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Oxford Cambridge and RSA

GCSE

Further Additional Science A

Twenty First Century Science Suite

General Certificate of Secondary Education **J246**

OCR Report to Centres June 2016

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

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

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

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General Comments

There was a good spread of marks, candidates scores ranged from 0 to 44 out of a maximum of 60 marks with a score of approximately 26 marks. Very few candidates scored at the higher end, perhaps indicating that higher achieving candidates were correctly entered for the higher tier.

Many candidates appeared to have been well prepared for the examination, attempting the majority of questions. However many candidates had problems with Q3a, one of the six mark, extended writing questions (details in the next section). A number of these candidates did score well on the objective 'tick box' questions which perhaps indicates a lack of application rather than lack of ability with extended writing.

Most candidates used the spaces provided for their responses, very few extending their answers to other parts of the paper. An increasing number of candidates however did not seem able to limit their answers to the provided space and used additional examination sheets.

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:

Question 1
1(a) Most candidates were able to identify the statements relating to the function of the skeleton, however a number of candidates did not follow the instructions in the question and ticked two boxes.

1(b) Many candidates struggled to link the property of the joint part to the job, this then limited the marks gained as the marks were awarded for the complete link between Part – Job – Property.

1(c) Many candidates were able to gain at least one mark here, although a number gave weak responses such as 'break' for joint injuries.

1(d) There was a wide spread of responses in this question, showing that candidates had a good knowledge of the role of physiotherapists.

Question 2
2 This extended writing question was well answered by the majority of candidates. Many candidates were able to calculate the BMI and interpret the data and go on to formulate conclusions and suggest suitable actions.

Question 3
3(a) Unfortunately the success of the previous extended writing question did not continue with this question. Candidates found great difficulty interpreting the bar chart and connecting the data together. This resulted with poor scoring across the question.

3(b)(i) Knowledge of examples of biomedical engineering for the treatment of heart disease was quite well answered, many candidates giving correct responses, however many vague answers such as 'transplant' failed to gain marks.

3(b)(ii) Candidates tended to gain a mark for one of the acceptable answers, but again many weak responses, 'it may not work', failed to score.

3(b)(iii) Failure to respond well in the previous part had a negative impact here, very few candidates gaining credit.

Question 4

4(a)(i) Mathematical skills in the next two part questions were disappointing. Many candidates mistakenly interpreted <30 as 30 or less and also failed to add 'when stopped smoking'.

4(a)(ii) Very few candidates were able to correctly calculate the increase in percentage of fat, most mistakes were due to incorrect reading of the scale.

4(a)(iii) Most candidates were able to state one correct conclusion relating to non-smokers still having a risk of developing cancer.

4(a)(iv) Once again many candidates were able to recognise that number of years smoking was important in coming to a conclusion.

4(b) Most candidates exhibited good knowledge of the effects of unhealthy lifestyle choices.

Question 5

5(a) Most candidates gained one mark for recognising the reasons why sunlight was regarded as a sustainable source of energy.

5(b) As in previous series candidates still have great difficulties with open/closed loop systems. Many candidates gained one mark for explaining one effect but failed to recognise that the system would become open loop once the changes had occurred.

5(c) This question reflected the range of abilities within the candidates, marks gained were split with similar numbers gaining zero, one or two marks. Many incorrect responses reflected some candidates' inability to correctly read the question. Many responses referred to animals being affected, when the question specifically required a response about the effect on groups of people.

Question 6

6(a) Well answered question, many candidates gaining both marks.

6(b) Many candidates showed that they had a good knowledge of thermoregulation and gained both marks.

6(c) This good knowledge continued here again with most candidates achieving both marks.

Question 7

7(a)(i) Very few candidates were aware that enzymes were found in biological washing powders.

7(a)(ii) This question probably gained the least correct responses on the whole paper. Many incorrect answers referring to either the cheese not having meat in it or was not made from cow's milk. Only a minority knew that the enzyme (chymosin) was made from genetically modified yeast.

7(b) The final extended answer question produced a range of responses reflecting the ability of the candidates. Most were able to recognise the ability of bacteria to replicate very quickly but failed to consider the ideas behind genetic modification to produce a range of products.

A163/02 Further Additional Science A Module B7 (Higher Tier)

General Comments:

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

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. Question 2 was answered exceptionally well by the vast majority of candidates and it was clear that they had learnt this section of the specification very well. Answers were a credit to centres.

The trend for candidates to write outside the allocated area was reduced this year by the introduction of an extra answer sheet at the end of the paper. However many candidates failed to clearly identify which question they were answering. Indeed, it was not uncommon for these additional answers to be incorrectly identified with candidates writing down the incorrect question number. Candidates should be advised that this jeopardises their chances of being correctly awarded the marks that they deserve.

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 1

1(a) This was answered well by most candidates. Examiners were looking for two lifestyle and two medical answers. Good answers included reference to alcohol or tobacco consumption and exercise for part (a)(i) and family history, medication or health problems for part (a)(ii).

1(b)(i) This was also answered well, with most candidates correctly performing both calculations to score the mark.

1(b)(ii) Many candidates failed to read and act upon the question. The most common error was for candidates to fail to explain each conclusion. Thus “more blood flow to the muscles” did not gain marks but “more blood flow to the muscles to provide oxygen” did gain marks. It is vital that candidates read questions carefully and act upon the instructions provided.

1(b)(iii) This was only answered well by the most able candidates who realised that all of the 5 litres per minute of blood must go to the lungs.

1(c) This was well answered with most candidates scoring both of the marks available.

Question 2
This question was a level of response question and overlapped with the foundation tier.

This question was answered exceptionally well by almost all candidates. Credit was given for candidates calculating the BMI, referring to data in the table, then drawing appropriate conclusions and finally indicating what action "Neil" should take. Most answers were a pleasure to mark with the majority of candidates scoring full marks. The only criticism was that some candidates did the BMI calculation in the white space next to the table, but did not refer to the calculation when they wrote their answer. Examiners were instructed to look at the white space before awarding the mark to ensure that candidates were given the mark that they deserved.

Question 3
This question discriminated well between candidates.

3(a)(i) Most candidates gave the correct answer of 4.5 cm. The most common incorrect response was 6.5 cm.

3(a)(ii) Examiners credited answers from three areas. For example, good responses included reference to the risks involved in the operation, the fact that patients in Group 1 were not operated upon, and finally that some patients simply decided not to have the operation.

3(b) This was well answered with the most common response being that the benefits outweighed the risks.

3(c) Many candidates struggled with this. Good answers included responses such as perceived risk is what the patients think the risk is and calculated risk includes data/statistics/numbers. Candidates should avoid tautology such as saying perceived risk is what the patient perceives and calculated risk is what the patient calculates.

Question 4
This question was overlap with the foundation tier.

This question also discriminated well between candidates.

4(a)(i) Most candidates scored both marks for saying "less than 30" and "when they give up smoking". However several candidates only gave one of the responses thus scoring only one of the marks. Only a few candidates stated that "<" meant more than.

4(a)(ii) Many candidates struggled with the percentage calculation. Credit was given for the correct answer without the calculations but candidates should be warned that this is a risky strategy. Some candidates were awarded one mark for correctly showing the calculation even though they completed the calculation incorrectly. Candidates would be well advised to show their calculations.

4(a)(iii) This was a good discriminator. Good answers included "the older you are when you stop, the higher the risk" or "even if you have never smoked there is a small risk". The most common error was to refer to the time that a person had been smoking. This was not credited as it was impossible from the data to determine the length of time that people had smoked. Indeed that was covered in the next question.

4 (a)(iv) This required candidates to demonstrate that they realised that this would allow the determination of time that people had smoked.

Very few went on to score the second mark by referring to the length of time spent smoking affected the risk of developing cancer.

4(b) This was another example of where some candidates did not read the question carefully. Simply identifying lifestyle choices did not gain marks unless the choice was explained. Thus "a sugary diet" did not score but "a diet rich in sugar could lead to type 2 diabetes" did score.

Question 5
This was the second level of response question.

Good answers included points from three different areas. Examiners were looking to credit answers that referred to the ecosystem and biodiversity, answers that referred to the world community such as climate change and production of oxygen, and answers that referred to the local community such as erosion and local jobs. Most candidates scored at least four marks on this question.

Question 6
This question was answered well by the majority of candidates.

6(a) This was very well answered with good responses including the idea of environmental impact, raw materials used, production or transport and finally disposal. Candidates should be applauded with how well they answered this question.

6(b) Most candidates scored at least one of the two marks. A common incorrect response was "How much will it cost to manufacture the plastic …"

6(c) This was answered well with credit being given for the increased cost to the shopper but the reduction of litter or the reuse of plastic bags. Credit was not given for ideas about fewer bags are used or more are recycled.

Question 7
7(a) Most candidates scored one or two marks in part (a) and some managed to score all three. Crossing out was common and this made the marking of some candidate's responses more difficult. Candidates should be encouraged to carefully decide their answers before putting the ticks into the boxes.

7(b) A wide range of responses were accepted for answers to part (b). Good responses included oxygen, the removal of carbon dioxide, food, tourism or medicines. Answers that included "clean air" or reference to agriculture were not credited.

7(c) Most candidates scored both marks in part (c), with the most common answers including reference to dead or decaying matter, animal waste or oxygen/carbon dioxide.

Question 8
8(a) This was the third of the six mark level of response questions and was targeted at A* candidates. Most candidates scored four of the six marks for correctly referring to how the gene is obtained and how it is inserted into the bacterium. Good answers referred to the gene being from a human, cutting the gene out with enzymes and using a vector for insertion into a bacterium. Many went on to write about replication of the bacteria to produce insulin. Only the most able candidates went on to score six marks by referring to the use of a gene probe to identify which bacteria had been modified.

8(b) This was an easy end to the paper with almost all candidates identifying "may cause disease" as the correct answer.

A173/01 Further Addition Science A Module C7 (Foundation Tier)

General Comments:

Candidates used their time well. Some individual candidates left questions unanswered but in general candidates attempted all questions. Candidates were mostly appropriately entered for the foundation tier paper. A very small number of very high and very low scores were recorded.

Candidates showed sound understanding of chemistry at a foundation level across most questions.

Comments on Individual Questions:

Question 1
1(a) Over half the candidates knew the correct symbol for a reversible reaction. Two complete arrows facing in opposite directions was the most common incorrect response.

1(b) This question was well answered, almost all candidates knew which conditions increase the rate of reaction.

Question 2
2(a) Almost all candidates knew at least one correct fact about fermentation. The two incorrect distractors were both frequently chosen, implying that some candidates think that sugar is a waste product and that a very high temperature favours the process.

2(b) Many candidates thought that the water boils and kills the yeast.

2(c) Most knew that ethanol is made more concentrated by distillation.

Question 3
3(a)(i) Bulk and fine chemicals are a difficult area to address clearly. Although the manufacturing techniques are different (large scale and small scale) it is not correct to say that only small amounts of fine chemicals are *used*. Very large amounts of compounds such as paints, dyes and drugs are used every day, but each 'run' is on a small scale. Most candidates did know that the two types of chemicals are produced on a different scale, but some did not express this very clearly.

3(a)(ii) Most candidates extracted information from the table, such as the use of fine chemicals on people and animals, to gain one mark. Fewer linked this to the need to monitor purity for safety reasons or to reduce the risk of harm.

3(a)(iii) Almost all candidates correctly identified at least one stage which involved making chemical compounds.

3(b) This level of response was shared with the higher tier paper. Most foundation tier candidates, as expected, gained marks in level 1. The main reasons for earning low marks were because candidates copied out the information in the table but did not add to the information to explain why the process is not sustainable. So, for example, stating 'the process produces carbon dioxide' was not enough to gain credit unless the answer added 'which causes climate change'. Candidates need to understand that 'explain' questions always ask them to add explanations to the data, not merely repeat it.

3(c)(i) The word 'by-product' did not seem to be well known. Less than half correctly identified oxygen as the by-product from the equation.

3(c)(ii) Most gained a single mark for identifying one or other of the two correct statements about catalysts.

Question 4

4(a) Candidates produced high quality answers, many gaining marks in the level 2 marking band. Typically they discussed or compared either the bond energies of two or more atoms, or the sizes. Many recognised that fluorine did not fit the pattern, but did not always express their ideas clearly enough to access level 3.

4(b)(i) About half of the candidates correctly identified the most appropriate energy level diagram.

4(b)(ii) Almost every candidate showed some understanding of energy changes during reactions. About a third gained full marks.

Question 5

5(a)(i) This question proved difficult for many candidates. Although almost all knew what a range involved, many included the rough values rather than only the accurate value. A common answer which was accepted as correct, was to reverse the range, giving the higher value first.

5(a)(ii) Most correctly asserted that acid A did not need more repeats, but acid B did, and linked this to the size of the ranges.

5(b) Most knew that the solution would be made in the beaker and transferred to the flask. However, many were not clear about the function of the flask. Some thought that it was used to measure out the volume of water, which would then be poured into the beaker. Others thought a mixture of solid and water would be placed in the flask before shaking. Only the most able discussed rinsing the beaker and rod into the flask or filling the flask exactly to the line.

Question 6

6(a) Questions in the past have asked students to calculate *Rf* values or identify the contents of simple chromatograms in short questions. Candidates typically answer such questions well. In this case, they were asked to discuss conclusions about the safety of some sweets based on the dyes they contain. Candidates found this very difficult. Firstly, candidates did not always identify the dyes in the sweets. Secondly, many were unsure whether sweet 2 was safe or not, as it included both a safe and an unsafe dye. Candidates did not typically realise that it would not be possible to judge the safety of sweet 3 as it contains an unidentified dye.

6(b) The measurements to make to calculate *Rf* were not well expressed. Many discussed measuring the position of the dyes from the solvent front, rather than the start line. Few candidates stated clearly 'from the start line to…'.

6(c) Just under half of the candidates knew the function of a locating agent. The other distractors were all popular choices.

6(d)(i) Candidates were unsure whether the quantity of dye was represented by the height of the peak or by the retention time.

6(d)(ii) Most candidates did not know what 'quantitative' and 'qualitative' meant. A few said that the data gives information about 'what is in the sweet and how much'.

Question 7

7(a) Most candidates gained at least one mark, and about half gained all three for selecting the correct names and formulae for the alkanes.

7(b)(i) Again, most candidates gave clear comparisons of the alkanes and alkenes to gain at least one mark. Many correctly discussed the presence of double bonds or compared saturation or unsaturation.

7(b)(ii) Most gained at least one mark, usually for a correct structure for hexane. Common errors included omitting hydrogen atoms, usually from hexane, or putting too many hydrogen atoms on the carbons closest to the double bond in hexane.

A173/02 Further Addition Science A Module C7 (Higher Tier)

General Comments:

This paper was well answered and all candidates were able to complete the paper in the time available. Very few candidates left any questions blank.

Comments on Individual Questions:

Question 1

1(a) As this was the first question on the paper examiners gave credit for the identification of relevant statements from the table, without demanding that candidates take their answers any further than that. Most candidates were able to link bulk manufacture to the need to produce millions of tonnes a year. Interestingly, many candidates then suggested that drugs are examples of the fine chemical industry because they are needed in small quantities. As this is merely the reverse argument to the previous point it was not enough to gain the second mark.

A few candidates realised that fine manufacture was usually associated with the need to carry out small production runs of different substances. Credit was also given to those candidates who suggested the need to control purity as the reason for fine manufacture.

1(b) There were many excellent explanations for the unsustainable nature of hydrogen production from methane. Both atom economy and global warming were usually well discussed. Examiners were pleased to see how many of even the weaker candidates realised that vague references to 'pollution' and it being 'harmful' would be inadequate, and so made specific mention of global warming. The problem of high temperatures was also well discussed, with only the weakest of candidates suggesting 'cost' or 'the safety of the workers' as a reason for this unsustainability. The factor which was least well covered was the non-renewability when using fossil fuel as feedstock. Many candidates were familiar with the idea that resources might run out, but could not take this idea past the abstract words in order to fit the concept into a cogent framework. Responses such as "it is unsustainable because the water will run out if we use it too much" were not uncommon.

1(c) This question tended to be well answered, though Q1ci showed that candidates still do not always read the question carefully enough. A significant number ticked the box for 'the rate of reaction is lower', presumably thinking that they had been asked to *describe* the effect of lower temperature on rate rather than *explain why* some reactions might work at a lower temperature.

The calculation of atom economy proved to be more stretching at all levels of ability, though examiners were pleased that the vast majority of candidates had shown some suitable working. Consequently a large number gained one mark even though their final answer was incorrect. A very common mistake was to add the mass of the hydrogen to the mass of only one oxygen instead of two.

1(c)(iii) Many candidates used the same argument both ways round by saying that by-products could be used for other purposes, waste products could not. As in Q1a, these candidates were only able to gain one of the marks.

Question 2

2(a) The thermochemical calculation for bond making was slightly better attempted than for bond breaking, with the most able candidates gaining credit for giving the correct signs in front of their answers.

2(b) This question was designed to allow the most able candidates to demonstrate their ability, and it worked well. The pattern in the halides was identified by many. When discussing the elements, more able candidates identified a problem with the bond energy of fluorine and chlorine. Few seemed to be aware of traditional labelling of fluorine as anomalous, and appeared to be working this out from inspection of the table. Many candidates suggested that fluorine and iodine fitted the pattern and the anomaly lay with the bond energies of chlorine and bromine. Others suggested that there was no pattern whatsoever for the halogens as elements.

Question 3

3(a) Almost all candidates successfully identified the two ranges, with the most common mistake being to include the values for the rough reading in their range. In this case, examiners allowed answers such as '25' instead of '25.0', though that will not always be the case in future. Candidates also showed an excellent ability to decide and explain whether more readings should be taken.

3(b) The most able candidates showed an easy understanding of the relationship between acid strength and pH, and of concentration and the amount of sodium hydroxide used in a titration. Others had great difficulty in coping with the idea that an acid could be both strong *and* dilute, or weak *and* concentrated, and tried to combine them in some way. Answers such as "D and F are both strong acids because they have a pH of 1, but D is the stronger of the two because it uses more sodium hydroxide" were not uncommon.

This question also exposed other misunderstandings. Many candidates suggested that the smaller the amount of alkali used, the *more* concentrated the acid would be. Also, and unsurprisingly, many felt that low pH numbers indicated weak acidity. In several cases examiners suspected that candidates understood the material, but that the candidates' expression was ambiguous to the point where examiners were not able to award the mark with confidence.

This question asked candidates to differentiate between two very specific terms: acid strength and acid concentration. This meant that examiners had to focus carefully on the precise words that candidates used. A lack of precision in answering let some candidates down here, since very general statements such as 'it was the most/least acidic' were inadequate in this context – and had to be ignored.

Question 4

4(a) Most candidates could use the chromatogram to decide how many dyes were present in the sweets. The most common wrong answers were three and five, presumably because there were three sweets, and the three sweets showed five spots on the chromatogram.

4(b) The vast majority of candidates realised that sweet 2 had an unsafe dye as the spots matched, and many also noticed that sweet 3 had an unidentified dye which could also be unsafe.

4(c) Many candidates had clearly carried out paper chromatography and could describe the measurements to take in order to calculate R*f* values, and often used terms such as 'mobile phase'. However, answers such as "he needs to measure the spot and the solvent front" suggested that some candidates were unable to express their understanding clearly enough to gain credit.

4(d) Most candidates realised that locating agents are used when there is a problem with visibility of spots. As answers such as 'to identify or locate the dye' did not address this underlying aspect, they were unable to gain credit.

4(e)(i) Most candidates could identify dye C as the one used in the largest quantity. The more able candidates could see that it was the peak height that gave this information, whereas the others quoted both peak height *and* retention time and so failed to get the second mark.

4(e)(ii) Most candidates appreciated that one should compare the printouts in order to identify the dye, and able candidates went on to specify that it was the R*f* values or retention times that should be compared.

4(e)(iii) Most candidates were able to give examples of quantitative information which can be obtained from chromatography, but the term 'qualitative' was less well understood.

Question 5

5(a)&(b) Interestingly, far more candidates could identify the two substances which react to form an ester than could select the formula of the substance found in vinegar.

5(c) Almost all candidates made an intelligent attempt at describing the role of a condenser and were able to gain some credit, and some even recognised that a condenser in this configuration is called a reflux condenser. The most able candidates, however, had a very clear understanding of why it is used.

5(d) Distillation was widely recognised as the first stage in purifying the ester, but there was then much confusion. In many cases a variety of solids were added, sometimes 'to remove the acid' but often merely 'to purify it'. Examiners were uncertain what candidates meant when they used phrases such as 'tapping out' without further explanation, so in this case did not give credit for the term.

Question 6

6(a) Able candidates appreciated that an equilibrium would be reached when nitrogen and hydrogen are heated together in a closed container, and went on to give some explanation. Others suggested that the conditions must have reduced the yield, that the reaction produces waste products, and that the reaction does NOT reach equilibrium.

6(b) Almost all candidates understood that recycling unreacted hydrogen and nitrogen would affect the yield and not the rate of the reaction. They had only a partial understanding of the links between yield and rate with temperature, pressure and catalyst, but the misunderstandings were spread across all the possibilities without any clear threads.

6(c) Most candidates could identify the correct statements about nitrogen fixing organisms, though, surprisingly, more understood that their reactions depend on enzymes than that the reactions happened at room temperature.

A183/01 Further Additional Science A Module P7 Foundation Tier

General Comments:

The paper examined knowledge and understanding of Physics module P7. The eight questions included three 6-mark (Level of Response) extended writing items and they covered all five topics of the P7 syllabus.

The paper was generally well attempted and produced a good spread of marks with typical scores ranging from single figures up to the low fifties. The performance of a very small number of candidates indicated that they should perhaps have been entered for the Higher Tier but for the vast majority, the Foundation Tier was appropriate.

Candidates demonstrated a range of skills in their responses. Questions examined the ability to recall and select knowledge, to apply skills, knowledge and understanding in unfamiliar contexts and to analyse and evaluate evidence to make reasoned judgements and draw conclusions.

Some questions in particular were good predictors of the overall performance of the candidates. In these questions, the most able candidates were able to apply knowledge of relative sizes and distances to explain solar eclipses; describe a sequence of changes related to nuclear reactions in low mass stars and give a balanced argument regarding the merits of investing in a space telescope.

Comments on Individual Questions:

Question 1
This question addressed syllabus statements in P7.1 Naked eye astronomy. Candidates were given a diagram of a time-lapse observation of the night sky and asked to justify two conclusions regarding the direction and duration of the observation. Most candidates, at this level, did not deduce that the image could only be produced by directing the telescope at the Pole star and therefore did not draw a correct conclusion about the direction. Most gained marks for supporting the conclusion about the duration of the observation but only the more able equated the one-quarter turn to a 6 hour time period. In the third part of this question most candidates recognised that the reason for a different observation of the night sky was due to Earth's rotation around the Sun but many did not develop their argument to explain what the different observation was i.e. different stars.

Question 2
This six-mark extended writing question, targeted at grades up to E also addressed P7.1. The most able candidates at this level were able to produce very good diagrams showing the relative sizes and distances of the Sun and Moon and the positions they must be in to produce a solar eclipse on Earth. Often, these candidates attempted to draw rays to show regions of shadow. Although, all marks could have been gained from a labelled diagram alone, there were many good explanations of the phenomenon. Weaker candidates tended only to express the idea of the Moon blocking the light from the Sun with little or no appreciation of the effect of relative size and distance.

Question 3
This question addressed syllabus statements in P7.3 Mapping the universe and P7.4 The Sun, the stars and their surroundings. A very common (and incorrect) answer to the first part of this question about the age of the Universe was 14,000 billion years. In the second part, most candidates were able to use the data correctly in the speed of recession formula. Part 3 of the question proved more challenging. Candidates needed to convert a temperature of 3 kelvin to a temperature in degrees Celsius. Recall of -273 and correct addition was required for both marks.

Question 4
This question addressed syllabus statements in P7.4 and also tested mathematical skills. Candidates were given data relating to the distances of five stars. Four distances were similar and one was a clear outlier. Candidates were informed that four of the stars were formed in the same nebula and were instructed to calculate the mean distance to these stars. Many candidates selected the correct four stars and calculated '170'. The third mark on this question was for explaining their answer. Many candidates interpreted this as: explain how you calculated the mean. They should, of course, have explained why they chose those particular stars.

Question 5
This six-mark extended writing question, targeted at grades up to E addressed P7.4. Candidates were required to recall how low mass stars similar to the Sun evolve to become red giants and then shrink to become white dwarfs. Almost all candidates were able to describe a physical change as the low mass star evolved. Many were able to name one of the stages, but very few got both red giant and white dwarf. Only the most able candidates at this level were able to recall the fusion of heavier elements as the star runs out of hydrogen.

Question 6
This question addressed syllabus statements in P7.2 Light, telescopes and images. Most candidates were able to apply the formula: power = 1/focal length or use the relationships in the data table to deduce one or both of the correct answers in the first part of this question. In part 2 of the question, candidates were required to choose the lens that would be the best objective lens for a telescope. Many candidates correctly identified the lens with the largest diameter (D) but very few were able to relate this large size to the increased amount of light that it would capture. In the third part of this question, candidates were required to identify three changes to light as it enters a lens at right angles to the surface by circling the correct word. Many candidates were able to identify that wavelength would change but only the most able recognised that this was due to the change in speed. The third mark is more difficult to analyse but it would appear that the term 'at right angles to' has confused most candidates.

Question 7
This question addressed syllabus statements in P7.3. Candidates were required to identify and label the objects on a diagram that illustrates how parallax is used to measure the distance to nearby stars. Most candidates were able to identify the star but did not discriminate when labelling the background or distant stars. The symbols representing the baseline of the parallax diagram were also frequently mislabelled; a common misconception being that these represented parts of a telescope. Very few candidates at this level were able to correctly identify the parallax angle. In the third part of this question, candidates needed to calculate a distance based on a seconds of arc measurement. Candidates appear to be familiar with the format and many made the correct substitution. However, as very few candidates were able to identify 'parsec' as the correct unit, it would appear that they may have only been recalling how to do the calculation rather than applying the definition of the parsec unit of distance.

Question 8

This question addressed syllabus statements in P7.5 The astronomy community. Most candidates were able to describe at least one advantage, using Ideas about Science, for international collaboration on large space projects. Many also recognised that decisions about the distribution of funding for scientific projects are made by governments.

8(b)(ii) This six-mark extended writing question, targeted at grades up to C also addressed P7.5. When answering 'for and against' style questions candidates should be encouraged to make as many points as possible. The most able candidates were able to describe the advantages for producing much better images and explain why. They were also able to describe particular difficulties relating to access and cost. Candidates were also able to gain credit for recognising that such technology was there to make new discoveries, satisfy scientific curiosity and produce awe-inspiring images to motivate others into studying astronomy.

A183/02 Further Additional Science A Module P7 (Higher Tier)

General Comments:

The candidates covered quite a wide range of abilities, with a large proportion of candidates at the lower end of the ability range. Candidates who are entered inappropriately to the higher tier are often unable to access questions and have very limited opportunities to demonstrate what they know. There was no evidence of candidates running out of time. Very little evidence was seen of candidates 'killing time' in the exam by scribbling or 'doodling' on the paper, so it appeared that they were kept occupied for a large part of the time.

There was a noticeable increase in the number of candidates writing on continuation sheets at the end of the paper. When this is done it should be clearly indicated that the answer is continued. This should only be necessary in rare cases. The space provided for answers being an indication of the depth of answer required. Most candidates using extra sheets where simply repeating information from the stem of the question or from their own answers. Conciseness is desirable in answers, particularly the 6 mark questions which also assess the quality of written communication, with most filling the available space with writing.

Candidates did not always read the full question in the 6 mark extended response questions and as a consequence only addressed part of the question, often limiting the marks available to them, some practice in planning answers to the 6 mark questions might be helpful.

Many candidates did not have the mathematical skills required for the higher paper, this was particularly apparent in Q4 and Q6, where the weaker candidates were often at a loss as to how to address the questions. A significant proportion of candidates gave answers to many of the calculation questions showed no or little working. These answers may be incorrect just by a power of ten and if working had been shown then some credit could have been given.

Comments on Individual Questions:

Question 1

1(a)(i) In labelling the diagram the most common errors were candidates not being specific when describing the 'distant/background' stars. Most candidates not meeting this marking point simply labelled these as 'stars' and treating the diagram as a lens diagram and so labelling the star to be measures as the 'focus' or 'focal point'.

1(a)(ii) The most common error was drawing the angle between the 2 dashed lines i.e. twice the half-angle.

1(b) The most common calculation errors arose where candidates thought that they needed to use trigonometric functions (sin 0.71 etc.) or that they needed to address the 'seconds' and so were dividing by 3600 etc. Many candidates who were not able to carry out the correct calculation still managed to state the correct unit and so score 1 mark. The most common incorrect unit given was the light-year.

Question 2

2(a) The most common correct responses were centred around the idea of sharing costs. The small number of candidates not scoring on this question often referred to outcomes i.e. 'lots of countries get to use the telescope' or 'findings can be shared'.

2(b)(i) The most common correct response was 'governments'. The most common incorrect responses were; NASA, ESA, the public and Astronomers.

2(b)(ii) When giving advantages and disadvantages, candidates should aim to produce a balanced view with an equal number of advantages and disadvantages. They should not be over-influenced by their own personal opinion. The used of good scientific language (refraction, absorption, etc.) is more likely to access higher levels of marks. The majority of candidates were able to identify some of the following advantages and disadvantages: clearer images, no light pollution, no atmospheric pollution, expensive to set up, expensive to maintain, difficult to maintain and new discoveries. Alongside this, a significant number recognised that a broader range of electromagnetic waves would be detected and that money could be spent elsewhere.

The most common responses that were not worthy of credit were: better for the environment, can use computers to control telescope/process data, less 'interference' unqualified (not many candidates were able to state specifically what was happening to the radiation e.g. refraction, absorption, scattering etc.) and difficult to get to (for viewing).

Question 3

3(a)(i) Many candidates were unable to give clear responses to this question. Although the majority of candidates referred to changes in wavelength, speed or direction, many did not state the nature of the change. The most common correct response was 'light slows down' which, due to the nature of the question stem, was taken to mean 'when passing into the lens'. Very few referred to the passage of light into or out of the lens. A small number of candidates incorrectly referred to frequency changes.

3(a)(ii) Where attempted, this question was not well answered. Many candidates either ignored the pre-drawn top ray, choosing to replace this with a ray directed towards the principal axis or showed the bottom ray refracting and then running parallel to the principal axis.

Many candidates, however, recognised that the centre ray continues in a straight line and the majority were aware that the image is formed where light rays cross albeit not always where all three lines crossed.

3(b)(i) The most common incorrect responses were 'Y' and 'Z' presumably because they had the longest focal length and largest diameters respectively and so presented the largest values within a given column of the table.

3(b)(ii) Although many candidates selected the correct lens (W), a significant number did not use an appropriate superlative adjective when stating their reason for choosing the lens i.e. 'short' focal length rather than 'shortest' or 'powerful' rather than 'most powerful'.

3(b)(iii) A common misconception was that a longer focal length would be best for viewing distant objects. Those correctly identifying 'Z' often then did not either use the superlative when describing the diameter or link the diameter to light collection.

3(b)(iii) Candidates tended to either take a mathematical approach by first calculating the magnification to show that the magnification was actually 30 and then explaining that this was still the highest magnification or they took a qualitative approach and stated that this combination of lenses would give the highest magnification but that this was not a magnification of 300, often then evidencing this with a calculation. Both of these approaches tended to arrive at 2 or 3 marks. A smaller number of candidates were able to give a reason why this combination was the highest magnification.

Question 4

4(a) The most common error was to calculate the mean of all distances. The explanation was often stated as 'this is the average'. Another common error was to calculate half of the furthest distance or half of the range and suggest that the best estimate for the cloud is somewhere in the middle.

4(b) A small but significant number of candidates were able to identify range of the values they used in part (a) and hence gained this mark.

Candidates generally knew how to calculate a mean but the uncertainty was which numbers to use. Most calculated the mean of all the stars.

Question 5

5 This question proved to be the most challenging. Most candidates did not read the question carefully enough to realise that it is the value of the Hubble constant that required support from the Cepheid variable measurements and not the distance obtained from the Hubble equation. It is important to present information in a logical order in this case starting with closer Cepheid variables, then moving to slightly further galaxies then the use of Hubble equation in more distant galaxies.

The most common errors involved many candidates referring to the idea of pulsating stars/'period' or measuring observed brightness. Fewer candidates successfully linked luminosity, observed brightness and distance to star. Very few candidates linked Cepheid variable stars within Galaxies.

The majority of candidates who mentioned the Hubble constant either stated the equation as given without suitable rearrangement or gave confused ideas about using the Hubble constant to work out the speed of recession.

Question 6

6(a) There is some confusion among candidates between "fission" and "fusion" as well as knowing that Helium is a product of the reaction and not a reactant.

6(b)(i) Very few candidates stated the correct rearrangement of the equation before substituting in values. Most common errors were; omission of the 'squared' in the working/calculation and incorrect processing of the data in standard form resulting in power of ten errors.

6(b)(ii) The most common error was to multiply the two relevant values or to introduce another value into the equation e.g. their answer to (b)(i) or the speed of light. Again, as in (b)(i), candidates were not always able to correctly process values in standard form.

6(c) The most common marking points met were 'produced in core' and 'light/radiation/photons from surface/photosphere. Although many candidates partially described the transfer of energy within the star, few mentioned both convection and radiation. This was a less common, but still significant, issue with the idea of energy being radiated at the surface. Some candidates gave a partial description e.g. 'light is then given out' (not stating where from) or 'it leaves the surface' (not telling us the form of the energy).

Question 7

7 This question again required logical sequencing of ideas. It is confusing to both candidate and examiner when answers to the three parts of this question are mixed together. Some of the misconceptions encountered were as follows; the stars are actually fixed in space (only true with respect to Earth), the tilt of the Earth's axis explains the different times, the spin of the moon affects the time it takes to travel, the relative distances and sizes of the objects. Diagrams were successfully used by a number of candidates to show the spin of Earth and its orbit around the sun.

A194 Further Additional Science A Controlled Assessment

General Comments

Overview

This was the fourth session for the assessment of the Twenty First Century Science suites Investigation controlled assessment. It was a real pleasure to see how most centres had responded to advice and guidance from previous years. There were fewer centres requiring adjustment than last year and in general these changes were smaller. 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.

A serious cause for concern continues to be the increase in malpractice cases. These nearly always involved centres who are giving too much guidance or feedback. They are giving too much guidance because all candidates are following same methods, same limitations and improvements, same references, etc.

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 level 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 criterion 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 at 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 Twenty First Century 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 <u>before</u> 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 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 '*correct 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 at 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

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: *Michelle Spiller, 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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