OCR Report to Centres

January 2013

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General Certificate of Secondary Education

Gateway Science B (J261)

OCR REPORT TO CENTRES

Overview

Candidates are starting to come to terms with the new aspects of the examination when compared to the previous specification. These include 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 to analyse evidence, make reasoned judgements and draw conclusions based on evidence. The latter were assessed in detail 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.

The questions requiring knowledge of 'How Science Works' received variable responses. 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 are starting to come to terms 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 section D questions.

Candidates generally performed well on calculation questions on the higher tier papers. 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. Candidates continue to take care with the use of case and subscripts.

There was evidence, most noticeably on B712 papers but also on B711/02, of candidates running out of time and leaving the last few questions on the paper blank.

A number of candidates demonstrated misconceptions in the following areas: the effect of alcohol on the liver, recessive alleles, use of indicator species, the removal of carbon dioxide from air by photosynthesis, confusion between acid rain, global warming and ozone depletion, energy transfer along food chains, natural selection and what is meant by a genus. In chemistry the misconceptions included: how emulsion and oil paints dry, addition reactions of ethene, the number of atoms in a formula with brackets, the name of the salt given the names of the acid and base and how to neutralise an acid by titration. In physics common misconceptions included the meaning of frequency of a wave and calculating frequency given wavelength and speed, specific heat capacity, mechanism of heat transfer, how an IR remote control works, disposal of radioactive waste, big bang theory and red shift.

B711/01 Foundation Tier

The level of difficulty of the paper appeared to be appropriate for the ability range of the candidates, producing a good distribution of marks, covering almost the whole mark range available. In a large number of cases candidates answering two mark questions only gained one mark. They often neglected to give more than one idea in their answer. All candidates appeared to have had sufficient time to complete the paper, with the majority attempting most of the questions.

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

The majority of candidates had attempted all three levels of response questions. There was some evidence that candidates had been well prepared for the new style of questions. Responses at all three levels were seen.

Candidates found the questions that required mathematical skills difficult. Few candidates were able to calculate means or identify anomalies. However, it was evident that candidates could use the equations provided on page 2 of the examination paper, as many were able to calculate the speed of a wave.

Comments on Individual Questions:

Q1(a) The majority of candidates answered this question correctly.

Q1(b)(i) Most candidates successfully gained one mark for the idea of slower reactions; fewer, however, went on to explain that this might cause a crash.

Q1(b)(ii) Many candidates gained credit for realising that the amount drunk was above 4 units. The correct calculation of 4.45 units was rarely seen.

Q2(a) Very few candidates correctly calculated the mean without the anomaly. A few candidates included the original mean in their calculation, making their answer too high. Others forgot the decimal point and made the answer 42. Some gave an answer but it was not clear where it came from. Candidates should be encouraged to show their working as many calculators cause issues when they divide a total.

Q2(b) This question was successfully answered by most of the candidates. Very few scored zero.

Q2(c) Very few correct answers were seen. Iris and pupils were the most common incorrect answers.

Q2(d) Over half the candidates chose the correct answer.

Q3 The majority of candidates provided a Level 1 answer, either for a risk of high salt intake or some interpretation of the data. Very few linked the high blood pressure to heart disease or strokes. Many candidates included ideas about obesity or diabetes as they found it difficult to distinguish between a high salt diet and a diet high in fat or sugar.

Q4(a) The majority of candidates correctly identified diphtheria.

Q4(b) Most candidates were able to interpret the data correctly.

Q4(c) The majority of candidates gained one mark, normally for the idea that both pathogens were transferred by a mosquito. Many lost the second mark for not being specific enough. They could identify the fact that they were different pathogens but did not link the pathogen to the disease.

Q4(d) Most candidates scored at least one mark for either 'antibodies' or 'white blood cells.' The actual understanding of the process of the white blood cells producing antibodies and then going on to engulf the pathogen was not present in most cases. Candidates tend to refer to white blood cells 'fighting' or 'killing' the pathogen. These terms do not gain credit.

Q5(a) The majority of candidates could interpret the data to provide a correct answer in part (i). However fewer were able to recall the meaning of the term thermochromic to give a correct answer in part (ii).

Q5(b) Candidates got very confused with this question, with many failing to distinguish between binding agent and solvent. Many believed they did the same job and answered in terms of 'They....' followed by a single function. A popular answer for binding agent was to bind it all together. Popular answers for solvent were to make it waterproof, dissolve things or give it smell.

Q5(c) The most popular answer tended to be protect from rust; very few candidates went on to give a second reason and therefore only scored one mark.

Q6(a) This question differentiated well, with only the more able candidates gaining a mark. In many cases it was left blank or one of the names from the diagram was used.

Q6(b) The majority of candidates gained both marks for this question. Few wrong answers were seen.

Q6(c) Many candidates struggle with the concept of a non-renewable fuel. The most common answer is to incorrectly state that it cannot be used again.

Q6(d) Few candidates gained both marks. Common wrong answers were 12 and 26 respectively, which suggests that they simply counted the number of carbon and hydrogen atoms.

Q7(a) Candidates that scored marks tended to provide a Level 1 answer for identifying aspects of the different compounds. Few candidates could explain how to convert ethene into compound B. Those that attempted to do so confused polymerisation with cracking. A number of candidates also tried to explain how the diagrams could be changed ie the addition of brackets or adding 'n'. Many candidates also misidentified 'n' as nitrogen.

Q8(a) The majority of candidates successfully identified gas B.

Q8(b) Candidates were able to gather information from the table but were unable to express their answers clearly. They did not refer to the individual gases but instead stated that 'they reacted with marble'. Few candidates identified A as being alkaline as it had a high pH value. Many incorrectly referred to the effects on humans or the solubility in water.

Q8(c) Only the more able candidates were able to recall the function of a catalytic converter.

Q8(d)   About half of the candidates answered this correctly. Many used the correct words but put the symbols in the wrong place. Candidates should be discouraged from attempting symbol equations when the question asks for a word equation.

Q9(a)   More candidates were able to correctly measure the amplitude in part (i) then the wavelength in part (ii). The most common incorrect answer was a wavelength of 2cm or 8cm.

Q9(b)   Error carried forward from (a) (ii) enabled most candidates to gain both marks for calculating the speed.

Q10(a)   Few candidates could recall the seismometer. Richter scale and earthquake detector were common wrong answers.

Q10(b)   Many candidates scored one mark for either tsunami or collapsing buildings, but few gained both marks. A number of candidates referred to the shockwaves as causing the earthquake instead of the other way round.

Q10(c)   More candidates scored one mark rather than two, as they tended to only provide one idea. Many incorrectly thought he could spend more time in the sun by going in the shade.

Q11(a)   The majority of candidates successfully identified flask D.

Q11(b)   Candidates were more likely to give the incorrect answer of white than the correct answer of dull black.

Q12(a)   This question differentiated well, with answers at all levels being regularly seen. Some candidates failed to score marks as they spent all the money in one go, not realising the money was spread over six years. Some candidates suggested a plan by using the words 'then buy' but did not make it clear that the different methods had to be bought in different years. Only the more able candidates gave a full answer which included a calculation of pay back.

Q12(b)   This question was poorly answered, with few able to give a cohesive answer. Many referred to saving money but not on heating bills.

Q13(a)   This question provided opportunity for the more able candidates to demonstrate their understanding. There were very few that correctly calculated the amount of heat energy. Many forgot to multiply by 2 twice, either because they did not realise the mass was 2kg or that the temperature was 2 °C.

Q13(b)   The majority of candidates realised that more or hotter water would increase the amount of heat given out. Some, however, incorrectly suggested placing silver foil behind the radiator.

Q14(a)   About half the candidates correctly identified the digital signal.

Q14(b)   Very few candidates gave two correct ideas. Many confused infrared with microwaves. Candidates who suggested remote controls could not be awarded marks as this was in the question.

B711/02 Higher Tier

General Comments

It was clear that some candidates prepared well and were successful as a result. A significant number of candidates were entered for the incorrect tier (about 10%), which was evident from many omissions to questions from some candidates and lack of ability in answering the 6 mark questions. These candidates scored less than 15 marks. The 6 mark questions were marked using a level of response approach. Candidates attempted to answer the questions and therefore almost always gained some credit. Candidates need to address **all** aspects of the questions to gain access to the higher levels. Those questions addressing aspects of 'How Science Works' were better answered than in January 2012. Questions addressing Assessment Objective 2 (apply skills, knowledge and understanding of science in practical and other contexts) and Assessment Objective 3 (analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence) were also better answered than in January 2012. Candidates understood the need to quote evidence to support conclusions.

Candidates continue to perform well in calculations and more care was taken in this session with writing chemical formulae correctly (using the correct case and subscripts).

Overall, assistant examiners and team leaders felt that the question paper was appropriate to the ability range of intended candidates. There was limited evidence of lack of time, with only a small number of candidates failing to finish.

Comments on Individual Questions

Section A

Question 1

1(a)   Almost all candidates correctly answered this question and made a positive start.

1(b)   This question was well answered, with the majority of candidates correctly calculating 4.45 units. Those who were unable to perform the calculation correctly frequently scored 1 mark for recognising that their calculated figure 'adds up to more than 4'.

1(c)   Only the best candidates scored on this question. Many candidates mentioned that alcohol was toxic, which was insufficient to score.

Question 2

2(a)   Most candidates successfully attempted this calculation. Where the calculation was incorrect, this was often due to taking the means of the mean column rather than Diane's mean.

2(b)   Most candidates correctly identified a pattern related to either age or   gender. Better candidates noted both. Weaker candidates talked about later attempts being slower than the first attempt, but did not name specific individuals to support their suggestion.

2(c)   Just under half of candidates correctly stated 'retina'. A number of candidates gained credit for more detailed answers referring to rods and cones. Common misconceptions included 'iris', 'lens' and 'cornea'.

2(d)   Parts (i) and (ii) proved difficult for most candidates. In part (i) common answers referred to 'not dominant' and did not score. Many candidates made no reference to alleles. In part (ii), the commonest answer was 'a gene', which, again, was insufficient to score. Part (iii) was better answered with over half of candidates scoring the mark.

Question 3

3   This level of response question differentiated well. Only the best candidates gained Level 3. The question had a significant degree of complexity. Most candidates recognised that the light intensity was uneven through both filters and were able to score Level 1. In addition a correct evaluation of a conclusion gained Level 2. This was usually an observation that Carol's conclusion was correct because the plant was growing towards the light. Answers referring to control of variables or the need for the repeats were rare.

Question 4

4(a)   Just under half of candidates scored 1 mark on this question, usually for either a reference to mosquitoes laying their eggs or breeding in water or for there being fewer mosquitoes as a result. Better candidates scored both marks.

4(b)(i)   This proved to be a challenging question, with a wide range of possible correct answers. The most common was reference to active immunity making antibodies and passive immunity having antibodies injected.

4(b)(ii)   The mechanism of active immunisation was well understood by more   able candidates. Weaker answers lacked precision. For example, rather than stating that a harmless form of the pathogen is injected, weaker candidates would often refer to 'a harmless form of the disease injected'. Answers of this type usually scored 1 mark, as candidates usually went on to talk about the production of antibodies.

Section B

Question 5

5(a)   Both parts of this question were well answered by the majority of candidates.
5(b)   The mechanism of how emulsion and oil paints dry was not well understood. Answers frequently lacked precision or had other components of the paint, other than the solvent, evaporating. Oil paints drying by oxidation was seen only from the best candidates.

5(c)   This 'How Science Works' question was well answered, with the majority of candidates scoring both marks and demonstrating a good understanding of the ethical issues involved.

Question 6

6(a)   Most candidates correctly identified crude oil **A** in part (i). Part (ii) differentiated well, with the majority of candidates scoring at least 1 mark, usually for 'more petrol'. Better candidates entered into more depth, discussing transport costs and politically unstable countries and gaining 2 or even 3 marks.

6(b)   Just over half of candidates scored 1 or both marks on this question. Weaker candidates confused cracking with fractional distillation or   suggested that the fuel oil would be stored.

Question 7

7   This question differentiated well across the ability range. To gain Level 3, candidates needed to display their knowledge of chemistry to deduce information about all three compounds **and** suggest how ethene is converted into dibromoethane **and** poly(ethene). A number of candidates struggled to express themselves clearly and others thought that compounds **A** and **B** were alkanes. Two correct deductions **or** one conversion were required for Level 1. Deductions at this level were often 'ethene has a double bond'. Level 2 required three deductions **and** one conversion. The most common correct conversion was reacting ethene with bromine.

Question 8

8(a)   This question assessed Assessment Objective 3 (analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence). About two thirds of candidates scored marks on this question. It differentiated well. Most candidates initially discussed the action of the solutions of the gases on marble and/or steel. Less common was a discussion of the pH values of the different solutions.

8(b)   About a quarter of candidates scored 2 marks on this question. A number of candidates did not balance the equation and scored 1 mark. Changing the formulae was a common reason for scoring zero. Candidates paid good attention to case and subscript.

8(c)   Most candidates scored 1 or both marks on this question, usually for correct references to ozone depletion and/or global warming. Some confused the two ideas and lost marks.

Section C

Question 9

9(a)   About a fifth of candidates were able to state 80 waves per second and so scored this mark. Many merely stated '80 Hertz' or confused frequency with amplitude.

9(b)   About a third of candidates correctly stated 12cm in part (i). Common incorrect answers were '3', '6' and '24'. The calculation was attempted more successfully. Error was carried forward from part (i). The most common error was to multiply the wavelength and speed together.

Question 10

10(a)   This calculation was challenging. The rearrangement of the equation posed the greatest problem. 0.24kg scored 3 marks, a correct substitution scored 2 marks and, if the answer was incorrect, a recognition that the temperature change was 2^oC scored 1. Many candidates divided 2000 by 4200 and then multiplied the answer by 2, therefore stating 0.95 as their answer.

10(b)   Few candidates understood that the oil needed to enter at a higher temperature or that a higher flow rate was needed. Many stated that oil has a higher boiling point or referred to water rather than oil.

Question 11

11 This question differentiated well. Most candidates scored Level 1, with a minority scoring Levels 2 and 3. The key to the levels was in the degree of complexity used to describe heat transfer. At Level 1 a rudimentary description of heat loss, such as 'loft insulation reduces conduction', was sufficient. At Level 2, an explanation was required, eg air is a poor conductor and so reduces conduction. At Level 3 a particle level explanation was required, eg during conduction there is a transfer of kinetic energy between particles. The latter was only seen rarely. Few candidates recognised that energy is lost in other places than through the roof.

Question 12

12(a) This question was not well answered. Only the best candidates recognised that the signal is digital and that there is a code related to a specific channel. Most gave vague answers referring often to lasers or the IR sending a signal to the TV.

12(b) Most answers were vague, eg microwaves are stronger than IR, which did not score. The most commonly awarded mark was 'microwaves penetrate 1cm into the food'. The best candidates talked about microwaves being **absorbed** by fat or water molecules rather than cooking fat or water molecules. There were correct references to heat reaching the centre of the potato by conduction.

12(c) Just over half of candidates scored on this question. Many drew one reflection and did not then go on to draw the second. Common misconceptions were to draw the ray being refracted, or with clearly incorrect angles of reflection, or to have the ray exiting along the edge of the prism.

Question 13

13(a) Most candidates scored at least 1 mark on this question, showing an understanding of the difference between S-waves and P-waves.

13(b) Just under half of candidates scored this mark. '20' and '30' were the most common incorrect answers.

13(c) About a third of candidates scored this mark. Many candidates referred to the skin absorbing the sun or that dark skinned people could stay out longer with no explanation of why.

B712/01 Foundation Tier

The quality of the responses was significantly lower than that seen in June 2012. Many centres had entries in single figures, suggesting that most of the candidates were re-sitting this module.

Section A

Question 1
(a)(i) Approximately half of the candidates were able to correctly calculate the energy used for growth. Of those scoring in this part of the question, the majority gained both marks.
(a)(ii) Candidates were able to say that both used the same amount of energy for respiration and so were equally active, but far fewer were able to explain why Tom was correct.
b) Candidates did not realise that the larvae change into adult insects and few were able to state how they differed from the larvae. Examiners were looking for examples such as wings and legs.
c) Candidates generally scored 1/2 for this part. The choice of answers was evenly spread across the responses.

Question 2
Part (a) proved difficult for the majority of candidates, with many failing to answer the question. Many candidates described the changes that had occurred, but few used the theory of natural selection to explain how the modern penguin has evolved. Poor handwriting and language skills hindered many candidates in this question. Most candidates failed to progress beyond level 1. Part (b) was answered well, with the majority of candidates scoring at least one mark. Many candidates failed to read the question in part (c), which excluded streamline adaptations, and repeated those answers given in 2(a).

Question 3

This question was about gases in the atmosphere. Parts (a)(i) and (a)(ii) were answered the best. Most candidates knew that plants and animals put carbon dioxide into the atmosphere, but few knew that the process was respiration and not breathing. In part (a)(ii) candidates knew that plants took carbon dioxide out of the atmosphere but did not know it was called photosynthesis. Breathing was a common answer again e.g. plants breathe in carbon dioxide and breathe out oxygen. In part (b) few candidates knew that nitrogen was unreactive, with many candidates thinking it was poisonous. In (b)(ii) only a few candidates were able to identify nitrate or ammonium as the way nitrogen is taken in by plants.

Section B

Question 4

(a)(i) About a quarter of candidates correctly said the essential element was potassium.
(a)(ii) Few candidates mentioned essential elements. Whilst some candidates identified nitrogen and phosphorous, many more included hydrogen, sulphur or oxygen, which was incorrect. Candidates were able to identify a reason for using fertilisers, but often gave vague answers such as "to make them grow better", which were not credited. The ideas of quicker growth or increased crop yield were needed to score marks. Several candidates knew about run off into rivers, but a number thought that the runoff killed wildlife.
(c) Only about a fifth of candidates could identify the acid needed to make a sulfate. Few candidates knew how to test a solution to see if it was neutral.

Question 5

In part (a) most candidates knew the sign meant that the reaction could be reversed, although there was a wide variation of language used. In part (b) candidates were able to interpret the data accurately, but several erroneously said the catalyst did not affect the reaction, when they meant it did not affect the yield. Part (c) was not well answered. Examiners were looking for straight-forward answers such cost of chemicals, machinery, energy or staff.

Question 6

In part (a) few candidates knew what was meant by an alloy. In part (b) many candidates were not selective in the properties needed to make a railway carriage and copied down all of the properties in the table. Whilst many candidates were able to choose a metal with a reason, for example 'steel is the strongest', few went on to explain why this was important e.g. so the carriage could support the load, did not easily damage etc. The majority of candidates were at level 2. Where candidates had chosen inappropriate properties such as magnetic or good conductor, the lower mark in the level was awarded. In part 6(c) there were very few good answers to explain the advantages of recycling. Many concentrated on getting cheap spares to repair other carriages. This answer was excluded as the question clearly looked for answers other than cost.

Question 7

In part (a) only a minority of candidates were able to balance the equation correctly. In part (b) most candidates knew that hydrogen was needed to make ammonia. In part (c) most knew that chlorine was needed to make bleach.

Section C

Question 8

In part (a) the examiners were looking for direct current as the answer; however the most common answer was renewable. Part (b) produced good answers, with the majority of candidates doubling the area of the panels. Part (c) produced many vague answers which failed to score. Examiners were looking for ideas of wind turbines or some form of passive heating.

Question 9

About a quarter of the candidates were able to calculate the efficiency of the power station correctly as 0.375. For those working in percentages, examiners insisted on the % sign with the answer to score full marks. About half the candidates identified **B** as the most efficient power station as it produced 50J more than **A** from the same amount of coal.

Question 10

This question was targeted at grades C and D and differentiated well at this borderline. Some candidates produced good answers, realising that each waste needed to be considered for its activity, half life and the type of radiation. Others produced vague answers about putting them in lead containers, but gave no indication of how to dispose of them. In part (b) about half of candidates were able to reduce the risks in handling radioactive materials.

Question 11

This question was answered well by most candidates. In part (a) candidates identified the lamp as the appliance to use the least energy in one hour; however toaster was also a common answer. In part (b) most candidates realised that the cost depended on time, so for the same power, the one used for the longest time was the most expensive. Part (c) was straightforward for the majority of candidates who calculated the correct power of184W. Part (d) proved more difficult, with about a quarter of candidates realising that the appliance with the highest power has the largest current if the voltage is the same for each appliance.

Question 12

Few candidates knew that stars give off light because they are very hot. Many thought that they reflected light from the Sun. Most candidates answered part (b) correctly, realising that it was too cold to survive and that it was too far away so would take too long to get there. In part (c) candidates usually gave one correct effect - the most common being craters formed - but few gave two effects, which were needed to score full marks.

Section D

Question 13

Most candidates were able to give the correct value for carbon dioxide from the graph in part (a)(i). In part a(ii) few candidates correctly described the changes shown in the graph. Whilst one mark was given for an answer of went up, went down and then went up again, a more detailed answer in terms of the dates on the graph was needed for full marks. Candidates generally identified the link in that the carbon dioxide in the air and the temperature of the Earth went up together. More detail was needed for full marks. The most common response for the second mark was that the graphs followed the same pattern. Part (b)(i) had the highest correct response rate on the paper. Over four fifths of candidates correctly identified the three countries with the lowest emissions and went on to explain that they had the lowest populations. Candidates found part (b)(ii) difficult to answer and the question had a high omission rate. In part (b)(iii) candidates usually scored 1 mark for the idea that a small population produced a large amount of carbon dioxide, but some lacked the language skills necessary to explain fully.

B712/02 Higher Tier

General comments

This was the second time that this examination paper, having the data analysis and evaluation section D, was available to candidates. Candidates found this section quite difficult and sometimes relied on subject knowledge rather than evaluating and analysing the data provided.

There was evidence that some candidates did not have sufficient time to finish all of the examination paper and often parts of section D were incomplete.

A small proportion of candidates would have been better suited taking the Foundation Tier examination paper instead of the Higher Tier.

Most candidates answered the three six mark questions and sometimes needed extra additional answer sheets for all the information they wanted to include. Candidates often included irrelevant information in their answers and did not use the correct scientific terminology.

Candidates found Section B the least demanding section and found Section A the most demanding.

Centres should remind candidates of the importance of organising their answers to quantitative questions to allow the award of error carried forward marks. Candidates are also uncertain about the use of decimal places and significant figures.

Comments on Individual Questions:

Question One

This question focused on the gases in the atmosphere and was the least challenging question in Section A.

In (a)(i) many candidates appreciated that living organisms produced carbon dioxide but often did not name a process that made carbon dioxide. The mark scheme allowed respiration, decomposition or decay, but a significant number of candidates gave combustion that was described in the stem or breathing. Many candidates did not recognise photosynthesis in (a)(ii) and often just referred to the carbon cycle. A significant proportion of the candidates did not attempt this question.

Candidates in (b)(i) often mentioned acid rain, but many gave a vague description of the effects of acid rain. A significant proportion of candidates referred to ozone depletion rather than acid rain. It was not sufficient to refer to harm to plants, buildings or metals. Instead candidates needed to refer to corrosion of metals, erosion of buildings and killing plants. The term indicator species was rarely mentioned in (b)(ii) and the most common correct answer just referred to lichens. A significant proportion of the candidates did not attempt this question.

Question Two

This question focused on energy transfers within an ecosystem.

Candidates often got one of the percentages correct in (a) but found it much more difficult getting all three correct. Candidates need to round up or down correctly when quoting answers.

In (b) candidates rarely mentioned the loss of energy through respiration or movement and often gave answers such as insects only ate a little amount of plant or the birds did not get much from each insect. Many candidates did not attempt this question.

In (c) the best answers referred to not enough energy available to be transferred. Other candidates did not mention energy transfers at all and focused on the lack of predators of the birds of prey, with answers such as there are no animals to eat the birds of prey.

Question Three.

This question used the context of penguins to assess various aspects of the specification. Candidates found the whole of this question very challenging.

Candidates in (a) often focused on the differences between the two species rather than explaining how one evolved into the other species. To get more than level 1 (two marks) candidates had to give more than a general description of evolution and had to relate it to the two penguin species. Candidates often described three of the stages of evolution but they often failed to mention the passing of genes and also the length of time needed for evolution. The quality of written communication in this question was often quite good although candidates often did not use the technical terms variation and competition.

Most candidates could not give the correct genus in (b). Common misconceptions included giving vertebrates, birds or even mammals.

In (c) candidates often did not refer to the lack of predators after the extinction of the dinosaurs. A common misconception was that evolution had to be rapid to adapt to the new conditions on Earth. Hardly any candidate referred to the idea of more safe habitats.

In (d)(i) candidates often appreciated that both live in water but very seldom mentioned that they would have similar adaptations. The mark scheme required reference to DNA in (d)(ii) but most candidates did not give an answer that included DNA. Candidates often focused on the ability to produce fertile offspring instead.

Candidates found the application question about the counter current system in penguins very demanding and often did not attempt the question. Candidates very rarely mentioned warm blood transferring heat to cold blood. Many candidates confused arteries and veins.

Question Four

This question focused on the preparation and use of fertilisers.

In (a) almost all candidates were unable to calculate the correct number of atoms in the formula. Some candidates calculated the relative formula mass and others the number of elements in the compound.

Although some candidates gave calcium carbonate in (b), a significant proportion of candidates gave potassium sulfate instead.

In (c) many candidates appreciated that fertilisers could only be absorbed by plants if they were in solution. Candidates were not given credit for answers that did not refer to the absorption of the fertiliser. It was not sufficient to refer to fertilisers being soluble so they could move through the soil.

In (d)(i) some candidates appreciated that sulfuric acid was needed to prepare potassium sulfate, however other acids such as hydrochloric and nitric acid were also given as answers. Very few candidates could describe the experimental procedure used in (ii) and often candidates

did not attempt the question. The use of a burette or titration was seldom used by candidates and often mixing and evaporation was used.

In (e) candidates often appreciated that fertilisers could improve crop yields and cause eutrophication. However a large proportion of candidates did not state which would be the best outcome for the majority of people so were not awarded full credit for the question.

Question Five

This question focused on the large-scale manufacture of chemicals.

In (a) candidates were often able to interpret the data about percentage yield. A common error was to not refer to the direction of change e.g. changing the temperature increases the percentage yield. This type of answer was not given credit since it did not refer to the fact that as the temperature increases the percentage yield increases.

Candidates in (b) were often unable to explain how to reduce the cost of manufacturing hydrogen. It was not sufficient to refer to just using a catalyst without stating that this would speed up the reaction. In the same way automation was not sufficient on its own without mentioning that this would reduce the labour costs. A common misconception was to not use a catalyst since this would save the cost of the catalyst – these candidates did not appreciate the importance of having a high rate of reaction. A significant proportion of candidates did not attempt this question.

Question Six

Candidates often gave several advantages and disadvantages of both metals but did not select the relevant properties needed by a railway carriage. The best answers focused on density, corrosion and strength and did not mention magnetic properties, thermal or electrical conductivities. To get level 3 candidates had to make some decision about which metal would be best. The command word evaluate appeared in the questions and Centres should advise candidates that this implies that some form of final justified decision needs to be made.

Question Seven

This question focused on the electrolysis of aqueous sodium chloride and was the most challenging question in Section B

In (a) most candidates could not balance the equation. A common misconception was to change the formula or even leave some out.

Candidates often did not use the idea of OIL RIG in (b) and even if they did failed to link this with the correct electrode reaction. Common misconceptions involved the use of gain or loss of hydrogen or oxygen. Candidates had to be careful to refer to the reaction and not the actual electrode itself since the cathode supplies electrons which are taken up by the reaction.

Question Eight

This question focused on the theory of plate tectonics.

In (a) many candidates appreciated that a theory is often not accepted immediately because there is not sufficient evidence or that it takes time for peer review. A common answer that was not given credit was a reference to religion.

The best answers for (b) used a labelled diagram to explain subduction. A common error was to omit the reference to the difference in density between the two tectonic plates.

Question Nine

This question was about generating electricity.

In (a) many candidates were distracted by the diagram and gave answers that only referred to the use of steam to turn turbines. The best answers appreciated that there was relative movement between a coil and a magnet within the generator.

In (b) the most common answer was 0.28 rather than 28%, although both of these gained full credit in the mark scheme. Candidates found the use of standard form very difficult and did not write down the correct numbers or could not enter these numbers into their calculators. A significant proportion of the candidates did not attempt this question.

In (c) candidates had to refer to the efficiency of the power station rather than in the homes. A common misconception was to refer to making the steam useful rather than using the energy in the steam instead of wasting the energy.

Question Ten

This question focussed on photocells.

In (a) many candidates were not able to use ratios to calculate the area as 1500 cm^2. The most common answer was 3750 cm^3.

Candidates were able to use the data to show that one set of results supported or did not support the conclusion. Candidates found it much more difficult to explain that only some of the results supported the conclusion and that they had to use all of the data, not just one set.

Question Eleven

This question was about radioactivity.

The six mark question (a) was common with the Foundation Tier examination paper. Candidates often forgot to give a way of disposing of each type of radioactive waste. Where methods of disposal were given they were not always linked back to the type of radiation being emitted. As a result many candidates did not achieve L3. The most popular way of storing all three of the radioactive sources was to bury underground. A common misconception was to store in a glass container. Another misconception was that the radioactivity disappeared after the first half-life.

Candidates were often able to give uses for beta and gamma radiation in (b)(i) and (ii). The most popular answer was to measure the thickness of paper for beta and for cancer treatment for gamma. A common misconception was that gamma radiation was used for X-rays.

Question Twelve

This question was about comets and Near Earth Objects.

In (a) candidates often referred to gravity but did not always state that the force of gravity increased as the comet gets nearer to the Sun. A common misconception included reference to the heat of the Sun.

Candidates in (b) often gave vague and imprecise answers and did not specifically state that the NEOs had to be monitored and then destroyed or deflected by use of missiles. Some candidates thought NEOs were in the atmosphere and linked the question to ozone pollution or the greenhouse effect.

Question Thirteen

This question was about red shift. Candidates found this question the most challenging in Section C and often candidates did not attempt one or both of the part questions.

In (a) candidates had to clearly describe that the distant galaxies were moving away from the Earth or each other. Many candidates just referred to the universe expanding.

In (b) many candidates did not compare the speeds of the two galaxies but did link the distance from the Earth with the degree of red shift.

Question Fourteen

This question formed section D of the examination paper and did not require any subject knowledge.

In (a) candidates were often awarded one mark but did not give sufficient detail to get two marks. It was necessary to give the correct link between surface temperature and the levels of carbon dioxide in the atmosphere. The second marking point involved comparing the shapes of the two graphs. Some candidates only referred to one peak in both graphs and this was not sufficient to suggest that the pattern shown in both graphs was similar.

Some candidates could calculate the percentage in (b)(i) but often did not quote the value to one decimal place. The correct answer was 22.9% and candidates that wrote 23% were only given one mark rather than two.

In (b)(ii) candidates focused on the population and the carbon dioxide emissions and gave trends such as the greater the population the more carbon dioxide, or LEDC produced less carbon dioxide than MEDC. Candidates did not use the last column in the table to identify some trends or patterns.

Candidates found (c) quite challenging. It was not sufficient to just state the data from the table to be awarded marks. Candidates had to compare the factors between each gas e.g. carbon dioxide has the shortest lifetime but the greatest concentration and then make a comment about the overall contribution to the greenhouse effect. There was some evidence that candidates had run out of time and often candidates made very poor use of scientific terminology. Some candidates described the origin of the pollutants instead of using the data. Centres should advise candidates that questions in Section D do not require subject knowledge.