GCSE

Additional Science A

Twenty First Century Science Suite

General Certificate of Secondary Education **J242**

OCR Report to Centres

June 2012

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

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

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

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Overview

This session is the first for the new style of exam papers for Additional Science, with the introduction of the three six-mark questions in each. Many candidates did gain credit in the six-mark questions. The frequency of questions not being attempted by candidates was comparable to previous years with the exception of A152/02, where it was much higher.

As always, candidates should take special care in reading the question. In the pressure of the examination it is very easy to make mistakes of interpretation, which can then severely limit the number of marks available to the candidates. Centres are recommended to train candidates in strategies such as highlighting significant words to enable the candidates to identify the thrust of each question. Centres are also reminded that six-mark questions often demand that the candidates consider more than one aspect of a problem, and so examiners reserve the Level 3 marks for those candidates who clearly address all the required aspects.

A151/01 Modules B4, C4, P4 (Foundation Tier)

General Comments

Most candidates completed all the paper and there was no evidence that shortage of time was an issue. There was no indication that any question was not answered as intended.
The paper allowed candidates to perform well and there was a good spread of marks.
Candidates at this level seemed to struggle with the Level of Response questions, particularly with assessment of quality of written communication, but there was plenty of opportunity to show positive achievement.

Comments on Individual Questions

Q1 This concerned factors affecting photosynthesis and plant growth. In (a)(i), candidates were required to suggest a value for height gain for a particular value of hours of light. A range of answers were accepted and most candidates scored.
Part (a)(ii) proved more challenging, as the question asked candidates to use data to suggest an optimum time for running lights for maximum growth at minimum cost, and to explain their choice. Those giving a correct time were generally able to score the second mark for the explanation. Some said that the plant does not grow after the optimum, rather than there was no increase in growth with increased hours of light. In part (a)(iii), the great majority of candidates scored at least 1 out of 2 marks for identifying 3 key words in sentences about the investigation.
Question (b) concerned structures within a plant cell and their roles in photosynthesis. It was a Level of Response question worth 6 marks. It was a challenge to the candidates, and many failed to score. Most candidates could identify the nucleus but the chloroplast was often given as 'mitochondria', and many confused the cell membrane with cell wall. Of those who did successfully engage with the question, there was a full spread of marks, including some scoring all 6 Level 3 marks.

Q2 Candidates were asked to consider the oxygen requirements during scuba diving. Part (a) asked for an explanation of the greater volume of air used per minute while swimming compared with resting. This proved difficult. Only a small number of candidates scored both marks for two of: more energy needed, more respiration, more oxygen needed. Some candidates just restated that more air is needed when exercising. Answers were often not comparative and references to anaerobic respiration were quite common. In part (b), candidates were required to use a calculation to select an appropriate dive time, incorporating a 5 minute safety margin. Many gained both marks but a common error was to include the 5 minutes in the dive time. Anaerobic respiration was well known for part (c).

Q3 This concerned the activity of an enzyme. In part (a), candidates were required to use a graph to make a judgement of a suitable temperature for a washing powder enzyme and give an explanation. Many failed to recognise that the enzyme operated at low temperatures and stated that it would work best at 37^{o}C or body temperature. Denaturing was a common successful response. Few candidates scored both marks. In part (b) very few failed to score at least 1 mark, by indicating two reasons for questioning a claim based on scientific scrutiny.

Q4 In part (a), the symbol for harmful substances was well known, and the majority of candidates were able to put three halogens in order of reactivity using given results for part (b). Many were unsuccessful in giving a word equation for the reaction between chlorine and sodium iodide in part (c) – a range of incorrect responses was seen, such as referring to sodium chlorine rather than chloride.

Q5 Most candidates knew that salt crystals are colourless and scored in part (a). Fewer seemed familiar with the procedure of flame testing for part (b), but most were able to suggest that the colour of the flame would change and scored at least 1 mark. Only about half of the candidates were able to score in part (c)(i) by selecting the correct number of protons in a sodium atom, but more were able to give the electron arrangement of a sodium ion in part (c)(ii). Part (c)(iii) was a challenge – few could identify that both melted sodium chloride and sodium chloride solution would conduct electricity.

Q6 This question concerned the use of sodium to transfer heat in a nuclear power station. Part (a) was very well answered – the great majority of candidates were able to select the correct temperature for the melting point of sodium. Suggesting and explaining potential problems using properties of sodium for part (b) proved very difficult. Common answers involved explosions but without explanation, and many stated that the pipes would melt. The reaction of sodium with water and the subsequent release of hydrogen were not well known.

Q7 Candidates were asked to explain why Mendeleev left spaces in his Periodic Table and give the significance of the arrangement of Te and I. This was a 6 mark, Level of Response question and proved a real challenge. A majority failed to score, and no candidates reached Level 3 by giving a full explanation of both features. When marks were gained, it was usually for the idea of undiscovered/unknown elements or the principle that elements are placed in groups. Candidates commonly referred to electron and proton number. Answers frequently stated that both missing elements or Te and I are in the same group.

Q8 In part (a)(i), candidates were required to calculate a speed of fall and an average speed to complete a table. Few gained both marks, and many failed to score. One issue here was answers which were obviously correctly calculated but not rounded up correctly. Part (a)(ii) required candidates to use data to comment on a statement that cake cases were falling at a steady speed. Although most candidates seemed aware of the correct idea, very few scored as their answers were too vague or did not specifically relate their answer to the statement. Candidates were more successful in identifying the factors in the experiment as controlled, changed or outcome in part (b), where most scored at least one of the two available marks.

Q9 This was another Level of Response, 6 mark question. Candidates were asked to use ideas about force and momentum to explain changes in speed of a ball thrown up and falling down. This again proved a challenge. Although a majority of candidates scored, very few indeed reached Level 3. Many answers contained elements which were credit-worthy but which were often embedded within vague and confused ideas. This restricted the available marks, due to the quality of written communication. Surprisingly few stated that the ball would slow down as it moved upwards. There were few correct references to the effect of air resistance. Possibly momentum provided the least successful route to marks. Many candidates confused gravity with gravitational potential energy.

Q10 This was a question about energy transfers and momentum changes in a parachute landing. Part (a) required candidates to identify two correct statements regarding falling at steady speed, and only a small minority gained both marks. It appeared that the idea of constant kinetic energy because of constant speed was better understood than that gravitational potential energy is lost.
Part (b)(i) asked for a calculation of safe momentum from force and impact time, and (b)(ii) for a statement about safe landing based on a calculation from speed and mass and comparison with the figure for maximum safe momentum change. In both cases, only a minority were able to score.

Q11 Candidates were asked to describe forces acting on a walker. Only a minority managed to score any of the three available marks. Direction of forces was required in order to credit suggestions, and this was often missing.

A151/02 Modules B4, C4, P4 (Higher Tier)

General Comments

Most candidates were appropriately entered for the higher tier paper, but some candidates gave weak performances and may have been given a better opportunity to show what they know if they had been entered for the foundation paper. Candidates who are working at a weak C or a D grade would benefit from taking the paper at foundation level.

Candidates made good use of time, only a few candidates left questions blank. Most made a full attempt at the six mark Level of Response questions. In general, the standard of communication was appropriate, as revealed by the data showing that most candidates gained 2, 4 or 6 marks (the higher marks in each level). The most common error in these questions was to fail to address the task fully. Candidates should be advised to reread the question several times as they draft their answers.

The objective questions were generally well answered. In almost all cases candidates made the correct numbers of choices (for example ticking two boxes where asked to do so). Some candidates left some of these questions blank. They should be encouraged to use educated guesswork to exclude some distracters and attempt every question.
Answers with two or three marks available usually need multiple points to be made to meet the mark scheme points. In some cases candidates showed poor examination practice by giving fewer points than the marks available.

Comments on Individual Questions

Q1 Part (a) showed a broad spread of marks. About a fifth of the candidates failed to score any marks. Common errors were to confuse the cell membrane with the cell wall and to confuse chlorophyll with chloroplast. Some candidates thought that mitochondria were the organelles responsible for photosynthesis, but in general the cell functions were well understood. The most common route to a Level 2 answer discussed general functions of the cell parts but did not necessarily relate these to their role in photosynthesis, as the question asked.
In (b)(i) many candidates repeated the question but did not clearly explain the link between mass and photosynthesis.
Part (b)(ii) proved difficult for all candidates. Many did not understand that the rate would follow a similar pattern at the start, or that it would eventually level off.
In (b)(iii) 'temperature' was a common correct answer, but this was not always linked to enzyme activity. Most candidates scored a single mark.

Q2 In part (a) most candidates were able to calculate the volume of air needed, but very few were able to process the data to give a time for the swimmer to stay underwater. Many candidates did not extract the relevant data from the question to do the calculation.
Part (b) was well answered, with a spread of marks scored. Many candidates realised that the swimmer would use more energy and some went on to comment on the effect of this on oxygen requirements and respiration. A relatively common error was to discuss anaerobic respiration linked to oxygen supply.

Q3 Part (a) proved very demanding for candidates. Most did not fully engage with the information given, and did not link enzyme activity to the pH in the question (i.e. low pH in the stomach). Vague, general answers that discussed 'pH affecting enzyme activity' were not credited. Better answers discussed the effect on the enzyme of the low pH and its outcome on the shape and activity of the active site with the substrate.
In 3(b) about half the candidates correctly selected both relevant comments about peer review.

Q4 In part (a) most candidates gained a mark for correctly processing the data to make a prediction within the acceptable range.
In (b) some candidates only answered one of the bullet points, limiting their score to a single mark. Some thought the ‘pipes would melt’, failing to recognise that the melting point of sodium is still relatively low compared to that of other metals, or that engineers can easily engineer materials to be used in hostile environments such as a nuclear reactor. Some candidates gave vague answers such as the sodium would explode. Better answers correctly discussed the reactivity of sodium with water in the boiler.
Just under half of the candidates knew that sodium atoms lose an electron when they form an ion in part (c).

Q5 Answers with incorrect formulae scored zero in part (a). Most candidates failed to give the correct formula for sodium chloride, the most common incorrect answer being $NaCl_2$.
In part (b) candidates needed to correctly designate at least 4 statements as true or false to gain a mark. About half the candidates did not do this, implying some confusion about what happens during dissolving.
There was a spread of achievement from 0 to 3 marks in part (c). Many candidates did not mention that a spectrum would contain lines, but many did mention that different elements produce different colours. Better answers discussed the different positions of lines in the spectra of different elements.
In (d) about two fifths of candidates gave a fully correct atomic structure for sodium, with a similar percentage gaining a single mark for some partially correct values in the table.

Q6 Most candidates found this question very demanding, with over half of candidates failing to meet Level 1 standard. The most straightforward way of candidates scoring up to Level 2 was to discuss why Mendeleev left gaps for A and B. The reversed positions of Te and I, and the reasons for reversing these elements, was much more rarely seen expressed correctly.

Q7 In part (a)(i) most candidates correctly calculated at least one missing value; about a fifth of candidates calculated both.
Candidates found it difficult to clearly express their ideas in part (a)(ii). Many tried to answer without discussing the data in the table.
In part (b) some candidates incorrectly discussed the idea of air resistance or inaccuracy of the stop watch. Fewer discussed the idea that with such short times there would be a large human error in the use of the stopwatch. There was an even spread of candidates who made one or two correct points.

Q8 Candidates found discussion of the action of a parachute in terms of energy very difficult, with very few gaining access to Level 3 by discussing how work done on the parachute keeps the kinetic energy of Ben constant. Answers which gave arguments in terms of balanced forces were awarded up to Level 2, allowing many candidates to score some credit.

Q9 All of question 9 proved very demanding for candidates. Just over a third of candidates gained at least one of the two available marks for calculating braking force in part (a).
Candidates’ answers showed an even spread of marks from 0 to 2 in part (b)(i).
In (b)(ii) very few candidates identified the correct relationship when the car skids to a stop.
In (c) again very few candidates correctly recognised the correct displacement – time graph.

Q10 Candidates found part (a) of this question very challenging, with only about a tenth of candidates correctly identifying the statement that applied to the ball in flight.
In part (b) candidates understood the idea that the force would be decreased if Jill moved her hand down, fewer related this to the longer time taken over which the force acts.

A152/01 Modules B5, C5, P5 (Foundation Tier)

General Comments

The Additional Science paper at foundation tier had a small entry cohort for the first year of assessment of this new specification.

Candidates made good use of their time; there was no evidence of a significant number of candidates having insufficient time, with very few examples of the last question being unanswered.

Most candidates followed the rubric and engaged well with the examination, doing well on short questions. Unsurprisingly at this tier the longer open response type questions proved more difficult. Candidates should be praised for answering these questions where they could, only a few failed to attempt any of these questions. A number of candidates seemed unable to plan their answers to these questions to match the specific requirements of the question and simply wrote about the topic in general, which limited their mark. Where planned answers and explicit links to the question were seen (for example numbering of the four risks asked for in question 3), the candidates generally matched the criteria needed for the awarding of marks and so scored highly.

Comments on Individual Questions

Q1 Gases. The candidates were required to identify the main gases in the air, which most did well, but there was confusion about the relative amounts of nitrogen and oxygen. Some candidates were not careful about the symbol for oxygen, with examples of Co_2 (cobalt?) seen. Argon's chemical symbol was available in the Periodic Table on page 20.
Part (c) required an explanation of boiling using ideas of forces and size. Although most candidates described the forces and size they failed to link them to boiling (particles separating) and therefore did not gain full marks.
For part (d) on formula masses, about half the candidates could calculate a molecular mass, but the majority then failed to realise that 40 molecular masses is 40 times larger.

Q2 Chemical tests explicitly referred the candidates to the data sheet in the question paper (which was based on appendix H of the specification.) Candidates who had noted page 3 addressed the question clearly and scored well; others seemed unaware of the information and scored poorly.

Q3 Part (a) (lead mining) was an overlap question with the higher tier. The question asked for four likely risks, how they are created and who would be affected. The biggest problem for candidates was in not identifying FOUR risks, and therefore limiting the marks available. Candidates who explicitly numbered/itemised the risks scored better than those who wrote more general responses. Candidates usually extended the risk to how it was created, but seemed to forget to identify who was affected.
In part (b) candidates struggled to identify the constituents of a molecule, with examples of P, b and O apparently meaning that there were 3 atoms present. In part b(iii) with oxygen in the stem of the question, many candidates put oxidation for losing oxygen.

Q4 Thermistors. Many candidates correctly described the correlation for part (a) but very few explained it. For a question about thermistors, references to “heat” or “temperature” were notable by their absence from responses. In part (b) many candidates showed a sound grasp of calculating power and resistance, but seemed to struggle to describe how these results fitted into the table and therefore affected their confidence in the correlation.

Q5 Electric motor long response question. Candidates struggled with this question even though there was significant evidence that they had done the experiment with comments such as “wrap the wire around the plastic middle bit." Candidates’ familiarity did not seem to translate into ordered logical understanding and explanations. Few candidates labelled the diagram appropriately, putting N is North and + is positive rather than “magnet”, “wire” etc. The use of only two labels was needed to access the criteria for full marks. In the written section, many responses described the operation of a generator, few described the current flow or how the magnetic fields interacted to produce movement.

Q6 A.C. For part (a) the indication of a.c. is the frequency, but many candidates selected “voltage”. Candidates did better in b(i) on the structure of a transformer but were less sure of the theory behind it for b(ii).

Q7 Circuits. In selecting the role of components in a circuit, the role of the battery was clearly understood, but the role of the other components was much more troublesome, with many confusing the ammeter and voltmeter. Part (c), the addition of a series resistor caused many candidates to flounder, with many examples of repeatedly amended responses indicating a lack of clear understanding.

Q8 Cell divisions. In part (a) many candidates scored one mark for identifying the most growth, but did not get the second mark for linking this to cell divisions as required by the question. Part (b) was a long response question aimed up to grade E. There are two ideas in the question, the use of a powder and the idea of the plant being identical. Many candidates are to be congratulated on identifying several points AND developing them into a coherent response. The key area for many was that they only planned for one idea, which would be insufficient to obtain the six Level 3 marks on any of the longer open response questions in this paper.

Q9 Genes. In part (a), many candidates realised that there were equal amounts of C and G, but failed to realise that the total percentage should add up to 100. Examples of 21% for C and 21% for G (total 84%) were common. In part (b), “proteins are made in the nucleus” was a common error. Part (c) discriminated well between those who made random comments, those who repeated the same comment several times and (the majority) who made three valid suggestions.

A152/02 Modules B5, C5, P5 (Higher Tier)

General Comments

Candidates were entered appropriately for this tier. This is the first summer session to contain the six-mark extended writing questions, and examiners commented on the effort that candidates put into answering them. These questions often demand that the candidates consider more than one aspect of a problem, and so examiners reserved the highest Level 3 marks for those candidates who clearly addressed all the required aspects.
The new format may have caused some candidates to have problems with their time planning, which led to later questions being rushed.
Examiners noted that many candidates appeared to be unfamiliar with the term ‘property’.

Comments on Individual Questions

Q1 Candidates of all abilities were able to identify at least some of the substances from their physical properties in part (a), and were also able to gain some of the marks for explaining sodium chloride solution conductivity, despite much confusion between electrons and electrodes. Most candidates knew that movement was involved, and some were able to take this further and discuss ions and charge. In each case the number of marks achieved in the question gave a good indication of each candidate’s overall ability. The most able candidates explained why nitrogen and oxygen have low boiling points in terms of the strength of forces, and some realised that these forces are *between* molecules.

Q2 Part (a) of this question was the first of the six-mark extended response questions on the paper. It was designed to assess candidates’ ability to make simple judgements based on information given and to apply those judgements in the area of Ideas about Science, specifically the section on risk. Candidates responded well to this task, suggesting a wide range of hazards which indicated careful thought about the question. Able candidates covered all the specific requirements of the question, that four risks should be discussed, and so gained marks at Level 3.
In (b) the higher level candidates balanced the equation successfully and could also state that this was an example of a reduction reaction. Many candidates who did not know the term sensibly suggested “de-oxygenation”, though that was not enough to gain credit. The relative formula mass was calculated by many. The calculation of percentage mass was, as intended, a harder task.

Q3 Whilst able candidates correctly identified the variable resistor as the component which allowed Anna to vary the current, the incorrect choices were fairly evenly spread across all the other components in the circuit. That the property of the component was ‘variable resistance’ was understood by more able candidates. Many candidates gave the name of the component rather than its property so examiners did wonder if candidates were familiar with the term ‘property’.
In (b) many responses correctly identified the correlation between resistance and power for a thermistor. Only a few candidates went on to explain the correlation, so two of the three marks were not accessible to most. The calculation in (c) was a more difficult task. Many divided the large number by the small number.

Q4 Part (a), the description and explanation of a step-down transformer, was the second of the six mark extended response questions. This question assessed recall of a topic which candidates traditionally find difficult. Candidates who fulfilled the requirements of the question by giving both details of construction and also an explanation of how the transformer works gained marks at Level 3. Most candidates knew that coils are involved,

and many realised that there would have to be a core. Far fewer responses went beyond this basic level of understanding. There was often confusion between transformers and electric motors. A significant number of answers discussed reasons for the use of transformers but gave no details of transformers themselves, so did not gain credit.
Even though candidates were not able to describe how transformers work in the previous part, there was a real understanding of the link between the ratio of turns and the ratio of voltages in (b). Many candidates were able to score the first mark. The most able candidates then took that information further to explain that the lamp could be run safely.

Q5 This multiple choice question on the electric motor was designed to stretch the most able candidates.

Q6 The calculation of the voltage across the LDR in (a) was also designed to be stretching and was answered successfully by a few candidates. Many candidates showed different degrees of partial understanding of the behaviour of light-dependent resistors in part (b).

Q7 Able candidates correctly worked out the percentage of the base for (a) and explained why knowledge of the percentage was not enough to determine the genetic code of the protein for (b).
Part (c) was the third six-mark extended response question and assessed a combination of recall and understanding. It was intended to be a difficult question, so it was encouraging to see many candidates were prepared to have a go at it. Many were able to gain credit for reference to the part that DNA plays and some were able to explain the idea of coding and switching. As before, candidates who addressed all of the main aspects of the question were able to score marks at the highest level. At the other end of the spectrum, responses such as “myosin is not made in nerve cells because it is not needed” were common. These did not gain credit.

Q8 Many candidates correctly mentioned experienced, specialised and unspecialised for part (a), but found some difficulty in completing the rest of the table. Part (b) discriminated well, with the most able candidates realising that, as in the fertilised egg cell, there would be 46 chromosomes in each cell of the embryo.
The impossibility of eliminating all risk was well understood in part (c).

Q9 Many candidates gained the first mark for using or discussing the rate of tree growth in (a)(i), and a few went on to allow for the 0.5 metre initial height of the tree. Most candidates were able to make significant comments about the variability of plant growth and possible reasons for that variability for (a)(ii).
A knowledge of a significant feature of either tissues or organs caused many candidates to struggle in (b).

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