Examiners' Report/

Principal Examiner Feedback

Summer 2017

Pearson Edexcel GCSE

In Physics (5PH2H) Paper 01

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Paper 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, 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 1 or 2 marks each and longer questions worth 3 or 4 marks each. The two 6 mark questions were used to test quality of written communication.

5PH2H_01_Q01aii

Question Introduction

Most candidates were able to give at least two products of fission with energy and neutrons being the most popular. A great many were also able to recall that there were daughter nuclei produced and often gave the name of at least one possible new element; usually Krypton. It was common to see reference to daughter cells rather than daughter nuclei.

5PH2H_01_Q01aiii

Question Introduction

The chain reaction was generally well understood and clearly described, although weaker candidates tended to confuse key vocabulary such as nucleus/atom/element and also described the process as a reaction. There was also some confusion between uranium and daughter nuclei and many wrote about daughter nuclei undergoing fission.

5PH2H_01_Q01b

Question Introduction

The difficulties of starting nuclear fusion were well known and very many candidates described the repulsion between the two nuclei for one mark. Unfortunately, many then went on to either write about high pressure and temperature or to simply repeat the statement in the stem about it needing large amounts of energy. Examiners were looking for an understanding that the nuclei needed to be moving together at very high speed or with very high **kinetic** energy. A mark would also have been given for stating that it needed a "very high temperature" (but not simply a "high temperature" , which is too vague)

5PH2H_01_Q02a

Question Introduction

Most candidates showed that they knew how electrons, neutrons and protons were arranged in an atom.

5PH2H_01_Q02ci

Question Introduction

The idea of charge transfer was well known and clearly described. Some lost a mark by not specifying the direction of charge transfer. There was much less incorrect mention of positive charges moving than in previous years.

5PH2H_01_Q02cii

Question Introduction

Although many candidates correctly wrote about the negatively charged chips being attracted towards the positively charged rod, a significant number of candidates made assumptions about the drum being negatively charged (which was not mentioned in the question) and described the chips being repelled from the drum.

5PH2H_01_Q02ciii

Question Introduction

This was a popular question and answered well by a majority of the candidates. Where mistakes were made it was to do with simply writing about earthing (which was given in the stem of the question) without explaining why it was necessary. Examiners were looking for either a process such as removing the charge or a hazard such as the possibility of sparks or electric shock.

5PH2H_01_Q03a

Question Introduction

This was usually well answered with well laid out calculations and correct evaluations. As usual, credit was given for a partially correct method provided that the working was clear.

5PH2H_01_Q03b

Question Introduction

Many candidates concentrated on forces pulling the cabins up and down rather than the energy change or transfer. Sometimes energy was mentioned, but usually in the context of an ability to push or pull objects. Other candidates had the idea of GPE transferring to KE but usually only in one cabin rather than between the two cabins. It was also common to see reference to gravitational energy rather than gravitational potential energy.

Examiner Comment

This is typical of many similar answers which were all about forces rather than energy transfer. 0 marks.

5PH2H_01_Q03ciii

Question Introduction

This was generally done better than the previous calculation. Once again, the main challenge for weaker students was to recognise which formula to use. They often chose the first formula in the list which contained distance. (Speed = distance /time) or which contained two quantities which they could recognise in the question (force = mass x acceleration).

5PH2H_01_Q03ci-ii

Question Introduction

In part (i) Candidates had to recognise that the work done in stopping the car was the same as the kinetic energy which the car had when the brakes were applied; 510 000 J.

However very many attempted to use the equation for kinetic energy and substitute various numbers into that equation.

Look at the command word (usually the first word in the sentence). If you are asked to “state a value” then you will not need to do a calculation.

The first challenge in (ii) was to recognise which formula to use from the sheet supplied.

Many candidates seemed to scan down the list and select the first one which included mass and velocity; the expression for momentum. They then attempted to substitute into that; even though there were two unknown values: momentum and velocity. Better candidates recognised that the expression for kinetic energy was the one to use and substituted their value from part(i) into this equation.

Evaluation required several mathematical steps including a transposition involving a fraction and a squared term and then finding a square root.

Full credit for part (ii) was given to candidates who had an incorrect value in part (i) but then successfully used that value of KE to arrive at a velocity which was correct for their KE.

As usual with calculation items, partial credit could be obtained for clearly showing substitution of correct values into a correct expression, even if the subsequent transposition and evaluation was wrong. This requires candidates to show their working. Incorrect answers with no working shown cannot get any credit.

Examiner Tip

If the question asks you to "state" a value then you will not need to do a calculation. You just need to pick out the correct value.

5PH2H_01_Q04aii

Question Introduction

Although many candidates correctly placed an ammeter in series with the lamp and battery, there were a large number who either used a voltmeter or placed the ammeter across the lamp. There were also a large range of symbols used: the letter M in a square box was common.

Examiner Comment

It was very common to see a voltmeter being incorrectly used to measure current.

Examiner Tip

Make that sure you know the difference between a voltmeter and an ammeter and know how they are connected in a circuit.

5PH2H_01_Q04aiii

Question Introduction

This calculation was generally done well. It is pleasing to see that many more candidates are showing all of their working. This allowed the examiner to give partial credit for correct substitution and/or transposition even if the final arithmetic of the evaluation was wrong.

5PH2H_01_Q04bi

Question Introduction

Most candidates were able to us the correct formula to find the power. The most frequent errors were to either ignore the fact that the current was given in mA or to multiply the final answer by 1000 instead of dividing. A few candidates did give an answer as 9600mW. This was perfectly acceptable.

Examiner Comment

Good candidates changed the mA into A before substitution into the formula

Examiner Tip

Check the units in the question carefully. Do any conversions before you do the rest of the calculation.

5PH2H_01_Q04bii

Question Introduction

This proved to be a challenge to very many candidates. Examiners were looking for an explanation which first recognised that, if the current in the lamp was not exactly half when half the voltage was applied then the resistance of the lamp must have changed. The reason for this is that the lamp is less bright / the filament is at a lower temperature. The 3rd mark was for explaining that this change in resistance in terms collisions in the lattice. Several candidates recognised that there was a change in resistance but failed to link this to the lamp. Some credit was given for this.

One very common, incorrect, approach was to assume that the power remained the same and attempt to demonstrate that the current would be twice as large.

5PH2H_01_Q05b

Question Introduction

Candidates usually recognised the formula to use and successfully substituted and transposed to arrive that the correct answer of 12. The most common, incorrect, approach was to select the formula for momentum: perhaps because values for both mass and velocity appeared in the question

5PH2H_01_Q05di

Question Introduction

It was usually recognised that the graph showed that the air resistance increased with velocity for one mark. This was often stated as a "positive correlation". The second mark was for stating that the relationship was not linear. Much fewer candidates scored this mark. Several did make an attempt by quoting pairs of values from the graph but failed to draw any conclusions from these pairs of values.

5PH2H_01_Q05dii

Question Introduction

Candidates seemed to be very familiar with this scenario and could often give a clear explanation of terminal velocity. However, the question did ask for explanations of how the velocity changed during the descent and so focusing only on the final part of the descent at constant velocity meant that their answer could not get above level 1. Another common error was to describe the forces acting (often in detail) without being clear about how the velocity changed as a result.

There was also much confusion in the use of terms such as acceleration, momentum, and resultant force. In particular, it was often stated that air resistance and the force of gravity were both resultant forces.

Nevertheless, many candidates gave good answers at level 3.

Clearly labelled diagrams often helped an otherwise slightly ambiguous written response, but examiners did see many diagrams with incomplete labels. These usually contributed little to the answer.

5PH2H_01_Q06ai

Question Introduction

This was answered well. Examiners often saw correct reference to different mass numbers for the same atomic number, but most correctly identified a different number of neutrons for the same number of protons. The most common error was to not mention that the proton number was the same. This was too ambiguous to score the mark.

5PH2H_01_Q06aii

Question Introduction

There were many cases of candidates reading the information incorrectly; in particular, not recognising that the half-life of thorium was given in years whereas that of radium is given in days.

Even so, it was disappointing that so few candidates seemed to understand the term “activity” of a radioactive isotope. It was commonly held that because thorium has a longer half-life than radium, the thorium sample decays more slowly (true for 1 mark) and therefore has a higher activity (not true). There was also much confusion about half-life. Very many candidates seemed to think that the thorium lasts for exactly 1.9 (or sometimes, 3.8) years. This misconception in particular hampered a good response to the next question item.

5PH2H_01_Q06bii

Question Introduction

Very many candidates reached at least Level 1 by correctly describing the hazards (or dangers) of radioactive isotopes; usually in terms of damage to / mutation of living cells by alpha particles if they were absorbed by those cells.

The next level was more difficult. Once again there was much evidence of misconceptions such as radioactive decay occurring suddenly: "after 1.9 years the thorium decays into radium, then after 3.6 days the radium decays into radon". There was also a widespread confusion between the radioactive half-life of a particular isotope and how long that isotope might be retained by the body. Typically, candidates thought that thorium remained in the body for 1.9 years.

Even so, many candidates reached level 2 by correctly reasoning that the risk of using this toothpaste was due to the possibility of swallowing, (or having in the mouth) an alpha emitter in direct contact with their cells.

For level 3, examiners were looking for evidence of a discussion about the risks. Good candidates picked up plenty of clues both in this part of the question and in the previous items; such as alpha cannot penetrate even thin materials (and therefore present little risk while in toothpaste is in its tube) or that the amount of thorium used was very small. Additionally, the question about activity prompted some to reason that the actual chance of alpha particles being emitted by the thorium during the short time that it is in the mouth is relatively small. Responses which could go on to give a scientific reason why the risks might be less than immediately supposed were usually scored at level 3.

Paper Summary

Based on their performance on this paper, 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
- identify the known and unknown quantities in a numerical problem before selecting a formula to use for the calculation
- make sure that they recognise SI prefixes such as m and K and how to handle these in calculations.
- use the marks at the side of a question as a guide to the form and content of their answer.