GCSE

Additional Science B

Gateway Science Suite

General Certificate of Secondary Education **J262**

OCR Report to Centres

June 2013

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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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General Certificate of Secondary Education

Gateway Additional Science B (J262)

OCR REPORT TO CENTRES

Overview

This session presented the first opportunity for candidates to certificate for this specification. Of the approximately 40 000 candidates entered for B722, the ratio between higher and foundation entries was about 2:1. B721 was again offered at foundation and higher tier and attracted a much smaller number of entries, many of whom were resitting following January 2013 or June 2012 attempts. The controlled assessment unit B723 was also taken for the first time this year. Centres and candidates seemed to have learnt from their experiences on the science controlled assessment and performed well on this new unit, despite the additional need to construct a hypothesis.

Answers to the extended writing questions have improved, as candidates have gained experience on these. However, there are still many cases where candidates are not addressing the whole of the six mark question. It is also worth noting that candidates can use space on the same page to complete their answers, as long as they do not write outside the margins (additional sheets of paper are not always required). On B722, candidates experienced section D questions for the first time. These questions involve data analysis, including both graphical and numerical questions. The questions on this section were answered well and made a positive contribution to most candidates' performance. It was often the recall questions that candidates found most difficult and this was most evident on the questions concerning the contribution of scientists to the development of the periodic table and the role of detritivores in recycling minerals.

On a positive note, more care is continuing to be shown in the writing of chemical equations using symbols.

B721/01 Modules B3, C3, P3 (Foundation Tier)

General Comments

The level of difficulty of the paper appeared to be appropriate for the ability range of the candidates, producing a good distribution of marks. The approach to two mark questions seemed to have improved slightly since last June with more candidates attempting to give more than one idea to a two or three mark question Candidates appeared to have had sufficient time to complete the paper, with the majority attempting most of the questions.

The quality of candidates' spelling, punctuation and grammar was good however there were a few cases where deciphering a candidate's writing posed a serious difficulty.

The majority of candidates had attempted all three levels of response questions. There was some evidence that candidates had been well prepared for the new style of questions. Responses at all three levels were seen, however candidates tended to score better in section A Q3a. This was mainly due to the level of response questions in sections B and C both being common to the higher tier paper.
Candidates found the questions that required some mathematical skills difficult. Few candidates could draw a smooth curve and only the more able candidates were able to correctly calculate speed and work done.

Comments on Individual Questions:

1(a) This was generally well answered by the majority of candidates. Most gained at least 2 marks for this question. Cytoplasm tended to be an incorrect answer for nucleus and some candidates gave protein as the coded information.

1(b) Less than half the candidates gained marks for this question. The most common correct answer seen was double helix. Many candidates tried to draw the structure but very few actually labelled it, or if they did most labelled it incorrectly.

1(c) Most candidates gained the mark; some however doubled the number to give the incorrect answer of 148 or they went with the human chromosome number of 23.

2(a) The majority of candidates gained both marks.

2(b) Candidates tended to gain a mark in part (i) for the idea of more food being available. However part (ii) was not answered very well. Many candidates made vague comments such as 'it is unnatural' or they referred to people not liking the taste. Candidates often incorrectly referred to diseases or reductions in variation showing they had confused genetic engineering with selective breeding.

3(a) The majority of candidates were able to describe the complete pattern shown in the graph and therefore were awarded level 2. Very few candidates managed to successfully explain the graph in terms of muscle activity and oxygen transport. Some candidates were confused by the graph and described the pattern in terms of the speed that Peter was running and not his heart rate.

3(b) **(i)** Many candidates failed to understand that the intensity or type of the exercise would need to be kept constant.

3(b) **(ii)** The majority of candidates failed to understand the term evaluate. Instead they just described the pattern in the results. Of those that referred to the conclusion many agreed that Peter was correct but then contradicted themselves by describing a pattern that did not fit his conclusion.

4(a) The majority of candidates gained at least one mark, normally for describing plant A as growing more or faster. Candidates that mentioned enzymes often showed that they did not understand that enzymes work at optimum temperatures. Many incorrectly thought there would be more enzymes in warmer temperatures.

4(b) Many candidates misunderstood the term 'extend' and described alternative investigations. However many candidates gained one mark for the idea of increasing the range of temperatures.

5(a) The majority of candidates could identify the correct loss in mass.

5(b) Many candidates found it difficult to explain the idea of a limiting reactant. Many thought it was a reactant that had a limit or that it would stop reacting after a while. Few understood it would be used up completely during the reaction.

5(c) **(i)** The majority of candidates could accurately plot the points although many forgot to plot a point at 0,0. However many candidates found it difficult to draw a curve though most of the points. Sketched lines and thick lines were common.

5(c) **(ii)** Very few candidates correctly identified the marble chips as being larger and even less were able to explain their answer in terms of reaction rate being slower. Many referred to mass incorrectly believing that more or less mass had been used or collected.

5(d) A large proportion of candidates failed to answer in terms of collisions, many simply stated the reaction would be faster without explain why. Of those candidates that achieved level 2 most talked about particles moving faster at higher temperatures or they mentioned more collisions. Very few candidates successfully explained concentration in terms of more crowded particles. Those that mentioned particles tended to just say there were more. Other common misconceptions included the idea that the `reaction would be faster as the acid is stronger when it is more concentrated` and increasing the temperature `melted the particles or marble chips` or `increased their rate of dissolving`.

6(a) Few candidates were able to identify the spirit burner. Many candidates called it a Bunsen burner, glass jar or even a beaker.

6(b) The majority of candidates gained one mark for the idea that less fuel was burned but few realised that all the temperature rises were the same. Many candidates thought the temperature rise would be adequate for heating the shed, showing a lack of understanding of investigation.

6(c) Less than half of the candidates could explain the idea of an exothermic reaction. Many incorrectly thought it was dangerous or gave out a gas.

6(d) The majority of candidates gave the correct answer to this question. Some candidates incorrectly thought they had to provide the atomic number of the elements.

7(a) Few candidates could explain atom economy, many thought it would improve the effectiveness of the drug.

7(b) Most candidates correctly identified method B however a number of them lost the second mark for not making a comparison. These candidates tended to refer to either high atom economy or high percentage yield instead of stating that both were higher.

7(c) **(i)** The majority of candidates gained at least one mark and a large proportion gained both marks for this question. Some candidates lost the second mark as they identified the cost of materials which had been given in the stem.

7(c) (ii) Candidates tended to give a correct answer to this question.

7(d) Most candidates gave the safety idea as their answer to gain one mark, only the more able candidates gave the second idea of making sure the painkiller works.

8(a) The majority of candidates were able to correctly interpret the graph.

8(b) (i) Few candidates were able to correctly calculate speed to gain both marks. However many candidates showed they understood how to calculate speed but were unable to make the conversion from kilometres to meters.

8(b) (ii) The majority of candidates gained one mark, mostly for the idea of changing speed, however few went on to provide a creditworthy second idea.

9(a) Most candidates gained at least one mark, normally for the idea of reducing injury. Many candidates attempted to explain some fundamental ideas but referred to the bag slowing down the forward motion rather than making reference to the increased time taken. The correct calculations for change in momentum were not seen at this level.

9(b) The majority of candidates gained one mark mostly for the idea of seatbelts causing injury, a second mark was often awarded for the idea of becoming trapped.

10(a) (i) The majority of candidates gained marks for this question however most of those only gained one mark as they used the length of the escalator and not the vertical distance in their calculation. A few candidates used both of these distances as part of their calculation.

10(a) (ii) Very few correct answers were seen for this question. Some candidates gave the answers the wrong way round and others clearly had little understanding of these forms of energy. Many candidates incorrectly referred to `height or weight`.

10(b) About half the candidates correctly identified that twice as much work was done.

11(a) The majority of candidates were unable to correctly describe and explain the forces acting on the ball. Many answered in terms of energy or speed. Of those that mentioned gravity many neglected to mention the direction in which gravity pulled the ball. Very few understood the idea of balanced forces instead they referred to terminal velocity.

11(b) Many candidates incorrectly thought there was no gravity on the Moon or that object have no weight on the Moon. Only a small proportion of candidates gained both marks.

B721/02 Modules B3, C3, P3 (Higher Tier)

General Comments

Many candidates had been well prepared for this new style paper, having learned from the experiences of B721/02 in June 2012 and January 2013. About 900 of candidates from the entry of almost 8800 would have been better served by entry to the foundation tier having scored less than 15 marks. Most candidates attempted all the 6 mark questions with varying degrees of success. These questions are marked using a level of response mark scheme using the concept of 'best fit'. The biology question on the effect of exercise on pulse rate was targeted at grades up to grade A. The chemistry question concerned with rates of reaction was targeted at grades C and D. The physics question which concerned how airbags protect car drivers when they are involved in a crash was targeted at all grades up to A*. General messages from the 6 mark questions continue to include candidates needing to address **all** aspects of the question in their answer in order to access level 3. Candidates should understand that if they require more space to answer these questions, they may use any blank space left on that page before asking for extra paper.

Candidates continue to perform well in straightforward calculations. Calculations involving more than one step or where a change of unit is required, e.g. kilometres to metres, were less well answered. The writing of the chemical equation in question 6(c) was generally well answered.

Overall, assistant examiners and team leaders felt that the question paper, although challenging, was appropriate to the ability range of candidates intended. There was little evidence of lack of time.

37 marks were required to gain grade A and 19 for grade C.

Comments on Individual Questions

Section A

1(a) This question was correctly answered by over two thirds of candidates. Common incorrect answers were 148 and 37.

1(b) Most candidates could recall that DNA is a double helix with cross links of bases and scored 2 marks.

1(c) This question was targeted up to A*. Only the best candidates scored marks, understanding base sequences coding for amino acids, triplet codes and that base sequence will be different for the different proteins. Most candidates referred to the functions of the two proteins in the body and failed to score.

2(a) This question was very poorly answered even by good candidates. Most candidates confused genetic modification with cloning and talked about extracting the nucleus from a resistant plant and implanting it in another cell, which failed to score. Extracting the resistant gene was rarely seen. Inserting the resistant gene into the DNA of a soya bean even less so.

2(b) The most commonly awarded mark was for quoting religious, moral or ethical reasons. Many candidates talked about genetically modified soya bean plants being 'unnatural', 'organic', not tasting nice' or the 'idea of playing God'. None of these responses was sufficient to score.

3(a) About a quarter of candidates performed this calculation correctly. Candidates who were unsure did not use the answer given for plant **A** to see how the calculation should be done. A common incorrect answer was 71.4%. This was presumably arrived at by dividing 4.5 by 6.3 and multiplying by 100. Another incorrect answer was 28.6% obtained by correctly working out the difference in height (1.8cm) but then dividing by 6.3 rather than 4.5.

3(b) Most candidates scored at least 1 mark on this question with many scoring 2 or 3 marks. Most candidates could state that the rate of growth of plant **A** was greater. Many linked the increased growth to enzymes working better in warm conditions. Fewer gained the third mark linking enzyme action with photosynthesis or mitosis.

4(a) The question asked candidates to explain the pattern on the graph between 4 and 20 minutes. Many candidates merely stated that the pulse rate slowed down because Peter had stopped exercising. This restricted them to level 1. Better candidates talked about oxygen debt, anaerobic respiration or build up of lactic acid during exercise scoring level 2. Only the best candidates gave a detailed explanation in terms of oxygen required to break down lactic acid, lactic acid taken to the liver or that pulse rate decreases gradually because lactic acid is broken down gradually, which was required for level 3. The question differentiated well.

4(b) Just over a third of candidates scored on this question. Most scored 1 mark for recognising that the recovery time levelled off at 14 minutes. Very few attempted to explain this in terms of maximum oxygen debt reached.

4(c) Although a significant number of candidates scored 1 mark on this question, few scored 2 marks. The most common correct answers mentioned lower flow rate or that the blood was under less pressure. Common misconceptions were that oxygenated and deoxygenated blood were mixed or that blood could only flow one way.

Section B

5(a) Most candidates could read 200 seconds off the graph and scored the mark.

5(b) Only better candidates understood that the limiting reactant is used up first or is not in excess. There were vague references to 'the reactant that doesn't last long' which failed to score.

5(c) Just over half of candidates scored on this question. Those that scored only 1 mark usually drew the line with a less steep slope. Many candidates then failed to level the line off at 0.47g and lost the second mark. Many lines were drawn carelessly, losing marks. For example lines which just exceeded 0.47g lost the second mark.

5(d) This question discriminated well. Most candidates scored level 2 or 3. Candidates needed to refer to collisions in their answer. A number talked about more reactions which was insufficient. Candidates that could explain one of the factors fully or both partially scored level 2. Complete explanations for both factors scored level 3. The effect of temperature was better answered than the effect of concentration, with candidates frequently referring to the increased energy of the particles at higher temperatures leading to more collisions. Although not required at this level (grade C), significant numbers of candidates referred to increased collision frequency or more successful collisions. The most common reason for loss of marks was to state just 'more particles' when referring to increased concentration rather than more crowded particles or particles closer together.

6(a) About a third of candidates correctly calculated the mass of water in this question. The most common incorrect answer was 50.4g. This was invariably arrived at by multiplying 0.6 (mass of fuel **C**) by 4.2 (specific heat capacity) and by 20 (temperature change). These candidates did not understand the need to rearrange the equation and use the value of 4200J as the energy transferred when 0.6g of fuel **C** burns.

6(b) This question was targeted up to A* and was poorly answered with few candidates able to describe the energy changes involved in making and breaking bonds. Where 1 mark was scored, it was usually the catch mark for recognising that exothermic reactions transfer heat to the surroundings.

6(c) Better candidates scored both marks on this question and balanced the equation successfully. Weaker candidates often scored 1 mark for placing the correct formulae in an equation. There were numerous examples of failed attempts to balance the equation which scored 1 mark because the formulae were correct. The presence of an oxygen atom in ethanol was overlooked by a number of candidates.

7(a) Few candidates could perform this calculation correctly. Atom economy is generally not well understood by candidates. Many of those who did understand the concept did not add the relative formula masses correctly, by failing to note that it required 2NaCl when calculating the total relative formula masses of the products.

7(b) By contrast this calculation was performed well by most candidates. A minority inverted the numbers or failed to multiply by 100 and thus failed to score.

7(c) Answers to this question were characterised by vagueness. Most candidates grouped atom economy and percentage yield together thus restricting themselves to 1 mark, and made vague references to 'less waste'. The best answers were from candidates who treated the two ideas separately and understood the difference between them.

7(d) This question was well answered. Most candidates could interpret the data provided and state that the type of vaccine can be easily changed and also the quantity made thus gaining 2 marks.

Section C

8(a) Most incorrect answers were **A** and **D** or **A** and **C**. Most candidates did not appreciate that it was non-linear areas of the line that were required.

8(b) About half of candidates scored on this question. The need to change kilometres to metres and minutes to seconds proved a step too far for most candidates. These candidates usually gained 1 mark. They used the correct equation but inserted the incorrect numbers usually getting an answer of 0.5m/s.

8(c) **(i)** Only better candidates could calculate the relative velocity as 5m/s. Many candidates took the average of the two speeds or simply added them together.

8(c) **(ii)** Those candidates who scored the mark in part (i) usually scored the first mark for stating that relative velocity is the difference between the two speeds. Few gained the second mark for stating that both cars were travelling in the same direction.

9(a) Most candidates scored level 1 on this question. The majority of candidates did not attempt to use calculations in their answer thereby restricting themselves to a maximum of level 2. Most candidates used the data to state that the time to stop was greater with an airbag. There were many incorrect references e.g. 'it slows down the time for impact' which were not creditworthy. There was confusion between the terms force and energy, which some candidates used interchangeably. The most common points made were that the collision lasted longer and less injury was caused. A few candidates discussed the reduction in force or the airbag absorbing energy. A few candidates calculated decelerations thinking that they were forces.

9(b) Most candidates scored at least 1 mark on this question with many scoring 2 marks. Weaker candidates stated that the government has shown or told people about the wearing of seatbelts without stating how this was done. The use of adverts and that wearing seatbelts is a legal requirement, were popular correct answers. A small minority of candidates misunderstood the question and gave a description of how seatbelts work.

10(a) This question was poorly answered by all but the best candidates. Most did not understand the need to calculate the work done and then divide by the time taken. Those that did often used the incorrect value for the distance travelled or did not include the weight of Miranda's shopping and gained 1 mark only.

10(b) The best candidates recalculated the power, stated it had halved because the time had doubled or the speed was halved and scored 2 marks. Others just said that the power decreased because it took longer, scoring 1 mark. A number of candidates stated that the power had increased or stayed the same and did not score.

11(a) Candidates found this question challenging. Most of the problems were due to a lack of understanding of the term 'fuel consumption' as used in the table. Many could not interpret the unit of fuel consumption correctly. Many candidates thought they were answering the question and then had to try and find a link to the amount of emissions given out. However many were able to rescue some marks by reference to different driving styles or differing road conditions. Many candidates thought that Tanya was driving faster than Sarah whereas the reverse is true.

11(b) (i) This question was well answered with most stating 'tiredness', 'lack of concentration' or 'drinking alcohol' as correct answers. A small minority calculated the differences and did not score.

11(b) (ii) This was less well done than part (i). Many candidates did not score through a lack of precision e.g. stating weather conditions without specifying what the weather conditions were. Wet or icy roads were common correct answers.

B722/01 Modules B4, C4, P4 (Foundation Tier)

General Comments

This was the first sitting for candidates in this new specification. The paper differentiated well and performance across the three sections of the paper appeared to be fairly consistent, allowing candidates to demonstrate their knowledge and understanding across Modules B4, C4 and P4.

The longer 6 mark questions, which were marked using a level of response approach, were generally well answered, with the exception of question 4(d). A significant proportion of candidates did not attempt this question and most candidates appeared not to have covered this aspect of the How Science Works / Chemistry content of the specification.

Section D, which assessed Assessment Objective 3 (analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence) was well answered with candidates applying their skills to interpret the data in the questions that were set.

Candidates performed well in calculations and many candidates took care when writing chemical formulae correctly (using the correct case and subscripts).

Candidates used their knowledge and skills appropriately to respond to the questions on counting methods in ecology/interpretation of data, elements in the Periodic Table and electrostatic charge.

Candidates did not seem to have the knowledge required to respond to questions about detritivores, distinguishing between claims/opinions and scientific evidence, development of the Periodic Table, features of longitudinal waves and nuclear 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

Section A - Module B4

1 This question tested ideas about ecology in the local environment.

1(a) In part (i) most candidates were able to suggest a reason why pitfall traps are the best way of catching ground beetles, usually suggesting that the beetles would not be able to escape or that pitfall traps catch animals that live on the ground. When candidates did not gain credit, it was usually because they gave answers in terms of the speed of the beetles. Good responses to part (ii) described the idea of a container in a hole in the ground with the second mark scored for covering the trap of putting bait in the trap. Candidates who simply described digging a hole in the ground scored a maximum of one mark.

1(b) Most candidates correctly calculated the population sizes in part (i). Good responses in part (ii) described the beetles being better hidden from their predators, and having more food because there was more prey, in the overgrown area. When candidates failed to gain credit it was usually because they gave vague answers in terms of more food for beetles, but not linking this to prey.

1(c) Good responses to this question described the fact that earthworms increase the rate of decay of dead vegetation, which provides minerals or nutrients for plant growth. Most candidates simply described the earthworms ‘eating’ the dead vegetation and did not gain credit.

2 This question was about investigating photosynthesis of pondweed.

2(a) Good responses to part (i) used the data to describe the relationship between distance, light and rate of photosynthesis. In part (ii) candidates needed to appreciate that using a measuring cylinder or gas syringe would lead to more accurate results.

2(b) Osmosis/diffusion in part (i) was not well known. Good responses to part (ii) described plant cells needing water for photosynthesis and support (or to stay turgid). Candidates who failed to gain credit usually gave vague answers such as ‘to stay alive’.

3 This question focused on how growth of plants can be maximized and ideas about how science works.

3(a) This 6 mark question was targeted up to grade E and discriminated well. Many candidates were able to describe suggestions to maximize growth, or one suggestion to maximize growth with an appropriate explanation, and gained credit at Level 2 (3-4 marks). To gain credit at Level 3 (5-6 marks) candidates needed to describe and explain suggestions to maximize growth. When candidates did not gain credit it was often because they discussed providing the lettuces with plenty of water and light, both of which were mentioned in the stem of the question.

3(b) This question assessed the ‘How Science Works’ aspect of the specification and required candidates to distinguishing between claims/opinions and scientific evidence. Good responses showed an understanding that Tom’s views were not scientific because he is only expressing an opinion and you cannot quantify taste.

Section B - Module C4

4 The question was about elements in the Periodic Table.

4(a) **(i)** Chlorine was a common misconception.

(ii) Fewer candidates now confuse groups and periods in the Periodic Table and most correctly identified chlorine **and** iodine or oxygen **and** sulfur.

(iii) Magnesium was usually correct.

4(b) Most candidates, even those who had correctly answered (a)(ii), suggested that sulfur was in period 6. Candidates who correctly identified sulfur as in period 3 were not always able to explain their answer in terms of electron shells.

4(c) Although candidates were told in the question that the product of the reaction between sodium and iodine is sodium iodide, many gave ‘sodium iodine’ as the product of the reaction.

4(d) As mentioned in the general comments, a significant proportion of candidates did not attempt this question and most candidates appeared not to have covered this aspect of the How Science Works / Chemistry content of the specification. Many candidates simply restated the information given in the question, i.e. Dobereiner noticed triads and Newlands developed the law of octaves, and failed to gain credit.

5 This question was about atomic structure.

5(a) Electron and nucleus were usually correct.

5(b) Both incorrect responses were seen more frequently than the correct isotope.

6 This question focused on the reaction of alkali metals with water and required candidates to analyse evidence and draw conclusions based on evidence.

6(a) Good responses to this question analysed the experimental observations and used the observations to describe how they supported the conclusion. When candidates did not gain credit it was usually because they did support their answer with evidence, simply restating the order of reactivity given in the question.

6(b) This question required candidates to write a balanced symbol equation for the reaction of sodium with water. One mark was awarded for the correct reactants and products and 1 mark for the correct balancing. The balancing mark was dependent on the correct formulae, but 1 mark was allowed for a balanced equation with a minor error in subscripts or formulae. When candidates did not gain marks it was often because they tried to balance the equation by changing the formulae given, e.g. $NaOH_2$.

7 This question was about metals.

7(a) This question, which required candidates to evaluate evidence and draw conclusions, was well answered with most candidates explaining that metal A is used because it is cheaper and has the lowest density. Credit was not given for references to metal A being light.

7(b) Most candidates scored one mark for appreciating that the metal needed to be strong. Fewer candidates appreciated that the metal also needed to be flexible.

7(c) Most candidates correctly identified the elements in bornite.

Section C - Module P4

8 This question was about the electrostatic charge.

8(a) Positive and negative were usually correct in part (i). Most candidates scored two marks in part (ii) for the idea that the dust would be attracted to the brush.

8(b) Most candidates gained one mark for two or three correct statements in part (i). Uses of electrostatics in part (ii) were not well known.

9 This question focused on electricity.

9(a) Most candidates correctly calculated the resistance of the wire as 3 ohms.

9(b) Good responses to this question clearly linked the length and thickness of the wires to both the current and resistance. Candidates who did not gain full credit often repeated the reverse argument, e.g. the longer the wire the lower the current and the shorter the wire the higher the current. This kind of statement was only awarded one mark.

9(c) Many candidates correctly calculated the power of the lamp as 5.4W and then explained that this is approximately half, or not exactly half, the power of the wire.

10 This question focused on medical physics.

10(a) This 6 mark question was about radioactive tracers and was targeted up to grade C. At the simplest level, a candidate who correctly suggested isotope C/gamma as the best isotope to use scored Level 1 (1-2 marks). Credit was also given to candidates who did not select isotope C, but made a relevant reference to isotope A/alpha or isotope B/beta. To gain Level 2 (3-4 marks) candidates needed to justify their choice of isotope C with reference to the length of half-life or ability to penetrate out of the body. As in the other 6 mark questions on the paper, candidates had to address all aspects of the question to gain credit at Level 3 (5-6 marks). Many candidates did not justify their answer with reference to half-life **and** ability to penetrate out of the body so did not gain credit beyond Level 2.

10(b) Most candidates appreciated that the radiation dose received from the scan is less than the annual background radiation. Fewer candidates gained a second mark for the idea that the radiographer is a professional or that his friend was merely stating an opinion.

10(c) Many candidates could not identify a compression in part (i). Less than half of candidates correctly identified the wavelength as A in part (ii).

11 This question tested ideas about nuclear reactions.

11(a) Common misconceptions were W and Y.

11(b) Good responses to this question explained that diagram R shows the joining of two nuclei.

Section D

12(a) 360 was usually correct in part (i). In part (ii) many candidates appreciated that Bob's statement is not true because everyone is different. Fewer candidates explained that the value stated by the teacher is an average.

12(b) Most candidates suggested that ultrasound scans are safer, less painful or non-invasive. Candidates often described ultrasound as easier and quicker, but these responses did not gain credit.

12(c) Most candidates correctly used the scales to read off the surface area as $1.5m^2$ in part (i). Many candidates correctly used their answer from part (i) to calculate the cardiac index in part (ii). Error carried forward was allowed from an incorrect value in part (i). Good responses then determined whether their answer lay within the range 3.5 ± 0.5 and correctly explained whether Jenny's heart was healthy or not. Again, error carried forward was allowed from an incorrect calculation of cardiac index. Cardiac index being more accurate was a common misconception in part (iii).

12(d) Most candidates correctly interpreted the graph and stated that larger mammals have a lower heart rate and longer life expectancy.

B722/02 Modules B4, C4, P4 (Higher Tier)

General Comments:

This is the first sitting for unit 2 in this specification.
Candidates coped well with the data interpretation questions on section D of the paper and indeed this section often tended to raise the marks of candidates. Similarly on the rest of the paper, the answers to the graphical interpretation questions were good and the calculations were handled well. This was particularly the case in the half-life calculation in Q13 (a). However, many candidates seemed to lack the factual detail to answer a number of the questions, particularly on the biology section in Q1(b) and Q3 (c). The candidates also seemed to find the identification of the ions in Q6(a) difficult and the work of Newlands and Mendeleev was not well understood.

Comments on Individual Questions:

1(a) **(i)** This calculation was well answered.

1(a) **(ii)** Candidates who gained marks did so for recognising the increased or decreased chance of predation, depending on the colour referred to. A number of candidates correctly stated that Lily would be able to spot the white painted ones more easily. To score both marks candidates then needed to say what effect this would have on the estimate of population size.

1(b) Many candidates were able to score at level 1 for the idea of earthworms and woodlice feeding on dead or decaying matter, although some candidates thought that the detritivores were responsible for the decay themselves. In achieving levels 2, some candidates wrote about a mineral such as nitrates, but did not always link a named mineral/element to its function in a plant.
To score at level 3, candidates needed to write about increasing surface area for decomposition and give named minerals/elements with a function. This proved very difficult.

2(a) **(i)** Candidates scored well, recognising the link between distance/light intensity and the number of bubbles/oxygen produced. The best answers also gave the relationship of increasing light intensity to increasing photosynthesis.

2(a) **(ii)** Some candidates recognised that bubbles were different sizes and needed to be collected, but did not mention ‘volume’. The best answers gave an adequate practical measure for improving accuracy by measuring the volume of oxygen produced.

2(b) **(i)** This question was a test of candidates’ factual recall and proved to be a good discriminator.

2(b) **(ii)** Candidates often failed to score marks by tending to simply re-phrase the problem land plants have in obtaining water and how vulnerable they are in contrast to water plants. Better answers made reference to storing water and sometimes about support and wilting.

3(a) **(i)** Successful answers stated that a hydroponic set-up was a closed system so there was no chance of leakage into rivers, barring accidents. The main error here has simply to state that the fertilisers do not get into rivers without giving a reason.

3(a) **(ii)** This question required candidates to refer to increased knowledge or awareness. Answers stating that the level of pollution now is greater than in the past did not gain credit.

3(b) This question proved very challenging. In order to score any marks here the candidates needed to link the uptake of minerals to active transport.

3(c) Candidates often answered the question why or when stomata open, rather than how. The factual recall of the opening mechanism proved very challenging.

3(d) Candidates often scored marks by describing xylem as containing dead cells or hollow tubes. A number of answers stated the function of xylem, rather than the structure.

4(a) A well answered question.

4(b) Candidates were usually able to achieve 1 mark for at least one correct response. The relative mass of the proton was the most common incorrect answer.

5(a) The best responses simply stated the formula of calcium chloride rather than trying to give an answer involving charged ions or an equation.

5(b) The sodium ion was the most accurately written with the correct electronic structure and charge. Other candidates failed to score by showing donated electrons on both ions or drawing a covalent structure. Some candidates drew the electronic configuration of the original element atoms.

5(c) In good answers candidates wrote accurately about ionic bonds. Marks were lost by only referring to strong bonds or intermolecular bonds and discussing the movement of electrons.

6(a) The recall of the confirmatory tests for bromide and sulfate ions proved very challenging with many answers stating that both tests were correct or assigning the wrong test to the wrong ion.

6(b) This question was well answered with many correct equations given.

7(a) Answers contained a variety of descriptions, including different colours and solids or liquids.

7(b) Candidates generally made a fair attempt at the melting point by following the trend. Wrong answers almost invariably gave temperatures that were too high.

7(c) Generally well answered, though there were various inaccurate versions of bromide. Symbol equations were sometimes attempted.

8(a) The most common answer here was B, with the correct reason being a high electrical conductivity, for 1 mark. To score full marks, candidates needed to state A, with low density rather than light as the explanation.

8(b) Candidates needed to refer to the low temperature needed rather than saying that it was very expensive to make or that it was very dangerous.

9 The best answers here included references to the similarities between Newland's and Mendeleev's approach and the differences. The differences often included Newlands 'octaves' and Mendeleev's 'gaps'. The factual recall required in this question was found very challenging and there were many incorrect references to electron shells and protons.

10(a) Those candidates who knew the basics of electrostatic charges usually gained 3 marks. Incorrect answers often referred to negative or positive protons moving. Often the cloth and brush started off being charged before any rubbing.

(b) The first two gaps were often filled in correctly but the last gap proved most problematic.

11(a) The application of Ohm's Law was usually correct although some candidates used the length of the wire in their calculations.

11(b) Candidates could often pinpoint the relationship between length, thickness and resistance but some did not answer the question and described the effect on current instead of resistance. To gain full marks candidates needed to use comparative terms and also include a quantitative statement.

12(a) This question was well answered with candidates regularly achieving 4 marks for identifying gamma and describing the short half-life. The main confusion was the need to be penetrating to escape the body rather than the need to be able to penetrate into the body.

12(b) A correct assessment of the risk was given by most candidates but there were very few references to the professional knowledge of the radiographer rather than the advice of a friend.

12(c) This question proved very challenging. To score marks the candidates needed to comment on the separation of the particles rather than just referring to the pressure at points M and L.

13(a) (i) This challenging calculation was well answered by many candidates.

13(a) (ii) This calculation proved far more challenging than that in part (i). Candidates seemed to need more experience of working with standard form.

13(b) (i) Answers here were very varied, with various additions of the numbers on the left hand side of the equation.

13(b) (ii) It is important for candidates to state high temperature rather than just heat or temperature and similarly, high pressure.

14(a) This was well answered with safer being the most common creditworthy answer. Easier or quicker or gives instant results, were the most common wrong answers.

14(b) (i) Well answered.

14(b) (ii) The calculation was usually correct, (some with error carried forward from (i)). To obtain the second mark, candidates needed to read the information provided and describe any answer between 4.2 and 2.8 as healthy.

14(c) Well answered by most but 3000 was an occasional incorrect answer (5 x 600).

14(d) (i) Some good data interpretation was seen here with many candidates identifying the two trends.

14(d) (ii) There were some good answers here, with medicine and health care the usual reason for longer life expectancy. Some candidates just stated that humans had evolved to have a longer life expectancy.

B723 Controlled Assessment

This was the first full year of assessment for Controlled Assessment. The number of centres entering candidates for the separate sciences was higher than in previous years following the national trend. Many centres had entries for all five specifications and these were, as far as possible, dealt with by the same moderator.
Most centres followed the procedures for carrying out assessment, submission of samples and application of marking criteria with little problem but there were, as always, exceptions. Problems faced by some centres are described below and centres should take care to avoid them when entering candidates next year.

Carrying out the assessment:

The word 'Control' in Controlled Assessment refers to control of the candidates to ensure that the work completed is the candidate's own. Some centres gave candidates far too much guidance as to how plan, execute and write about the task. Centres should ensure that all of the work, not just the 'high control' part 3, is the candidate's unaided work.
For the same reason, writing frames are not permitted. This includes generic ones which do not refer directly to the task.
Candidates can work together in groups of no more than three but the plan produced by any candidate must be their own work not a copy of that of other members of the group. Plans within a group will, of course, be similar but examples were seen by moderators of plans which were identical. The same principle applies to tables of data and graphs.
Controlled Assessment tasks can only be used in the year printed on the front cover. They can be completed at any time but can only be submitted in that year. A 2012 task done in 2012 cannot be submitted in 2013 neither can a 2014 task done a year early. If a task is completed but not submitted in the appropriate year it cannot be used.
Some centres submitted tasks from 2012 and 2014 and some centres submitted a mixture of different years. Such mistakes are not without penalty.

Submission of samples:

Many centres organised their samples of work very well whereas others adopted a rather more random arrangement which varied according to which teaching group the candidate was in. It is helpful to moderators if the work is arranged in order with the front page of the part 3 booklet at the front.
This page is what the moderator needs to look at first as it contains all of the essential information; year, specification, task name, candidate name, centre number, candidate number and the marks for each Skill quality. It is disappointing when this page is incomplete. In too many cases centre number and/or candidate number were missing. Sometimes the marks were not completed or were wrongly totalled.
Centres are asked to ensure next year that in the sample sent for moderation this sheet is at the front of the candidates' work and is correctly and completely filled in.

Application of the marking criteria:

This is dealt with in detail below under the heading of the individual Skill qualities but a few general points follow:
The 'Additional guidance' given below the criteria in the Teacher Guidance for each task, should not be used as a mark scheme.
No other mark scheme, whether from the internet or generated by the centre should be used. The only valid mark scheme is the marking criteria provided by OCR.
There have been issues in some centres this year where candidates were disadvantaged by centres using mark schemes other than the official marking criteria.

Guidance follows on how to apply the Criteria when marking a candidate's work.

Researching:

It is the notes which the candidate makes on their original research which are assessed. The original research may not be the candidate's work as it may have been done at home or in a group. The original research need not and, indeed, should not be included in the sample nor may it be taken, by the candidate into the final (part 3) session.
To gain higher marks candidates must 'select' 'appropriate' information/sources. The only acceptable way to demonstrate this is to ensure that the information presented in the notes is relevant to the bullet points in Stimulus 2 and covers them thoroughly. In addition, there should be a reference in the text of the notes to show the information sources.
Moderators frequently saw the work of candidates who had wrongly been given high marks for extensive notes (often copied straight from sources) which were not focussed on or entirely pertinent to the questions posed in the Stimulus sheet.

Planning:

Take care when deciding if a plan is repeatable. As a science teacher you will know what the candidate intends but to score 4 or more the plan should have sufficient detail for it to be carried out by a non-scientist. This includes how apparatus should be set up, a range of values to be investigated and the number of replicates. For the higher marks a more detailed treatment of variables, ensuring accuracy and avoidance of errors is needed.
A significant number of candidates explained the control of variables in great detail and explained how accuracy would be ensured and errors avoided but then let themselves down by writing a very sketchy plan. This work was not worthy of the high marks given because of the lack of sufficient detail to allow it to be repeated.
It should also be noted that a plan should not be written in the past tense. This gives the impression (sometimes justified) that the plan was written after the investigation had been carried out. This is not what the Controlled Assessment task demands.
In Additional Science and the separate sciences this Skill quality also involves the writing of a hypothesis. For higher marks, the hypothesis should be justified with correct science which is clearly understood by the candidate.
However, the hypothesis is only part of this skill quality and an excellent hypothesis with justification cannot, alone, lead to a high mark. Equally a poor, unjustified hypothesis does not necessarily mean a very poor mark.

Collecting data:

This Skill quality should mean a high mark for most candidates if they have been properly instructed. It was sometimes under-marked in some centres. If data are tabulated with correct headings and units for columns and values are to an appropriate number of decimal places, there is no reason why a mark of 6 should not be given.
However, raw data should be recorded and this was not always the case. For example if a temperature change was being measured, the initial and final temperatures should be recorded not just the change. Mixed units e.g. minutes and seconds are also not appropriate. Time should be recorded as minutes or as seconds. Examples of both these types of error were seen this year.

Managing risk:

Evidence for this skill should be found in the plan and also in the answer to question 4 in part 3. However, the first part of the statement in the criteria is only really addressed by a risk assessment in the plan. Only this is an analysis of the risk before activity starts.
A simple statement of general safety rules can, as clearly shown in the criteria, only be awarded 2 marks. If risks specific to the task are identified and suitable responses suggested then 3 or 4

marks are available. To gain the higher marks 'significant risks must be evaluated'. There should be mention of how likely it is that that risk will occur and of the consequences if it does together with appropriate procedures to avoid/minimise it.
If an activity is 'low risk' then this should be stated. Little credit can be given for risks which have been 'invented' so that the candidate has something to write about.

Processing data:

Processing involves the use of 'mathematical techniques'; at least two for marks above 2. One of these may be a technique concerned with graphing (plotting or constructing an appropriate scale). It is, of course necessary for these techniques to be used accurately. Wrong averages, wrong plotting or scales which are too small or non-linear will not do.
There is no need for the candidate to undertake 'complex mathematical techniques' unless they form part of the task undertaken. However, for the highest marks some treatment of the uncertainty of data is essential (the easiest way to accomplish this is by the use of range bars).
A graph deserving of six marks should have axes labelled with quantities and units. Axes should be constructed so that the graph occupies at least half of the A4 sheet. A best fit straight line or curve as appropriate should complete the graph together if range bars if used.

Analysing and interpreting:

Candidates should be informed that it scientific explanation of the trends is necessary and explicit in the criteria. Credit can be given for an explanation given later in the conclusion section. Centres sometimes gave lower marks than necessary for this skill quality because they did not take into account explanations which the candidate later gave in answer to the final two questions.
Where comparison with secondary data is merely a statement that data from other groups was much the same, little credit can be given. What is expected for higher marks is a comparison between two sets of data; the candidate's and those of another candidate. The secondary data used should be included as part of the sample. This was rarely seen in the samples moderated.

Evaluating:

Evaluation is, perhaps, the most difficult Skill quality for candidates. Many candidates attempt this by explaining in some detail what they did and stating how successfully they followed their plan and how good their results were. This deserves very little credit especially when it is clear from their raw data and from their graph that their data was anything but good. The statement 'my data is good because it is primary data' was not uncommon.
Both the quality of the data in terms of accuracy and repeatability and the weaknesses in the method which led to any problems need to be addressed. Suggestions for improvement were often made but an explanation of why that would make the data better was seldom seen. Candidates should be encouraged to start their evaluation by looking at their data to find any inconsistencies (there almost always are some) and then describe how the method could have led to these. Conclude by explaining how the method could be improved to get better data. Simply stating I would repeat it 5 times rather than 3 is worth little.

Justifying a conclusion:

This Skill quality was usually marked accurately by centres. Candidates should be advised that some science is needed in answer to questions 5 and 6. In question 5 the words 'explain your answer' should be taken to mean reference to their data and the scientific explanation of the trend observed. In question 6 the requirement for science is stated more clearly and reference needs to be made to their research notes also.

Good candidates often find the space allowed in the answer booklet rather too small. Candidates can use continuation sheets if necessary. These should be clearly labelled with candidate name and number together with an indication of the question number.

Another, perhaps better, solution is for centres to create their own answer booklet. As long as the first page is kept and the wording of the questions is not changed this does not count as a writing frame. It allows centres to provide more space for their candidates to give answers to the questions posed.

There are a number of documents available to assist centres with the application and administration of these tasks.

- **The specifications for the Gateway Science Suite**

- **Gateway Science Suite Guide to Controlled Assessment**

- **Exemplar tasks with marked candidate's work on the OCR website**

- **Candidate guidelines for controlled assessment** (section H of the guide to controlled assessment) also available separately from the website. These guidelines may be used by candidates in all parts of the controlled assessment.

- **The assessment criteria**. These may be given to candidates but the wording may **not** be simplified or changed in any way. Issuing the additional guidance to candidates is strictly forbidden.

Centres are thanked for the many hours of work put into running the assessments, marking the assessments and preparing the sample for submission. In the majority of centres this work resulted in a moderation process which was accomplished without too much trouble.

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