Version 1.0 02/03/12

General Certificate of Secondary Education

Science A 4406

SCA1HP Unit 5

Report on the Examination

2012 Examination – January series

Further copies of this Report are available to download from the AQA Website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

Science A
Higher Tier SCA1HP

General

There were 15 questions on the Higher Tier paper. Questions 1–8 targeted grades C–D; of these questions 1, 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'. '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 3) 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.

Question 1 (*Standard Demand*)

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

(a) Students were asked to describe changes in length of the two sides of the stem. The majority of students gained a mark however, many students answered the question in terms of 'plants', 'seedlings' or 'seeds'. Many students described the shapes of the two lines on the graph then went on to state that the stems grew diagonally.

(b) Many students ignored the command word 'Explain' and went on to give virtually the same answer as in part (a). A common misunderstanding was to infer that auxins were alive and were killed by light. Many students stated that auxins inhibited the growth of the shaded part of the stem, contradicting their descriptions in part (a). Others stated that auxins inhibited the growth in the illuminated part of the stem. Very few students referred to the effect of hormones on cell elongation.

(c) The specification refers to weed killing and growing cuttings as two uses of hormones. Very few students seemed to be aware of these. Most students answered vaguely in terms of increased growth or crop yields. 'Fertilisers' was a common answer as were 'phototropism' and geotropism.

Question 2 (*Standard Demand*)

(a) Although many students correctly gave FSH and LH, there was an overall impression that many students chose any two of the four hormones named in the specification.

(b) (i) Most students described the correct pattern but a small number of students were confused by other data in the table, referring to the number of treatments or to the number of embryos transferred, rather than percentage successful pregnancies.

(b) (i) Many unacceptable responses answers referred to vague ideas of ethical issues, such as 'some people don't like it' and the common 'it's against their religion'. Some students incorrectly referred to selecting characteristics during IVF. Some students believe 'older women can't care for children'. There is a general good understanding of the high cost of IVF treatment, but few who discussed this elaborated in enough detail to link this with the chances of successful treatment. Some students described data not directly linked with the question, for example, 'more embryos transferred in older women', without going on to explain why this is an ethical issue.

Question 3 (*Standard Demand*)

In this question students were assessed on their ability to evaluate an investigation. 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 evidence supporting the newspaper's claim, evidence that did not support the claim and to give a reasoned conclusion. They were also required to make an appropriate reference to the presence or absence of polyphenols in the chocolate.

The majority of students managed to include a least one piece of evidence supporting the claim and one piece of evidence not supporting the claim. However, only the better students considered the polyphenols.

Good, reasoned conclusions were relatively rare. In this question a reasoned conclusion might have stated that although a particular piece of evidence supported the claim, other particular evidence against the claim was stronger, so the claim should be rejected.

Question 4 (*Standard Demand*)

(a) Most students answered this question correctly however, it was still surprising to see how many students could not use the data in the table to find the correct answer.

(b) Whilst most students were able to interpret the data given in the table and draw correct conclusions regarding the patterns of the properties, some students referred to boiling point rather than melting point. Another common response was to describe reactivity rather than physical properties.

(c) Students generally answered in terms of strength, though some did not gain credit as they failed to give a comparison eg 'strength' rather than 'stronger'. Other incomplete responses referred to the melting point, but without appreciating that it gave a lower working temperature or that the lead pipes would not melt.

Question 5 (*Standard Demand*)

(a) Few students demonstrated understanding of the role of the stirrer in this investigation. Many thought that the magnetic hotplate magnetised the ball affecting the rate at which it dropped. The most commonly obtained mark was for the distribution of energy throughout the water, usually obtained in terms of all the water having the same temperature. Many attempted to answer in terms of convection currents or density changes etc. Very few students realised how the stirrer would assist in a uniform temperature distribution throughout the hydrocarbon or that the hydrocarbon would have the same temperature as the thermometer. Only a tiny proportion of students picked up two marks.

(b) (i) Over half of students gained at least one mark. The most commonly obtained marking point was for stating that as the temperature increased the viscosity decreased. Many students simply described the graph without drawing any conclusions from the data. Others made reference to the hydrocarbon rather than to the ball falling. A common mistake amongst those who tried to interpret the graph was that the viscosity of A was greater than that of B.

(b) (ii) Less than a fifth of students were able to answer this question correctly. Common mistakes included simply repeating the question, answering in terms of thickness or simply quoting figures from the graph. Others answered in terms of the different water temperatures. Of those who realised that the chain length was an important factor, a fair proportion thought that A was longer than B.

Question 6 (*Standard / High Demand*)

(a) (i) The mechanism of the process was poorly understood by most students. However, many students did state that carbon was more reactive than iron. Often there was just a straightforward description of the reaction rather than an explanation. Many students lost marks through incorrect chemistry or confusion about what was reacting eg stating that carbon reacted with iron.

(a) (ii) Students found this question difficult with only a tenth of students gaining full credit.

(b) Again, students found this question difficult with about a quarter of students able to pick up at least one mark.

Question 7 *(Standard Demand)*

(a) There was widespread confusion about what efficiency is exemplified by statements such ‘appliance that’s the least useful’. The lowest level of acceptable response ‘the bulb with lots of energy wasted’ gained one mark. To gain two marks, which very students managed to achieve, they should have made it clear that efficiency is about proportion or percentage, rather than simple comparative statements about the amount of energy lost. Many students stated that it was ‘the bulb that loses the most energy’ which is incorrect because out of the three bulbs, the halogen bulb wastes the most energy as it has the highest energy input.

(b) It was clear that many students are unfamiliar with the use of Sankey diagrams to calculate efficiency. The statement 'Show clearly how you work out your answer' was misunderstood throughout the paper to mean 'Write a description of where the numbers come from', rather than the expected outcome – a clear calculation. However, of the students who did pick up marks the majority were able to gain full credit.

(c) The difference between the question set, 'What effect does the wasted energy have...' rather than the question the students perceived ie, 'What is the wasted energy from...', resulted in many students gaining zero marks on this question.

(d) Most incorrect answers focused on the efficiency of the LED bulb rather than the fact that the energy input was only 2 J compared with 40 J and 50 J for the other two bulbs. Just under a half of students answered this question correctly.

(e) (i) Many students ignored the instruction, 'Use ***only*** the information in the table to answer the following questions', leading to the incorrect answer of LED, or a statement about efficiency. Students who did follow the instruction often gained one mark for filament bulb, but not always for the correct reason, eg 'the cheapest'. A fifth of students gained full marks on this question.

(e) (ii) Again, many students ignored the instruction, leading to the use of the Sankey diagrams to answer the question. Many incorrectly stated that, 'the LED bulbs last a long time', which makes no comparison with the other two bulbs. The filament bulb lasting 1000 hours may also be considered a long time, but a comparative statement was needed for the mark to be awarded.

Question 8 *(Standard Demand)*

(a) Whilst most students correctly chose the water filled heater was a common answer, many students failed to identify the highest power output as the reason, despite the stem of the question stating that the power output was shown. Many students answered in terms of surface area or of the high specific heat capacity of the water.

(b) (i) Almost a quarter of students were able to explain the term U-value. Students could score this mark most easily by stating that 'U-value is a measure of the effectiveness of an insulator' – the specification statement. Other acceptable answers described U-value as the rate of energy transfer through a material. Incorrect answers most commonly referred to how much energy was being lost, with no reference to time or the rate of energy transfer.

(b) (ii) Less than half of the students chose the correct response of 'low', almost as many opting for 'high'.

(b) (iii) Over a third of students could give at least one correct factor. Factors which gained credit included 'size of house' and 'number of windows'. Many students simply named types of insulation and received no credit. However, where students qualified insulation types by stating 'Whether the house has double glazing or not', credit was given.

Question 9 *(High Demand)*

(a) Most students knew that a dead or inactive form of a pathogen is used in a vaccine. However, some students gave weak answers which gave 'disease' or 'germ' rather than pathogen. A surprising number gave 'antibody' or 'antigen'.

(b) Students continue to confuse the command terms 'describe' and 'explain'. Significant numbers repeated themselves in part (b)(i) and (b)(ii).

(b) (i) A surprisingly large number of students could not describe the differences shown in the graph. Many students obviously did not use the graph at all and gave descriptions of the immune response, rather than the differences between antibody production after vaccination and exposure to pathogen. To gain credit, comparisons should have been given. Some students attempted a comparative response but in terms of the pathogen being killed quicker rather than producing antibodies quicker.

(b) (ii) Many students stated that the smaller and slower response to the vaccine is because the vaccine is at a lower concentration or volume than later exposure to the pathogen. There were frequent references to white blood cells or antibodies knowing how to kill the pathogen. Many students stated that more antibodies were produced after exposure because the pathogen was more dangerous and had to be killed, whereas the vaccine was not dangerous so did not warrant a response.

Question 10 *(High Demand)*

(a) Parts (a)(i), (a)(ii) and (a)(iii) were considered by examiners as a whole, so that students had to link a dug with its effect on the body and its effect on performance.

(a) (i) The most common acceptable answers included steroids and stimulants, but 'stimulus' and 'stimuli' were not accepted. Most students scored a mark on this question.

(a) (ii) Just over a half of students answered this question correctly. Many students confused effect on the body with effect on performance and gave, in effect, an answer to part (a)(iii) here. For example, an effect of a steroid on the body is to enhance muscle growth, but its effect on performance is to increase speed or strength.

(a) (iii) About two-thirds of students gained a mark for this question. A surprising number of students gave answers in terms of enhanced mental effects.

(b) The most common acceptable 'for' was that competitions would be fairer, but many students answered in terms of competition being more exciting or the improvement of world records. A surprising number of students expected to gain two marks by giving 'fairer' as a pro and 'unfair' as a con. However, where the unfairness was qualified, credit could be given. Only a tenth of students gained full credit for this question.

Question 11 *(High Demand)*

(a) There was the usual confusion between the two types of neurone; these types should be familiar to students hoping to gain grades A and B.

(b) Knowledge and understanding of the word 'synapse' was seen far more frequently than the idea of a chemical being released from X. Many students stated that the impulse had to 'jump the gap'. A surprisingly large number of students described a reflex arc in detail rather than answering the question.

Question 12 *(High Demand)*

(a) Although many students correctly referred to differences in boiling points, relatively few referred to differences in condensation temperature. Less than a tenth of students scored two marks.

(b) The vast majority of students knew the general formula, but failed to gain credit by using lower case letters of the atomic symbols and failing to use subscripted numbers for the number of atoms.

(c) Most students gave at least a reasonable attempt at a displayed formula with over half gaining full marks. However, of those students not achieving full marks many omitted the carbon-carbon bond or drew it as a double bond.

(d) As in part (b), many students lost marks by not using upper case letters for atomic symbols, or subscripted numbers for the number of atoms. Balancing the equation correctly proved beyond most students, but many were given two marks for $C_4H_{10} + 13O \rightarrow 4CO_2 + 5H_2O$.

Question 13 *(High Demand)*

(a) It was pleasing to note that the majority of students could correctly complete the diagram of the electronic structure. Where mistakes were made in the configuration, one mark was awarded for showing 11 electrons.

(b) The formation of sodium chloride was less well understood with less than a tenth of students able to gain three or four marks. To gain full marks it was necessary only to state that a sodium atom loses an electron to become a sodium ion and that a chlorine atom gains an electron to become a chloride ion. Many students stated that seven electrons were transferred. There were frequent references to the sharing of electrons. Few students realised that losing an electron results in a positively charged ion and vice versa.

Question 14 *(High Demand)*

(a) The most common (incorrect) answer was that the elephant would absorb a lot of heat through its large surface area. It was extremely rare to see a student who appreciated that the volume / mass of an organism has also to be taken into consideration and therefore gained no marks. Students clearly had had difficulty transferring the more common idea of a small animal losing heat in the cold quickly to the reverse of the large animal not losing heat quickly enough. Some students were awarded one mark for the idea that the elephant's dark colour would result in more rapid energy absorption. Very few students gained full marks for this question.

(b) Common misconceptions included elephant particles evaporating and even heat particles evaporating. Many students realised that energy / heat was transferred to the water from the elephant resulting in evaporation, but the connection was often imprecise. The idea of the particles with the greater KE leaving the water was stated by some students but the concept of the remaining water having a lower average energy extremely rare. A small proportion of students were able to gain three or four marks.

Question 15 *(High Demand)*

(a) Most students gained at least one mark by stating that conduction was involved, but a surprising number confused conduction, convection and even radiation. Many students answered in terms of free electrons, but the idea of the transfer of energy by collisions was rarely seen.

(b) (i) Few students realised that there was more to the question than both temperature and power increased, omitting reference to increasing rate.

(b) (ii) Most students simply advised the homeowners to turn the temperature down, not considering the data about temperature difference. The temperature on a thermostat is controllable but the temperature difference to the air proved to be a difficult concept.

(c) The calculation was often correctly performed but relatively few gave a fully correct unit (J/kg^0C). A number of students could not use a calculator correctly to work out 58 000 / (58 $\times$ 10).

Grade boundary ranges www.aqa.org.uk/gradeboundaries

UMS conversion calculator www.aqa.org.uk/umsconversion