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General Certificate of Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Report on the Examination

2009 examination - June series

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Science B / Physics
Higher Tier PHY1H

General

Overall this seemed to be an accessible exam for most candidates with questions 3 and 4 in particular getting good responses. As usual, some errors were evidently caused by not reading the question carefully enough or by vague reference to technical terms with no understanding. For example in Q3 part (b), the question referred to the compact stereo being left on standby – many candidates did the calculations in terms of one of the other items, or even all of them. Reiterating information given in the question rarely earns credit and candidates need to add their own interpretation or demonstrate extra knowledge and understanding if they are to perform well. Good candidates seemed keen to give more information than was required for maximum marks.

Question 1 (Standard Demand)

(a) (i) The majority of candidates correctly identified the HESS telescope.

(a) (ii) The majority of candidates gave the correct answer, infra red.

(b) This question was answered reasonably well, with the majority of candidates scoring at least one mark. Marks were often lost because answers were given in terms of 'why is the image better' rather than 'how is the image better'. Although in the minority, quite a few answers indicated that the telescopes' images were of the Earth itself, or that rays were being sent out by the telescopes.

(c) Most candidates had the idea of a clearer image but many expressed themselves in vague terms eg a better image. A good number of candidates knew that microwaves would be absorbed by water but a significant proportion had the microwaves absorbing the water or thought that the heat caused by the absorption was the problem. Many answers did not include the word microwave but were about the (electromagnetic) waves from the question stem or even a reference to light. Many weaker answers were concerned about the condition of the telescope if kept in a moist environment eg going rusty or about water on the lens. Only a few candidates linked the absorption of the microwaves to the telescope receiving less information/sensitivity.

(d) Surprisingly, not many candidates seem to have spotted that there was a fourth signal in the radio telescope image; of those who did, few linked this to a star or galaxy. Most candidates commented on the variation in signal strength and tried to link this to size, distance or speed. Red and blue shift were also mentioned a number of times.

Question 2 (Standard Demand)

(a) (i) Only half the candidates answered this correctly. The most common correct answer was some reference to noise/interference with some candidates giving very detailed explanations of the removal of interference from the signal. Only a small number of candidates referred to the use of digital signals in computers and although a number had the idea of digital being better they often went on to talk about an improved picture or sound rather than discussing the quality of the signal.

(a) (ii) The majority of candidates gained the mark for referring (sometimes in great detail) to the use of microwaves in cooking.

A small number gave the simple response 'in a microwave' and did not earn any credit. Only a few candidates mentioned the use in communications but most of these answers incorrectly referred to radio/television or even the TV remote control.

(b) (i) Only a minority of candidates gained the mark here. Most of the candidates knew that they needed to study the health of users/non-users but unfortunately the vast majority intended to do some sort of experiment which involved making volunteers use phones over a period of time and monitoring them. Candidates should be aware that medical experiments are not done on people to see if something is harmful. Those candidates who were going to research users health quite often neglected to mention that they would need to compare with non-users. Some candidates who used the term test/experiment went on to explain that they would study health data demonstrating that the terminology in this question was a problem. The candidates' confusion and poor expression of ideas in a limited space was a concern.

(b) (ii) Whilst many answers may have indicated the idea of increasing the sample size, the wording tended to be too brief or imprecise, for instance 'repeat the test' without specifying whether this was with other people or the same set of people.

(b) (iii) Virtually all candidates identified the issue as being an ethical one.

(c) (i) Many candidates were using the terms 'reliable', 'accurate', 'precise' and 'valid' (and sometimes all of these) without showing any understanding of their meaning, thus scoring no marks. As with ISAs, the term 'fair test' on its own, without any further explanation, does not qualify for a mark. A significant minority of candidates realised that, unless the tests were the same, it is not possible to make any comparison between the phones.

(c) (ii) A fairly straightforward question that was well answered. Most of those who did not score gave answers that had nothing to do with the information given or referred to microwaves being emitted rather than absorbed. Some candidates answered in terms of mobile phone masts and thus could not be given credit as they did not answer the question that was asked.

(d) Almost all candidates scored a mark here for demonstrating the need to avoid bias or the possibility of result manipulation. The candidates have perhaps too readily accepted the idea that people cannot be trusted to do a job properly or examine data impartially if given enough financial incentive to do otherwise.

Question 3 (Standard Demand)

(a) (i) This calculation was correctly done by most candidates. Of those who did not score full marks, some gained credit for calculating the useful energy as 480 J, but were then unable to complete the calculation correctly. Others arrived at the correct numerical answer, but added an incorrect unit such as J or J/s.

(a) (ii) A wide range of responses was seen. A number of answers had the energy changing into light/sound and therefore being used by the person watching the television. There were indications that many candidates had not read the question carefully enough to appreciate that it referred to the 'useful' energy and what happens to it 'eventually'.

(b) (i) Just under half of the candidates gained full marks. The most common incorrect answer was 1750 showing no conversion from watts to kilowatts. Many candidates did not read the question carefully and instead of referring to the compact stereo, chose another item or all of the items together.

(b) (ii) The candidates that answered correctly in part (b)(i) generally scored this mark. Many candidates scored the mark for error carried forward mostly from an answer of 1750. A significant but small number of candidates made errors on converting pence to pounds or multiplied by 0.12 but forgot to put in £ sign. Some candidates who had failed to do the correct conversion in part (b)(i) arrived at a cost of £210 for leaving a small electrical item on standby for about a week!

(c) This was very well answered by many candidates. A common mistake seen was that the electrical appliance itself was giving off heat, which contributed to global warming, or more bizarrely, was giving off carbon dioxide.

Question 4 (High Demand)

(a) This question was generally well answered though some candidates had misread the key and confused hydro with oil. Some candidates only gave a simple response about the decrease in oil and had not read the question well enough to spot that it contained a plural.

(b) (i) Surprisingly only just over half of the candidates could correctly name the process. Most incorrect answers gave the name of a chemical process.

(b) (ii) Only the better candidates were able to gain full credit for a clear explanation of the process. Many candidates failed to gain any credit for omitting the word 'steam' and/or giving descriptions of 'heat' turning turbines.
Some candidates tried gave an explanation of nuclear fission, clearly having not read the question.

(b) (iii) Few candidates gained both marks. The majority gained one mark for stating a 'no CO_2 released' type answer or that nuclear power stations are reliable. The most common incorrect responses were 'nuclear fuel is efficient'/ 'nuclear fuel will not run out'/ 'nuclear fuels produce more energy'/ 'nuclear fuel is renewable'.
A worrying proportion of candidates talked about burning the nuclear fuel.

(b) (iv) This was well answered with the majority of candidates knowing that the waste was radioactive. Extra information was often given such as the effect on tissue, food chains, etc and the long half-life. Weaker responses referred to the waste as reactive or were concerned with greenhouse gases or acid rain.

(c) Many good answers were seen. The second mark was often lost because of a reference to CO_2 destroying the ozone layer or simply repeating the given phrase 'climate change'.

Question 5 (High Demand)

(a) Candidates showed some confusion between conduction, convection and radiation with only just over half of the candidates gaining the mark.

(b) The majority of candidates correctly identified the freezer but less than half of these went on to give the correct reason of greater temperature difference with the others merely noting that the freezer was colder.

A number of weaker candidates indicated the fridge because they thought it would be easier to raise its temperature to match the surroundings.

(c) Many candidates scored a mark for correctly identifying that the white shiny surface is a poor absorber of heat. Whilst there were many answers referring to the surface reflecting the heat, there were also answers of 'reflecting the cold'. A few candidates seemed to think that we needed to reduce the heat loss from the fridge freezer to the room. Non-physics answers of fitting in with kitchen colour schemes and being easier to clean were fairly frequent.

Question 6 (High Demand)

(a) (i) Less than half of the candidates realised that gamma is too weakly ionising to be used in the detector. Many candidates seemed not to have read the question carefully enough and answered in terms of either a different type of alarm or of the danger posed by penetrative gamma rays.

(a) (ii) This was reasonably well answered though some candidates thought the half-life too long and therefore a health hazard.

(a) (iii) There were a great variety of answers given, with only just over a half being correct. Weaker candidates mentioned different numbers of a wide variety of things including electrons, protons, atoms and charges.

(b) (i/ii) Many candidates made a reasonable attempt at these questions. The second mark was sometimes lost by candidates stating general penetrating properties of alpha and beta radiation, and not referring to the situation shown.

(c) (i) The question was answered very poorly by most candidates with very few gaining two marks. Candidates did not appear to have read or understood the question and attempted various responses relating to finding where the polluted area was. Common mistakes were that the pollution would block the radiation from being detected or the gold somehow reacts with the pollution even changing colour. A large number of answers indicated that the isotope would be placed in the polluted area and would make its way upstream to be detected at the offending site. A number gave an answer 'use as a tracer' without adequate explanation. Of the small number of candidates who had the basic idea correct, about half of them failed to say that the tracer would need to be added to different places at different times.

(c) (ii) The majority of candidates gained both marks for correctly finding the half life to be 2.7 days but a significant number lost a mark for assuming their answer had to be a whole number of days and rounding up to 3. Another common error was to assume that the count rate had fallen to a background level at the end of the graph line thus subtracting 150 from the readings and obtaining an incorrect result for the half life.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.