Examiners' Report
June 2012

GCSE Physics 5PH2H 01

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June 2012

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Introduction

This was the first examination of the second unit of the new specification. The unit was divided into six topics and all six topics were tested in the examination.

The topics were:

- static and current electricity
- controlling and using electric current
- 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, each question increased in difficulty as the question progressed. Within the question paper, a variety of question types were included, such as objective questions, short answer questions worth one or two marks each and longer questions worth three, four or five marks each. The two six mark questions were used to test quality of written communication.

It was encouraging to note the positive way in which the vast majority of candidates approached the paper.

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 do well in calculations involving changing the subject of an equation
- did not think through their answers before writing.

The quality of written communication 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)

Here there was a mark for substituting into the equation, a mark for changing the subject of the equation and a mark for working out the correct answer.

Full marks were awarded for the correct answer without working. If the correct answer was not obtained then credit could be gained for the working if clearly shown.

It was encouraging to see candidates gaining full marks for this question near the start of the paper but more would have gained at least 1 mark if they had shown all their working.

A common error was to use the power (from part(a)(i)) and not the work done.

(ii) The weight he lifts has a mass of 240 kg.
Gravitational Field Strength = 10 N/Kg
The energy gained by the mass is equal to the work done when lifting it.

Calculate the height he lifts this mass. (3)

mass = 240kg
GFS = 10N/Kg

$$\text{Height} = \frac{GPE}{m \times g}$$

GPE = 5040J

$$\text{vehicle Height} = \frac{5040}{240 \times 10} = \frac{5040}{2400} = 2.1$$

height = 2.1 m

ResultsPlus
Examiner Comments

All the working was shown.

Question 1 (b)

Responses here showed a good understanding of the fact that if the mass was not moving no work was being done. The majority of candidates scored this mark as the examples show.

(b) After lifting the mass, he must hold it steady for 3 seconds.
During this time, he does no work on the mass.

State why he does no work on the mass in this time. (1)

He doesn't move the mass therefore no work is done against gravity

ResultsPlus
Examiner Comments

A good, concise response.

(b) After lifting the mass, he must hold it steady for 3 seconds.
During this time, he does no work on the mass.

State why he does no work on the mass in this time.

(1)

Because the mass doesn't move anywhere

ResultsPlus
Examiner Comments

A straightforward correct answer.

Question 1 (c)

The vast majority of candidates scored the marks for calculating the momentum. Only about half of these, however, used the correct units.

Question 2 (a) (i)

This question was answered correctly by all but a few candidates.

Question 2 (a) (ii)

Again the vast majority of candidates answered this correctly.

(ii) Explain why the ball moves upwards.

(2)

The ball is moving upwards since it also has a positive charge and is therefore repelling the positivly charged plate underneath it.

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Examiner Comments

A good example of a brief, well written explanation scored both marks.

Question 2 (b)

Many candidates lost marks here by simply stating that the charge had 'gone to earth'. They did not seem to appreciate that electrons travel from earth (or the lid) to the ball.

(b) The ball discharges when it hits the earthed lid.

Explain how the ball loses its charge.

(2)

Because the lid is earthed it neutralises the charge in the ball by electrons flowing from the lid to the ball.

ResultsPlus
Examiner Comments

This one got the correct charge flow in the correct direction.

Question 2 (c)

This required the candidates to write their ideas as a logical progression. The majority scored at least 1 mark but both marks were scored usually by those who would go on to score a high mark for the whole paper.

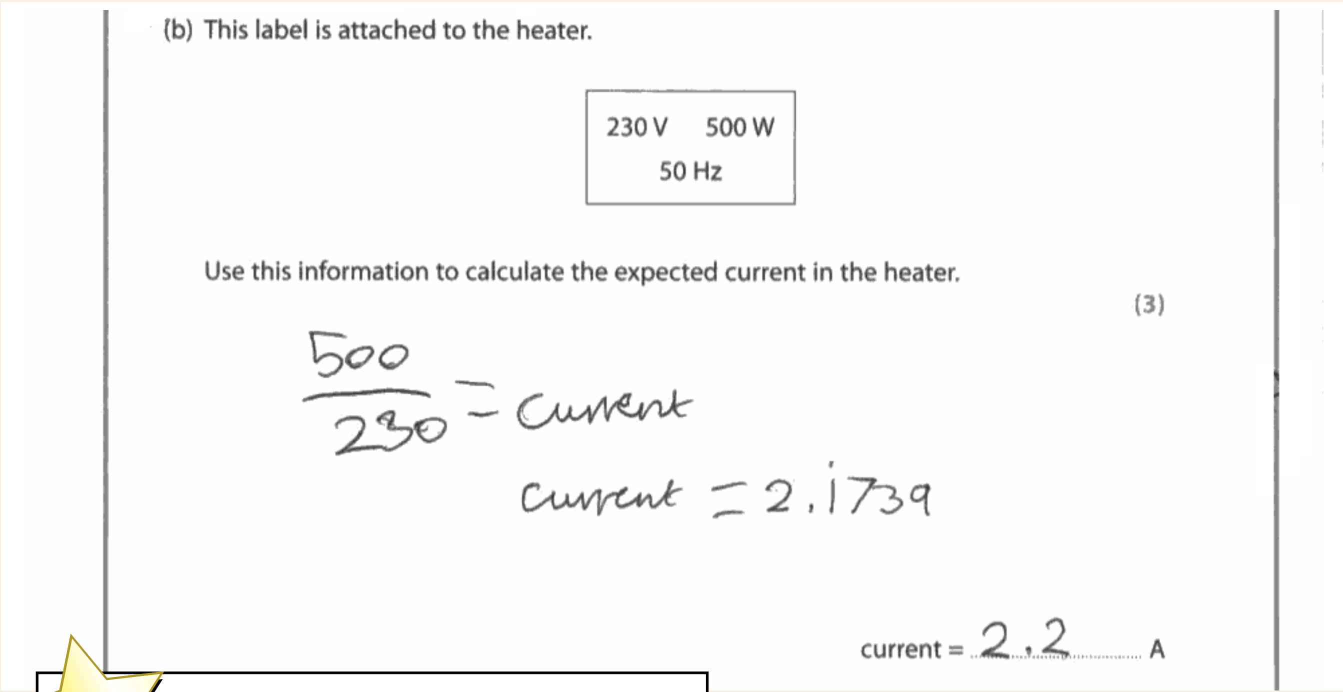
Question 3 (a)

Well answered by most candidates.

Question 3 (b)

Here, as in 1a(ii), there was a mark for substituting into the equation, a mark for changing the subject of the equation and a mark for working out the correct answer.

The majority of candidates scored full marks but more would have scored something if they had shown their working clearly.



(b) This label is attached to the heater.

230 V	500 W
50 Hz	

Use this information to calculate the expected current in the heater.

(3)

$\frac{500}{230}$ = current

current = 2.1739

current = 2.2 A

ResultsPlus

Examiner Comments

This got full marks for the correct answer even though the working was not fully shown.

Show all the stages in your working: e.g.

current = power/voltage

= 500/230

= 2.2 A

(b) This label is attached to the heater.

230 V	500 W
50 Hz	

Use this information to calculate the expected current in the heater.

(3)

$P = I \times V$

$I = \frac{P}{V}$ $\quad I = \frac{500}{230}$

current = 0.22 A

ResultsPlus

Examiner Comments

Here the candidate changed the subject of the equation correctly (1 mark) but did not go on to substitute the correct values in the equation. If the change in subject had not been shown, this would have scored zero.

Question 3 (d)

Examiners were looking for explanations in terms of electron collisions in the lattice. This was not well answered with many candidates referring just to the idea of heat loss due to friction.

(d) When a charge flows in a resistor, the resistor becomes hot.

Explain why the resistor becomes hot.

(2)

Because ~~when an~~ current is the rate of flow of charge. When current flows in a resistor, electrons collide with the ions in the lattice and give the ions extra energy which is why it becomes hot.

ResultsPlus

Examiner Comments

A good example of a response gaining both marks.

Question 3 (e)

Many answered this well, interpreting the graph and using the numbers in the calculation although the majority did not cope with the powers of ten.

Question 4 (a)

Most candidates scored at least 1 of the 2 marks available.

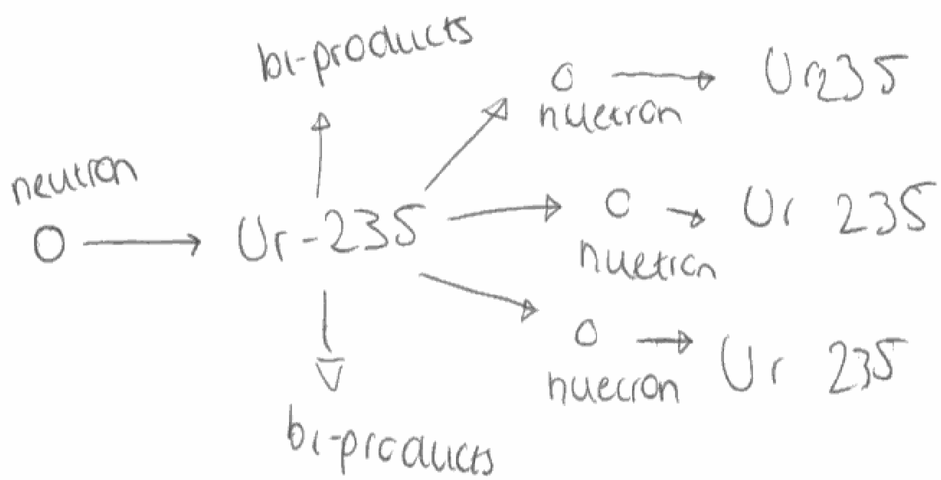
Question 4 (b)

It was encouraging to see that about half of the candidates were able to score full marks for explaining how fission can start a chain reaction. Good use was made of diagrams.

(b) Energy is released by a nuclear chain reaction.

Describe how the fission of a uranium-235 nucleus can start off a chain reaction. You may draw a diagram to help with your answer.

(3)



A neutron is fired at Uranium 235 which then causes two bi products to be made (these are usually krypton and barium but the can be different Also two or three nuetrons are made which means that the could collide with more uranium for more reactions

ResultsPlus
Examiner Comments

This clearly labelled diagram would score full marks on its own.

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Examiner Tip

Even if marks are not scored on a diagram, drawing it can help you to structure your answers.

Question 4 (d)

This was not answered well by many candidates. Examiners were looking for explanations involving the removal of electrons from atoms, as shown in the first example. Common errors included detail about the damage caused to cells by ionising radiation as shown in the second example.

(d) Barium-142 emits beta radiation.
Beta radiation is ionising.

Explain what happens when beta radiation ionises.

(2)

Beta is negativly charged, so when it goes past atoms it can ionise them by repelling the electrons in the atom and pushing them out so they lose the electrons.

ResultsPlus
Examiner Comments

Both marks awarded.

(d) Barium-142 emits beta radiation.
Beta radiation is ionising.

Explain what happens when beta radiation ionises.

(2)

It can get into the body and anger the cells by ~~knocking~~ mutating the nucleus which can then multiply rapidly into something like cancer.

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Examiner Comments

This one did not include an explanation of ionisation and scored zero.

Question 4 (e)

A good response would have referred to the nuclei having the same charge and the need for a lot of energy to overcome the force of repulsion between them. Only a few candidates scored both marks, most candidates scoring zero for just stating the conditions required such as high temperature and pressure.

(e) A fusion reaction does not have radioactive products.
However, it needs large amounts of energy to make it happen.

Explain why large amounts of energy are needed to make a fusion reaction happen.

(2)

Large amounts of energy are needed for a fusion reaction as the atoms need to be able to collide ~~This means that~~ Atoms move around more at very high temperatures meaning that the ~~more~~ higher the temperature the higher the rate of collision

(Total for Question 4 = 10 marks)

ResultsPlus
Examiner Comments

This response looked at how the high energy was achieved and not why it was needed. Scored zero.

(e) A fusion reaction does not have radioactive products.
However, it needs large amounts of energy to make it happen.

Explain why large amounts of energy are needed to make a fusion reaction happen.

(2)

Large amounts of energy are needed to break the electrostatic repulsion of two positively charged hydrogen particles so you would need ~~loads of~~ high temperature and very high pressure. break the electrostatic repulsion

(Total for Question 4 = 10 marks)

ResultsPlus
Examiner Comments

Both marks awarded.

Question 5 (b)

Most candidates failed to realise that because the velocity was changing, the area under the graph or the idea of average velocity had to be used to calculate the distance fallen. Few candidates scored full marks.

(b) Estimate how far Christine falls in the first 2 s.

(3)

Distance = area under the gradient

$\frac{1}{2} \times 2s \times 20m/s = 20m$

Christine falls = 20 m

ResultsPlus

Examiner Comments

Even though the word 'gradient' was used instead of line or graph, the working was clear enough and the answer was correct so this scored 3 marks.

Question 5 (c)

The majority of candidates were able to explain the difference with many making reference to vectors.

(c) Explain the difference between velocity and speed.

(2)

Velocity is a vector quantity and so gives a direction and magnitude whereas, speed just gives a magnitude (size).

ResultsPlus

Examiner Comments

The vector approach.

(c) Explain the difference between velocity and speed.

(2)

Speed is the distance travelled in a certain time in any direction; velocity is the speed in a stated direction.

ResultsPlus

Examiner Comments

A completely acceptable response without mentioning vectors.

Question 5 (d)

In this question candidates were expected to relate the changing velocity to the changing resultant force on the skydiver. Most candidates were able to reach Level 1, usually by referring to the fact that at terminal (constant) velocity the resultant force was zero. About half reached Level 2. There were many good, coherent responses, scoring 6 marks.

A common misconception was that an increase in air resistance produces a decrease in velocity.

*(d) The graph shows how Christine's velocity changes from the time she leaves the plane until she reaches terminal velocity.

Explain, in terms of forces, why her velocity changes as shown in the graph.

(6)

When she jumps her weight is much greater than the resistance force which is air resistance. This means she accelerates. But slowly as she accelerates her acceleration slows because the air restance is increasing. As shown in the graph, she jumps and her acceleration is fast but as she continues her acceleration decreases because the resultant force is bigger. The resultant force on her is still forwards her gravity (weight). When she reaches terminal velocity, her forces acting on her are balanced. The resultant force is zero so she cannot speed up anymore.

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Examiner Comments

A complete response, which showed a good understanding of the relationship between resultant force and acceleration and how and why the resultant force changed throughout the graph. Scores 6 marks.

ResultsPlus

Examiner Tip

The question directs you towards the graph so try to make your explanation refer to all parts of the graph. There are labels on the graph which you could use in your answer.

*(d) The graph shows how Christine's velocity changes from the time she leaves the plane until she reaches terminal velocity.

Explain, in terms of forces, why her velocity changes as shown in the graph.

(6)

One Christine jumps out of the plane, the force of gravity acting on her is greater than the force of air resistance. This allows her to accelerate whilst falling. As she falls for a longer period of time the forces of gravity and air resistance begin to even out, thus creating the upwards curve on the velocity-time graph. Once the parachutist has fallen for about 14 seconds, she reaches terminal velocity, otherwise known as maximum speed. At this stage all the forces acting on her are balanced. This is represented as a straight line on the graph.

ResultsPlus

Examiner Comments

This did not quite make it to Level 3 as it did not explain why 'gravity and air resistance begin to even out' so it scores 4 marks.

*(d) The graph shows how Christine's velocity changes from the time she leaves the plane until she reaches terminal velocity.

Explain, in terms of forces, why her velocity changes as shown in the graph.

(6)

Her velocity changes are shown ~~on~~ the graph because it shows the acceleration of her. When she has reached a terminal velocity she has stopped accelerating. This is because her ~~for~~ forces are balanced.

ResultsPlus
Examiner Comments

This was just about enough to score 2 marks. It would have been better had the forces (weight and air resistance) been named.

Question 6 (a)

A correct response here would involve realising only a small percentage of the food was radioactive material so the activity level would be low.

The most common error was to discuss the different types of radiation and their ability to penetrate 'out of the body'.

Radioactivity and health

6 (a) Radioactive materials can be a risk to health.
Some food contains radioactive material.

Explain why people can eat this food without serious risk.

(2)

This food dosn't have a high concentration of radiotin material. Also the source of radioactivity is very weak and so cannot do much damage, if any, to internal organs.

ResultsPlus
Examiner Comments

This response got both marks.

Radioactivity and health

6 (a) Radioactive materials can be a risk to health.
Some food contains radioactive material.

Explain why people can eat this food without serious risk.

(2)

Because there is very little radioactive material in the food and this radiation only makes up a small percentage of the total percentage of background radiation about 12%, which is quite lo

ResultsPlus
Examiner Comments

A more detailed response, relating to background radiation, scored both marks.

Question 6 (b) (ii)

This was quite a challenging data interpretation question and it was encouraging to see more than half of the candidates managed to arrive at the correct answer of 12.5.

Question 6 (c)

Candidates demonstrated a good understanding of half-life with the majority scoring both marks.

(c) Half-life is an important factor to consider when choosing isotopes for medical treatments.

Explain what **half-life** means.

(2)

Half life is the time taken for half the undecayed nuclei to decay.

ResultsPlus
Examiner Comments

A text book definition for full marks.

(c) Half-life is an important factor to consider when choosing isotopes for medical treatments.

Explain what **half-life** means.

(2)

Half life is the time taken for the activity/Bq of a substance to divide by two.

ResultsPlus
Examiner Comments

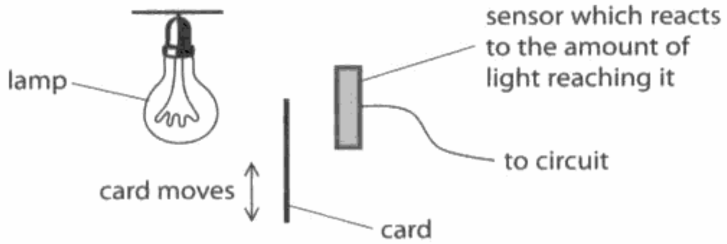
This was not a text book definition but still made the meaning clear. Scored full marks.

Question 6 (d)

Here candidates were asked to demonstrate their understanding of a use for a radioactive source by comparing it to a model of the device. Most candidates achieved mark Level 1 by matching the components in the model with the components in the real machine. The more successful reached mark Level 3 by also comparing the processes and the way in which the components interacted.

*(d) A teacher decides to model how a machine checks the level of the liquid in medicine bottles.
The machine uses a radioactive source to sound an alarm when the level of liquid becomes too low.

He sets up the arrangement shown.



The piece of card can be moved up and down between the lamp and the detector.
Each part of the teacher's arrangement corresponds to a part of the machine.

By comparing the parts of the teacher's arrangement to the parts of the machine, discuss how effective this model is.

(6)

The lamp in the teachers experiment represents the radioactive source, the sensor represents the G-M tube that would measure the amount of radiation coming through and finally the card represents the amount of liquid in the bottle. The model is effective because ~~he~~ if the card is too low then the sensor will detect too much light and ~~stand~~ sound an alarm, just as if the amount of liquid was too low then the radiation which couldn't usually get through would be able to and the G-M tube would detect it and sound an alarm.

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Examiner Comments

This was an excellent response, matching the main components of the model with the machine and succinctly comparing how they both worked. This would score all 6 marks.

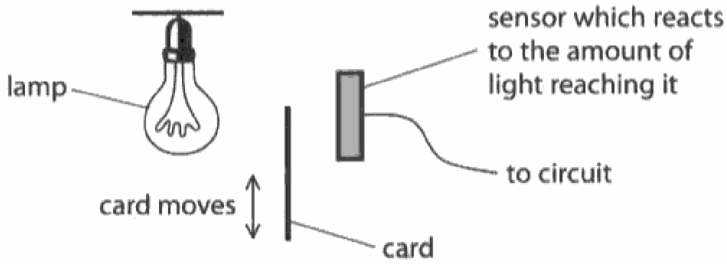
ResultsPlus

Examiner Tip

A simple structure to your answer is the key to success in a question like this.

*(d) A teacher decides to model how a machine checks the level of the liquid in medicine bottles.
The machine uses a radioactive source to sound an alarm when the level of liquid becomes too low.

He sets up the arrangement shown.



The piece of card can be moved up and down between the lamp and the detector.
Each part of the teacher's arrangement corresponds to a part of the machine.

By comparing the parts of the teacher's arrangement to the parts of the machine, discuss how effective this model is.

(6)

The lamp and the light coming from it represents the ~~medicine bottles and liquid within it.~~ radioactive source used to detect a low level of liquid. The card represents the amount of liquid in the medicine bottles. By moving the card the whole way infront of the light source the sensor will loose its source of light meaning the circuit cannot continue. Moving the card the whole way infront of the light ~~indicates~~ represents not enough liquid within the medicine bottles. Moving the card completely out of the way of it as it the light represents a full medicine bottle ~~which~~ allows the circuit to flow

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Examiner Comments

This response made a good attempt at matching the components but did not mention a radiation detector, e.g. a G.M. tube and went wrong in comparing processes. This would be at Level 2, and scored 4 marks.

Paper Summary

In order to improve their performance candidates should:

- make sure that they have a sound knowledge of the fundamental ideas in all six topics
- get used to the idea of applying their knowledge to new situations by attempting questions in support materials or previous examination papers
- show their working at each stage of a calculation
- use the marks at the side of a question as a guide to the form and content of their answer
- use diagrams to help them to structure their answers, for example in Q4b
- read the question carefully and underline the key words, for example in Q5d "Explain, in terms of forces.....as shown on the graph."If the change in subject had not been shown, this would have scored zero.The question directs you towards the graph so try to make your explanation refer to all parts of the graph. There are labels on the graph which you could use in your answer.

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