



**General Certificate of Secondary Education**

**Science A 4406**

**SCA2HP Unit 6**

**Report on the Examination**

*2012 Examination – January series*

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**Science A**  
**Higher Tier SCA2HP****General**

There were 14 questions on the Higher Tier paper. Questions 1–6 targeted grades C–D; of these questions 2, 4 and 5 were common with the Foundation Tier paper. Questions 7–14 targeted grades A\*–B.

Some command words were not fully understood by significant numbers of students. ‘Explain’ generally means give the reason for. The answer should normally contain link words such as ‘because’ or ‘so that’. ‘Give a conclusion’ does not mean describe the data. ‘Evaluate’ means give arguments for, arguments against and a reasoned conclusion.

The Quality of Written Communication (QWC) question (question 4(b)) was generally well attempted, but significant numbers of students lost marks by not using good English, or failing to organise information clearly.

Many students did not confine their answers to the spaces provided, instead writing in the margins or blank parts of other pages. These portions of the script are not scanned and the examiner may not be able to read what is written there.

In the opinion of the examiner, the majority of students had sat this examination too early in their course as exemplified by the large number of part-questions that were not attempted and the general lack of understanding of many topics.

**Question 1 (Standard Demand)**

This question addressed a topic new to the specification leading to considerable variation in responses from different centres.

- (a) (i) Less than half of the students recognised that the fur around the eyes would protect the eyes from dirt underground. A surprising number of students stated that the eyes would prevent the animal being seen by predators or that the eyes were not needed underground.
- (a) (ii) Almost all students made a reasonable reference to tunnelling or to catching prey.
- (a) (iii) Students generally found it difficult to put their thoughts into words and many ended up by virtually repeating the question eg ‘They can feel where they are going’.
- (b) (i) Almost all of the students made a good attempt at drawing the pyramid. A few failed to label the ‘layers’. Only a minority drew an inverted pyramid.
- (b) (ii) Less than half of the students gave light as the energy source. ‘Plants’ and ‘the Sun’ were common unacceptable answers.

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**Question 2 (Standard Demand)**

- (a) It was pleasing to note that, although this type of question had not been set before, almost half of the students gained full marks. The range of acceptable answers for two marks was 32 %–42 %. Students were awarded one mark if they gave an acceptable number of squares covered by the plant (acceptable range 8–10.5), but failed to calculate the percentage correctly.
- (b) (i) This question required a description of the distribution of the two species and the majority of students gained both the available marks. Students awarded one mark generally described the distribution of only one of the species.
- (b) (ii) This question asked students to suggest reasons for the distributions they had described in part (b)(i). Consequently, the majority of students failed to make suggestions and merely again described the differences in the distribution. The most common adaptation given was the squat build of the Greater plantain, but these students had difficulty in articulating why this was an advantage. Several students correctly gave the increased length of the Ribwort plantain as an adaptation for absorbing light when growing amongst other plants in the field.
- (c) Almost half of the students were able to predict the distribution of plantains in the football field and to give a reason for the prediction. Students who did refer to a particular species of plantain were often awarded a mark for stating that there would be more plantains in the football field because of lower human influence.

**Question 3 (Standard Demand)**

- (a) Less than a tenth of the students gained full marks for this question, indicating a general lack of understanding of the cracking process. The only mark gained by many students was for recognising that the broken pottery acted as a catalyst. The majority of students did not realise that the octane and ethene had been produced by the breakdown of the decane. These students generally described spurious reactions occurring in the test tube.
- (b) (i) Only half of the students could name ethene; unsuccessful students generally opting for ethane.
- (b) (ii) A majority of students knew the general formula. However, they failed to gain credit by using lower case letters of the atomic symbols and failing to use subscripted numbers for the number of atoms. Only a third of students gained a mark for this question.
- (b) (iii) The majority of students correctly opted for the displayed formula with the double bond, but significant numbers opted for the first alternative with the single bond.

**Question 4 (Standard Demand)**

- (a) (i) Although the specification clearly states that students ‘should know that scientists once thought that the features of the Earth’s surface were the result of the shrinking of the crust as the Earth cooled down following its formation’, only a tenth of students could quote this statement. The vast majority ignored the diagrams and gave descriptions in terms of the Wegener theory.

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- (a) (ii) Only a quarter of the students were able to give suggestions in terms of evidence. Most continued with the Wegener explanation they had given in part (a)(i).
- (b) In this question, students were assessed on their ability to both describe how the positions of the continents had changed and to explain the processes that had brought about change. They were also assessed on QWC - their ability to use good English, organise information and use appropriate specialist terms. Significant numbers of students lost at least one mark by not observing the QWC criteria. To attain level 3 (5–6 marks), students needed to include a description of the changes in position and to give a clear scientific explanation of the processes bringing about the changes. At this level students were expected to give an explanation in terms of energy release from radioactive processes in the core, causing convection currents in the mantle, causing the plates to move. The sequencing of events and the use of technical terms were important factors in an answer being allocated to level 3. Answers allocated to level 2 generally omitted at least one of the processes or did not use the correct terminology.

**Question 5 (Standard Demand)**

- (a) It was surprising that less than half of the students could name a nuclear fuel. Fossil fuels were named by many students.
- (b) Most students could name the generator, fewer could name the turbine and less than a fifth could name the boiler / heat exchanger.
- (c) (i) Less than half of the students gave step-up transformer, the others generally giving step-down. Over a fifth of students did not attempt the question.
- (c) (ii) The majority of students realised that the voltage was increased, but relatively few went on to explain that this increase would result in decreased energy loss from the wires. Many students answered unacceptably in terms of power loss.
- (d) Two-thirds of students were able to give at least one acceptable factor, usually cost or the disposal of waste. There were many vague answers in terms of pollution, non-renewable fuels and 'danger'. Many students gave pre-prepared answers in terms of advantages and disadvantages of nuclear fuels which did not really address the question set.

**Question 6 (Standard Demand)**

- (a) The vast majority of students had no idea why individual results are important - they may show anomalies. Other acceptable alternatives were that the average data may not show sufficient precision, or would not show the range. Most students fell back on guessing accuracy, sensitivity, reliability or resolution.
- (b) Most students were able to give at least one factor, usually the type of phone or the number of hours used.
- (c) Only a third of the students were able to give two acceptable conclusions. Many simply described parts of the data. To gain credit, statements had to be comparative eg 'mobile phone use has a greater risk (than using corded phones)'. Less than a tenth of students scored zero marks.

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- (d) The majority of students gained the mark by referring either to other factors causing brain cancer or to previous use of mobiles. A minority agreed with the student's statement.

**Question 7 (High Demand)**

- (a) Only half of the students made some kind of reference to genetic material, the rest being content to state that the organisms are identical.
- (b) Only a tenth of students gained all four marks. Most gained one mark for the use of an electric shock, but did not go on to state that this would stimulate cell division. Descriptions of nuclear transfer were usually confused. Very few students described the transfer of a body cell nucleus into an empty egg cell. Most students mentioned implantation, but few gave uterus or womb.
- (c) The vast majority of students ignored the question (why is cloning humans against the law?) and answered in terms of 'against religion', 'not natural' or 'not ethical'. Acceptable answers included the human rights of the clone, potential personality problems and lack of knowledge of side effects. A tiny proportion of students achieved full marks for this question.

**Question 8 (High Demand)**

It was encouraging to see many excellent answers gaining five or six marks. Failure to gain full marks was usually due to not using the technical terms photosynthesis or respiration, or giving confusing accounts of decay and fossilisation. Most students were able to gain at least one mark for this question.

**Question 9 (High Demand)**

To gain full marks students were required to explain why most head lice are no longer killed by the chemical. Many students gave pre-prepared answers for natural selection but did not link mutation / variation with the production of resistant head lice. Most students, as expected, gained the mark for survivors breeding / passing on resistance gene. However, many stated that the characteristic was passed on.

**Question 10 (High Demand)**

- (a) (i) Only a fifth of students were familiar with the term hydrogenation, most of the others giving 'hardening'.
- (a) (ii) The vast majority of students were unfamiliar with the conditions stated in the specification (60 °C and a nickel catalyst). Most students could go no further than 'heat'.
- (b) Only a fifth of students answered in terms of spreading or the making of cakes / pastries. Most students answered in terms of melting.

**Question 11 (High Demand)**

- (a) (i) Most students read the graph correctly, but only half of the students followed this up by doing a correct calculation.

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- (a) (ii) Many students referred to plants or to photosynthesis but relatively few connected the two. This was reflected in only a fifth of students gaining full marks.
- (a) (iii) The vast majority of students ignored the time scale and answered either in terms of human effects eg deforestation. Others answered in terms of animals absorbing the oxygen. Answers involving catastrophes wiping out plants were rare. Less than a fifth of students were able to score at least one mark.
- (b) Many students gained credit by stating that the production of organic molecules supported the theory, but very few referred to the fact that no structures / organisms were formed.

**Question 12 (High Demand)**

It was apparent that students had not revised this topic since none of them gained either three or four marks. No student gained the conclusion mark. Generally, the only marks gained were by referring to increased land use for sugar cane production or for the use of renewable / non-renewable resources. The energy requirements of the two processes were poorly understood. Most students were very confused about the relative amounts of carbon dioxide given off by the two processes. Few realised that fuel combustion releases carbon dioxide in the hydration process.

**Question 13 (High Demand)**

- (a) Only a fifth of the students gained all three marks. Reflection and refraction were frequently confused. Weaker students frequently did not attempt to name diffraction.
- (b) Although almost half of the students gained the correct answer, it was evident that weaker students simply guessed.
- (c) It was apparent that most students are unfamiliar with working in standard form, a mathematical requirement for Higher Tier students on this new specification. Only one third of the students scored one mark, the majority of which for  $1.5 \times 10^8$ .

**Question 14 (High Demand)**

- (a) The majority of students were not familiar with the direction of oscillations of the air particles compared to the transfer of energy in a sound wave. Almost one third of the students did not attempt the question.
- (b) (i) Over half of the students correctly identified an area of rarefaction, but many students 'hedged their bets' by placing the R very close to the boundary between the two areas, receiving no credit.
- (b) (ii) Students used a wide variety of methods to indicate wavelength, many drawing a waveform. Only a fifth of the students indicated wavelength correctly, the most common error being to include the whole of two darkly stippled areas and one lightly stippled area.
- (c) (i) Most students knew that the effect was named after Doppler, but there was a wide range of spellings of his name.

- (c) (ii) The standard of most drawings was poor; it was often difficult to discern a student's intentions. The most common mark obtained was for showing a decreased wavelength at Listener B. The increased wavelength at Listener A proved more difficult since most students seemed reluctant to draw less than two complete waves in the space provided. Thus students drew one wave with the original wavelength and one with a longer wavelength, receiving no credit. The mark for amplitude was often lost by not centring the waves on the centre horizontal line.
  
- (d) (i) Only a tiny minority of students gave correct answers in terms of increased wavelength or decreased frequency. The majority of students answered in terms of movement of galaxies.
  
- (d) (ii) Most students failed to indicate the direction of movement of the galaxy with respect to the Earth, Sun or our galaxy.

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