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GCSE

Further Additional Science A

Twenty First Century Science Suite

General Certificate of Secondary Education **J246**

OCR Report to Centres June 2015

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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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A163/01 Twenty First Century Biology A Module B7 Foundation Tier

General Comments:

There was a good spread of marks, candidates scores ranged from 0 to 54 out of a maximum of 60 marks with a mean score of approximately 25 marks.

Many candidates appeared to have been well prepared for the examination, attempting the majority of questions. However a number of candidates did not attempt Q5, 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' and quantitative skill questions however, 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. However an increasing number of candidates did not seem able to limit their answers to provided space and used additional examination sheets.

Candidates appeared to be better prepared for questions involving calculations. It was encouraging to observe that there were fewer scripts where candidates indicated that they did not have a calculator available.

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) Candidates were able to identify a number of questions that should be asked by fitness trainers prior to starting an exercise programme but found difficulties explaining their importance. This limited the majority of candidates to level one and two answers.

(b)(i) This part was poorly answered with nearly half the candidates unable to interpret the data on the graph.

(b)(ii) The second part of the graph data interpretation question was better answered, error carried forward enabled many of the candidates to access this mark.

(b)(iii) There was some confusion amongst candidates in this part of the question with many wrongly thinking that an improved fitness level would produce a higher heart rate.

Q2 (a) Most candidates were aware of the function of white blood cells, however this was not the case with platelets and plasma.

(b) The simple cell structure of the nucleus was not recognised by many candidates, however the biconcave nature of red blood cells was better known, however over half the candidates failed to gain any marks in this part.

(c)(i) The major blood vessels leading to and from the heart were not known, approximately 65% of candidates failing to recognise any of aorta, vena cava, pulmonary artery or vein.

(c)(ii) The function of valves was better understood, over half the candidates scoring here.

(c)(iii) Most candidates struggled to explain what was meant by a double circulation.

(c)(iv) Even more candidates could not explain the differences in the diagrams between a human and frog heart.

(c)(v) Data interpretation is an area which many candidates at this level find difficult. This was very apparent here.

(c)(vi) This part was better accessed by the candidates, the majority were awarded both marks.

Q3 This extended writing question was well answered by many candidates with approximately 70% being awarded a level 2 or 3 mark.

Q4 (a) Many candidates found it difficult to make suitable suggestions for the very large differences in the number of eggs produced by humans and fish, however were far more successful in suggesting a suitable answer in parts (b) & (c)

Q5 (a) As in previous years closed loop systems appear to be causing problems for the majority of candidates at this level, only 25% of candidates achieving more than a level 1 mark.

(b) This problem was continued in this part and is clearly an area of the specification that is poorly understood by the majority of the candidates.

Q6 This whole question was better answered, candidates clearly more knowledgeable concerning the areas of biodiversity and sustainability.

Q7 The calculation caused problems for many candidates, however the parts concerning genetic modification were answered much more successfully.

Q8 (a) Surprisingly the question on ordering the sizes of various structures was poorly answered, many candidates were under the impression that the cell was the smallest structure.

(b) & (c) These objective ‘tick box’ question parts were well answered.

A163/02 Twenty First Century Biology 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.

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 to structure their responses.

The trend for candidates to write outside the allocated area continues. In the past, candidates have tended to write in any white space that they can find. This is nearly always caused as a result of the candidate failing to think the answer through before commencing to write. It is common to see most of the lines allocated filled with a repeat of the question before the candidate even begins to answer it. Now, the trend is to write on additional answer booklets. This practice should be discouraged. All too often this results in rambling responses that drift away from the original question. Candidates need to be taught and encouraged to write concisely and only use the space provided for their answer.

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:

Q1a

This was the first of three six mark questions and was intended to assess candidates at levels grade D to grade A.

The first part of the question required candidates to complete and label a diagram showing an artificial replacement for a knee joint. Most candidates completed this task successfully, but common errors included incorrect labels or not completing the drawing, but still writing the labels to no- existent parts of the diagram. Unless it was clear where the labels were pointing, they did not score.

The second part of the question required candidates to both describe the properties of various parts of the joint and then provide an explanation of these properties. An example of a good answer included “tendons are non-stretchy and connect muscles to bones so that the muscle can move the joint.”

In order to score six marks, candidates were required to answer both parts of the question adequately.

Q1b

Good answers to this question included reference to dislocation or torn ligaments or tendons. Answers that referred to sprains, strains or fractures, did not score.

Q1c

Most candidates managed to score both marks on this question by quoting either rest, ice, compress or elevate. Candidates that only quoted two or three of these methods scored just one mark. Simply stating RICE did not score.

Q1d

Part (d) was answered well by most candidates. Examiners were looking for an understanding the role of the physiotherapist was to rehabilitate and return the injury to normal. However answers that referred to exercise or strengthen the joint were also credited.

Q2a

Although this question was answered well by most candidates, a significant number failed to score all three marks. Credit was not given for simply naming the parts. Good answers stated that white blood cells fought infection, platelets clot blood and plasma transported nutrients around the body. Answers that referred to red blood cells did not score.

Q2b

This question was surprisingly well answered and most candidates were not put off by the context. Many candidates scored both marks for realising that a lack of a nucleus provided extra space for haemoglobin and the shape gave a large surface area for the absorption of oxygen.

Q2ci

Many candidates provided three correct labels and thus scored the full three marks. The most common error was to label the chambers of the heart, rather than the blood vessels. Surprisingly several candidates thought there was a left and right aorta. These responses did not score.

Q2cii

This proved to be trickier than the normal “what is the job of a valve” type of question. The contest of being a valve inside of the heart prevented many candidates from simply stating that it prevented the backflow of blood and thus scoring the mark. Good answers also included atria and ventricles.

Q2ciii

This question was not answered well. Most candidates had a vague idea of what was meant by a double circulation but were unable to put their idea into words. Good answers made it clear that blood was pumped to the lungs and the body on each circuit and that it went through the heart twice on each circuit. Answers such as “the heart pumps oxygenated blood and deoxygenated blood” did not score.

Q2civ

Most candidates managed to score one mark for this question, but very few managed to score both marks. The first mark was awarded for a correct observation, such as the frog’s heart only has three chambers. The second mark was for realising that this would make the transport of oxygen less efficient, or that oxygenated and deoxygenated blood would mix.

Q2cv

Once again, most candidates only scored one of the two marks available. The first mark was for realising that mechanical valves had a better survival rate. Credit was not given for stating that the older the valve, the lower the number of survivors as this would happen anyway because as time passes people die and not necessarily from a faulty heart valve.

Very few candidates realised that data did not exist after 15 years and assumed that there were no survivors at 20 years.

Q2cvi

Good responses to this question included how many patients were involved with each study, or an example of how patients in each group were matched. These examples included age, medical history, lifestyle questions and BMI.

Q3

This was the second six mark question and was targeted up to grade A. Although the context was unusual, examiners were looking for an understanding of temperature control. Weaker answers referred to cooling down in icy water and warming up by lying in the sunshine. More able candidates referred to the hypothalamus action as a control centre to regulate vasoconstriction and vasodilation and giving an account of how these two processes work. Credit was also given for heat loss by evaporation of water from wet skin.

Q4a

Better responses to this question referred specifically to the diagram and gave arguments both for and against it being a closed loop system. Good answers referred to carbon being recycled by being released from the burning fossil fuels and then reabsorbed by plants through photosynthesis. Arguments against it being a closed loop system included fossil fuels taking a very long time to be produced and subsequently burnt and that carbon dioxide was being released faster than plants could reabsorb it.

Q4b

Simply stating that outputs or losses equalled inputs or gains, was sufficient to score this mark.

Q5a

This was the third of the six mark questions and was targeted up to grade A*.

Good answers included a very good account of eutrophication and then went on to relate this information to the data in the table and finally concluding that pond A was eutrophic. The most common error was to fail to use the data in the table and just give an account of eutrophication. Less able candidates often thought that fertiliser was toxic and that lead to the direct death of all pond life. These candidates often failed to score on this question.

Q5bi

Candidates needed to convey the idea of harm to humans who ate the contaminated crops. However correct reference to harm to the environment or bioaccumulation was also credited. References to eutrophication did not score.

Q5bii

This question was only answered well by the most able candidates. Candidates who stated how serious the risk was, and the chances of it happening, scored both marks.

Q5biii

In order to score both marks for this question candidates were required to give an advantage of using the pesticide, such as improved crop yield, and also state that the risk was quite small. Answers that referred to having confidence in scientists or farmers scored one mark. Answers that stated the benefits outweighed the risks scored both marks.

Q5ci

Candidates scored surprisingly well on this question. A wide variety of responses were accepted by examiners, to include 3 in 1000, 3/1000, 0.003 or 0.3%. Evidence of correct working or 1 in 1000 scored one mark and the correct answer always scored both marks. Candidates should always be encouraged to show their working as this can often salvage a mark even when the incorrect answer has been given.

Q5cii

This question was not well answered. What should have been two straightforward marks were often thrown away because the candidate had failed to read the question carefully. Candidates were explicitly told to use their answer from part (5ci) in their answer. Time and time again candidates failed to do this and gave a generic answer about perceived and calculated risk that did not score. Good answers used the data calculated in the previous question and this was credited as an error carried forward even when they gave an incorrect response to the previous question. This was a similar error seen in the eutrophication question when candidates failed to refer to the data in the table. Good answers stated that a perceived risk of a 50% increase seemed high but the actual risk of 0.3% was in fact very low.

Q6ai

Most candidates performed well on this question, stating that stem cells were unspecialised but could become specialised to develop into any type of cell.

Q6aii

This question proved to be more difficult with most scoring only one or two of the three marks available. Many stated that stem cells could be made to specialise into nerve cells. Fewer went on to state that these nerve cells could then produce dopamine. The most common error was in thinking that specialised nerve cells could be transplanted into the brain with very few candidates understanding that the stem cells had to be placed into the brain before they began to specialise.

Q6b

Most candidates scored one mark for this question with the most common correct answer being that the battery would run out or need to be replaced. Other good answers included the idea of rejection or that the pacemaker would not change the heart beat rate to match the demands made by the body. Although credit was not given for the idea of pacemaker failure, credit was given for the idea of electromagnetic interference disrupting the pacemaker.

A173/01 Twenty First Century Chemistry A Module C7 Foundation Tier

General Comments:

Candidates used their time well and were generally well prepared for the examination. Some individual candidates left questions unanswered but in general candidates attempted all questions.

Many of the questions on this foundation tier paper involved objective tasks where candidates made choices in tick box questions or chose words to complete sentences. These were very well attempted, showing that candidates have very good techniques at answering these questions.

Many of the questions on the paper involved the interpretation of data. Candidates showed very good data processing skills, using the data in the questions in their answers and extracting data from both tables and graphs to gain marks.

For the six mark questions, it is important that candidates read the question carefully and make sure that they address all of the task. To reach level three, there are often two or three aspects that need to be discussed. A common reason for only gaining partial credit was to discuss only some aspects of the question, for example in questions 4 (b) and 5 (a) (see below).

Comments on Individual Questions:

Question No.
Q1 (a)

Almost every candidate correctly interpreted the table to choose ‘growing crops on farms’ as the main route for fixing nitrogen.

Q1 (b)

Almost every candidate correctly identified that 50 million tonnes of nitrogen are fixed by the Haber process annually.

Q1 (c)

Most candidates correctly used the information to construct a fully correct word equation. Candidates need to read the information carefully to identify the reactants and products, all of which were given. Answers which did not score often had incorrect products, such as ‘nitrogen hydroxide’ or ‘ammonia and water’.

Q1 (d)

Most knew that natural gas and steam are the source of hydrogen for the Haber process.

Q1 (e)

Most candidates gained at least partial credit. Some did not divide by two, implying that they had not read all of the information. Some who were unsure how to do the calculation showed good technique by trying different ways of multiplying and dividing the numbers until they reached a plausible number.

Q1 (f)

Some very good answers were seen which discussed both rate of crop production and eutrophication. There were two aspects to this question, how fertilisers are useful and how they cause pollution. A common reason for a partial score was to address only one of the aspects.

Q1 (g)

A full spread of marks was seen through the choices candidates made. Most identified at least one correct condition and many knew that enzymes worked as catalysts, although 'acids' was a popular incorrect choice.

Q1 (h)

Although some knew which chemicals were made on a large and small scale, some gave all of the answers the wrong way round. This may be because candidates think that food additives and fragrances are common products and so must be made on a larger scale than the two named bulk chemicals.

Q2 (a)

Most knew that oils are used by plants for energy. The other choices were all seen.

Q2(b)

A very large proportion of candidates correctly selected 'saturated' and 'unsaturated' as the correct terms to describe the molecules. A common reason for only gaining one of the available two marks was to put the two round the wrong way in the gaps in the sentences.

Q2 (c)

This level of response question was targeted up to grade D. A table of information was given and candidates were asked to identify the advantages and disadvantages of the enzyme and to say which catalyst is best. Some excellent answers were seen with a relatively high proportion of candidates gaining level 3. Best answers clearly classified the points about the enzyme into advantages and disadvantages and explained which catalyst was best by referring to the shortcomings of the other catalyst. In this type of question it is important that candidates consider carefully what they are asked to do. Common reasons for lower scores included not clearly identifying advantages and disadvantages. Merely copying out the information in the table does not show an understanding of which features are positive or negative. Candidates also need to make sure that they say which catalyst is best.

Q2 (d)

Most candidates correctly identified that A has a lower activation energy than B. However, the second mark was much less frequently scored. This was usually either because the candidate did not go on to make a second point or because the candidate thought that both reactions were endothermic. A common misconception seems to be that if products have less energy than reactants the reaction is endothermic.

Q2 (e)

Almost all candidates knew that carbon dioxide is produced by combustion of the compound. Although some knew that the other product would be water, hydrogen was a common incorrect answer.

Q3 (a) (i)

Most candidates correctly interpreted the formula to say that it contains three different elements. Both '4' and '2' were common incorrect answers.

Q3 (a) (ii)

Again, interpretation of the formula was very well attempted with most candidates recognising that the formula contains two carbon atoms.

Q3 (a) (iii)

Most knew that 'COOH' shows that the formula is a carboxylic acid.

Q3 (a) (iv)

About half of the candidates knew that a weak acid is less reactive than a strong acid. Some candidates thought that the acid was more dilute. The first statement was correct for the formula (it does contain carbon, hydrogen and oxygen) but does not answer the question. This was another popular incorrect choice. Candidates need to check that the answer they choose is both correct and answers the question.

Q3 (a) (v)

Although some candidates knew that weak acids have a higher pH, many chose the response that suggested that the pH of weak acids is lower.

Q3 (b) (i)

The majority of candidates knew that esters have distinctive smells. Some thought they were distinguished by their colour.

Q3 (b) (ii)

Almost every candidate knew the symbol for a reversible reaction.

Q3 (b) (iii)

Most knew that reactants and products are both present at equilibrium.

Q3 (b) (iv)

This question was well answered. Candidates showed very good data processing skills, commonly quoting correct numbers from the graph to support their answer. The most common reason for scoring less than full marks was that some candidates thought that the horizontal line on the graph meant that the reaction continued at a steady rate, rather than this shows that the reaction has finished.

Q3 (c)

Over half of all candidates correctly calculated the relative formula mass of ethanol. Candidates need to take care to look at the numbers of each type of atom in the formula before beginning their calculation (in this case there were two carbon atoms and six hydrogen atoms to be taken into account).

Q4 (a)

Most candidates knew that the reaction is exothermic and that energy to start a reaction is activation energy. Candidates need to remember that breaking bonds involves energy being taken in, making bonds involves energy given out. Most inverted the two selections.

Q4 (b)

This level of response question had three aspects to the task. Candidates needed to discuss renewable, by-products and sustainability. To gain a level 3, candidates needed to address all three aspects. Commonly one was omitted. Most candidates knew and understood both what by-products are and that they can lead to a process being wasteful. The term 'renewable' was difficult for candidates to explain clearly Explanations such as 'can be re-used' or 'can be re-made' or 'can be recycled' are not enough. Answers which gained credit included the idea of an unlimited supply, or a non-finite resource. Although many candidates used the word 'sustainable' in their answer only the very best answers made it clear that this meant that the process could continue in the future indefinitely.

Q5 (a)

This level of response question asked for two aspects to be discussed; why there are two spots and why spot 1 is higher. In common with Q4 (b) it is important that candidates take a moment to make sure that they will address both parts of the question before they begin to write. Most knew that water or a mobile phase carries or moves the spots. A common misconception was that the distance moved depends on either the concentration of the ink or its relative mass. Fewer candidates clearly explained that the two spots come from different components or colours in the ink. The best answers made reference to the distance moved in terms of the solubility of the inks in the water. Some also discussed the affinity or attraction of the inks to the paper or stationary phase.

Q5 (b)

Almost all candidates correctly measured the distances on the chromatogram and correctly calculated the *Rf* for Spot 1. Those who did not usually gained one mark for at least one correct measurement from the chromatogram.

Q5 (c)

Although some knew that sometimes spots cannot be seen, in general the function of a locating agent was not well known. Common answers which were not enough to gain credit included repeating the question, 'to locate the spots' or to imply that the spots needed 'to be found'.

Q5 (d)

Most candidates gave at least one point to justify the approaches of Jane and Mike. There were three marks for this question. Candidates need to consider the number of marks when they make their answer to make sure that they make three clear points to gain all three marks.

A173/02 Twenty First Century Chemistry 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. With one exception, Q4(a), fewer candidates than in previous years left any questions blank.

As always, candidates must take great care when reading the question. Examiners suspect that some candidates lost marks for this reason, especially on Q2(ci) and Q3(d).

Candidates who need more space for their answer are recommended to use extra space available on the page before going to a supplementary answer book.

Comments on Individual Questions:

Q1(ai) Most candidates knew that plant oils are used for energy. Those who didn't still chose sensible options such as 'for growth' or 'for repair'.

Q1(aii) Many candidates had a clear sense of why molecule A was saturated, and the more able candidates went on to show precision in their thinking and expression and so gained credit. It was not enough to talk about single bonds and double bonds without identifying that the bonds were *between* carbon atoms. Both the molecules contained C=O bonds, so general statements such as "Molecule A has no double bonds" were not true.

Q1(b) This question and Q3(a) both covered equations, and were designed so that one would be slightly more testing than the other. For this equation a large majority of candidates were able to give appropriate formula and also to balance the equation.

Q1(c) Candidates answered this question at a range of levels. Those who quoted information from the table without taking that information any further were able to score some credit. Those who commented on that information were obviously able to score much more.

Many candidates realised that the ability to coat the enzyme onto a solid surface would be an advantage. Answers which then explained *why* this might be an advantage were the hallmark of the most able. Suggestions that this was an advantage because it would obviate the need for a 'mixing in' stage was a common misunderstanding. Fewer candidates understood why it would be an advantage for an enzyme to speed up the one reaction only. Many suggested that the sodium hydroxide would be more versatile because it catalysed a range of reactions.

Q2(ai) Almost all candidates realised that the carboxylic acid group is –COOH.

Q2(aii) The majority of candidates knew that weak acids are less reactive than strong acids. The most common mistake was to suggest that weak acids are more dilute than strong acids.

Q2(aiii) Most candidates knew that weak acids have a higher pH than strong acids. The most common misconception was, unsurprisingly, that they have a lower pH.

Q2(bi) Most candidates knew that the product of the reaction was an ester. The most common error was to suggest that it would be an alcohol.

Q2(bii) Many candidates calculated the relative formula mass correctly, and many realised that the theoretical yield would simply be a tenth of the relative formula mass. Candidates who got the relative formula mass incorrect were still able to score this second mark.

Q2(ci) Good answers referred to 'a strong acid' as the catalyst, or named a suitable strong acid. 'Sodium hydroxide' was the most frequent incorrect suggestion, closely followed by 'iron', 'enzymes' and 'yeast'.

A significant minority of candidates appeared to mis-read this question as, instead of stating *what* catalyst was used, they wrote about what a catalyst is used *for*.

Q2(cii) Able candidates were able to explain that a catalyst speeds up a reaction by lowering the activation energy, and some gained the third mark by mentioning that the lower activation energy was for an alternative pathway.

However, a large number of candidates found it difficult apply ideas about energy to the context of catalysis. A common suggestion was that catalysts speed up a reaction by giving the system more energy, causing an increase in collision rate.

Q3(a) This equation question proved to be more stretching than question 1(b). Almost all candidates copied out the formula of ammonia correctly, but often struggled with the formulae of nitrogen and hydrogen molecules, especially nitrogen. A very common answer was $N+H_3 \rightleftharpoons NH_3$

Those who got the formulae correct were almost always able to balance the equation. The equilibrium sign was used in most cases.

Q3(b) The vast majority of candidates knew that the main use of ammonia is in the manufacture of fertilisers. The most common incorrect suggestions were 'hair dyes', 'cleaning products' and 'explosives'.

Q3(ci) The graph was interpreted correctly by almost all candidates.

Q3(cii) In explaining why the amounts do not increase when equilibrium has been reached, many candidates were able to talk about the reverse reaction. The most able candidates took this further and stated that the two reactions had the same rate

Q3(ciii) That this type of equilibrium is called "dynamic" discriminated well at the lower end of the range.

Q3(d) The question asked candidates to explain how and why recycling the reagents affected the yield. Whilst most candidates addressed the 'why', a significant number did not address the 'how' and made general statements such as "the yield would be affected" without suggesting what the change would be.

Q4(a) This question was designed to allow candidates to show that they knew which distances to measure when calculating Rf values. To that end the diagram had seven horizontal lines and no fixed ruler. The working of most candidates indicated that they recognised that the two important measurements were the spot distance and the solvent distance, and almost all measured the spot distance correctly. However, a very significant number thought the solvent distance was the distance from the water surface to the solvent front.

A third of candidates who got the wrong answer scored at least one mark for showing their working. Many of these could have scored a further mark if they had written the general relationship for calculating Rf value. Candidates who got the wrong answer and did not show their working of necessity scored zero marks.

An unusually high number of candidates did not attempt this question

Q4(b) Examiners were pleased to see that the vast majority of candidates introduced the terms 'mobile phase' and 'stationary phase', and used these terms correctly. However, a large minority missed the significance of the word 'attractions' in the question stem, and appeared to be writing out a general explanation of paper chromatography without reference to the specific cueing of the question.

Explanations in terms of density of the spots were not uncommon.

Q4(c) Most candidates were able to state either a similarity or a difference between the two types of chromatography. More able candidates provided both.

Q4(d) Candidates across the full range of the ability spectrum were able to make sensible comments about the two approaches to sampling.

Q5(a) Most candidates knew that the liquid would be water, and many explained that it came from the reaction of the methane. Weaker answers tended to talk about 'condensation' without any further explanation, or suggested that the water vapour came from the air. The most common incorrect suggestion was that the liquid was methanol.

Q5(bi) As in other years, examiners noted that candidates' ability to state which bonds are made and which broken is often independent of their ability to do the thermochemical calculation. It was not uncommon for candidates who got Q5(bi) wrong to go on to give the correct answer for Q5(bii).

Q5bii It was gratifying to see that the majority of candidates realised that the energy change would be negative.

Q6 Candidates tackled this question on sustainability with enthusiasm, though answers were often a little unfocussed. Explanations of renewability often mentioned 'protecting the environment' and 'less pollution', but did not explain what the term 'renewable' actually meant.

A significant minority of candidates did not appear to recognise the term 'atom economy'.

A183/01 Twenty First Century Physics A Module P7 Foundation Tier

General Comments:

The paper examined knowledge and understanding of Physics module P7.

The paper was generally well attempted and produced a good spread of marks across most of the questions with typical scores ranging from single figures up to the low fifties. The candidate's performance this year was weaker than 2014 which may indicate a more demanding exam but it is likely that many more borderline candidates were entered for the higher tier paper.

Candidates demonstrated a range of skills in their responses. Many candidates are now clearly at ease in responding to the tasks set by the extended writing questions. The parallax question, which required a diagram, was an exception. Strong candidates make links between the different aspects described in the question stem. These questions differentiate well. Candidates who achieve well on these questions generally perform well on the paper as a whole. There is a tendency amongst weaker candidates however, to provide rehearsed answers from previous examination questions.

Candidates were able to interpret and evaluate data in a variety of formats, appropriately in calculations and comparisons. The most able candidates were also able to recall correct scientific terminology, apply abstract ideas about parallax measurements and describe a sequence in the formation of a protostar. Candidates were given opportunities to apply ideas about science (IaS), describe, explain and draw conclusions. Objective questions provided opportunities to test comprehension and recall.

Three issues for teaching emerge however. Firstly, many candidates lack the skills to draw and label scientific diagrams clearly. Secondly, few candidates seem to understand what is meant when they have to justify an answer they have given and thirdly ideas about confirming or checking measurements are often confused with ideas about accuracy, precision and averaging.

Comments on Individual Questions:

Question No.

1 Telescopes

In part (a) candidates were asked to draw how a mirror brings parallel light to a focal point. Candidates found this difficult. Weak diagram drawing skills meant that some candidates could not draw parallel lines with sufficient accuracy. Many candidates drew refraction through a lens. However, in part (b), most candidates could identify 'reflection' as the name for what happens to light at a mirror, select explanations in part (c)for why mirrors are used in telescopes and (even more) select the properties of large telescopes in part (d). Few candidates were unable to calculate the power of the lens with focal length 2m in part (e).

2 Formation of a protostar

This extended response 6-mark question asked candidates to describe how a protostar forms and what happens to the gas particles, to include ideas about temperature, pressure and volume. The common misconception between the nebula and the protostar meant that many candidates were confused about whether the volume was increasing or decreasing. Many good descriptions of the effect of gravity on pressure and temperature changes in the hydrogen cloud were seen. The kinetics of the gas particles were rarely described however. Fusion was frequently described but many candidates described the fusion of hydrogen with helium.

3 Sun, Moon and stars – data handling & Kepler Graph

In part (a)(i) most candidates identified the correct apparent movement of the Sun, Moon and stars and even more gave a correct explanation for this in part (a)(ii). In part (a)(iii), very few candidates used the term 'correlation'. They may not have understood the question 'Do the data show a relationship?' as most were able to describe the relationship, which was the 'justify your answer' part of the question. Common misconceptions about time and speed meant that weaker candidates missed a mark for identifying distance and time as the variables. In part (b)(i) most candidates could plot the point for Earth but few were able to plot the point for Mars to the required ½ small square accuracy. However, most were able to draw and use an accurate best fit line in parts (b)(ii) and (iii).

4 Cepheid variables – data handling

In part (a) candidates were required to select four words from a choice of five to complete a passage describing how Cepheid variables are used to determine distances to galaxies. Strong candidates had few problems with this, though many considered that 'shape' was the correct linking idea to the period or the luminosity. Weaker candidates could generally only link 'brightness' to 'observed'. Very few candidates did not get both marks in part (b)(i) for calculating the mean distance (four numbers, each to 2 d.p), with a majority able to use their answer to identify the correct galaxy containing the C-V in part (ii). Intriguingly, only a minority of candidates could select the correct value of the number of parsecs in a megaparsec in part (iii) but, most were able to apply the speed of recession formula in part (c).

5 Parallax

This extended response 6-mark question asked candidates to describe how parallax is used to measure the distance to nearby stars and include a labelled diagram in the answer. This was a difficult question for the candidates and out of reach for many. Examiners were looking to give credit for responses that showed an idea that an angle was involved, an idea of a baseline – ideally opposite ends of Earth's orbit, but Earth's diameter was allowed, and an idea of relative movement. This last idea, that observations are compared against a background of stars was least secure in candidates understanding. Many, who scored any marks, gave the angle idea. For the baseline, some even described using their thumb to find the distance to the star. As with question 1.(a), diagrams were often weak, with little care or precision in their construction and labelling was often absent. Even the most basic diagram would have given an idea of a triangle with a baseline for which some marks would have been gained.

6 Radio telescope observations and Ideas About Science

In part (a) candidates were asked about some repeated readings of a series of pulses detected by a radio telescope. More than half the candidate's responses reveal confusion about the confidence that the scientist has in her observations and the accuracy of those observations. For the answer to part (b), fewer still were able to cite the additional evidence, given in the question stem, that added certainty to one of the scientist's conclusions. In part (c)(i) candidates generally linked a yes/no conclusion to an advantage or a disadvantage, often considering both but not always gaining credit for some of their ideas. In parts (ii) and (iii) a large number of candidates demonstrated genuine confusion regarding the evidence for extra-terrestrial life. In the syllabus this is a recall statement yet most candidates were compelled to invent something in part (ii) and provide an imaginative supporting argument in part (iii). Knowledge of the discoveries of extra-solar planets is clearly not secure at this level. In part (d) only a small number of the ablest candidates recalled that neutron stars were the remains of supernovae. The question had a high omit rate indicating unfamiliarity with the term. Most candidates, who attempted the question, described star formation in nebulae.

7 Astronomical observatories

This extended response 6-mark question, common with the Higher tier exam, asked candidates to explain why observatories are built on isolated high mountains considering the advantages and disadvantages and suggesting, with a justification, an alternative location. There were many well developed answers to this question describing and explaining the advantages and disadvantages of putting telescopes on the tops of mountains. However, possibly because this was the last question, many able candidates did not address the task of suggesting an alternative location. Of those that did address this aspect of the question, very few recalled that telescopes in space had greater advantages and overcame many of the disadvantages of mountain based telescopes.

A183/02 Twenty First Century Science Physics A (P7) Higher Tier

General Comments:

The candidates covered quite a wide range of abilities, with the increase in candidates at the lower end of the ability range noted last year continuing. 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. 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 extend prose 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 Q3, where the weaker candidates were often at a loss as to how to address the question.

Comments on Individual Questions:

Question 1

a) Answered very well by most candidates, if they did not receive the mark they have usually referred to accuracy. Many candidates do not know the differences between accuracy and reliability.

b) Most candidates correctly said another telescope.

ci) Most candidates got the communication mark and the potential danger, they mainly lost the mark by not having a conclusion. Often there was just a list of advantages and disadvantages.

cii) Very few said no evidence, the most common answers were the wow signal, UFO's, lots of space junk and footprints on Mars!

ciii) Whilst many knew that extra solar planets had been found, many were unclear about the nature of the plants with many suggestions of water found on these planets. Many fanciful ideas were repeated from part ci e.g. UFOs.

d) Answered well with most candidates referred to super giant and the remains of a supernova. Most common weak responses described the formation of a proto star.

Question 2

a) Was well answered by most candidates, the most common error was Canada.

b) Most responses contained several good advantages and some disadvantages but missed out on giving an appropriate alternative location. It was common for candidates to fill the space with advantages rather than dividing the space provided into the 3 sections required by the question. Candidates would benefit from practice in planning the answers to the 6 mark questions.

Question 3

a) This was generally not answered well. The most common error was to draw a straight line for the line of best fit, when the points were clearly forming a curve. Other common errors were incorrect labelling of axes e.g. no units or poor choices of scale e.g. 10 squares = 0.3. In general plotting was good.

bi) This was not answered well by most candidates. Few were able to describe the features of the graph that showed it was directly proportional. A common response was to give examples of data points without describing the general features. It seemed that weaker candidates didn't understand the question at all.

bii) Many candidates started the calculations, but then got lost. Most candidates who got at least one mark for getting to 1.95, but failing to use this value to find T.

ci) Most candidates could calculate the square and cube values. However a large proportion of candidates did not understand what was meant by 3 significant figures.

cii) Candidates often used appropriate maths but then failed to indicate that their two results were similar and hence fitted Kepler's relationship. Most candidates who got the marks did say both numbers were close, some candidates did work the ratio of the 2 numbers and stated this was the same as for Kepler's relationship.

d) Most candidates identified the correlation as distance increases as time decreases, however hardly any mentioned the need for a mechanism or explanation. Few could explain what was required for a causal link. A common error was to misread causal as a "casual" link. Weaker candidates stated there was no correlation because 'one went down as the other went up'.

Question 4

The best responses wrote short sections on each method, clearly identifying the key features. Weak responses made vague statements about methods, often containing incorrect physics. It was not uncommon to see candidates including information that featured in previous papers rather than applying their knowledge to the current question. Links between the three methods were often missing or simply said that Hubble depends on the other two, with no further explanation. A common misconception had Hubble the wrong way round so they wanted to measure distance with Cepheid variables and the use Hubble to calculate speed of recession.

Question 5

a) Most commonly answer were moving towards the supergiant part from some part of the main sequence but most then incorrectly curled back towards the white dwarfs, very few stopped at the supergiant region.

b) By far the most common error was to start with hydrogen followed by helium. Otherwise this was generally well answered.

c)i This was a demanding question with some strong distractors, the most common errors were 'photons turn into electrons in atoms' and 'the colour of the electron depends upon the photon'. c)ii was generally answered well the most common error was to only circle one answer, the most common incorrect responses were 19 and 32.

d)i and d)ii were essentially recall and incorrect answer did not seem to bear any relationship to the question, simply illustrating that the energy transfers were not known. d)iii was usually answered quite well, common errors included adding the 273 and incorrectly recalling the value as 237.

Question 6

Responses that gave the correct sequence were likely to gain top of level 2 and showed a good understanding of the processes involved. Weak responses often made unrelated statements or stated links between quantities with no reference to the formation of a star. The best responses were able to write a clear, non-contradictory 'story' which referenced the mathematical relationship within the prose. Unfortunately many candidates just quoted formulas linking P,V and T without relating these to the context.

A194/02 Further Additional Science A Controlled Assessment

General Comments:

Overview

This was the third 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 previous years. 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.

A serious cause for concern was 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 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 to 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 <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 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 '*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 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 7-8marks. 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: *Michelle Hawley, 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.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

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Facsimile: 01223 552627
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