



# **General Certificate of Secondary Education**

## **Science B 4462 / Physics 4451**

### **PHY1H      Unit Physics 1**

# **Report on the Examination**

*2008 examination - June series*

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# Physics

## Higher Tier PHY1H

### General

The ability to gain credit was limited by a poor expression of ideas by some candidates. The ability to extract information appropriately from that given in the question also limited the achievement of some candidates.

Mathematical skills also reduced the ability to gain marks either through simple errors or badly set out work.

A small but significant number of candidates presented answers which were difficult to read due to handwriting style and poor spelling. Candidates should be reminded to write legibly and use black ink.

### Question 1 (*Standard Demand*)

- (a) Candidates who answered in terms of the bulk movement of air tended to score better than those who referred to particles. Although the fact that particles gained energy was correctly stated, many candidates answered in terms of the particles vibrating or expanding. Many candidates used the expression 'heat rises' rather than 'heated air rises'. A significant number of candidates misinterpreted the question and explained about the conduction of heat through the skewer and potato.
- (b) This was correctly answered by the majority of candidates.
- (c) A well answered question with very few failing to gain a mark. A variety of responses was seen with the most popular referring to temperature of surroundings, surface area or the metal skewer.
- (d) There were many good answers in terms of the heat being reflected, or the foil being a poor emitter of radiation. More general answers referring to insulation or reducing heat loss failed to score a mark.

### Question 2 (*Standard Demand*)

- (a)(i) The vast majority of candidates understood that a good absorber would be the one which reflects the least radiation.
- (a)(ii) It was pleasing to see many candidates correctly referring to categorical data. A common answer which was not given credit was that it was easier to see the results on a bar chart.
- (a)(iii) A generally well answered question. However, many candidates merely referred to the reflection of UV without any mention of the relative reflectivity of the snow. Weaker responses gave the idea that grass would be a greater hazard as having absorbed so much UV it could then be subsequently given out to the golfer at some later time. Similarly, the skier was expected to be protected by the snow reflecting the UV away from him.
- (a)(iv) Almost all candidates answered this correctly by using either cancer or burning in their response. The most common wrong answer referred to tanning.
- (b)(i) Many candidates gained credit for recognising low UV transmission, but very few attempted to justify the '95%' claim. A number of responses indicated that candidates thought the terms 'absorption' and 'transmission' were the same thing.

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- (b)(ii) This question discriminated. The common error was to think that if the sunglasses absorbed the UV that this would be dangerous for the eyes. There was also confusion between absorption and reflection in some cases.
- (c)(i) Almost half of candidates chose the correct response.
- (c)(ii) This was very well answered by the majority of candidates.

### Question 3 (*High Demand*)

- (a) Many candidates scored marks by realising that cloud cover or light pollution do not affect the Hubble telescope and that light does not have to pass through the atmosphere to reach it. This was however not always clearly related to the position of the telescope. Very few candidates used technical terms correctly to refer to distorted images or scattering of light.
- Many answers in terms of the telescopes' orbital distance or mirror size were irrelevant to this question. A number of candidates also suggested that clearer images would be obtained as a space telescope is closer to the objects being observed and apparently did not appreciate the comparative distances involved.
- (b) The idea of pre-testing was generally understood, although not always well expressed. Many candidates did not appreciate that the distance to the James Webb telescope was too great for astronauts to travel to. Many weak responses were concerned with the difficulties of carrying out repairs in space (eg without gravity) or the inconvenience of travelling so far just to discover that the wrong parts/tools had been taken. A number of candidates mentioned the effect of burning fossil fuels during the launch of a rocket.
- (c) Most candidates correctly identified that a scale model would allow faults to be identified before launch. Some weaker responses thought the model was to give an idea of the dimensions of the actual telescope or more generally to “see what it looks like”.
- (d) Common mistakes were: a failure to mention the atmosphere; not realising that optical telescopes collected visible light rays and thinking that the telescopes were sources rather than receivers of radiation. In addition, some badly worded answers referred to the telescopes themselves travelling through the atmosphere or being absorbed by it.

### Question 4 (*High Demand*)

- (a)(i) Most candidates correctly identified renewable energy as a source which does not run out. Some candidates continued to say that it was replaced as quickly as, or more quickly than, it was used. The most frequently seen incorrect answer was to say that the source could be used again.
- (a)(ii) A well answered question with most candidates able to successfully identify two renewable energy sources. If the mark was lost it was mostly for including solar (which was given in the question) or for simply using the word water.
- (b)(i) Whilst the majority of candidates correctly selected the maximum energy input at an angle of  $30^\circ$ , few responded in terms of the pattern of increase to and decrease from this maximum.
- (b)(ii) Some candidates completed the calculation correctly to obtain all 3 marks. Most candidates made a start on the calculation but common mistakes were to use the average energy input rather than the maximum, to overlook the area of the solar cells, or to divide the energy input by 0.15 instead of multiplying.

- (c) Most candidates were able to successfully make the link between the amount of energy required and that provided by the solar cells, realising that the National Grid would be needed to supply the shortfall. A small number of candidates evidently did not know what the National Grid was and some thought the purpose of remaining connected was to monitor the household use of electricity. Some gave the impression that they thought the National Grid was the only way to get electricity or that this was needed to ensure safety and/or the correct voltage.

#### Question 5 (*High Demand*)

- (a)(i) Whilst quite a lot of candidates were able to work out that 25% of the energy was lost through the roof, many failed to realise that they needed to work out 25% of the cost.
- (a)(ii) This calculation proved rather difficult for many candidates.
- Overall in part (a) there were a surprisingly large number of minor arithmetical errors and several answers which candidates should have recognised as unrealistically small or large eg in part (ii) answers such as £1 or £200,000.
- (b) Candidates scored well with most gaining credit.

#### Question 6 (*High Demand*)

- (a)(i) A number of candidates answered this question in terms of different half-lives. A significant number stated that there were 3 more neutrons without specifying which isotope, although those who clearly identified the correct isotope did gain credit for this. About a third of the candidates had an incorrect neutron number eg 1 or 2 or 134 or thought it was the proton/electron number. A few included a reference to neutron and proton in their answer.
- (a)(ii) Some candidates gave good responses and were able to correctly describe the full process of the unstable neutron splitting into a proton and a high speed electron in addition to the required response.
- This question needed two parts to gain the mark and many candidates only gave part of the required response. A large number of errors were caused by referring to electrons from the shells/electrons surrounding the nucleus or (oddly) electrons from electrons. A few described what beta particles could do in terms of penetration or ionising power. A significant minority had it as an electromagnetic wave,  $2p+2n$ , helium nucleus or simply a neutron ejected from the nucleus.
- (a)(iii) The majority of candidates had a correct idea of how to perform this calculation, although not all arrived at the correct answer. A common mistake was to identify four half-lives but then to write the time as 4 days. Answers of 40 days (ie 5 half-lives) were also common. The number of candidates making simple arithmetic mistakes in their response was disappointing (eg  $8 \times 4 = 30$  or 36). There were a small number of instances of candidates who worked out the correct answer but then wrote a completely different answer in the space provided.
- (a)(iv) A quarter of candidates were able to obtain 2 marks showing a good understanding of half lives of radioactive isotopes and their decay. There were a significant number who did not make a comparison such as much longer but most responses went on to give sufficient information by quoting figures in a detailed answer. The language of some candidates was often imprecise using terms like weak or reactive. Some answers concentrated on the beta and gamma emitted by iodine and some candidates thought that either the decay all stops at the half-life or didn't

start till then or was given out just at the exact time of the half-life. Few responses referred to the 20 years which was mentioned in the question.

- 6 (b)** Most candidates made a reasonable attempt and gained one mark for recognising an increase in thyroid cancer incidences after the explosion, or that there were incidences before the explosion. A good number recognised that there could be other factors which had not been mentioned, showing an understanding of 'how science works'. Many candidates misquoted the data and said that 45 million children had developed thyroid cancer after the explosion. A number of candidates expressed the idea that thyroid cancer could be caught by contact with an 'infected' person.
- (c)** Well answered by the majority of candidates who recognised the significance of a control group. The most common incorrect response was 'healthy people'.
- (d)** Although only a minority of candidates could obtain 2 marks, the majority obtained at least 1 mark. Common incorrect responses referred to nuclear as renewable, a cheap fuel, efficient or good for jobs. There was some indication that the students had been aware of the current political debate but this gave rise to some vague, misleading or scientifically incorrect comments. Many had the idea that nuclear caused no pollution though a few qualified this by mentioning pollutant gases/greenhouse gases, this being the most common correct response. A number of candidates realised that nuclear was reliable and a few good candidates gained the mark for the idea of a concentrated energy source. However, more often this concept was poorly expressed with no reference to the mass required to produce the energy or by merely making a comparison with coal.

### **Mark ranges and award of grades**

Grade boundaries and cumulative percentage grades are available on the [Results statistics](#) page of the AQA website.