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Examiners' Report
June 2012

GCSE Physics 5PH2F 01

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June 2012

Publications Code UG033056

Introduction

This is a report on the performance of candidates in the first sitting of Physics/Additional *Science Unit 2: Physics for your future*. The form of external assessment for the Additional Science paper is now a single 60 mark theory paper rather than a series of 24 multiple choice questions followed by a 30 mark theory paper. The new paper does contain some multiple choice questions but these are interwoven with questions requiring a somewhat more complex response from candidates. The level of complexity varies from short response questions for 1, 2 or 3 marks to extended writing questions worth 6 marks.

The Quality of Written Communication is assessed within the 6-mark questions. It was particularly pleasing to note the much improved performance on such questions on this P2 paper compared to that on the first P1 paper for the 2011 specification. Candidates wrote more, and more sensibly, in this series.

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 (b)

It is good practice in all calculation questions, to show the working.

(b) David runs 100 m in a time of 9.80 s.

Calculate his average speed.
State the unit.

(3)

Speed = Distance / Time

Speed = 100 / 9.8 m/s

Speed = [illegible]

= 10 m/s

average speed = 10 unit m/s

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Examiner Comments

This candidate followed good practice and scored full marks. At this level, the number of significant figures was ignored.

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Examiner Tip

A surprisingly large number of candidates incorrectly expressed the units as 'mps'.

Question 2 (b) (iii)

Questions on electrostatics often produced quite low scores.

Most candidates who scored marks did so by noting the observation point that the pieces of paper were picked up and stating that opposite charges are attracted. They did not account for the appearance or position of the opposite charges.

Few commented on the idea that the pieces of paper needed to be small if the paper is to be picked up.

(iii) The boy puts his charged comb near some small pieces of paper.

Explain what happens.

(3)

The comb has become negatively charged, so when he places his comb near small pieces of paper, the electrons of the paper repel away, and so the protons (of the paper) are attracted to the electrons (of the comb), this makes the comb pick up pieces of paper. This happens as the paper is neutral, it has no charge.

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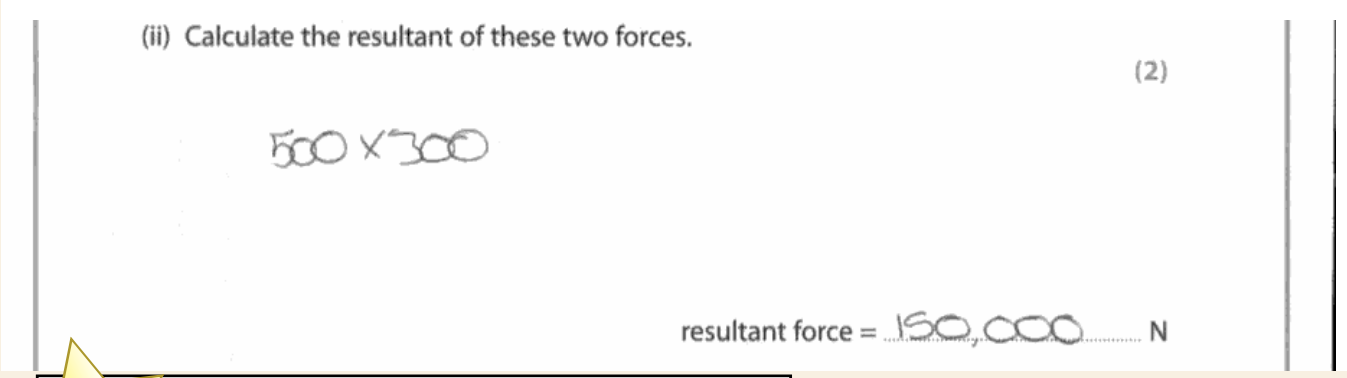
Examiner Comments

The candidate made a good attempt at explaining how the paper became charged by induction and why this led to the paper being attracted to the comb. It was worth three marks.

Question 3 (a) (ii)

There were several quite simple calculations on this paper. In general, they were well done and many candidates, as shown in question 1b, laid out their working clearly. Other candidates, however, played Countdown with numbers.


(ii) Calculate the resultant of these two forces.

(2)

500 x 300

resultant force = 150,000 N

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Examiner Comments

This candidate even showed working to give the incorrect answer. Many others simply wrote this same incorrect answer. 800, 0.6 and 1.6 were also seen on quite a few occasions. These of course gained no credit since there was no scientific basis for them.

Question 3 (a) (iii)

Sometimes, points of the compass may be appropriate, but not on this occasion.

Making a list did not really help either. Even if one of these was correct, a wrong answer would cancel it out.

There were many acceptable answers which could gain the mark, e.g. 'to the right', 'forward' and 'towards the boat'

Question 3 (b) (ii)

As mentioned before, showing working can help to score partial credit.

(ii) The mass of the water skier is 54 kg.
At the top of the jump, she is 5 m above the water level.

Calculate the amount of gravitational potential energy she gains in rising 5 m.
Gravitational field strength = 10 N/kg

(2)

Mass 54kg x g 10N/kg x h 5m =

gain in gravitational potential energy = 2060

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Examiner Comments

Here the candidate gave sufficient indication for the substitution mark. The arithmetic to attain the final value was incorrect. So the candidate scored 1 out of the 2 available marks.

Question 3 (b) (iii)

This question asked for a description of the *energy changes* that happen.

(iii) When the water skier reaches the top of the ramp, she lets go of the rope.

Describe the energy changes that happen between the skier leaving the ramp and reaching the top of the jump.

(2)

When the skier leaves the ramp air resistance pushes her up and gravity pushes her down. She also reaches her terminal velocity when in the air. She also accelerates upwards.

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Examiner Comments

Some candidates put down as many technical terms as they could recall, often in a contradictory manner, in the hope that one might be worth a mark. This candidate scored zero.

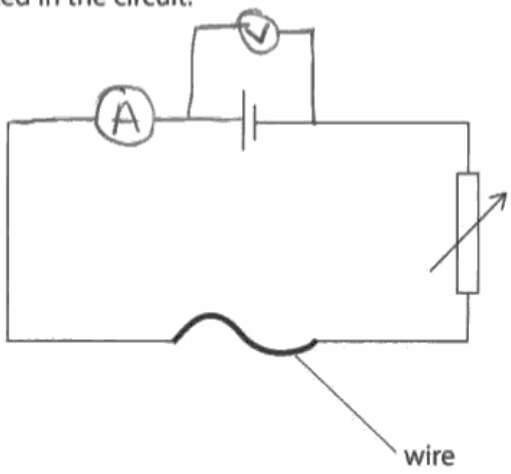
Question 4 (a) (ii)

Circuit diagrams often cause problems, particularly positioning the voltmeter.

(ii) The diagram shows an incomplete circuit for measuring the resistance of a length of wire.

Complete the diagram to show how an ammeter, —(A)—, and a voltmeter, —(V)—, should be connected in the circuit.

(2)



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Examiner Comments

This candidate scored 1 out of 2 for correctly completing the circuit with an ammeter in series. The second mark, for the voltmeter, needed it to be in parallel with the correct component, i.e. across the wire under test.

Question 4 (b) (iv)

It cannot be repeated too often, showing working can help to gain marks.

(iv) $R = \frac{V}{I}$

Calculate the resistance of the piece of wire when the current is 1.5 A.

(3)

3 ÷ 1.5 = 0.4

resistance = 0.4 Ω

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Examiner Comments

This response was awarded 2 from the 3 available since the candidate had read '3' from the graph and substituted correctly. The only error was in the arithmetic of the division. If the 0.4 answer was given with no working - no marks.

Question 5 (a) (iii)

Questions asking for a description can be answered usually by a list of ideas. This question concentrated on the difference between the two given types of radiation.

(iii) Cobalt-60 is radioactive.
It emits beta radiation and gamma radiation.

Describe the differences between beta radiation and gamma radiation.

(3)

Beta is more ionising than gamma radiation. Beta is an electron which has a charge of -1 where as gamma has a charge of 0. Gamma is a wave and is blocked by thick lead, beta can be blocked by alliminum. Gamma is used in medical tracers.

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Examiner Comments

In this response, the candidate listed sufficient differences to gain the 3 marks available. (Listing is all that is required for description questions.)

(iii) Cobalt-60 is radioactive.
It emits beta radiation and gamma radiation.

Describe the differences between beta radiation and gamma radiation.

(3)

the differences between gamma & beta radiation is gamma radiation is the strongest radiation & it can be used to treat cancer but also can give you cancer as for beta radiation is very weak and isn't used in much ~~be~~ beta radiation isn't harmful as gamma

ResultsPlus
Examiner Comments

The strength of the ionising radiations and the relative danger they pose depend on the situation and quantity used. The comparisons here - strongest, very weak, not used as much, not as harmful - were insufficient to score any marks.

By contrast this response did score 1 mark for the penetration idea.

(iii) Cobalt-60 is radioactive.
It emits beta radiation and gamma radiation.

Describe the differences between beta radiation and gamma radiation.

(3)

gamma is a stronger and therefore can penetrate things better. Gamma is a lot more dangerous. gamma radiation is a lot smaller then beta radiation.

ResultsPlus
Examiner Comments

The relative danger from ionising radiation depends on the situation in which it is being used. (The relative size of the radiation is an interesting one.)

Question 5 (b)

This was the first of the six markers. Among other things, it was to test the candidates' Quality of Written Communication. In the two extended writing questions of this type, there was no prescribed factual content or guided route towards an answer.

It was important that candidates realised that moving from one level to the next was not simply doing more of the same as was done at the lower level. Thus, Level 1 might simply involve mention of a fact or idea. To move to Level 2, involved some extension, reasoning or discussion of that fact/idea or linking it to another fact/idea. Scoring at Level 3 may involve considerably more reasoning/discussion of both advantages and disadvantages or of both similarities and differences etc.

The highest possible grade for the Foundation paper is C. This response was considered sufficient for 6 marks on this paper

*(b) Fission and fusion are two different types of nuclear reaction.

Describe the similarities and differences between nuclear fission reactions and nuclear fusion reactions.

(6)

The differences between nuclear fission and fusion is that nuclear fission is produced in nuclear power station, where as nuclear fusion currently can only be produced by the sun and the stars. Nuclear fusion can only occur is extremely high temperatures, where as the temperature does not really affect nuclear fission. Nuclear fission is a chain ~~The similarities~~ reaction. The similarities are that they both produce energy. They are both also nuclear reactions and a dangerous. The biggest difference is that Nuclear fission is used to split apart and nuclear fusion is used to join together.

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Examiner Comments

Where they were asked for similarities and differences, candidates were expected to give both. One structure for the response was to list the differences and then the similarities or vice versa. Here, the differences outweighed the similarities but the crucial point about energy release by both was given.

This candidate correctly indicated the difference between splitting and joining but details were limited.

*(b) Fission and fusion are two different types of nuclear reaction.

Describe the similarities and differences between nuclear fission reactions and nuclear fusion reactions.

(6)

Nuclear fission seperates the atom whereas nuclear ~~fusion~~ fusion tries to join two atoms of the same charge. Both methods don't produce carbon house gases, so this is good for the environment. Both methods use uranium-235 and have a control rod made of graphite to shut the station down if anything goes wrong. Both use heat in there process.

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Examiner Comments

Listing things that neither does/did is generally not a good way of showing similarities. There are many things which neither of these does such as emit positrons, etc. The candidate's explanation then drifts in to incorrect physics. This response only received 2 marks.

This response gave much more detail than merely stating that one is splitting and the other joining. It is thus at Level 2.

*(b) Fission and fusion are two different types of nuclear reaction.

Describe the similarities and differences between nuclear fission reactions and nuclear fusion reactions.

(6)

There both to do with making a nucleus a different size. Nuclear fission is when the nucleus splits into smaller nuclei and they are called daughter cells. Nuclear fusion is when to nucleus' colide together causing them to emurge it to a bigger nucleus.

ResultsPlus
Examiner Comments

Ideas were not totally clear such as confusion with biological fusion and fission of cells instead of smaller nuclei and other sub-atomic particles but at this level the spelling, punctuation, grammar and correct use of most technical terms was just sufficient for the award of 4 marks.

Question 6 (a) (iii)

Responses were anticipated in terms of rocks. These were not discussed only in terms of being underground. The idea, however, was clear.

(iii) Background radiation from radon gas is different from place to place in the UK.

Explain these differences in background radiation.

(2)

Radon gas is in rocks, its emitted from rocks. Houses are built from these rocks, therefore houses that use radon filled rocks to build ~~them~~ will have more of that radiation in their home compared to those who dont have houses from radon filled rocks.

(b) Scientists have changed their ideas about the hazards from radioactive sources

ResultsPlus
Examiner Comments

The comparison was made between places with the type of radon-emitting rock and others without. This scored both marks.

A number of candidates believed radon gas seemed to originate from nuclear power stations.

(iii) Background radiation from radon gas is different from place to place in the UK.

Explain these differences in background radiation.

(2)

It depends where you live, if you life nearer a powerstation more radon gas will be detected than if you live far away from a powerstation

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Examiner Comments

There was some contribution to background count from nuclear power stations. Radon gas was clearly linked in the specification to rocks and the different concentrations of radon to the variation of rock types round the country. This candidate's response did not merit any marks.

Question 6 (b)

The emphasis in this question was on how the ideas have changed over time.

(b) Scientists have changed their ideas about the hazards from radioactive sources.

Describe how their ideas have changed since radioactivity was first discovered.

(2)

When it was first discovered it wasn't known how dangerous radioactivity is. It was used in things like toothpaste and painting watch hands. Now it is used very carefully and is a lot more restricted with its uses.

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Examiner Comments

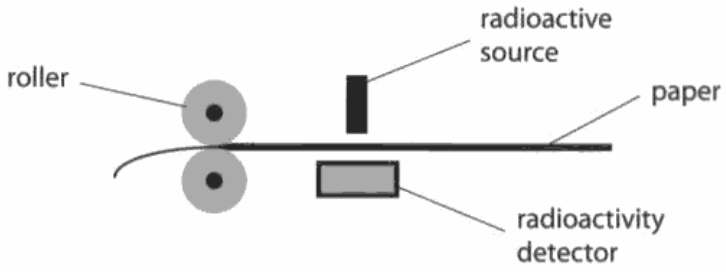
This was awarded 2 marks for noting how the danger and people's reaction to it have changed with time. Phrases like "When it was first discovered ..." or words like "Now" help to bring out the comparison.

Question 6 (c)

Responses to this question were rather less well done than the previous 6-marker. This may be, in some cases, because of shortage of time but there were some candidates at least who did not score despite several lines of writing. These candidates did not really get to grips with the physics of the thickness gauge or any potential dangers or safety precautions needed. There are three main factors involved in the choice of source: the working of a thickness gauge with paper, the safety of workers etc., and the effects of half-life. Discussion of safety issues dominated while reasoning about penetration effects was limited and there was little mention of the reasons for thinking about the half-life of the source.

This candidate simply listed factors without any reasons or discussion.

*(c) The diagram shows how rollers can change the thickness of paper in a factory.
A thickness gauge controls the rollers.
The thickness gauge contains a radioactive source and a detector.
If the paper is too thick, the reading on the detector goes down.
This causes the rollers to be pushed closer together.



The radioactive source used must be chosen carefully to be effective and used in a way that is not a hazard to workers.

Discuss the factors to consider when choosing and using this radioactive source.

(6)

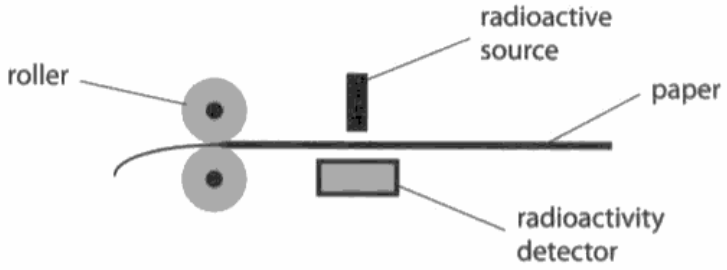
~~How long are people~~ Things they should consider are, How long people can be around it? How radioactive is it? ~~How~~ What are the dangers? what are the ~~pros~~ goods things about it? And, how much is there around? And finally has it been used before?

ResultsPlus
Examiner Comments

If any one of these had been expanded upon, it would have raised the response to Level 2. The grammar spelling and punctuation are fine though there is a shortage of technical terms. As it is, then, it is worth a score of only 2 marks.

This response showed that the candidate became carried away down a side shoot. The candidate, however, gave a considerable amount of information about the need for safety and how it might be achieved.

*(c) The diagram shows how rollers can change the thickness of paper in a factory.
A thickness gauge controls the rollers.
The thickness gauge contains a radioactive source and a detector.
If the paper is too thick, the reading on the detector goes down.
This causes the rollers to be pushed closer together.



The radioactive source used must be chosen carefully to be effective and used in a way that is not a hazard to workers.

Discuss the factors to consider when choosing and using this radioactive source.

(6)

One factor would be ~~the~~ how harmfull it could be on the body or inside the body, like alpha, it can't penetrate through skin but once in your body it is highly dangerous. So they would have to think about how close the workers will have to be to the radioactive source and if they do have to ~~be~~ be within a certain range than they would have to wear protective ~~cl~~ clothing, like gloves, glasses ect... But it would also depend on how long ~~the~~ the worker would have to be exposed to the source on a daily bases.

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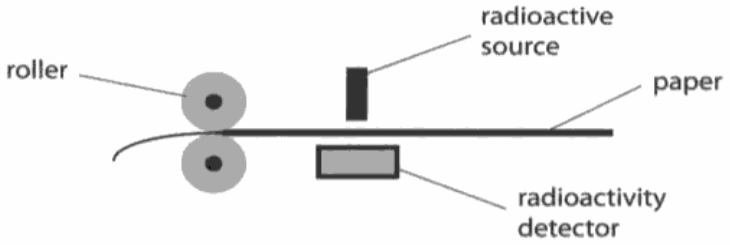
Examiner Comments

Only one factor was discussed so the response is at Level 2. The spelling, punctuation and grammar were acceptable and there was some appropriate use of technical terms. Accordingly, it was awarded 4 marks.

To score the maximum marks for the question, it was not necessary for the response to be comprehensive. The maximum grade for candidates sitting this paper was grade C, a fact which tempers expectation.

*(c) The diagram shows how rollers can change the thickness of paper in a factory.
A thickness gauge controls the rollers.
The thickness gauge contains a radioactive source and a detector.
If the paper is too thick, the reading on the detector goes down.
This causes the rollers to be pushed closer together.



The radioactive source used must be chosen carefully to be effective and used in a way that is not a hazard to workers.

Discuss the factors to consider when choosing and using this radioactive source.

(6)

when choosing the radioactive source you'd have to consider what type of radiation it was for alpha is not able to penatrate many surfaces whereas gamma radiation is far more dangerous. when using the radioactive source you'd have to think about the radioactivity detector working properly to ensure its safe for the workers aswell as the levels of exposure to radiation the workers are at risk of because over-exposure could be highly detramental and

(Total for Question 6 = 12 marks)

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Examiner Comments

This candidate correctly identified that the type of radiation was important. There was some discussion of the radiation to use though this was not fully developed as to how the degree of penetration related to the thickness of the paper.

Safety has been discussed particularly in terms of the level of exposure and the dangers of overexposure.

Sentences were well constructed and spelling well done. The mis-spelling of 'penatrate' and the occasional lack of an apostrophe did not prevent the thrust of the discussion being clear. This candidate was awarded 6 marks at the level of the Foundation paper.

Paper Summary

In order to improve their performance, candidates should:

- ensure that they show working in calculations
- practise ways of describing directions
- practise taking a topic and brainstorming ideas about it
- learn the difference between the words describe and explain in terms of the type of response each requires
- distinguish between similarities and differences
- make comparisons between similar things
- make lists of the properties of things such as protons, electrons etc.
- read through the specification and note/underline anything you do not understand, ready to ask your teacher
- learn the units in which basic quantities such as current, power etc are measured
- remember where radon gas comes from.To score the maximum marks for the question, it was not necessary for the response to be comprehensive. The maximum grade for candidates sitting this paper was grade C, a fact which tempers expectation.

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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