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General Certificate of Secondary Education

Science A 4405 / Physics 4403

PH1HP Unit Physics P1

Report on the Examination

2012 Examination – January series

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Science A / Physics
Higher Tier PH1HP

General

Questions 1 and 2 were common to the Foundation Tier paper and were set at standard demand. Question 3 and parts of question 4 were also set at standard demand. The rest of the paper was made up of questions written to high demand.

Although the majority of students attempted all parts of all questions, a significant number of students did not attempt question 8. This would suggest that some students ran out of time. Students that ran out of time may have done so by writing far more than was needed to answer a question; this was particularly true in question 2(b). However, often what was written was not relevant to answering the question. There are still many students that given four lines to answer a question will fill two or three of the lines by copying out the question and then require additional space.

The questions involving calculations were generally answered well. However, the standard of English often let students down when answering questions requiring extended writing. In questions that ask students to 'explain', a simple statement is not enough. If the question is worth three marks there should be three connected statements. It may help students to remember that the answer to an 'explain' question should include the word 'because'.

Question 1 *(Standard Demand)*

(a) This question was very poorly answered with just over half of students scoring zero. Many students wanted to explain the process of evaporation rather than explaining the reason for their choice of line. Many students lost the first mark for assuming that the draught from the fan warmed the cotton wool, thereby increasing the rate of evaporation. Many answers were given in terms of drying the cotton wool which then provided insulation to keep the thermometer warm.

(b) Just over half of students gained the first mark for increase in surface area, but then went on to link this to a greater exposure to the Sun or increased exposure to the wind. Answers in terms of the water being unable to escape from the plastic bag were common.

Question 2 *(Standard Demand)*

(a) Most students were able to explain the purpose of transformer X. However, a significant number of students think that increasing the voltage will make 'electricity travel faster'. A number of students made contradictory statements such as 'increases the voltage' and 'increases the current'. Despite this being only a two mark question, many students wrote long answers going outside of the answer space. These answers usually included everything the student had ever learnt about the National Grid, including the purpose of step-down transformers and the links made with both power stations and consumers.

(b) There were many good answers to this question, with both advantages and disadvantages for both types of cable clearly given. However, for a significant number of responses the salient points had to be filtered out from overlong answers that often started with an unnecessary discussion of step-up and step-down transformers. Whilst just under two-thirds of students scored at least three marks, nearly a fifth of students scored one or zero. These students either completely misunderstood the question, gave answers far too vague for credit or it was not clear which type of cable was being

referred to. Nearly a tenth of students gained six marks. These students gave organised responses in a logical sequence; often well within the space allocated.

(c) This question was not well answered, although nearly a third of students did score both marks. The majority of students gave answers that were inaccurate or lacked sufficient detail to be given any credit. Students should be encouraged to include figures from the graph in their answers, for example, 'The strength of the underground cable fell' lacks detail; 'The strength of the underground cable fell to zero at 30 metres' would gain credit. Some students seemed confused by the label on the x-axis of the graph and seemed to think the distance related to the length of the cable, hence there were many answers along the lines of 'overhead were better as they went further'.

(d) Most students gained this mark.

Question 3 *(Standard Demand)*

(a) Many students gained full credit, or at least two marks, for calculating energy as 18.2 kWh. The most common errors were to use an incorrect time, six hours being popular and / or to calculate cost by dividing 18.2 by 5.

(b) This was very poorly answered, with just under a tenth of students scoring the mark. Most students simply repeated the stem of the question and added that it was for the electricity companies to make more money. Few students realised the significance of a lower cost and the surplus of energy at night.

(c) This was poorly answered with two-thirds of students scoring zero. Many students seemed to think that the purpose of the super-efficient insulation was to completely stop any energy / heat transfer to the room. These students seem not to understand the purpose of room heaters!

(d) Nearly half of the students scored both marks. However, all students should be encouraged to copy the equation from the equation sheet and then substitute figures. If this is done correctly, students will score at least one mark. There were a significant number of errors made in transforming the equation. Students showing only an incorrect transformation gained no credit. A significant minority of students used a temperature change other than the 100 °C given.

Question 4 *(Standard / High Demand)*

(a) (i) A very small proportion of students were able to give a correct and concise answer. Few students confused the two types of wave but many tended to describe properties such as 'travel through a vacuum' rather than explain the difference between the two types of wave. Many students lost one mark by talking in terms of the direction of the wave rather than the direction of energy transfer. A number of students gained one mark by simply drawing a representation of the two waves.

(a) (ii) The specification states that 'mechanical waves may be either transverse or longitudinal'. This answer was given by few students; however, correct examples of mechanical waves such as seismic waves were acceptable. Most students named a part of the electromagnetic spectrum or sound. A significant number of students gave 'heat waves'.

(b) This was better answered with two-thirds of students scoring the mark. Although not penalised for this, the quality of the completed diagrams left a lot to be desired. Students should, in general, be encouraged to take more care and with this particular diagram to draw the diffracted wavefronts the same distance apart as the incident wavefronts. There was evidence that some students had been taught interference, unfortunately this seems to have led to incorrect diagrams being drawn.

(c) Most students were unable to apply the idea of diffraction, introduced in part (b), to answer part (c). Of those students that correctly stated the sound waves would be diffracted or that the light waves would not be diffracted, few then related the wavelength of the wave to the width of the doorway. Most answers were in terms of refraction, reflection or sound travelling through walls. This was despite being told the sound could only be heard when the door was open.

Question 5 *(High Demand)*

(a) (i) Two-thirds of students scored this mark.

(a) (ii) Many students scored this mark because they realised the need for a control in order for a comparison to be made. The most common non-creditworthy answer was to just measure room temperature without any reference as to why this was needed. There were a significant number of answers in terms of the possible effects of scattered / reflected / refracted / diffracted light.

(a) (iii) Over three-quarters of students scored at least one mark, usually for red light being the hottest or outside the spectrum being cooler. Few students linked temperature rise to wavelength. Common errors included reference to there being infrared within the visible spectrum and red light having the shortest wavelength.

(b) This was a very poorly answered question with only just over hardly any students scoring both marks. Most answers were very confused and lacked accurate scientific information. Many students clearly did not know where the infrared region was, whilst others thought that red light and infrared were the same thing or that infrared can be seen.

(c) Standard form is now part of the mathematical requirements for this specification. Whilst it was pleasing to see that some students were capable of using data given in this form, it was clear that the majority of students did not know what to do with the powers. There were also a significant number of students that were unable to transform the equation correctly. This usually resulted in zero marks, as no correct substitution was shown.

(d) This question was not answered well. Many students tried to link their answer to the absence of the Sun at night and / or more light during the day making it harder to see the criminal on the camera. A number of students gained one mark for reference to the temperature difference between the criminal and surroundings but, without reference to infrared. Some students thought the criminal would show up better as they were hot from running away!

Question 6 *(High Demand)*

(a) (i) Almost a half of students gained both marks. The common errors were to multiply 8 by 20 without then dividing by 100 or divide 20 by 8 giving an answer of 2.5.

(a) (ii) A significant number of students thought this question could not be answered due to lack of data. These students had failed to read the question stem that told them both bulbs had the same useful power output. Students scoring both marks in part (a)(i) usually also scored this mark. However, there were a significant number of students giving answers in excess of 100 %.

(b) Students presented numerous versions of a Sankey diagram. Some students failed to label the two outputs and so limited themselves to one mark. A number of students gave three output arrows. Students would be well advised to spend some time practising drawing neat, labelled diagrams.

(c) (i) Students were asked to use the data and not simply to repeat it. However, there were many good answers that compared the cost over the same period of time and gained both marks. Different, but still valid answers, which used correct calculations in terms of cost per hour or hours per pound spent, were regularly seen.

(c) (ii) There was a wide variety of answers, many unfortunately, too vague to credit. The most popular correct answer was in terms of 'waste less energy'.

Question 7 *(High Demand)*

(a) The majority of students scored at least one mark. The most common error was simply to refer to 'object / something' moving towards an observer without any reference to a wave source. Many students scored one mark for changing frequency / wavelength.

(b) Clearly, many students still do not understand what is meant by red shift. There are still many answers in terms of galaxies looking red or galaxies moving towards the red end of the spectrum. Answers often referred to planets or also talked about blue shift. The better students did score two or three marks, being able to describe red shift and relate it to at least one relevant point about distant galaxies.

Question 8 *(High Demand)*

(a) The term 'nuclear fission' was well known. However, it is alarming how many students think that nuclear fuels are burned in order to release energy. The process of generating electricity was not well described; many students seem to think that it is the turbine that generates the electricity. An advantage of nuclear fuels 'reliability' was often given. However, many students spent a lot of time and filled a lot of space describing numerous disadvantages of nuclear energy and / or the advantages and disadvantages of wind with no reference at all to nuclear energy.

(b) Nearly a fifth of students did not attempt this question. Many students simply repeated the stem of the question and had no idea about the storage of the carbon dioxide following its 'capture'. A common error was the assumption that 'carbon capture' involves the removal of the existing carbon dioxide from the atmosphere.

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