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Examiners' Report
June 2013

GCSE Physics 5PH2F 01

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Introduction

This examination sets out to allow candidates to demonstrate that they can accurately recall concepts and phenomena in physics and can communicate their understanding using both qualitative and quantitative models. The broad base of ideas used in the specification relates the understanding of significant concepts to important uses for today and in the future. The assessment is through multiple choice questions, short answers, extended writing, calculations and analysis. Candidates need to be familiar with the use of equations, be able to express their ideas clearly and concisely and interpret scientific data which is presented in a variety of ways.

The work produced for the examination showed that candidates have gained confidence in answering the six-mark questions. Generally they have become better able to assimilate information and present it in the form required to answer the question. However, many candidates are confusing important concepts in electricity such as current, power and voltage, and concepts in mechanics such as energy, force and work.

It is important that candidates are able to draw a single line of best fit on a graph. They also need to appreciate that a curved line has a greater significance than simply that one quantity increases as the other quantity increases.

The formulae sheet at the front of the examination paper should be familiar to candidates and should be used on a regular basis throughout the course. Although full marks are given for correct answers to calculations, with or without working, writing down the correct formula enables candidates to substitute in an equation even if they are unable to make further progress. It was also noticeable that a number of candidates seemed to confuse the divide and multiply function on their calculator.

The following report provides further amplification of these points with examples of candidates' responses in this examination.

Question 1a

The use of gamma radiation to sterilise medical equipment and to irradiate food was well known. There was less understanding of the uses of alpha and beta radiation.

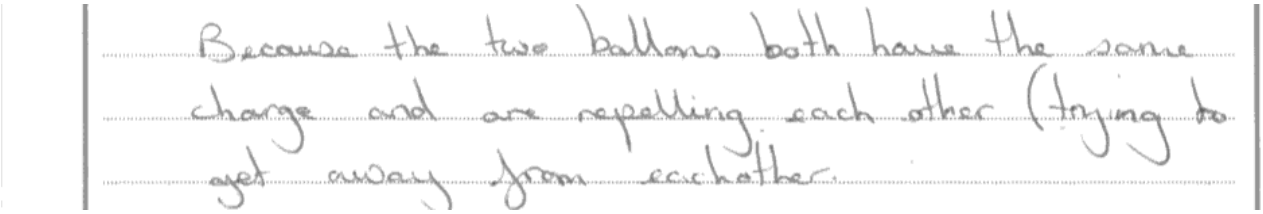
Question 1d

Most candidates could recall at least one precaution to be taken when working with radioactive samples; the most popular being methods of reducing exposure such as secure storage of the sample and avoidance of direct contact. Fewer considered reduction of dose by limiting the duration of exposure or the monitoring of that dose. Some considered, quite rightly, precautions which limited exposure of people other than the worker(s) by various control methods.

There were a surprising number of responses which suggested goggles to protect the eyes. It is possible that these candidates confused ultra violet radiation with radiation from radioactive sources.

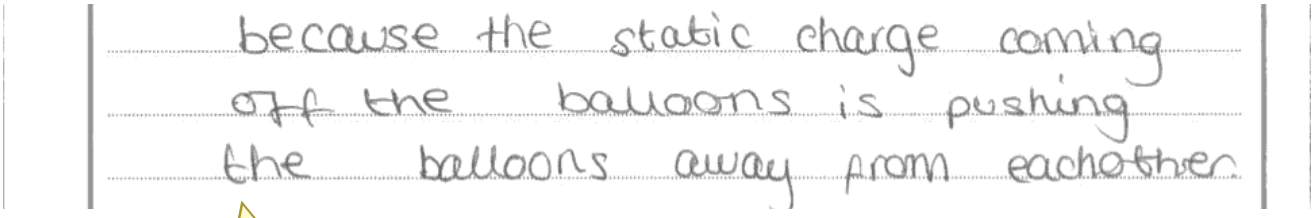
Question 2a

Most candidates correctly stated that the two balloons repelled each other. Better candidates could state that this was because they both had the same charge. At this stage in the question the nature of the charge had not been declared and examiners would accept 'both had positive charge' or 'both had negative charge'. There is still some misunderstanding of the term **static** with answers such as '*both balloons have static*' being fairly common.



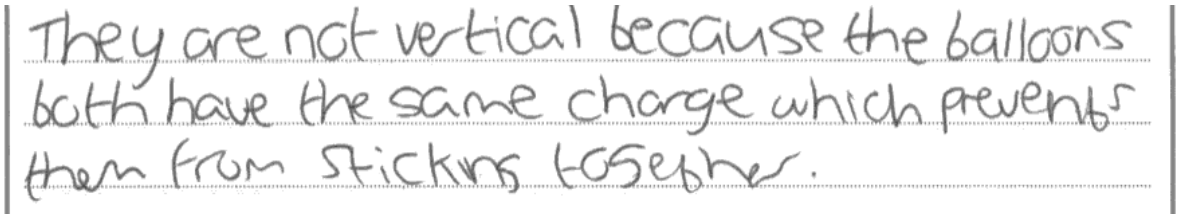
ResultsPlus
Examiner Comments

A good, clear answer which scored both marks.



ResultsPlus
Examiner Comments

This scored a mark for the idea that the balloons were pushing each other away, but *static charge* is too vague for the other mark.

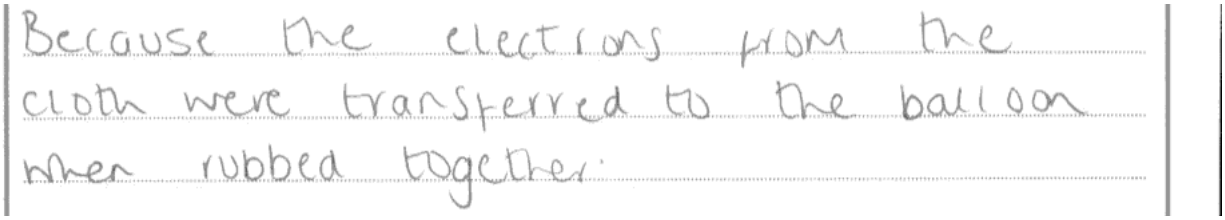


ResultsPlus
Examiner Comments

This gets a mark for writing that the balloons have the same charge but does not actually state that the balloons repel and so did not get the other mark.

Question 2bii

At this stage in the question, candidates had been told that the balloon had a negative charge and so answers which tried to give the balloon a positive charge could not be accepted. Those who appreciated that electrons could be transferred usually went on to give the correct direction from cloth to balloon: unlike candidates who thought that positive charge moved (either 'positive electrons' or 'protons'). Surprisingly few candidates mentioned friction even though this is clearly mentioned in the specifications. This would have given a mark regardless of any subsequent errors in nature and direction of charge movement.



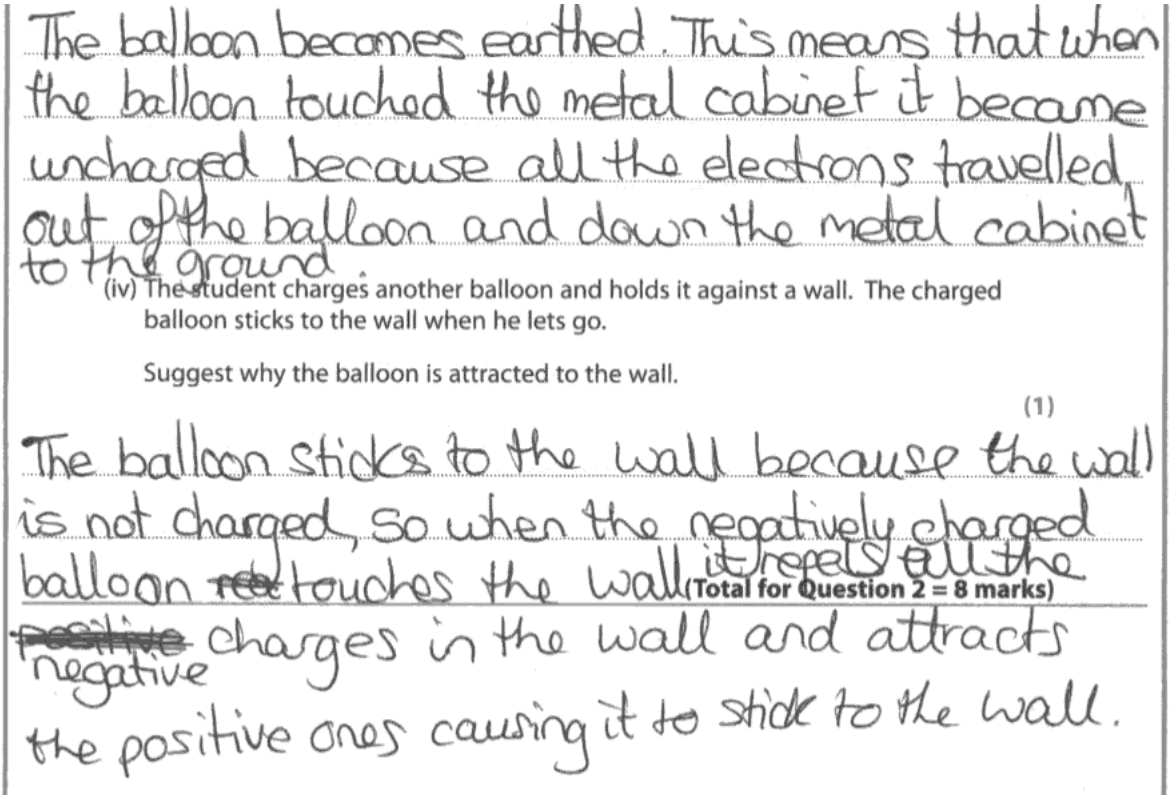
ResultsPlus
Examiner Comments

A good, clear answer which scored two marks.

Question 2biii-iv

In part iii, many candidates seemed to miss the point that the cabinet was metal and tried to describe the balloon being attracted or repelled. Examiners were looking for responses which described the movement of charge from balloon to cabinet. Failure to mention the nature of the charge was not penalised but an incorrect statement that positive charge moved was not accepted. Earthing is mentioned explicitly in the specification and candidates who correctly used this term scored a mark. The flow of electrons in a metal is also in the specification and mention of this scored a mark.

In part iv, examiners were looking for either correct use of the term induction or a description in terms of charge separation at the surface of the wall. It was pleasing to see that a good many candidates were able to give a very clear description of this process. Candidates who wrote that the wall had a positive charge without directly specifying that this was at the surface, were given the benefit of the doubt. Candidates who only stated that '*opposite charges attract*' did not give sufficient detail to score a mark.



The balloon becomes earthed. This means that when the balloon touched the metal cabinet it became uncharged because all the electrons travelled out of the balloon and down the metal cabinet to the ground.

(iv) The student charges another balloon and holds it against a wall. The charged balloon sticks to the wall when he lets go.

Suggest why the balloon is attracted to the wall.

(1)

The balloon sticks to the wall because the wall is not charged, so when the negatively charged balloon ~~not~~ touches the wall it repels all the ~~positive~~ negative charges in the wall and attracts the positive ones causing it to stick to the wall.

(Total for Question 2 = 8 marks)

ResultsPlus
Examiner Comments

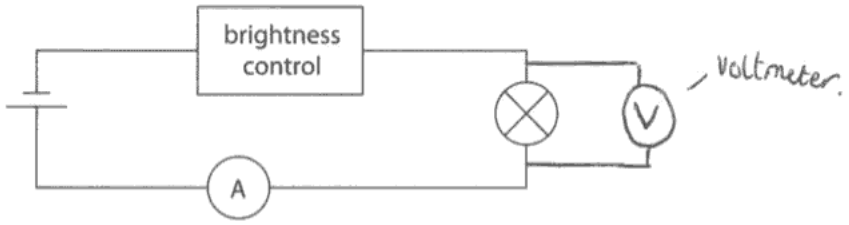
This response easily made all of the possible mark points in the first part. The description of electrostatic induction is good and is typical of many responses seen.

Question 3bi

The majority of candidates knew the correct symbol for a voltmeter but most of them placed the voltmeter in series with the other components. A large number seemed to know that it had to be placed in parallel with something but then placed it across the ammeter or the battery.

The voltmeter must be connected across the lamp to measure the voltage across the lamp.

(b) She builds this circuit to test the lamp in the torch.

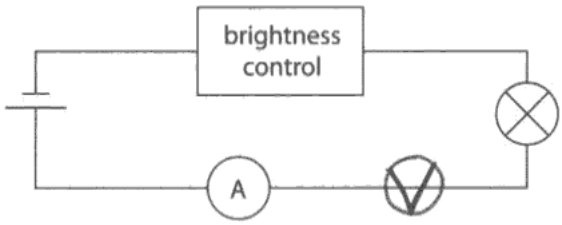


(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the lamp.

(1)

ResultsPlus
Examiner Comments

This is a correct answer.



ResultsPlus
Examiner Comments

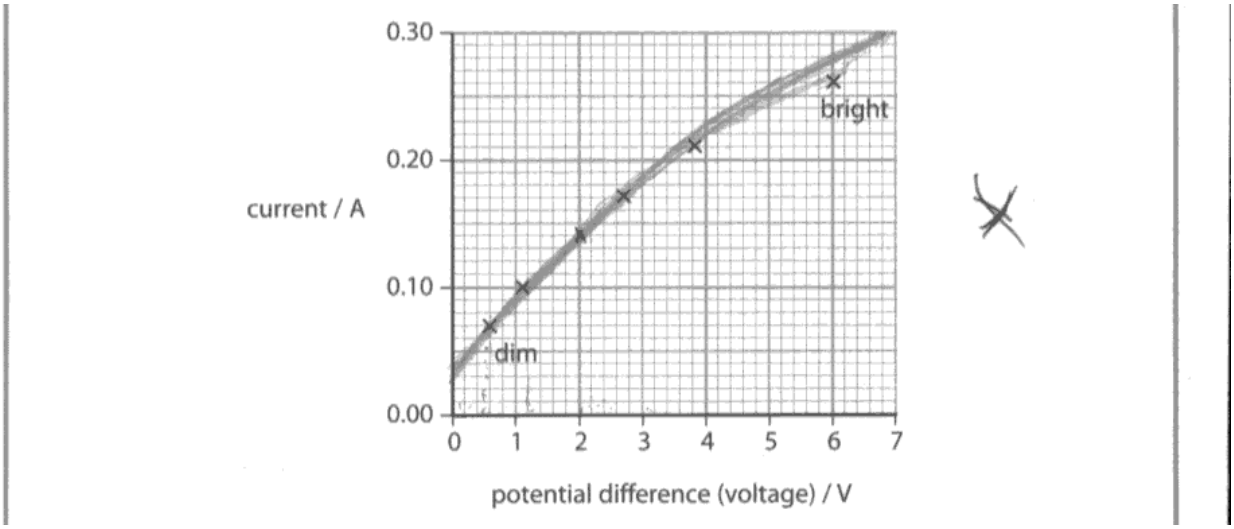
This is an incorrect answer.

Question 3bii

Because the formula at the front of the booklet has V as the subject of the equation, candidates were provided with a box containing the re-arranged expression for calculating current. Most candidates were able to substitute the correct values into this expression. The evaluated answer was not a whole number and better candidates were able to round this to a suitable number of significant figures to give an answer of 23. Examiners would, however, accept a value which could be rounded down to 23.

Question 3ci

Most candidates made an attempt at drawing a smooth curve through the points. There were very few 'dot to dot' lines and very few straight lines of best fit. Examiners allowed a tolerance of half a square but there were a significant number of lines which missed one of the points (usually at the ends) by more than the tolerated amount. No data was supplied for current at 0 volts and so the line did not need to go to the origin.

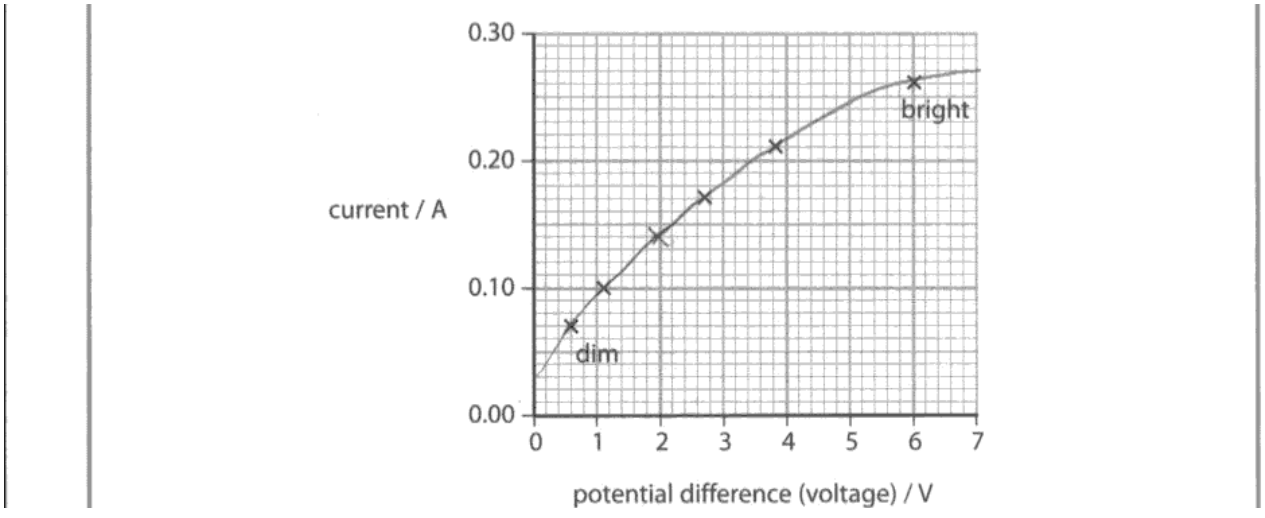


ResultsPlus
Examiner Comments

This line is much too thick and consists of two or more lines in some places. Some parts of one line do go through some points but other parts of other lines are too far away from the points. Most of the lines miss the top point completely.

ResultsPlus
Examiner Tip

Do not draw a graph line with a thick pen. You could make a few attempts with pencil and then draw your final, best, line in pen. Then erase your pencil lines. Make sure that you only end up with one line.



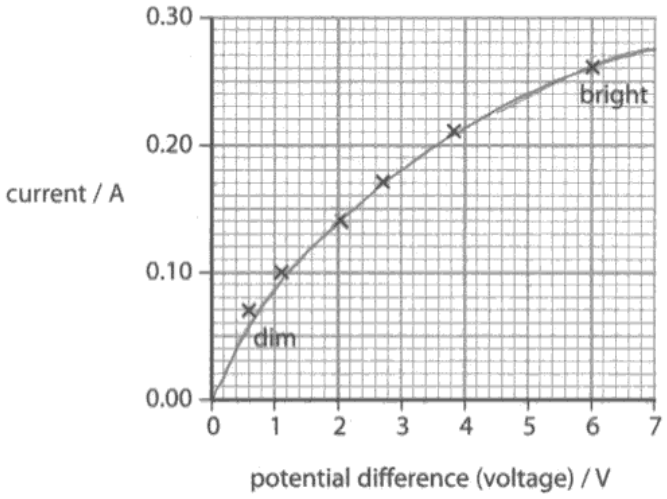
ResultsPlus
Examiner Comments

This is a nicely drawn graph and the line goes through all the points. It scores 2 marks.

The line did not need to go through the origin and did not need to be extended beyond the top point. Examiners ignored any part of the line that went beyond the top point or below the bottom point.

ResultsPlus
Examiner Tip

Practise drawing smooth lines on a graph.



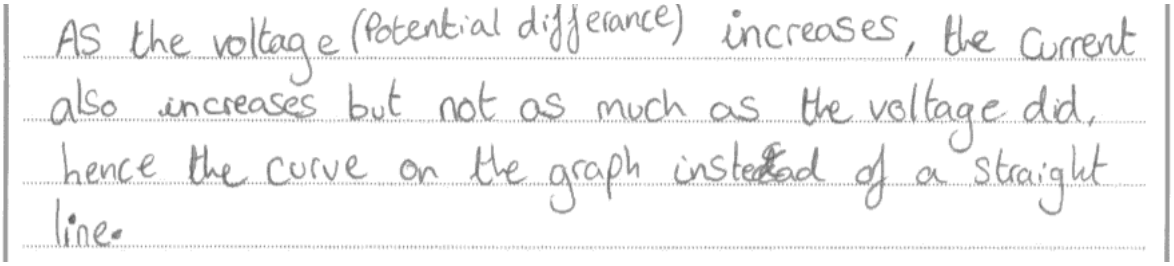
ResultsPlus
Examiner Comments

The top half of the line is good but it starts to wander towards the bottom. It misses the last point by too much.

Question 3cii

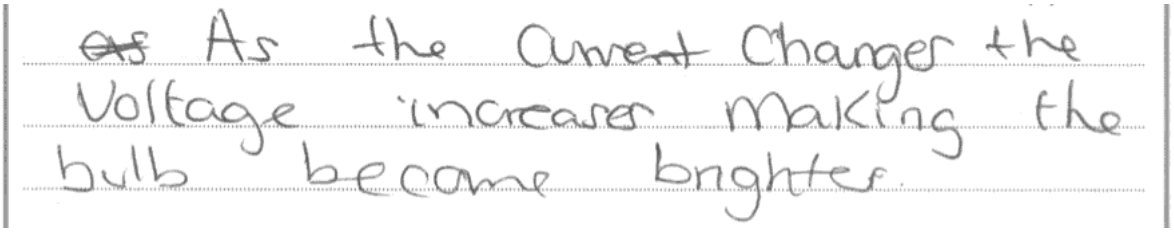
Most could state that the current increased as the pd was increased. There were very few who recognised that the two were not directly proportional. Credit would have been given for a statement which implied that the gradient changed or simply one which mentioned that the graph line was a curve. In spite of the fact that the previous stem had referred to a *curve of best fit* very few candidates mentioned this.

There was one mark for writing that the current increased as the voltage increased. The second mark was for writing that the two were not directly proportional or that the line curved.



ResultsPlus
Examiner Comments

This is a good answer which scored two marks.



ResultsPlus
Examiner Comments

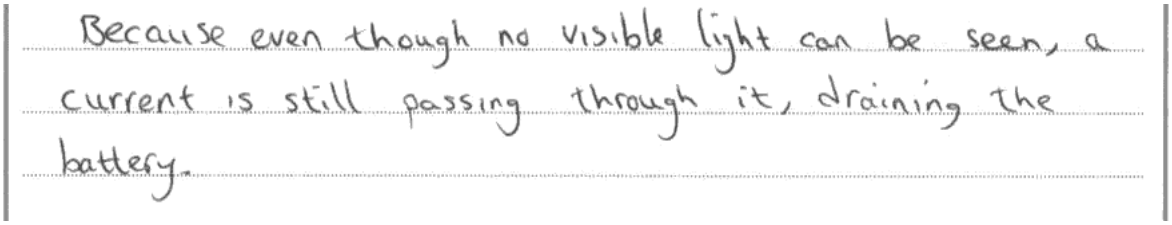
The candidate has written that the current *changes.* This is not the same as *increases.* It did not score any marks.

ResultsPlus
Examiner Tip

A *change* could be getting bigger or getting smaller. Make sure that you express yourself clearly.

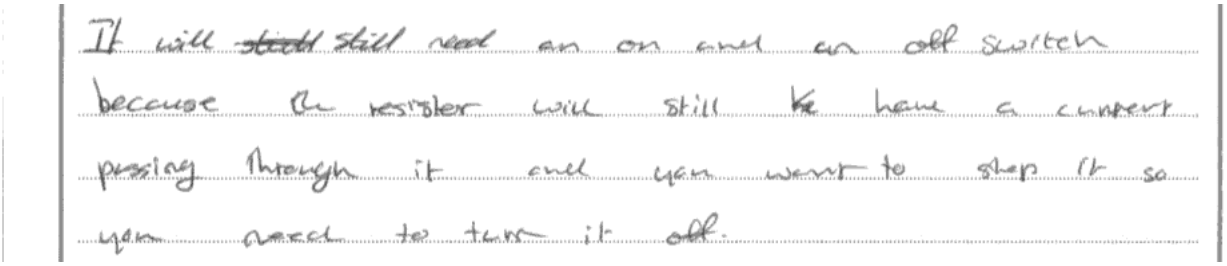
Question 3ciii

Candidates were expected to recognise that when the control was at the dim position, there was still a current (of 0.07 A) in the circuit. They could then go on to suggest that this would waste energy stored in the battery. They could express this in terms of draining the battery. Examiners were looking for correct use of terms like current and energy. Very many candidates used words such as power, electricity, voltage and current incorrectly.



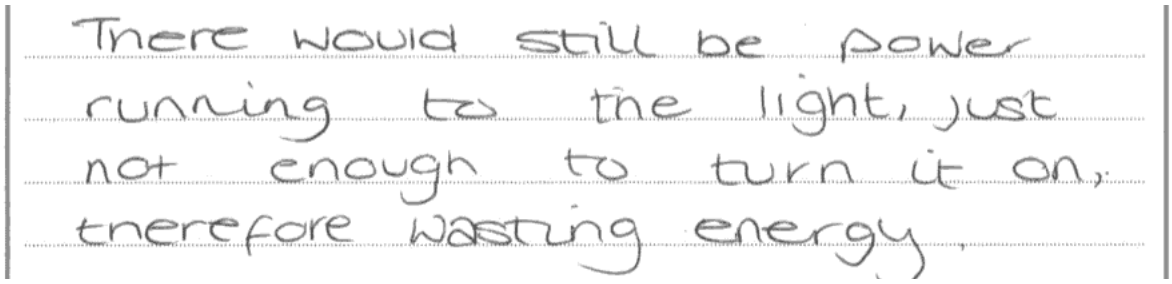
ResultsPlus
Examiner Comments

This simple answer scores both marks.



ResultsPlus
Examiner Comments

This makes the point about a current in the circuit and scores the first mark. It does not go on to make the second point.



ResultsPlus
Examiner Comments

This makes a correct point about wasting energy but the first statement is incorrect.

ResultsPlus
Examiner Tip

Power is not the same as current. Make sure you know how to use these words correctly.

Question 4ai

A large number of candidates confused nuclear stability with being chemically inert or unreactive.

It has a full outer shell of electrons

ResultsPlus
Examiner Comments

This explains why an element might be chemically unreactive. It did not score a mark.

will not decay

ResultsPlus
Examiner Comments

This is an acceptable answer.

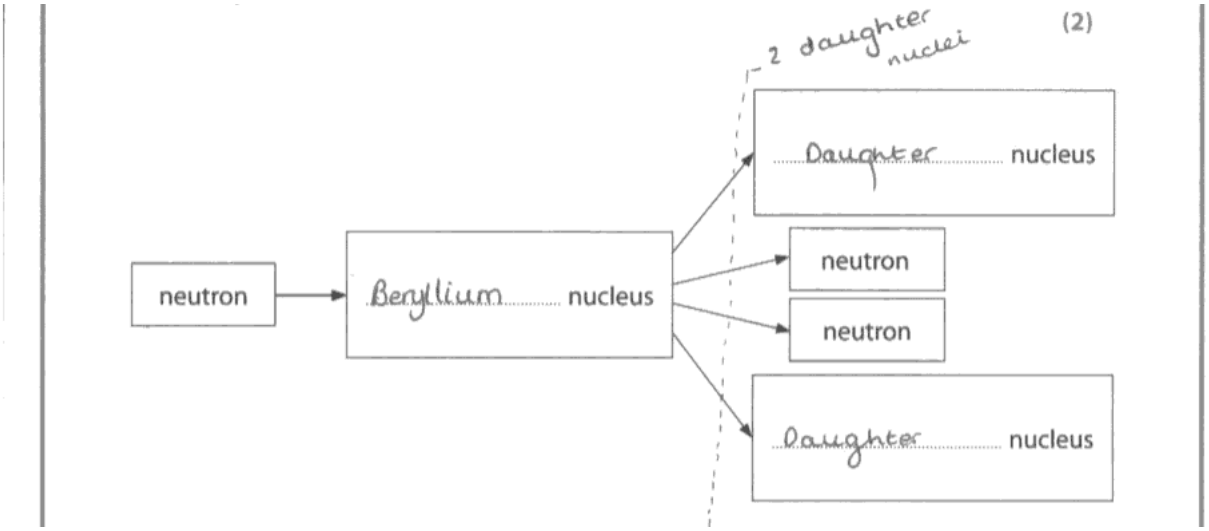
non-radioactive,

ResultsPlus
Examiner Comments

This is a short, correct answer.

Question 4bi

The idea of a flow chart to describe nuclear reactions seemed unfamiliar to many candidates. Examiners were looking for beryllium in the first box for a mark. The second mark was for recognising that an alpha particle was a helium nucleus. Very few candidates scored two marks.



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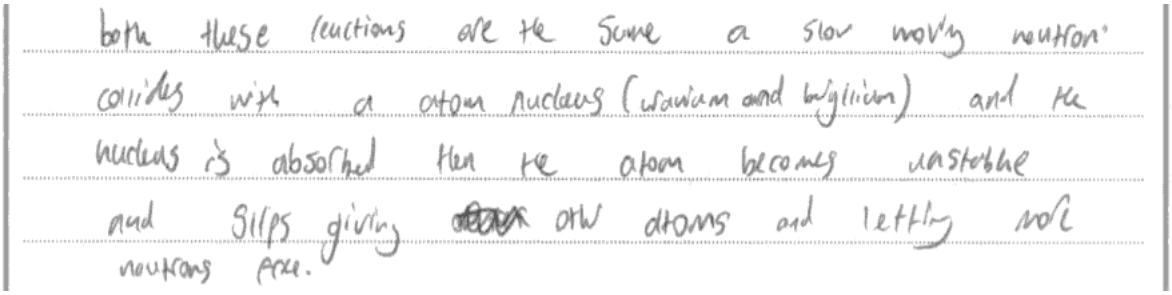
Examiner Comments

Beryllium in the first box scores a mark. Although examiners were looking for helium in the two right hand boxes, the term daughter nuclei is used to describe the products of nuclear fission. It is correct in this context and so was accepted for the second mark.

Question 4bii

Candidates could describe the similarities between the two reactions; such as a neutron entering the nucleus which becomes unstable and splits to produce more neutrons and smaller (daughter) nuclei. They could also describe the differences; such as that the daughter nuclei from uranium fission are not helium but heavier nuclei. Most candidates could score at least one mark for describing fission and many scored all three marks easily. There is still much incorrect use of terms like atom, nucleus, molecule and even cells.



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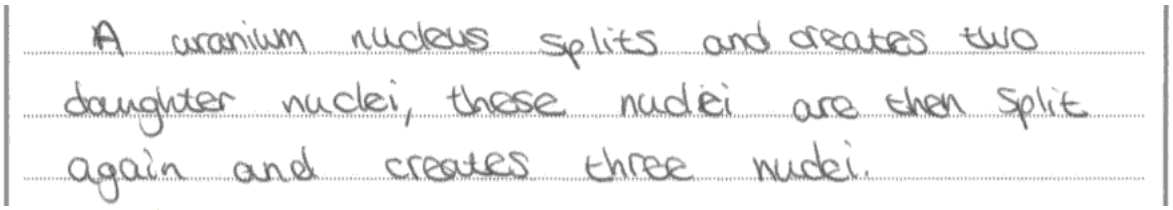
Examiner Comments

A mark was given for mentioning a neutron coming in. A mark was given for the nucleus becoming unstable and a mark for neutrons being released. The examiner would NOT have accepted '*giving other atoms*' (it should be '*other nuclei*') but the candidate had scored three marks with the rest of the response.

There was a widespread misunderstanding that the daughter nuclei would continue to divide.

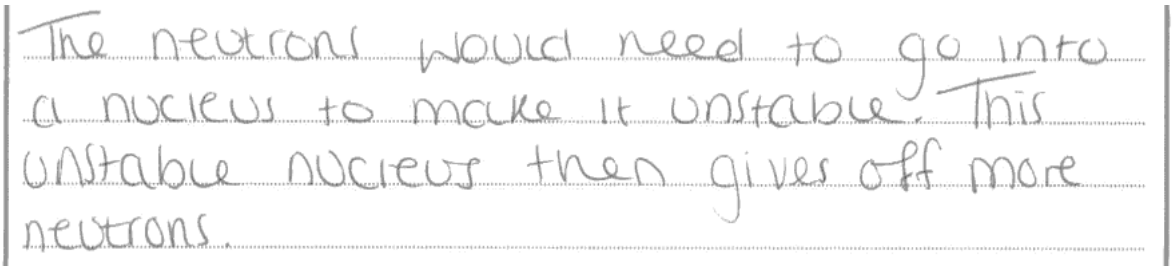


ResultsPlus
Examiner Comments

A mark was given for the nucleus splitting and another mark for mentioning daughter nuclei. No marks for those nuclei splitting again.

Question 4biii

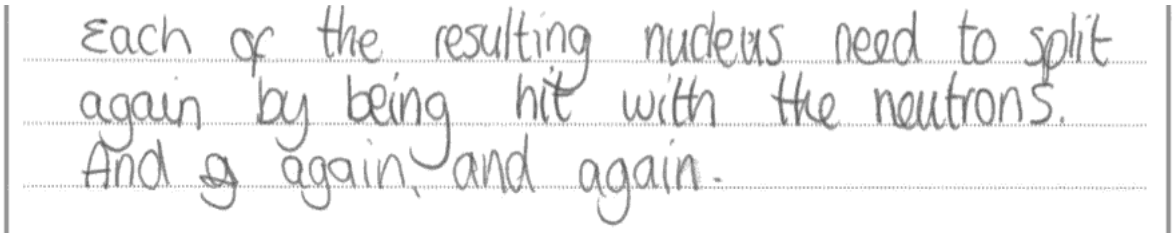
Although the general idea of nuclear chain reaction was widely known, many candidates confused this with chemical reactions.



ResultsPlus
Examiner Comments

This is an acceptable answer. It describes how a neutron can split a nucleus which then produces more neutrons. It scored both marks.

Many candidates were confused about the sequence.



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Examiner Comments

There is a mark here for recognising that neutrons must collide with a nucleus for the chain reaction to proceed. However, the candidate has incorrectly stated that the resulting nuclei are split again. 1 mark only was given.

Question 5aiii

Candidates should be aware that if they are asked to state a value then a calculation is not necessary. This question asked candidates to 'state the size' of the resultant force between 10s and 15s. The graph shows that the car had a constant velocity during this time and so the resultant force must be zero.

ResultsPlus
Examiner Comments

The answer should be simply 0.

ResultsPlus
Examiner Tip

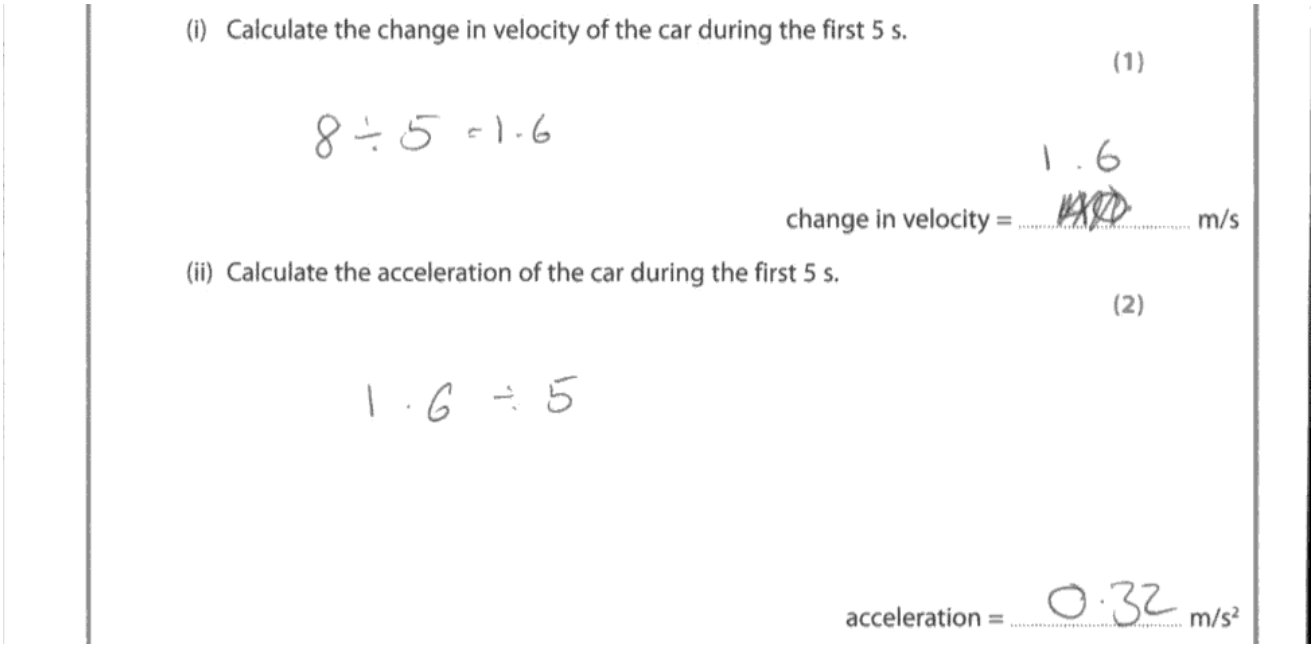
You do not need to do a calculation if you are simply asked to 'state the size' of something.

Question 5ai-ii

For the first part of this question (i), candidates needed to subtract the starting velocity (0) from the velocity at 5s (8 m/s) to arrive at an answer of 8 m/s. Many candidates calculated the acceleration in this part by finding the gradient of the line.

In the second part (ii), candidates needed to divide the change in velocity in part (i) by the time taken (5s) to find the acceleration (1.6 m/s^2). Provided that working was shown, examiners allowed full credit for an error carried forward from (i) into (ii).

Although the answer to part (i) is incorrect, the candidate has carried on to use the value to calculate acceleration and has shown the working. The examiner could clearly see that the candidate knows how to find acceleration and awarded 2 marks for part (ii).



(i) Calculate the change in velocity of the car during the first 5 s.

(1)

8 ÷ 5 = 1.6

change in velocity = 1.6 m/s

(ii) Calculate the acceleration of the car during the first 5 s.

(2)

1.6 ÷ 5

acceleration = 0.32 m/s^2

ResultsPlus
Examiner Comments

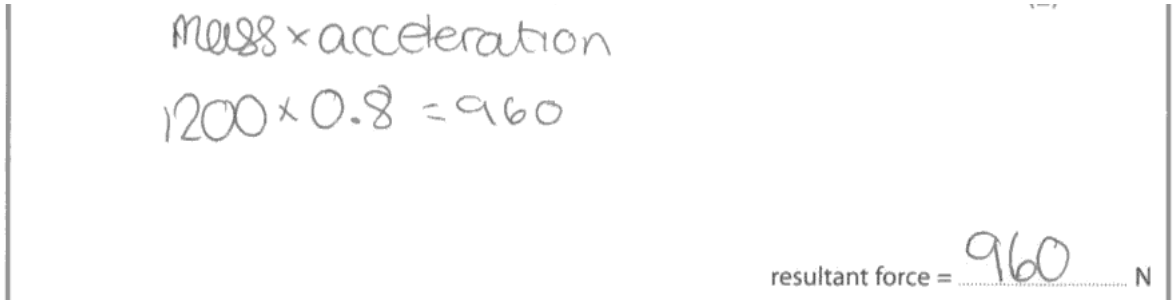
Candidates need to be clear about the difference between 'change in velocity' and 'rate of change in velocity' (ie acceleration).

ResultsPlus
Examiner Tip

'Calculate' does not always mean that you have to multiply or divide. It can also mean add or subtract.

Question 5b

This was a straightforward calculation for most candidates. The most common error seemed to be incorrect use of the calculator by carrying out a division of 1200 by 0.8 to produce a result of 1500. As usual, candidates could score 1 mark if the substitution was correctly shown.



ResultsPlus
Examiner Comments

This clearly laid out response scored 2 marks.

A mark was given for substituting the correct values into the equation.

ResultsPlus
Examiner Comments

The expression 1200 Kg x 0.8 is correct for one mark.

Unfortunately the candidate seems to have used the divide function on the calculator and so could not get the second mark.

resultant force = 1500 N

ResultsPlus
Examiner Comments

The candidate may have made the same mistake and pressed divide rather than multiply on the calculator. Unfortunately, there was no working shown and so no marks were scored.

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Examiner Tip

Always show your working.

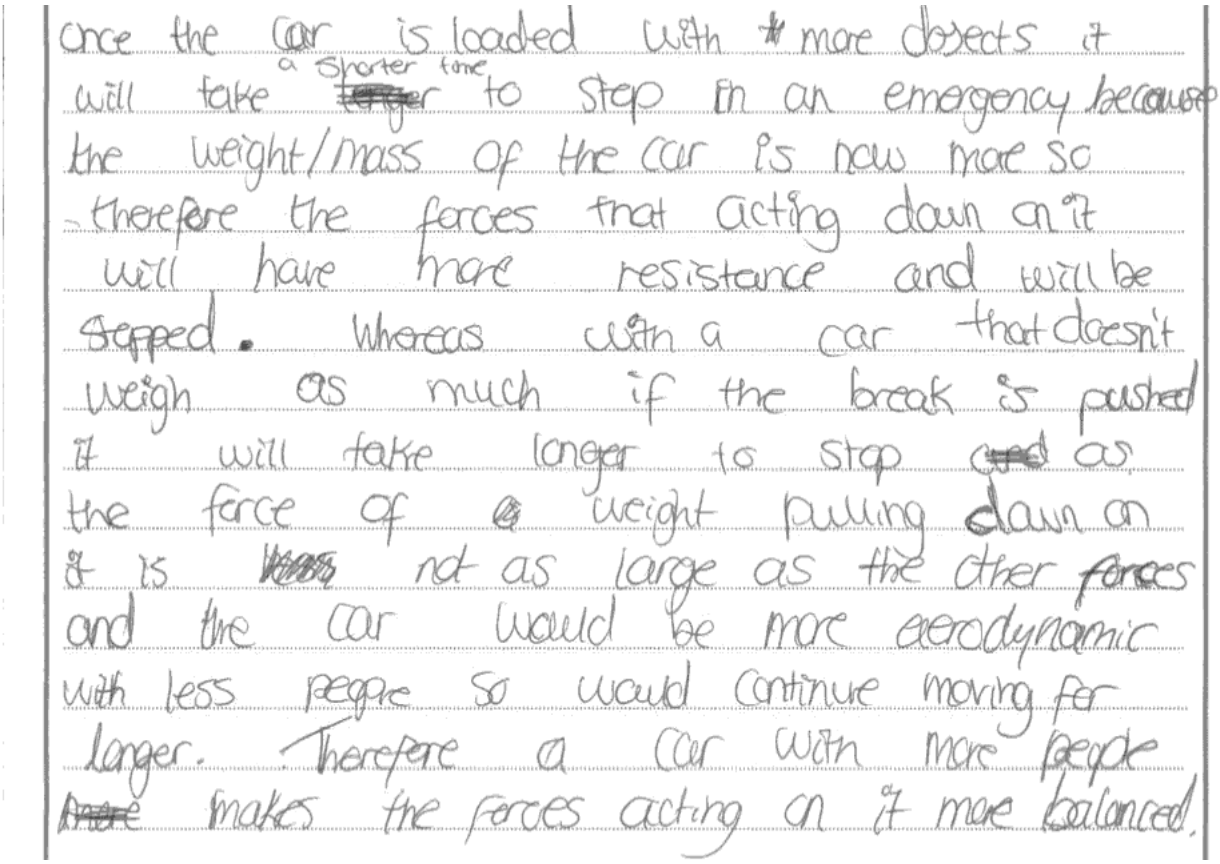
Question 5c

Most candidates realised that the extra passengers and luggage would increase the overall mass of the car. However, very many expressed this as an increase in weight rather than mass. This seemed to lead them towards considering downwards forces on the road and, very often, increase in friction. They then drew the conclusion that this would make the car stop more quickly in an emergency. There was a widespread misunderstanding that it was friction between the tyres and the road which was responsible for stopping the car when the brakes were applied. It was surprising that a large number of candidates thought that a heavily loaded car could stop more quickly than one with just the driver.

Candidates who correctly used the term 'increase in mass' very often went on to reason that the car would take a longer time to come to halt. This was sometimes nicely expressed in terms of momentum or kinetic energy and sometimes expressed in terms of forces and rate of change of velocity.

It was sometimes difficult for the examiner to decide whether 'takes longer to stop' referred to a longer time or a greater distance.

There were quite a few candidates who suggested that the passengers might distract the driver. They often went on to give a good description of how this could affect overall stopping distance by increasing the thinking distance. Examiners gave credit for this.



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Examiner Comments

This answer makes a correct statement about the mass or weight increasing when the car is fully loaded. This is a level 1 response. It then goes on to consider resistance and forces pulling the car down to arrive at a conclusion that the car will stop quicker than an unloaded car. This is incorrect and so cannot reach level 2. It scored only 2 marks.

This is because there is a heavier mass and this means that the resultant force will change, so it will take the car longer to stop.
The mass is pushing down because of gravity, and the air resistance is making the car slower than if there was air. so the resultant force of all these forces would be bigger, however the lighter car's resultant force would be smaller, ~~the~~ the ~~car~~ lighter car would take a shorter time to slow down ~~beg~~ because its mass is lighter so less gravitional force.

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Examiner Comments

The candidate links the increase in mass with taking 'longer to stop'. It is not clear whether this is a longer time or a longer distance. The answer goes on to describe air resistance and gravity which is not relevant in this situation. It then goes on to mention resultant forces, but, once again, this is not in the correct context. The examiner ignored the second and third sentences. The candidate eventually goes on to state that the lighter car takes a shorter time to stop without mentioning distance. This is a good level 2 response but does not quite make the links clear enough to reach level 3. The quality of written communication is appropriate. It scored 4 marks.

~~Bec~~ Because the force will change and increase meaning it will take longer to stop because force is measured by mass x acceleration and because the car has a higher mass it will take longer to slow down in a emergency meaning it order requires a bigger distance away in ~~to~~ to stop on time.

ResultsPlus
Examiner Comments

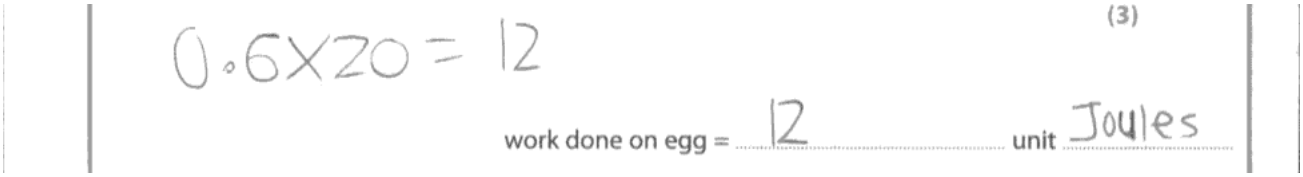
Although it not clear what force is being referred to, the answer makes very good points about an increase in mass resulting in a longer time to stop and so a longer distance travelled. This is a level 3 response. The quality of written communication is appropriate for this level. It scored all 6 marks.

Question 6a

Only a minority of candidates knew that kinetic energy was being gained as the egg fell. Most gave the answer 'gravitational potential energy'.

Question 6b

Most candidates carried out the calculation correctly but many then gave an incorrect unit.

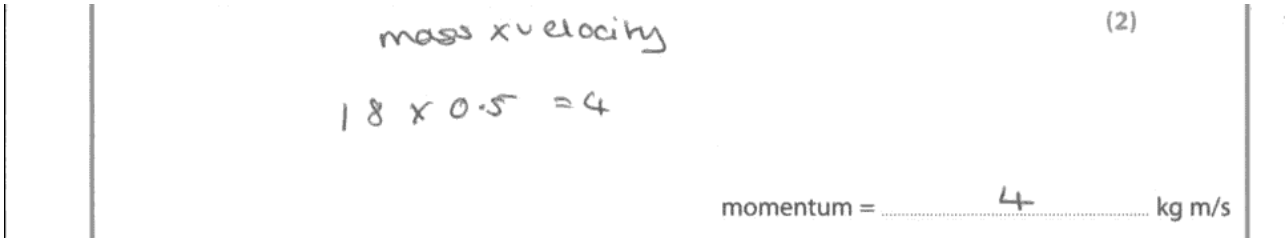


ResultsPlus
Examiner Comments

This is a well laid out response with the correct value and an acceptable unit. It should be spelt with a lower case j.

Question 6c

Most candidates gave the correct answer of 9 (kg m/s). As usual, credit could be given for a correct substitution into the equation even if the evaluation was wrong.



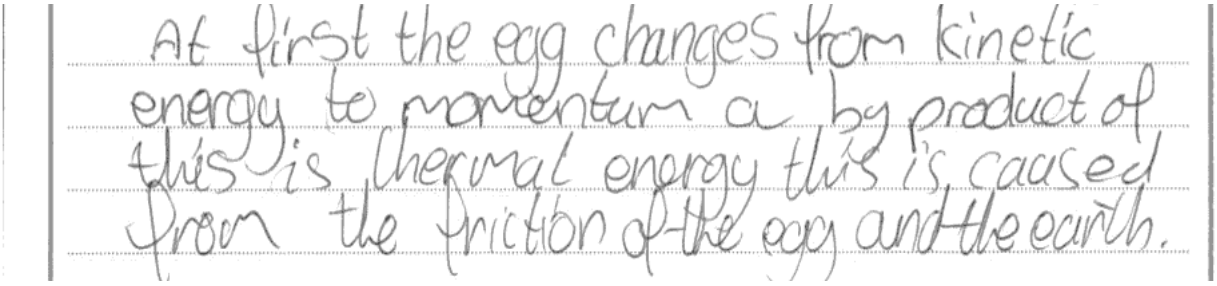
ResultsPlus
Examiner Comments

One mark was given for the substitution (18 x 0.5).

Question 6d

Examiners were looking for a description of energy changes. This could have included kinetic to gravitational potential as the egg rose, or vice-versa as the egg fell. Credit would also have been given for describing other changes such as kinetic to sound when the egg hit the floor. A statement about conservation of energy would also have been accepted. There seems to be much confusion about energy among candidates entered for this paper. Energy was often used as another word for force and/or momentum. A large number of candidates wrote entirely about forces without mentioning energy at all. They could not score any marks for this question. Many candidates could mention kinetic energy and gravitational energy but it was not clear that they appreciated that there was a gradual conversion between the two. There was a widespread view that the change occurred suddenly when the egg was at the top of the trajectory.

Many candidates could give a simple description of energy change from one type into another.



ResultsPlus
Examiner Comments

The candidate has written that kinetic energy changes into thermal energy. This is a level 1 response. There is some confusion about momentum. It seems to imply that momentum is a type of energy (which is wrong). There is not sufficient detail to bring it to level 2. This scored 2 marks.

The egg gains upthrust, and air resistance when it is threw into the air, The egg throughout the sequence uses kinetic energy. when the egg reaches 10m and begins to fall it gains gravitational potential energy, when the egg hits the ground the energy is lost from the egg and ~~energy~~ given to the surroundings, as energy can only be transferred and not destroyed.

ResultsPlus

Examiner Comments

This response starts with a description of forces which is not relevant here. However, it does go on to describe a change from kinetic energy (KE) to gravitational potential energy (GPE) even though it implies that the GPE increases as it falls. The final sentence is an acceptable description of conservation of energy and was enough to lift this to a level two and score 4 marks.

When the egg is in the students hand the egg has gravatational potential energy, when the student throws it up it will accelerate and will have a kinetic energy and as it gets higher its kinetic energy starts to change to gravational potential energy because its accelleration and velocity are decreasing ad when it reaches its highest point all the energy will be gravatational potential and as it falls its velocity and acceleration will increase and this will be kinetic energy and when it hits the floor all the kinetic energy will turn to sound and heat energy.

ResultsPlus

Examiner Comments

This is a very clear description of energy changes which scored 6 marks.

Paper Summary

In order to improve their performance candidates should:

- become familiar with the information on the formulae sheet and use it in the examination
- read the question carefully and underline the key words, for example 'energy changes' in Q6(b)
- name the forms of energy when describing energy transfer
- practise drawing a neat, single line of best fit; particularly where this is a curve rather than a straight line
- show substitution in equations for calculations instead of just giving the answer
- make sure that they know the difference between key concepts like current, voltage and power and between key terms like atom and nucleus.

Grade Boundaries

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

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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