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General Certificate of Secondary Education

Science A 4406

SCA1HP Unit 5

Report on the Examination

2012 examination – June series

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Science A
Higher Tier SCA1HP

General

There were 16 questions on the Higher Tier paper. Questions 1–9 targeted grades C–D; of these questions 1, 2, 4, 5, 7 and 8 were common with the Foundation Tier paper. Questions 10–16 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 8) 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)*

Most students knew some of the words used to describe the structures involved in a reflex action, although they were often given in the wrong order. The receptor was often incorrect, with sensory neurone frequently being given as an incorrect response. Sensory and motor neurones were often named correctly. A range of responses were given for CNS. Spinal cord was allowed, but incorrect answers included relay, which was already given in the sentence, synapse and brain, demonstrating some knowledge but not sufficient to gain a mark. Spine and spinal column were not allowed as these are made of bone. For effector several students gave reactor or gland. Over half of the students gained at least three marks for this question.

Question 2 *(Standard Demand)*

Most responses demonstrated a good understanding of the precautions required when preparing agar plates. A quarter of students scored either three or four marks for this question. However, in many cases students had not read the question properly and described how to reduce risk to the experimenter rather than only growing bacteria from the milk. They talked about incubation temperatures and how to prevent bacteria escaping from the Petri dish, rather than preventing microbes from the air entering the dish. Many students mentioned sterilising the equipment, or gave a description of this which was allowed, but did not go on to say that this killed bacteria. A few students mentioned wearing gloves, but did not say that they had to be sterile. A large number of students said the dish had to be sealed and some thought it had to be airtight, which was ignored.

Question 3 *(Standard Demand)*

The vast majority of responses were in terms of roots growing towards water and nutrients, which was ignored. Roots growing downwards to provide stability was also frequently mentioned. Marks gained were usually for reference to gravity or geotropism. Some students also gained a mark for stating that auxins or hormones were involved, although many then went on to explain the response of a shoot to light, rather than of roots to gravity. Very few students gained the marking point for the idea of auxin / hormone inhibiting growth. A significant proportion of students had the misconception that auxin in the roots promotes growth.
A similar question is on the specimen papers, but about the growth of a shoot. Generally, it would seem that 'Control in plants', which is new to the specification, is still not familiar to students.

Question 4 *(Standard Demand)*

(a) It was good to see that most students wrote the formula using capital letters and subscripts. There were only a few who wrote lower case letters or numbers that were as large as the symbol letters or superscripts. Writing an incorrect formula, such as C_3H_6 or $C_3\ H_{6+2}$ were the most common errors.

A few students were unsure what a formula is and gave both chemical and displayed formulae to gain the mark.

(b) A very well answered question. Errors made included a double bond in the structure or no bonds being drawn between the carbon atoms. Several students just added one hydrogen atom to show methane.

(c) A surprising number of students included various oxides and hydroxides of butane as one of the products. Other incorrect inclusions were hydrogen, carbon, butane, butene, hydrocarbon and propane. Often when formulae were given they were written incorrectly with superscripts so could not be credited. It is best for students to write names of chemicals if a word equation is asked for.

(d) Few students knew that smoke contains carbon, with many thinking that smoke is carbon dioxide. Many responses just included information given in the question. A few said that smoke is produced due to incomplete combustion and mentioned the production of carbon monoxide but not carbon.

Taking questions (c) and (d) together, students do not know the products of complete and incomplete combustion of hydrocarbons.

Question 5 *(Standard Demand)*

(a) Most students drew the correct electronic structure of 2,8,7. Some errors were made with counting, especially when the electrons were positioned separately. Fewer errors were made when students drew the electrons in pairs.

(b) Many responses gave vague statements about lithium joining or bonding with chlorine without explaining what happened to the lithium atom, which was what the question asked. There was much confusion with covalent bonding and sharing electrons, which limited the answer to a maximum of two marks. The transfer of atoms, rather than electrons, was often mentioned. A lot of students picked up one mark for mentioning that a full outer shell was achieved.

Question 6 *(Standard and High Demand)*

(a) Some students answered the question in terms of advantages and disadvantages of quarries, rather than economic and environmental reasons. They did not realise that the company would want to present advantages for both reasons and gave a variety of arguments against the opening of a new quarry. Many students gained a mark for the economic reason of providing more jobs. A lot of students incorrectly thought that the quarry would be a tourist attraction.

(b) Both products were required to gain one mark. Students often named either carbon dioxide or calcium oxide only, or one of the products was named incorrectly. Common incorrect products were limewater or slaked lime. Incorrect processes named were combustion, melting, cracking and distillation. Students would benefit from learning definitions and examples of all these processes.

(c) (i) A third of students answered this question correctly. A symbol equation was asked for, but many students wrote a word equation so gained no marks. The most common errors were incorrect formulae. Calcium oxide was represented incorrectly as CaO_2 or Ca. Calcium hydroxide was usually written correctly, as it was given in the question. A surprising number did not know the formula of water. Students could not gain the marks if formulae were written with lower case letters or superscripts.

(c) (ii) Compared to the January 2012 exams more students knew the test for carbon dioxide. However, a variety of other gases and chemicals were named. Similarly, a variety of colour changes were given. Students mixed up tests for hydrogen, oxygen and carbon dioxide. The tests for carbon dioxide and for unsaturation are the only two that students need to learn for Unit 2 C1. Almost a fifth of students did not make any attempt at answering this question.

Question 7 *(Standard Demand)*

(a) Many students were confused by having two independent variables and answered in terms of the effect of temperature on humidity, rather than the effect of each of these on the drying time. Others related the effect of trial number on drying time, stating trial number 3 was an anomaly. A lot of students gave two correct converse statements about one of the independent variables to gain one mark, but others gave contradictory statements so negating the mark. There were a lot of vague responses stating that temperature affects the drying time, but did not explain how it affects it. There were many responses that quoted data from the table. Describing data is **not** a conclusion.

(b) The majority of students answered this question correctly. The most common correct answer given was amount of paint applied. However, many students had not read the question properly and restated temperature or humidity as a factor.

Question 8 *(Standard Demand)*

In this question students were assessed on both their scientific knowledge and 'QWC' - their ability to use good English, organise information and use appropriate specialist terms. In most cases the level of QWC matched their level of scientific knowledge.

Students were asked for three pieces of information about energy transfer from both the roof **and** windows of a house: to name the processes of energy transfer, to suggest methods to reduce the rate of energy transfer and to explain how the methods reduced the rate of energy transfer. Most students made reference to both roof and windows, usually giving two correct methods to reduce energy transfer to gain two marks at Level 1. To progress to Level 2, students had to also mention at least one process and attempt to explain at least one of the methods. The processes were often omitted or incorrect, limiting the marks to two. For Level 3, a detailed description for both the roof and windows was required, to include a process of energy transfer, a method to reduce it and an explanation of the method for each area of the house. Students should be guided to read questions carefully and follow the instructions given. Where processes were given they often demonstrated a poor understanding of conduction, convection and radiation. Heat was often said to rise, rather than hot air. Air being a poor conductor, or air being trapped in insulation were rarely mentioned. Few responses said that energy is transferred through glass by conduction.

Question 9 *(Standard and High Demand)*

(a) The question asked for two methods of energy transfer prevented by the vacuum. Many students did not understand the question and gave examples of forms of energy or words describing changes of state. Radiation was often given as one of the responses. The majority of students gained at least one mark for this question.

(b) The majority of correct responses were for reflection of radiation, with most students stating heat rather than infrared radiation, which was allowed. A few answers gained the mark for stating the shiny metal was a poor emitter of radiation, but those that stated no radiation was emitted were not credited. Incorrect responses included reference to absorption and conduction of radiation.

(c) Many students selected the wrong equation from the sheet and tried to calculate efficiency. A mark was picked up by the majority of students for calculating the temperature change but then made errors in the rearrangement of the equation. Even where a correct substitution and rearrangement of the equation was shown, students often came up with the wrong answer, probably due to misuse of their calculator and not realising 4200×78 had to be calculated first. A third of students scored full marks.

(d) By far the most common answer was 300 J as students forgot to convert the time to seconds. Several students tried to use the wrong equation. An answer of 930 was often given, from multiplying power by temperature. Only a few students gained two marks for this question.

(e) Many creditworthy responses were in terms of saving energy or saving money. Some students said it wasted less water which did not gain the mark as this was too similar to the information given in the stem of the question, and a different advantage was asked for.

Question 10 *(High Demand)*

(a) Few students stated that drugs alter chemical processes in the body. Where marks were gained it was for saying the body suffers withdrawal symptoms, or craves the drug without it.

(b) Marks could be gained from a mix of yes and no explanations as long as it was clear whether they were supporting or refuting the claim. A lot of students answered the question as though an evaluation of the data had been asked for. Most students said the data supported the claim and stated that no non-drinkers used hard drugs. Any pattern linking the amount of alcohol drunk with drug use was usually poorly expressed, but many students gave comparative figures from the table to support their answer. Some students had not read the table headings and thought that all drug users were drinkers. Some students gave good responses saying the data did not support the claim due to the age of people sampled not being representative of the whole population or the number involved in the survey not being known. Few students said hard drug use may be linked to other factors.

Question 11 *(High Demand)*

(a) The majority of students did not understand how to calculate BMI. Problems related particularly to (height in m)^2, which was either ignored or an addition of 1.8 + 1.8 was carried out. Many students could not rearrange the equation. The most common answer was 57.6, which made the man underweight.

(b) When the answer to question (a) was incorrect many students made up a category, for example, obese. The answer was marked according to any weight category stated in question (b). Many students said the man should eat a balanced diet, whether he was underweight or overweight, demonstrating a misunderstanding of the term. A balanced diet will not result in a change in body mass as energy consumed will equal energy transferred. Many students gave vague statements about eating a healthy diet when a good answer should have referred to the amount of energy in the diet. Most students suggested changes to the man's lifestyle, but did not go on to suggest reasons for the changes, which was asked for in the question. Just over a tenth of students gained either three or four marks for this question.

Question 12 *(High Demand)*

(a) Very few students gained full marks. A variety of incorrect hormones were given ranging from testosterone to LH and FSH. Many students did not realise that birth control pills are used to prevent pregnancy and gave advantages of maturing more eggs or increasing fertility.

(b) Students are not clear about the roles of the various hormones in the menstrual cycle. A number of students gained the second marking point for saying the concentration of hormones was high, but did not state that LH causes egg release. A reference to the sudden increase in body temperature was sometimes mentioned, but often vague descriptions of temperature changes throughout the cycle were given. The question told students to use information from both graphs but many responses only referred to Graph 1 and hormone concentrations.

Question 13 *(High Demand)*

(a) Many students did not understand the question and described what gold looks like or its properties, particularly its position in the reactivity series, rather than its structure. Most students said that gold had 79 protons, but often mixed up the numbers of electrons and neutrons. Some thought the total number of particles added up to 197. A few students gained the last marking point for a description of the positions of the three particles in the atom. A few tried to work out the electron arrangement and ran into problems, but this did not affect their marks.

(b) (i) Responses stating that copper rich ores are in limited supply were rarely seen and most statements about environmental impact or economic reasons were generally too vague. Environmental impact had to relate to scars on the landscape due to traditional mining. Most responses about cost were not qualified, 'it's cheaper' was not enough to gain the mark. Many students mentioned that it was cheaper or more environmentally friendly than electrolysis, not realising that the final stage in phytomining to extract the copper is by electrolysis. Just over a tenth of students answered this question correctly.

(b) (ii) This question was not answered well and over a third of students did not attempt to answer it. Phytomining is a new topic to the specification and perhaps is not familiar enough to students. Students rarely gave the three stages of phytomining. When an attempt to answer the question was made, many students gained one mark for saying it involved the use of plants. If they went on to talk about plants absorbing something, they usually incorrectly stated copper rather than copper ions, compounds or minerals. Some students mentioned that the plants were burned, but did not explain that copper was extracted from the ashes. Although this was a high demand question, students at standard demand should be able to explain the stages of phytomining.

Question 14 *(High Demand)*

The vast majority of marks awarded were for comparisons of emissions given in the table. Students rarely explained the consequences of these emissions. Many students attempted to give a conclusion but found it difficult to support, making vague comments about biodiesel being more environmentally friendly. A very small proportion of students were able to be credited with three or more marks.

Question 15 *(High Demand)*

(a) Many responses stated that a U-value of zero meant that it was a good insulator. This was insufficient for a mark as no energy would be transferred; it is a perfect insulator. A lot of students answered in terms of efficiency and wastage of energy, or simply gave a definition of U-value without explaining what zero meant. Almost a fifth of students did not attempt an answer.

(b) (i) A third of students scored one mark while no students scored full marks for this question. Many students said a high specific heat capacity meant that lots of heat was needed to raise its temperature or that it could store a lot of heat, which was allowed for the first marking point. A few students just gave a definition of specific heat capacity and gained the second marking point only.

(b) (ii) Many students had used information from the previous questions and explained in terms of the U-value being zero and concrete having a high specific heat capacity. Some said the wall was well insulated or was very thick. Some students picked up the first mark for saying the water in the pipes was at 20 °C, but very few could explain that there was no temperature gradient.

Question 16 *(High Demand)*

(a) A large number of students gave liquid A as their answer, so gained zero marks. The most common correct answer was that liquid C cooled the quickest. Some thought it was being heated and there were a lot of references to boiling.

(b) Very few students gave a correct response. Most said that the room temperature prevented it cooling further, or that room temperature was 7 °C. There were many incorrect references to boiling or freezing points, condensing and turning to a liquid. A poor understanding of cooling by evaporation and change of state was demonstrated.

(c) Many students did not understand the graph which led to confused responses. It was clear that evaporation is not well understood. Few students realised that the particles with the most energy evaporated. The most common mark gained was for particles escaping from the liquid. Some students gave descriptions referring to the total energy of the liquid reducing but few went on to mention that this lowered the temperature of the liquid. They usually just repeated information given in the question and said the liquid cooled down, which was not enough for the last marking point.

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