

GCSE

Biology A

Twenty First Century Science Suite

General Certificate of Secondary Education **J243**

OCR Report to Centres June 2014

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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.

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A161/01 Twenty First Century Science Biology A (B1, B2, B3) Foundation Tier

General comments:

Overall, candidates appeared to find the paper straightforward, with most questions being attempted. Very few sections were unanswered suggesting that the paper was accessible to most candidates.

Attempts at the six-mark extended-writing questions suggested that candidates were prepared for this type of question; however, Centres need to ensure that candidates know that unless they address all sections of the question in detail they will not achieve a Level 3 mark.

There was evidence of some candidates struggling with the mathematical content of the paper. Centres should be reminded to address the mathematical skills outlined in Appendix C of the specification.

The paper was suitably challenging and discriminated well between candidates. Despite some tailing off of responses towards the end of the paper, time restraint did not seem to have been a problem for most candidates.

Comments on individual questions:

- 1(a) This question was answered well with a large proportion of candidates scoring both marks. Those candidates that did not score any marks seemed to confuse the symptoms for cystic fibrosis with those for Huntington's disease. Of those candidates gaining one mark it was observed that often candidates chose one symptom for both Huntington's disease and cystic fibrosis.
- 1(b)(i) Most candidates successfully completed the Punnett square and gained both marks for this question. Centres should remind candidates to take care with the letters used to complete the Punnett square and ensure that the difference between the lower case letter and upper case letter is clear. There were occasions when this difference was not clear and resulted in marks being lost. Examiners were instructed to use an error carried forward for the second marking point to ensure candidates were not penalised for the same mistake twice.
- 1(b)(ii) Candidates found this question particularly difficult even if marks had been awarded in part (b) (i). There appeared to be a misunderstanding as to the genotype which would give rise to cystic fibrosis with many candidates incorrectly identifying Tt. As a result common incorrect answers were 75% and 50%.
- 1(c) The vast majority of candidates scored one mark for this question more often than not for the identification that a benefit would be to plan treatment for the baby. Many candidates stated a benefit and a risk but did not develop this further to identify that the benefits outweigh the risks and therefore did not gain the second mark.
- 1(d) Generally this question was answered well. Common incorrect answers made reference to potential harm to the mother or the inaccuracy of the test.

- 2(a) A surprising number of candidates did not score a mark for this question. Common incorrect responses included the use chromosome numbers (23) or single letters (X or Y).
- 2(b)(i) This mathematical question did not appear to cause candidates any problems and the majority were awarded the mark.
- 2(b)(ii) Candidates found this second mathematical question difficult with few candidates scoring any marks. Common incorrect calculations included adding 1.2 to 1000 or dividing 1000 by 1.2. A higher number of candidates did not attempt this question compared to other questions.
- 2(b)(iii) This also proved to be a difficult question. Those candidates that did score 2 marks were often awarded the marks for identifying that the ratio could have been a result of the termination of female foetuses. Those candidates gaining one mark frequently did so for reference to gender selection. Many candidates were familiar with China's one child policy but did not always apply this knowledge effectively. Incorrect responses included suggestions that the male chromosome/gene may be stronger.
- 3 This was the first six-mark extended-writing question. A large range of responses at all levels were observed with many candidates achieving Level 2 and Level 3. Candidates provided good, detailed descriptions and examples of both genetic and environmental influences. Unfortunately some candidates did not discuss both elements and in these cases the mark was limited. Fewer candidates identified characteristics that would be influenced by both genes and the environment, which again limited their mark. A common error made by candidates was in the selection of a characteristic determined solely by the environment, many candidates incorrectly identified height and weight. Examiners were pleased to see full and very good answers to this question.
- 4(a) Many candidates gave a good description of the method that could be used to measure the pulse rate and came very close to scoring a mark for this question but failed to then explain that the beats should be counted over a period of time and subsequently lost the mark.
- 4(b)(i) The majority of candidates were able to use the formula given to calculate the cardiac output. Those candidates that did not appear to use a calculator often got an incorrect answer.
- 4(b)(ii) A surprising number of candidates did not appear to know how to calculate the range for this data. Many answers were expressed with the higher number given first. Candidates should be reminded how to present the range. Examiners were instructed to use an error carried forward from part (b) (i) to ensure candidates were not penalised for the same mistake twice.
- 4 (b)(iii) This question was generally well answered though some candidates failed to gain the mark due to a reversed order or the presentation of the pulse rates rather than the individuals names.
- 4(b)(iv) The majority of candidates correctly identified one or both reasons as to why the order of fitness presented could be incorrect.
- 5(a) This mathematical question proved more demanding. Many candidates struggled to use the formula provided to generate a correct answer and failed to identify that r was the radius of the zone of inhibition. Common mistakes observed included r^2 or $r \times 2$. Candidates who understood the formula gained two marks.

- 5(b) Candidates were asked to use data to draw conclusions from the results. Candidates who did not score in part a, were not disadvantaged in this question as the correct answers could be identified despite an incorrect answer to part a. A range of marks were observed for this question. A common error made by candidates was the identification that ‘water kills more bacteria than any antibiotic’ and that ‘antibiotic C must be water’.
- 5(c) This question proved more difficult. Candidates found it difficult to explain why it was important that all the paper discs were the same size. Many candidates scored one mark for using the term ‘fair test’, but struggled to express what they meant by this term and could not relate it to the investigation. Centres should be encouraged to address this problem. Very few candidates stated that using the same size paper discs allowed a fair comparison of the antibiotics and even fewer candidates were able to relate the size of discs to the same amount of antibiotic used in each test.
- 5(d) The vast majority of candidates answered this question well. They were able to explain that new antibiotics were tested both for safety and effectiveness. These reasons were expressed in many ways.
- 6 This was the second of the six-mark extended-writing questions. Again a range of responses were observed for this question. Candidates awarded Level 1 often had difficulty describing the correlation presented and failed to identify other factors that demonstrated similar correlations. Many candidates were awarded Level 2 for the correct identification of obesity, smoking, salt, alcohol or drug abuse as factors with similar correlations. Fewer candidates were awarded Level 3 as, although factors were identified, the expected correlation which would be observed was not stated. Some candidates lost marks for stating that ‘drinking’ would present a similar correlation without highlighting that it was alcohol which was being consumed. Factors less commonly discussed included stress, age and high blood pressure.
- 7(a)(i) The majority of candidates scored one mark for this question, correctly identifying that the number of extinctions was increasing. Fewer candidates correctly identified that there was no initial increase.
- 7(a)(ii) The vast majority of candidates scored the mark for this question, those failing to gain the mark frequently gave the number of extinctions as just below 40,000.
- 7(b)(i) The majority of candidates gained one mark for this question for correctly identifying a consequence of increased population. A good range of answers were observed, demonstrating candidates’ knowledge of the consequences of an increasing population. Many candidates went on to develop this answer providing a result of the consequence identified. Some candidates lost the second marking point for stating two consequences rather than developing one.
- 7(b)(ii) Many candidates lost the mark for this question for simply identifying the section of Boris’ statement that was incorrect. Although this in part was correct they failed to develop the answer and explain why this was the case and as a result could not be awarded the mark.
- 7(c) The vast majority of candidates scored both marks for this question, correctly identifying why biodiversity is important.
- 8 This six-mark extended-writing question was common with the Higher Tier and, as anticipated, candidates found this extended writing question the most difficult. Many candidates did not have a good grasp of the processes of selective breeding and natural selection and as a result found talking about their similarities and differences

problematic. Many candidates gained marks for the correct identification of a feature of either natural selection or selective breeding or in many cases features about both. Unfortunately many candidates were unable to develop their answer and make a comparison of the two processes. Common similarities discussed included the correct identification of both as methods of breeding and the processes involving the selection of favourable characteristics. A common difference frequently observed highlighted the human control of selection in selective breeding and the lack of this in natural selection. Some candidates did confuse selective breeding with gene manipulation and IVF.

- 9 Candidates did not appear to have a good working knowledge of the carbon cycle and as a result this question was often one that candidates struggled with.
- 9(a) A range of answers were observed for this question, with many candidates correctly identifying all three processes.
- 9(b) A surprising number of candidates could not identify that the animals were eating the plants and those that did identify this often failed to develop the answer further.
- 9(c) Candidates also found this question difficult. Very few candidates understood the role of microorganisms. Those that did, however, often went on to score two marks for this question.

A161/02 Twenty First Century Science Biology A (B1, B2, B3) Higher Tier

General comments:

Candidates demonstrated that they had secure knowledge of many aspects of the specification such as construction of genetic diagrams, discussing the implications of testing for genetic disorders, factors that can increase the risk of heart disease and how to measure pulse rate and how new drugs are tested. The majority of candidates were able to process data confidently to calculate the mean of experimental results and work out probabilities.

Candidates did not seem to have the knowledge or skills required to respond to questions about perception of risk, interpretation of practical results on antibiotic activity and explaining how gender is determined by the sex-determining gene on the Y chromosome. Other areas of the specification that candidates did not perform well on include recycling of carbon through the environment, comparing natural selection to selective breeding and being able to explain the meaning of a fair test and why it is important.

Comments on individual questions:

- 1(a) This was a well answered question. Many candidates were able to produce a correct genetic diagram and probability. Some candidates limited their mark by not using the letters provided.
- 1(b)(i) To get the mark for this question, candidates needed to identify either 'more fetal cells' or 'no need to separate maternal from fetal cells'. Answers linked to accuracy/reliability did not get the mark.
- 1(b)(ii) Many candidates were able to compare the methods given and give an advantage for the new one.
- 1(c) Candidates demonstrated secure knowledge in relation to genetic testing. Good responses were able to discuss in detail a variety of relevant factors.
- 2(a) Good responses linked chromosomes to the correct gender. Answers using genes or DNA did not get the mark.
- 2(b) This was a challenging question. Candidates needed to know about the sex-determining gene on the Y chromosome and how it has its effect on gender.
- 3(a) Most candidates were able to give all 3 correct responses to this question.
- 3(b) Many candidates knew the implications of a genetic test in relation to insurance companies and so scored at least 1 mark.
- 3(c) The best responses were able to utilise the idea that perceived risk is different to the calculated one.
- 4(a) This was a well answered question. Where candidates did not get the mark, they either described a method with no measurement or used an incorrect unit of time.
- 4(b)(i) 6900 was the correct response.

- 4(b)(ii) Most candidates were able to process the data accurately and identify the correct person.
- 4(b)(iii) The best responses recognised that pulse rates can vary in addition to stating a way of increasing the confidence in the results.
- 5(a) Most candidates were able to calculate correctly the total area of A.
- 5(b) A good discriminator. Only some candidates were able to link correct descriptions to explanations and conclusions. Recognition that clear areas were due to antimicrobial action was required to gain level 3 marks.
- 5(c) Good responses were able to explain what a fair test is and why it is important.
- 5(d) This was a well answered question, demonstrating that candidates have secure knowledge on how drug trials are carried out.
- 6(a)(i) Most candidates were able to give the 2 correct responses required.
- 6(a)(ii) It was encouraging to see that most candidates could interpret the graph correctly.
- 6(a)(iii) The best responses were able to describe the correct trend and explain it in relation to human activities.
- 6(b)(i) Most candidates were able to identify a relevant method to prevent extinction of species.
- 6(b)(ii) The best responses were able to produce two reasons why preventing extinctions is important to the environment.
- 7 This question differentiated well. Good responses were able to provide a number of similarities and differences between natural selection and selective breeding.
- 8(a) Most candidates were able to give the 3 correct responses required.
- 8(b) This was a challenging question. Responses had to include the importance of recycling carbon as well as describe a transfer process.
- 8(c) This was a challenging question. The best responses were able to explain why not all of the carbon had been transferred to the fox. Responses which discussed energy transfer did not gain marks.

A162/01 Twenty First Century Science Biology A (B4, B5, B6) Foundation Tier

General comments:

Many candidates showed that they had been well prepared for this paper. Instructions on how many boxes to tick in parts of some questions were well followed. Some calculated responses could have been improved by showing working out as well as the final answer e.g. in Q4.

The longer written answers were all generally attempted, especially Q2 and Q8. Where these responses could be improved it was almost invariably by recalling more scientific detail, e.g. giving a full description of the chemical changes in photosynthesis in Q2, or about chromosomes in mitosis and meiosis in Q5, or about reflex arcs in Q8. The best responses to these questions showed a clearly planned structure.

The description and interpretation of graphs involved in Q1 (d) and Q3(d) were challenging. The best responses showed awareness of how to describe a range and of how to apply the key idea of correlation. Responses where the comprehension of what a correlation means were confused and were difficult to award many marks to.

Candidates who correctly used technical terms such as mitosis, meiosis, zygote, and phototropism were better able to construct accurate and succinct responses to the questions.

Comments on individual questions:

Q1(a) This question was often well answered with a succinct phrase.

Q1(b) The answer called for three ticks, which most candidates did offer. It was most common for marks to be scored for “active site” and “enzymes are proteins”. Only the most successful candidates were able to link this to “made from instructions in genes”.

Q1(c)(i) The question was best answered by those who used technical vocabulary e.g. “digests”. Some responses which did not score were couched in vague terms which often restated the question.

Q1(c)(ii) Those who did score a mark most often did so for the idea of the enzyme denaturing at high temperature. It was much less common for candidates to score the optimum temperature marking point, and many were explicit in giving 37°C or body temperature as the optimum, showing that their thinking was limited to the context of the human body.

Q1(d) This question was often well answered in terms of giving pH6 as the optimum, and some were able to score a further mark for describing the range. Few went on to explain that the enzyme does not work below pH3 or above pH9 clearly enough for a mark to be awarded.

Q2 A well answered question by those who coupled a clear description of photosynthesis with features of the plant which could account for the rapid growth. The very best used an equation to summarise photosynthesis. Far from all responses showed a clear or complete description of photosynthesis, and this greatly limited the marks they could score.

- Q3(a) Correctly answered by many who could correctly spell both aerobic and anaerobic. The substantial minority who did not score the mark seemed not to be aware of the terms at all rather than simply making spelling errors.
- Q3(b) This part was well answered by many candidates. A number of others were able to score 1 mark by showing some working.
- Q3(c) The question required candidates to realise that lactic acid would be produced by anaerobic respiration, and a number scored this marking point by linking this to pain or cramp. Candidates also needed to realise that Type A (aerobic) respiration provides a lot more energy than anaerobic respiration.
- Q3(d)(i) This was a challenging question which required candidates to understand the difference between positive and negative correlation. Some responses were limited by giving only a trend e.g. in section A the heart rate goes up. The best responses were ones where the consideration of the graph was organised into the four sections on the graph.
- Q3(d)(ii) Part dii was very well answered by the majority of candidates.
- Q4(a) The question required the response 'zygote', where this was not given the most common incorrect response by far was 'embryo'.
- Q4(b) Candidates found this a challenging question which required them to double the number of bacteria each generation. Many responses were 6 or 8 rather than the correct 7, but credit for doubling could only be given where there was evidence of working out on the paper.
- Q4(c) Candidates needed recall of the fact of specialisation after the 8 cell stage, and the realisation that this represents three doublings. The question was very challenging, and the most common response seems to be 8.
- Q4(d) This question was challenging in requiring the unprompted response of stem cells along with the idea that they would specialise at a later stage. It was most common to see descriptions of later specialisation scoring one of the marks.
- Q5 The question was sometimes well answered by those who could name both mitosis and meiosis. Candidates also needed to be able to develop their answers with descriptions of what happens to the chromosomes in each of the processes.
- Q6(a) Part 6a was very well answered.
- Q6(b) Candidates were required to recall of the term phototropism as opposed to photosynthesis.
- Q6(c) This question showed that it was challenging to link the idea that light energy is needed for photosynthesis to the idea that this would lead to the plant producing more food or glucose.
- Q7(a) Part 7a was very well answered.
- Q7(b) This part was often well answered, with the great majority of candidates at least indicating option D.
- Q7(c)(i) This part was fairly well answered. Where a mark was dropped it was by choosing one of the wrong options instead of realising that the patient needs to give informed permission for the research.

Q7(c)(ii) Part 7cii was very well answered, most candidates choose the correct pair of options.

Q7(d) This question often yielded one mark, more rarely both for realising that both the sensory and motor neurons would be affected.

Q8 Candidates were required to give details about how the response would arise within the squirrel and to go beyond the most basic level of what the squirrel would do.

A162/02 Twenty First Century Science Biology A (B4, B5, B6) Higher Tier

General comments:

Few candidates left blank spaces, suggesting that there were no problems in finishing the paper within the time allowed.

Comments on individual questions:

- Q1 (a) This question asked for the direction of oxygen and carbon dioxide through the stoma of a plant which was photosynthesising. Most candidates answered correctly. If it was wrong it was usually because the arrows were going in the wrong direction or arrows were pointing in the same direction or arrows were not labelled at all. Some candidates didn't put gases going into and out of the stoma but to the side or entering through the upper surface of the leaf.
- Q1 (b) There was no specific pattern for incorrect answers here. Ticks next to "water vapour builds up inside the rolled leaf" seemed to be the most popular answer. There were 3 marks available here and this is usually a hint but not always to put three ticks. Candidates who put more than 3 ticks lost a mark even if they had 3 correct. Most common score was 2 marks.
- Q2 Candidates were given a graph of rate of reaction of an enzyme against pH. They had to explain how enzymes worked and relate it to the graph. A considerable number just gave a general explanation of why pH affects rate, with excellent explanations but with no reference to the graph they could only achieve level 1. Many candidates scrapped into level 2 by discussing the graph and also mentioning denaturing of enzymes. Candidates who got level 3 - 5 marks often lost the final mark by not discussing both sides of the graph, or by making an error such as the incorrect pH number for the optimum (usually pH7). Many candidates discussed temperature, which was a pity as their explanations were excellent but scored no marks. Many thought the rate was increasing (to pH 6) because the particles were moving faster. Candidates obviously understood why increased temperature increases rate but few understood why pH does. However, there were some excellent answers, including the idea of changed charges on atoms on the active site, denaturing, breaking of bonds and substrate unable to fit. This was then linked to both sides and the middle of the graph.
- Q3 This question is about energy and respiration.
- Q3(a) The candidates were given a formula to enable them to calculate a ratio. Many candidates gave fractions so could score a maximum of 1 mark. Some managed to get to 19.2 in their working but chose a different answer e.g. 96/5 which suggests uncertainty about what was required or what a ratio is.
- Q3(b) Most candidates realised that Type A released more energy with fewer scoring the lactic acid mark. Weaker answers focussed on the provision of oxygen as being necessary to survive/ complete the race and/or the need for water/hydration. Some candidates didn't answer the question and just discussed what aerobic / anaerobic respiration were and the fact that marathon runners need lots of oxygen.

- Q3(c)(i) Candidates often lost marks because the sections (A, B, C and D) weren't specified. Some lost marks as they seemed to run out of steam or maybe space as they gave good answers for the first couple of sections then didn't do the others. They can obviously look at graphs and pick out patterns. They talked in terms of increase / decrease and not really in terms of positive/ negative correlation. Correlations were generally not well understood with many thinking that C showed no correlation and D a negative one. Candidates do not appear to understand negative correlation, candidates think that going down is negative correlation, i.e. in D they said negative correlation (instead of positive) as both decrease.
- Q3(c)(ii) Generally candidates knew that confidence in a conclusion means repeating things on the same person. The most common wrong answer was the last box – repeating the same experiment with other runners.
- Q4(a) This question required candidates to tick correct boxes concerning genes switched on in cells for photosynthesis to take place. Three marks were available and many candidates realised they should tick 3 boxes, generally scoring between 2-3 marks. Unfortunately, some only ticked 1, or more commonly, 2 boxes so couldn't gain the full 3 marks. Others ticked more than 3 boxes so lost a mark for each extra incorrect tick. There was no pattern to the wrong answers which suggests that candidates were unclear as to the function of a gene.
- Q4(b) This required candidates to tick correct boxes concerning ethical issues surrounding the use of embryonic stem cells. Two marks were available and this was well answered with many candidates gaining both marks. Unfortunately, some only ticked 1 and others ticked more than 2 boxes so, as above, lost a mark for each extra incorrect tick.
- Q5 The question was well answered by a significant proportion of the candidates i.e. they were awarded 5 or 6 marks and there were remarkably few no responses. A few candidates gave excellent responses which were restricted to just coding or making points and were therefore limited to Level 1 but these were very much in the minority. Most responses awarded Level 1 marks were simply because of lack of knowledge. Similarly a few candidates gave good answers with several coding or making points but only a single point for the other aspect and were limited to level 2 because of this. One common 'error' seen was the occasional protein/enzyme being formed in the chloroplast. Not many except the very best candidates utilised the '3 bases needed to code for one amino acid' point although several did recognise that proteins/enzymes were made out of amino acids and that this involved a triplet code and some idea of a sequence or order. Some candidates completely misunderstood the question and gave details about how enzymes work (lock-and-key, etc.) but nothing creditworthy. Other common mistakes referred to the triplet code of amino acids or that at the ribosome the amino acids were made or that the bases are amino acids.
- Q6(a) Many candidates were confused by this question. In this question the candidates were required to work out the difference between two auxin concentrations. It was very poorly answered and many candidates were unable to perform the calculation involving standard form. Many answers contained a string of 9s from some rather strange subtractions! They incorrectly interpreted 10^{-6} and ended up with answers 10 or 100 times less than they should. Another common error involved subtracting 10^3 from 10^6 or 10^{-6} . Some candidates did manage to gain 1 working mark and some did manage to perform the calculation correctly to gain full marks.
- Q6(b) In this question candidates were asked to interpret a graph showing the effect of auxin concentration on the growth of shoots. They could gain 3 marks from 7 marking points; it was not well answered with many candidates scoring 0 or 1 mark. Six of the seven mark points required figures to back up a statement. In many responses either no

figures were quoted or the figures were not within the acceptable ranges. E.g. the % stimulation increases up to 8ppm, the range of 6-10 was acceptable but many candidates were giving 5 or very commonly, 1-10ppm. Similarly, 70-90 was acceptable for 80 ppm where % stimulation equals 0 but many candidates were quoting 100ppm. Quite a lot of candidates mistakenly commented on root growth and others compared root and shoot growth.

- Q6(c) Candidates were asked to explain how auxin caused phototropism in shoots. This question was well answered in general. Many candidates gained marks 'auxins go to the shady side, make cells here elongate and cause the shoot to grow towards the light'. Some did not gain the last mark because they described the shoot 'moving/facing/turning' towards the light which was not acceptable. Only a tiny handful of candidates recognised that auxins were produced in the shoot tip and a few more mentioned diffusion. A few failed to gain credit because they talked about negative phototropism in roots but this was usually part of a weaker response and they often managed the 'shoot grows towards the light' mark. Some students failed to recognise the effect of the higher auxin level on one side and did not mention cell elongation or more/faster cell growth.
- Q7(a) This question asked candidates to comment on two conclusions a student made regarding the results of an experiment where different areas of the brain were stimulated. Not many candidates were able to gain full marks for this question but the question was answered well by the stronger candidates who were able to link 'flashing lights' and 'sounds' to a sensory response and movement to a motor response. Weaker candidates found this difficult to express, with some simply rephrasing parts of the question and some simply stating that they agreed. Some candidates related the conclusions to their own knowledge of the functions of parts of the brain but didn't comment on the results that the conclusions were based on. Others gave confused answers that tried to relate the conclusions to the reflex arc and not the results. Some candidates linked to motor and sensory neurons. Some students did reference the fact that there were not enough results / information to make accurate conclusions. Very few commented on the positions of the letters but those that did mostly linked this to the 'not enough information' marking point.
- Q7(b) This question asked candidates to tick boxes about statements linking to SSRIs. The question was generally well answered with many scoring 2 or 3 marks. Nearly all picked up at least 1 mark for this with some ticking more than 4 boxes and losing a mark. Common mistakes were incorrectly ticking the 1st and 5th boxes showing a misunderstanding of how SSRI's affect serotonin.
- Q7(c) In this question candidates were asked to discuss ethical issues associated with using brain damaged patients for research. This was answered well in the main, with the majority of pupils either mentioning the idea of informed consent (some expressing this as the patient not being aware or understanding) and / or harming the patient further. Few candidates were able to express the idea that the patient may not benefit directly from the research. Some candidates clearly didn't understand the concept of 'ethical issues' with some mentioning problems with obtaining reliable results. Others simply stated that it was 'disrespectful' or that people would object due to 'religious reasons'.
- Q8(a) This question asked candidates to identify conditioned reflexes. This question was very well answered with most candidates gaining the full 2 marks. A common mistake was ticking the top box (insect flies away when it sees sudden movement).
- Q8(b) This question concerned Pavlov's conditioned dogs and candidates had to link each action with its correct description. Many achieved full marks with a few getting one and not many achieving 0 on this joining boxes question. A common mistake was getting the primary and secondary stimulus the wrong way around.

- Q8(c) Candidates were asked to give an example of a useful conditioned reflex. On the whole, this was not answered well. Some pupils answered with an example relating to birds associating the bright colours of a caterpillar with a bad taste / feeling ill and therefore avoiding them in order to prevent them from being poisoned. Other good answers included examples relating to training animals (e.g. dogs to sniff out drugs or to behave well). A lot of candidates gave examples of simple reflexes such as dropping a hot plate and others used an example given in 8d of not dropping a hot plate. Some obtained one mark by explaining the usefulness of the reflex (e.g. not damaging skin / not dropping food on the floor). Weaker candidates simply re-stated one of the examples already given in 8a.
- Q8(d) Candidates were asked for an explanation as to how the brain can over-ride a reflex to drop a hot plate. This was answered poorly by most candidates. Some suggested that the brain could stop the pain receptors from detecting the pain, others simply stated that the brain 'chose to keep hold of the plate', others said that the brain could modify the reflex arc / stop the motor neuron from sending a message. A small number of pupils were able to state that the brain sent a message to the muscles in the hand to keep hold of the plate. Very few candidates were able to state that the brain sent an impulse to the effector. Signal and messages were the imprecise terms used by candidates. Candidates also answered along the lines that the impulses would arrive at the brain and be either rerouted, stopped altogether or modified to make the impulse far less intense as a result, and so the effector would not respond. Others thought that through repetition you would gradually be able to get used to the pain and hence keep hold of the plate.
- Q9 In this question candidates were asked to suggest why a predator appearing causes a rapid response in a squirrel and to describe the processes that occur to allow the response to happen. Most pupils answered this very well, with many scoring 6/6 marks. Clear knowledge of the neuron pathways from receptor through to effector was demonstrated by many. Very strong answers included references to muscles as effectors as well as glands producing adrenaline. Few candidates referred to the properties of impulses (electrical, fast, short-lived) or to synapses. Weaker answers simply stated that the squirrel would 'run away' or 'see the predator and run'. Some responses referred to the 'eyes' or 'ears' of the squirrel and to the brain, but details of the pathway were either not given or were incorrect. Common mistakes included students referring to conditioning in the response and association of the predator with previous confrontations.

A163/01 Module B7

General comments:

This was the second time that candidates were able to access this new specification paper. There was a good spread of marks, candidates scores ranged from 0 to 46 out of a maximum of 60 marks.

Many candidates appeared to have been well prepared for the examination, attempting the majority of questions. However several candidates did not attempt the six mark, extended writing questions as well as some of the other questions that required the candidates to answer with a written response of several sentences. A number of these candidates did score well on the objective 'tick box' and quantitative skill questions however, which perhaps indicates a lack of application rather than lack of ability.

Most candidates used the spaces provided for their responses with very few extending their answers to other parts of the paper. Candidates should be reminded that additional examination sheets should be used if their responses are likely to extend beyond the available space.

Candidates should be encouraged to have access to a calculator. It was disappointing to observe a number of scripts where candidates indicated that they did not have one available, however there were fewer than in last year's examination.

There were a number of specification areas that appeared to be causing some problems for the candidates. These will be highlighted in the next section.

Comments on individual questions:

Q1 (a)(i) Candidates answered this part well, the majority being able to accurately interpret the scale on the graph.

(a)(ii) The majority of the candidates correctly interpreted the second chart, however some candidates used the diastolic value.

(b) The wide range of acceptable days ensured that most candidates could access this mark.

(c) There were a wide range of acceptable answers here, however a number of candidates failed to gain the mark by going down the diet route.

(d)(i) There was a disappointingly high number of candidates who were unable to calculate a mean.

(d)(ii) The idea that the mean is the best estimate of the true value was known by very few candidates.

(d)(iii) This section was answered well, most candidates able to interpret the data in order to obtain the range.

(d)(iv) This section proved to be quite difficult for a number of candidates as the data on three pages needed to be accessed in order to obtain the evidence.

Q2 (a) The extended writing question differentiated well with many candidates able to discuss the functions of the skeleton, however fewer able to discuss how joints work.

- (b)(i) A number of candidates did not know the meaning of the word 'symptom', however were able to gain the marks for the treatment of a sprain injury.
- (b)(ii) Several candidates were under the misapprehension that joints could 'break' and failed to give correct injuries.
- Q3 (a) The idea that red blood cells do not have a nucleus to allow for more haemoglobin or to allow more oxygen to be carried was very poorly understood.
- (b) Likewise the problems associated with carbon monoxide was very poorly understood, very few candidates gaining many marks here.
- Q4 Once again this extended writing question differentiated well. Many candidates understood that insulin had a role in control of blood sugar, however were unsure whether it raised or lowered the level.
- Q5 (a) Many candidates failed to understand the concept in this question and merely answered that there would be more plants grown rather than the idea that reproduction has many failures.
- (b)(i) Many candidates failed to do what they were asked in the question, to compare. Many answers only wrote about one condition or failed to use numbers.
- (b)(ii) This question was answered well, many candidates able to interpret the data.
- (b)(iii) However many candidates failed to extend this interpretation of data in this section and confused range and mean in the answers.
- (b)(iv) This was a well answered section, with many candidates knowledge of how science works enabling them to score well.
- Q6 Once again this extended writing question had a wide spread of marks. Many candidates were able to take the information from both areas and produce a response that answered the question, namely 'prediction and explanation'.
- Q7 (a) This was well answered indicating that many candidates knowledge of genetic modification was good.
- (b) There was a large problem in this question with candidates not knowing what a herbicide does. A number knew that it killed something but many were under the misapprehension that it killed insects.
- Q8 (a) – (d) This area of the specification was poorly answered last year and although slightly better answered this year it still indicates that candidates are still unsure about open and closed loop ecosystems. The question was worth seven marks in total and it was only part (c) about ecosystem services that gained many marks.

A163/02 Module B7

General comments:

Most candidates were well prepared for this paper and made a very good attempt at answering all of the questions.

The paper included three, six mark questions. Centres that scrutinise the mark scheme for this paper will notice that the marking of these questions is more structured and the mark scheme allows credit for what the candidates know and can do. The majority of candidates made an excellent attempt at answering these questions and were well prepared as to how to structure their responses.

The paper was suitably challenging and discriminated well between candidates. Very few sections were unanswered suggesting that the paper was accessible to most candidates. There was no evidence that any of the candidates ran out of time.

Comments on individual questions:

Question No. 1

This question proved to be an accessible start to the paper, giving encouragement to less able candidates.

- (a) (i) Most candidates correctly identified both the diastolic and systolic pressure readings from the graph. Both readings were required to score the mark.
- (a) (ii) This question was also well answered, with most candidates determining from the chart, that the blood pressure readings were in the high category.
- (b) Once again, candidates scored well on this question. As it was hard to be specific concerning the exact date that the medicine was administered a range of answers from day 27 to day 35 was accepted.
- (c) This was also answered well by most candidates. A wide range of responses were accepted, but vague answers that just referred to diet were not. Better answers referred to exercise, varying activities, smoking, or stress.
- (d) (i) Most candidates scored two marks for this question. Some candidates however answered incorrectly and wasted the opportunity of scoring at least one of the marks, by not showing their calculations. Students should always be encouraged to show their calculations as this can often salvage at least some of the marks.
- (d) (ii) This proved to be a more challenging question. Vague answers that just referred to producing a more accurate result were not credited. Better answers referred to being closer to the true value or being able to compare with other sets of data. It is time well spent for centres to ensure that candidates are familiar with all the statements that deal with definitions in the specification.
- (d) (iii) Candidates performed well on this question, correctly identifying the extremes of the range from the data in the table.

- (iv) This question was not answered well. Many candidates failed to make it clear that their answer referred to data both before and after the medicine was taken. This lack of comparison resulted in some candidates failing to score. Another error was that most candidates only used data from the systolic readings on the graph and failed to refer to the diastolic data. Examiners used 'error carried forward' to determine the date the medicine was taken in order to compare before and after data.

Question No. 2

- (a) This was a six mark, level of response question that assessed candidates up to A*. Examiners were looking for answers that referred to monitoring and control of both high and low body temperatures. Most candidates performed well on this question with reference to receptors and the hypothalamus monitoring changes in temperatures and then describing how effectors were responsible for maintaining a constant body temperature. An area of concern is the number of candidates who refer to blood vessels in the skin moving closer or further away from the surface. This is such a basic error, that when this occurred, examiners were unable to give full marks for what otherwise may have been an excellent answer.
- (b) This question elicited a wide range of responses from thermostats to open loop systems. Good answers gave either negative feedback or antagonistic and then explained that greenhouse two was better as the temperature could be lowered. Vague answers that just referred to heat rather than temperature control, were not credited.

Question No. 3

- (a) Most candidates scored at least one of the marks for this question by inferring that substances passed through the capillary wall. Fewer candidates went on to refer to pressure or that plasma was involved in the formation of tissue fluid.
- (b) Candidates found this question more accessible than part (a). Good answers included reference to diffusion and the transfer of oxygen and glucose to cells and the removal of carbon dioxide and urea from cells.

Question No. 4

This was the second level of response, six mark question. It was targeted at candidates up to grade A.

Lower level answers simply referred to the effect of insecticide on the targeted insects and how their removal would influence the food chain. Better answers stated how the insecticide would be passed on through the food chain. The best answers referred to the build-up of insecticide to lethal levels due to top carnivores eating a larger number of organisms lower down the food chain.

Question No. 5

- (a) Most candidates managed to score the mark for this question. Examiners allowed a wide range of 84 to 90 minutes for person A in order to ensure that any reasonable answer was credited.
- (b) This question proved to be more challenging. Candidates were asked to state how the level differed between the two people. A common failing was simply to state what was happening to one of the individuals rather than compare the two.

- (c) Some candidates failed to realise that this was a three mark question and consequently needed three conclusions. Good answers included the idea that A was a diabetic, produced too little insulin and that B was healthy.
- (d) Good answers referred to increasing confidence in the prediction but not necessarily proving that the prediction was correct. However this question was not answered well by most candidates. Answers that stated that it proved the prediction was correct did not score.

Question No. 6

This was the third of the level of response questions and was overlap with the foundation tier. It was targeted at candidates up to grade C.

As expected for higher tier candidates, this question was answered well by most candidates. Examiners were looking for three specific areas in candidates answers. Credit was given for predicting what would happen to Helene as she rose to the surface, what problems this would cause her and finally how these problems could be prevented.

Question No. 7

- (a) This proved to be the most challenging question on the paper and was only answered well by the most able candidates. Credit was given for correctly identifying which of the three statements were correct and then giving a credible reason why, for each statement. Centres would be well advised to spend more time on this area of the specification.
- (b) This question proved to be harder than was anticipated. Candidates could either state that it was open or closed loop. Although they were not credited for this, they were then credited for justifying their decision. Some candidates gave the opposite reasons for their decision and were not credited. Others only gave a partial explanation and thus only received one of the two marks. Good answers for open loop gave examples of things that were both added and taken away. Good answers for closed loop gave examples of things that were retained within the greenhouse or were recycled.

Question No. 8

- (a) This was answered well with most candidates scoring all four marks.
- (b) Examiners were looking here for some physical evidence that the DNA was in fact carrying the allele. Good answers referred to glowing under UV light, or even that the black colour in the diagram indicated the presence of the allele.

Question No. 9

- (a) This was a straightforward multiple choice question that required three correct responses for three marks. It was answered well by most candidates.
- (b) This multiple choice question required three correct responses for two marks and was also well answered by candidates.

A164 Controlled Assessment

Overview

This was the second session for the assessment of the 21C Science suites Investigation controlled assessment. It was a real pleasure to see how most centres had responded to advice and guidance from last year. There were far fewer centres requiring scaling than last year and in general these changes were smaller. However a significant proportion of centres still had their marks altered this session, with large scalings. The most common cause of significant changes to centres marks still relates to the hierarchical nature of the marking criteria, details of which are addressed below.

Candidates' scripts from a small number of Centres were overly long, although timings indicated in the specification are for guidance only; it was clear that in some instances these had been exceeded markedly to the extent that in some instances this was malpractice. Candidates should not be allowed unreasonable amounts of time and it should be impressed upon candidates that producing reports is an exercise in conciseness.

Administration

A significant number of centres entered candidates for the wrong component, significantly delaying the requesting of manuscripts. Please note that the suffix /01 is for entry via the repository (i.e. electronic copies of candidates work) and the suffix /02 is for the normal postal moderation.

Documentary evidence of internal standardisation was also supplied in a large number of instances, but for many Centres, this was not provided. Much inconsistent marking seen suggested that internal standardisation procedures had not been applied by some Centres, and Centres are reminded of their obligations:

'It is important that all internal assessors of this Controlled Assessment work to common standards. Centres must ensure that the internal standardisation of marks across assessors and teaching groups takes place using an appropriate procedure.' Section 5 of the specifications suggests some ways in which this can be carried out.

In general the provision of samples was very good, with work sent promptly with all the correct administrative documents. When not correct the most common omission was the CCS160 Centre Declaration although a number of centres failed to attach the Coursework cover sheet to the front of each candidate's work, which always causes problems to the moderator. When submitting samples please do not use plastic wallets, the preferred method for holding a candidates work together is treasury tags. There were few clerical errors this session, but where they did occur they were nearly always the result of careless addition or transcription of marks.

Few Centres provided their Moderator with detailed accounts of how the tasks and levels of control were administered; where present, these aided the moderation process.

Annotation

Annotation of candidates' work was excellent in many instances, but variable from Centre to Centre, and sometimes within a Centre. The annotation ranged from *just a series of ticks here and there to the relevant skill area code written adjacent to where the point had been made, backed up by a supporting comment*. We would always encourage centres to adopt the latter of the two approaches. Please note that it is a requirement that 'each piece of internally assessed work should show how the marks have been awarded in relation to the marking criteria'.

Hierarchy

A significant number of centres did not treat the criteria as hierarchical. Where this was the case centres were often significantly out of tolerance. Each statement at a lower must be met before marks can be awarded at a higher level. So for example all the criteria at level 1-2 marks need to be met before 3-4 marks can be awarded.

When marking the work each criteria should be annotated where it is met. Beginning with the lowest level and working up to the level where a criterion is not met. This will determine the level of marks awarded. If the candidate meets all the criteria a given level then the higher of the two marks is awarded. Where the candidate meets some of the criteria in a level the lower of the two marks must be awarded.

For example, in strand Eb a candidate who fails to make any comments about outliers is limited to a maximum of 3 marks no matter how well they consider the degree of scatter and general pattern of results. A consequence of this is that it is important that:

- candidates are taught to address lower level criteria as well as higher level criteria.
- teachers take care in identifying where the criteria are met otherwise quite large alterations in marks may result during moderation.

Particular criteria that have not been addressed by candidates are identified below

Interpretation of assessment criteria

Sa – formulating a hypothesis or prediction

For 21C Sciences a scientific hypothesis is a tentative explanation of science related observations or some phenomenon or event. The key point here is the idea of the explanation. A useful hypothesis allows a prediction to be made from it that can be tested experimentally.

The most common difficulties here were insufficient science used to develop the hypothesis. A common mistake was to provide 'a large chunk' of scientific knowledge but not relating this clearly to the development of the hypothesis.

Secondly, major factors were not considered before selecting a factor for the development of the hypothesis. It is not sufficient to state a factor, give a hypothesis and then list other factors as control variables. Candidates are recommended to structure their reports to make this process clear.

At the highest levels 7-8 marks it is important that candidates consider all relevant factors prior to selecting one. A quantitative predication must be derived or related to the hypothesis not simply an unjustified guess.

It is worth mentioning that work in this strand may not be credited for work in strands Ra or Rb which are carried out under conditions of high control.

Sb - Design of techniques and choice of equipment

In this session, this strand was often generously marked. It was often not possible to justify the centre marks because students limited themselves to a maximum of 5 marks by failing to explain their chosen range of data. It was disappointing to find that the range (of the independent variable) was rarely explained. Centres seemed to believe that just 'stating' the range was sufficient. This explanation can be pragmatic, 'there were only 5 different strength lens available', based on safety issues, 'the upper end of the range was limited to 2M as any more concentrated would be too corrosive' or based on prior knowledge/preliminary work 'from PE I know students cannot do step ups steadily for more than 3 minutes' or 'my preliminary work showed a reasonable change in the dependent variable of this range'. Note both ends of the range should be mentioned.

Good scientific justifications of the method, equipment and techniques selected must be provided for candidates to be awarded marks in the 7-8 mark level. Some candidates carried out preliminary work prior to the experiment proper. Although not a requirement, if it is practicable to do so in the allotted time, this can help to candidates to justify the method, equipment or range used. Justifications, however, were often weak, and the reasons for the use of a particular method, in particular, were often not provided. Many candidates produced tables, ostensibly to justify the equipment used, but these often listed every piece and simply described how they were used rather than justifying the choice, some very mundane statements were seen. At this 7-8 mark level, candidates should be using terminology such as 'resolution', 'accuracy' and 'precision' in their justifications.

In this strand, candidates are also required to review aspects of Health and Safety, ranging from comments, through to producing full and appropriate Risk Assessments. These were sometimes absent, and where a high mark had been awarded, Centre marks had to be lowered significantly. It is suggested that there is no excuse for omitting Risk Assessments; this phase of the task is under limited control, and more importantly, a Risk Assessment is a prerequisite to any practical work being carried out. Risk Assessment proformas can be used, and these should include the chemical, organism, piece of equipment or activity that is likely to constitute a hazard, the hazard defined (using the appropriate terminology), the associated risk(s), and measures intended to reduce risk. Risk Assessments should pertain to the experiment in question and not to generic hazards and risks (though clearly, candidates are not penalised for the inclusion of these).

Please also note the hierarchy of awarding marks here; hazards must be identified for 3-4 marks, with 'some precautions' to minimise risk for 5-6 marks. While the word 'some' is used, it was not possible to support Centre marks where arguably the most important safety precautions are omitted e.g. the use of low voltage power supplies in electrical experiments. For 7-8 marks, for a Risk Assessment to be 'full', it must refer to *all* potential hazards and risks. This includes such things as using low voltage power supplies, limiting concentrations of solutions and the source of biological materials. Here, candidates should be encouraged to use statements such as 'low hazard' and 'limited risk'. Candidates should also consider hazards and risks of a final product of the experiment, e.g. the products of a chemical reaction or incubated agar plate. For a Risk Assessment to be 'appropriate', the hazard/risk must be appropriate to that for the chemical/equipment/activity used or undertaken. At this level they should ideally refer to PAT testing of electrical equipment, COSSH, Cleapps Hazard cards or other similar documents and show an awareness of who/where the first aider is in case of injury.

C - Range and quality of primary data

Errors in marking in this strand tended to be at the higher end. The '*correctly recording of data*' at the 5-6 mark level requires meaningful column headings, correct units and consistency in the number of significant figures/decimal places used. To match 6 marks, candidates need to show consistency both with the number of decimal places reported for their raw data and the actual measuring instrument as well as including all quantities and units in table headings.

In strand C there is no need to do more than 2 sets of results if there is close agreement between the two sets obtained. If they are not close, however, then there is a need to do a further repeat for this value –an intelligent repeat. The *regular repeats or checks for repeatability* criterion would then be matched and a possible outlier could be identified. In the new (2011/2012) specifications for Twenty First Century Science, statement 1.6 in the 'Ideas about Science' has clarified the definition and treatment of outliers (compared with the version in the legacy (2006) specifications) to state, "*If a measurement lies well outside the range within which the others in a set of repeats lie, or is off a graph line on which the others lie, this is a sign that it may be incorrect. If possible, it should be checked. If not, it should be used unless there is a specific reason to doubt its accuracy.*" Potential outliers in data collected during a Controlled Assessment should be handled in accordance with this statement, with the expectation that at this stage the measurement will be repeated/checked.

Please note that experiments that 'pool' data from a class are not suitable for this controlled assessment. Strand C is based on the primary data collected by the candidate. Data collected by other candidates is secondary data. It is very likely that a student pooling data with other students in a class will be limited to the 1-2 mark level.

A - Revealing patterns in data

Overall, the quality of work in this strand was disappointing. Arguably, this should have been the strand of the Practical Data Analysis where candidates scored the highest marks, but it was here where often the largest discrepancies between Centre and Moderator marks occurred.

Some graphs seen were of poor quality. There was clear evidence that some Centres had not checked the plotting of points carefully before awarding marks. Graphs drawn without appropriate scales, e.g. where these were non-linear, or without one or more labelled axes, and poorly-drawn lines of best fit, were often, incorrectly, awarded high marks. If the scale is inappropriate, or points are plotted incorrectly, the candidate mark cannot exceed four. Likewise, if an inappropriate line of best fit has been applied, a mark above five cannot be awarded, irrespective of whether the candidate has drawn range bars. For marks to be awarded in the highest mark levels, range bars must be drawn accurately (in addition to there being minimal errors in the plotting of data). The scales chosen by candidates often made difficult accurate plotting of data, as did crosses drawn with unsharpened pencils, particularly where millimetre graph paper was used. Although it is not essential that graph scales should start at (0,0), where axes begin with a 'zig-zag' section it is important that candidates do not extend their line of best fit into this 'undefined' area. This bad practice was seen on a number of occasions.

Please note that if computer generated graphs are produced they will be marked in exactly the same way as hand drawn graphs. In particular the grid lines on the graph must allow the plotting to be checked to 2 significant figures.

In some instances, however, candidates that were awarded very low marks having drawn very poor graphs could be awarded three or four marks owing to their calculations of means, a point sometimes overlooked by Centres.

Centres are reminded that for candidates to be awarded marks at the 5-6 mark level and higher, graphs having gridlines should be produced. They should not be drawn on lined paper. Where computer software is used to generate graphs, these should have appropriate scales, appropriate labelling, and gridlines. For candidates to score high marks, lines of best fit and range bars should be drawn manually.

Ea - Evaluation of apparatus and procedures

This was generally well assessed by centres however the common errors consisted of over marking candidates who suggested improvements but did not consider the limitations, hence not meeting the criteria at 3-4 marks.

Some improvements mentioned were trivial or lacked the detail required for higher marks. In general doing more repeats is unlikely to be a significant improvement.

There was some confusion over improvements to the experimental procedure and apparatus which is addressed here in Ea and the additional data or methods which can be used to increase confidence in the hypothesis which falls in stand **Rb**

Eb - Evaluation of primary data

A major stumbling point here was the requirement for outliers to be considered at level 3-4 marks. A significant number of centres ignored this requirement. In addition there appeared to be some confusion over what an outlier is, both amongst candidates and teachers. The criteria state '*individual results which are beyond the range of experimental error (are outliers)*'. Not all anomalous results are outliers, in particular averages are not outliers and a set of data points for a single value cannot all be outliers. In the new (2011/2012) specifications for Twenty First

Century Science, statement 1.6 in the 'Ideas about Science' has clarified the definition and treatment of outliers (compared with the version in the legacy (2006) specifications) to state, *"If a measurement lies well outside the range within which the others in a set of repeats lie, or is off a graph line on which the others lie, this is a sign that it may be incorrect. If possible, it should be checked. If not, it should be used unless there is a specific reason to doubt its accuracy."*

Potential outliers in data collected during a Controlled Assessment should be handled in accordance with this statement. Candidates are permitted to draw a graph of their results during the (limited control) data collection stage of the Controlled Assessment task. This may help them to identify potential outliers. Ideally, any data points that look to be potential outliers should be re-measured, and this is easiest to achieve if they are identified during the data collection session ie. strand C.

For 5-6 marks, although there were some often good discussions of spread of data, 'repeatability' was not always discussed. Candidates should discuss the spread of data qualitatively at this level, and quantitatively to obtain the highest marks at the top mark level at 7-8 marks. Candidates' evaluations were often very long, but many covered the pertinent points in the first few sentences.

Ra - Collection and use of secondary data

This strand was poorly addressed by many candidates.

The intention in Strand Ra is that candidates should do some research and find their own examples of secondary data. The OCR data in the 'Information for candidates (2)' document is only provided as a back up for those who fail to find any relevant secondary data from their own research.

Generally candidates are limited to 5 marks in Strand Ra if all they use is the OCR data and/or results from another candidate or group. In order to access 6 or more marks in Strand Ra candidates must present a 'range of relevant secondary data', which means that some data from the candidate's own research must be included and the source(s) of the data must be fully referenced. Guidance on referencing can be found in the 'Guide to Controlled Assessment' handbook for Unit A154 / A164 / A174 / A184 (Practical Investigation). The direct download link is <http://www.ocr.org.uk/Images/77479-guide-to-controlled-assessment.pdf>

Secondary data can be of different types:

- the data provided by OCR in the 'Information for candidates (2)' document;
- data collected by other candidates doing the same (or a similar) investigation;
- data from other sources (e.g. textbooks or the internet).

Data do not necessarily have to be quantitative; they can be qualitative. Students do not necessarily have to find a table of numbers that looks exactly like the one they have generated from their own experiment; graphs, descriptions of trends, conclusions, mathematical relationships, relevant constants, models and simulations can all be presented as secondary data.

It is helpful to the moderator if candidates included copies of the secondary data that they discuss in their report. This could be cut and pasted into the report (so long as it is clearly identified as third-party material), or may be attached to the end of the report. The material included should be carefully selected and cropped to show only the relevant parts, rather than comprising swathes of irrelevant material indiscriminately printed out.

Rb - Reviewing confidence in the hypothesis

This strand was also over-generously marked by some Centres. Candidates should be encouraged to re-state their hypothesis at the beginning of the review section to provide focus for this strand. Candidates often discussed findings but did not refer the hypothesis at all, or say if their data supported it. All candidates should make at least a statement referring to whether the hypothesis has been supported (or not), and the extent to which the data support the hypothesis.

At the 3-4 mark level upwards, candidates should make reference to some science when explaining their results. This was rarely done. It is not sufficient to merely refer to science used in Sa, as Sa is carried out under conditions of low control whereas Rb is done under high control conditions. At level 5-6 the science must be used to support the conclusion about the hypothesis.

When giving an account of extra data to be collected this must go beyond simply suggesting improvements to the procedure used, which is assessed in Ea. Different techniques or experiments that will provide additional data to assess the hypothesis are required for this strand.

Sources of Support

OCR offers several avenues of **free** support, including:

- A 'Guide to Controlled Assessment' handbook for Unit A154 / A164 / A174 / A184 (Practical Investigation). The direct download link is <http://www.ocr.org.uk/Images/77479-guide-to-controlled-assessment.pdf>
- INSET training events for 2013-14 are available details may be found on the OCR website at <http://www.cpdhub.ocr.org.uk>
- We offer a Controlled Assessment Consultancy service, in which candidate work that you have marked will be reviewed by a senior moderator prior to moderation. To make use of this service, post photocopies of three marked pieces of work to the following address: *Science Team, OCR, 1 Hills Road, Cambridge, CB1 2EU.*

Typically, we encourage Centres to send work which covers a range of attainment or which illustrates particular points of concern. The Controlled Assessment scripts should be marked and annotated before being photocopied. Please include a covering note on Centre-headed paper, and give a contact email address. A senior moderator will look at the work and will write a report on the Centre marking, which we will email or post back to you within 6 weeks. You can then make adjustments to your marking, if you wish, before submitting marks for moderation in May.

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