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Oxford Cambridge and RSA

GCSE

Chemistry A

Twenty First Century Science Suite

General Certificate of Secondary Education **J244**

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.

CONTENTS

General Certificate of Secondary Education

Chemistry A (Twenty First Century) (J244)

OCR REPORT TO CENTRES

A171/01 – Chemistry A Modules C1, C2, C3 (Foundation Tier)

General Comments:

Candidates performed well on all aspects of the question paper with the exception of parts of question 5 where candidates were required to give a free response. The clarity of responses was improved, with lines joined clearly and tick boxes clearly identified. Level of response questions were well structured and often gave essential linking of ideas needed to achieve levels 2 and 3.

There were only 2 parts of the paper where candidates were reluctant to respond. These were the calculation of the mean, and to a lesser extent to provide the name of the products of electrolysis. These are areas for improvement in future examinations.

Comments on Individual Questions:

Question 1
1(a) Most Candidates chose the correct answer with no obvious wrong answer consistently selected.

1(b) Generally well answered but 'hydroxide' was frequently chosen incorrectly.

1(c) Few candidates selected both correct answers, however the majority of Candidates could correctly identify 'carbon dioxide' as one of the 2 substances formed when a hydrocarbon burns.

Question 2
2(a) Generally well answered, and done so neatly.

2(b) Many candidates were able to correctly select the relevant data and explain why the petrol car was better. Quoting the data was not enough to score the full marks here and this was the area where candidates appeared to lack the skills needed to access the highest level on a frequent basis. The release of gases into the atmosphere was often confused with burning of the gases. Fewer candidates could articulate the effects of the pollutant gases on the atmosphere. Greenhouse gases and the ozone layer were often confused when used to attempt this question.

Question 3
3(a)(i) This question required the calculation of the changes in 'fossil fuels burned' (millions of tonnes) for at least 2 of the sections of a 10 year period. The command words 'use the data' required such a calculation to enable both marks to be scored. A significant number of candidates didn't attempt the calculation, or incorrectly calculated these values over 2 ten year periods. The final evaluation of the data was generally well done, even when the values were incorrect.

3(a)(ii) Generally well answered from an extrapolation of the graph.

3(b)(i) Most candidates could identify the general upward trend in the data. A significant number could also identify either the fluctuations in the data or the maximum point of the graph.

3(b)(ii) Generally well answered, with 'increased' being identified for the first space and 'correlation' identified for the last space. The only issue was the middle statement. 'Reaction' was a common incorrect response here.

Question 4

4(a) There were many positive aspects to the candidates' responses, and they were able to select the good points in Matt's investigation. However, many did not understand the difference between precision, reliability, accuracy and controlling variables. They tended to use the term "fair test" for explaining every nuance of Matt's testing. Centres would be well-advised to ensure that candidates use the term "control" variable correctly in future. Candidates struggled to link their ideas about controlling variables to positive aspects of the plan. E.g. Matt used the same mass each time. This was a control variable.

4(b)(i) Most candidates could identify the range correctly.

4(b)(ii) Most candidates could identify the outlier correctly.

4(b)(iii) Candidates struggled to give a method to decide if a result was an outlier, instead they offered suggestions as to how they could remove this outlier to have the least impact on the data. This simply didn't answer the question.

4(b)(iv) A significant number of candidates did not attempt this question. Those who did could add the numbers together but failed to divide by 5. Of those that wrote down the correct process, there were several that had clearly not pressed '=' on the calculator before attempting the operation of division.

Question 5

5(a) Candidates could give a property of plastic but it was often not related to the 'bucket'. For example being flexible is not the most important property for this item, but it was regularly quoted. Candidates also gave two properties rather than one property and an explanation.

5(b)(i) Candidates lost marks here because they did not read the rubric of the question. They selected different forms of polymers or used metals as examples. Some candidates gave a use with no material.

5(b)(ii) This was often difficult to score as the previous part of the question had been poorly answered. Candidates often gave just one reason why plastic was better than the material they had suggested.

Question 6

6(a) Few candidates recognised 'chlorine' as the element present in PVC. Nitrogen was a popular incorrect response here.

6(b) Most candidates struggled to identify the correct repeat unit. The most frequently chosen incorrect response was that depicting two and a half repeat units.

6(c)(i) A range of responses here with no real pattern of incorrect choices.

6(c)(ii) Candidates could explain the 'leaching' of the plasticiser from the wrapping into the food and then explain the idea of these plasticisers getting into the body through the consumption of this food.

Question 7

7(a)(i) Most candidates could give the 2 correct values.

7(a)(ii) Although many candidates were able to correctly identify the reasons that the eco-trainers were better, successfully selecting the data to support their explanations, they did not then make the link between sustainability and harm to the environment. This meant a large number of level 2 responses. Unfortunately some candidates didn't 'use the data' from the rubric of the question and so were limited to level 1 by quoting information from the diagram.

Question 8

8(a) Most candidates could identify an advantage and disadvantage of adding salt to food. This showed continuing improvement from previous Examination sessions.

8(b) The candidates struggled to make the connection between the solution mining, the purity of the salt collected and the use in food products.

8(c)(i) Most candidates could identify the role of water in the process and the need for this to be pumped into the ground (as well as pumped out again). Fewer candidates could identify the process of dissolving as one which takes place to produce the brine solution to return to the surface.

8(c)(ii) Only a limited number of candidates could identify any of the products of the electrolysis of brine.

A171/02 – Chemistry A Modules C1, C2, C3 (Higher Tier)

General Comments:

This paper was well attempted with a high mean mark. It differentiated effectively allowing strong candidates to show their knowledge and understanding of the subject.

Candidates showed a good understanding of how to measure the properties of materials. They had no problem calculating the best estimate of the true value. They used this, along with the range, to decide if the results could inform the choice of a material for a particular purpose.

There was some lack of clarity to answers, especially in the level of response questions. Candidates should read the question carefully and plan their answers around exactly what they are asked. They should try to be specific in their answers and remember that vague comments such as 'environmentally friendly' or 'harmful chemicals' do not gain marks. They should also give themselves time to read through their answers to these long questions to ensure they make sense and do not contain contradictory comments.

Some candidates ignored requests in questions to 'use data', so did not gain marks. When this request is given they should show the data they have used and explain how they have reached their answer.

The number of no response answers was small, but there were some candidates who had run out of time. They had often spent considerable time writing excessively on the level of response questions. Candidates should be reminded that the space given on the paper indicates the amount of writing needed for a complete answer. Also, this year, there appeared to be more candidates than usual who struggled to respond to the higher level questions. They would have been better suited, and possibly gain a better grade if they had taken the foundation tier paper.

Comments on Individual Questions:

Question 1
1(a) This was expected to be an easy start to this paper, but few candidates were able to say that burning in oxygen and not air gave a faster reaction or reached a higher temperature. They focused on ideas related to the other gases in air or on complete combustion.

1(b) Most candidates remembered the definition of a hydrocarbon and answered this correctly.

1(c) Balancing the reaction was well done, though a number of candidates lost marks because of poor drawing. Representations of molecules of water and carbon dioxide were given so there is no excuse for repeating these diagrams without touching atoms.

Question 2
2(a) Generally well answered though a third only scored 1 mark. There was no pattern for incorrect answers.

2(b) This question discriminated well. More knew the oxidation step than the reduction step. A common wrong answer for the reduction stage was to say that nitrogen monoxide was reduced to nitrogen **and** oxygen.

2(c) This first level of response question was answered well with good differentiation between the levels. Most used the data to achieve level 1. Some were vague about the effects of the

pollutants, repeating ideas of fatal, harmful and polluting. More failed to comment on banning from cities or just wrote they were banned because of pollution or harmful gases which did not gain marks. Another common problem was that candidates were uncertain about the difference between using something and producing something. It was not uncommon to read that petrol cars use more carbon monoxide than diesel cars.

Question 3

3(a) In part (i) candidates were able to extrapolate a graph and give the correct result. Part (ii) asked about the difficulty in extrapolating further. Most gained marks by stating that fossil fuels were a finite resource and other sources of renewable energy would be used. Few marks were awarded for population increase, nuclear energy and more efficient power stations.

3(b) Many gained 1 mark by describing an increase in both graphs, but few seemed able to describe the correlation shown by these graphs. They should be encouraged to think about what happens in the second graph as the first one changes; i.e. as fuel burned increases, what happens to the increase in global temperature? Some were confused between correlation and cause.

Question 4

4(a) This question was an overlap question with the foundation paper and there were very good discussions of the features of the experiment for a level 2, with many accessing level 3 by giving detailed reasons for the differences and merits of the three plans. However weaker candidates were often vague when linking reasons to features. It was not uncommon to find a list of features followed by the sentence 'making it fair and accurate'.

4(b) Parts (i) and (iii) of this question were done well. Candidates have no problem spotting outliers and calculating the best estimate of the true value. More difficult was explaining whether to include or discard outliers in the calculation. A common wrong answer was to calculate the mean, with and without the outlier, and see if there was a difference: candidates were unaware that it is important to make a decision about the outlier **before** the mean is calculated. Part (iv) of this question discriminated well. Some weaker candidates failed to gain marks because they did not use the data. Others wrote about the best estimate or the range, but not both. Some of those discussing the range believed, incorrectly, the difference was because one range was narrower than the other.

Question 5

5 This was another discriminating question. Most could link molecular size to boiling range, but only better candidates were able to describe the role of intermolecular forces in the boiling ranges. Confusion over intermolecular forces and bonds was common with candidates believing that bonds in the molecules broke when liquids boiled. Some had learned about fractional distillation and wrote about this instead of answering the question. And there are still some candidates who confuse boiling and burning.

Question 6

6(a) A large percentage did not name the atom correctly in part (i). All sorts of answers were given ranging from chloride to atoms such as helium, silicon or argon. More were able to draw the monomer of PVC having been shown part of the molecule in part (ii). Correct diagrams here were generally drawn well.

6(b) In part (i) few could explain logically why adding plasticizers makes PVC more flexible. Only half the candidates scored any marks, with very few gaining the full three. There were many mixed up ideas about polymer modifications. Some confused adding plasticizers with breaking crosslinks and others suggested adding plasticizers affected the crystallinity of the PVC. The main problem with answers to part (ii), was that candidates thought PVC was harmful and did not realise it was the plasticizers that leached into food which may cause harm when eaten.

Question 7

7 There was plenty to write about in this question, but unfortunately, very few reached level 3. Far too much effort went into restating data from the question paper without analysing it or using the prompts in the question to structure their answer. Reasons such as plants being carbon neutral were rare, as was the use of the word 'resources.' Some did discuss the total energy and greenhouse gases, but then spoiled their argument by saying the disposal figures were the same. This level was usually given to those giving figures that totalled those in the table. The additional information points were mainly scored by how long they lasted or the impact of their use. A few mentioned water, but no-one discussed the impact of growing crops for materials rather than food.

Question 8

8(a) In part (i) most got B at the beginning and many C at the end, but the mark for AG in the middle proved more difficult. This type of 3 mark question is often attempted too quickly, without thinking through the whole process. Part (ii) was well known by almost all.

8(b) Part (i) was a discriminating question with able candidates scoring both marks for the products of electrolysis. Part (ii) proved difficult for many. In this and in part (iii) there seemed little understanding of the link between chlorine made, the electricity used to make 1 tonne and the total electricity used. Candidates were much more likely to extrapolate and interpolate along the rows to reach the wrong answers. Also, because of this lack of understanding of the data on electricity used, many only gained marks in part (iii) for an increase in chlorine production and a decrease in toxic products.

A172/01 Chemistry A Modules C4, C5, C6 (Foundation Tier)

General Comments:

The paper produced a good spread of marks with no evidence that candidates struggled to complete it on time. Most candidates attempted all the questions with the extended writing questions being most likely to be omitted.

Candidates did not always think about all that the question was asking and would lose marks by not going on to give the additional detail required.

Many candidates are trying to structure their answers to the six-mark extended-writing questions. The best answers used a brief plan to ensure that their response would include all the required points. Other did not address all the parts of the question, just writing anything they knew that might be relevant which limited the level they could achieve. In order to access the higher marks responses must include more details and scientific points.

Candidates' knowledge of experiments was often poor and they struggled to recognise observations or devise simple methods.

Comments on Individual Questions:

Question 1

1(a) Candidates struggled to identify properties of Group 1 elements. The most common incorrect answers discussed electron/atomic structure or said they were solids. 'Metals' was the most common correct answer.

1(b)(i) This was answered well by most candidates. Incorrect answers included writing the names of the elements or using proton number. Candidates who had identified the relative atomic masses in 1(b)(i) were usually able to identify the trend correctly for 1(b)(ii). Many said they were odd numbers or talked about reactivity. Many candidates clearly identified the positions of hydrogen, fluorine and chlorine in the modern Periodic Table for 1(b)(iii). Common errors included confusing groups with rows and placing hydrogen in Group 1. Most candidates identified the missing group as Group 0 for 1(b)(iv), with Group 5 being the most commonly chosen incorrect response. In 1(b)(v), the reason that elements were missing from the earlier table was because they had not yet been discovered was well known by candidates although a significant number thought that it was because they did not have a relative atomic mass. Almost all candidates showed that they had used the Periodic Table to identify the elements for 1(b)(vi) and most chose the correct symbols of Be and B. Some gave names instead of the symbols requested and others used atomic numbers instead of relative atomic masses and so gave F and Na instead.

Many candidates did not know that the elements in the modern Periodic Table are listed in order of proton number for 1(c). Relative atomic mass and the type of bonding in the elements were both popular choices.

Question 2
Most candidates who attempted the extended writing question **2** were able to identify sodium and rubidium in minerals A and B although some concentrated only on reasons for not being able to identify the elements, frequently not referring to the flame colours at all. There were some good responses that went on to explain the problems with identifying the element in mineral C due to the absence of a green flame in the table although some thought that a green flame must mean chlorine or a mixture of two other flame colours.

Question 3
The colours and states of the halogens required for **3(a)** were not well known and few candidates got 3 marks. The identity of the missing particles in fluorine as neutrons for **3(b)(i)** was better known although a significant number chose electrons instead. Most candidates were able to gain at least 1 mark for the electron arrangement in **3(b)(ii)** by putting 2 electrons in the inner shell although a significant number lost the second mark by putting 8 electrons in the outer shell.

Question 4
Candidates struggled to relate their knowledge of the particles in solid and aqueous sodium chloride to the information given in the diagrams in 4(a). There were some good descriptions of the arrangements but links of these to relevant properties were less common so limiting the level possible. There were frequent references to atoms or molecules in spite of ions being clearly shown in the diagrams and some did not refer to particles at all.

Most candidates showed that they understood the correlation between the mass added and the freezing point in 4(b)(i), although there was some confusion about whether the freezing point was increasing or decreasing as it became more negative. Many went on to give the extra detail about the amounts. Few were unable to correctly predict the freezing point in 4(b)(ii) although some omitted the negative sign. There were some good answers in 4(c)(i), explaining why it is an outlier by either stating what the freezing point would be if the trend continued or stating the mass that had produced the given freezing point. Again there was some confusion as to whether the freezing point was higher or lower than expected as it was a less negative number. Some answers were too vague, such as 'did not fit the pattern'. The need to repeat a test which has produced an outlier was well understood by candidates for 4(c)(ii) although some described drawing graphs and lines of best fit. Few candidates were able to describe any suitable experiments for 4(c)(iii). Some did have the idea of adding a further range of masses but most just added 50g in one go. Others did realise the need to keep the amount of water the same but hardly any described the need to measure the freezing point.

Question 5
In 5(a) many candidates did not discriminate between oxygen and KCl. A typical answer would be that they were both soluble. The fact that oxygen is a gas was rarely mentioned. In 5(b),the symbol for graphite was seldom seen and usually incorrect e.g. G/Gr and oxygen was often O. Potassium and chlorine were more commonly correct although there were quite a few references to chloride.

Question 6
There were some very good energy level diagrams drawn which clearly showed the relative size of the energy changes. Marks were often lost for lack of arrow heads or labelling. Some candidates struggled with the diagrams but were able to use the data given to compare energy or temperature changes.

Question 7
Answers to 7(a) showed that few candidates can have seen/used a pH meter as most referred to 'colour' and indicator. Some did realise that they would get numbers but did not know the relevant ranges for acids and alkalis. A few tried to link it with the bonding given in the table. In 7(b), more candidates were able to use the information in the table to explain that alkalis can be

covalent or ionic although some did not use examples from the table as requested. In 7(c), most were able to link at least two substances with the correct state symbol with solid and gas most frequently linked successfully. Some seemed to think that (s) meant solution.

Question 8

Most candidates could write a correct word equation from the formula equation given in 8(a), although some omitted signs and arrows and others confused silver with sodium and got it the wrong way round. A significant number did not respond at all. Again, many omitted to answer 8(b) and few gave good descriptions of the experiment. Few knew the term 'funnel' and many thought that the solution which ended up in the beaker was to be put in the oven to get AgCl. In 8(c), many candidates correctly chose chlorine as the other element formed when light shines on silver chloride. The most popular incorrect choice was hydrogen although significant numbers of all incorrect responses were seen.

A172/02 Chemistry A Modules C4, C5, C6 (Higher Tier)

General Comments:

Candidates used their time well. Some individual candidates left questions unanswered but in general candidates attempted all questions. However, the standard of responses to the questions was weaker than seen in previous years. This was particularly significant in questions which tested formal chemical knowledge and in the level of response questions. This suggests that some candidates are not well prepared for the examination and may be better served being entered for the foundation tier.

Although examiners try, where possible, to ensure that the quality of science determines the mark, rather than the quality of written English, it is important that candidates express their scientific ideas clearly, with all of the necessary logical links. The quality of expression in some answers was insufficient to be awarded marks because the necessary scientific reasoning was not expressed clearly. Examples of this included candidates not linking their ideas clearly in questions Q1 (c) (i), Q2, Q3 (c) and Q4a.

For the level of response 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 (for example discussing both missing and unknown elements in question 2). In addition, these questions are often preceded by a stem which includes numerical data or other information. Marks are not generally awarded at the higher level for copying out selections from this information. It is important that candidates use the data as evidence to back up the points they make, or extend and explain the information rather than merely repeat the information in the question. As mentioned above, the quality of the responses did not always make the necessary logical connections or arguments that this type of question demands on a higher tier paper.

Comments on Individual Questions:

Question 1

1(a) Most candidates gained at least a mark. The two most common errors were to either discuss structure, rather than properties, for example by stating that elements had one electron in their outer shell, or to only give one property.

1(b)(i) Most candidates gained both marks. Candidates need to take care to read the question carefully. Symbols were asked for and names were not given credit.

1(b)(ii) Some candidates confused Newland's 'rows' with Periodic Table 'groups', hence incorrectly stating that carbon and silicon are in the same row of the Periodic Table. Some mistakenly thought titanium was in Group 2.

1(b)(iii) Although most were able to identify 'Group 0' or 'Group 8' as the missing group, some thought the halogens were missing. This suggests that they had failed to notice fluorine and chlorine in row 1.

1(c)(i) The main problem with answers to this question was that candidates did not structure their answers well. Many showed confusion between the reasons for reversing the elements and the reason for leaving gaps. For a higher tier question, it is important that candidates express themselves clearly and make the relevant links. In this case 'for undiscovered elements' and 'because of properties' alone were answers which did not show that candidates understood the reasons for each decision that Mendeleev made. Better answers clearly linked each of Mendeleev's changes to its correct reason.

1(c)(ii) Most knew that elements are arranged in terms of proton number, but 'the relative atomic mass' was a common incorrect choice.

Question 2

2 This level of response question was not well answered. This was mainly because the question asked for conclusions and explanations. In most cases neither were given fully. The question asked for 'elements the mineral does and does not contain'. Many candidates did not discuss any evidence or conclusions for those elements which were absent. In addition, although most referred in vague terms to 'the spectra' for the elements, the discussion was often only in vague terms. The best answers discussed the relative position of lines in the spectrum. Many candidates did not complete the task; many omitted any discussion of why the spectra data cannot be used to identify all of the elements in the mineral.

Question 3

3(a) Many candidates gained no marks for this question. The states and colours of the halogens were not well known. Some thought that chlorine was orange. Many thought that iodine was a liquid.

3(b) Most gained at least one, and many gained both of these marks about the structure of Group 7 atoms and ions.

3(c) Most candidates did not know the meaning of the term 'diatomic'; many gave properties of halogens such as reactivity or state. Those who had an idea of the meaning often showed only partial understanding which was not enough to gain credit such as 'they go round in pairs'. Many confused molecules, elements and atoms, stating that 'it contains two elements' or 'it contains two molecules'.

Question 4

4(a) This level of response question was poorly answered, with about a third of candidates gaining no marks. The candidates were provided with diagrams of the structure of sodium chloride both as a solid and in solution. It was expected that they describe the changes on the diagrams and link these to the properties of each. In common with other questions, the logical links between structure and properties were not usually well expressed. In addition, most candidates made fundamental chemical errors, for example discussing covalent bonds, molecules, moving electrons or intermolecular forces. Many candidates made no mention of ions in their answers.

Better answers discussed melting and/or boiling points and conductivity in terms of structure. About 10% of candidates gained a mark in the level 3 marking band.

4(b)(i) Most gained a single mark for describing a trend in the data. Some went further to quantify this trend by identifying that each 5.0g increase leads to a -3 ^{o}C decrease in freezing point. Some mistakenly said that the relationship is a 'positive correlation'.

4(b)(ii) Most answered this well and extrapolated the trend to work out the freezing point. Some omitted the unit or gave an incorrect unit such as cm^3.

4(c)(i) There were three marks available for this question. Many candidates gave a single response such as 'it goes up'. This was another situation where the logical connections were not well expressed. Best answers discussed how the trend was secure for 25.0 g of salt and then went on to work out a prediction for 35.0g and compare it to the experimental value.

4(c)(ii) This question asked for a description of some experiments. Most candidates did not gain any marks for this task. Most discussed carrying out repeats or 'testing 50g'. Few identified clearly that the volume of water would need to be controlled, a range of values for the salt would need to be chosen and the freezing point measured for each. Many candidates talked in vague terms about 'seeing how long it will take to freeze' or 'see what happens when it freezes'.

Question 5

5(a) Vague answers such as 'the melting point is low' or 'the melting point is high' or incorrect answers such as 'it is lower than bromine' were common. Few stated clearly that it would be lower or equal to the melting point of lead bromide (373 ^{o}C).

5(b) No marks were given for stating 'negative electrode' alone, the correct electrode needed to be linked to the correct reason. This proved very challenging for candidates. The fact that metals are always discharged at the cathode was not well known. Hence only about a third of candidates gained this mark.

5(c) This question demanded that candidates work out the charge on a lead ion and then use the symbol for the lead ion to construct a half equation. This is a higher demand task. Less than 10% of the candidates gained a mark for this question.

Question 6

6 Clear, unambiguous, correctly drawn diagrams could gain all six marks for this question. This meant that many candidates gained marks in the level 2 and level 3 mark bands. Candidates generally seemed to handle energy level diagrams better than they managed the longer reasoned answers which the other level of response questions demanded. Common basic diagram errors were to miss the 'product' labels off the diagrams; to omit the arrow heads on the enthalpy changes or to draw the arrow heads in the wrong place (upside down or not clearly meeting the product line). In terms of the chemistry involved, most realised that both the reactions for sodium chloride and potassium chloride were endothermic and showed this on the diagrams. Some recognised that the energy change for sodium chloride was smaller in value, and represented this correctly. Only the most able further recognised that the value of the potassium chloride energy change was smaller in value than that of lithium chloride.

Question 7

7(a) Most know which substances in the list were acidic.

7(b) The main issue that caused candidates difficulties was that many thought that calcium bromide was an alkali. This led them to incorrectly answer that alkalis have a pH of '7 and over'. However, many correctly stated that ammonia is a covalently bonded alkali, whereas the others are ionic.

7(c) The states of ethanoic and citric acid were not generally known. Few thought that either of them were solid.

Question 8

8(a)(i) Most stated that 'a solid is formed'. This was not awarded a mark because it does not 'use the equation to show'. Some candidates did discuss the state symbol (s) linked to precipitate, but most failed to gain a mark.

8(a)(ii) About half the candidates correctly wrote the word equation. Common incorrect answers included using incorrect names such as ‘sodium chorine’ or ‘sodium nitrogen oxide’.

8(b) Most did not realise that silver chloride would produce chlorine when it breaks down to form silver. Oxygen and hydrogen were commonly seen.

8(c) The preparation of dry solids from aqueous solutions or precipitates was not well known. Many gained a single mark, usually for knowing that it was necessary to heat sodium chloride solution strongly.

A173/01 Chemistry 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.

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A173/02 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. 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.

A174 Chemistry 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 scaling 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 before selecting a factor for the development of the hypothesis. It is not sufficient to state a factor, give a hypothesis and then list other factors as control variables. Candidates are recommended to structure their reports to make this process clear.

At the highest levels 7-8 marks it is important that candidates consider all relevant factors prior to selecting one. A quantitative predication must be derived from 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 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 i.e. 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 to 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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