GCSE

# Science B

# OCR Report to Centres

# June 2013

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**General Certificate of Secondary Education**

**Gateway Science B (J261)**

**OCR REPORT TO CENTRES**

# Overview

Following on from the first sitting of B711/01 and B711/02 in January 2012 and the subsequent unit 2 papers in June 2012, all papers were taken for the third 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. Many candidates requested extra sheets to answer these questions. Candidates should be told that it is acceptable to use any space left **on the same page** to complete their answers rather than write one or two words on an additional sheet.

The 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 should 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.

Candidates generally performed well on calculation questions which did not require a change of unit. 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. Questions involving the use of standard form or where units needed to be converted e.g. kilometres to metres were less well answered.

The writing of chemical formulae and equations was generally well done except where it was necessary to recall or work out an uncommon formula e.g. sodium sulfate. The use of correct case and subscript was generally done well.

Centres have had another year's experience of the controlled assessment and candidates' performance on this aspect of the course has improved. The thresholds have been raised slightly with 38 marks required for grade A, 29 for grade C and 15 for grade F.

# B711/01 Foundation Tier

**General Comments:**

- In general the paper was balanced and accessible to all candidates.
  Few candidates failed to complete the paper, although there were a significant number of candidates who failed to answer a variety of questions throughout the paper.
- Answers, in the main, were appropriate to the question and there was little evidence of guessing taking. Questions which tested the quality of written communication sometimes lacked development by candidates. This often limited the access to the higher marks in this type of question. The question on types of combustion were not well answered.
- No artistic embellishments were observed indicating that the candidates were 'on task' throughout the session.
- The rubric of most questions was interpreted correctly.
- Candidates continue to find difficulty in questions which test the candidates' ability to apply their knowledge and understanding. Most candidates were able to apply their knowledge of the skin as a barrier to explain why damaged skin needs to repair quickly. Very few candidates were able to balance a symbol equation for nitrogen monoxide reacting with oxygen. Some candidates wrote the word equation whilst others just copied the equation in the question. Many candidates could calculate percentages in Q.3(bii) and wave speed in Q.12(b).
- Candidates, as in previous exam series', need to be more aware of making comparisons to avoid losing marks. Candidates should also be more alert to applying their knowledge to given situations in questions.

**Comments on Individual Questions:**

**Module B1**

**1(a)** Whilst many candidates gave the correct answer there was quite a number of apparently random numbers.

**(b)** The majority of candidates gained the identification of gender mark but were often too vague to gain the mark for the idea of putting the male and female together. The idea of testing for general health was common but needed to be more specific and linked to genetic disorders to gain credit. A few candidates gained the inbreeding mark but this exact term was rarely used and the answers tended to be of the related or family variety.

**(c)** Many gained a mark for wide field of view or able to see all around. The term 'monocular vision' did not appear to be widely known but most candidates gained the 'avoiding predator' mark.

**2(a)** The correct answer of pancreas was common. Oesophagus was also frequently seen.

**(b)** Many candidates focused their responses on using information about healthy diets, but less specifically related to diabetes. About a third mentioned insulin, fewer linked this to blood sugar levels, and most said it was caused by too much fatty food. The use of the food pyramid was poorly explained with very few candidates relating the size of the boxes specifically to the amounts of different foods. There was also some confusion between 'hypo' and 'hyper' effects which led some candidates to say that (all) diabetics needed to have more sugar.

**2(c)** Many appeared to confuse the job of the retina with the iris or lens, with many responses describing the job of the retina as controlling the amount of light entering the eye or the ability to focus on near or far objects. Creditable answers seemed to be related to colours or detecting light. Many answered in insufficient terms of just being able to see.

**3(a)** The correct response of B was probably the most common option, but responses of A and then C were also frequently seen.

**(b)** **(i)** This was well answered by most candidates.

**(ii)** Many candidates did get 75% but there was very little working shown, so it was hard to know what candidates were calculating – or to give 1 mark. 70%, 80% and 85% were the most frequent incorrect responses.

**(iii)** A small number of candidates scored a mark for this question. The question asked them to use their answer for part (ii) which seemed to stop candidates looking at the 65% in the question, so they ignored the lower end of the range and as a consequence their evaluation did not identify a need to intensify the training.

**4(a)** Most candidates knew that athlete's foot is a fungal infection. Occasional incorrect responses of bacteria or virus were seen. Some candidates incorrectly wrote about sweaty socks or wearing other people's socks/shoes.

**(b)** Most candidates got at least one of the marks with many gaining both. Non-creditworthy responses included reference to 'strength' or 'legality'.

**(c)** Most candidates gained at least one mark. Where they didn't, it was often because they were describing the athlete's foot infection spreading as opposed to a secondary infection getting in through the damaged skin.

**Module C1**

**5(a)** Candidates were good at matching food additives to their jobs.

**(b)** Many candidates just repeated information from the question so did not gain credit. Very few responses stated that either a gas or carbon dioxide was being given off, or that it was irreversible.

**6(a)** Most candidates got the mark, but there was also a few gases named that weren't in the table.

**(b)** **(i)** Many knew that cars and factories produced CO, but a large number said that there were more people or more pollution in the city centre which did not gain credit.

**(ii)** Frequently candidates did not make comparisons and just quoted the figures given in the table.

**(c)** Most candidates mentioned sulfur dioxide, some hydrogen sulfide, and a few candidates had difficulty clearly expressing the comparison.

**(d)** Only a few candidates were able to balance the symbol equation. Some candidates gave word equations.

**7** Complete and incomplete combustion were not well understood. Where marks were awarded, it tended to be for knowledge of the products carbon dioxide or carbon monoxide. Many candidates wrote about the amount of hydrogen and carbon atoms involved or oxygen going in for one and out for the other, or combustion without oxygen.

**8(a)** Many gained credit for rotting or decay. There were a significant number that appeared to associate the term 'biodegradable' with re-use or recycling.

**(b)** Creditworthy answers tended to centre on the idea of information for others or checking. Many of the candidates appeared to confuse 'chemist' with 'pharmacy'.

**(c)** A few correctly named the polymer. There were a number of no response answers and 'polythene' and 'chloroethene' were common responses.

**(d)** Most gained credit here.

**9** The properties of perfumes were very well understood.

**Module P1**

**10(a) (i)** When candidates did provide a response, reflection was often given.

**(a) (ii)** Most candidates did understand the term reflection. Bouncing off was also seen but not credited.

**(b)** Where credit was given, it was often for bright. Most candidates referred to how lasers were safe, colourful or looked good.

**(c) (i)** Most candidates were credited with the 'on – off' mark'. Lack of clarity of expression often stopped candidates getting the second mark.

**(ii)** Few got this correct. Candidate responses mainly concentrated on cost or speed of transmission.

**11** Most received credit for the times but often the reason given was just 'if you double the thickness you double the time'. Common misconceptions were that doubling the thickness of the pizza means that you double the depth of penetration of microwaves or it increases the percentage of fat/water. Very few responses contained the idea of conduction. A number of candidates gave time without making any reference as to the method of cooking.

**12(a)** Many candidates could identify wavelength.

**(b)** Calculation of wave speed was comfortably answered by most candidates.

**(c) (i)** Most candidates were in tolerance when attempted. Those that calculated 12(b) incorrectly went on to plot 'their point' correctly.

**(ii)** This question was usually done well. Occasionally candidates referred to wavelength rather than wave speed.

**(iii)** Candidates gave a wide range of responses, many were just outside the tolerance.

**13(a)** This question was well done, with visible light the only other response given.

**(b)** Most candidates got at least one mark. Some candidates referred to the test having been repeated so it was fair/reliable, or identified one test result as being the best.

**(c)** Some candidates knew about recording on a seismometer and many were credited for ideas about warning people about the tsunami. A number of candidates' responses were in terms of how tectonic plates caused earthquakes.

# B711/02 Higher Tier

**General comments**

Most candidates had been entered for the correct tier but a few would have benefited from being entered for the foundation tier as they had a significant number of no responses throughout the paper. The use of standard form was considerably better than in the June 2012 paper. The How Science Works questions were well answered with candidates often describing several examples of why scientists publish their work and giving suggestions about how the confidence of conclusions can be increased.

Candidates used their knowledge and skills appropriately to respond to the questions that involved interpreting graphs and diagrams and using information from tables. These included the diabetic food pyramid, percentage saturation of blood, properties of polymers and the time taken for skin to burn using a new sunscreen. The level of response questions differentiated well with the majority of candidates attempting them. Candidates also used their knowledge and skills to answer questions involving data and the interpretation of data. These included questions about calculating ratios from a table showing the numbers of cases and numbers of deaths for different types of cancer, information about different fractions to estimate the boiling point of an alkane with the formula $C_{11}H_{24}$ and information about different methods of heating a pizza to estimate cooking time using infrared and microwave. Candidates used their skills to answer questions requiring an explanation or a suggestion to new situations. These included the treatment of a patient with 100 per cent oxygen at high pressure and the function of the de-multiplexer.

**Comments on individual questions**

**Section A – Module B1**

**1(a)** **(i)** Most candidates gained the mark by identifying the number of pairs of chromosomes.

**(a)** **(ii)** Most candidates gave the sex chromosomes of a human male as being XY. A few candidates gave the sex chromosomes of a human female, XX or simply wrote gametes or sperm.

**(b)** Candidates that gave a clear genetic diagram using XX and XY often scored both of the marks available from their diagram. Candidates were usually able to identify the parent genotypes but had more difficulty with the identification of all four offspring genotypes.

**(c)** Candidates had good knowledge of the term 'monocular vision' or were able to describe the positioning of the eyes on the head of the macaw. Some candidates had difficulty explaining how the images produced from monocular vision caused the poor judgement of distance.

**2(a)** To gain the mark for this question, candidates needed to give the answer 'blood sugar level'. Many candidates gave the answer of sugar level and a few gave the name of the hormone involved, insulin.

**(b)** This question differentiated well. Candidates achieved higher marks when they linked the information in the food pyramid with their knowledge about type 1 diabetes. Good answers included information about the size and content of the different food groups in the pyramid and about the use of insulin injections to manage type 1 diabetes. A few candidates wrote about type 2 diabetes but most candidates were able to describe the usefulness of the pyramid for people suffering from diabetes.

**(c)** To gain marks for this question candidates needed to know the function of the retina. Candidates who wrote about receptors or rods or cones often went on to describe how they were used to detect light and colour. Many candidates thought the retina was used to control the amount of light entering the eye or to refract or focus the light.

**3(a)** **(i)** Most candidates were able to explain that reducing or stopping smoking was a lifestyle change that would reduce their risk of lung cancer. Some candidates identified smoking but failed to describe a lifestyle change. Few candidates were able to gain the second mark available and many just wrote about more exercise, less alcohol and good diet as ways to be healthy in general rather than relating these to reducing their risk of lung cancer.

   **(ii)** Most candidates were able to calculate the ratio between cases and death for thyroid cancer in both males and females. The most common answers were 558:138 and 1596:216. A number of candidates were also able to give the ratios in their simplest form.

   **(iii)** This was a challenging question. Candidates needed to use the ratios from part (ii) to explain that males are more at risk of dying from thyroid cancer. When candidates did not gain the mark it was because they stated that males were more at risk but failed to explain how the ratio showed this.

**(b)** Candidates who used the information to describe that a new way of thinking is required to explain the results or that these results were being used to develop new lines of research usually gained one of the marks available. Many candidates just copied sentences from the article and so did not gain marks.

**4(a)** Most candidates gave the answer of 2 hours. A few candidates used the graph to find the relevant times but failed to calculate the difference.

**(b)** This was a challenging question. Most candidates were able to state that the oxygen will replace the carbon monoxide. However, they failed to explain this in terms of haemoglobin or the formation of oxyhaemoglobin. A few candidates muddled carbon monoxide with carbon dioxide.


**Section B – Module C1**

**5(a)** Most candidates estimated the boiling point of the alkane between 160 oC and 180oC. Some candidates just gave the range from the table of 160 – 250oC.

**(b)** Most candidates were able to explain that petrol has a smaller molecular size or that it has fewer carbon atoms per molecule. Only a few candidates also linked this to weaker intermolecular forces.

**(c)** This was a challenging question. Candidates that used a specific example from the table to describe how large molecules in low demand can be cracked to give small molecules in high demand usually gained both marks. Many candidates just wrote about low and high demand but failed to link this to the size of the molecules. Some candidates explained what cracking was without using the information in the table. A few candidates confused cracking and fractional distillation.

**6(a)** Most candidates were able to identify sulfur dioxide. A few candidates did not gain the second mark because they just quoted the figures from the table and did not write a comparative statement about the relative concentration in the air near a volcano compared to that in a city centre. A few candidates also gave the answer of hydrogen sulfide as a cause of acid rain.

**(b)** Most candidates were able to write a correct symbol equation for this reaction. Almost half of these candidates were also able to balance the equation. Very few candidates had errors of case or subscript.

**7** This question differentiated well. Most candidates were able to give a disadvantage for incomplete combustion. Many candidates attempted the word equations. To gain higher marks candidates needed to write symbol equations for complete and incomplete combustion. Good candidates attempted these equations but had difficulty balancing at least one of them.

**8(a)** Candidates tended to give answers about the new type of polymer being biodegradable or soluble in water, a repeat of the question. Many gave answers about the new polymers being eco-friendly and only a few candidates were able to link the properties to the idea that less land-fill sites would be required.

**(b)** Most candidates were able to explain that this polymer was not a hydrocarbon because it contained oxygen.

**(c)** This How Science Works question was well answered by candidates. They were able to explain why it was important for chemists to publish their results. The most common answers were to check the results and so that other scientists can use the results for further work. Some candidate linked this to the new type of polymer mentioned at the beginning of the question.

**(d)** Most candidate were able to explain that being colourless allowed the driver to see through the windshield. A number of candidates confused the properties of hardness and strength or thought that high density was important. A few candidates just listed the properties and did not explain why they were important.

**9(a)** Most candidates were able to label the hydrophobic and hydrophilic ends of the emulsifier or describe them in their answer. Fewer candidates then went on to describe that the hydrophobic end is bonded to oil and the hydrophilic end is bonded to water. Many candidates just described the ends in terms of 'water hating' and 'water loving'.

**(b)** Most candidates explained that a potato is easier to digest if it is cooked because it is softer. Good answers included the idea that cooking breaks down cell walls and that this then allows the starch inside the cell to swell.

## Section C – Module P1

**10(a) (i)** Good answers to this question about refraction explained that there was a change in speed or that the materials had different (optical) densities. Some candidates described reflection rather than refraction.

**(ii)** Most candidates were able to draw a correct ray diagram. Some candidates failed to complete the last reflection to Alex.

**(b)** To gain the marks for this question, candidates needed to explain the meaning of the words intense and coherent. Good answers included the waves being in phase and the ray having a low divergence or being a narrow beam. Many candidates gave a general statement about lasers but failed to explain the meaning of the words.

**(c) (i)** Most candidates explained that the code could be sent using flashing light. Some candidates then went on to explain how the code could be sent by using different length pulses of light. Good answers included specific examples of the letters in the code or that dots were short pulses of light and dashes were long pulses of light.

**(ii)** Candidates found this question challenging and many thought it would be quicker. Good answers tended to explain the advantage in terms of longer distances possible, multiplexing or less interference.

**(d)** Good answers often described the function of the multiplexer first and then concluded that the de-multiplexer must be the separation of the signals. Some candidates thought that the de-multiplexer joined the signals together.

**11** This question differentiated well. Most candidates were able to estimate the time using infrared radiation and microwaves, with 10 minutes and 3 minutes the most usual estimates. Many candidates then went on to give simple reasons in terms of size or depth of pizza and the different methods of cooking using infrared radiation and microwaves. Good answers also included correct references to conduction and the fact the length of time for microwave cooking is influenced by the increased amount of fat or water in the larger pizza.

**12(a)** This question was challenging. Good answers showed the correct use of standard form. Some candidates quoted their answers to an incorrect power of ten but still gained two marks for the correct equation and partial working. Some candidates correctly used the equation to divide the wave speed by the wavelength but failed to perform the calculation.

**(b)** **(i)** Good answers explained that frequency increases as energy increases. A few candidates were unable to understand standard form and so did not gain this mark.

**(ii)** This question was challenging. Good answers clearly linked the wavelength to the frequency and then to the energy and potential danger. The majority of candidates failed to make these links.

**13(a)** **(i)** Good answers included a comparison about the darker skin containing more melanin compared to the lighter skin or the darker skin being able to absorb more ultraviolet radiation than the lighter skin. Some candidates understood the reason for the reduced cancer risk but failed to give a comparative answer. A few candidates thought that darker skin offers less protection.

**(a)** **(ii)** Most candidates identified **C** as being the conflicting evidence and some then went on to explain that this test would need to be repeated to increase the confidence of the conclusion. Some candidates wrote about a general description involving fair testing and so did not gain the second mark.

**(b)** Good answers included details about more radiation reaching Earth and so an increased risk of skin cancer. Some candidates only explained the danger of ultraviolet radiation and did not give answers in terms of the consequences of a depleted ozone layer.

# B712/01 Foundation Tier

**General Comments**

The paper performed well with all questions scoring. The mean mark was down slightly compared with last summer and a standard deviation which was similar to last summer. Centres should be congratulated on their correct targeting of entries for this paper.

**Section A**

**1**     This question was about food webs.

**(a)**     About one third of candidates correctly named a producer. A significant number of candidates incorrectly gave sunlight as the answer.

**(b)**     Several candidates stated that the energy passed through named animals in the chain. This was credited with 1 mark but to gain full marks candidates had to correctly name an organism and state it was **eaten** by another correctly named organism and continue for at least 2 stages of the chain.

**(c)**     Approximately three quarters of candidates correctly identified the dragonfly as an insect.

**(d)**     Very few candidates answered this question correctly. They did not realise that the dead platypus joined the dead animals in the web. The majority thought that it turned into bacteria and described the original web. Examiners were looking for two ideas – eaten by mayfly larvae, freshwater shrimp or freshwater snail, decomposed by bacteria or the idea that the elements are returned as nutrients to the ground.

**2**     This question was about binocular and monocular vision.

**(a)**     The majority of candidates were able to calculate the mean and came to the conclusion that two eyes are better than one for judging distance.

**(b)**     Approximately half the candidates stated that everyone's eyes could be different or stated that you should test more than one person but few gave both answers.

**3**     This was a level of response question concerning lemurs in Madagascar.

**(a)**     This proved to be a challenging question for most candidates. The question asked about advantages and disadvantages *to the people of Madagascar.* A significant number of candidates wrote about advantages to the lemurs. These generally scored 2 marks. Few candidates scored full marks – to achieve this they needed to identify advantages and disadvantages and fully explain one of them.

**(b)**     The majority of candidates were able to state why species become endangered, the most common correct answer was hunting.

**(c)**     Few candidates gave a correct definition of species. The crucial point, missing from most answers, was that they produce fertile young. In part cii most candidates knew that the idea of natural selection was developed by Darwin.

**4**     This question was about predators and prey.

**(a)**     The majority of candidates gave 1980 as the year when the wolf population was highest. Candidates were then asked to **explain** the change in moose population. A large

proportion of candidates described the change in moose population and failed to score. Examiners were looking for the link between rising moose numbers and falling wolf numbers and then some explanation as to why this should happen for example less moose being eaten.

**(b)** Candidates were asked to explain how the moose was adapted to avoid being eaten. There were 3 marks for this question and three explanations were expected for full marks. In order to score, each adaptation had to have an explanation; for example large antlers to help them fight off wolves. Several candidates only gave the adaptations and therefore failed to score.

**Section B**

**5** This question was about neutralisation.

**(a)** About one third of candidates were able to give the correct colours for litmus in acid and alkaline solution, of the rest approximately half gave one of the colours correctly.

**(b)** The word equation proved difficult with only a minority of candidates correctly giving the product as potassium nitrate.

**(c)** Most candidates were able to give a reason why scientists work is reviewed by other scientists but few gave two reasons. This is another case where candidates should adjust the number of responses they give to the number of marks on offer in the question.

**6** This question was about metals and alloys.

**(a)** Marks for this question were spread evenly across all marks. For each property examiners expected candidates to compare tin and lead to solder. To score full marks 3 of the 4 properties mentioned had to be used. Candidates were able to answer this question but failed to gain full marks by (i) describing less than 3 properties and (ii) comparing solder to either tin or lead but not both.

**(b)** Few candidates were able to answer this question correctly. Solder was the correct answer with a reason that it had a low melting point. Many candidates went for either silver or copper because of their conductivity.

**(c)** Just over half the candidates chose aluminium for aircraft bodies and gave one or more correct reasons. All properties were chosen but examiners were looking for low density and low cost.

**7** This question was about industrial processes.

**(a)** About half the candidates correctly calculated the percentage as 50% but significantly less could give a correct explanation for the percentage being so high.

**(b)** This part produced few correct answers.. Examiners were looking for ideas that steam is easy to make and made from water. Or the reverse argument ethene is difficult to make and is made from oil which is expensive.

**(c)** The majority of candidates were able to describe the meaning of reversible reaction.

**8** This question was a level of response question on fertilisers.

About three quarters of candidates scored on this question. The majority of candidates stated that fertilisers make plants grow, this was not enough to gain credit and as in previous years the candidates must say to grow more, or larger, or quicker, or to improve

yield. The disadvantages of fertilisers were well known, with eutrophication being described particularly well by candidates. Less well known was how fertilisers work. Examiners were looking for ideas such as: dissolve in water, absorbed through the roots, provide essential elements to the plant. Poor answers about the working of fertilisers meant that few candidates reached the higher level 3 mark.

**Section C**

**9**     This question was about electrical generation.

**(a)**   This question was poorly answered. When a similar question was asked in the past candidates made similar errors. Examiners were looking for a simple circuit connecting the wire to the ammeter for 1 mark with a second mark for some sort of relative motion between the wire and the magnet. The question stated 'your answer must include a diagram'. Candidates who did not include a diagram scored a maximum of 1 mark on this question. The most common error was to connect the magnet in series with the ammeter and wire.

**(b)**   Very few candidates could correctly state that AC means alternating current.

**(c)**   This question was testing two points of the specification, efficiency and, in the mathematical requirements, significant figures. Working marks for 400/900: 40000/900; 46.7 or an incorrect correction to 46 all scored 1 mark. Only the correct answer of 47(%) scored 2. In the second part examiners were looking for a statement such as less energy is wasted but this was rarely seen. Candidates often stated less steam is wasted.

**10**    This was a six mark level of response question in fuel for power stations.

**(a)**   Candidates were asked to use information provided to discuss the advantages and disadvantages of different types of fuel for a remote power station by the sea. The majority of candidates scored level 2 with several candidates scoring all 6 marks. Many candidates did not make full use of all the information in the question and few linked the location to advantages or disadvantages. For example; being remote, new roads and rail links may be needed. In order to score level 3 they were required to choose a source, several candidates did not do this and so were restricted to a maximum of 4 marks.

**(b)**   The majority of candidates were able to provide different opinions about the construction of a wind farm.

**11**    This question was about nuclear radiations.

**(a)**   Most candidates correctly completed the diagram showing the stopping of radiation or one of the radiations. The most common error in completing the full diagram correctly was to take the alpha ray through the aluminium to the paper absorber.

**(b)**   Only a quarter of candidates were able to give a correct use for nuclear radiation. The most common correct answer was to treat cancer. The most common misunderstanding was to generate energy in a nuclear power station.

**12**    This question was about the universe. Candidates found this question straight forward .

**(a)**   Examiners were looking for a large number of stars.

**(b)**   Examiners were looking for the idea that it was a long way for the radio waves to travel. Any answer that indicated a long way was accepted even though some of them were too large a distance (several light years away) or too short a distance (thousands of miles away).

**(c)** The composition of an asteroid was well known but the consequence of a collision with a large asteroid was less well known.

**13** This question was about electricity.

**(a)** Most candidates gave a correct reason for the fire costing the most to use each hour.

**(b)** proved difficult for all but the best candidates. At foundation level candidates were only expected to use the equation power = voltage x current. Applying this to the mains gives a maximum power or 6900W. The total power of the appliances only add to 6000W so all four appliances can be used at once.

## Section D

This was the data section.

**14** This question is about the effect of alcohol on driving ability.

**(a)** The majority of candidates chose Lucy which was correct but failed to say she had the largest **increase** in reaction time or stopping distance. The most common mistake was to state she had the slowest reaction time which was incorrect. In part (ii) few candidates were able to describe how to make the test fair and often repeated the question by saying make sure they all had the same amount to drink. Candidates could have given many different correct responses, a full list is given in the published mark scheme but some of the more common ones were travel at the same speed, use the same car, same road conditions etc.

**(b)** About half the candidates plotted the graph correctly and drew a straight line. The extrapolated line gave a time for part ii of between 8.3 and 9 hours. Candidates were allowed credit for their reading from an incorrect graph only if it had been continued to cross the time axis.

**(c)** Candidates were able to complete the table correctly but in part (ii) struggled to come up with a meaningful conclusion. The examiners were looking for a statement that said the figures appear to be the wrong way round or some other explanation such as road deaths depend on other factors or not all road deaths are caused by alcohol.

# B712/02 Higher Tier

**General Comments**

Many candidates had been well prepared for this new style paper, having learned from the experiences of B712/02 in June 2012. About 3000 candidates from the entry of over 35000 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 a conservation project to protect lemurs in Madagascar was targeted at grades C and D. The chemistry question concerned with eutrophication and the use of fertilisers was targeted at all the grades covered by the paper. The physics question which concerned the identification of types of radiation was targeted at all grades up to and including 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 attempted the data response questions in section D well. Very few omissions were seen except for those candidates who ran out of time. 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 of unit is required, e.g. watts to kilowatts, were less well answered. The writing of the chemical equation in question 4(b) was poorly answered. Candidates were required to recall or be able to work out the formula for sodium sulfate which proved a step too far for most.

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

**Comments on Individual Questions**

**Section A – Module B2**

**1(a) (i)** About two thirds of candidates scored the mark on this question. Those who failed to score usually inverted the pyramid or drew an irregular pyramid. A few pyramids were incorrectly labelled.

**(ii)** This question was very poorly answered with most candidates focusing on dry biomass only and not mentioning size and number. Candidates did not clearly express that biomass at each trophic level was the product of number of organisms and the average dry mass of the organism.

**(b)** This question was well answered by higher ability candidates. Many candidates gained one mark, usually for mentioning nitrates. Typically nitrogen-fixing and denitrifying bacteria were mentioned which failed to score.

**(c)** About a third of candidates scored the mark on this question. A number of candidates had interesting versions of platypus or ornithorhynchidae e.g. 'platipi' and 'ornithorhynchidipus' which did not score. 'Anatinus' was another common incorrect answer.

**(d)** This question was answered well with many candidates appreciating the importance of evolving or adapting to their environment or habitat.

**(e)** Only the best candidates scored marks on this question. Weaker candidates merely repeated the answer to 1(d). Many candidates stated that the echidna and platypus evolved to lay eggs rather than that the mammals did not evolve to have live young. Candidates were not often sufficiently precise to give the idea of geographical isolation, often just stating that the mammals lived on an island.

**2(a) (i)** The majority of candidates scored 2 marks for correctly calculating 22. A variety of other incorrect numbers were calculated and often it was not possible to tell how these numbers had been arrived at. A number of candidates omitted the question.

**(ii)** Many candidates did not appear to use the information in the table and just gave reasons coming from general knowledge. As a result, the cheetah was often given even when the calculations in part one had been correct. Candidates often referred to the thick fur of a cheetah. Candidates often thought that a large surface area to volume ratio was an advantage. Many answers did not link this ratio with heat loss. The weakest candidates often referred to penguin's huddling together for warmth.

**(b)** This question was not well answered except by the best candidates. Again the weakest answers talked about penguins huddling together for warmth. Candidates often muddled the artery and vein and the idea of heat transfer from warm blood to cold blood was often missing even from answers that scored two marks.

**3(a)** This question was common with the foundation paper. A number of candidates misinterpreted the question and focused on the lemurs rather than the people. Typically candidates wrote quite a lot and covered both advantages and disadvantages. A small number of candidates appeared not to understand the meaning of conservation. Candidates were more likely to refer to tourism, tour guides and collecting wood, rather than education and medicines. The question differentiated well across the ability range with most candidates scoring at level 2 or 3. Those candidates who only referred to lemurs rather than people were restricted to level 1.

**(b)** Candidates appear to have learned the definition of species and the question was well answered.

**(c) (i)** Most candidates scored at least one mark on this question. Frequently the first chain was calculated correctly but the second one had common errors of 4.2% or 5%. Some candidates got answers more than 100% but did not seem to realise that this was impossible.

**(ii)** Candidates often scored one mark but rarely scored two marks. Candidates either just referred to the percentage they had calculated rather than focusing on the significance of the percentage in terms of energy loss or just regurgitated the question. Very few candidates noted the energy losses at each trophic level due to the correctly named life processes.

## Section B – Module C2

**4(a)** This question was answered correctly by the majority of candidates. The correct answer was potassium nitrate, however, salt and nitric oxide were also offered.

**(b)** Candidates could not recall the formula of sodium sulfate and as a result could not write a balanced equation. Many of the equations presented were not balanced and had unusual formulae for sodium sulfate e.g. NaS and NaSO4.

**(c)** Most candidates scored at least one mark on this question and better candidates scored all three marks. Some candidates chose to answer only half the question. They either wrote about where the work could be published or wrote about why it is published. Incorrect answers commonly featured trying to describe the idea behind the experiment.

**5(a)** Most candidates selected aluminium and were able to support that choice with two correct properties. A common weakness was to refer to weight rather than density. A few candidates just concentrated on relative electrical conductivity and failed to write about another property.

**(b) (i)** Most candidates were able to make a sensible comment about each metal in terms of its suitability for making the electric cables. Again a number of candidates referred to weight rather than density. And some candidates only compared all three medals in terms of one property thus restricting themselves to 2 marks.

**(ii)** Copper and silver were the most popular answers presumably due to their better electrical conductivity. Many candidates failed to appreciate the importance of low density.

**6(a)** About a third of all candidates could correctly read off the graph. The most common incorrect answer was 72%. This was arrived at by reading off the line for 25atm rather than 200atm.

**(b)** This question was well answered with most candidates being able to interpret the graphs.

**(c)** Again this question was well answered. Where there was an incorrect response the candidates had usually ignored yield and answered in terms of rate of reaction.

**(d)** This question was targeted at grades up to A*. Only the best candidates scored two or three marks. Answers were often confused. Candidates tended not to focus firstly on the temperature and then on the pressure and as a result it was often impossible to determine whether the comments were related to temperature, pressure or both. Candidates often scored by stating that high pressure was either very expensive or potentially dangerous.

**7** Candidates often managed to get level 2 by appreciating the importance of an algal bloom. A number of candidates did not mention aerobic bacteria using up the oxygen in the water and so did not progress to level 3. Some candidates thought that fertilisers poisoned aquatic life and some that fertiliser formed a layer on the surface of the water. Weaker candidates thought that fertilisers killed bugs or weeds. When referring to the use of fertilisers, many candidates gave vague answers in terms of 'to make plants grow', 'to make better plants' or 'help plants grow'. Candidates often gave lengthy answers but perhaps should take more care to ensure that the information is presented in a clear and logical way and that all aspects of the question are addressed. The question discriminated well across the ability range.

**Section C – Module P2**

**8(a)** Most candidates scored at least one mark on this question with many scoring both. No pollution was the most common mark awarded. Many candidates related the question to wind farms rather than the context provided and so gave standard answers about wind farms. Weaker candidates wrote about noise and visual pollution.

**(b) (i)** Candidates found this calculation quite difficult and a variety of different answers and no responses were seen. Some candidates were confused by the large numbers involved. The mathematical understanding of dividing by a decimal fraction was challenging for many candidates who scored highly in the rest of the paper. However some candidates who did not achieve in the extended written answers did well on this question.

**(ii)** If part (i) had been attempted most candidates were able to show that the number from part (i) needed to be divided by 33000.

**(c)** Candidates found the cost calculation extremely demanding and often got confused with the powers of ten. Candidates often did not show clear working out which could be easily followed. There was significant confusion with converting £ to pence.

**9** Candidates found this question very challenging and many misinterpreted the question and thought that there were many different sources. Other candidates just gave the properties of gamma, alpha and beta radiation and were therefore restricted to level 1. The best answers were clearly explained in a logical way often giving reasons why each type of radiation was present or why it was not present. Many candidates did not appreciate that the source could be emitting more than one type of radiation and, as a result, once they had decided gamma was present decided that the other two could not be present and limited themselves to level 1. Most common scoring responses identified and described why the source was emitting gamma. Better candidates explained how alpha could be eliminated and only the highest ability candidates correctly used the data to deduce that the source also emitted beta radiation, gaining level 3.

**10(a)** Candidates could evaluate the data and the most popular answers referred to the supply time and the availability.

**(b)** Candidates often confused what would be an advantage to a homeowner and to the government. Typically candidates referred to 'free electricity' and to a reduction in pollution but did not qualify these answers in any detail.

**11(a) (i)** Just under half of all candidates could correctly identify a supernova. White giants, black dwarfs, neutron stars and nebulae were common incorrect answers.

**(ii)** Good answers mentioned gravity and subsequent processes as well. Weaker answers had the gas particles coming together but did not mention gravity.

**(b)** Most candidates scored one mark for galaxies moving away but failed to give comparative statements for the other two gaps in the sentences.

**12(a)** Candidates often explained the formation of the Moon rather than give evidence. Some candidates referred to the presence of craters. Other candidates referred to a lack of iron rather than a lack of an iron core. The idea that the density of the Moon is less than that of the Earth was not well known.

**(b)** The most common correct answers referred to craters or the extinction of the dinosaurs. Better candidates appreciated that some unusual elements have been discovered with some even naming iridium. Only a few candidates described sightings of asteroids.

**13(a)(i)** The most popular answer was 'Lucy' but weaker candidates did not refer to the greatest increase in reaction time or stopping distance. 'Mike' was the most popular incorrect answer. Significant numbers of candidates calculated the changes but, with the reaction time, often gave the answers as seconds rather than hundredths of seconds. This meant that although candidates understood the differences between individuals they did not use and interpret the data given correctly and failed to gain the second mark.

**(ii)** Many candidates did not appreciate that they had to make a comment about both stopping distance and reaction time and, as a result, few candidates were awarded 2 marks. Many candidates did not quote data at all. Calculations, when done in the table were usually quite accurate and acceptable. Some interesting answers compared Emily and Lucy who had the same reaction time and stopping distance before drinking.

**(iii)** Candidates were often able to suggest a reason for the differences, but some answers were vague rather than focusing on obvious differences such as gender, age and body mass. Weaker candidates simply restated the question saying that ' they reacted differently' which did not score.

**(b)** **(i)** Many candidates could choose a suitable scale and plot points. Errors in plotting were often due to a poor choice of scale. Many candidates did not go down to zero on the y-axis and this gave them problems for part (ii). Some candidates did not draw the line of best fit.

**(ii)** Candidates that had extended the y-axis to include zero almost always scored this mark. If the y-axis was discontinuous very few candidates scored the mark. The question clearly stated at the outset that the graph will be used to determine the time taken to remove all the alcohol from Jeff's blood.

**(c)** Many candidates assumed that there must be a link between legal alcohol limits and death rates and so did not look for evidence that there was not necessarily a link. Many candidates compared the data in the second column with the legal alcohol limit and failed to score. Better candidates realised the importance of using death rate rather than total number of deaths and gained 2 marks.

# B713

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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