Pearson

Examiners' Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel GCSE In Science
(5PH3H) Paper 01

edexcel

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your candidates at: www.pearson.com/uk

Summer 2017
Publications Code 5PH3H_01_1706_ER

Paper Introduction

The Physics component of the Science2011 aims to test the contents of the specification, by giving opportunities to all candidates to show their knowledge and understanding, as well as stretching the most able with more demanding applications of fundamental knowledge. Questions were set to test candidates' knowledge, application and understanding from the five topics in the specification:

1. Radiation in treatment and medicine
2. X-rays and ECGs
3. Production, uses and risks of ionising radiation from radioactive sources
4. Motion of particles
5. Kinetic theory and gases

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 two longer questions worth three marks each. The two six-mark questions were used additionally to test candidates' quality of written communication.

General comments

The performance of candidates was very similar to that in 2016, with the mean mark obtained being practically the same. Candidates coped well with the majority of questions. The quality of written language 6-markers were well answered. For the first of these two longer questions (5c) many could describe how ultrasound is used to produce scans for diagnosis, going on to cite how ultrasound was used in treatment, for which the vast majority talked about how ultrasound could be used to break up kidney stones. The second long answer question(6b) was tackled well by many candidates, who knew about the production of gamma rays from electron-positron annihilation and could go on to describe their detection using triangulation from sensing the pairs of gamma rays given off. Both the medical physics questions showed some candidates' misconceptions, where their knowledge was misapplied or conflated. For example some described elements of CT scanning or gamma beam therapies in the wrong contexts.

Successful candidates were:

- well-acquainted with the content of the specification
- skilled in graphical work
- competent in quantitative work, especially in using equations
- well-focused in their comprehension of the question-at-hand
- willing to apply physics principles to the novel situations presented to them

Less successful candidates:

- had gaps in their knowledge
- misinterpreted graphical forms
- misread and / or misunderstood the symbols used in equations
- did not focus sufficiently on what the question was asking
- found difficulty in applying their knowledge to new situations

This report provides comments on the questions in the paper, noting the successes and pitfalls of candidates in attempting each question.

Comments on the performance of candidates

Question 1

Most candidates attempted to calculate the power of the lens in part (a), but only a few realised that the focal length needed to be in metres in order to obtain the power of the lens in dioptres, D.

Only a very few candidates were able to correctly identify where to label the focal length of the lens in the diagram; it seems this is not very well known, and that most candidates were not very familiar with working with ray diagrams. In contrast, many candidates correctly worked out the magnification of the lens by taking the image height divided by the object height. A few arrived at the correct answer by the use of similar triangles (taking image distance divided by object distance). Nearly all candidates recognised that a negative image distance was associated with a virtual image.

Question 2

Part (a) (multiple choice) was answered correctly by almost all of the candidates, who realised that ionising radiation increases the probability of causing the mutation of DNA in cells.

Most candidates could at least name two different ways by which medical staff can be protected from exposure to ionising radiation. The most common answer was via the use of lead aprons, with the use of lead shielding and monitoring via dosimeters also being well known by many candidates. Vague references were not credited e.g. 'protective clothing' and 'gloves'. Whilst there were some good answers to part c, placing a radiation source inside a patient to treat a cancer, many candidates went off track by describing the firing of beams of gamma rays from outside the body. The practice of reading the question very carefully, highlighting key words – here – 'placed inside the patient' cannot be overestimated. For part (d) the mark scheme allowed for four different pathways in getting the marks. Most candidates achieved this, with talking of a short half-life, followed by explaining that this lessens exposure to radiation, being the most common approach. Unfortunately no marks could be given to the candidate who talked of the isotope having a 'short after-life'!

Question 3

Many candidates correctly completed the symbol for the nucleus, but a substantial number showed various confusions over the numbers involved. Most candidates correctly plotted the points on the graph but best fit curve drawing was lacking in a substantial number of responses, with curves being drawn underneath most of the points, multiple lines (tramlining) being drawn or lines being drawn point to point, or in stages, so that an acceptable one best fit curve could not be credited. Most candidates knew that beta-minus emitters were located above the N-Z curve of stability.
The vast majority of candidates knew the β^+ decay process well and obtained to correct answer $p \rightarrow n + \beta^+$
The quark structures of neutrons and protons were extremely well known.

Question 4

Almost all the candidates' recognised 'particles moving past each other' as a description of the liquid state for part (a) the multiple-choice question. Most candidates could explain pressure in terms of the collisions of particles with the walls of the container. Some included the idea that this imparted a force but very rarely was the explanation completed in terms of pressure being the result of (a sum of) force(s) over an area. Either the equation $p = F/A$ or a word equivalent explanation sufficed for the third mark. In contrast, most candidates explained the increase of pressure with temperature well in terms of an increase in speed, **kinetic** energy or momentum followed by an increase in the frequency of collisions (with the wall). A good many candidates summed the pressure due to a column of water with the air above arriving at 606 kPa. Quite a substantial number of candidates tried, unsuccessfully, to convince examiners that the pressure of the water alone – 505 kPa – was roughly the same as the 600 kPa required.
Candidates have proved over the years that they are very capable of applying gas law formulations to before and after situations. Q 4c (ii) was no exception, with many candidates arriving at the correct answer.

Question 5

Almost all candidates knew of endoscopes, in answer to 5 (a). Most could figure out percentage changes to work out the originating intensity in 5 (bi). Mathematical competence in transposing the equation Intensity = power / area was evident in the many correct answers to 5 (bii).
5 (biii), the multiple-choice question, was only answered correctly by a quarter of candidates. In this case the distractors worked well and only the highest ability candidates showed a good understanding of why the intensity of radiation decreases with distance according to the nature of the medium it passes through.
For the first of the 6 markers, as indicated before, candidates' knowledge, understanding and application of ultrasound was tested. The indicative content of the mark scheme was often matched by candidates discussing ultrasound reflecting off boundaries in the body in some detail, followed by the application in treatment of shattering kidney stones. That latter aspect was often not very detailed but the mark scheme allowed for full marks to be obtained if the former aspect was delved into in some detail, followed by less detail for the treatment side. Note that indicative content is just that; many candidates were also credited for showing further knowledge e.g. concerning the use of ultrasound in blood flow measurement.

Question 6

6 (ai) (multiple-choice) was answered correctly (force towards the centre due to a magnetic field) by two thirds of candidates.
Many candidates knew that an accelerating voltage was used to accelerate protons across the Dees for (a ii). Candidates were also credited in this part for citing magnetic fields as being responsible. This represented a widening of the mark scheme to credit what candidates knew about the forces involved. Many candidates also knew of the process used in a cyclotron to produce radioactive nuclei, involving the transformation of a stable nucleus into an unstable one. A compensatory mark was given for candidates talking of proton-proton collision even though this is not the required process. As in other areas some conflation of ideas may have occurred e.g. with the LHC proton-proton collisions. There were some excellent answers to the final 6-marks question, as indicated earlier, with annihilations described accurately and how the position of the tumour was located via the intersection of gamma ray tracks,

including ideas of triangulation. Many of the diagrams drawn made candidates' ideas clearer and enhanced their explanations.
Where candidates went astray was often due to not reading the question carefully and going into treatments via gamma beams. As well as that, some candidates tried their luck through a rephrasing of elements of the wording in the question. Examiners are aware of that and only credit genuine answers which introduce the required explanations.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom