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Examiners' Report
June 2013

GCSE Physics 5PH2H 01

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Introduction

This unit is divided into six topics and all six topics are tested in the examination.

The topics are:

- controlling and using electric current
- static and current electricity
- motion and forces
- momentum, energy, work and power
- nuclear fission and nuclear fusion
- advantages and disadvantages of using radioactive materials.

It was intended that the examination paper would allow every candidate to show what they knew, understood and were able to do. To achieve this, the parts of each question increased in demand as the question progressed. Within the question paper, a variety of question types were included, such as objective questions, short answer questions worth 1 or 2 marks each and longer questions worth 3 or 4 marks each. The two 6-mark questions were also used to test quality of written communication.

Successful candidates were:

- well grounded in the fundamental knowledge required
- willing to think, use their knowledge to solve new problems and apply their knowledge to unfamiliar situations
- able to analyse and interpret data in graphical form
- able to tackle calculations methodically and show the stages in their working
- able to construct their explanations in a logical order, using the marks at the side of the questions as a guide.

Less successful candidates:

- had gaps in their knowledge
- found difficulty in applying their knowledge to new situations
- found difficulty in analysing and interpreting data in graphical form
- did not show their working in calculations
- did not think through their answers before writing.

The quality of written communication (QWC) was generally appropriate to the level of response.

When it was not, the mark within that level was reduced, if possible.

This report will provide exemplification of candidates' work, together with tips and/or comments, for a selection of questions. The exemplification will come mainly from questions which required more complex responses from candidates.

Question 1 (a) (ii)

This question was mainly based on the act of cleaning a trophy which comprises a metal cup on a plastic base.

(ii) Explain why the base gains a negative charge when she rubs the trophy with the cloth.

(2)

because the electrons are transferred from the cloth to the base of the ~~base~~ trophy.

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Examiner Comments

Many demonstrated a clear link between the thing moving and the direction. Some were more vague and omitted the words 'the base of' from a response such as that shown. Others scored the second mark using the (loose) idea of friction. There were the usual incorrect references to positive electrons and proton movement.

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Examiner Tip

Take every opportunity to reinforce the concept that it is the negative electrons which move, either in electrostatics or when there is a current in a wire. Only in electrolysis, really, do positive charges move. Refer to the structure of the atom to provide a reason for this. (See also comments for 3bi.)

Question 1 (a) (iii)

Normally, 'suggest' questions are worth a single mark. This particular item was worth two marks.

> (iii) The metal cup does not become charged when she rubs the trophy.
> Suggest why the cup does not become charged. (2)
>
> Because metals are good electric conductors. This means electrons flow through them with ease and do not separate easily.

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Examiner Comments

This response was only worth 1 mark. It is insufficient to say either 'metals are conductors' or 'the cup is earthed'. Both of these ideas are necessary for the suggestion. Misconceptions were rife.

For example: some candidates referred to 'the base is earthed' others contradicted themselves by writing 'as metals are conductors, the electrons are held tightly in place' a common lack of precision was that 'metals are not insulators', which is not the same as 'metals are conductors' metals can be charged provided they are insulated. Note this is different from saying they are insulators.

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Examiner Tip

Read through your answer at the end if you have time. Make sure you have not contradicted yourself.

In contrast, this example contains both ideas even though not well expressed.

> (iii) The metal cup does not become charged when she rubs the trophy.
> Suggest why the cup does not become charged. (2)
>
> Because the cup is made of metal, which is not an insulating material, it is a conductor, so electrons will not be knocked off to form a charge, it will become earthed.

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Examiner Comments

This was awarded 2 marks.

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Examiner Tip

This example is suitable for presenting to students, during lessons, in a variety of redacted forms, to illustrate linguistic points.

The idea of precision in writing is returned to in item 2cii.

Question 1 (b)

There were 2 marks for this item - for stating the situation and for stating between which objects/people the spark passed. One of the most common answers referred to lightning passing from a charged cloud to the ground.

Other acceptable examples included pulling clothes off over your head and touching a car when charged up because of contact between driver's clothes and seat. Pressing on/off light switches was not accepted and nor were references to sparks caused by high temperatures.

(b) Describe **one** situation where separation of electric charge can create a spark.

(2)

It can create a spark when you rub your nylon shoes/ socks on a carpet and then touch a door handle as you have built up static electricity from rubbing them together.

(Total for Question 1 = 8 marks)

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Examiner Comments

The situation was clearly explained. There was sufficient to score the second mark because there was linkage between the charged person and the door handle.

Sometimes, the situation was ambiguous.

(b) Describe **one** situation where separation of electric charge can create a spark.

(2)

when you touch a metal object, e.g a door handle the electrons move from you and to the door handle which creates a small spark.

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Examiner Comments

Here it was not clear who or what was charged but there was enough to score the second mark, only.

Question 2 (c) (i)

There were three explicit calculations on this paper - 2ci, 3aiii and 5aii. All were good discriminators near the C/D boundary. Near the A boundary nearly all scored full marks.

(c) (i) Calculate the change in gravitational potential energy as the student falls 50 m.

Give the unit.

(3)

GPE = M × g × h

= 60 kg × 10 N/kg × 50 m

= 30000

change in gravitational potential energy = 30000 unit J

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Examiner Comments

This candidate received full marks (2) for the numerical calculation plus 1 mark for the unit. Total score: 3 marks.

(c) (i) Calculate the change in gravitational potential energy as the student falls 50 m.

Give the unit.

(3)

50m × 60kg × 10 = 30000 kg m/s

change in gravitational potential energy = 30000 unit kg m/s

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Examiner Comments

Without the unit, this answer is worth 2 marks.

(c) (i) Calculate the change in gravitational potential energy as the student falls 50 m.

Give the unit.

(3)

60 kg x 600 x 50 = 1800000

change in gravitational potential energy = 1800000 unit GPE

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Examiner Comments

Although some 'working' is shown, the absence of a written equation cannot help to score any marks for substitution - score 0.

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Examiner Tip

Copy the equation you intend to use from the data sheet provided. In this case however, the incorrect use of 600 instead of 10 for g would have prevented you scoring.

(c) (i) Calculate the change in gravitational potential energy as the student falls 50 m.

Give the unit.

(3)

60 × 600 × 50

change in gravitational potential energy = 1800000 unit Joules

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Examiner Comments

When asked for, the unit mark can be scored independently of the numerical working. This response was therefore worth 1 mark.

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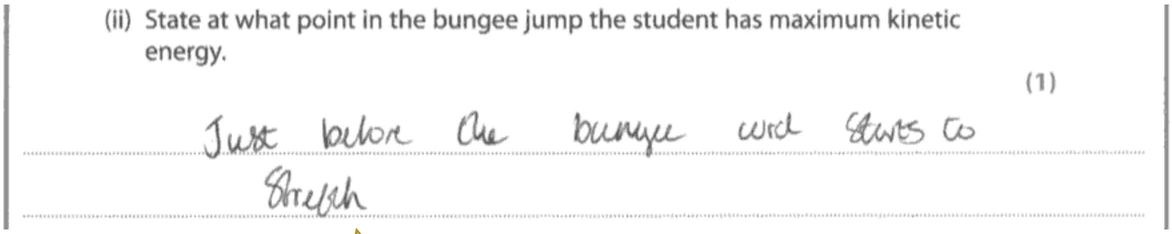
Examiner Tip

Think what you are calculating and recall the unit for that quantity - ie distance - m, force - N, power - W etc.

Question 2 (c) (ii)

This item followed a multiple choice item (2a) in which two of the options covered large periods of time (before ...) and the key and one other showed instants of time (when ...). The multiple choice item produced good discrimation by reflecting performance on the paper as a whole.



(ii) State at what point in the bungee jump the student has maximum kinetic energy.

(1)

Just before the bungee cord starts to Stretch

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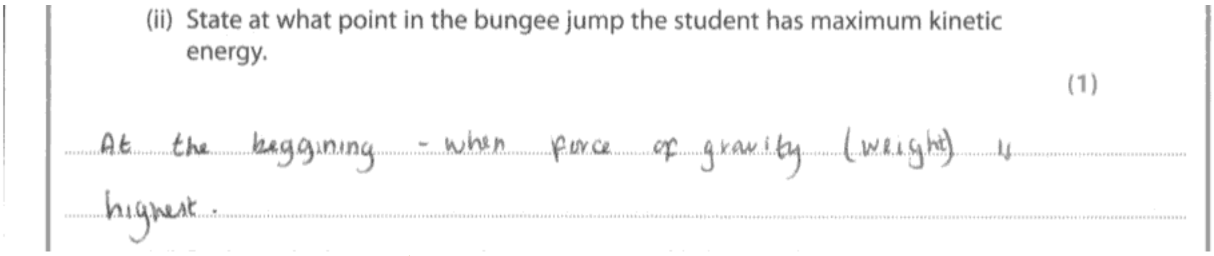
Examiner Comments

This response expressed the point needed concisely and scored the mark.

Other correct responses included 'after falling 50 m' and 'just as the cord becomes straight'.

The stem describes how the cord ‘becomes straight and starts to stretch when he has fallen 50 m.’

One common misconception involved mixing up KE and GPE.



(ii) State at what point in the bungee jump the student has maximum kinetic energy.

(1)

At the beggining - when force of gravity (weight) is highest.

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Examiner Comments

This is an exact single moment in time but was incorrect and scored 0.

Other responses were vague such as 'while falling', 'when stretching' or 'at the bottom' (of what).

.

Question 2 (c) (iii)

The inefficiency of energy transfers was tested here.

Many candidates presented either the energy transfer or the reason for this. Few presented both.

(iii) Explain why his maximum kinetic energy is likely to be less than your answer to (c)(i).

(2)

Energy as heat lost to surroundings due to air resistance when falling. (or possibly sound energy when rope stretching)

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Examiner Comments

The idea that the surroundings are heated scored 1 mark and 'due to air resistance' scored the second.

Marks are often lost through the use of the general words 'it', 'they' etc.

(iii) Explain why his maximum kinetic energy is likely to be less than your answer to (c)(i).

(2)

because some energy is converted to sound and heat energy, not all of it will be converted to kinetic.

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Examiner Comments

The 'it' here could refer to some energy, heat energy etc.

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Examiner Tip

When writing, try to avoid using words such as 'it' and 'they'. Take the little extra time needed to say exactly what you mean.

A variety of incorrect numerical responses were given for this. The most common referred to the fact that calculations of KE involve the factor of 1/2 and 'so must be less than the other'. Another example involved the gravitational field strength.

(iii) Explain why his maximum kinetic energy is likely to be less than your answer to (c)(i).

(2)

This is because gravitational potential energy (G.P.E.) is always more than kinetic energy, as it is to do with the energy of gravity on Earth acting and is multiplied by 10 always. ~~whereas kinetic energy~~ is

(Total for Question 2 = 8 marks)

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Examiner Comments

This scored 0.

Question 3 (a) (iii)

This was the second of the calculations and involved the transformation of an equation of general form X = Y x Z.

The equation to be used was V = I x R. The three marks were for transposition, substitution and evaluation.

(iii) The supply voltage is 12 V.
At 20 °C the current is 0.047 A.

Calculate the resistance of the thermistor at this temperature. (3)

pd = current x resistance

resistance = pd / current   12 / 0,047 = 255,31914

resistance = 255,31914 Ω

ResultsPlus
Examiner Comments

The candidate here carried out the three tasks in that order and scored 3 (full) marks for that even though the number of significant figures shown was somewhat excessive.

The marks for transposition and substitution can be in either order.

(iii) The supply voltage is 12 V.
At 20 °C the current is 0.047 A.

Calculate the resistance of the thermistor at this temperature. (3)

R = I x V

R = 0.047 x 12

0.564 = 0.047 x 12

R = 0.564

resistance = 0.564 Ω

ResultsPlus
Examiner Comments

Here, 1 mark was scored because although the equation was transposed incorrectly, the candidate has correctly linked the numerical values to the appropriate symbol. This mark was only awarded *because the working was shown.*

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Examiner Tip

Show your working in all calculations. Some marks are then possible even if you arrive at the wrong answer.

The same wrong answer without working scores zero.

(iii) The supply voltage is 12 V.
At 20 °C the current is 0.047 A.

Calculate the resistance of the thermistor at this temperature.

(3)

resistance = 0.566 Ω

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Examiner Comments

The writing of the triangle is not the same as writing the equation. Clearly, this candidate does not know how to find the equation from the triangle. Although some candidates find the triangle a useful tool for transposition, the result of that use needs to be shown.

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Examiner Tip

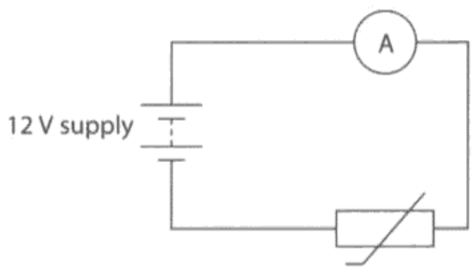
If you want to use a triangle, make sure that you write the equation down in symbols after using the triangle.

Question 3 (a) (i)-(ii)

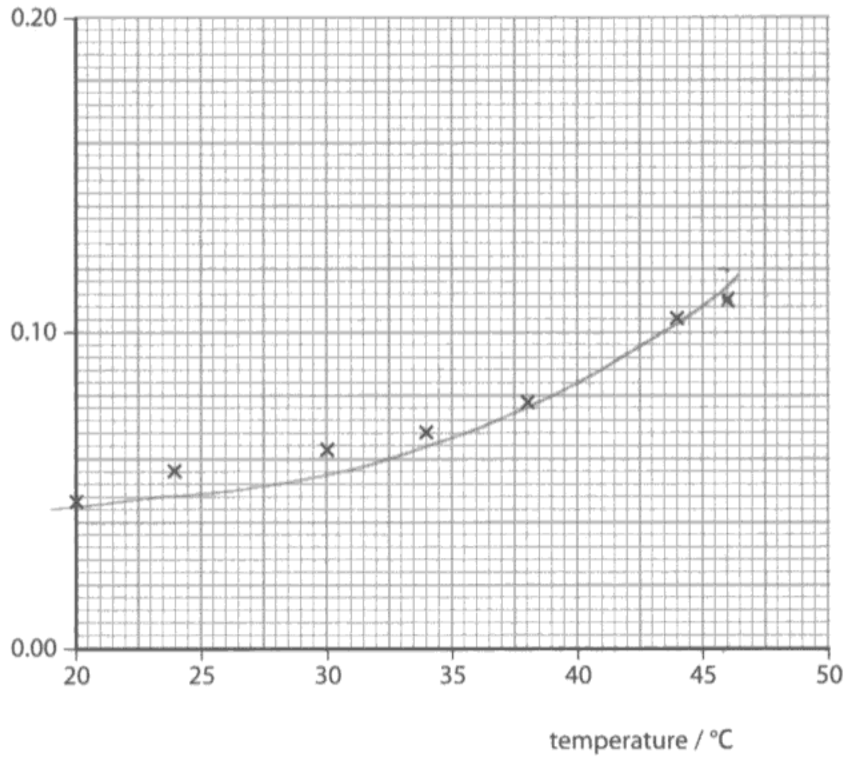
The ability to plot a point on a graph and draw the curve of best fit were tested here.

Electric current and temperature

3 (a) A designer is going to use a thermistor in a temperature gauge. He connects the thermistor into this circuit.



He heats the thermistor and measures the current at different temperatures. Here are some of the results plotted on a graph.



At 47 °C the current was 0.138 A.

(i) Plot this value on the graph.

(1)

(ii) Draw the curve of best fit through the points.

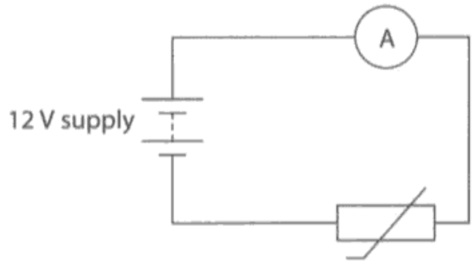
(1)

ResultsPlus
Examiner Comments

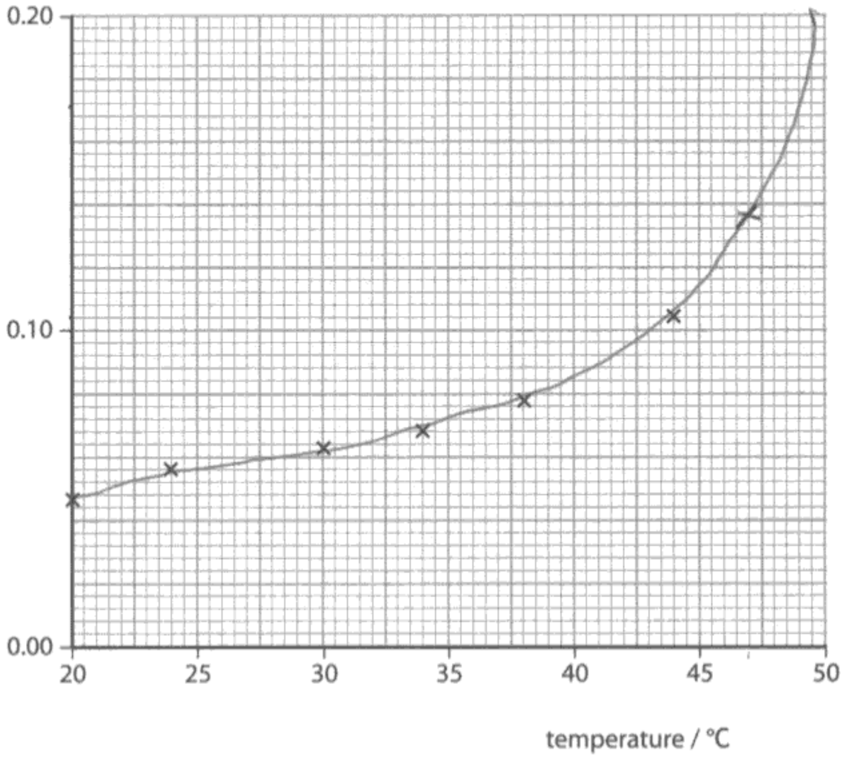
Many candidates failed to plot the point correctly, erring in use of one or both scales. This response scored 0 for both parts.

Electric current and temperature

3 (a) A designer is going to use a thermistor in a temperature gauge. He connects the thermistor into this circuit.



He heats the thermistor and measures the current at different temperatures. Here are some of the results plotted on a graph.



At 47 °C the current was 0.138 A.

(i) Plot this value on the graph.

(1)

(ii) Draw the curve of best fit through the points.

(1)

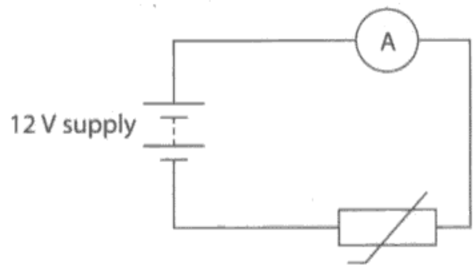
ResultsPlus

Examiner Comments

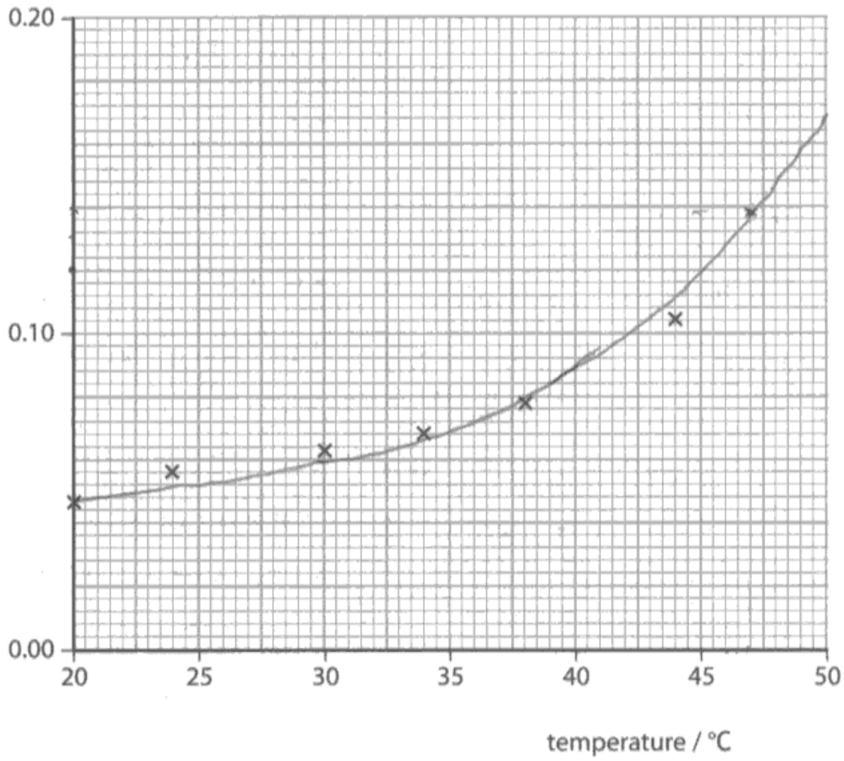
Some leeway was allowed in the curve drawing. Both accuracy of point plotting and curve drawing were sufficient here. This scored both marks.

Electric current and temperature

3 (a) A designer is going to use a thermistor in a temperature gauge. He connects the thermistor into this circuit.



He heats the thermistor and measures the current at different temperatures. Here are some of the results plotted on a graph.



At 47 °C the current was 0.138 A.

(i) Plot this value on the graph.

(1)

(ii) Draw the curve of best fit through the points.

(1)

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Examiner Comments

The point was plotted correctly in many cases but the curve of best fit was often poor. This scored 1 for part (ai) and 0 for (aii).

Question 3 (a) (iv)

Some students found difficulty in following through the steps in an argument. This item tested this skill.

'Explain...' items usually involve a minimum of two steps although the outcome can be stated in one.

(iv) Use this graph of current against temperature to explain the relationship between resistance and temperature for this thermistor.

(2)

As the temperature increases the resistance of the thermistor decreases.

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Examiner Comments

This response omits any explanation and simply states the relationship. It scores 1 of the 2 marks available.

The graph only shows a relationship between current and temperature.

(iv) Use this graph of current against temperature to explain the relationship between resistance and temperature for this thermistor.

(2)

When the temperature increases the current also does which shows that the resistance goes down the high the temperature is.

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Examiner Comments

The argument continues that an increased current occurs when the resistance decreases. This response scored 2 marks.

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Examiner Tip

If asked to use data, then the examiner expects you to use it.

(iv) Use this graph of current against temperature to explain the relationship between resistance and temperature for this thermistor.

(2)

~~The As the increase in temperature of thermistor, the~~

As the temperature increases the resistance also increases in the thermister.

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Examiner Comments

To make this response, it is likely that the candidate has assumed that the graph was one of resistance against time.

Question 3 (b) (i)

This item was based on the specification statement: 2.13 Explain the energy transfer (in 2.12 above) as the result of collisions between electrons and the ions in the lattice.

(b) (i) When there is an electric current in a resistor, the resistor gets hot.

Explain why the resistor gets hot. atomic ions

(2)

Because electrons collide with the ions in the wires causing them to overheat. This causes the resistor to get hot due to the collision of electrons within the circuit.

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Examiner Comments

Clearly this response scores 2 marks for the mention of electrons (as charge carriers) and for collisions either with ions or with other electrons.

(b) (i) When there is an electric current in a resistor, the resistor gets hot.

Explain why the resistor gets hot.

(2)

The resistor gets hot because electrons are moving through the resistor and then they're kinetic energy is becoming heat energy.

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Examiner Comments

One mark only here for the mention of electrons but no mark for the collision process.

There were varied incorrect ideas for this including a brief statement about 'friction'.

(b) (i) When there is an electric current in a resistor, the resistor gets hot.

Explain why the resistor gets hot.

(2)

because lots of current goes into the resistor but only a certain amount of current can go out of the resistor at a certain time.

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Examiner Comments

The idea of a traffic jam or a black hole was insufficient to score any marks, not least because the reference was to current rather than electrons.

Question 3 (b) (ii)

The influence of the act of measurement on the quantity being measured was tested in this item.

The majority of candidates recognised a common problem of measurement.

(ii) Suggest why the thermistor in a temperature gauge might indicate a temperature slightly higher than the actual temperature of its surroundings.

(1)

because it is a resistor so it will heat up itself, therefore increasing the temperature. Heat energy is given out by the thermistor.

(Total for Question 3 = 10 marks)

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Examiner Comments

This candidate realised that the current needed to operate the device itself heated the thermistor to a temperature above the surroundings and thus influenced the measurement. It scored 1 mark.

(ii) Suggest why the thermistor in a temperature gauge might indicate a temperature slightly higher than the actual temperature of its surroundings.

(1)

This is a safety precaution. Also, it does this to show that there is too much current flowing.

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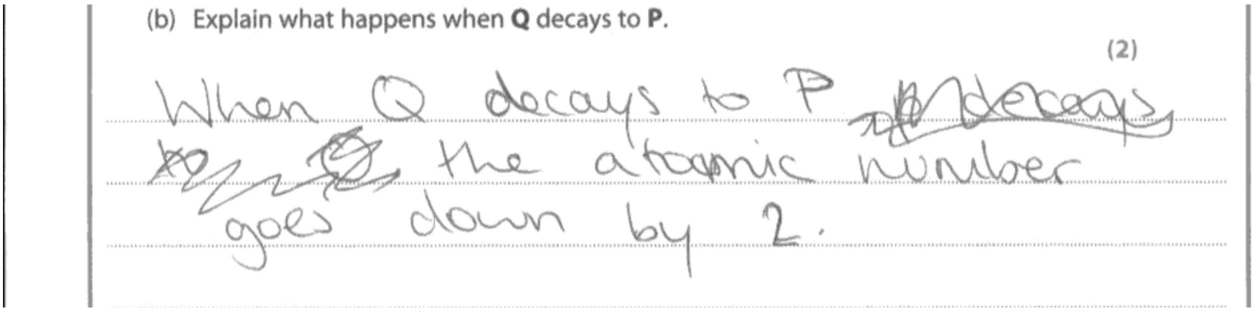
Examiner Comments

This illustrates the most common incorrect answer - involving safety. Important though safety is, this scores 0.

Question 4 (b)

Candidates were asked to interpret data presented in an unusual way. They were told that U-238 may undergo either radioactive decay or nuclear fission. A chart gave the atomic and mass numbers for some decay products of U-238.


(b) Explain what happens when **Q** decays to **P**.

(2)

When Q decays to P the atomic number goes down by 2.

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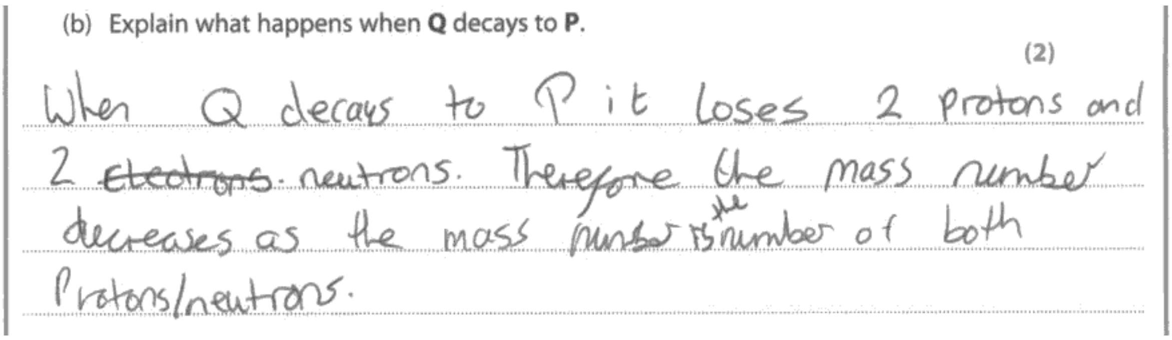
Examiner Comments

This is a statement of part of the information which can be read from the chart. It was insufficient for the first marking point which could be scored by reference to change in both mass and atomic numbers. This scored 0.


(b) Explain what happens when **Q** decays to **P**.

(2)

When Q decays to P it loses 2 protons and 2 neutrons. Therefore the mass number decreases as the mass number is the number of both protons/neutrons.

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Examiner Comments

An alternative way of scoring the first mark was in terms of proton and neutron numbers. This scored 1.

To score the second mark an explanation was required. These changes obviously referred to radioactivity rather than fission, although many chose the latter.

(b) Explain what happens when **Q** decays to **P**.

(2)

Q (uranium - 238) emits an alpha particle, which is a helium nucleus containing 2 neutrons and 2 protons. This nucleus has atomic number 2, and mass 4, so Q goes from ~~number~~ mass 238 to 234 and number 92 to 90. This is isotope P.

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Examiner Comments

This comprehensive explanation scored 2 marks.

Question 4c

(c) Explain what happens when **P** decays to **O**.

(2)

When P decays to O the mass number stays at 234 but the atomic number increases by one.

ResultsPlus
Examiner Comments

This statement embraced sufficient reference to the data to score the first mark. It does not go on then to relate this to radioactivity and beta emission, clearly not fission or even fusion!

(c) Explain what happens when **P** decays to **O**.

(2)

when P decays to O the new nuclei have the same mass number so they dont lose any electrons but they have a different atomic number so they lose protons.

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Examiner Comments

There are many reasons why this scored 0 marks. Not least of these being the statement that the atomic number was DIFFERENT.

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Examiner Tip

With data like this, you should give numerical values where possible, ie 'rose from 90 to 91' or 'rose by 1' but not simply 'rose'.

Question 4 (d) (i)

This item asked for inference from the data given on a table.

This proved to be an item of high discrimination with only the more able really successful in relating the distance travelled in air to the range expected of the different radioactive particles.

(i) State the name of this type of particle.

(1)

alpha, ~~beta~~, ~~gamma~~

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Examiner Comments

Some candidates arrived at the correct answer presumably by a process of elimination!

Question 4 (d) (ii)

The descriptions of a relationship shown on a graph were limited.

(ii) Use information from the graph to describe how the distance travelled in air depends on the energy of the particle.

(2)

The higher the energy of the particle the further the ~~did~~ distance travelled. the lower the energy particle released the less distance travelled in the air.

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Examiner Comments

Most, like this example, managed to score the first mark.

(ii) Use information from the graph to describe how the distance travelled in air depends on the energy of the particle.

(2)

The energy of the particle increases ~~as~~ as the distance increases; gradient of the graph increases

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Examiner Comments

Comparatively few made any attempt to go further either to describe the curved nature (as here) or to assume it was straight and give a value for the gradient. This example scored 2 marks.

Question 4 (e)

Some questions on more recent specifications have involved understanding of very modern, and relevant, applications of physics.

Candidates were required to relate the information, they were given in the stem, to their knowledge of chain reactions.

(e) Uranium-238 can only undergo nuclear fission by absorbing fast neutrons.
The fission emits neutrons which very quickly lose their energy.

Suggest why the fission of uranium-238 does not produce a chain reaction.

(2)

The neutrons given out from the fission of U-238 lose their energy and therefore their speed, very quickly. This means the neutrons given out aren't moving fast enough when they reach another U-238 atom to cause a chain reaction.

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Examiner Comments

Here, the candidate relates that the loss of *energy* will mean that the neutrons are not travelling *fast* enough (1 mark) to cause a chain reaction *when they reach another U-238 atom* (1 mark). This then scored 2 marks.

(e) Uranium-238 can only undergo nuclear fission by absorbing fast neutrons.
The fission emits neutrons which very quickly lose their energy.

Suggest why the fission of uranium-238 does not produce a chain reaction.

(2)

The fission of uranium-238 does not produce a chain reaction because the uranium-238 atom forms two daughter nuclei, such as barium-141 and Krypton-96

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Examiner Comments

This response is a good example of material which is correct but irrelevant to the question. It contains no creditworthy ideas and so scored 0.

Question 5 (a) (ii)

The third explicit calculation involved the transposition of an equation of general form X = Y/Z.

(ii) The car now accelerates in a straight line.
Its average acceleration is 12 m/s².

Calculate the increase in velocity of the car in 4.0 s.

(3)

$a = \frac{\Delta v}{t}$

$a \times t = \Delta v$

$12 \times 4 = 48$ m/s

speed = 48 m/s

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Examiner Comments

There was no hesitation in awarding this the full (3) marks.

Again, the transposition and substitution marks can be awarded in either order.

(ii) The car now accelerates in a straight line.
Its average acceleration is 12 m/s².

Calculate the increase in velocity of the car in 4.0 s.

(3)

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

speed = 3 m/s

$12 \text{ m/s}^2 = \frac{(v-u)}{4}$

$\frac{12 \text{ m/s}^2}{4 \text{ s}} = 3 \text{ m/s}$

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Examiner Comments

Here, the substitution is carried out correctly before the incorrect transposition and so scores 1 mark.

(ii) The car now accelerates in a straight line.
Its average acceleration is 12 m/s^2.

Calculate the increase in velocity of the car in 4.0 s.

(3)

$S = \frac{D}{T}$

$\frac{13}{4} = 3.$

$\frac{13}{4} = 3$

$12 \times 4 = 48$

speed = ...3........ m/s

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Examiner Comments

The lowest part of this response could be said to show the correct transposition, substitution and evaluation. However, this was, in effect, a list of possible things to do with the two numbers - essentially giving the examiner a choice. The candidate then wrote the incorrect choice in the answer space. This scored 0 marks.

Question 5 (b)

This item asked for a comparison to be made between the data supplied for two vehicles.

In contrast, some candidates ended up losing rather than using the data.

(b) This table shows data about two other cars.

car	mass	time taken to reach 30 m/s from rest
family car	1400 kg	10 s
sports car	600 kg	5 s

The owner of the family car claims that although the sports car has greater acceleration, it produces a smaller accelerating force than his family car.

Explain how these figures support his claim.

(2)

The family car is heavier than the sports car therefore the sports car takes less time to reach a certain destination.

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Examiner Comments

This candidate has presented less data than that which was quoted and unsurprisingly scored 0 marks.

This item asks for the use of given figures to support a claim.

(b) This table shows data about two other cars.

car	mass	time taken to reach 30 m/s from rest
family car	1400 kg	10 s
sports car	600 kg	5 s

The owner of the family car claims that although the sports car has greater acceleration, it produces a smaller accelerating force than his family car.

Explain how these figures support his claim.

(2)

As the resultant force = mass x acceleration, the sports car has a smaller mass by over 1/2 of the mass of the family car and the time for the sports car to accelerate to 30m/s is exactly 1/2, ∴ there will be a smaller resultant force.

ResultsPlus
Examiner Comments

This was one of various successful ways of using the data appropriately. This scored both marks.

(b) This table shows data about two other cars.

car	mass	time taken to reach 30 m/s from rest
family car	1400 kg	10 s
sports car	600 kg	5 s

The owner of the family car claims that although the sports car has greater acceleration, it produces a smaller accelerating force than his family car.

Explain how these figures support his claim.

acceleration = $\frac{30}{10}$ = 3m/s² × 1400 = 4200
6m/s² × 600 = 3600

(2)

The force of the family car: 3m/s² (acceleration) × 1400 (mass) = 4200 N, where as sports car: 6m/s² (higher acceleration) × 600 = 3600 N = smaller force than family car.
4200 − 3600 = Difference of 600N between the family and sports car.

ResultsPlus
Examiner Comments

A second strategy involved calculations.

ResultsPlus
Examiner Tip

Here the accelerations were calculated and then the forces themselves worked out and compared. This was well worth both of the 2 marks scored.

Question 5 (c)

This six-mark question presented candidates with the opportunity to show their power of written communication in a familiar situation. There were quite a few examples of candidates presenting pre-prepared but irrelevant answers about breaking (sic) distances etc and the use of air bags and crumple zones.

The vast majority were able to compare the relative decelerations of the driver, car and shopping, although this was little more than common observation from an every day situation. Since this was a science examination, various degrees of explanation were needed to progress to higher levels. As the question was open-ended, there was opportunity to explain what happened in terms of forces and/or energy and/or momentum.

Explain what happens next to the car, the driver and the shopping bag.

(6)

The driver will jolt forwards but won't actually move anywhere because of his seatbelt. The shopping however will ~~b~~ be pulled of the seat with a strong force and most likely the contents will fall out of the bag.

ResultsPlus
Examiner Comments

For this, there is limited comparison of the decelerations of the person and the shopping. There is little more here than common observation. It is a level 1 answer for 2 marks. To move to level 2, some science needs to be used to explain at least one of the decelerations.

Explain what happens next to the car, the driver and the shopping bag.

(6)

The car will stop very suddenly and the momentum of the car will continue inside the car. The drivers seat belt will slow down the charge in momentum, which will gradualy stop the driver. The shopping bag's change in momentum is very fast, so therefore more damage will be done to the shopping bag as there is nothing to slow down the change in momentum. The car will stop, the driver will stop slowly, the shopping bag will stop when it ~~th~~ collides with somthing in front of it.

ResultsPlus

Examiner Comments

There is a clear comparison of the decelerations of all three objects. Combined with the effect of the seat belt on the rate of change of momentum, and the explanation of the effect of rapid change in momentum on the shopping, shows sufficient science to move this into a level 2 answer worth 4 marks. A little more science, for example in terms of stretching of the seat belt or further explanation of the shopping *continuing at the same velocity,* would have raised this to a level 3 response.

Explain what happens next to the car, the driver and the shopping bag.

(6)

The ~~ca~~ car stops suddenly so it's kinetic energy is transferred into energy working on the brakes to stop. This means that its momentum will decrease but is conserved.
The shopping bag will get the kinetic energy from the car and it will move which will

ResultsPlus
Examiner Comments

There is insufficient relevant science or everyday observation of the effect to score any marks. Technical terms such as kinetic energy, momentum and conserved are used but convey little scientific understanding. This scores 0 marks.

Explain what happens next to the car, the driver and the shopping bag.

(6)

The car stops virtually ~~emi~~ imediatly because of the breaks but the driver gets forced forward but luckily the seatbelt prevents him from going through the car window and pulls the driver back into his seat. The shopping bag flies forward into the window and doesn't stop because it has nothing to stop it unlike the car and driver.

ResultsPlus
Examiner Comments

There is good comparison of the relative decelerations of all three objects and some science implied during discussion of the idea of inertia or conservation of momentum for the shopping bag. Misspellings of brakes and immediately are not serious enough to reduce the mark for quality of written communication. This is a level 2 answer scoring 4 marks despite the erroneous statement about the driver being forced forward.

Question 6 (a)

Few candidates scored both marks on this process of tracing.

The first mark could be scored either by naming the detector or describing what to do with an (unnamed) instrument.

Radioactivity

6 (a) An underground oil pipe starts to leak oil.
To find the leak, a technician adds a gamma source to the oil flowing in the pipe.

Describe how the technician can find the position of the leak.

(2)

He can have a geiger counter which finds sources of gamma and if there is a huge reading it probably means the leak is there.

ResultsPlus
Examiner Comments

This scored for the Geiger counter and for the idea of the leak being at the place of a 'huge reading'. Thus, a score of 2 was obtained.

Radioactivity

6 (a) An underground oil pipe starts to leak oil.
To find the leak, a technician adds a gamma source to the oil flowing in the pipe.

Describe how the technician can find the position of the leak.

(2)

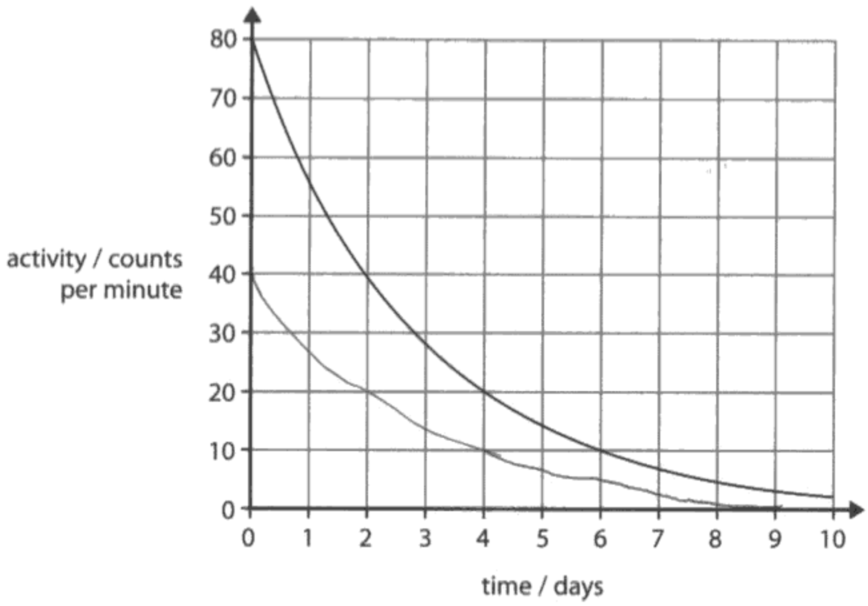
Because where the radiation is he can detect where the oil has travelled and where there is no radiation is where the leak is.

ResultsPlus
Examiner Comments

The explanation of neither idea was sufficiently clear to score a mark here. At best, the description is ambiguous. This scores 0.

Question 6 (c) (ii)

This item tested the ability to use data to construct a graphical representation of the effect of a change in initial conditions. Parts 6ci and 6cii appear together. A large majority correctly identified the half-life as 2 days, in part i, but comparatively few knew how to use this with different initial conditions for part ii.



(i) Use the graph to find the half-life of the material.

(1)

half life = ...2...... days

(ii) Another sample of the material has an initial count rate of 40 counts per minute.

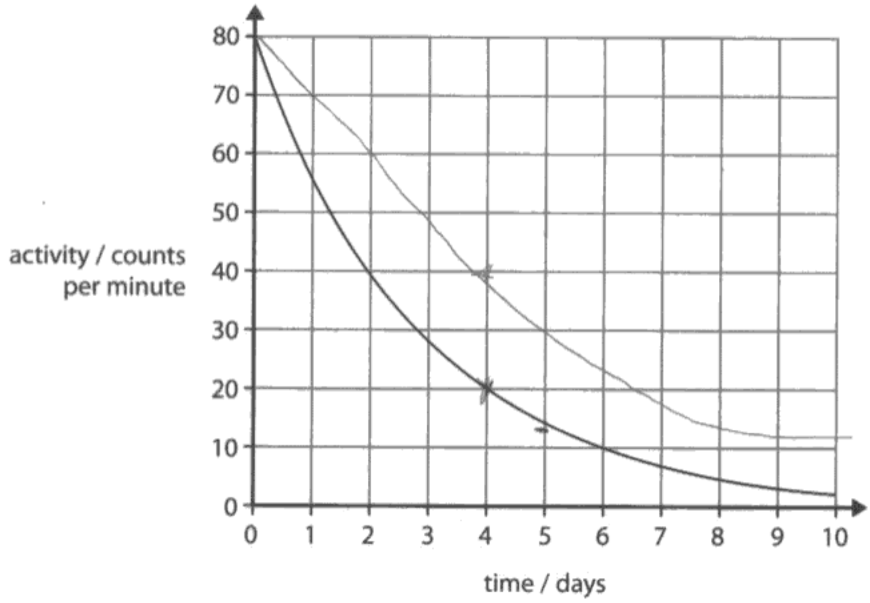
Sketch, on the same axes, the activity of this sample for the first 4 days.

(2)

ResultsPlus
Examiner Comments

Despite the wobbly line this was a good **'sketch'** as it included the important points at 40, 20 and 10 which showed the shape of the curve. It was good enough to score both of the 2 marks.

Perhaps the most unusual answer was this.



(i) Use the graph to find the half-life of the material.

(1)

half life = 2 days

(ii) Another sample of the material has an initial count rate of 40 counts per minute.

Sketch, on the same axes, the activity of this sample for the first 4 days.

(2)

ResultsPlus
Examiner Comments

It scored 0 for part ii.

Question 6 (d)

This question was about background radiation and again there were examples where candidates wrote information which was superfluous to requirements, including such details as the percentage of background radiation from certain sources and the effect of the radiation on the human body.

The item could be answered in a variety of ways. To reach level 1, it was necessary to look at only one aspect - the need for measurement, how and why the experimental procedure was followed and how the measurement was used in the analysis. (Some aspects of the procedure were given but the reason for them was not).

*(d) Some scientists carry out an experiment to measure the radioactivity from a source to be used in a factory.
They measure the background radiation before and after their experiment.
They take the background count at the same place as they do their experiment.

Explain how this procedure helps to make sure that the results of the experiment are valid.

(6)

The background radiation comes from many places - the sun, food etc. The background radiation is measured before the experiment to give the scientists an idea of how much there is in the atmosphere in the factory. It is then measured again afterwards to make sure it has not increased or decreased during the experiment. The amount of radiation is then taken away from the actual amount coming from the source, to ensure the result they get is accurate and not in any way misleading - it also tells them whether the device is safe or not.

(Total for Question 6 = 12 marks)

ResultsPlus
Examiner Comments

This response uses all three aspects of the situation. The first 5 lines provided enough for the 'Need for measurement', lines 5-8 is just sufficient for the possibility of change with time in the 'How and why' section and lines 8-11 clearly satisfies the 'Analysis' section. It gives the minimum for scoring 6.

*(d) Some scientists carry out an experiment to measure the radioactivity from a source to be used in a factory.
They measure the background radiation before and after their experiment.
They take the background count at the same place as they do their experiment.

Explain how this procedure helps to make sure that the results of the experiment are valid.

(6)

They do this so they can then minus the background radiation from the radiation in their experiment to get an accurater reading and therefore have better results.

ResultsPlus
Examiner Comments

This clearly states what to do with the measurement after it has been taken but does not give any cause of the radiation or discussion of the procedure. It thus scores 2 marks.

Paper Summary

Based on their performance in this paper, candidates should:

- make sure that they have a sound knowledge of the fundamental ideas specified for all six topics
- make sure that they understand the meaning of terms like force, momentum, acceleration and velocity and that they use these words accurately and in the correct places
- get used to the idea of applying their knowledge to new situations by regularly attempting questions, about topics they are dealing with, in support materials or previous examination papers
- show their working at each stage of a calculation and continually practise calculations involving changing the subject of an equation
- use the marks at the side of a question as a guide to the form and content of their answer.

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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