OCR
Oxford Cambridge and RSA

GCSE

Additional Science B

Gateway Science Suite

General Certificate of Secondary Education **J262**

OCR Report to Centres June 2015

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This report on the examination provides information on the performance of candidates, which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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OCR REPORT TO CENTRES

B721/01 Additional Science B modules B3, C3, P3 (Foundation Tier)

General Comments:

- In general the paper was balanced and accessible to all candidates. There was, however, a significant number of candidates who had no responses even to multiple choice type questions.
- Answers were appropriate to the question and there was little evidence of guessing taking place. On the contrary it seemed that candidates were prepared to leave the question unanswered rather than guess. Questions that tested the quality of written communication were affected by a lack of literacy skills. Many were unable to express answers clearly and were unable to construct meaningful sentences. This often limited the access to the higher marks in this type of question. Some of these questions were no response answers but in the main candidates did have an attempt.
- Candidates were on task throughout the session and there was some evidence that some struggled to complete in the time available due to the no responses towards the end of the paper.
- The rubric of most questions was interpreted correctly.
- Candidates continue to find difficulty with questions that test the candidates' ability to apply their knowledge and understanding. Marks ranged from single digits to mid-sixties and it is encouraging to see higher marks are now being obtained by more able candidates.
- Most candidates were able to describe how to take a resting pulse. Encouragingly, most candidates could use data on a graph to identify a correct range.
- As in previous exam sessions candidates need to be more aware of making comparisons to avoid losing marks. Candidates should also be more alert to applying their knowledge to given situations in questions.
- Some questions were answered very well but they tended to be those with a lower demand on literacy. As in previous years, many candidates seemed to understand many science concepts but found it difficult to translate understanding into clear and concise meanings.

Comments on Individual Questions:

Question No 1.

Q 1(ai). This was quite well-answered by most candidates. Surprisingly some candidates put the correct answer in the table but a different answer on the answer line and therefore did not score.

Q 1(aii). Many candidates knew where to find the pulse and the need to count for one minute. Fewer recognise the need for the subjects to be sitting relaxed.

Q 1(aiii). There was some confusion here, as many candidates' responses referred to fitness levels in these five students, clearly misunderstanding the question. Marking points two and three were rarely seen.

Q 1(bi). Only the higher ability candidates scored this mark with others identifying it was CO2 but not 6CO2.

Q 1(bii). This was answered well and many candidates were able to state that the blood carries oxygen around the body. Where the candidates answered incorrectly they tended to state that blood was carried to the muscles/rest of the body or that it was needed for energy.

Question No 2.

Q 2(ai). Good responses, but sometimes candidates read the chart incorrectly and gave 12-14 as the answer. Some gave 3 as an answer for the number of years where the girls are taller.

Q 2(aii). Most candidates scored this mark. Where incorrect, many gave that he should be 130cm tall.

Q 2(b). Surprisingly few correct responses on this recall question. Many referred to faulty genes or to the chromosome so did not score.

Q 2(c). Many candidates scored one mark for this question using the idea that the data needed to be validated in some way (checked/make sure it is correct/know it is right). Where two marks were scored it tended to be for further evidence or to develop work further. Most candidates simply wrote a one-point statement and did not expand for the second mark.

Question No 3.

Q 3(a). Very few candidates wrote about specificity in their response and where they did they tended to write about the only chemical that would fit the shape. There was little mention of the lock and key mechanism. There were very few responses where a diagram was used to show the specificity. On the rare occasions where a full description was given, it tended to be that luciferase helped speed up the reaction or that the optimum temperature was 250C. Very few wrote about denaturing of enzymes at higher temperatures. The most common answer to the question involved weak partial descriptions that the light decreased as the temperature was raised and that it ‘was higher when the temperature was low’.

Q 3(b). Most candidates scored at least two marks here. Very few candidates identified the need for the process to be repeated with the offspring. Where no score was given the candidates often referred to cloning or genetic engineering in their response.

Question No 4.

Q 4(a). Most scored one mark for idea of blood travelling further but very few identified the idea of needing a greater pressure.

Q 4(b). The responses to this question were weak. Most candidates wrote about the heart needing to be controlled otherwise there would be damage to the body or a heart attack. Where rate was mentioned the candidates wrote that the rate needed to be controlled but either chose that it needed to be reduced (to calm the heart down), or didn’t state a direction for change. Very few gave the idea that more oxygen was needed. Many referred incorrectly to needing more blood.

Question No 5.

Q 5(a). Most were correct but ‘C’ was also a common incorrect response.

Q 5(b). A significant number of candidates wrote ‘changing temperature’ and ‘changing amount’ of reactants. This misconception needs addressing as they need to be aware that changing can mean an increase or decrease. The most common response to score two marks was increasing the temperature and using a catalyst. The idea of stirring was occasionally seen together with more collisions.

Q 5(c). Well-answered with a few not scoring for the idea of dissolving, evaporating or no more particles.

Q 5(di). Most candidates attempted this question and it was answered correctly in most cases. All four types of graphs were selected in the responses.

Q 5(dii). This question often tended to score 1 mark, occasionally 2. The most common correct response was comparing the loss of mass after 4 minutes between the two marble chip sizes. Where candidates discussed surface area, many incorrectly believed that small marble chips had the smaller surface area and that this is why they dissolved quicker.

Question No 6.

Q 6(a). Most candidates scored here, although spelling of 'diamond' was poor.

Q 6(b). Again this was a reasonably well-answered question.

Q 6(c). Not well-answered by the majority of candidates. There were very few correct responses for either marking point. The majority of candidates just repeated the question in their answers. . Better responses seen were 'store drugs inside', 'enclose the drug' and 'transport the drugs' but very rarely were two marking point put together.

Question No 7.

Q 7(a). Candidates often drew correct diagrams but did not label them correctly (or at all) and so lost marks. Many did not draw the thermometer in the water. A significant number had the fuel and water in the same container and, rather worryingly from a safety point of view, had the fuel heated by a Bunsen burner. Some candidates mistook the point of the question and drew graphs of the temperature against the fuel.

Q 7(b). Quite well-answered as many candidates stated it was the largest temperature change and others actually calculated the change in temperature next to the table. Those who were incorrect tended to give that C had the highest temperature at the end. Some gave another letter as they had incorrectly subtracted the start and end temperature.

Q 7(c). This was attempted well by most candidates. Where incorrect, candidates had used heat rather than oxygen or had put in too many arrows. For example, ethanol →oxygen→carbon dioxide + water

Question No 8.

Q 8(a). Not a well-answered question. Many candidates wrote the names of reactants or confused products and reactants (giving MgSO4). Some gave the elements included as a list e.g. hydrogen, sulphur and oxygen.

Q 8(b). This was very poorly attempted by the majority of candidates and many no responses were recorded. Most candidates added together the Mr of all of the compounds.

Q 8(c). This was either answered very well with a correct calculation and losses (evaporation, transfer and filtration losses stated) or scored level 1 or zero. Where zero was scored many of the candidates talked about not adding enough reagents or measuring incorrectly.

Question No 9.

Q 9(a). A well-answered question. Candidates who did not score did not complete the graph and therefore decided that boat B won the race.

Q 9(b). Many candidates were able to calculate the speed of boat A and state that boat A was faster. Comparisons were also made of the speed of the boats over the first 1000 metres although hardly any candidates recognised that this area too was a constant speed. Some calculated the speed in this section and these tended to be the candidates that scored full marks. Some candidates forgot to include units or gave m/s as the unit but with a value linked to m/minute. Most who attempted the question could state that boat A was faster. Very few recognised that both boats were slower for first 1000m or both boats went faster after 1000m.

Question No 10.

Q 10(a). Although many attempted this question few candidates scored any marks. There was very little use of data in the answers and there tended to be generic statements such as 'as the speed went up so did the thinking and braking distances'. When data was used the thinking distance was correctly used but many read the braking distance as the full height of the bar.

Q 10(bi). A well-answered question.

Q 10(bii). A significant number only scored one mark here as they were not specific about the road conditions, weather conditions or the conditions of the brakes/tyres. Most could state that this made the roads slippery or less grip.

Q 10(c). Most candidates answered this question but the answers were very variable. Many candidates had the idea that the belt was weaker than a normal seatbelt and that the button could break easily. Some wrote about general benefits of using seatbelts rather than adjustable seatbelts.

Question No 11.

Q 11(a). Usually correct but when not the candidate included the time in the calculation.

Q 11(b). This question was answered well with many higher ability candidates correctly calculating the work done and also stating that the difference was due to his larger weight.

Q 11(ci). Many candidates did not answer this question. Even when attempted, it was answered poorly with many incorrect answers commonly including Joules, Amps, Ohms, kg and metres.

Q 11(cii). Most candidates gave 'climb faster' or 'add more weight' for correct answers. Weaker responses referred to lose weight, get fitter or go to the gym more often.

Question No 12.

Q 12(a). This question was poorly answered with hardly any candidates getting both marks. Most left out the mass in the answer. It appeared that very few candidates used the equations to help them answer the question.

Q 12(b). Weak responses were seen. Many gave the book on the second shelf because it had the biggest surface area, or the book on the bottom shelf as it had 'less far to fall'. Even when the correct book was selected many did not give both highest and heaviest book, often only one reason was given.

B721/02 Additional Science B modules B3, C3, P3 (Higher Tier)

General Comments

This 75 mark higher paper gave a good range of marks and the answers demonstrated that candidates generally were well-prepared and appropriately entered for this tier. As always though, some candidates would have been better suited to the foundation paper as they had very limited access to the more challenging questions. Some candidates' handwriting was very poor and they might have benefited from the use of a scribe or word processor.

The paper was of an appropriate length and there were very few examples of candidates running out of time. Although a few candidates left some answers blank, these 'no responses' tended to be scattered throughout the paper rather than concentrated at the end.

It was evident that candidates demonstrated their knowledge, understanding and problem solving abilities in tackling the level of response questions. Many candidates highlighted key words in the questions and so these answers tended to be more focussed and structured.

A significant number of candidates struggled to rearrange equations correctly and to follow logical steps when expressing their answers mathematically. They also found it difficult to read data accurately from the various graphs in the different sections. The increasingly problem-solving approach to questioning generally tends to make questions more demanding and this again has made this paper more challenging for some candidates. Some answers though illustrated misconceptions of some science ideas and these are explained in the comments on individual questions in the next section.

The How Science Works questions were nearly always attempted and these types of question showed improved performance compared to June 2014.

Comments on Individual Questions

Question No.

Section A – B3

Q1ai This question required candidates to use information to determine whether the athlete is respiring anaerobically. The majority of candidates were awarded one mark for correctly calculating the percentage or heart rate in beats per minute. Candidates did not always compare the calculated value with the athlete's percentage or heart rate and therefore were not awarded two marks.

Q1aii This question was about the causes of fatigue in muscles cells. The first marking point for lactic acid was well known by candidates. Very few made reference to oxygen debt; instead they thought there was no oxygen involved. The incomplete breakdown of glucose was not a common answer. A few candidates only gave general answers in terms of fatigue, tiredness and cramp.

Q1bi The majority of candidates were able to finish the symbol equation for aerobic respiration. Most of these candidates also correctly balanced the equation. A number of candidates did not attempt this question or they used words rather than symbols.

Q1bii Candidates usually stated the function of mitochondria rather than applying their knowledge to answer the question about the needs for many mitochondria in muscle cells. They explained that mitochondria are the site for respiration but did not link this to the need for more respiration. Incorrect responses included stating that mitochondria were needed for protein synthesis or repair.

Q1biii This question about hyperbaric oxygen therapy was challenging. Candidates were awarded marks for explaining that the athlete was able to exercise for longer. A few candidates identified that aerobic respiration could happen for longer, but many did not differentiate between aerobic and anaerobic respiration. Few candidates realised that there would be less lactic acid build up.

Q2ai The majority of candidates attempted this data analysis question about growth rates. Those who quoted the extremes of the range correctly usually also gave 27.5 as their answer.

Q2aii This question required candidates to suggest why the range for boys at age 13 is greater than the range for boys aged two. Many candidates wrote about puberty or growth spurts but some just referred to adolescence or that the boys at age 13 had a longer time to grow. A few candidates thought that diet, lifestyle or natural variation has more of an effect in teenagers than in young boys.

Q2b This question required candidates to explain DNA replication. Most candidates gained at least one mark for either explaining that DNA unzips or that the correct base paring is A-T.

G-C. Many candidates chose to illustrate their answers with excellent labelled diagrams. Very few mentioned complementary base pairing in their answers. A significant number of candidates did not read the question carefully enough and gave extensive answers about mitosis.

Q3a This question was the first level of response question on this paper. The candidates were asked to use data from the graph. Most candidates used the graph to determine the optimum temperature as being between 25-26C. Many candidates then explained that the enzyme was being denatured after this optimum temperature. However, few could then go on to explain that the active site shape was changing. The lock and key mechanism, when explained, was done well but in most answers it was just mentioned as candidates found it difficult to explain the meaning of enzyme specificity.

A few candidates tried to explain why the enzyme might have an optimum temperature of 25C or why an enzyme is a biological catalyst, but this was required for this question. There were many descriptions about the shape of the graph in terms of light intensity and change in temperature, but again this was not required for this question.

Q3b Candidates were asked to compare the effect of temperature on enzyme activity using a graph showing two different temperatures in the winter and summer. The majority of candidates were able to interpret the graph and stated that the enzyme was more active in winter and/or at 25C. Few candidates were able to gain the third mark by quoting data from the graph or by stating that the effects were more noticeable under certain conditions. Many tried to compare data; sometimes this was done poorly with candidates copying figures incorrectly, using 3.5 in place of 3.6 for example. Some candidates became very confused in attempting to separate out temperature and seasonal effects.

A few candidates tried to explain why the enzyme activity varied using ideas about denaturing and the need to maintain body temperature. This was not required for this question about comparing the effect of temperature on enzyme activity.

Q4a A wide variety of answers was seen for the structure in a real heart represented by part A in the artificial heart. Most were incorrect parts of the heart or named blood vessels and there was confusion between the left and right side and the ventricles and atria.

Q4b The majority of candidates gained the mark for the idea that part B in the artificial heart has to pump blood to the body or has to pump blood further. Fewer candidates mentioned the need for a higher pressure.

Section B – C3

Q5a The majority of candidates were able to write a symbol equation for the reaction. Some candidates missed out S on the right hand side of the equation and a few more struggled to balance the equation. A few candidates tried to add formulae together, S2O2, or used incorrect formulae, Na2Cl2.

Q5b The majority of candidates selected 50C for when the reaction is the fastest. A few interpreted a long time as a faster reaction and gave 20C instead of 50C.

Q5c This question was about the reacting particle model in terms of a more concentrated solution. The majority of candidates gave the answer that a more concentrated solution would have more collisions, better answers explained that these would be more frequent collisions. Fewer candidates conveyed the idea of more particles in the same volume or more crowded particles.

Q5di The majority of candidates gave 16 minutes as the correct answer for the time taken for the reaction to finish, although 1.7 and 20 were common incorrect answers.

Q5dii The majority of candidates correctly chose line graph as the way to present the results. A few chose bar chart, while others chose histograph.

Q6a Candidates found it difficult to explain what is meant by allotropes. Many candidates thought they were different compounds or atoms having different forms or structures. A few candidates used ideas about protons and neutrons as the definition of an isotope in their answers.

Q6b About 50% of candidates gained this mark for answers about it being slippery or because layers can slide. A few candidates wrote about atoms slipping or sliding rather than layers of atoms sliding. A few also wrote about forces between atoms rather than between layers.

A common misconception was that graphite is a good lubricant because it is a liquid.

Q6c Where candidates gave the answer of ‘electrons’ they usually explained that these electrons were delocalised or free. Some candidates thought that graphene conducted electricity because it is a metal. Others thought that there was space for the electricity to flow between the layers or across the single layer.

Q7a A few candidates gained both marks for this question about atom economy but the majority found it challenging. Most candidates made an attempt at this question but used 95 / 113 x 100 to get 84% as they had not considered there being 2H2O in the product.

Q7b Some candidates were able to describe why a company would want as high an atom economy as possible. A few candidates gave incomplete answers in terms of less waste or general economic reasons.

Q7c The majority of candidates identified correctly the bond breaking process as endothermic, although exothermic and catalytic were common incorrect answers.

Q8a This question was the second level of response question on the paper with the majority of candidates achieving level 2. Most common correct responses included in either the written response or from a labelled diagram; measure temperature of water with a thermometer, measure mass of fuel, use of a spirit burner and use water in a beaker.

Most candidates attempted the calculation of the mass of water but many did not include the unit of mass, g, in their answer.

The question required the candidates to describe the experiment and to calculate the mass of water used. Some candidates only described the experiment, but did not attempt a calculation; others only performed the calculation, but did not describe the experiment in detail.

Common misconceptions were using a Bunsen to heat the water and mixing the fuel with the water. Many candidates did not label their diagrams and some candidates did not give the unit for the mass of water or gave the answer in ml or cm3.

Q8b Candidates found this question challenging as they found the idea of energy transferred per gram difficult. Common misconceptions were just using 1.2 x 4.2 x 20 and using the mass of the fuel rather than the mass of the water.

Q8c Candidates also found this question challenging. They needed to use all the results from the experiment but many did not consider the energy per gram of fuel. A few candidates realised that only a small amount of A had to be burned to give a large amount of energy. Candidates who identified A and then calculated the correct energy per gram also calculated the energy per gram of all the fuels.

Answer C was a common incorrect answer, because candidates noticed that it gave out the most energy and biggest temperature rise, without realising that a lot of fuel was burned to achieve this.

Section C – P3

Q9a The majority of candidates identified boat A, extrapolated the graph and made another relevant comment about the whole race. The most common interpretation was that boat A was faster or took less time to complete the race than boat B. A few of the extrapolations were poorly attempted with curves, lines not being continuous or using very thick pens. Some candidates did not make an attempt at the extrapolation and thought that the race ended at 4000 m rather than 6800 m.

Q9b This question was the third level of response question on the paper. The question required candidates to calculate the gradients and so compare the speeds of the two boats over the whole race. They were asked to give their calculations of speed in m/s. Many candidates attempted the gradient calculations and understood what they represented. Where gradients were calculated correctly they were usually for the first 1000m of the race. A few were confused by the units and either did not quote the units or gave incorrect units for speed. These units were usually metres per minute or kilometres per hour. Many candidates did not show any working and confused speed and acceleration.

Few candidates gave good comparisons as they did not state which parts of the race were being compared. Boat A being faster at the start was the most common correct comparison. Some candidates managed to note that both boats increased in speed after 1000m but few noticed that B was then quicker than boat A. Many thought that the gradient for boat A was steeper than boat B throughout the race because boat A won the race.

Q10a The majority of candidates were awarded at least one mark for this question involving using data from the graph. Many quoted braking distances and thinking distances from the graph but many of these quotes were inaccurate. Some quoted the overall stopping distance rather than the comparison required between braking distance and thinking distance. A number of candidates gave correct qualitative answers but did not attempt to use any data in their answer despite the question asking them to use data from the graph in their answer.

Q10bi Most candidates were successful in working out it was the condition of the tyres which affected the braking distance.

Q10bii Most candidates identified wet roads or icy roads as a factor that increases braking distance. Many then explained that these road conditions decreased friction or grip. A few candidates gave incomplete answers in terms of general weather conditions, road conditions or tyre conditions. A few thought that driver distractions or alcohol affected the braking distance.

Q10ci Most candidates identified that comfort was the issue, but some tried to give a second change such as suggesting that a law needs to be made to make it compulsory to wear a seat belt.

Q10cii The majority of candidates gained one mark for a benefit of wearing seatbelts. There were a few vague answers about the risks of this comfortable seatbelt including the driver relaxing too much. A few candidates only wrote about comfortable seatbelts being safe in general terms. Good answers included reasons why they were not as safe. These reasons included the seatbelts not stretching or not providing full protection during an accident.

Q11ai This question required candidates to select the correct information from the table and calculate Riya's power. Most candidates attempted the calculation but found it difficult to substitute force x distance into the equation for power.

Q11aii Candidates were required to suggest two different ways power could be increased. Many candidates successfully used the equation to suggest two different ways. Some candidates thought that losing weight, getting fitter, being stronger or completing the task in more time would increase the power. Other candidates only made one suggestion.

Q11b Candidates that used the equation to show that Niklas was correct gained the two marks for this question. Some candidates struggled to rearrange the equation or just gave the answer that it was because they had the most power.

Q12ai Most candidates realised that at terminal speed the KE is constant because the speed is not changing.

Q12aii This question was very challenging with many candidates not understanding the word dissipated. Most candidates wrote about air resistance and the energy transfers of the skydiver.

Q12b This question was about the forces on a skydiver standing on the ground was also very challenging. Nearly all candidates answered in terms of a falling body with air resistance and drag and not about the skydiver not moving and standing on the ground.

B722/01 Additional Science B modules B4, C4, P4 (Foundation Tier)

General Comments

The paper differentiated well and performance across the three modules of the paper appeared to be fairly consistent, allowing candidates to demonstrate their knowledge and understanding across Modules B4, C4 and P4. Candidates found Section D, the analysis of data section, more challenging.

The longer six-mark questions, which were marked using a level of response approach, were generally less well answered than in 2014, with candidates generally scoring best on the physics Six-mark question.

Candidates demonstrated the ability to apply their knowledge and understanding of science to unfamiliar contexts and were able to analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence.

Candidates used their knowledge and skills appropriately to respond to questions about photosynthesis & ecosystems, decay, water resources and electrical circuits.

Candidates did not seem to have the knowledge required to respond to questions about minerals for plant growth, flame tests / testing water, atomic structure, use of radioisotopes and fission/fusion.

Overall, examiners felt that the question paper was appropriate to the ability range of candidates intended. There was no evidence of lack of time.

Comments on Individual Questions

Question 1

(a) Many candidates correctly completed the word equation for photosynthesis. Oxygen as a reactant and water as a product was however a common error.

(b) Many candidates appreciated that temperatures would be too low for photosynthesis, but examiners awarded the mark for ‘water would leave the bacteria by osmosis’ less frequently.

Question 2

(a) Many candidates correctly identified transpiration. Respiration was a common misconception.

(b) Good responses in part (i) described how water is taken up by the roots / root hairs and then moves up the stem. Examiners rarely awarded the third mark, which was for the idea that water is pulled up by water evaporating from the leaves. ‘A’ was a common misconception in part (ii). The idea that the plant is still losing water, but would not lose as much as it does in the light, was not well understood in part (iii).

Question 3

This six-mark question was targeted up to grade C. Many candidates were able to describe a simple trend shown on the graph, or make reference to fertilisers increasing crop yield, and gained credit at Level 1 (1 – 2 marks). To gain Level 2 candidates needed to describe a simple trend and include reference to fertilisers containing minerals for plant growth or increasing crop yield. An answer that included reference to the role of at least one mineral in plant growth and

linked the decrease in land use to increasing yield as result of increasing fertiliser use was required to gain credit at level 3 (five - six marks). Very few candidates attained the higher levels on this question.

Question 4

(a) Candidates generally understood the different roles that organisms have in breaking down leaves and were able to analyse the data about the size of the organisms to indicate correctly whether the organisms could get into bags B and C.

(b) Most candidates correctly identified that the leaves decayed fastest in bag A in part (i). Good responses to part (ii) indicated that this was because earthworms can get into bag B. Candidates however were not able to explain this answer further in terms of earthworms increasing the surface area for the bacteria / decomposers to work on. In part (iii) most candidates appreciated that the temperature would be lower in winter and good responses went on to suggest that bacteria / decomposers / earthworms would be less active.

Question 5

In all four parts of this question a wide range of incorrect responses was seen.

Question 6

(a) Many candidates identified correctly that there are three different elements in the formula K_2SO_4. Seven, being the number of atoms in the formula, was a common misconception. Examiners also frequently saw the answer two, presumably from candidates who thought the different elements were K and SO.

(b) This six-mark question was targeted up to grade C. To gain credit at level 3 (five – six marks) candidates needed to give a complete description of the flame test. They also needed to explain that the test with barium chloride indicates the presence of sulfate but that the flame test indicates the presence of sodium rather than potassium. Most candidates were unable to describe how to do a flame test and could not analyse the results to explain whether they supported the idea that the water was polluted with potassium sulfate.

Question 7

(a) Most candidates could name a water resource.

(b) Most candidates correctly completed the table in part (i). Good responses in part (ii) described that all the water available is needed.

Question 8

(a) Good responses selected metal Y as the best metal to make the watering can because it does not react with water. Candidates who chose one of the other metals did not gain credit for the question.

(b) The mark scheme gave credit for a wide variety of properties of metals. Candidates who did not gain credit often wrote their answer in the form of questions, e.g. ‘Is the metal strong?’ and did not gain credit. Answers such as ‘strength’ also did not gain credit, as it was not clear if the candidate was referring to high or low strength.

Question 9

(a) Good responses explained that there is more evidence about atomic structure being found because better technology or equipment is available nowadays.

(b) The meanings of atomic number and mass number were not well known by candidates. Mass number as 'the mass of the atom' was a frequent misconception and many candidates thought that atomic number is the number of protons and electrons added together.

(c) Good responses identified the element as sulfur because it has 16 electrons or an atomic number of 16. Credit was also given to candidates who realised that the element was in group 6 and period 3. Oxygen, with a mass number of 16, was a common misconception.

Question 10

(a) Most candidates correctly chose circuit A.

(b) The resistance of the lamp was usually correctly calculated as six ohms.

(c) Most candidates correctly choose 1.5W, although examiners saw all the other possible answers.

(d) Candidates gained two marks for correct ticks in all four rows of the table. One mark was awarded for three or two rows correct.

(e) Many candidates did not appreciate that appliances with plastic cases are double insulated.

Question 11

(a) This question needed candidates to appreciate that the glass, plastic and polythene rods can become charged. 'Two' was a common incorrect response.

(b) Good responses described that there is friction between Daisy's clothes and the car seat and that Daisy will become charged. Daisy will then get a shock when the charge flows to earth. Candidates who did not gain credit often gave answers in terms of the heat of the hot summer day causing Daisy and/or the car seat to become charged.

(c) Candidates needed to identify that paint sprayers **and** defibrillators use static electricity to gain the mark.

Question 12

This six-mark question was targeted up to grade C. At the simplest level, a candidate who made a relevant comment about the badge, appreciating that it monitors the radiation, gained Level 1 (one – two marks). To gain Level 2 (three – four marks) candidates needed to either explain why Edward needs to wear a radiation badge (in terms of the damage that nuclear radiation can cause) or explain how the badge works. As in other six-mark questions on the paper, candidates had to address all aspects of the question to gain credit at Level 3 (five – six marks). Many candidates did not gain credit at Level 3 as they did not refer to why Edward needs to wear a badge **and** how the badge works. It is worth centres stressing to candidates that they must address all aspects of the question to gain full marks.

Question 13

(a) Good responses to this question identified isotope D because gamma radiation penetrates the skin or can be detected outside the body and has a short half-life so won't be in the body for long to damage cells. Candidates who failed to gain credit often gave answers in terms of radioactive isotopes used to treat cancer, rather than tracers.

(b) The fission and fusion models were not well understood by candidates. Answers in terms of splitting the **atom** or joining two **atoms** were common and did not gain credit.

(c) Good responses described rocks as a source of background radiation, with the level varying because different or more rock is found in different places. Mobile phones as a source of background radiation was a common misconception.

Question 14

(a) Good responses in part (i) appreciated that spider silk is strong so would stop bullets and has a low density so that the jacket is lightweight to wear. One mark was awarded if candidates identified strong and lightweight as properties of spider silk without explaining the advantages of these properties. Many candidates still use the word 'light' instead of low density or lightweight and did not gain credit. In part (ii) good responses calculated that graphene is 10 times (or 4500 MPa) stronger than steel. One mark was awarded to candidates who realised that graphene was stronger, without the calculation. When candidates did not gain credit they usually simply stated that the difference in the strength was 4500 MPa.

(b) In part (i) most candidates calculated correctly that indium will run out in nine years. 95% was usually correctly calculated in part (ii). Good responses in part (iii) gave four reasons why the discovery of graphene is important. Candidates who failed to gain full credit usually did not make four different points in their answer.

B722/02 Additional Science B modules B4, C4, P4 (Higher Tier)

General Comments

Entry numbers have continued to increase on this higher tier paper and there was a small number of candidates who were clearly entered for the wrong tier and would have been more suited to a foundation tier entry. Candidates on the whole attempted all questions and there was no evidence that they had insufficient time.

Numeracy skills appear to be improving but candidates are still not rounding some of their answers correctly. The main difficulties on this paper were seen in the chemistry questions involving bonding. There is still much confusion in candidates' minds between metallic, ionic, covalent and intermolecular forces.

Candidates are also losing marks through imprecise terminology. This could be seen in their definitions of half-life and of saprophytic nutrition along with references to voltage flowing and the difference between density and weight.

Comments on Individual Questions

Question No.

Q1(a) This was a well-answered question to start the paper. The majority of candidates could complete the balanced equation.

(b) Many candidates referred correctly to the effect of temperature on enzyme action but there are still some that stated that they are denatured by the low temperatures. Far fewer could explain the effects of high salt concentration on the bacteria.

Q2(a) The route of water movement was described correctly in many answers but only a small number could identify the driving force behind the movement.

(b) About half the candidates described correctly the function of the water in preventing evaporation.

(c) Whilst more than half of the candidates identified the correct graph, far fewer could explain the results in terms of closing stomata. Common mistakes included the stomata being open at night and closed during the day. There was also confusion with candidates stating that the guard cells closed rather than the stomata.

Q3 The best answers here stated the precise role of the minerals in fertilisers and realised that with increased use, more crops could be grown on less land.

Weaker candidates simply referred to nutrients improving growth or simply described one of the patterns in the graphs.

Q4(a) Although this question has been asked in the past, very few candidates could give a good description of how saprophytes feed.

(b)(i) For a higher tier paper, a surprisingly high number of candidates could not calculate the percentage decrease correctly.

(ii) Even though many candidates could state the correct bag, there was considerable confusion between the role of decomposers and detritivores. Many candidates thought that the earthworms decayed the leaves or implied this by saying that they break down leaves.

(iii) Answers here were often too vague, without references to enzymes, reproduction rate or the respiration of decomposers.

(b) This was also well-answered, with references to lubrication and the digestive action of saliva both commonly featuring in answers

Q5 The four objective questions in question 5 tended to score equally across the cohort with slightly less than half the candidates answering correctly on each one.

Q6 Candidates found this question particularly challenging. Many managed to give a description of a functional flame test but found the test results very difficult to interpret. In many cases they had not seemed to have learnt these tests.

Q7(a) The majority of candidates could correctly calculate the percentages.

(b) Better answers here referred to the fact that area C was using most of the water that was available, rather than just the highest amount of water used.

Q8(a) There are still many candidates that are referring to covalent or intermolecular bonds when trying to describe metallic bonding. There were some good, labelled diagrams but even then some were contradicted in prose.

(b) Most candidates could correctly identify the free electrons as the reason for conductivity. However, the explanation for the high melting point were hampered by the same inaccuracies that were seen in part (a).

9(a) This question was well-answered with references to improvements in technology and in understanding. A number of candidates gave irrelevant answers referring to the discovery of new elements.

(b) This question differentiated well with the most-able candidates being able to give reasoned explanations for their answers.

10 This question proved to be the most challenging on the paper.

(a) Very few candidates gave the correct answer of six, with four being the most common error. It seemed that the majority of candidates only counted the atoms in one plane.

(b)(i) Few candidates correctly referred to the strength of ionic bonds and again there were many incorrect references to covalent and intermolecular bonding.

(ii) This question was beyond most of the candidates and there were very few correct references to the charges on the ions.

Q11(a) The majority of candidates could correctly use Ohm's Law to calculate the resistance.

(b) One mark from two was the most common score here.

Q12(a) Some candidates could define half-life but there were many vague statements such as nuclei disappearing.

(b) Candidates seemed to find this calculation more difficult than working out the half-life from a graph. Some halved 3200 several times but could not then convert this to a half-life.

(c) Again a lack of precision in their answers cost some candidates, with references to seeing if it would penetrate the body, presumably referring to the isotope rather than the radiation emitted.

Q13(a) The majority of candidates identified correctly the error in the wiring of kettle two but the exact function of the fuse was not well understood or described.

(b) Most candidates could calculate the power correctly but the rounding of the answer was incorrect in a number of cases. Some candidates multiplied the voltage by the power and obtained a very high current that had to be carried by a 13A fuse!

Q14(a) There did seem to be less reference to positive electrons than has been evident in the past but some candidates did lose marks by referring to the ball gaining positive charges rather than a positive charge.

(b) The fact that wire is a conductor seemed to be assumed by most candidates and so was not mentioned. Vague references to electricity flowing into the ground were not credited.

Q15(a) Some candidates drew or stated that more neutrons were released by the collision and others stated that the nucleus splits. Far fewer candidates could put these two ideas together.

(b) This question was answered well, with reference to boron or control rods.

Q16(a) There was the common confusion between density and weight in the answers here. A number of candidates also thought that touch screens should be as dense as possible to resist poking.

(b)(i) This question was designed to be challenging and did indeed prove so. Candidates found the standard form difficult to cope with and there were few correct answers.

(ii) This was a much more accessible calculation and was well-answered by most.

(iii) A number of candidates stated correctly that an indium screen could work as the resistance could be low enough but far fewer followed this up with the fact that the transparency would be quite low.

(c) Candidates did quite well at bringing together information from all parts of the question but again imprecision cost some, with references to graphene being light or confusion between graphite and graphene.

B723 Additional Science B Controlled Assessment

General Comments

Overall, centres are coping well with the controlled assessment process and some excellent work with good clear marking has been submitted.

Most centres submitted work that was well organised and easy to follow with all of the appropriate documents enclosed and clear annotations explaining why particular marks had been awarded. This aided the process of moderation and centres are thanked for the effort involved.

Some centres, however, are still submitting work with errors of various kinds:

- There has been a number of clerical errors where marks submitted to OCR differ from those on the work sent to the moderator. Centres are advised to double-check the marks on scripts before sending them to the moderator. In particular, if internal moderation has taken place and marks are changed, it needs to be clear which mark is being submitted.
- A significant number of centres has submitted the wrong task for the year. Tasks are only valid for one year and it is not permissible for centres to submit work either using tasks from previous years or from the next year. Any centres that used a task from next year are reminded that they will not be allowed to use this task again in the coming year.
- A number of centres also gave more support to their candidates than is acceptable. No form of writing frame, table grid or guidance notes, other than those provided as part of the task, is allowed to be given to the candidates. Use of such material can reduce the marks available to candidates, as their own work has not met the marking criteria.
- Centres are reminded that in signing the CCS160, centre authentication form, they are guaranteeing that the work submitted is each candidate's own unaided work.

Previous reports have given considerable guidance on the application of the marking criteria, how to avoid common errors and the requirements for the award of high marks. Centres are advised to consult the reports written in 2012, 2013 and 2014 in addition to the notes given below.

Comments on each Skill quality

Research: Work submitted was generally of a high standard. Candidates frequently demonstrated that they were aware of the need to produce a full bibliography with full URLs when referencing internet sites. Few candidates made use of resources other than those on the internet, but when a text book is referenced then page numbers should be given. The range of sources used was generally suitable and relevant to the tasks.

Some candidates put a lot of effort into an analysis of the sources commenting on their likely reliability and accuracy and giving reasons for their decisions. This is not a requirement of the marking criteria and candidates could be advised to use their time to better effect. The main issue for the award of high marks lies in the candidate’s ability to select relevant information from the sources. This needs to be specific to the bullet points in part one and to be scientifically correct. It is rarely possible to effectively fulfil this requirement by simply cutting and pasting from web sites as it usually means that irrelevant material is copied alongside relevant material.

Planning: Candidates generally tackled this effectively. The methods now often include a diagram that helps to explain the plan and detailed information that can easily be followed by someone else. The most common weakness in this skill quality is an insufficient consideration of how errors can be minimised. This is required at all marking points above two with the difference between three and six being in the depth and detail given by the candidates.

In all but the science specification, candidates need to produce a suitable hypothesis. This should be based on the information given in part two. Candidates make it more difficult for themselves when they choose to investigate something that is not really what the task was asking for. For higher marks candidates need to provide a detailed scientific justification for their hypothesis.

Candidates should indicate clearly any changes they might have made to their plan. For example, candidates need to select a suitable number and range of data points as part of their plan. If the number in the plan differs from the number used in the actual experiment then an explanation of the change should be given.

Collecting: This was one of the highest scoring of the skill qualities. Candidates generally produced clear tables with full headings and units and quoted data to an appropriate and consistent number of decimal places in line with the equipment they had chosen. Some centres penalised candidates for inconsistency or errors in processed data such as averages. Marking in this skill quality needs only be applied to raw data. Some centres over-marked by giving high marks when all of the raw data had not been recorded and processed data was shown instead. For example, initial and final temperatures should be recorded and not just temperature change.

Candidates are not allowed templates to use in these tasks. If candidates have been given a table to complete then it is unlikely that they would be able to get many, if any, marks for this Skill quality.

Managing Risk: This was also a high scoring skill quality but some centres are still being too generous. The following comment was made on last year's report and bears repeating, as some centres are still failing to take it into account when giving high marks.

The criteria for 5/6 marks state 'All **significant** risks in the plan **evaluated**'. The risk of having a heart attack whilst squeezing a clothes peg is not significant. Too many times candidates invent spurious risks. 'Evaluated' means that the candidate needs to appreciate and state whether it is a low risk or a serious risk.

The criteria also state '**Reasoned** judgements made to reduce risks by **appropriate specific** responses'. The highlighted words speak for themselves.

Processing data: Graphs were well drawn by most candidates. However, some centres are still giving high marks when candidates have inappropriate scales on one or more axes. A graph does not need to have the point (0,0) on the scale in all cases. As a general rule the data points should cover at least half of the available space.

Some of the tasks have been designed with the opportunity for more able candidates to use more complex mathematical techniques that are relevant to the task; for example, calculating an energy change. However, candidates do not need to carry out an additional complex mathematical technique in order to get high marks if there is not a process that is relevant and adds to the understanding of the task. For example, calculating a gradient may be irrelevant and provide no additional useful information, particularly when candidates do not understand what the gradient shows.

Without some form of processing of uncertainty then full marks are not available in this Skill quality. Range bars are generally the most accessible method for candidates to use.

Analysing & Interpreting: There were some tasks this year in which candidates failed to obtain data that supported their hypothesis or the hypothesis given. For example, in those who undertook the portable stoves experiment, some candidates failed to control the amount of fuel used in each experiment, by either burning a fixed mass of fuel or calculating a temperature change per gram, and obtained data which showed no real trend at all. Candidates should not try to force their hypothesis on to the data. There were some candidates who were given high marks for stating that a trend was supported when only two out of four data points followed this trend. They may then have commented that the other two data points were anomalies. This is not good science and is not worthy of high marks. Candidates may obtain high marks by pointing out that the data does not show a clear trend, comparing this to data from secondary sources and making appropriate comments to explain the differences.

Evaluating: Although often marked well by the centres this continues to be a Skill quality that candidates find difficult. This is partly because candidates need more space to answer question 4 of part 3 than is available on the standard version. Centres may provide candidates with a reworked version of part 3 with more space available for answers if they choose to, as long as the wording is identical to that provided in part 3. This can be easier for candidates than using additional paper.

Question 4 of the task requires candidates to evaluate their method, their data and to make comments about risk. Many candidates fill the space available but focus primarily on just one of these issues and consequently can only score low marks.

To obtain high marks candidates need to make a “detailed and critical consideration” of the data. This is rarely seen. Although range bars are often included as part of processing, many candidates do not understand the significance of them and how they relate to the quality of the data. Where data is of poor quality, candidates need to try to link this to their method and explain why their plan gave rise to data that did not match their expectations or where there were a number of anomalies. Suggestions for improvement should ideally be derived from this rather than chosen almost at random.

Comments about risk do not contribute significantly to the mark for analysis but can be used to further support the mark awarded in the risk Skill quality.

Conclusion: As with analysis and evaluating, the conclusion should be based on the actual data obtained. In most cases candidates are justified in saying the data supports the hypothesis but in some cases this is not the case and candidates should say so and go on to explain why.

There is also the requirement in this skill quality for candidates to link their research clearly to their own experiment and to appropriate scientific knowledge and understanding. Question 6 of part 3 provides an opportunity for this but it is to be remembered that evidence for any of the marking criteria can be obtained from any part of the candidates’ work. Annotation helps considerably if marks awarded are related to work from elsewhere in the task.

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