GCSE

Additional Science A

Twenty First Century Science Suite

General Certificate of Secondary Education **J242**

OCR Report to Centres

January 2013

Oxford Cambridge and RSA Examinations

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

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

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

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General Certificate of Secondary Education

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OCR REPORT TO CENTRES

Overview

The units assessed this session were A151 and A152. Note that this is the last time this specification will be assessed in a winter series; henceforth, assessments for this specification will be offered in the summer series only. Unit A153 will be assessed for the first time in summer 2013.

This is the second season for the new style of exam papers for Additional Science, and examiners have commented that candidates appear to be more comfortable with the six-mark free response questions. Six-mark questions which asked the candidates to make suggestions were better answered than questions which needed a greater level of recall. In this case the requirement to write at length exposed many misconceptions in candidates' basic knowledge – misconceptions that tend not to be evident in shorter answers.

While candidates were much better prepared for the free-response questions than last year, many still fail to answer the question actually set. In the pressure of an examination it is easy to make mistakes of interpretation, which can severely limit the number of marks available to the candidate. Centres are recommended to train candidates in strategies such as highlighting significant words in the question to enable them to structure their answer around those points.

Centres are also reminded that the six-mark extended-writing questions often demand that the candidate considers more than one aspect of a problem, and so examiners usually reserve the highest level marks for those candidates who clearly address all the required aspects.

Candidates should be reminded that if they wish to change their answer, the old answer should be crossed out and a new one written in its place. There were instances of alterations (e.g. from a 5 to a 6) that created a completely ambiguous response. Where a response is ambiguous, examiners have little option but to give zero credit.

With regard to objective tick-box questions, it is always worth reminding candidates that, irrespective of whether or not the number of ticks required is stated in the question, the number of marks allocated to the question does not necessarily equal the number of ticks required. This principle also applies to the number of lines drawn in a 'join the boxes' type question.

Most candidates were entered for the appropriate tier of each examination. Weaker candidates who are entered for Higher Tier papers do not have a pleasant experience and are usually unable to demonstrate what they know and understand. This clearly has an adverse effect on the grade that they will receive. Centres should enter weaker candidates for the Foundation Tier where they are more able to demonstrate what they know and understand, and complete the examination feeling that they have had a positive rather than a negative experience.

A151/01 Twenty First Century Additional Science A (B4, C4, P4) Foundation Tier

General Comments

Most candidates were able to complete the paper within the available time. The paper allowed candidates to perform well and there was a broad spread of marks. The candidates had most difficulty with the six-mark extended-writing questions, although there is some evidence that the performance at higher levels has improved.

Comments on Individual Questions

1 **(a)** Candidates were required to name the gas given off from pondweed when exposed to light from a bulb at varying distances. This was surprisingly badly answered – the most common wrong answer was carbon dioxide, with chlorophyll and hydrogen also seen.

(b) **(i)** Asked candidates to suggest reasons for variation in results for a given distance. Many candidates misinterpreted the question and said that it was due to the lamp being closer. Only a small minority scored marks, by giving suggestions such as different plant samples being used, or the temperature changes caused by the bulb heating the water.

(ii) Candidates were asked to calculate the average number of bubbles produced at a given distance. Most were able to give the correct answer of 20, although 19 and 21 were also seen.

(iii) This question required a general conclusion from the data about the how the rate of photosynthesis varies with light intensity. It was poorly answered, many answers referring to the distance from a lamp and/or numbers of bubbles.

(c) **(i)** Candidates were asked to select two pieces of equipment from a list for an investigation. Light meter and quadrat were the correct choices, but only a minority could score the mark by identifying both.

(ii) Only a minority of answers correctly stated that the number of plants would be lower closer to the tree, and linked this explicitly to light intensity. Many referred to the growth of the plants or failed to explain the trend.

2 This was a six-mark extended-writing question. Candidates were asked to explain statements about a weightlifter using differences between aerobic and anaerobic respiration. There were some good answers giving a concise comparison of the two types of respiration using ideas of oxygen usage, energy release and reactants and products. Many vague answers simply restated information given in the question. A considerable proportion suggested that aerobic respiration is the “breathing” or “taking in” of oxygen.

3 **(a)** In this part, candidates were required to identify the line on a graph corresponding to an enzyme from a bacterium living in the sea, with an explanation. Most could score at least 1 mark for identifying the correct graph, but the second mark required a link to the activity of the enzyme, and this was often missing.

(b) Candidates were told that an enzyme was tested after being heated to 100 °C and cooled. They had to suggest and explain what the result would be. This was not well answered; although candidates referred to denaturing, many seemed to think that the enzyme would work again when it cooled to 20 °C.

4 **(a)** The requirement was to circle three words or phrases to complete statements about the results of an osmosis experiment. Only a minority were able to score by identifying at least two correctly.

(b) This part asked candidates to select the best suggestion for an improved approach, and a majority were successful here.

5 **(a)** This question required candidates to select the correct meaning of a hazard symbol. The correct answer, toxic, was very well known.

(b) Asked candidates to select the diagram for a molecule of chlorine. Only a minority were able to make the correct choice.

(c) **(i)** The question asked for a word equation for the reaction of iron with chlorine. This was well answered, with most gaining at least 1 mark, and half of the candidates scoring both for a complete answer. Common incorrect answers gave “iron chlorine” as the product, or “iron + chloride” as reactants.

(ii) Few were able to correctly identify all three of iron, chlorine and iron chloride as solid, liquid or gas, but many were able to give at least two for 1 mark.

(d) Required candidates to give the number of electrons in an atom of chlorine, given the atomic number and relative mass. Only a minority gave the correct answer of 17, many giving 18.

6 **(a)** Required candidates to give the formula for potassium chloride. This was well known, although a significant number of answers failed to score as the wrong case was used for one or more of the letters.

(b) Was also well answered – the majority of candidates could state that two atoms of sodium react with one molecule of chlorine.

(c) The requirement was to state the meaning of an electron configuration of 2.8.1 for sodium. A majority were able to score at least one of the two available marks. Common incorrect answers referred to the numbers as atoms or protons.

(d) Looked for an explanation of why molten sodium chloride conducts electricity. Few candidates were able to score even 1 of the available 3 marks. There were few references to ions and references to charge were vague and often inappropriate. The most frequent way that candidates scored 1 mark was for reference to particles being able to move. Many said that “it” is a metal and so can conduct electricity, and references to electrons were common.

7 Was a six-mark extended-writing question. It required an evaluation of two points of view regarding whether three elements are in the same group of the Periodic table, based on data. This proved difficult for most candidates, more than half failing to achieve Level 1. Credit was possible for answers supporting either point of view, but many candidates seemed to pick properties at random rather than to provide reasons why the property supports the viewpoint. Very few were aware of the key principle of trends, and thought that elements belonging to the same group should have the same or very similar melting point of elements or oxides.

8 **(a)** Asked for suggestions as to why the results for a given road surface were not the same. There were some good answers, but many candidates still gave answers that referred to the different surfaces. Common valid answers included wear in tyres, brakes or road surfaces, different force applied to brakes and variation in reaction times.

(b) Candidates were asked to give reasons why the results showed no clear difference between two surfaces. The fact that the mean result was the same for both was well recognised, but fewer were able to suggest that the range for the two overlapped.

(c) Asked for ways of deciding between the two. This again was well answered – most recognised the need for more repeats, and a pleasing number of candidates suggested valid additional tests which would help, such as changing the car, initial speed or tyres.

9 Was another six-mark extended-writing question. It asked candidates to use ideas of forces to explain how the gas emerging from a firework rocket makes it move upwards. There was a good spread of responses but in general it was poorly answered. The idea of force pairs and interaction was not well understood, or it was incorrectly applied. Few were able to go beyond the information given, that the gases move downwards, to state the relevant forces acting to provide upwards movement, with the correct direction. Many thought the bottle was important, that the gases became trapped inside the bottle or pushed against the ground. Incorrect use of the term upthrust was often seen. Some credit was often gained by referring to gravity and air resistance opposing motion or acting downwards.

10 **(a)** Required candidates to say which car had the greatest acceleration from given speed change and accelerating time. Many candidates failed to realise that, as stated in the question, calculations were needed, and tried to comment from the raw data.

(b) Calculation of kinetic energy proved very difficult.

(c) Most candidates scored at least 1 mark, for identifying that work is done on an accelerating car, and many scored the second mark for realising that the driving force must be greater than the counter force.

11 **(a)** Asked which distance-time graph showed a bicycle not moving. This was well answered.

(b) Asked which graph showed the greatest speed. This was also well answered.

12 Required selection of words to complete three sentences describing climbing up stairs. It was well answered, with most candidates being able to score at least of the two available marks.

A151/02 Twenty First Century Additional Science A (B4, C4, P4) Higher Tier

General Comments

Candidates were entered appropriately for this tier and had enough time to answer all the questions.

Examiners commented that the six-mark extended-writing questions were better attempted than in the last exam session, with far fewer candidates making no response. Those candidates who had had some practice in organising their thoughts into a coherent sequence tended to contradict themselves much less frequently, and to score more highly. Candidates are reminded that written communication is not limited to continuous writing. Answers which used bullet points or annotated diagrams often resulted in clear communication of all the salient points, and so were able to gain the maximum mark.

Comments on Individual Questions

1 **(a)** Most candidates were able to correctly link the graph to the enzyme, and many gained the second mark by going beyond the shape of the graph to discuss what the graph represented.

(b) Able candidates realised the enzyme would be denatured, and some could even then predict the shape of the new graph. It is important to realise that examiners were looking for more than interpretation; they were looking for a specific comment about the shape of the graph itself. It is worth noting that this question exposed significant misunderstanding of the finality of the process of denaturing. While many candidates stated that the enzyme would be denatured in the first experiment, they then assumed that the same enzyme would start working again in the second experiment. Answers such as “The enzyme will denature slower because it has already been heated” were common.

2 Most candidates realised that nitrogen would get into the plant through its roots, and many realised that the mechanism would be linked to either diffusion or to active transport and to the idea of concentration gradients. Thereafter, the understanding got a lot less certain, with many references to osmosis. However, examiners commented that, despite their confusion, by choosing to discuss either active transport or diffusion candidates were approaching the question from a sensible direction. Able candidates took their reference beyond ‘nitrogen’ to nitrogen compounds or even to nitrates, and the most able candidates went on to discuss conversion of the nitrates into amino acids or to proteins in the seeds.

3 **(a)** Able candidates had no difficulty in writing a balanced symbol equation for photosynthesis. The most common errors were to write a word equation or to get confused with respiration.

(b) Many candidates appeared not to concentrate on the results for the 10 cm distance, so the task of deciding the narrowest range of results proved surprisingly difficult.

(c) Many candidates understood that light was no longer a limiting factor, and the most able candidates were able to name alternative limiting factors.

4 **(a)** The task of predicting the change in potato length form the concentration of the sugar solution was well done, and almost as many went on to predict the concentration of the cell contents. Surprisingly, part (ii) had a comparatively high omit rate.

5 **(a)** The task of balancing the equation for part (a)(i), and of identifying the numbers of protons, neutron and electrons for Q5(b) proved to be very affective differentiators, with able candidates scoring well. However, in part 5(a)(ii) far fewer candidates were able to identify the state symbols from the information given in the text.

(c) Explaining how a chlorine atom changes to a chloride ion proved to be another excellent differentiator. Most candidates realised that there would be a transfer of a single charge, and the more able linked this to the outer shell. There were many misconceptions about the charge on the electron, and also the charge of the ion once the electron had been transferred. References to protons and to positrons were quite frequent.

(d) Surprisingly, all but the most able candidates were hampered by not knowing the formula of sodium chloride, with $NaCl_2$ being a very common choice. Others did not realise that chlorine gas would be Cl_2.

(e) Few candidates could describe the structure of a sodium chloride crystal as an ionic lattice, and this question had a comparatively high omit rate. Weaker candidates described the appearance of sodium chloride crystals without reference to the structure. Many of those who did describe the structure referred to molecules and to covalent bonds.

(f) Fewer still could explain why sodium chloride conducts electricity when dissolved in water. References to sodium being a metal were common.

6 Candidates responded well to the challenge of explaining whether the properties shown in the table conclusively showed that the elements were in a group or not. While weaker candidates made general statements about properties being similar or different, able candidates limited their discussion of similarities to the formulae, and went on to describe the trends, or lack of them, in the other properties.

7 **(a)** The tick boxes tended to be poorly answered, with only one of the responses being correct.

(b) Most candidates did not realise they had to calculate the work done and the GPE gained, and just compared the force and the weight.

8 Most candidates could link ice and friction to surface and movement, and some went on to use suitable concepts such as ‘force’ and ‘interaction pair’. Examiners were looking for ideas such as momentum change before they awarded the highest level, and this was rare.

9 Candidates found the calculations involving momentum change and forces to be extremely difficult, despite the formula sheet at the front of the paper. The need to write a calculation out on the page for Q9(a)(ii) led to a very high omit rate. However, the explanation of how a bullet proof vest helps its wearer was well attempted, with many candidates realising that the bullet would take longer to stop or that the force would be reduced. Question 9(b)(iii) was also well answered.

10 (a) Able candidates calculated the acceleration of all three cars and correctly identified the 'GoFar' as having the greatest acceleration. They also successfully applied the formula from the front of the paper to the calculation of the kinetic energy of the car at its top speed. Those who did not understand how to calculate acceleration merely discussed the time to reach maximum speed, and were not able to gain credit. They also were unable to calculate the kinetic energy.

A152/01 Twenty First Century Additional Science A (B5, C5, P5) Foundation Tier

General Comments

The candidates seemed to be entered for the appropriate tier and made good use of the time available. There was no significant evidence of shortage of time. It was pleasing to note that they generally engaged with the examination in a positive manner with very few examples of graffiti, frivolous comments or questions not answered.

The quality of answers for free response questions seems to have improved, with candidates generally showing an improving ability to justify points that they make with explanations, so that in these questions a candidates' mark increasingly reflects their science ability rather than their ability to express ideas clearly. However there are still candidates with a tendency to re-write the information in the question.

There were fewer scripts showing a disparity between the physics, chemistry and biology aspects where students who do well in two sections score badly in a third section.

Comments on Individual Questions

1 **(a)** Most had an attempt at CO_2 but many didn't know steam was water, giving for example "St" as the symbol. Other common mistakes were the use of lower case letters (e.g. h2O) or incorrect subscripts (e.g. H_2O_2).

(b) Was generally well answered, though "silicon dioxide has a high melting point" was a common error

(c) **(i)** Despite the instruction to include a calculation, many did not and were at risk of losing marks by writing that planes make 340 000 tonnes per day incorrectly. Rather fewer went on to compare the CO_2 from planes with the amount from the volcano, many repeating the stem of the question by saying that it was less.

(ii) This six-mark extended-writing question focussed on why numbers in the internet article may not be reliable. The article gave three areas of information, each with comments such as "estimated", about" and "on average". Candidates who only addressed one of these areas were unable to access full marks. Others outlined the issues without giving practical reasons, such as "the number of flights cancelled is 'about' because it will be different at weekends". It was pleasing to note that many candidates appreciated that information from the internet should be treated with care.

(d) Many candidates seemed to struggle with this question about why one reactant (fuel) had less mass than the total mass of products. Oxygen was also listed as a reactant but while most candidates at least attempted the question, ideas such as "you also need to include the mass of the oxygen" were rare. Many responses talked about "fuel being a liquid but carbon dioxide is a gas" as the cause of the difference.

(e) Many candidates realised that this was a strong covalent bond, but far fewer appreciated that it was a lattice structure with many bonds to be broken. A few ascribed the high melting point to the fact that it had come from a volcano.

2 **(a)** Many candidates did well with this section on electrolysis, the most common error was to describe it as electromagnetism.

(b) Candidates tended to realise that melted oxide is a better conductor than a solid, but were less clear about what happened at the electrodes.

3 **(a)** This question on electric circuits gave fewer good responses than expected. There were many examples with two ammeters or two voltmeters, bulb symbols or "M" for meter.

(b) **(i)** Although many drew the line accurately, a significant number of candidates drew a row of crosses with no line.

(ii) The question requires a comparison of the quoted value for the resistor with Jill's measurements, but few calculated Jill's result and so were unable to compare. Many candidates focussed on the R in 4R7 and therefore missed the point of the question.

(c) **(i)** Although some scored well, there were a considerable number of vague answers rather than specific suggestions for the difference. Responses such as "they did it differently" were too vague to credit, while "he may have used a defective meter" was credited.

(ii) Many candidates realised that repeating the experiment would provide further evidence, but not all then realised that you should average the results.

4 It was pleasing to see a clear understanding of the working of an electric motor displayed by many, with no clear pattern of wrong responses.

5 **(a)** This was well done generally, the usual mistake being to divide the voltage and current.

(b) There was a pleasing number of candidates who accessed this question about parallel circuits and calculated either the current or the power of a bulb, scaled it up by six, and then compared it with the output of the generator. The usual problem was answers that said "yes" but gave no justification for their response.

6 This six-mark extended-writing question differentiated well. Most candidates correctly referred to static of some kind, and many went on to make a good attempt to explain charge transfer, although sometimes in a confused way (e.g. "positive electrons"). A few also attempted to explain the effect in terms of electrostatic attraction and repulsion. Poor answers were generally characterised by repeating the question rather than giving an explanation for the effects.

7 **(a)** In this genetic code question, many knew the double helix has four bases, but a significant number thought it was the bases' structure rather than the order.

(b) A large number of candidates were aware that the genetic code makes proteins, with no consistent pattern of answer from those who got it wrong.

(c) Most candidates knew that the nucleus contained DNA, but fewer realised that copies went into the cytoplasm, with "membrane" as a common error.

8 **(a)** A question that many found difficult, with no clear pattern in the wrong responses.

(b) This question also proved challenging to candidates' knowledge of multiple sclerosis, with patients' views being ignored. When Tom was selected, some simply copied the justification from the speech bubble rather than explaining why this view is unreasonable.

(c) Although many candidates realised that one case is not enough to show a correlation, there was a number of candidates who seemed unfamiliar with the model of animal testing, expressing the view that "animals are not humans" as a reason why one case did not work.

9 **(a)** Plotting of the points was generally done well, but there were some cases where it was difficult to see the points, while those who plotted crosses could be more clearly awarded credit. The line of best fit was drawn acceptably by many, with "point to point" lines or straight lines of best fit as the usual errors.

(b) Although there were many good answers, some candidates found the concept of Week 0 difficult. Some candidates recognised that the stem was not growing but failed to gain a mark for explaining that the plant was still growing – in its roots.

10 There were a few cases of this question not being attempted. Although candidates generally wrote a lot, many candidates missed the point of the question – an explanation of why the different number of chromosomes in each cell means that they need different methods of cell division. There was a familiarity with mitosis and meiosis but often without reference to the question, and an appreciation of the different chromosome numbers not solidly linked to the question from others. A significant number explained why a sperm cell has half the number of chromosomes but it was disappointing how few of these then went on to explain why skin has a full set of chromosomes, and therefore limited their marks. There were relatively few totally wrong answers, but further development of the explanations would have resulted in more marks for the majority of candidates.

A152/02 Twenty First Century Additional Science A (B5, C5, P5) Higher Tier

General Comments

Candidates were entered appropriately for this tier and had enough time to answer all the questions.

Examiners commented that the six-mark extended-writing questions were better attempted than in the last exam session, with far fewer candidates making no response. Those candidates who had had some practice in organising their thoughts into a coherent sequence tended to contradict themselves much less frequently, and to score more highly. Candidates are reminded that written communication is not limited to continuous writing. Answers which used bullet points or annotated diagrams often resulted in clear communication of all the salient points, and so were able to gain the maximum mark.

Comments on Individual Questions

1 **(a)** Most candidates successfully calculated the amount of carbon dioxide saved each day, and a large majority went on to compare that figure with the amount emitted by the volcano.

(b) Most candidates were able to make valid comments about the reliability of unverified sources on the internet, and so gained at least Level 1. More able candidates appreciated that more than one number was under discussion, and went on to suggest reasons why each might not be accurate. Those candidates who discussed reasons for the inaccuracy of all three numbers were able to get to Level 3.

(c) This question was a very effective differentiator, with many candidates realising that silicon dioxide must have strong bonds. Able candidates went further to discuss a giant structure having lots of these bonds. A sizeable minority suggested that the bonds would be ionic, and so were not able to gain full credit.

2 **(a)** While able candidates were more likely to explain why aluminium cannot be extracted by reacting aluminium oxide with carbon, even they did not always find this task easy. Many went no further than the wording of the question, giving such answers as "'The aluminium doesn't react" or "It can only be done with electricity".

(b) Able candidates showed a simple calculation to prove that the relative formula mass of aluminium oxide is 102, but most candidates struggled with this question. The most able went on to recognise which of the calculations would give the mass of aluminium which could be extracted from the oxide. Other candidates often chose either the third or the fourth option.

(c) Many candidates were aware that the ions move during electrolysis, and that aluminium oxide will conduct when both melted and in solution. The most common misconception here was to suggest that the aluminium oxide would conduct only as a liquid or only in solution. Some candidates even knew that at the negative electrode the positive ions gain electrons.

3 Most candidates either explained one of the phenomena described in the question or realised that rubbing the balloon caused charge transfer, though the charge transfer itself was often poorly explained with many references to “positive electrons” and to “charged neutrons”. The most able candidates went on to do both very successfully. Weaker candidates often discussed friction or tried to explain the effects in terms of energy.

4 **(a)** Many candidates correctly put the ammeter in series, and the more able candidates were able to place the voltmeter in parallel. No credit was given if non-standard symbols were used.

(b) While the current calculation was much better done by able candidates, there were many able candidates who still found this difficult.

(c) While most candidates were able to eliminate “best estimate”, they found it difficult to connect each statement to its appropriate type.

(d) Very few candidates appreciated that, as the current increased, the resistance would get hotter and the power would increase.

5 Most candidates were able to correctly connect some of the statements about a generator. Explanations of why a power station generates a.c. often centred on ideas of pollution, green energy and health and safety rather than the need to step up the voltage.

6 Many candidates could describe meristems in terms of unspecialised cells.

7 **(a)** Candidates experienced great difficulty in calculating the percentage increases of haemoglobin and myoglobin in the blood, and instead tended to calculate the difference between the highest and lowest numbers.

(b) Weaker candidates missed the point of this question and discussed the need for penguins to breathe. However, more able candidates were able to describe in increasing amounts of detail the way in which the genetic code in the DNA can lead to the production of myoglobin, and so the question differentiated well.

(c) **(i)** Many candidates were aware that mitosis produces two cells, but had more difficulty deciding on the number of chromosomes in each new cell and even fewer realised that the new cells would be genetically identical to both the new and the parent cells.

(ii) Many candidates were able to identify one of the statements which explained why the brain cells do not produce myoglobin.

8 **(a)** Many candidates showed clear understanding of the effect of stem cell treatment on people with multiple sclerosis. The most common error was to suggest that the stem cells destroy damaged cells.

(b) Candidates found it difficult to step back enough to take the decisions necessary for treating individuals with a condition such as multiple sclerosis, so often failed to realise that the requirement that procedures be 100% safe is an unreasonable statement, with Bess and Megan being more popular choices. Similarly, few realised that the failure of a single animal test is not a sufficient reason for the abandonment of a trial, but a possibly unrepresentative result that needs further investigation.

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