GCSE

Additional Science (Route 2)

AS1HP

Report on the Examination

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General comments

Examiners continue to be concerned about a number of features that would enhance the marks students achieve but which would require very little additional effort on their part. These include avoiding leaving answer spaces blank and using rulers and calculators in appropriate places.

Students should also be reminded that simply copying out the information in the question is unlikely to gain marks and that they must 'add value' to what is given. In some questions this may be as little as making comparisons, using terms such as 'greater' or 'less than'.

Examiners also noted the number of students whose writing was so poor it was difficult to interpret. Simply, if the writing cannot be read, despite the best attempts of several examiners, then no marks can be awarded. Schools are reminded that it is possible to apply for a range of access arrangements for students, such as scribes or the use of a word processor.

It was evident that some students had started the examination well, but, as the questions became more demanding, had lost impetus.

Students should be reminded that they should answer in the spaces provided. These spaces are considered more than enough to accommodate an answer, even if half of it is crossed out and replaced. However, should more space be needed, students should use additional pages and not continue answers into the margins.

Question 1

(a) A high proportion of students correctly identified a control variable in the investigation. The most common answers referred to alginate beads, either in terms of composition or number. A few students used their knowledge of factors that affect the rate of photosynthesis to suggest factors such as 'temperature' or 'carbon dioxide (concentration)' but these were by no means common. Those students who failed to obtain the mark here often suggested 'light (intensity)' or 'distance between lamp and beaker / beads', which was the independent variable.

(b) Although most students correctly identified 'oxygen' as the gas produced during photosynthesis, nearly a quarter selected 'carbon dioxide', which was concerning at this early stage of the Higher Tier paper.

(c)(i) Many students recognised that from points A to B light intensity was increasing, thus gaining one mark. Fewer, though, linked this to an increase in the rate of photosynthesis. The third mark proved to be the most elusive, with only a relatively small proportion of students realising that the alginate beads would take less time to rise to the surface due to an increased production of oxygen. It should be noted that those students who had named the wrong gas in part (b) were not double-penalised in this part, thus if, for example 'carbon dioxide' had been circled in part (b), then the idea that 'more carbon dioxide would be produced' at B than at A was awarded the mark. There were a surprising number of students who believed that an increase of light intensity would bring with it an increase of temperature which would, in turn, increase 'evaporation of the beads'.

(c)(ii) Knowledge or understanding of limiting factors was not as good as the examiners had hoped. Many students misinterpreted the graph at C, suggesting that 'photosynthesis has stopped' or simply that photosynthesis could 'go no faster', without suggesting a reason why this was.

Those who did refer to limiting factors sometimes stated that 'light was at a maximum', contradicting the information in the graph.

(d)(i) Most students were able to identify an advantage of using *Chlorella* rather than vegetables. Many of these focused their ideas around the idea of it being easy or quick to grow, although there was also a significant proportion who referred to ideas about 'mould' or 'going off' which often had to be disentangled by examiners to determine quite what was being suggested.

The most common disadvantages referred to were based around the potential poor quality of nutrition provided by *Chlorella*, with responses such as 'not many vitamins / minerals' being relatively common. However, other ideas shown on the mark scheme were occasionally mentioned.

(d)(ii) The 'production of oxygen' was by far the most common response, although a considerable number of students referred to food, which had been specifically excluded by the question. A common misconception was that *Chlorella* would photosynthesise faster on the moon as it would be 'nearer the sun'.

Question 2

(a)(i) There was a lack of understanding of the process of chromatography with an inability to analyse the chromatogram. There were many vague descriptions but these were not necessarily related to the colour or position of the dots on the chromatogram. The most common correct response was that B had 'different numbers of spots' followed by the 'different colours of the spots'. There were, though, some high level responses in terms of relative solubility.

(a)(ii) The ability to interpret the chromatogram was again weak, with few realising that B contained Allura Red. Those who did obtain the mark often answered in terms of allergies or harm. The most common incorrect response was that the unsuitable food colouring contained 'too many additives' or had 'lots of spots'.

(b) 'More accurate' was the most common correct answer, followed by 'faster', although all the alternatives were seen. Incorrect answers showed no understanding of the chromatography process, with answers such as 'the ink line runs', 'paper rips' or 'colouring drips seen'.

Question 3

(a) A good proportion of students gained all three marks here, correctly completing the table with numbers they had either worked out from the symbols provided or had derived from the periodic table on the Chemistry Data Sheet. Those students who did not quote the correct values for proton and neutron numbers often reversed them, losing two marks in the process. However, provided the mass numbers were correct, or had been correctly derived by adding up the numbers of protons and neutrons given, the third mark was awarded.

(b) The more common mark to be obtained was that relating to informing the customers that the product had been irradiated. There were many references to the harm that radiation causes or references to radiation poisoning. Many responses described having 'too much radiation', not realising that treatment of the food does not leave radiation in the food.

Question 4

(a)(i) The examiners were disappointed on the whole with the answers given to this question. The students were required to answer in terms of 'distance' and yet the majority answered in terms of 'time'. Students need to use the specification in order to learn the definitions of certain terms, which are made clear there. Some students answered about thinking distance in terms of time, but then managed to secure a mark by answering about braking distance in terms of distance. There were quite a few who crossed out 'time' in their answers and replaced it with 'distance', which unfortunately did not then read correctly for their thinking distance answer.

(a)(ii) Although this presented a graph that many of the students would not have seen before, the question was answered well by a large number of the students. If they did get the thinking distance incorrect, there was still an error carried forward mark available which helped some to get a mark here.

(b) Many students knew a range of factors that affected either thinking distance or braking distance. The majority of students accessed Level two with ease by naming factors and their effects on stopping distance, or naming factors and an attempt at an explanation. What they struggled to articulate was how each factor affects the stopping distance and then an explanation for this effect in one coherent paragraph. Where they did know the connections between factor, effect and explanation they then limited their maximum mark to 4 by referring to 'time' throughout instead of 'distance'. The previous question was supposed to help clue them to this, but unfortunately that question was answered incorrectly by many of the students.

The majority of students gave 'alcohol', 'drugs', 'fatigue' and 'distractions' as the factors that affect the thinking distance. It was interesting to see the number that wrote about 'children in the back of the car' being a distraction, or 'talking on the phone'. The effect that these factors have was quite well known in terms of the effect on reactions and taking longer to think. However, there were still a number that incorrectly mentioned 'slows down reaction time' or 'reduces reaction time'.

A few students incorrectly thought that visibility (fog / rain / glasses) has an effect on thinking distance.

Condition of tyres and brakes, ice and rain on the road, and speed and mass of the car were many of the factors mentioned with reference to the braking distance. Many discussed the effects of rain / ice on the road in terms of grip, but didn't go into enough detail in terms of friction between the tyres and the road. Quite a few students demonstrated a good knowledge of the way car braking systems work, but failed to score maximum marks by not answering the question asked.

There were a number of students who could not organise their answers into a clear, logical order and this is certainly an area for practice for future papers. Common misspelt terms were 'tyres', 'brakes' and 'alcohol'.

Question 5

(a) Although most students correctly identified 'diffusion', reference to 'osmosis' was also commonly seen.

(b)(i) Many students referred to molecules of A and B jointly, suggesting that they would both move through the membrane into the surrounding water, paying scant notice to the size of the holes in the membrane. In most cases students referred to the molecules moving (or not) through the

membrane, rather than answering the question which asked about how the numbers of molecules might change. There were five possible routes to gaining the three marks available here; however, very few students referred to the eventual achievement of equilibrium for molecules of A. Examiners expected that, had students answered the question asked, far more of them would have gained two or three of the marks available. Examiners were also surprised at the number of students who referred to the movement of water into the model cell by osmosis – apart from not having been asked for, osmosis does not crop up until Biology Unit 3.

The examiners were also concerned about the number of students who failed to follow the command word 'describe' and added explanations to this part of the question. When these students came to part (b)(ii), they failed to give these same explanations which would have gained them at least one of the marks.

(b)(ii) A significant proportion of students failed to offer any response here. Many of these had already given, in part (b)(i), what would have been creditworthy responses, but had now exhausted their ideas. This is also true for many of those who made an attempt to answer but had already given a correct answer previously and now looked for something different. To award one mark, examiners were looking only for some reference to a consequence of the size of the holes compared with that of the molecules. The second mark here was more demanding and as expected, only particularly able students achieved this.

(c)(i) The examiners were surprised that so few students could identify 'respiration'. All sorts of alternative processes were offered instead.

(c)(ii) It appeared that most students had not understood the significance of the first part of the question, to give an answer 'in terms of oxygen passing into the blood from the lungs', as very few students appeared to have any idea of the importance of diffusion gradient. Most of the students who gained one mark here did so for explaining why the movement of blood is important, referring to the delivery of oxygen to body cells.

Question 6

(a) The idea that 'reactions would be separate' or that 'processes would not interfere with one another' was relatively common. Other often seen responses included reference to damage to one part of a cell not affecting other parts. All of these were acceptable.

(b)(i) A surprisingly high number of students could not offer any response to this part. The function of cellular components ought to be well revised. The most common error was to confuse the function of ribosomes with that of mitochondria. At times, due to the poor quality of handwriting, examiners had difficulty trying to determine whether students had written 'proteinsynthesis' as a single word or had written 'photosynthesis'.

(b)(ii) Again, there was a significant proportion of scripts where no attempt had been made, suggesting again that students had failed to revise the role of cellular components, as the first two of the available marks were straightforward recall from the specification. Of those students who did refer to respiration and energy, a proportion suggested that energy is 'made / produced / created' during respiration, 'stored in mitochondria' or used 'for respiration', rather than being 'transferred' or 'released' by respiration. The third marking point required a use of this energy by the ribosomes. Some students attempted to hedge their bets here and simply restate the question, 'for the ribosomes to function'. As previously, students were not penalised here for an error in part (b)(i), so an incorrect function in part (b)(i) would be given credit in the third marking point.

Question 7

(a) Common answers included 'fair', 'reliable', 'precise' or 'accurate', none of which were acceptable. The principle purpose of random quadrats is to 'avoid bias', which could be described, or to obtain a sample which is 'representative'.

(b)(i) Examiners were surprised that so many students appeared to have ignored the question or misinterpreted the key and described the effect of quadrat size on the mean values, rather than on the range of results. Even so, one mark was still available for describing the 'levelling off' at / above the 50 x 50cm quadrat. However, it was not common for students to describe this part of the graph, so few students achieved both marks in what should have been a fairly straightforward description.

(b)(ii) Whilst many students correctly recognised that the '50 x 50' quadrat would be the best to use, good explanations as to why were less common. Most of the other quadrat sizes were suggested, with 40 x 40 frequently chosen as being 'in the middle' or 'average'. A number of students were unable to interpret the information in the graph and suggested that 10 x 10 would be best as this would have the 'highest number of species', presumably again as they misinterpreted the key.

(c)(i) Correct descriptions of 'transect', including line transects and belt transects, were not uncommon; however, many students left their answers short by merely suggesting 'line' or 'string' without explaining where this line or string might be. Other incorrect descriptions included 'the area' samples are taken from, or 'lines that divide up a quadrat'.

(c)(ii) The most common error was to describe a biotic factor, such as 'grazing', 'competition' or 'seed dispersal by animals' rather than a physical factor which had been asked for. Even so, many students selected one of the hoped for responses, most commonly 'light (intensity)', the availability of 'water' or 'temperature'. Vague suggestions such as 'weather' and 'pollution' were considered insufficient but were ignored with further qualification.

Question 8

(a)(i) The majority of students were able to calculate the relative formula mass of nitrous oxide. There were few instances of students being able to calculate the correct value from (14 × 2) + 16. The most common errors were either to multiply 28 x 16, or a failure to realise that nitrogen had 2 atoms present, and just add 16 + 14.

(a)(ii) A much lower percentage of students were able to calculate the percentage of nitrogen in nitrous oxide. Common errors were: failing to realise that nitrogen had 2 atoms present and dividing 14 by 44; or reversing the percentage formula and calculating 44/28. Mathematical skills were also weak, with several examples seen of students rounding 63.6 down to 63.

(b) Relatively few students knew that a mole is the relative formula mass in grams. Those who gave '44' often forgot the unit which was essential for the mark. Common incorrect answers were '14g' or '28g'.

Question 9

(a)(i) Answers to this question were generally poor. Many students described the properties of gold rather than its structure. There was confusion with all types of bonding and a lack of understanding of particle types, with many answering in terms of 'gold molecules'. Others gave descriptions

relating to large structures of carbon atoms, particularly graphite. The conduction of electricity by delocalised electrons was answered better, though again there was confusion with graphite and the passage of delocalised electrons between layers.

(a)(ii) Again, there were many descriptions of properties of gold or malleability, with few students following the command word 'explain'. There was some confusion, with inter-molecular forces being mentioned quite frequently. References to 'layers of atoms' and to 'sliding' of these layers were infrequent.

(b) Many students failed to compare copper to the other metals and just stated that copper was 'cheap', had a 'high (relative) conductivity' or simply quoted figures from the table without any attempt to indicate whether these values were high or low. Many described the need for a high melting point to avoid fires without realising that household electrical wiring is unlikely to get to those temperatures unless there is already a fire.

Question 10

(a) Students often demonstrated a lack of knowledge of covalent bond formation, with less than half being able to state that methane had 'covalent bonds'; 'ionic' was seen almost as frequently. Few students were able to correctly describe covalent bonding, with a poor understanding of the process being demonstrated. Less successful students often described their answers in terms of atoms being shared / transferred.

Those who obtained the highest marks usually included a correct dot-and-cross diagram in their response, thus gaining three of the marks without the need for a lengthy description which would almost inevitably omit vital details.

(b) Again, few students followed the instruction to 'explain in terms of forces', linking their answer to a statement that methane had a 'low boiling point' rather than explaining the cause of this. Those students who referred to 'weak forces' then often negated the mark by stating that these forces were 'between atoms'.

Question 11

(a)(i) The lines drawn for the resistor were disappointing, despite the graph being in the specification. The majority failed to score any marks as the students rarely drew a straight line and therefore could not be awarded the second mark either. There was a variety of lines, curves and swirls, some relating to other components and some clearly random. The majority of students who did draw a straight line also made sure it went through the origin.

(a)(ii) Given that many had not answered (a)(i) correctly, there were very few who were then able to link what they had drawn to the fact that the temperature was constant. Even those who did draw the correct current-potential difference characteristic graph often still did not know what the correct assumption was, with many suggesting that current 'is proportional to the potential difference'.

(a)(i) About half the students knew the correct symbols for a battery or drew the four cells connected. Those who lost the marks usually did not draw enough cells or failed to connect them to the rest of the circuit. There were a few who connected the cells so that they faced each other.

(b)(ii) Despite the number of hints they had with the use of pictures, many students failed to link them to the question and therefore performed poorly. Quite a few recognised that the graph did not go through the origin in region A; however, there were many ways in which this was communicated. Some did correctly state that there was a voltage when there was no current, or gave values for potential difference and current at this point, which was acceptable. However, often the student described 'not having enough current' at this point. Most students gave only a basic description of the shape of the graph in region B, saying that the current increased with potential difference. However, at this level students are expected to be able to describe curves, particularly as they should have some knowledge of this type of curve from the filament bulb. There were hardly any correct answers for the reasons that they gave for their descriptions.

(b)(iii) Given the poor descriptions given in (b)(ii), the students then struggled to give meaningful answers, despite the fact that the majority of the answers they could give were generic improvements for this type of experiment. The majority gave an insufficient answer along the lines of 'take more voltages'; however, at this level they are expected to know about 'ranges' and 'intervals'. The same applies to the simple answer of 'take more readings'. This is only an improvement if something is then done with the repeated readings. It is worth noting that the specification makes reference to the type of experiments in this topic the students would benefit from having knowledge of.

Question 12

(a) This question was answered quite well. Many attained the first mark, but then did not use the correct terminology for the idea of acceleration.

(b) The majority of students scored 2 marks for their answer of '500' as they had not taken into account the fact that the force was given to them in kilonewtons and they had to convert to newtons. There were a few students who used the correct numbers in the correct places in the equation, but then failed to evaluate correctly, therefore gaining 1 or 2 marks for their substitution dependent on whether they had converted to newtons. Many who did this wrote down too few or too many zeros. A few re-arranged the equation incorrectly before any substitution and therefore scored zero. It is worth noting that it is good practice for students to substitute directly into an equation given on the Physics Equations Sheet rather than re-arranging the equation first.

(c) This was answered quite well; students were good at recognising that burning fuel will result in an increase in acceleration, but less convincing as to the reason why. For those who did not gain marks here, the main reason was that they thought the rocket would slow down as it would have no more fuel left to propel it. While this may be correct for a rocket that does not go into space, the question is about a rocket that is taking supplies to the International Space Station.

(d) A high number of students managed to attain the correct value of 450 and gain 2 marks; however, many failed to gain the third mark for the unit, with more popular incorrect answers of 'm/s', 'kgm/s^2', 'N/kg' and 'p'. There were a variety of ways to obtain the value of 450, but where students lost marks was in the final evaluation, either due to calculator error or a simple mistake. A few wrote '750 - 300' but then failed to subtract correctly.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

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