General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Report on the Examination

2012 Examination – January series

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SCIENCE B / PHYSICS

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General

Questions 1 to 4 were low demand, targeting grades E, F and G. Questions 5 and 6 were standard demand, targeting grades C and D.

The majority of students attempted all parts of every question, with few being left un-attempted. It was pleasing to note that in many scripts the standards of literacy and presentation appeared to be better than in previous years. However, the work of some students did cause problems. In some cases writing was extremely faint and difficult to interpret. Students should be reminded to use black ink whenever possible.

The standard of numeracy was generally pleasing. Students were able to substitute correctly into the equations that they were given and often went on to give the correct answer. However, a minority did not attempt any calculations and simply left these part questions blank. Students did not seem to realise that credit was available for showing working and not just for the final correct answer.

Question 1 (Low Demand)

(a) Most students scored at least two or three marks with 30% of students scoring all four marks. A common error was to suggest that 'infrared' causes sunburn.

(b)(i) Just over 62% of students gained this mark.

(b)(ii) Students usually found this question straightforward and were able to identify the pattern from the data in the table. Some students attempted to go down a numerical route, looking for links between the numbers in the table and consequently failed to gain credit.

(b) (iii) Many students realised that only one type of bacteria had been tested, and that others might not behave in the same manner. A minority of students suggested that the experiment should be repeated or that anomalies were present in the data and went on to score zero.

Question 2 (Low Demand)

(a)(i) Most students correctly chose the TV.

(a)(ii) Just over 50% of students did not appear to realise that 1100 W and 1.1 kW were the same power rating.

(b)(i) Many students were able to calculate the energy transferred. A minority thought, incorrectly, that they had to convert kilowatts into watts first.

(b)(ii) After scoring two marks for a correct answer in part (b)(i), most students failed

to calculate the cost correctly in part (b)(ii). Only a minority managed to get 18 p as their answer. A very common error was to multiply the time (3 hours) by the cost per kWh (15 p) to get 45 p.

(c)(i) Nearly 80% of students gained this mark.

(c)(ii) Answers such as 'good for the environment' or 'eco-friendly' were often given. These answers are considered too vague to gain credit in a physics examination. Many students managed to get one mark in this question, normally by linking the use of less electricity to the slowing of global warming or the greenhouse effect. However, few answers were seen that were worthy of two marks.

Question 3 (Low Demand)

(a)(i) Surprisingly many students did not score this mark. Many students concentrated on explaining that wind was a renewable energy source, forgetting that this was given in the stem of the question. Others simply suggested that wind was 'natural' or 'good for the planet'. Students found it difficult to differentiate between the cost of the wind as an energy source (free) and the cost of electricity from wind turbines, many imagining that it was free or very cheap.

(a)(ii) Many students were able to give one example of a renewable energy source, solar being the most popular. 'Water' was not accepted as an energy source unless it was apparent that the answer referred to 'falling water'.

(b)(i) Most students gained this mark.

(b)(ii) Many students tried to explain the shape of the graph and ignored the question that they were asked. The students appeared to assume that the horizontal axis represented time and suggested that the 'wind started low, gathered speed and then got so fast that the output dropped to zero – all in 25 seconds'. Others stated that there was either no wind or its speed was too high and so 'no power' would be generated. However, the question referred to power generation at a lower rate and so these answers were incorrect. Few students were prepared to give a wind speed appropriate to the scenario that the question outlined, but a minority were able to gain one mark for saying that the wind was too low during this time period. There were frequent references to the turbines freezing or icing up.

(b)(iii) The majority of students gained this mark.

Question 4 (Low Demand)

(a) The majority of students gained this mark.

(b) This question was well answered. Most students could give a correct consequence of exposure to radiation. Students should be told that answers such as 'radiation affects you' are insufficiently precise to gain credit.

(c) Most students scored this mark.

(d) Many students correctly identified 'gamma' as the radiation in question, but fewer students were able to give an unambiguous reason for their choice. Answers were either vague, for example 'gamma is strong' or simply listed general properties of the three radiations without linking them to this example. Other students stated that 'no radiation will pass through lead' despite evidence to the contrary. However, some good, clear answers were seen.

(e)(i) Too many answers were couched in terms of the general properties of alpha radiation and did not address the particular scenario in this question. Only a minority of students answered correctly that the material of the box would absorb alpha radiation, making the presence or absence of powder an irrelevance. Very few references were seen to the 'range' of alpha radiation and again many vague answers discussing the strength or weakness of the radiation were given.

(e)(ii) Nearly every student correctly identified M as the empty box. However, only a handful of students then went on to give a correct reason for their choice. Many thought that the reading for M was lower than the others (it's higher) and others simply appeared to pick M because it was different to K, L or N. The fact that beta radiation would be absorbed less by an empty box was rarely seen.

Question 5 (Standard Demand)

(a)(i) Only a small minority of students (24%) were able to identify 'conduction' as the method of heat transfer.

(a)(ii) This was poorly answered. Students did not appear to be able to even start to describe conduction. Convection or radiation were more often described. There were rare references to particles or atoms and the idea of energy being passed on by collision even rarer. There was a great deal of bad science, often having little to do with heat transfer. Even those students who mentioned vibrations of atoms or particles, suggested that the particles 'started to vibrate' as the process started, apparently not realising that they were already vibrating. Few marks were awarded in this question.

(b)(i) Most students gained this mark.

(b)(ii) This was generally well done. Students found it easy to extract data correctly from the graph in order to demonstrate the truth of the statement given in the question. Some students however, tried to answer the question without using any numerical data and consequently simply repeated the question in their own words.

(b)(iii) Many students appeared to ignore the graph and performed a calculation based upon the two quantities given in the question i.e. the area and the

temperature. Those students that used the graph were often able to find the rate of heat transfer at 20^{o} C (120 J/s) but did not realise that this was for 1 square metre. These students scored one mark. However, it was pleasing to see others go on to gain full credit for calculating the total rate of heat transfer for the full window. A significant minority (15%) did not attempt this question.

(c) This question was reasonably well done and students seemed to have a good knowledge of pay-back time and the economics of fitting double glazing. Many students managed a correct calculation and then went on to give an acceptable reason why this particular situation was not cost- effective. The most common method was to calculate the savings over 30 years (£4 800) and to conclude that this was less than the cost of installation (£5 280), giving a 'loss' of £480. There were however, students who did not address the question but simply described how double glazing works and others who had perhaps performed a calculation but given no evidence on their scripts. The latter group should be made aware that for full credit a complete answer is required.

Question 6 (Standard Demand)

(a) Most students gained some credit here, mostly by correctly identifying 'Y' as the correct graph. Many students then went on to write that this graph showed the Universe expanding but fewer were able to state that the Universe had started at a point. A significant number of students confused the Universe with the Solar System or the Earth, and therefore could only score the first mark.

(b)(i) Only a minority of students thought that red-shift provides evidence for both the 'big bang' and 'steady state' theories.

(b)(ii) Those students that scored the mark in this question tended to answer in terms of 'one theory having more evidence that the other'. The question was a general one about the support of the scientific community for a particular theory and those that answered in these terms tended to be more successful than those who attempted to discuss the evidence for the 'big bang' and 'steady state' theories in particular.

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