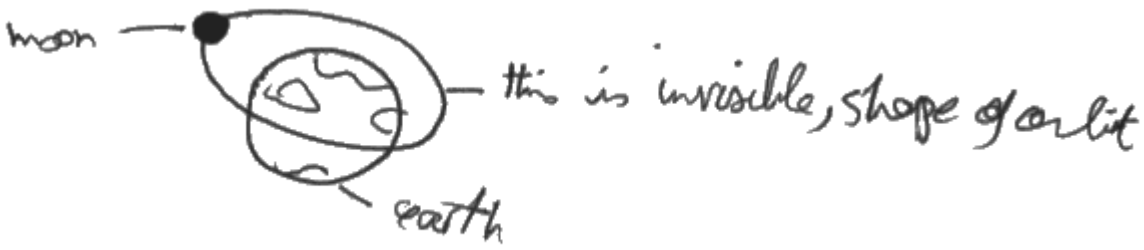
Introduction

The examination was written to assess 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' demonstrations of experimental skills and understanding. Candidates were provided with a full list of the formulae to be used in this examination. 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 and substitute data into given 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 (a)(i)

Most candidates were able to draw the diagram of the Moon orbiting the Earth accurately enough for both marking points. Weaker candidates either showed a lack of care to draw the Earth at the centre of the orbit or the orbit was too elliptical to be considered approximately circular. Some candidates attempted 3D drawings, which made it impossible to judge the shape of the orbit, and also added in unnecessary features such as the Earth's orbit around the Sun.

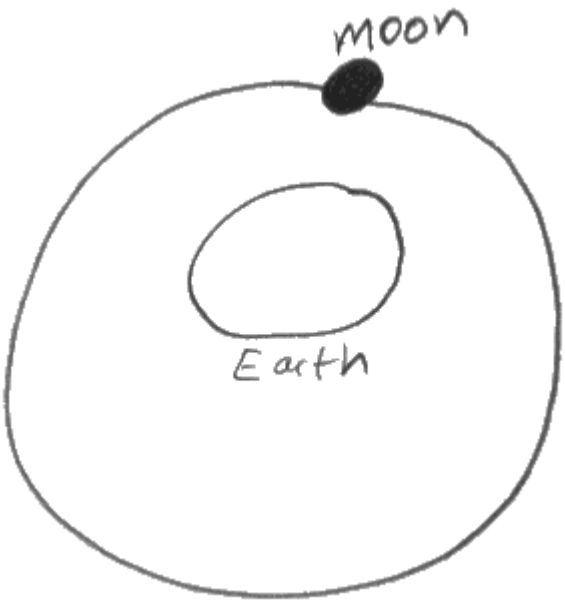


ResultsPlus
Examiner Comments

This response scored 0 marks. The attempt to draw the orbit in 3D makes it impossible to assess the shape of the orbit. In addition, the Earth is not clearly drawn in the centre of the Moon's orbit.

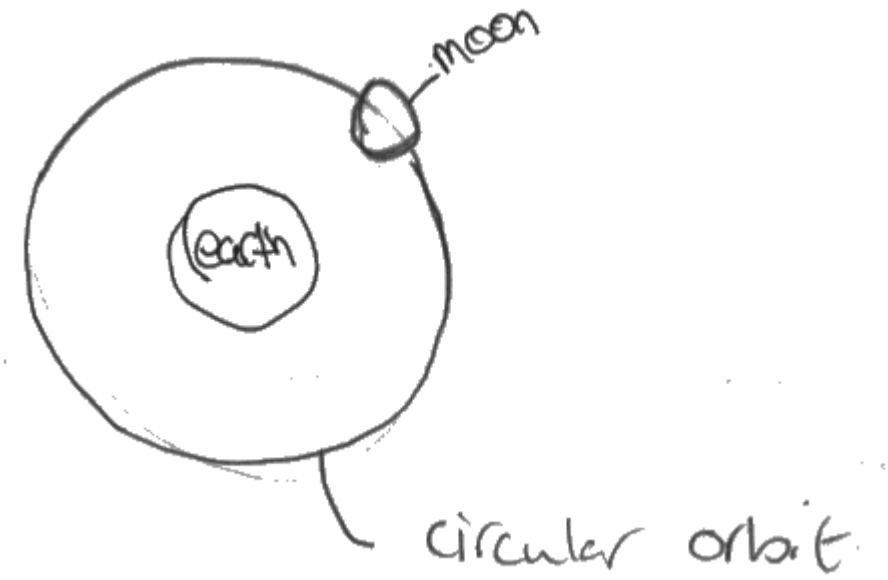
ResultsPlus
Examiner Tip

Candidates should avoid trying to draw orbital diagrams in 3D.
A simple 2D drawing is sufficient and will allow candidates to communicate their understanding more clearly.



ResultsPlus
Examiner Comments

This response scored 1 mark. The shape of the orbit is clear enough to be judged to be a circle. However, the candidate has not taken enough care over their placement of the Earth and it is not clearly at the centre of the orbit.



ResultsPlus
Examiner Comments

This response scored 2 marks. The orbit is clearly a circular shape and the candidate has labelled it as such for the avoidance of any doubt. The Earth is also clearly drawn at the centre of the orbit.

Question 1 (a)(ii)

Most candidates were able to provide a valid answer to this question. However, some candidates referred to gravitational potential (energy) or gravitational field strength, which were not credited.

Question 1 (a)(iii)

Most candidates were also able to provide a suitable object that orbits the Earth to gain the mark. The most popular incorrect answer was a comet, whilst other candidates thought that asteroids orbit the Earth.

Question 1 (b)

Most candidates could give a suitable difference between the orbits of a planet and a comet. Some candidates gave incomplete differences, such as stating that the orbit of a comet is elliptical without stating that the orbit of a planet is circular.

Question 3 (a)

Candidates found this question challenging, but over two thirds of all candidates were able to achieve the mark. The most common incorrect response seen was the idea that infrared causes cancer or cell mutations. Other candidates lacked detail in their responses and simply referenced "burns", which was not credited.

Question 3 (b)(i)

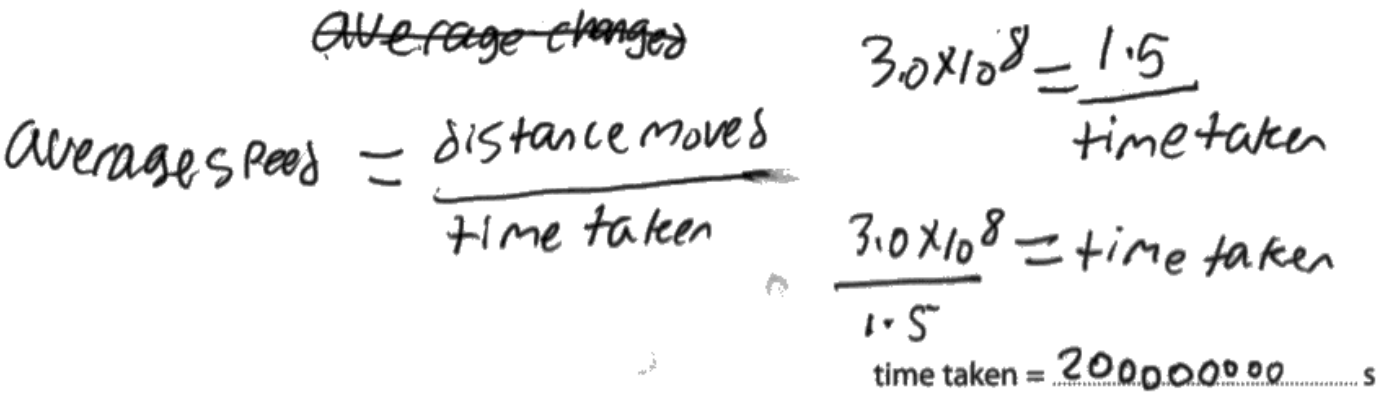
Most candidates were able to achieve at least 1 mark in this question, whilst the majority gained both marks. Common correct responses included references to both waves being transverse and both travelling in a vacuum at the same speed. Some candidates tried to give common uses of both visible and infrared waves, which were not credited.

Question 3 (b)(ii)

Candidates found this question much harder and nearly half of all candidates were not awarded any marks. Some candidates were too vague in their responses and stated that the waves had "different frequencies/wavelengths" without saying how they were different. These responses were not credited. Weaker candidates got the frequencies and wavelengths the wrong way round.

Question 3 (c)

Candidates performed well in this calculation and most scored full marks. Weaker candidates often scored zero marks because they incorrectly rearranged the formula as the first step in their working. Had these candidates substituted (correctly) the data before rearranging then they could have been awarded a mark for this.



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Examiner Comments

This response scored 1 mark. The initial substitution of data is correct, but the subsequent rearrangement is incorrect and no further marks were awarded.

ResultsPlus
Examiner Tip

Candidates who experience difficulty rearranging formulae should be advised to substitute data as the first step in their working.

velocity = $\frac{\text{distance}}{\text{time}}$

$3 \times 10^8 = \frac{1.5}{t}$

$t = \frac{1.5}{3 \times 10^8}$

$t = 5 \times 10^{-9}$

time taken = 5×10^{-9} s

ResultsPlus
Examiner Comments

This is a good example of a correct calculation. The candidate has shown their working clearly and arrived at the correct answer to gain full marks.

Question 3 (d)

This question was successfully attempted by most candidates where the majority of candidates achieved at least 1 mark for comparing the absorbing/reflecting abilities of the 2 paints. Weaker candidates wrote how black paint was a better conductor or white paint a poorer conductor of heat.

Because the Black paint absorb the radiation better than the white paint as the white paint reflect and emit the radiation.

ResultsPlus
Examiner Comments

This response was awarded 1 mark. The candidate has identified a relevant property of black surfaces, but has not linked this appropriately to energy transfer.

Black paint is a better absorber of infrared radiation than white paint. This means it absorbs the energy from infrared radiation faster and it absorbs more energy overall.

ResultsPlus
Examiner Comments

This response was awarded 2 marks. The candidate has identified a relevant property of black surfaces and then correctly linked this to energy transfer.

Question 4 (a)

Candidates found this question very challenging and had not, perhaps, previously considered the energy transfers during star formation. Most candidates correctly identified that the thermal energy store would increase and that the gravitational store would decrease. Confusion arose with what happens to the nuclear and chemical stores, which suggested that candidates struggled to differentiate between chemical and nuclear reactions. It was expected that candidates knew that nuclear fusion does not happen in protostars, but this was only linked to the nuclear energy store staying the same by the most able candidates.

Question 4 (b)

Just over half of all candidates knew that mass was the property of stars that determines its evolutionary path. The most common incorrect response was "size".

Question 4 (c)

This question differentiated well between candidates of different abilities. Most candidates achieved 2 marks, with a normal distribution either side. Marking points 3 and 4 were the most commonly awarded, with marking points 1 and 2 also seen in many responses. However, it was evident that there were some misunderstandings as to the differences between the two stars. Many candidates who were unsure simply stated that white dwarfs are white and red giants are red, which scored no marks.

a red giant star has a lower temperature, red colour ← low temp while white colour ← high temp. and a red giant is bigger that collapses into a white dwarf. so white dwarf has a higher temperature and pressure.

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Examiner Comments

This response is representative of the "standard" response to this question. The candidate was awarded 2 marks for the correct comparison of their temperatures (MP4) and the comparison of their sizes (MP3).

Red giant star makes fusion of heavier elements such as helium and after helium, but white dwarf star does not make fusion. White dwarf star is more denser than red giant star. White dwarf star ~~is more~~ has more higher temperature than red giant star. Red giant star has more luminosity than white dwarf star. Because white dwarf star is more smaller than red giant star.

ResultsPlus
Examiner Comments

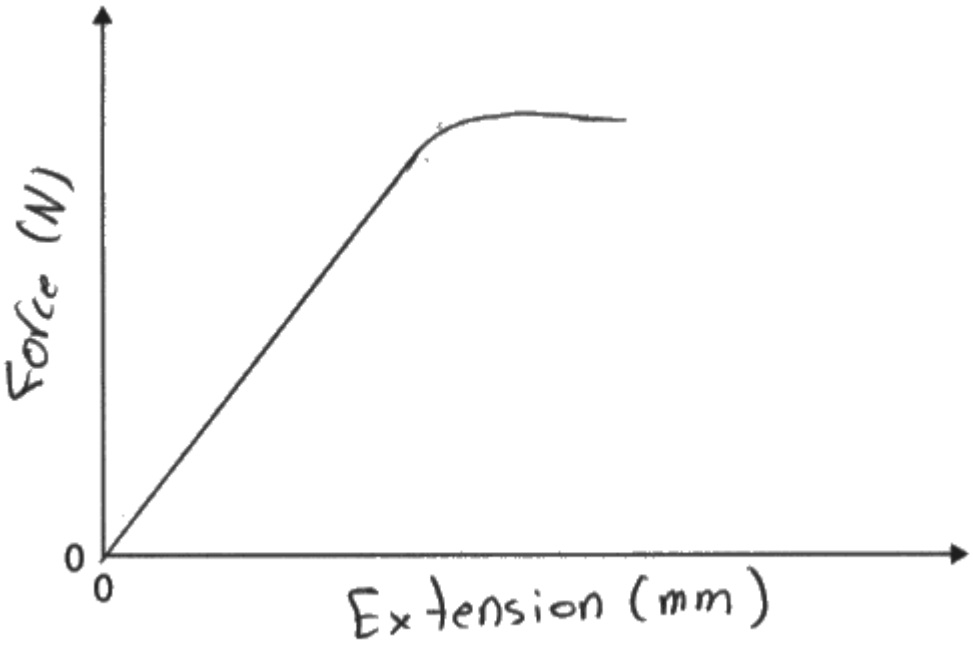
This response is indicative of a candidate working at the higher grade range. The candidate was awarded 4 marks for MP2, MP5, MP4, MP1 and MP3 (seen in this order). Only MP6 was missing from this response, but this marking point was rarely seen in any responses.

ResultsPlus
Examiner Tip

Candidates should look at the number of marks available for the question to determine how much detail is needed in their response. This question was worth 4 marks, so candidates should have aimed to include at least 4 differences in their responses.

Question 5 (a)

This question was more challenging than anticipated and highlighted many misunderstandings in candidates' knowledge of Hooke's law. Some candidates were eager to demonstrate their knowledge and included a curved section in their line, therefore losing this mark. Many candidates scored 2 marks, usually for the axes labels and start point of the line. However, some candidates used incorrect or inappropriate terms for the graph labels.

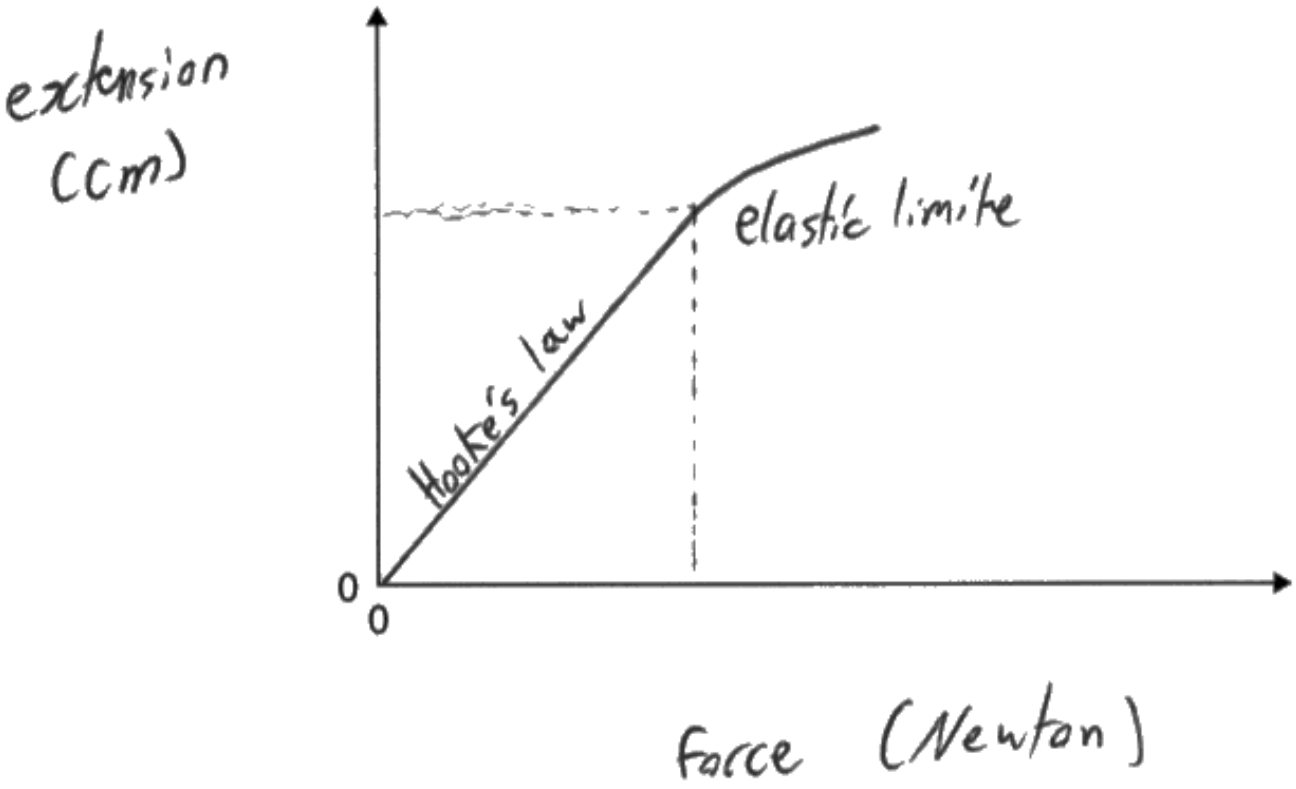


ResultsPlus
Examiner Comments

This response was awarded 2 marks. The axes labels are correct and the line starts at the origin. However, the candidate has included a curved section, which is incorrect for a material obeying Hooke's law.

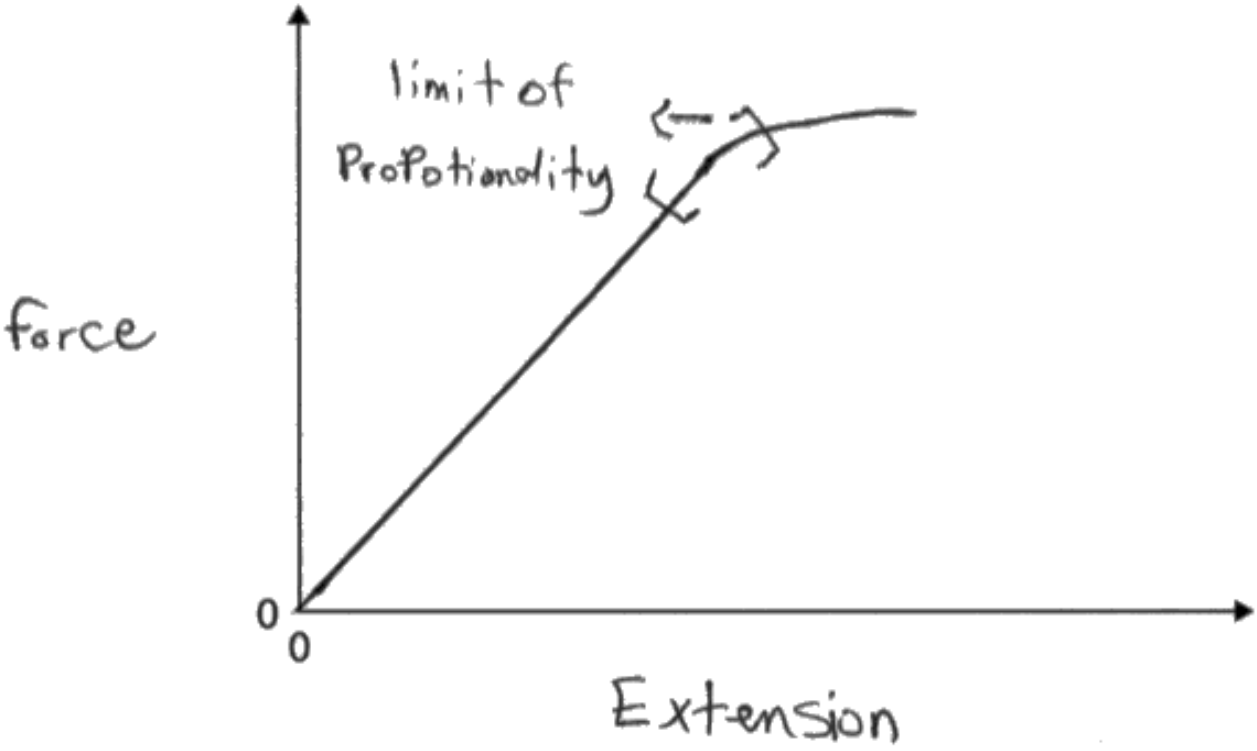
ResultsPlus
Examiner Tip

It is important that candidates read the question carefully so as not to misinterpret what is being asked of them.



ResultsPlus
Examiner Comments

This response was also awarded 2 marks for the axes labels and the line starting at the origin. This time, the candidate has marked the start of the curvature as the "elastic limit". However, this is incorrect and was not credited.



ResultsPlus
Examiner Comments

This response scored 3 marks. Although the line is curved, the labelling of "limit of proportionality" was deemed sufficient to indicate that Hooke's law was only being obeyed up to this point.

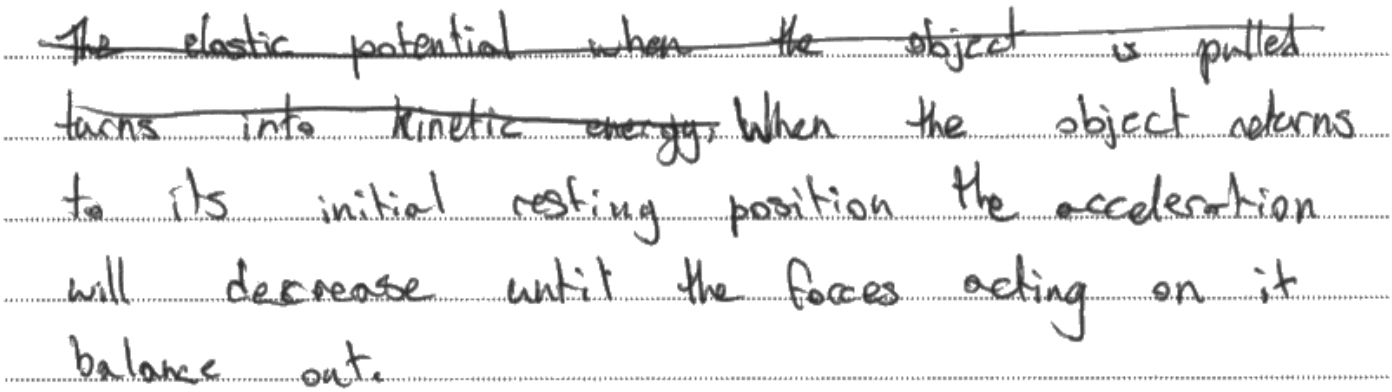
Question 5 (b)(i)-(ii)

Many candidates were able to answer Q05(b)(i) correctly. Weaker candidates used 'North' rather than the correct word, but in most cases the magnitude of the force was correct.

The calculation in Q05(b)(ii) was well answered by most candidates. Candidates were able to apply their knowledge of Newton's second law and obtain the correct evaluation. There were some power of ten (POT) errors seem in some cases as a result of candidates incorrectly trying to convert kilograms into grams.

Question 5 (b)(iii)

This question offered a challenging opportunity for candidates to demonstrate their knowledge and understanding of forces and how they are linked to changes in motion. Many candidates failed to read the question properly. They effectively explained what happened in a whole oscillation and not what was being asked for (from the point of release until when the mass first passes its resting position). Other candidates gave well-rehearsed explanations of terminal velocity, which were also irrelevant. More able candidates were awarded a mark for recognising that the acceleration would decrease, whilst the most able could link this to the forces involved in the scenario.



ResultsPlus
Examiner Comments

This response was awarded 2 marks. The candidate has identified that the acceleration would decrease and also linked this to the idea of the forces (eventually) becoming balanced.

(3)

As the object accelerates upwards the magnitude of the acceleration decreases as the extension of the spring gets less. The force of the spring that is being exerted on the object decreases making acceleration decrease until both forces are balanced and the object is resting.

ResultsPlus
Examiner Comments

This is an excellent response and indicative of a candidate working at Grade 9. The candidate has identified that the acceleration would decrease and supported this with a full account of the forces involved.

Question 6 (a)

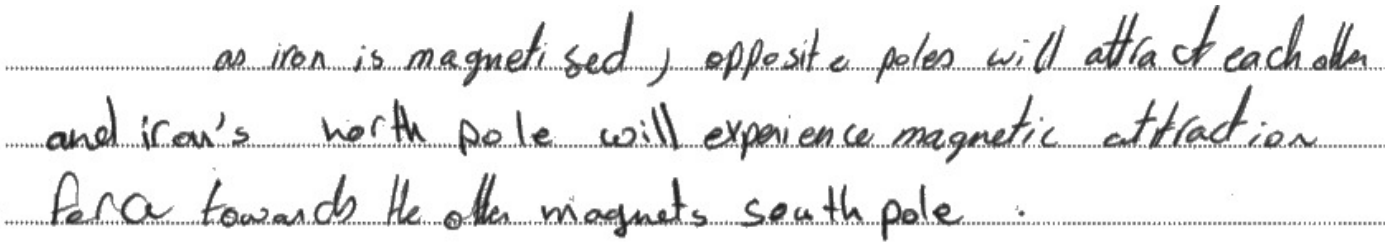
Most candidates answered this question correctly by drawing arrows directed towards the south pole. Some candidates did not get the mark as they drew contradicting arrows or arrows pointing in the wrong direction.

Question 6 (c)

Most candidates showed a good understanding of the relationship between the spacing of field lines and the strength of the magnetic field. Weaker candidates wrote about the size or length of the lines or how curved they were and tried to link this to field strength and were not awarded marks.

Question 6 (d)(i)

Candidates found this question challenging and more than half did not score at all. Although many candidates knew that the force was a result of opposite poles attracting, some did not think to refer to an induced north pole on the piece of iron. Most candidates who did get a mark for this did so due to labelling the diagram, as suggested in the question.



ResultsPlus
Examiner Comments

This response was awarded 2 marks. The candidate has labelled the piece of iron in the diagram to show clearly that a north pole has been induced. It is also clear in the response that opposite poles attract.

ResultsPlus
Examiner Tip

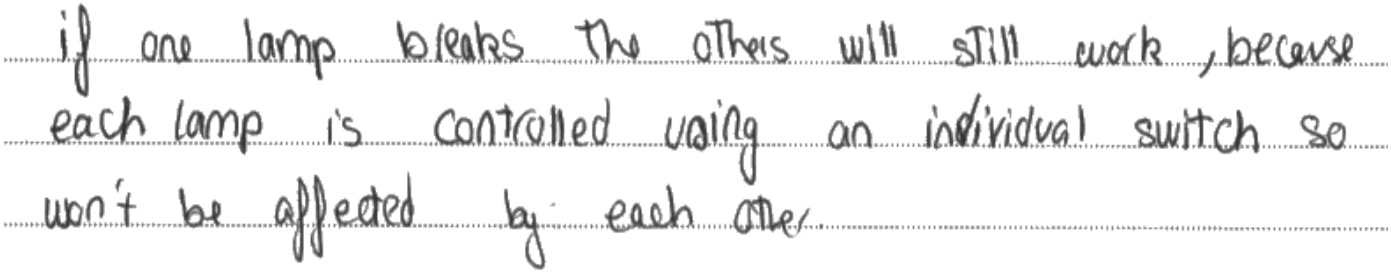
Candidates should take note of extra instructions in questions and follow them. In this question, the suggestion to label the diagram was included to make it easier for candidates to communicate their understanding.

Question 6 (d)(ii)

Most candidates had the idea of soft magnetic materials but weaker candidates wrote about soft metals or magnets. However, most candidates were able to articulate that the iron lost its magnetism when outside the magnetic field of the permanent magnet.

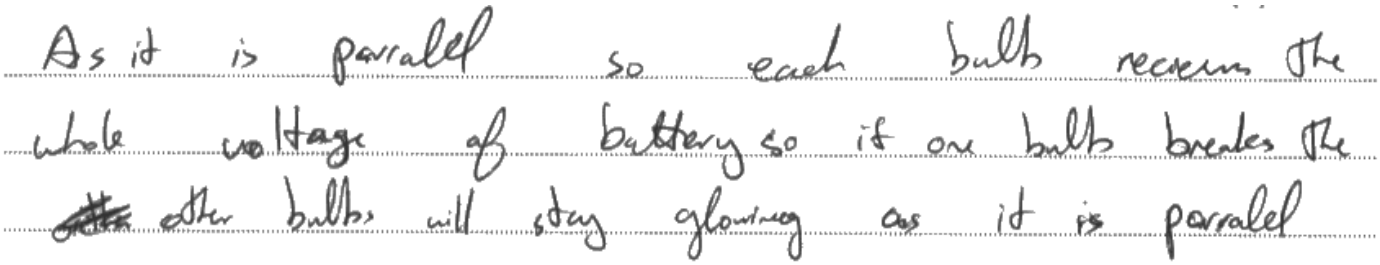
Question 7 (a)

Many candidates were able to gain at least 1 mark from this question. Many suitable advantages were seen in candidates' responses, but only the more able candidates explained this by linking it to the circuit being a parallel arrangement.



ResultsPlus Examiner Comments

This response scored 1 mark for the idea of the lamps working independently from each other. The link to the circuit being a parallel arrangement is missing from the response.



ResultsPlus Examiner Comments

This response scored 2 marks. The circuit is clearly referred to as being "parallel" and the idea of independent control is also communicated.

This circuit shows that the lamps are connected in parallel, and this is a good choice because if one of the lamps stopped working the others will continue to work and because the same voltage is supplied to the three lamps. Also they can control which lamps they want to turn on and which lamps they want to turn off

ResultsPlus
Examiner Comments

This response also scored 2 marks. This candidate has included several advantages of the parallel arrangement, all of which are correct.

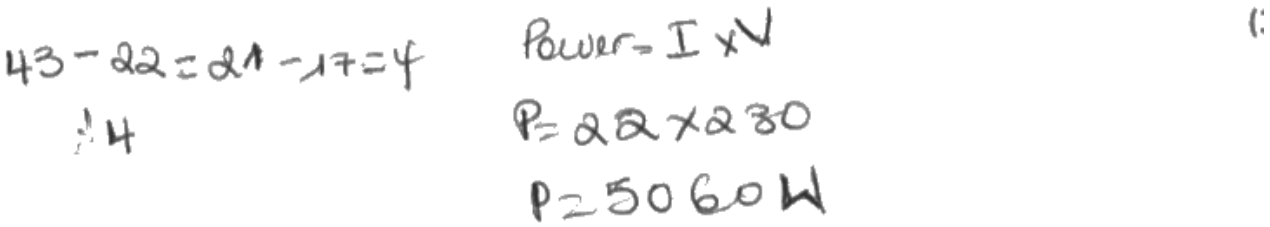
Question 7 (b)(i)

Over 90% of candidates scored the mark in this question.

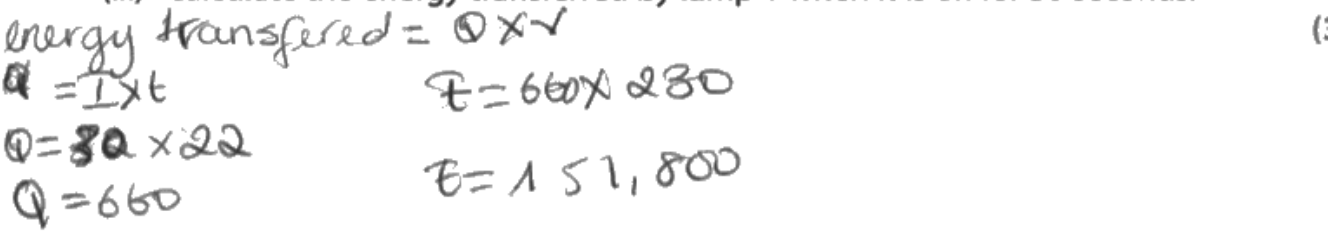
Question 7 (b)(ii)-(iii)

These questions were answered very well by most candidates and the majority scored full marks. In Q07(b)(ii), most candidates were able to calculate the correct power value but, as expected, a common mistake was failing to convert mA to A. Some candidates also lost a mark for not giving the final evaluation to more significant figures than the value given in the question.

A variety of methods were seen and credited in Q07(b)(iii). Candidates not scoring full marks usually made errors when converting mA to A or by choosing an inappropriate formula or method for their calculation.



(iii) Calculate the energy transferred by lamp 1 when it is on for 30 seconds.



energy transferred = 151,800

ResultsPlus Examiner Comments

This candidate only scored 2 marks in Q07(b)(ii) as the conversion from mA to A is missing from their working. The work in Q07(b)(iii) is unusual but correct and so was awarded 3 marks. Note that the power of ten (POT) error was not penalised twice in these linked calculations.

$P = I \times V$

$\times 1000$

$22\,mA \longrightarrow 0.022\,A$

$P = 0.022 \times 230$

$P = 5\,W$

(iii) Calculate the energy transferred by lamp 1 when it is on for 30 seconds.

$E = I \times V \times t$

$E = 0.022 \times 230 \times 30$

$E = 152\,J$

energy transferred = 152

ResultsPlus
Examiner Comments

This candidate was only awarded 2 marks in Q07(b)(ii) since their final evaluation was only given to 1 significant figure.

ResultsPlus
Examiner Tip

In "show that" style questions, candidates are expected to calculate the given value in the same way as any other calculation. However, there is an expectation to give the final evaluation to more significant figures than the value given in the question.

power = current × voltage

power = $\frac{22}{1000}$ × 230 = 5.06 Watts

(iii) Calculate the energy transferred by lamp 1 when it is on for 30 seconds.

(3)

power = $\frac{\text{energy transferred}}{\text{time}}$

$5.06 = \frac{x}{30}$

energy transferred = 151.8

ResultsPlus
Examiner Comments

This candidate has presented all their working carefully to obtain full marks in both calculations.

Question 7 (c)(i)

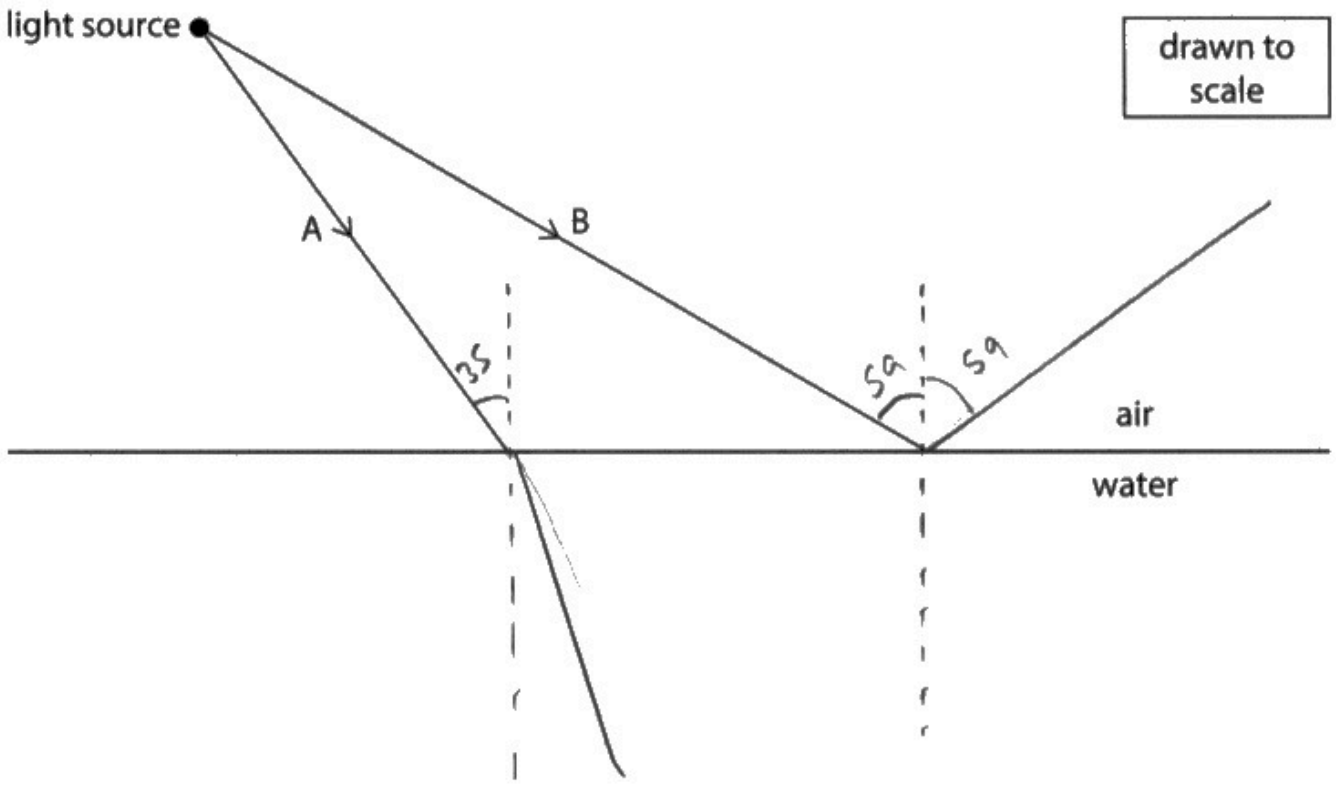
Less than a quarter of all candidates knew the correct definition of the term *voltage*.

Question 7 (c)(ii)

Most candidates scored both marks. Poor subtraction, or not understanding the diagram resulted in other answers being seen. Most candidates scored at least 1 mark.

Question 8

This question discriminated well. It was very encouraging to see a third of all candidates achieve 5 or 6 marks for their responses and many more were able to score 3 or 4 marks for their drawing and/or calculation. Some candidates thought that ray B would undergo total internal reflection and showed a reflected ray for this. Those attempting the calculations tended to do so correctly, but many candidates also calculated the critical angle, which was not relevant since the light was travelling to a medium with a higher refractive index. Candidates often did not read the instructions carefully and either did not include calculations in their response or misunderstood the purpose of the command word "explain" and did not include supporting reasons for the paths of the light rays. However, in most cases, diagrams were well drawn and appropriately labelled, which was pleasing to see.



we drew normal lines to find the angle of incident line A has an angle of incident of 35° while line B has an angle of 59° we used a protractor to find the angle of incident. Then we found the critical angle by $\sin C = \frac{1}{n}$ → $\sin C = \frac{1}{1.33}$ which is 48.75. so line A has an incident angle which is smaller than the critical angle so the line will be refracted. and line B has an incident angle which is larger than the critical angle so total internal reflection happens.

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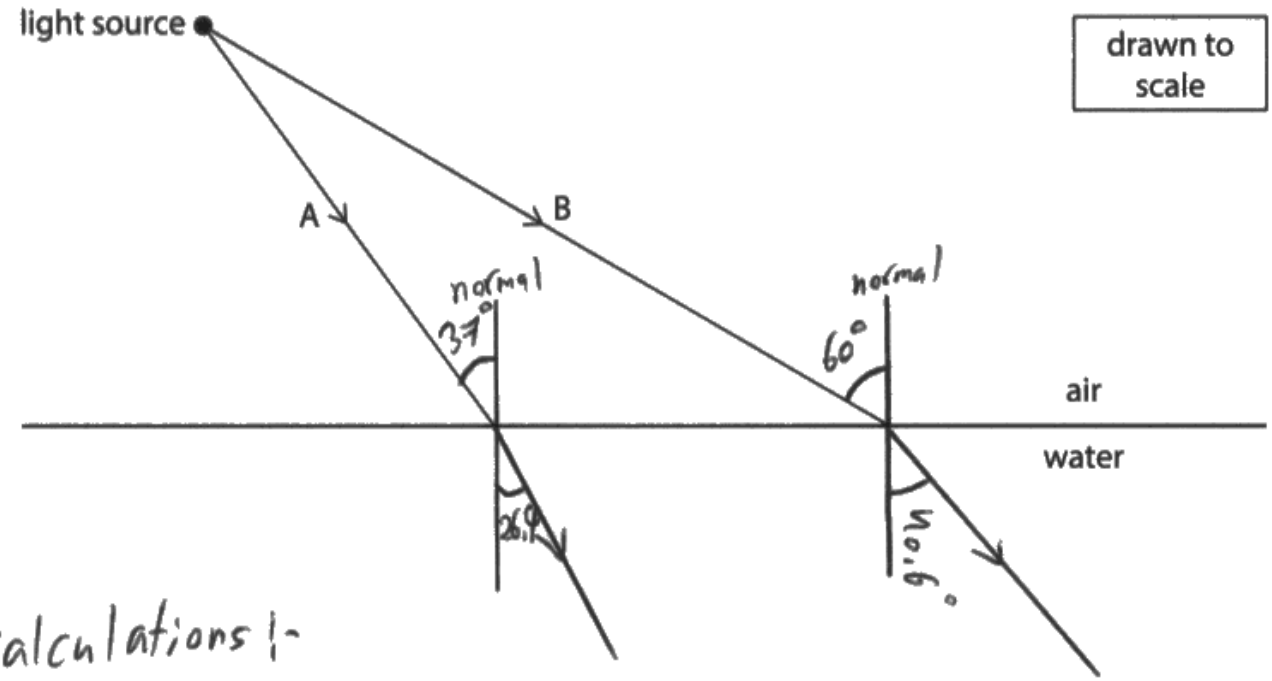
Examiner Comments

This response scored 2 marks. The candidate has drawn the path of ray A correctly (MP1) and measured the angles of incidence correctly (MP3). Ray B has incorrectly been drawn reflecting at the boundary. No relevant calculations have been provided or other reasons to support the paths of the rays.



Calculations :-

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

$$1.33 = \frac{1}{\sin c}$$

$$c = 48.75^\circ$$

A=

$$1.33 = \frac{\sin 37}{\sin r}$$

$$r = 26.9^\circ$$

B = $1.33 = \frac{\sin 60}{\sin r}$

$$r = 40.63^\circ$$

~~(from $n = \frac{1}{\sin c}$, c was deduced as 48.75° which is the critical angle of the water)~~

From $n = \frac{\sin i}{\sin r}$, A is refracted at an angle of 26.9° from the ~~(mattin)~~ normal

B is also refracted at a larger angle however, as the angle of incidence was greater. there is also a light reflection (but less than the refracted light

calculations:

$A = \frac{\sin}{} \; r = \frac{\sin 37}{1.33} = 26.9°$

B: $\sin r = \frac{\sin 60°}{1.33} = 40.63°$

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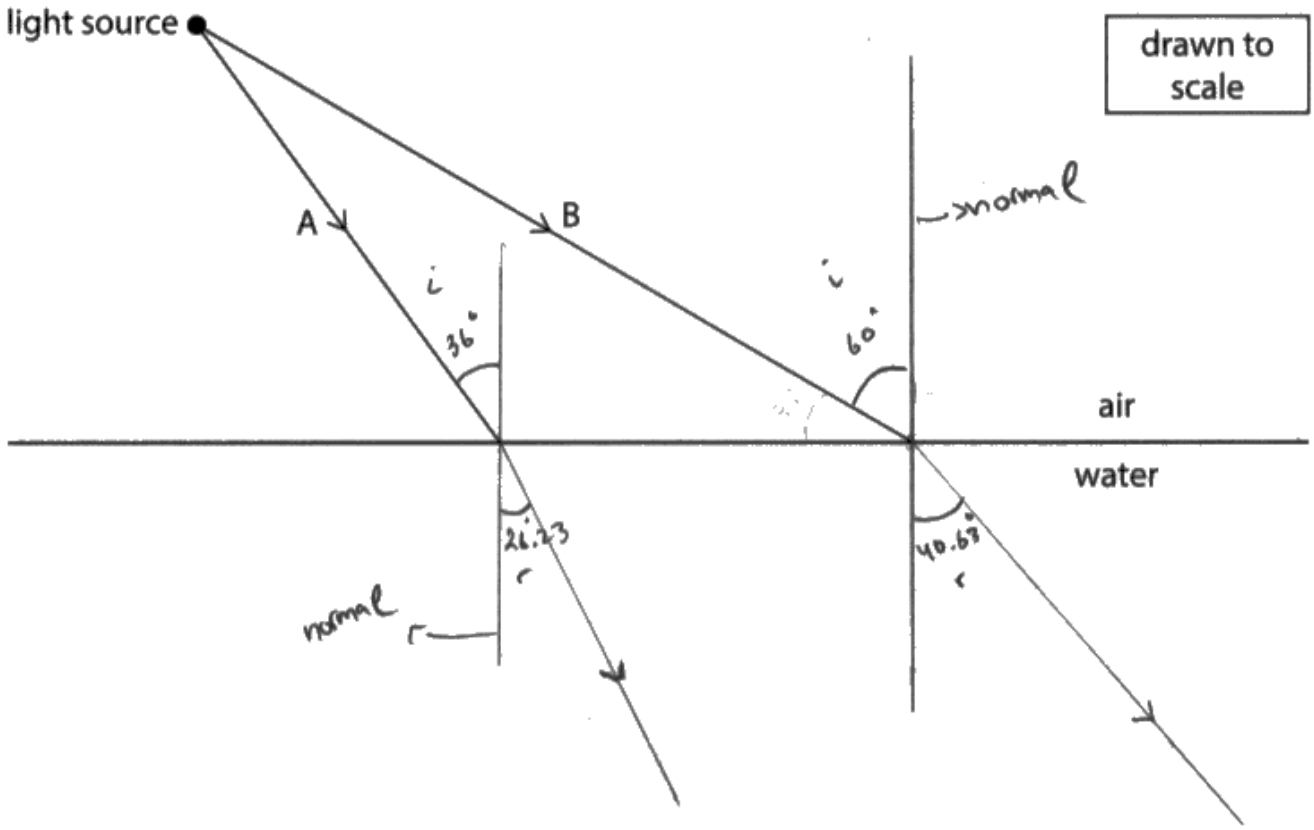
Examiner Comments

This response scored 4 marks. The candidate has drawn the paths of both rays correctly (MP1 and MP2), has measured the angles of incidence correctly (MP3) and has calculated the angles of refraction correctly (MP4). Beyond this, there are no further reasons given to support the paths of the rays that have been drawn.



Starting with line A, when we measure the angle of incidence, we get 36°. Using the equation $n = \frac{\sin i_A}{\sin r_A}$, we substitute our values. $1.33 = \frac{\sin 36^\circ}{\sin r_A}$.

$\sin r_A = \frac{\sin 36}{1.33}$ → $\sin r_A = 0.4419$ → $r = 26.2279 \approx 26.23$.

The angle of refraction is smaller than the angle of incidence, so we can say that the path will be closer to the normal line as shown on the diagram. We will do the same for B. Angle of incidence is 60°. Using the equation again... $1.33 = \frac{\sin 60^\circ}{\sin r_B}$ → $r_B = 40.628^\circ \approx 40.63^\circ$. Angle r_B is smaller than i_B, thus the path refracts towards the normal line too. Both lines refract since water is optically denser than air, thus the speed of light slows down and refract.

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Examiner Comments

This response scored 6 marks. The candidate has drawn the paths of both rays correctly (MP1 and MP2), has measured the angles of incidence correctly (MP3) and has calculated the angles of refraction correctly (MP4). In addition to this, the candidate has gained MP5 and MP6 for the explanatory statements at the end of their response.

Question 9 (a)

Most candidates were able to deduce the correct pressure for the air inside the bottle.

Question 9 (b)

Many candidates recognised that the air pressure in the plane increased on descent (and hence would be greater than that inside the bottle) but missed MP2 by then concluding that this would lead to the bottle being 'crushed', or repeated the stem that it 'collapsed' rather than referring to a (resultant) force.

The air pressure outside increases as the plane descends, so the outside pressure is more than the inside pressure, which makes it collapse.

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Examiner Comments

This candidate was awarded 1 mark for correctly recognising that the air pressure outside the bottle increases. This is not linked to any references to forces.

The air pressure outside has increased so it's greater the the air pressure inside, that made bigger force from outside than inside which causes the collapse

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Examiner Comments

This candidate was awarded 2 marks. There are correct statements in the response about pressure and effect on the force on the bottle.

Question 9 (c)

This question was answered to a high standard. Most candidates appreciated that the molecules collided with the bottle surface and that a force was transferred to the surface. Weaker candidates failed to develop their ideas to include the conversion of force to pressure.

The gas molecules move faster and they collide more so when they collide with the the surface of the bottle then move a pressure will be exerted on the bottle surface

ResultsPlus
Examiner Comments

This response was only awarded 1 mark for the idea that gas molecules collide with the surface of the bottle. This idea is then not developed or linked to how pressure is exerted.

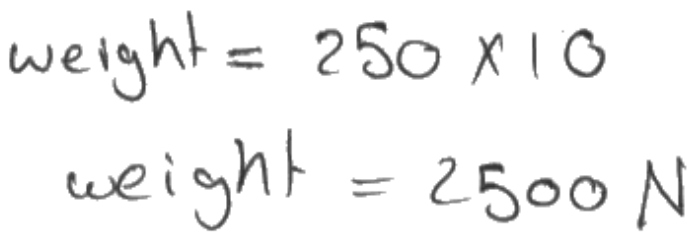
gas molecules move in a random motion, they collide with each other and with surface of bottle this collission exerts a force on surface of bottle, force per unit area ($\frac{F}{A}$) equals pressure.

ResultsPlus
Examiner Comments

An excellent (and concise) response that was awarded full marks.
A logical link between the collisions of gas molecules and the pressure on the container is successfully communicated.

Question 10 (a)

It was encouraging to see most candidates converting from grams to kilograms to score full marks in this calculation. Predictably, weaker candidates did not convert the units and obtained 1 mark instead.



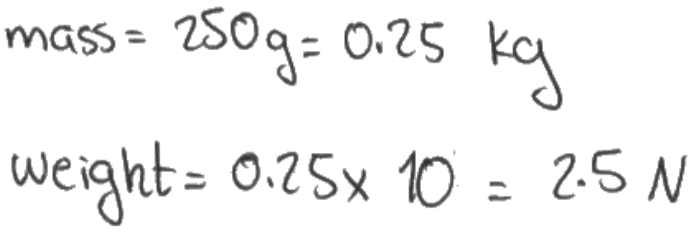
weight = 2500 N

ResultsPlus Examiner Comments

This candidate has not converted the units of mass from grams to kilograms, but was awarded 1 mark for their, otherwise, correct calculation.

ResultsPlus Examiner Tip

Candidates should be familiar with the standard units of quantities that are used in calculations.



weight = 2.5 N

ResultsPlus Examiner Comments

This response scored full marks. The final answer is correct and the candidate's working is easy to follow.

Question 10 (b)(i)

This question was generally well answered with a good knowledge of the different variables involved. Weaker candidates demonstrated confusion between independent, dependent and control variables.

Question 10 (b)(ii)

Most candidates could name at least one of the control variables in the investigation. Weaker responses such as "same load" and "same clamps" were seen frequently, but did not gain credit.

Question 10 (b)(iii)

Most candidates were able to gain at least one of the two available marking points (mainly for the ruler). Stronger candidates used drawings in their answers to help explain their method and this definitely helped the examiner to award marks. Weaker candidates gave vague answers about measuring the load without reference to markers or reference points. Several candidates mentioned the use of a set square but didn't link it to perpendicularity. Many candidates understood the importance of taking measurements at eye level.

He can use a ruler to measure hight but repeat measurements for the same length more than once then take an average to make sure it is accurate

ResultsPlus
Examiner Comments

This response scored 1 mark. The candidate has selected an appropriate measuring instrument, but does not give sufficient detail as to how to use it to obtain an accurate measurement.

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Examiner Tip

Candidates should be aware of the meaning of the term *accurately*. This means taking a measurement that is close to the true value.

using a ruler that is straight, and read from eye level
To reduce parallax errors plus repeat reading and take average.
to identify anomalies.

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Examiner Comments

This response scored 2 marks, for the idea of reading the ruler at eye level will help to improve the accuracy of the measurement.

(2)

Place another wooden strip on top of ~~a~~ the one used, make sure it is a ~~straight~~ straight line and not bended, using a ruler or meter ~~to~~ measure the distance between the bottom of the load and the bottom of the non-bended wooden strip, take multiple readings and take an average of concordant results to insure accuracy

ResultsPlus
Examiner Comments

This response also scored 2 marks. This candidate has described a method that would obtain an accurate result using a ruler.

Question 10 (c)

Most candidates scored 2 marks in Q10(c)(i). Weaker candidates lost marks for not measuring carefully from the diagram or for forgetting to use the scale factor.

In Q10(c)(ii), the scales constructed and plotting of data were completed to a high standard. Few mistakes were seen in this part of the question.

Candidates experienced greater difficulty in drawing the curve of best fit in Q10(c)(iii). Some candidates simply connected the data points with straight lines whilst others drew their curves too far from the data points.

There were some excellent responses in Q10(c)(iv) and most candidate recognised that a straight line would be needed, which wasn't shown in the graph. However, candidates demonstrated some misunderstanding about the term proportionality, with many indicating that although the relationship wasn't directly proportional, it was proportional because as one variable increased the other also increased. These responses were not given any credit.

Question 11 (a)

Many candidates struggled to convert 1 hour in to seconds and, of those that did, some then seemed unsure what to do next. A significant number of candidates just gave a response of 1.

Question 11 (b)(i)

Most candidates were able to score 2 or 3 marking points in this question. The biggest issue for weaker candidates was the inability to rearrange the formula and so the answers given were the reciprocal of that required. Weaker candidates tended to also miss the conversion step from seconds to minutes.

Question 11 (b)(ii)

Candidates found this question very challenging and it highlighted some interesting misconceptions about electric circuits. Many thought that a longer cable would cause electrons to take more time to travel – basing their argument on speed = distance/time and electrons travelling at a constant speed. Only the most able candidates appreciated that a longer cable would have more resistance, which would reduce the charging current.

long cable will Transfer charges more slowly, so more time taken this is because The ~~speed~~ distance increases while The speed is constant. so $V = \frac{d}{T}$. so as ~~speed~~ distance increases time also increases.

ResultsPlus Examiner Comments

This response highlights a common misconception about electric circuits. The length of the cable will not have any impact on the drift velocity of the electrons.

As the length of cable increase, resistance increases, so it takes less time to recharge.

As the length of cable ~~increase~~ decreases, resistance decreases, so it takes more time to recharge.

ResultsPlus Examiner Comments

This response scored 1 mark. The candidate has recognised that the resistance of the cable would be greater, but has not linked this to a lower charging current.

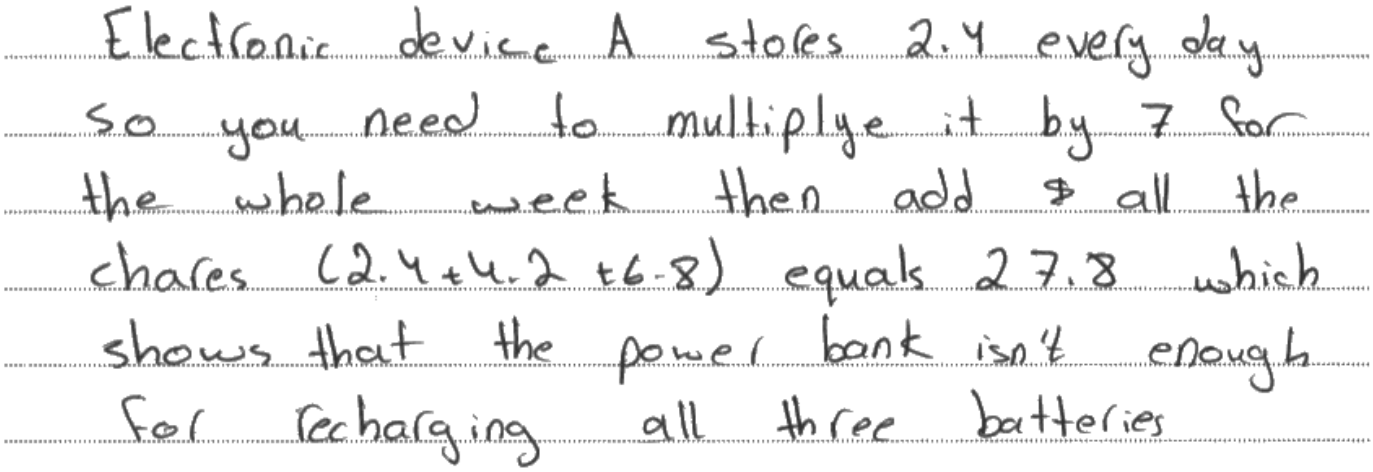
Using a long cable increases the resistance and so the current decreases and so the time taken to recharge increases.

ResultsPlus
Examiner Comments

An excellent (and concise) response that was awarded full marks.

Question 11 (c)

Many candidates were able access this question and do the calculations so MP1 and MP2 were seen very often. These candidates usually also scored MP3. However, some candidates did not provide a quantitative comparison between the total charge needed and the charge stored by the power bank, so missed out on MP2. MP4-6 were very rarely seen as most candidates did not attempt to think about the real world nature of the problem.


Electronic device A stores 2.4 every day so you need to multiplye it by 7 for the whole week then add 3 all the chares (2.4+4.2+6.8) equals 27.8 which shows that the power bank isn't enough for recharging all three batteries

ResultsPlus
Examiner Comments

This response scored 2 marks. The candidate has calculated the total charge needed (MP1) and concluded that the power bank is insufficient (MP3). However, they have not justified this with a quantitative comparison.

The maximum charge is not enough to recharge the batteries of the three devices because during the whole week the devices need 27.8 Ah because (2.4x7) + (4.2) + 6.8 = 27.8 while the power bank only provides 26.8 Ah.

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Examiner Comments

This response scored 3 marks. The candidate has calculated the total charge needed (MP1) and concluded that the power bank is insufficient (MP3). This time they have justified this with a quantitative comparison and so also score MP2.

device A takes up a total of 2.4x7 = 16.8 Ah for the whole trip.
device B takes up 4.2 for the trip and C takes up 6.8 for the trip.
16.8+4.2+ 6.8 = 27.8 Ah ☒ The required Ah is 27.8 but as the bank only stores 26.8, it is not suitable for the trip as it won't be able to charge all devices but could charge them partially.

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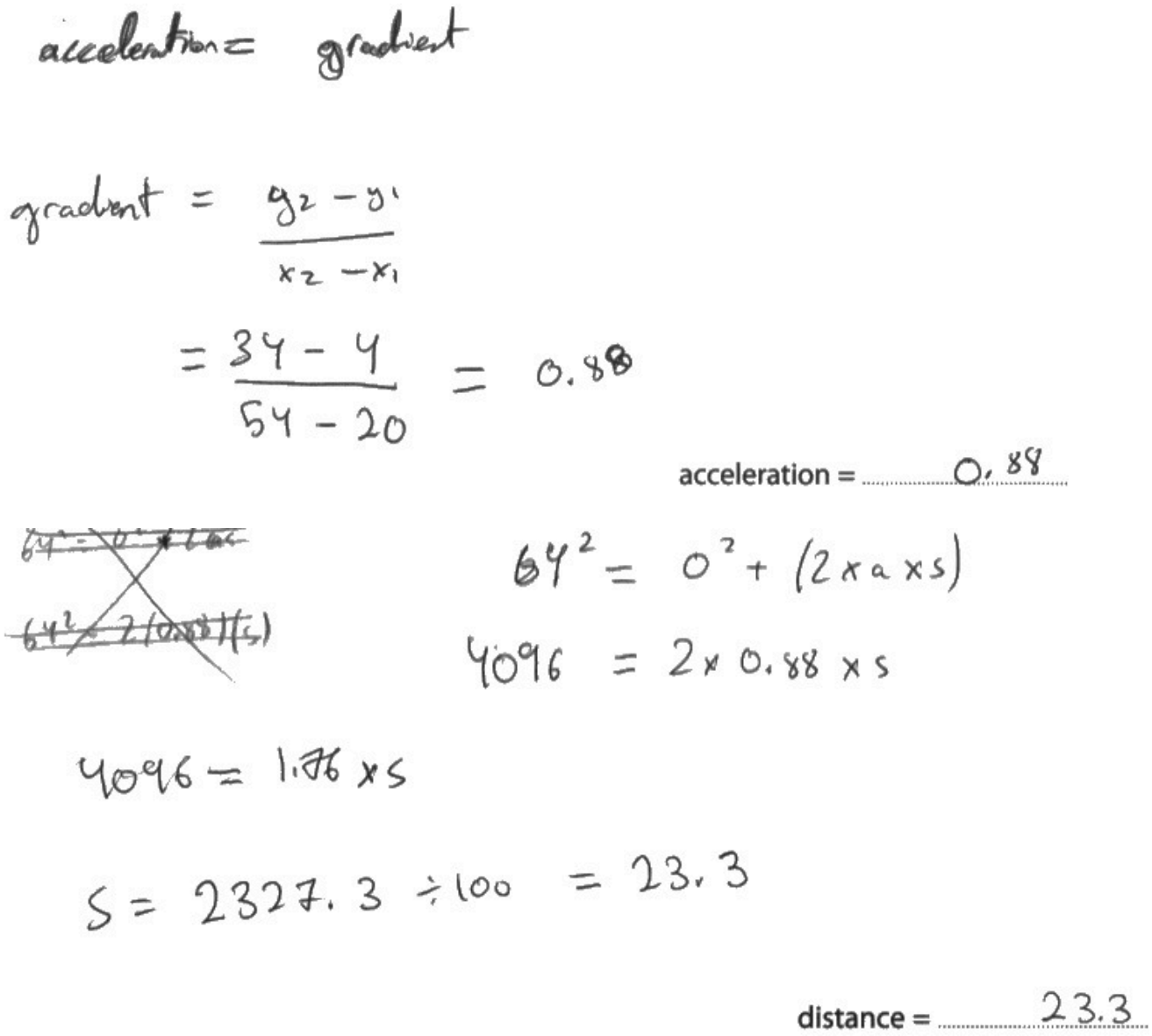
Examiner Comments

This response was awarded 4 marks. The total charge needed is compared to the charge stored by the power bank and a justified conclusion that it is insufficient is given. However, the candidate has gone a step further to suggest a way that the power bank could be used for the trip to gain an additional mark.

Question 12 (a)-(b)

Candidates found these calculations involving the graph very challenging, which was the original intention. Most candidates attempted to draw a tangent appropriately in Q12(a), but few then used this correctly to determine the acceleration. Many candidates simply read the velocity and time from this point on the curve and substituted them into the acceleration equation, which was not credited. Marks were awarded for how close the candidate's value was to the true value, which credited accurately drawn tangents.

A similar approach was used in Q12(b). Candidates were required to use an estimation method to determine the area under the curve. Candidates using more accurate estimation methods received more marks for their correct work. However, few candidates appreciated that they needed to determine the area to find the distance travelled.
Many candidates used $v^2 = u^2 + 2as$ and received no credit, due to this formula being invalid for non-constant acceleration.



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Examiner Comments

This candidate received 2 marks in Q12(a) for drawing a tangent and attempting to calculate its gradient. Their final answer is outside either of the allowed ranges due to making an error reading data from the graph.

In Q12(b), the candidate has used an invalid method and was awarded no marks.

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

$a = \frac{50 - 26}{20} = \frac{24}{20} = 1.2\ m/s^2$

acceleration = 1.2

(5)

Area under graph = distance

(trapezium)

Area of $R_1 = \frac{80 + 72}{2} \times 20 = 1520\ m$

Area of R_2 (rectangle) $= 40 \times 20 = 800\ m$

Area of R_3 (rectangle) $= 30 \times 40 = 1200\ m$

Area of R_4 (triangle) $= 30 \times \frac{1}{2} \times 20 = 300\ m$

Area of $R_5 = 21 \times \frac{1}{2} \times 20 = 210\ m$

Area of $R_6 = 4 \times 6 = 24\ m$

Area $= 24 + 210 + 1200 + 300 + 800 + 1520 = 4054\ m$

it is about 4054 m (not accurate)

distance = 4054 m

ResultsPlus
Examiner Comments

This candidate has used appropriate methods in both calculations to gain 3 marks in each part. However, the tangent drawn in Q12(a) has led to a slightly inaccurate value of the acceleration. Similarly, in Q12(b), the method used to determine the area lacks accuracy and so only scores 3 marks.

Gradient of the tangent = $\frac{\text{change in } y}{\text{change in } x}$

Change in y: 60 - 20 = 40

Change in x: 40 - 4 = 36

$\frac{40}{36} = 1.11$

acceleration = 1.1

Area of one small box: 2 x 2 = 4 m

Area of one large box: 20 x 20 = 400 m

Number of large boxes: 7

7 x 400 = 2800 m

Number of small boxes:

244

244 x 4 = 976

2800 + 976 = 3776

distance = 3776 m

ResultsPlus
Examiner Comments

This excellent response scored full marks in both calculations. The candidate has undertaken the calculations with care and precision.

Question 12 (c)

Most candidates recognised that the car was moving at a constant velocity after 80 seconds. However, only half of all candidates gained further credit for attempting to explain this. Some candidates gained a further mark for recognising that the forces on the car would be balanced or that the acceleration would be zero, but few candidates gained full marks.

At 72s the car started moving at a constant speed as shown in the graph then ~~count~~ continued to 100s so at 80s the car was moving at steady speed

ResultsPlus
Examiner Comments

This response scored 1 mark. The candidate has recognised that the car would be moving at a constant speed, but has not attempted to explain this.

the car is moving at a constant speed because the forces acting on the car become equal (balanced) ~~where the air resistance and friction~~ so there will be no accelerations. (resultant force is zero).

ResultsPlus
Examiner Comments

This comprehensive response scored 3 marks. The candidate has provided an excellent explanation of the motion of the car.

Paper Summary

Based on their performance on this paper, candidates should:

- Take note of the number of marks available for each question and use this as a guide for 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 use the formulae listed in the specification confidently in terms of substitution, rearrangement and evaluation.
- 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.

Grade boundaries

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