



**GCSE**

**Science B**

Gateway Science Suite

General Certificate of Secondary Education **J261**

## **OCR Report to Centres**

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**June 2012**

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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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## Overview

Following on from the first sitting of B711/01 and B711/02 in January 2012, the unit 2 papers, B712/01 and B712/02 were taken for the first time. There were a number of new aspects to the examination when compared to the previous specification. These included 6 mark extended writing questions, marked using a level of response mark scheme, an increased emphasis on 'How Science Works', and an increased emphasis on the assessment of candidates ability to apply their knowledge of science in new contexts and analyse evidence, make reasoned judgements and draw conclusions based on evidence. The latter were heavily assessed in section D of the B712 papers.

The majority of candidates attempted to answer the 6 mark questions. As a consequence most gained some credit. Examiners were able to award marks at all levels in each of the 6 mark questions. Centres could usefully explain to candidates that there is often more than one aspect to these questions and that **all** the aspects have to be addressed to access the higher levels.

Questions requiring knowledge of 'How Science Works', proved variable. Centres are reminded that there is a double page spread at the front of the specification, which details the knowledge and skills required to answer these questions and that the recommendation is that these aspects will be integrated into the teaching of the course.

Candidates also struggled with the new style questions, assessing Assessment Objective 3 (Analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence). Candidates need to quote specific examples of the data to support a conclusion rather than make generalised statements. Candidates performed well on the new section D. The average mark on this section was 4.4 out of 10.

Candidates generally performed well on calculation questions. Where there was a 'developed quantitative' question, i.e. a calculation where the answer obtained was then used for further processing, any error in the initial calculation was carried forward to the subsequent question, to avoid penalising candidates twice.

The writing of chemical formulae and equations was generally well done.

## B711/01 Modules B1, C1, P1 (Foundation Tier)

### General Comments

- In general the paper was balanced and accessible to all candidates. Most questions were answered, but there were a few candidates who seemed short of time to answer the last few questions.
- Most candidates were able to answer the examination paper with very few "No Responses" being given. The paper produced a wide range of marks.
- Overall, candidates found this paper challenging and marks ranging from low teens to low-forties were seen. It was very rare to see any marks in the fifties.
- There were many questions which required a recall of knowledge that proved difficult for candidates. They clearly lacked this knowledge. Also, there were some questions where some candidates gave responses that did not answer the question posed, but where higher scoring candidates' responses showed a clear understanding of what was expected.
- The majority of candidates were able to recall that Paracetamol is a painkiller, but only a minority knew that proteins are made up of amino acids. They could also identify what trophic level an organism was in. Only the most able candidates were able to describe reasons for choosing a nail varnish from presented data, but very few could describe how to test for carbon dioxide. Most candidates could calculate pay-back time, but few could place objects on the electromagnetic spectrum.
- The calculations on percentages on the paper were not very well answered by the vast majority of candidates.

### Comments on Individual Questions

- 1 (a) This question was not very well answered; very few identified both characteristics, with many getting neither. Candidates often seemed to think they had to choose one environmental and one inherited rather than those controlled by both.
- 1 (b) There were very few correct answers. A common incorrect response was to put atoms, but significant numbers left this as a 'no response'.
- 1 (c) Many candidates scored Level 1 marks here, but many did not address issues raised in the question about the effect of lack of protein, so failed to meet the higher level marking points.
- 2 (a) (i) This question was reasonably well answered. Common distractors were bacteria and viruses.
- 2 (a) (ii) This question was reasonably well answered. A common mistake here was to give actual body temp i.e. 37<sup>0</sup>C, rather than answer the question.
- 2 (a) (iii) Almost all got a use for Paracetamol as a painkiller/for headaches, but only a small number got the idea of blocking impulses.
- 2 (b) (i) Very few candidates could identify sickle cell anaemia as an inherited disorder.
- 2 (b) (ii) Most candidates scored one mark for the idea that not all the children recovered. Some candidates achieved the second mark as well, usually for 'not been tested on adults'.

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- 3 (a) (i) Many candidates identified the decrease and gained this mark.
- 3 (a) (ii) This question was quite well answered, but a number did not address the question asked, writing about gender differences.
- 3 (a) (iii) There was only a small minority that calculated the percentage correctly, but many scored the second mark by identifying that males were more at risk of dying than women.
- 3 (b) Most candidates did not know that antibiotics only kill bacteria so were not able to apply this to the question. Sometimes candidates mistakenly referred to antibiotics being used to kill viruses, and as a result, did not gain credit.
- 4 (a) Most candidates had no idea about how an impulse travels down a nerve. Only a minority of candidates referred to neurones and even less to electrical impulses or the speed of an impulse.
- 4 (b) Given the very poor response to part (a), almost all candidates also failed to be able to apply their knowledge of the spinal reflex.
- 5 (a) Almost all candidates scored this mark.
- 5 (b) This question was generally answered well, with most candidates suggesting they had used different evidence.
- 5 (c) Most candidates had the idea that the oil leak would harm sea-life, some named specific animals. However, although many mentioned the damage to beaches, very few referred to oil slicks.
- 6 (a) Generally a well answered question.
- 6 (b) Most candidates understood that the boiling point increases as the molecule gets larger. However, a misconception was to describe it as taking longer to melt.
- 6 (c) This question was answered well by most, with hexadecane as a common incorrect response.
- 7 (a) Many candidates did not score here, therefore this question discriminated well. A number knew water, but wrote the word not the formula and quite a number had lower case symbols, large 2's etc.
- 7 (b) (i) Considering the fundamental concept this question was testing, in general it was poorly answered. Very few candidates knew about limewater, and glowing and lighted splint was seen quite often.
- 7 (b) (ii) This question was poorly answered with many candidates writing about it reaching its melting/boiling point.
- 8 (a) This question was very well answered. Most candidates got maximum marks on this question.
- 8 (b) This question was answered well, with most getting the irritant idea and others, the idea of cost. A common incorrect response was "does it dissolve in water".

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- 9 (a) Most candidates achieved the correct response, but a few wrote 25%,  $\frac{1}{2}$ , binding medium or pigment.
- 9 (b) Many candidates were unclear on this question. Many were writing about properties of paint in terms of sticking to walls and coverage.
- 10 Often candidates were unable to access higher levels of response because of the way they structured their response. One property was often known, but the candidate did not link to uses. Disposal method was often known, but the candidate did not discuss the associated problems. Many candidates only mentioned one property or one disposal method.
- 11 (a) This question was answered well, with many candidates getting heat loss. Many candidates failed to get two marks, but gave a number of points from the first area of the mark scheme. Common responses were “finding bodies” and “police searches”, which were not credited.
- 11 (b) Many candidates did not refer to the idea of ‘trapped air’, so were unable to go beyond Level 1. Commonly, candidates wrote about thickness of materials. Only a very small number of candidates wrote about convection and air being a poor conductor or being a good insulator.
- 11 (c) (i) On the whole, this question was answered well, although lack of mathematical skills did hinder some.
- 11 (c) (ii) Many candidates scored one mark for the idea of lightweight being cheaper to fit. Many had the idea of heavyweight curtains saving more in long run, but failed to calculate £500.
- 12 (a) (i) Generally well answered for 1 mark which was usually making people aware, but only a few candidates gave a second answer.
- 12 (a) (ii) Very few scoring responses, most candidates appeared to not understand the question and what sort of response was required.
- 12 (b) Many candidates scored one mark here for cancer or brain damage. A common incorrect response was relating to ear problems.
- 13 (a) Not many candidates could recall this name, common incorrect responses were Richter scale, wave scale, and shock meter.
- 13 (b) (i) This was a poorly answered question. A whole range of numbers was seen and 3:15 seemed to be common.
- 13 (b) (ii) Poor responses following on from (b) (i).
- 13 (c) Many candidates knew P waves, but did not mention faster.
- 14 (a) This question was not well answered, there were large numbers of no responses or frequently, candidates put ‘light at the top’.
- 14 (b) This question was answered reasonably well in a lot of candidates responses.
- 14 (c) This question was poorly answered; many no responses and no evidence of candidates scoring all 3 marks. Those drawing the correct diagrams for refraction could not explain it.

## B711/02 Modules B1, C1, P1 (Higher Tier)

### General Comments

Some candidates were well prepared for this higher tier paper and successfully answered the biology, chemistry and physics sections. A significant number of the candidates were entered for the incorrect tier; this was evident by the large number of omissions to questions and poor knowledge and understanding of the higher tier specification.

Assistant examiners reported a significant number of no responses towards the end of the paper and it appears that candidates did not have sufficient time to answer all of the questions. Candidates have spent a large proportion of their time answering the level of response questions. These were often completed on additional sheets of paper. Many of the candidates started the level of response questions by rephrasing the question and it took several sentences before they started answering the actual question.

The new aspects of the specification proved difficult for many candidates. Those candidates who structured their answers and ensured they fully answered the question, gained many of the six marks available on the level of response questions. Nearly all candidates attempted to answer these questions and so generally gained some credit. As in January 2012, most of the questions addressing aspects of 'How Science Works' proved to be challenging to candidates, but a significant number appreciated why scientists publish the results of their studies. For questions where three marks were available, many candidates wrote about the same one idea in different ways and so, only gained one mark.

### Comments on Individual Questions

#### Section A – Module B1

- 1 (a) Just over half of candidates gained one of the two marks for this question. Common errors were to name the structures as genes, DNA or sex cells. Many candidates gave the combination for a female as XY instead of XX.
- 1 (b) Less than 30% of candidates gained the mark for knowing that proteins are made of lots of small molecules called amino acids. Many candidates did not attempt this question or wrote 'protein', 'molecules' or 'atoms'.
- 1 (c) Over 70% of candidates gained at least level one, and either one or two marks in their response to the first level of response question. Candidates were required to use the table of data and the information about calculating Estimated Average Requirements (EAR) in their answers. Those candidates who only commented in general terms about the data, only gained one or two marks. Candidates who quoted specific examples in the data and calculated the EAR for a healthy 10 year old boy, were able to score three or four marks. Very few candidates were able to analyse the information in the table to compare the risks of suffering kwashiorkor in developing and developed countries. Many candidates quoted the figures in the table without comparison.
- 2 (a) (i) Over 70% of candidates gained one mark for this question, but only 25% gained all three marks. The majority of candidates were able to place 'parasite' and 'host' in the correct places, but very few knew that a mosquito acts as a 'vector'.



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- 2 (a) (ii) Just less than half the candidates gained the mark for correctly describing how a very high temperature can lead to death. The most common correct answer was dehydration. The most common incorrect responses were to describe 'overheating' or 'organ failure'. A significant number of candidates thought that 'enzymes were killed' or that the 'blood boils'.
- 2 (b) Less than 50% of candidates gained some credit for this question. Most of these candidates did not identify the trial as a double blind trial, but were able to explain why doctors did not want to know which group were treated with hydroxyurea. This was usually answered in terms of 'bias', however, many candidates gave a vague answer such as 'fair testing' or 'as a placebo'.
- 3 (a) Over 50% of candidates gained a mark for this question. Most gained it for correctly working out the probability of the child having cystic fibrosis as 1 in 4 or  $\frac{1}{4}$  or 25%. Candidates needed to draw a clear and accurate genetic diagram showing the parental genotypes and the offspring genotypes for the second mark. Many candidates did not gain this mark because their F and f were not clear.
- 3 (b) The majority of candidates were able to suggest at least one difficulty that parents needed to consider when having the foetus tested for cystic fibrosis. This was usually about whether to abort the foetus if the test was positive. Some candidates simply stated that it would be a hard decision for the parents without explaining why. A few candidates also mentioned the danger of the test itself to the foetus and possible miscarriage. Some candidates thought that the baby would get cystic fibrosis in the future, if they were tested.
- 4 Almost all candidates were able to describe the link between cholesterol level and heart attacks, from the simple bar chart. Many candidates then repeated this relationship until they filled up the space given. Fewer candidates were able to explain that cholesterol causes plaques and even fewer, that the lack of oxygen to the heart can lead to a heart attack.
- 5 (a) Less than 40% of candidates were able to name the hormone as auxin. Many simply wrote 'growth hormone' or did not attempt the question.
- 5 (b) Just under 50% of candidates were able to draw a correct diagram showing the wheat shoot bending less towards the light. Less than 10% of candidates were able to explain that TIBA inhibits a plant hormone and so reduces cell elongation. Many candidates described phototropism or the action of auxin and did not attempt to interpret the information.

**Section B – Module C1**

- 6 (a) Candidates found it difficult to explain what is meant by non-renewable. Many wrote about it meaning 'fuel that can not be used again'.
- 6 (b) The majority of candidates were able to suggest one reason why it is difficult to estimate how many years it will take for a non-renewable fuel to run out. This reason was usually about increasing or decreasing fuel use in the future. Some candidates wrote about the difficulties in making estimates rather than giving specific reasons. Many candidates just rephrased the question.
- 7 (a) Fewer than 15% of candidates gained marks for this question. Very few gave answers in terms of longer molecules. A significant number of candidates described fractional distillation, but did not mention intermolecular forces in their answers. Many candidates wrote about cracking rather than fractional distillation.

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- 7 (b) (i) Over 60% of candidates worked out the value of x to be 8. The most common incorrect answer was 6.
- 7 (b) (ii) The majority of candidates were not able to construct a balanced symbol equation for the reaction. Just over 40% of candidates were able to construct a correct unbalanced equation. A significant number of candidates omitted the O<sub>2</sub> as one of the reactants but usually gave the correct products. Care is still needed when writing symbols as many candidates are using a lower case 'o' in CO<sub>2</sub>. Assistant examiners reported fewer candidates than in previous papers opting to write word equations rather than symbol equations.
- 7 (c) (i) Over 60% of candidates were unable to show, by calculation, that the mass of carbon dioxide was 7200g. Many candidates randomly multiplied, added, subtracted or divided the five numbers as their attempt at the calculation. Some candidates did not gain the mark because they used 80 km/h in their calculation.
- 7 (c) (ii) About half the candidates gained the available mark for this question. Most wrote about the amount of carbon dioxide being different because Debbie drives at lower speed or a different speed in town.
- 8 (a) The majority of candidates were able to identify ethene as being unsaturated because it contained a double bond. Fewer candidates gained the second mark for explaining why ethene is a hydrocarbon. A significant number of candidates wrote about carbon and hydrogen molecules or failed to mention that it 'only' contains carbon and hydrogen.
- 8 (b) The colour change when ethene is bubbled through bromine water was not well known by candidates. Only about 20% gave the correct colour change. Most candidates gave the correct colour at the start but not at the end. A significant number of candidates gave a change from colourless to orange. Clear and transparent were common incorrect answers.
- 8 (c) This question required candidates to draw the display formula for poly(ethene). Almost 30% of candidates left this question blank and many just copied the display formula for ethene from the question or left a double bond in the display formula.
- 9 (a) About 50% of the candidates gained some credit for this question about thermochromic pigments. The most common correct answer was 'baby spoons', but many of the candidates failed to explain that that colour of the baby spoon indicates a certain temperature. Many candidates gave vague answers about 'the food being too hot or too cold for babies'.
- 9 (b) Less than 30% of candidates knew that 'glow in the dark' watches were not as safe as they are today because they were radioactive. Many candidates just thought the watches were poisonous, toxic or harmful.
- 10 Answers to this level of response question usually included one or two properties of poly(ethene). The most common properties were 'strong', 'flexible' and 'waterproof'. Candidates found it difficult to explain reasons why these properties are required for plastic bags. Common vague answers included 'so it can hold the shopping' and 'so you can fit the shopping in'. Some candidates did not write about the properties, but instead concentrated on the problems of disposal, and so limited their marks. Other candidates did not write about the environmental problems or repeated the information in the question about the bags being non-biodegradable and the general problems this would cause. Littering and animals getting stuck in the plastic bags were common answers for low scoring candidates. Most candidates did not mention any economic problems and so, few candidates gained level three and five or six marks. Many candidates explained how the molecular structure of the poly(ethene) helps with stretching without mentioning any properties.

**Section C – Module P1**

- 11 (a) (i) Over 50% of candidates were able to describe temperature as a measure of hotness. Some candidates thought it was a measure of heat.
- 11 (a) (ii) Almost 70% of candidates recognised that the thermogram uses light and dark to show difference in temperature. Many candidates related their answers to colours rather than shades of grey.
- 11 (b) (i) Over 80% of candidates correctly calculated the payback time of lightweight curtains and heavyweight curtains.
- 11 (b) (ii) Over half the candidates scored at least one mark for explaining which type of curtain would be best to, fit but many failed to use the information in the table to explain why. Many candidates focussed on the difference in payback time rather than using all the information in the table. However, 20% of candidates did use the information in the table to calculate the £500 saving on fuel bills with the heavyweight curtains, over the 5 years.
- 12 (a) Almost 90% of candidates gained at least one mark for this 'How Science Works' question. The majority explained that scientists publish their result to inform the public about the dangers of microwave radiation. Some candidates also explained how the published results enable other scientists to check the results and to use the information for further studies.
- 12 (b) Candidates found the final level of response question very challenging. Only about 60% of candidates gained marks and this was usually for describing the possible objections from members of the public. The most common objection was visual pollution. Candidates often tried to use ideas about line of sight, diffraction and interference but often gave very muddled answers. Candidates that gained level two and three or four marks wrote about the need to position the transmitters high up or correctly described interference, as well as giving in to objections from members of the public.
- 13 (a) Less than 20% of candidates were able to describe the amplitude and timing of the largest seismic wave. Many gave the timing or just the amplitude of the wave and so did not gain any marks because both were required. Many found it difficult to interpret the recording.
- 13 (b) P waves was the most common answer, but candidates then failed to explain that P waves were faster than S waves and so did not gain the mark. Many just wrote about P waves arriving first.
- 14 (a) Only about 50% of candidates knew the correct wavelength order of electromagnetic waves. Most of the candidates who gained these two marks used some sort of mnemonic to remember the order.
- 14 (b) Candidates found the calculation of the frequency of infrared waves involving standard form challenging. Some candidates multiplied the speed and the wavelength in an attempt to calculate the frequency.
- 14 (c) (i) If candidates correctly calculated the frequency in part (b) they were also able to identify the band as C. Examiners used error carried forward from part (b).
- 14 (c) (ii) Candidates found the concept of prediction difficult and almost 40% of candidates left this question blank.

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- 14 (c) (iii)** Only 15% of candidates correctly described the relationship between wavelength and energy. The majority of candidates thought that as wavelength increases the energy also increases.
- 14 (d)** 40% of candidates gained marks for this question. They were usually able to describe the path of ray 2 as showing reflection, but often thought that ray 1 showed diffraction rather than refraction. Many candidates described the path of the rays in general terms such as 'bounce' and 'change of direction', but did not mention reflection or refraction in their answers. Some candidates did not make it clear which ray was ray 1 and which ray was ray 2.

## B712/01 Modules B2, C2, P2 (Foundation Tier)

### General Comments

This was the first examination of science paper 2 (B2, C2, P2), for the new specification, Entry of approximately 20000, was comparable with that for paper 1 in January 2012.

### Paper Statistics

Maximum possible mark 85; highest candidate mark 72; lowest candidate mark 0; mean mark 37.1; standard deviation 12.1.

All marks were accessible, but there were about 30 blank papers where candidates, having completed the front of the paper, did not attempt any questions.

Centres should strongly advise their candidates to read the question carefully and answer all parts of the question. This was particularly significant in the 6 mark questions where failure to do everything in the question, resulted in low marks for the answer.

### Comments on Individual Questions

#### Section A

- In 1a, candidates were asked about how the Arabian Oryx showed variation within the species. Whilst about one third gave correct answers, such as different shaped patches on the head and different size of horns, the majority explained why they were the same species by all having a black patch on the head and long horns, and so failed to score. In 1b (i), candidates were asked to show by calculation. These were important words and candidates who failed to show the calculations involved, did not score. For full marks, candidates needed to state the equivalent of  $250/2 = 125$  (1). In 2006, population is 115, as this is less than 125, the statement is correct (1). A large tolerance on the readings from the graph was allowed by examiners. In 1b (ii), again, in this question candidates failed to read the information in the question. The most common wrong answer was that they had been hunted for their horns. In order to score, this answer needed to be qualified by stating that the hunters had broken through the fences into the National Park. Other correct answers included disease, predators or escaping from the park. In 1b (iii), tourism, and to prevent extinction, were the most common correct answers.
- In 2a, only 30% of candidates correctly identified the stages of the food chain as trophic levels; binomial system was a common wrong answer. In 2b, the question informed candidates that mushrooms were decomposers, so no marks were awarded for stating that they decompose material. Candidates needed to explain what decompose meant, e.g. rot, break down etc., and then state what is being decomposed e.g. dead leaves, plants, and animals. An answer in terms of producing nutrients for other plants was allowed, along with the idea that they were a source of food for some animals. In 2c (i), which was a common question with the higher tier, less than half the candidates identified the reasons for energy loss as respiration, movement, excretion etc. In 2c (ii), a majority of candidates correctly answered this question in terms of humans eating other food and not just mushrooms. No credit was given to candidates who stated that humans were immune to the mushroom disease.

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- 3 This question performed well, with a good distribution of marks. The majority of candidates scored four, with only about 5% failing to score on this question. The mark scheme gives detail of how the question was marked, but important pointers to help candidates perform at their best are: the question asked “write about and explain” for those candidates who did not explain they could not achieve level 3. The question asked about similarities and differences both were needed for a high mark and the question was specific about being adapted to hunt and kill prey, so other differences and similarities such as lions live in hot climates were not relevant. In 3b, most candidates correctly stated that the prey population decreased.
- 4 In 4a (i) and (ii), the majority of candidates answered both parts correctly. In part (i), they had a better chance of survival was the expected answer. In part (ii), a statement about each view was expected for the mark i.e. one said the neck stretched, the other said it was born with a long neck. The candidates who only gave one part of the answer failed to score. In 4b (i), most candidates knew Darwin was the scientist responsible for the theory of natural selection. Part 4b (ii) was answered poorly by most candidates. Examiners were looking for the idea that there is now a vast amount of evidence in favour of this theory and that many scientists have done research and agree with the findings.

**Section B**

- 5 This question was answered well by most candidates. In 5a, the majority of candidates correctly chose steel as a container to hold molten copper. In part b, one mark was given for choosing glass and the other mark for being transparent and either cheap or strong. In part c, either steel or aluminium could be chosen, but the corresponding properties had to be correct. In both b and c, if an incorrect material was chosen, no marks were awarded for the properties.
- 6 A majority of candidates were able to explain what was meant by a reversible reaction, however, some candidates merely repeated the words in the question stating a reaction that can be reversed; this was not awarded any marks. Candidates were happy with extracting information from the table and the majority gave correct answers to parts (i), (ii) and (iii). Less than 10% were able to suggest why the actual conditions used are not those that would give the highest yield.
- 7 Candidates scored badly on this question. There were a large number of candidates (over 20%) who did not attempt the question and a further 25% who failed to score. The remaining candidates were all able to give a benefit or problem of using fertilizers, although some were not entirely accurate or tended to contradict themselves; these were awarded level 1. To achieve level 2 the name of one of the chemicals involved was needed; about 30% identified nitric acid as one of the chemicals. To achieve level 3, the names of both chemicals were needed; however, only about 2 in every 100 knew potassium hydroxide was the alkali. The most common incorrect answer was potassium. A significant number of candidates did not attempt to name the chemicals so, no matter how good their remaining answer, were unable to achieve high marks.
- 8 This question proved difficult for the majority of candidates. Very few candidates were able to correctly give the chemical test for chlorine. Of those who gave bleached indicator paper as an answer, several only scored 1 mark for failing to mention that the paper needed to be moist. In 8b, many different gases were given as answers, but only about 10% correctly identified the gas as hydrogen. In 8d, about a third of candidates correctly gave two uses of sodium chloride. Examiners were instructed not to accept ‘as food’, but accepted ‘on food or in food’; to de-ice roads was one of the other common correct answers. In 8e, only 40% of candidates correctly counted the number of atoms accurately and gave the number 12.

**Section C**

- 9** The majority of candidates correctly identified the planets in 9a and a significant number of candidates correctly explained why it was easier and cheaper to use unmanned spacecraft in part 9b. However, it was clear that several candidates had never heard of Ptolemy, with about 30% not attempting the question.
- 10** This question performed well, but a significant number of candidates failed to answer the question fully. Candidates were asked to make a decision about which bulb should be used and many just explained the advantages and disadvantages of each, therefore excluding the possibility of the highest marks. All the information in the question was relevant but in general, some was ignored. A common misconception was that the power of the lamp was a measure of the amount of light given out. Several candidates did not realise the significance of the five second delay with the fluorescent lamp and that the car would have passed before the sign lit up.
- 11** Question 11a was a low demand question. Examiners were expecting the two statements from the specification; power stations make electricity; National Grid transports it to homes. Candidates gave much more detail and described the generation, but forgot about it being distributed to the homes. In 11b, only a minority of candidates correctly calculated the efficiency. The majority divided 2400 by 600 to get an answer of 4.
- 12** In 12a, most candidates correctly chose radiation Y and often repeated the information in the table. Few answered the question fully, by explaining how to use a tracer to find a leak. Question 12b (i) was answered well, with the most common answer being to cause cancer. In 12b (ii), candidates did not relate it to the hospital situation and therefore gave incorrect solutions.
- 13** In 13a, most candidates correctly calculated the power of the washing machine and a significant number of candidates correctly answered 13b, explaining that cost depends on power and time used.

**Section D**

- 14** In 14a (i) most candidates were able to interpret the graph and correctly state how the energy generated by the two methods had changed over five years. Question 14a (ii) proved more difficult; many candidates gave a single statement that the energy would increase. This was given a token, one mark. Examiners expected candidates to describe what would happen to the three sources on the graph, separately. Most candidates stated that bioethanol would increase in 14b (i) and about half of these gave a correct answer for fossil fuels in 14 b (ii). In 14 c, most candidates chose St Mawgan, although a significant number chose Blackpool. The examiners were looking for the idea that it had the highest average wind speed for most of the year. Those candidates stating all year did not gain the second mark. Most candidates gave a correct answer to 14 c (ii).

## B712/02 Modules B2, C2, P2 (Higher Tier)

### General Comments

The paper produced a mean mark of 33.1, with a standard deviation of 12.0. Many candidates had been prepared well for this new style paper, having learned from the experience of B711/02 in January 2012. About 2500 of candidates from the entry of over 22000, would have been better served by entry to the foundation tier, having scored less than 20 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 natural selection was a high demand question graded up to A\*. Very few candidates scored level 3 (5 or 6 marks) on this question. The chemistry question concerned with eutrophication and a neutralisation reaction was targeted at all the grades covered by the paper. About one fifth of candidates scored level 3. The physics question, which concerned the choice of a lamp for a road sign, was targeted at grades C and D, and correspondingly scored better. A significant proportion of candidates gained level 3 on this question. 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 attempted the new data response questions in section D, well. Very few omissions were seen. The average mark gained was just under 5 out of the 10 available. As mentioned in January 2012, in answering questions of this type, candidates need to quote specific examples of the data to support a conclusion, rather than make generalised statements.

Candidates continue to perform well in straightforward calculations. Calculations involving more than one step or where a change in unit is required, e.g. watts to kilowatts, were less well answered. The improvement in the skill of writing chemical equations noted in January was continued, with appropriate care being used in the use of upper and lower case in symbols and subscripts for numbers.

Overall, assistant examiners and team leaders felt that the question paper, although challenging, was appropriate to the ability range of the candidates intended. There was no evidence of lack of time.

### Comments on Individual Questions

#### Section A

- 1 (a) Just over half of the candidates correctly stated 'class'. 'Classification' was a common incorrect response. Just under a fifth of candidates omitted this question.
- 1 (b) (i) Just over a third of candidates correctly answered this question, either recognising the universal nature of the name or stating that the binomial system provides information on the species and the genus. Incorrect answers usually had vague references to identifying species or environments.
- 1 (b) (ii) This question was well answered by better candidates who referred to mating and the lack of fertility of the offspring if the species are different. Some referred to comparing DNA and scored 1 mark. There were many references, by weaker candidates, to 'looking different' or 'living in different places' which did not score.



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- 1 (c) (i) Showing that a given conclusion is correct is a relatively new style of question. A lot of candidates scored 1 mark for correctly stating that, in 2001, the population of Arabian Oryx was 250 and that 50% of 250 is 125. Far fewer then went on to say that the population in 2006 was less than 125, to gain the second mark. The mark scheme gave credit for a range of methods of calculation. Some candidates wrote down a series of numbers with no explanation of what they were doing and failed to score.
- 1 (c) (ii) The mark scheme gave credit for a wide range of answers. The question required candidates to apply their knowledge to a novel situation. Most marks were gained for a reference to hunting or eating of crops. Few candidates talked about the impact on tourism.
- 2 (a) About half of candidates scored the mark, correctly quoting respiration, excretion or egestion (sometimes all three). Common incorrect answers referred to growth.
- 2 (b) Only better candidates scored well on this question. The idea of the requirement for dry mass was the most frequently scored mark. Fewer then went on to explain that this would entail killing humans, for the second mark. Many candidates thought that there were too many organisms to count and failed to score.
- 2 (c) This question was poorly answered. Few candidates understood that mushrooms break down proteins or amino acids into ammonia. There was a confusion with nitrifying bacteria and the idea that nitrogen was released.
- 3 (a) Just over half of candidates correctly identified 'mutualism'. Candidates with no idea stated words such as 'partnership' or 'parasite'.
- 3 (b) Better candidates often scored 2 or 3 marks on this question. Good answers were characterised by detail, e.g. long or deep roots as opposed just 'roots'. Weaker candidates' answers were characterised by vagueness, e.g. 'most of the plant is underground so it is cooler', and failed to score. A number gained the catch mark by recognising that the plants were camouflaged which offered protection from predators.
- 4 (a) Most candidates scored some marks on this question. Weaker answers tended to focus on ideas such as survival of the fittest or competition, but did not link them to the different amounts of food on the different islands and were therefore limited to level 1. Better candidates wrote about the differing amounts of food at differing heights on the different islands and could relate that to what would happen to the long and short necked tortoises, scoring level 2. Very few candidates wrote about the gene pool, isolation or speciation, which were required at level 3.
- 4 (b) This question addressed issues involving 'how science works' and was not well answered. Better candidates usually recognised that there was no proof or evidence available. Weaker candidates referred to mutation or answers were too vague to score.

**Section B**

- 5 (a) This question was well answered by the full range of candidates. Full credit could be gained by the choice of either aluminium or steel, provided that the correct justification was included.

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- 5 (b) (i) Better candidates scored both marks on this chemical equation. Weaker candidates scored either 1 mark or zero.  $\text{Fe}_2 + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$  was frequently seen and did not score. 1 mark is awarded for the correct formulae and the second for correct balancing. The balancing mark is conditional on the formulae being correct. Candidates who struggle with balancing are advised to complete the formulae only and settle for 1 mark, rather than to go on and try to balance the equation and run the risk of losing both marks.
- 5 (b) (ii) 15% of candidates omitted this question. Those that did attempt it found it difficult. Common incorrect answers included 'ionisation' or 'electrolysis'. The idea of loss of electrons, clearly shown in the equation, was not recognised.
- 6 (a) About half of candidates correctly wrote this equation. Frequently oxygen appeared as a reactant.
- 6 (b) This question was well answered with candidates being able to interpret the data correctly.
- 6 (c) Better candidates showed a good understanding of the ideas of rate versus yield and could apply them to this novel situation. Weaker candidates made vague references to compromise, without the necessary detail to score. Reference needed to be made to the reasons why a particular temperature or pressure was chosen, e.g. lower temperatures give a higher yield.
- 7 This question was well answered. Most candidates recognised the need to be able to predict future eruptions. Fewer linked this to the need for safety of people living near volcanoes or the provision of information about the structure of the Earth.
- 8 Most candidates attempted the question and gained some credit. A number of candidates described eutrophication, but did not state the chemicals required to make potassium nitrate. Candidates could usefully be taught that to reach the higher levels, all aspects of the question need to be addressed. The chemicals involved were not well understood. The acid required was often quoted as 'nitrogen' and the alkali as 'potassium'. At level 1, either one correct chemical or a rudimentary description of eutrophication was required. At level 2, one correct chemical and a description of eutrophication involving the accelerated growth of algae were required. At level 3, both chemicals and a description involving the role of bacteria in the process were required.
- 9 (a) Less than half of candidates could identify hydrogen. Common incorrect answers included 'sodium', 'oxygen' and 'carbon dioxide'.
- 9 (b) This question was targeted at A\* and only a very small proportion of candidates scored both marks. Some candidates were able to state that either hydrogen ions were discharged at the cathode or chloride ions at the anode, scoring the first mark. The second mark, involving an understanding that sodium ions and hydroxide ions were left in the solution, was rarely scored.
- 9 (c) This question was omitted by almost a quarter of candidates. Some candidates understood that water needed to be pumped into the mine for the first mark. Fewer understood that the salt then dissolved for the second mark. Many candidates simply referred to evaporation of saltwater and failed to score.

**Section C**

- 10 (a)** Better candidates correctly sequenced the events in a power station and scored 2 marks. A common omission was that coal is burned and weaker candidates often did not understand that the turbine turns a generator.
- 10 (b)** Over two thirds of candidates correctly completed this single step calculation.
- 10 (c) (i)** Very few candidates scored 2 marks on this question. Often the formula was inverted or the values were multiplied rather than divided. Candidates rarely converted megawatts to watts although failure to do this could still result in the award of 1 mark.
- 10 (c) (ii)** This question was poorly answered. Many candidates realised that there was reduced energy loss, but did not relate it to the idea that the current is reduced and failed to score. The marks were awarded for reduced current (1), and the idea that less current reduces heat loss (1).
- 10 (d) (i)** This question was correctly answered by most candidates. They could extrapolate the graph and read off a sensible value.
- 10 (d) (ii)** This A\* question was very poorly answered with vague references such as 'it's only an estimate so we can't be sure' which failed to score. The mark scheme required well expressed answers concerning environmental, economic, technological or political issues.
- 11 (a)** Only the best candidates scored full marks on this question. Many scored 1 mark usually for identifying that gamma radiation was given off by the source and a smaller number gained a second mark for linking this to the idea that there was a reduced count rate after the radiation had passed through lead. Many weaker candidates merely listed all three types of radiation and what they were absorbed by, thereby not addressing the question and failing to score.
- 11 (b) (i)** Ionisation was not well understood. The mark scheme required the idea of the loss or gain of electrons, but this was rarely seen. Some candidates wrote about an atom becoming an ion but did not state how this happens and failed to score.
- 11 (b) (ii)** About a third of candidates scored this mark, usually for the idea that cells are damaged. The higher level answer involving damage to DNA or chromosomes was rarely seen. Many candidates thought that cells were 'killed' and failed to score.
- 12** This question required students to process data, give advantages and disadvantages of the different lamps and come to a conclusion. Most candidates attempted the question and gained some credit with many level 3 answers seen. To gain level 3, candidates were required to give advantages and disadvantages of all three lamps and come to a reasoned conclusion about which one should be used. The idea that the fluorescent lamp takes 5 seconds to come on and its likely impact on use for a road sign was not appreciated by significant numbers of candidates, who consequently scored 5 rather than 6 marks. Also there was some confusion regarding the power requirements of the lamps. Some candidates thought that a high power requirement was a good thing, presumably confusing power requirement with power output.

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- 13 (a) This multi-stage calculation proved a challenge for many candidates. The main problem was the need to convert watts to kilowatts prior to substituting into the appropriate equation. In addition, some candidates did not convert pence to pounds. One of these errors was likely to lead to the award of 1 mark. A number of candidates divided the numbers rather than multiplying them and did not score.
- 13 (b) This question was not well answered. The mark scheme required the idea of evening out energy demand or that there was no need to switch off power stations or that electricity cannot be stored. Most candidates wrote about electricity not being wasted or the company making more money, both of which were unacceptable answers.
- 13 (c) About one third of candidates scored this mark. A number of candidates thought that off-peak electricity lacked sufficient power or was less effective than 'normal' electricity.

**Section D**

- 14 (a) This question differentiated well and produced the full range of marks. Better candidates recognised the trends for all three types of renewable energy. Weaker candidates wrote globally that renewable energy would increase and scored 1 mark.
- 14 (b) (i) Performance differentiated well in this question. Most candidates gained 1 mark for recognising that both bio-diesel and bio-ethanol increase. Better candidates scored the second mark for noting that bio-diesel usage had increased rapidly since 2003.
- 14 (b) (ii) The consequences of increased bio-fuel production in the USA were a difficult idea for most candidates with few recognising either, that there would be less land available for food production, or there would be less use of fossil fuels. A common misconception included 'increased global warming'.
- 14 (c) (i) Most candidates correctly identified St Mawgan as the best place to build the wind farm. Only the best candidates recognised that this was because St Mawgan had the highest wind speed for **most** months of the year. Many candidates incorrectly stated that St Mawgan had the highest wind speed throughout the year. Blackpool was the most frequent incorrect location stated.
- 14 (c) (ii) This question was correctly answered by over two thirds of candidates. Most candidates mentioned the type of landscape, noise, impact on wildlife, residents' objections or environmental issues – all of which were acceptable.

## B713 Controlled Assessment

### General Comments

This was the first year of this new form of assessment and, whilst there are some similarities with the old 'Research Study' and 'Data Task', there are also some distinct differences.

Many centres coped well with the new regulations, but a few had only a sketchy understanding of what was required. The same skills are assessed, but the amount of freedom which centres have has been restricted by the regulation introduced by Ofqual. Hence the term 'Controlled Assessment'. The most important differences are listed below.

- 1 Only tasks set for the year of assessment (in this case 2012) can be used. The use of tasks from previous or future years is not permitted and such use can severely impact both centres and their candidates.
- 2 Tasks cannot be modified to suit a centre; they must be used as printed.
- 3 No form of writing frame or template is allowed even if generic in nature.
- 4 There is no 'fall back' data and teacher generated data is forbidden. Only data generated by the candidate or by other candidates in the centre is permitted.

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

- **The specification for Gateway Science**
- **Gateway Science Suite Guide to Controlled Assessment**
- **Exemplar tasks with marked candidates' 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.

**Additional guidance:** is just that. Guidance as to the level of answer which might be expected. It is not a mark scheme. It should not be used as a mark scheme. There are other ways of satisfying the assessment criteria besides those exemplified in the additional guidance.

The assessment criteria printed in the specification and at the end of the teacher guidance for each task are the only means which may be used to assess candidates' work. Moderators do not consider either the additional guidance or any mark scheme produced by a centre. Additional guidance is for the use of teachers and must not be given to candidates.

### Administrative matters.

Candidates work encompasses the part 3 booklet together with their results and graph, the candidates plan together with any modifications or teacher notes and the candidate notes made from research material. These notes should include a bibliography but documents acquired during the research process should not be included.

The candidates' marks should be filled in on the front page of the part 3 booklet. If a centre designed sheet has been used to record marks it may be included but should not replace the record on the cover of the booklet.

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The candidate's name and candidate number should be included on all sections of the work.

The work including all loose sheets should be securely fastened together. A plastic sleeve is not a suitable alternative to a secure fastening.

It is helpful if the mark sheet (MS1) including which group a candidate belongs to is sent to the moderator.

Please ensure that the addition of marks is checked. Too many centres still submit work with arithmetical errors.

### **Problems with Individual Candidates**

If a candidate is absent for the research section of the task and there is no time for the task to be completed before Part 3 is undertaken then the candidate will have to work without research notes and will be disadvantaged particularly in answering question 6 in Part 3.

If the candidate is absent for the planning stage then they may be given the plan of another candidate (but not a teacher plan). They will score zero for planning but can access all other marks.

If a candidate's plan is so poor that it will not work or is dangerous, they can again be given the plan of another candidate. Their own plan should be marked and they keep that mark for planning but, thereafter, marks may be based on the alternative plan.

If a candidate is absent for the session where the investigation is carried out then they can be given the results of another candidate (but not teacher results). They will score zero for collecting data but can still access all other marks.

Candidates requiring the assistance of a scribe or amanuensis or with other access problems can receive help. For further details contact OCR.

### **Researching:**

#### **Research:**

It is essential that notes are made by the candidate as the research can be a communal effort. The notes must cover all the bullet points on the Part 1 stimulus sheet fully and there should be no extraneous matter which is not relevant to the answers. This last to satisfy the 'select' criterion. The sources are 'used' to produce the report and at least three sources must be used for the higher marks. These sources should be referenced in full ideally in a bibliography. The most common errors in poorer candidates were; the absence of notes, incomplete references, partial treatment of bullet point and the inclusion of irrelevant material.

#### **Planning:**

The plan written by the candidate must be their own work though, of course, it can be based on a plan agreed within a group working together. There should be sufficient detail to allow the plan to be carried out by a third party. This would include; how variables are to be dealt with, the apparatus to be used, how it will be set up, the range of values to be investigated and the number of replicates. In addition some account should be taken of how errors are to be avoided and how accuracy of measurements is to be optimised.

QWC (in particular spelling, punctuation and grammar) is also to be assessed in this skill quality so the importance of correct use of English should be stressed.

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Marks were lost by candidates this year when they wrote plans which were insufficiently detailed. The most common error was a failure to explain how apparatus was to be set up. A diagram can be of great help here but diagrams were rarely present. There is no need to artificially create a modification if none was necessary but if a change is made in the method used, as compared with the one given in the plan, then this change should be explained.

**Collecting Data:**

If results are tabulated with values to the appropriate number of decimal points, the columns are correctly headed with title and correct units, there is no reason why high marks should not be given.

There were a good number of centres where incomplete tables or ones containing no headings and/or units were given too much credit. There were a number of occasions when the units used were wrong.

Candidates should be instructed in the correct way to tabulate and display data. It is not a difficult skill.

**Managing Risk:**

More is needed than standard lab rules such as wearing goggles. The risks of the particular task should be 'analysed', described and suitable precautions explained. The easiest way to do this is by using a table with columns appropriately headed. Candidates should be given practice in creating such tables though the use of one as a template/writing frame is forbidden. If a task is inherently 'low risk' then this should be explained as part of the risk assessment. This is preferable to describing imaginary risks purely to gain credit.

Centres too often gave high marks to candidates who merely described standard laboratory rules such as putting stools under desks. No more than two marks are available if no consideration is given to the hazards of the particular task being undertaken. For the highest marks candidates should describe the hazard, state what harm it may cause and explain how it may be avoided.

**Processing Data:**

As in previous specifications, the skill quality involves the drawing of graphs and the manipulation of mathematical data. Graphs should be of sufficient size (at least half of an A4 sheet) the graph itself should be this size not the area covered by the axes/grid. Axes should be correctly labelled with quantity and unit and should have appropriate scales. The best fit line or curve should be appropriate to the distribution of the points and to the task concerned. Mathematical techniques include averaging and the techniques involved in deciding upon an appropriate scale for the axes. Graphing techniques can only count as one of the mathematical techniques for the purposes of the criteria.

This skill was marked reasonably accurately by most centres though there was a tendency to give too much credit to small untidy graphs.

Some centres tried to create an artificial situation which provided candidates with the opportunity to undertake some 'complex mathematical processing'. This is not necessary, though for the highest marks candidates should show 'an appropriate treatment of the level of uncertainty of data'. The use of range bars is probably the easiest way of doing this, though there are alternatives.

**Analysing and Interpreting:**

The questions in Part 3 guide candidates as to what is required in terms of describing trends and comparing with secondary data. However, the discriminators in this skill quality are linking the trend to the data and using science in their interpretation of the data. There is not a great deal of space in the 'answer booklet' and candidates should be encouraged to use additional sheets where necessary. Some of the points covered in the criteria may have been dealt with in the answers to questions 4 and 5. Information given in these answers is worthy of credit for this skill quality too.

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This skill quality was marked reasonably accurately. In some cases, marks given were too low as centres had not taken into account correct information given in the answers to later questions. For example 'data/information evaluated' and level of uncertainty of evidence analysed' are more likely to appear in the answer to question 4. The second of these two is probably best approached by a discussion of the information revealed by range bars.

If candidates have used the results from another group as a comparator for their secondary data, a copy of the data used should be included in the sample of work sent for moderation. This should be clearly labelled secondary data to avoid any confusion.

**Evaluating:**

Evaluation must address both data and method. The evaluation of the management of risk receives no credit in this skill quality; it contributes to the mark for 'management of risk'. Information worthy of credit may also be found in the answers to questions 2, 3 and 5.

QWC (in particular the use of technical terms) is also assessed as part of this skill quality and candidates should be instructed on the appropriate scientific vocabulary to use in describing the quality of their data.

Candidates should be advised to first consider the quality of their data and then how the strengths and weaknesses of their method affected it. It is important for them to address any ways in which the method could be improved. Many candidates stated that their data was good/accurate when a cursory examination of the graph clearly showed it was not. A common misconception seems to be that 'my data is good because I obtained it myself'. This implies that they think primary data is always better than secondary data.

**Justifying a Conclusion:**

The main discriminator in this skill quality is the way fully understood science is linked to the conclusion given. The conclusion should be linked to the hypothesis, to the data from the practical investigation and to the information obtained during research.

Candidates usually managed a link with the hypothesis but fell down by failing to comprehend what was implied by 'Explain your answer'. This explanation should involve a scientific account of why the trend observed occurs. To explain this fully additional sheets may well be required. Question 6 additionally requires that candidates answer a further question which links back to the notes which they made from their research.

Good answers to these questions were rare and candidates clearly need to be instructed regarding the depth of treatment required.

**Next Year: Additional Science and Separate Sciences**

The Controlled Assessment for Additional Science and Separate Sciences is very similar to that for Science. The only difference is that candidates must generate their own hypothesis to explain facts given in the Part 2 stimulus sheet.

The writing of hypotheses does not come naturally and candidates should be given some practice. A hypothesis should be testable by means of the investigation which they will subsequently plan. It is not necessary that every hypothesis which they generate in practice be tested. It is a better for them to attempt a number as a stand-alone exercises and then be given feedback on their suitability. The exemplar tasks on the OCR website should provide some suitable scenarios. Centres could also devise their own.



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