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General Certificate of Secondary Education

Science A 4406

SCA2HP Unit 6

Report on the Examination

2012 examination – June series

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Science A
Higher Tier SCA2HP

General

There were 15 questions on the Higher Tier paper. Questions 1–8 targeted grades C–D; of these questions 2, 3, 4, 5 and 7 were common with the Foundation Tier paper. Questions 9–15 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'.

The Quality of Written Communication (QWC) question (question 3) was generally well attempted.

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.

Question 1 *(Standard Demand)*

(a) Most students went down the route of camouflage when answering this question. Unfortunately, some did not explain that the change in coat colour meant that it was camouflaged in both summer and winter, many just mentioned being camouflaged against the snow in winter. A surprising number of students thought that hares are predators.

Where students tried to explain the colour changes in terms of heat loss they tended to get confused, saying the dark coat absorbed heat in summer, but as it would be warmer in summer than winter this was not logical. They should have explained the lighter coat emitted less energy than the darker coat, so helped it to stay warmer in winter.

(b) Most students said that smaller ears would have a smaller surface area. Many then went on to say that this would stop heat loss. This did not gain credit as there would still be energy lost, but it would be less; absolutes were not credited. Some thought smaller ears would be better so then the hare wouldn't be seen as easily or that European hares needed bigger ears for better hearing. Compared to question (a) students did not do as well.

Question 2 *(Standard Demand)*

(a) Almost all of the students made a good attempt at drawing the pyramid. A few omitted to label the pyramid. Only a minority drew an inverted pyramid.

(b) If the question had asked why energy decreases along a food chain most students would have gained full marks. However, the question asked about biomass. As references to energy were ignored this allowed most students to score one mark for loss in wastes. 'Not eating all of the organism' was a less common answer. There is a lack of understanding of biomass. Losses from the chain can only be due to something that has mass not being passed on. There were many references to respiration in terms of energy loss, which was ignored. If they had said carbon dioxide is lost due to respiration this would be correct as carbon dioxide has mass. Other incorrect answers referred to the sizes and numbers of organisms at each level.

Question 3 *(Standard Demand)*

In this question students were assessed on their ability to both describe differences between the tree on its own and the trees growing in a forest and to give reasons for the differences. They were also assessed on 'QWC' - their ability to use good English, organise information and use appropriate specialist terms.

To attain Level 3 (5–6 marks), students needed to include descriptions of at least two differences with correct explanations in terms of competition. Almost half of students attained Level 3. Most students attained at least Level 2 (3–4 marks) by giving at least one difference that they made a reasonable attempt to explain. A basic description of a difference or explanation was all that was needed for Level 1 (1–2 marks).

The question was well attempted with most students organising their answers logically. Some students said the trees in the forest competed for gases or water, which was ignored. Others said the leaves were eaten by animals, which was also ignored.

Question 4 *(Standard Demand)*

(a) Students who had read the question properly usually scored the mark as all the chemicals were stated in the question. Many gave steam instead of water, but this was allowed. Some students did not write the words carefully and made errors such as writing ethanal instead of ethanol, or ethane instead of ethene. It is always advisable to write a word equation rather than a symbol equation if this is what the question asks for, as many students made errors in the writing of formulae, for example, using lower case letters, superscripts or incorrect formulae. C_2H_6O was often given, which was allowed.

(b) The most common responses were that fermentation is cheaper, quicker or more environmentally friendly, none of which gained a mark. Some students did say that sugar (cane) grows in Brazil or that sugar (cane) is renewable to gain the mark. Few made reference to crude oil.

(c) Most students gain at least one mark. Many responses just copied information from the table without adding any value, so did not gain marks. Students needed to say fermentation was slower, produced a mixture of ethanol and water or was a batch process. Many answers referred to the cost, pollution and land use, all of which were ignored.

Question 5 *(Standard Demand)*

(a) Students who said adding compost and hydrogel increases the water holding capacity of the soil only gained one mark. They needed to clearly state that when used individually, each one increased the water holding capacity to gain two marks. Many students did not read the units given for the masses added and incorrectly stated that compost was better than hydrogel. Quite a few gained the last marking point for saying adding both compost and hydrogel gave the highest water holding capacity. There were some answers that just restated values from the table without explaining what they showed, so gained no marks.

(b) The idea of **many** monomers joining together or a **large** molecule being formed was needed in order to gain full marks; only a quarter of students achieved this. Many students gained one mark for saying the monomers bonded or joined together. Some gave reaction conditions, but this was not what the question asked. A description of what happened to the monomers was needed. Quite a lot of students mentioned that the double bond opened.

Question 6 *(Standard and High Demand)*

(a) A well answered question with almost all students gaining at least two marks. However, a surprising number of students think that carbon is a gas. Some did not relate their answers to the formula shown, saying argon and helium were present. Only the most able students responded in terms of ammonia and methane.

(b) The question asked students to describe the differences between the Earth's early atmosphere and the atmosphere today. However, many students did not give comparative statements about the gases but tried to explain why the levels of gases changed, which they were not asked to do. Students could gain marks for saying carbon dioxide was the main gas in the early atmosphere and nitrogen is the main gas today, but comparative statements would have been much better. Some students talked about carbon rather than carbon dioxide. Most students were able to gain at least one mark.

(c) The most common process given was distillation, although combustion and cracking were often named. Students who knew that the process was fractional distillation usually understood that the separation was due to the different boiling points, although some did answer in terms of condensing points. A fifth of students scored full marks for this question.

Question 7 *(Standard Demand)*

(a) Most students struggled to give two similarities of light and sound waves. The most common differences given were that light travels faster than sound and sound cannot travel through a vacuum. Many got transverse and longitudinal waves mixed up. Reference to mechanical or electromagnetic waves was rarely given.

(b) (i) A well answered question with three-quarters of students being awarded full marks. To gain full marks the working had to be shown. Some students worked out the correct speed, but then gave water or ethanol as the liquid instead of using the bar chart.

(b) (ii) Students usually gained at least one mark for either stating that as density increased the speed increased or for identifying mercury as an anomaly.

Question 8 *(Standard Demand)*

(a) Just under a third of students gained a single mark. Many students did not realise that the carbon is captured and stored in the form of carbon dioxide, so did not gain the first marking point. However, they went on to correctly say that it is stored in old oil fields or underground for the second marking point. Some students thought it was captured by plants for photosynthesis.

(b) The question asked for advantages and disadvantages of using hydroelectric power compared to coal-fired power stations. Although there were many points that could be made that did not have to be comparative statements, it is advisable to encourage students to use comparative statements. Many students said that setting up a hydroelectric power station is expensive, but this was insufficient to gain the mark as more expensive than coal was needed. The most common disadvantage mentioned was the destruction of habitats. Some students could not decide whether hydroelectric power stations were reliable or not, and contradictory statements negated the mark. Most students said that water was a renewable energy source as an advantage and many said there was no air pollution. Some had not read the question properly and said no carbon dioxide was produced.

Question 9 *(High Demand)*

Once again comparisons were needed for the first two marking points, so cheap or quick were not enough to gain the marks. For the last marking point it had to be clear that the new plants were identical to the parent plant, not just clones of each other. The majority of students did gain at least one mark.

Question 10 *(High Demand)*

Most students said industrial composting schemes would reduce landfill, but only a few said the compost could be sold. The third marking point needed a reference to nutrients or fertiliser being produced, as well as a reference to plants or soil. Over half of students gained at least one mark, with a tiny proportion achieving maximum marks.

Question 11 *(High Demand)*

The majority of students made a good attempt to answer this question. Many gained marks for stating the processes shown on the diagram, namely photosynthesis, respiration and combustion. A few linked the processes to an incorrect direction of carbon dioxide transfer, so negating the mark. Others demonstrated a good understanding of the carbon cycle and described the processes of decomposition and fossilisation, which did not gain credit as these processes were not shown on the diagram. Students found it a little more difficult to gain the marks for explaining the effects of the processes on the mass of carbon dioxide in the air. A comparison of the amount absorbed and released was required for one mark, and an overall conclusion that the amount in the air is increasing for the last mark. Just over a tenth of students scored five or six marks.

Question 12 *(High Demand)*

(a) A large number of students had not read the information given in the question, or the axes on the graph, and did not realise that the graph was showing arrival dates. Many students thought the graph was showing changes in the population sizes of the two birds. Many students gave confusing statements about increasing or decreasing arrival dates and some thought the birds did not stay as long in the UK. Clear statements about changes in migratory patterns were lacking with many just giving arrival dates of the birds in a specific year. Less than half of students were given at least one mark.

(b) Many students just said 'for food'. This was not enough to gain the mark as they had to say food was available earlier in the year (in the UK). Quite a lot of students gained the mark for a correct reference to competition with the Barn Swallow for food. Changes in temperature also had to be explained fully, for example, warmer earlier in the year (in the UK). References to global warming and climate change on their own were ignored. Very few students mentioned a mutation or change in genes as a reason for the change in migration pattern. Most students did not gain any credit for this question.

Question 13 *(Standard and High Demand)*

(a) (i) Most students knew the colour change for bromine water with an unsaturated compound. Some just said it would change colour or that it would go clear, a few got the colour change the wrong way round and said it would turn orange or brown. Some thought the oil would change colour, rather than the bromine water.

(a) (ii) Almost half of students gained full marks. A few gained the mark for sunflower oil, but then said because it had the least saturated fat, which is not clear enough for the second mark. The most unsaturated fat was needed. A lot of students gave butter as having the most double bonds, saying it had the most saturated fat. Some gave soybean because it had the highest smoke point.

(a) (iii) Many students gained a mark for correctly describing a pattern. Just quoting figures, or just describing one of the oils, was not enough for the mark. A few went on to give soybean, or as an exception sunflower oil, for the second mark.

(a) (iv) A correct oil and comparative explanation was needed for the mark. A surprising number of students gave sunflower oil because it has the highest smoke point, which is not what the table shows. Some said sunflower oil because it is the healthiest, but this was not enough for the mark. A reference to highest unsaturated or lowest saturated fat was needed. Several gave butter as it has the most saturated fat. A lot of responses included reference to boiling point rather than smoke point and this was ignored. A few mentioned the flavour which was ignored. Their answer had to relate to the information given in the table.

(b) (i) Less than a third of students gained this mark. The most common correct answer was so that they can be used as spreads. A few students mentioned to use for margarine, but few said for baking or in cakes or pastries. Cooking was mentioned a few times but this was not enough to gain the mark. Quite a lot of students said it would extend the shelf-life or so that it was a solid at room temperature, which were ignored. A few thought it was to make butter, which is incorrect.

(b) (ii) Less than a quarter of students gained at least a mark for this question. However, those students familiar with the topic could give all the reaction conditions for hardening vegetable oils. A lot of students suggested cooling the oil or adding an emulsifier to harden it.

(b) (iii) A diagram showing four carbon atoms linked with single bonds with open bonds at the ends of the molecule was needed for two marks. Many students drew the displayed formula of butane, which gained no marks. Some students lost one mark because they did not show open bonds at the end of the molecule. Many responses related to polymerisation rather than unsaturation. A fifth of students were given full marks for this question.

Question 14 ***(Standard and High Demand)***

(a) Most responses referred to the speed, wavelength or frequency of the waves or to the strength or amount of energy they transferred. All of these were ignored. Very few students said microwaves can travel through the atmosphere or that radio waves cannot.

(b) (i) Most students drew a reflected ray that met the end of microwave A. This was allowed, although it should have been reflected at a slightly larger angle than this. Most students drew a straight continuous line, but should be encouraged to use a ruler.

(b) (ii) The receiver was usually positioned where the two reflected rays met. Students could still gain a mark for question (b)(ii) even if they had drawn the position of the reflected ray incorrectly. Several students used their own symbol for a receiver, rather than the one shown in the question. This was allowed.

(c) There were two marks for a description of diffraction. Not many students mentioned that the waves spread out. There was a lot of confusion with reflection or refraction and the bending of waves. If they stated that the effect happened as waves went through a gap or around an obstacle they gained one mark.

There were two marks for explaining why the microwaves were not diffracted by the holes in the mesh. Many students said that the holes were too small, but this was not enough as they had to say that the wavelength of the microwaves was bigger than the holes. A few students knew that diffraction was only significant if the size of the hole was the same size as the wavelength. Half the students did not score any marks at all.

Question 15 ***(High Demand)***

(a) Less than half the students knew that the observed changed in frequency is called the Doppler Effect.

(b) (i) Many responses mentioned the speed, frequency or size of the wave, rather than answering the question which asked about the wavelength. A shorter wavelength or decreased wavelength was the correct answer, although smaller was allowed. A quarter of students scored a mark for this question. Many students said the waves were closer together which was not enough.

(b) (ii) Many students thought the speed of the reflected microwaves would be either slightly more or slightly less that the speed of the waves emitted by the radar gun. Others thought it would be twice or half the speed. A few gave units in cm/s but had not altered the figure to match. Just under half of students gave the correct answer.

(c) (i) Many students calculated that the car was travelling at 80 km/h for two marks. Some went down the route of calculating that at 70 km/h the change in frequency would be 3.5 kHz, so a change in frequency of 4 kHz must be above the speed limit, which was also correct.

(c) (ii) Most students gained one mark for calculating the change in frequency and some went on to calculate the speed being 40 km/h. Some also realised that it was moving away from the radar gun. A fifth of students were awarded full marks.

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