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GCSE

Chemistry A (Twenty First Century)

General Certificate of Secondary Education **J634**

Report on the Units

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Oxford Cambridge and RSA Examinations

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

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Introduction from the Chief Examiner

Ofqual produced a public report on GCSE Sciences in March 2009: 'Findings from the Monitoring of the new GCSE Science Specifications: 2007 and 2008'. This report (page 25) makes reference to an agreement between Ofqual and the Awarding Bodies 'to ensure that grade boundaries are set appropriately'. Part of this agreement required all the awarding committees to work towards a new national standard for this summer's series. This has had an impact on both the examined units and the coursework components awarded this summer, and has resulted in higher thresholds than might have been expected for a number of the key grade boundaries, across the 21st Century Science and Gateway Science suites of specifications.

Many candidates were well prepared for A321 and A322, showing a sound grasp of the concepts involved in modules C1 to C6. Weaker candidates performed less well, but most made a good attempt at the majority of questions. Relatively few 'no response' answers were seen. Papers in both tiers discriminated well, with very able candidates having the opportunity to score most of the available marks whilst weaker candidates were still able to score some marks throughout each paper.

On unit 3 (Ideas in Context plus module C7), most candidates performed well on questions set from the pre-release material. However, knowledge and understanding of module C7 shown by many candidates was far from satisfactory. A large number struggled to answer questions set on this part of the specification, with many showing very little familiarity with the concepts involved.

Centres must realise that C7 is not just another unit of equal comparability with C1 to C6. It is in fact three times larger than the other units and centres are well advised to regard it notionally as C7, C8 and C9, rather than just C7. This does of course mean that it requires three times the amount of teaching time given to the other six units.

Across all of the examination only a small number of candidates were entered for an inappropriate tier, and there was little indication that candidates had insufficient time to complete any of the papers.

Centres are reminded that this is the last examination series in the current format for these papers. From January 2010, about one third of the marks from these papers will be awarded on open-ended questions. Please refer to the OCR website for further details, including specimen assessment materials. This change in the format of these papers will mean that candidates who are not able to express themselves well in free response questions are likely to do less well than in previous series. As the free response sections of Higher Tier papers will be more demanding than those in Foundation Tier, centres will need to consider carefully which paper to enter candidates for.

A321/01 – Twenty First Century Chemistry A (C1, C2, C3) Foundation Tier

General Comments

The overall standard of candidate responses was improved from previous years.

Candidates on the whole entered the correct number of responses (or ticks) for each question.

The number of 'no responses' to questions was low suggesting that the paper was accessible to all candidates and the timing was appropriate.

Comments on Individual Questions

1 (a) Candidates could match the name and formulae of the compounds given to them. Fewer Candidates correctly matched the formulae to the molecules. Some candidates wished to change the responses they had made. If this is the case, the change should be made clear to the examiner either by using numbers or letters, or some other appropriate method, to indicate which response they would like marking.

1 (b) Candidates were, in most cases, able to identify the correct gas to match to the properties described. The most significant error made by candidates was putting only the first part of the name of the gas, rather than the full name, as given in the boxes in 1 (a). For example, 'sulfur' instead of 'sulfur dioxide'. This was deemed to be too vague.

2 (a) **(b)** Responses for these parts of the question were encouraging and showed improvement as candidates were more successful at identifying the need for reliable results and the reasons for selecting outliers. There is still a little more to do on the explanations for the result being an outlier, as candidates struggled to identify both correct reasons.

(c) This question gave the highest proportion of 'no response' answers indicating that this is still an area that some lower attaining candidates struggle with. This was more challenging as the number in column 3 (297) directly below the outlier was, by coincidence, lower than the remaining numbers in the range of values for 'after device fitted'. This led some candidates to believe that this value was also an outlier. The mark scheme therefore took this into account and gave credit for good science rather than simply numbers. Where candidates did lose marks, the most common error was to incorrectly calculate the mean.

(d) Correlation is a difficult concept for some candidates, so this was a well answered question. Centres have obviously worked hard on this area.

3 (a) This question was poorly answered. Candidates failed to recognise the similarity of the three parts of the Life Cycle Assessment for the spoons. Different materials would give a different environmental impact during manufacture, yet this was the most common incorrect response. Essential aspects of the Life Cycle Assessment are an area for future development.

(b) Sustainability is often confused but in this question the majority of candidates were successful at gaining some marks. A wide range of incorrect responses was seen, showing that this is also an area for future development.

(c) This question was well answered with many candidates scoring two or three marks. It was encouraging that most candidates could identify the relationship between melting point and the plastic softening, as well as the resistance to staining. Centres should encourage candidates to read each question carefully as this was interpretation of the information in a table rather than application of knowledge.

4 (a) Most candidates could correctly identify 'polyester' as the synthetic material.

(b) Polymerisation was understood in its simplest terms of small molecules joining to make large molecules. The more difficult aspect of this seemed to be the name of the process.

(c) Most Candidates could correctly identify the two component elements of a hydrocarbon and also the main use of crude oil.

5 (a) Candidates on the whole could identify that 'plants take nitrogen from the soil when they grow'. However, they were less successful at realising that this essential element was taken and not replaced when the crops were harvested. The nitrogen cycle is still an area of continuing development for centres. Candidates struggled to identify the elements present in a protein. A wide range of incorrect responses was seen here.

(b) Candidates struggled to identify the fact that 'during storage, crops may be contaminated by a mould that produces toxic chemicals'. They were more successful in recognising that 'some crops naturally contain toxic chemicals which cause harm if they are not cooked properly'. Candidates showed clear understanding of the role of scientific advisory committees to determine the safe levels of chemicals in food.

6 (a) Candidates answered this question poorly. There was little understanding of the fact that amino acids are the building blocks of proteins and so are used to synthesise proteins, as well as being the product of their breakdown. Candidates could identify the need to use the word, 'amino acid', but there seemed to be little pattern as to the placement in the top two gaps. 'Urea' and 'urine' were generally correctly identified.

(b) The majority of candidates scored no marks here. The common response was to draw lines to each box rather than to choose a limited number of boxes from the choice given. For those candidates that did identify the correct boxes, they often mixed up in the treatment of type 1 and type 2 diabetes. This is a much needed area for improvement.

(c) Most Candidates correctly identified 'obesity' as the major risk factor for type 2 diabetes.

A321/02 – Twenty First Century Chemistry A (C1, C2, C3) Higher Tier

General Comments

In general, candidates made a good attempt at all of the questions on this paper, with few question parts that were not attempted. Many candidates showed good knowledge and understanding, with a sound grasp of concepts involved in the first three units of the specification. Others showed a more patchy ability to recall and apply knowledge and ideas. Some areas of the specification were found to be difficult by all but the most able candidates. These included the concepts of conservation of atoms during a reaction, causal link, and the breakdown of proteins and metabolism of amino acids. As in previous years it was evident that a small number of candidates would have gained a more fruitful experience from sitting the foundation tier.

When presented with a number of statements, some candidates were not clear how many of these that they were required to choose. In some cases this number is stated, whilst in other questions it is not. For both of these styles, though more commonly for the latter, a number of candidates chose an incorrect number of responses.

There was no evidence that candidates had insufficient time to complete the paper.

Comments on Individual Questions

1 Most candidates performed well in this question, with only the lowest attaining scoring less than three marks and many of the more able scoring all six.

(a) Many candidates gained all three marks in this question. Amongst lower attaining candidates the most common errors involved incorrect names. Frequently, sulfur (mon)oxide was suggested for the middle row instead of nitrogen monoxide and carbon dioxide for the bottom row instead of carbon monoxide. The weakest candidates often made errors in the formulae.

(b) Although most candidates gained one mark, possibly by chance, only the more able could work out all three correct figures to gain full marks. The number of candidates scoring two marks was relatively small, probably indicating that those who understood how to work out the figures could then work out all three correctly.

2 This question discriminated well across the ability range, with the majority of candidates scoring three or four of the eight marks.

(a) A very large majority of candidates knew that taking results on more days gave a more reliable set of results and so gained this mark.

(b) Most candidates realised that the outlier was identified from the fact that it was well outside the range of the others, to gain the mark in part (i). The most common incorrect response was that the other results had a narrow range.
In part (ii), most candidates chose both correct answers to gain two marks, though a significant minority chose only one correct response. Very few candidates failed to score any marks.

(c) More able candidates understood the term 'real difference' and gained both marks. Many candidates gained only one mark, with only the lower attaining candidates failing to score.

(d) The majority of candidates could identify which statement supported the correlation, to gain the mark in part (i). A common error amongst lower attaining candidates was E, though all of the other incorrect statements were chosen by many of these candidates. In part (ii), only the more able candidates could identify D as the statement that provides a causal link. All of the incorrect responses were seen frequently.

3 Only the more able candidates performed well across all parts of this question, but most candidates gained a reasonable number of marks.

(a) The majority of candidates could identify the correct part of an LCA, with only the lower attaining candidates not gaining this mark.

(b) A very large majority of candidates correctly identified all three statements to gain full marks, with only the weakest making errors.

(c) Most candidates could identify one correct part of the LCA, whilst the more able identified both. Some candidates ticked only one box.

(d) The majority of candidates chose both correct responses to gain the one mark. Amongst lower attaining candidates, all of the incorrect responses were seen. Only a few candidates ticked just one box.

4 This question discriminated well across the ability range; the majority of candidates gained three or four marks.

(a) Only the lowest attaining candidates included response A in their answers and so lost the mark in part (i). All two letter combinations from B, C and D were seen and given credit, though B and C was the most common.
In part (ii), a large minority of candidates correctly chose A and D. Incorrect responses were not confined to the lower attaining candidates; B was the most common incorrect choice.
In part (i(ii), the majority of candidates correctly chose A and D again, to gain this mark. Perhaps surprisingly, more candidates were successful in (i(ii) than in (ii).

(b) The majority of candidates gained one mark, but only the most able gained both. It was quite common to see three ticks instead of two, which led to the loss of one mark.

(c) Many candidates ticked two correct responses to gain one mark, with the more able choosing all three to gain both marks. Only the lower attaining candidates failed to score, with many ticking only two boxes, one of which was incorrect.

5 Another question that discriminated well across the ability range, with most candidates gaining three, four or five marks.

(a) Most candidates knew that plants remove nitrogen from the soil and that this is not replaced when they are harvested, so gained both marks in part (i). A significant number of lower attaining candidates could only pick one correct response; very few could not pick either.
In part (ii), more able candidates knew that proteins contain hydrogen and carbon and so gained both marks. A number of others managed to give one of these elements to gain one mark, but a large minority of candidate could not name either. Common

incorrect responses included nitrogen, sulfur and water. Many other incorrect responses were seen, including sodium, potassium, phosphorus and glucose.

(b) In part (i), almost all candidates gained at least one mark, with the more able scoring both. Only the lowest attaining candidates could not choose either of the correct responses. All of the incorrect responses were chosen by these candidates, with no obvious pattern.
In part (ii), almost half of the candidates chose the two correct responses to gain one mark. Many candidates chose one correct and one incorrect response which gained no credit.

6 This question also discriminated well across the ability range, with most candidates gaining three or four marks.

(a) Very few candidates showed any knowledge of this area of the specification. Only a tiny number of the most able candidates entered four or five words correctly to gain two or three marks. A few more of the most able candidates entered three correct words to gain one mark. Amino acids, urea and urine were the most common correct words. The most common errors amongst candidates who gained one mark was to swap the places of liver and kidneys. Another common error was bladder instead of kidneys. The majority of candidates entered words that were related in some way to digestion and excretion. Weaker candidates gave answers that were mostly unrelated to the question.

(b) A large majority of candidates gained at least one mark, with many scoring both. A few of the weaker candidates did not tick three boxes. Only the lowest attaining candidates failed to tick at least two correct boxes.

(c) A large majority of candidates clearly understood the concepts of cause and consequence to gain both of these marks. Only the lowest attaining candidates failed to gain at least one mark.

A322/01 – Twenty First Century Chemistry A (C4, C5, C6) Foundation Tier

General Comments

The performance of candidates varied greatly between centres, but almost all candidates were prepared to attempt all of the questions and therefore there were relatively few "no responses".

Candidates made use of information given where questions required it, but were less secure when having to recall scientific fact.

It was evident where centres had completed practical work linked to the units because candidates' responses were more accurate; for example when identifying the correct chemicals, equipment and safety procedures. Thus, centres would be well advised to ensure that candidates experience practical work as often as possible, and include risk assessments as part of the learning experience.

Knowledge of the properties of metals was good, but knowledge of groups of elements and their reactions (groups 1 and 7, in particular) was poor.

Most candidates were able to identify elements given the symbols, but some lost marks due to poor spelling of scientific terms. Although phonetic spellings are acceptable, it was difficult to decide if the candidate themselves understood what he or she was trying to say, e.g. "natural" instead of "neutral".

Marks were lost by some candidates who failed to read the question rubric correctly and, for example, ringed one response instead of two or ticked two boxes instead of one.

Comments on Individual Questions

1 The responses to this question varied.

(a) Almost no candidates gained full marks although many did achieve one mark. Candidates were unable to recall the reactions of lithium or compare them to the reactions of other group 1 metals.

(b) In many cases, the diagram for part (b) (ii) was drawn again, underneath the question, rather than being drawn on the shells as requested in the rubric.

2 (a) Few candidates correctly identified the colours of solid iodine or iodine vapour in part (a) (i), which in some cases could suggest they had never seen them. Many chose "yellow" and confused the colour with iodine solution. Most candidates were able to identify at least one safe procedure.

(b) Most candidates were able to choose the correct response to part (b), "iodine solution kills bacteria".

3 (a) Most candidates were able to identify the correct response as "the colour of the flame".

(b) Few candidates were able to correctly identify the flame appearance through a spectroscope, and therefore answers were chosen at random.

(c) This was answered well and almost all candidates were able to give the correct names of the elements in KCl; lower-attaining candidates wrote “chloride” instead of “chlorine”.

4 (a) Fewer than half of the candidates were able to correctly identify the diagram of a water molecule.

(b) Most candidates were unable to write the correct formula of ethane having been given the diagram, although many were able to give the correct symbols for elements. Common errors included $2CH_2$ and numbers superscripted as in C^2H^4. The lowest-attaining candidates gave lowercase letters for symbols, or were unable to identify the elements correctly.

5 This question was answered well by the majority of candidates. They were clearly able to interpret information and were able to link properties to uses of metals.

6 (a) Overall, candidates performed well on this part of the question and were able to identify correctly what would be seen during the electrolysis of molten potassium iodide.

(b) Many candidates were unable to apply knowledge of bonding or state ionic bonding – answers were chosen randomly. Many, however, were able to state that iodine forms at the positive electrode.

(c) Candidates could not name lead as the element formed at the negative electrode.

7 (a) Candidates’ knowledge of acids used to form a specified salt was poor. Many candidates incorrectly named hydrochloric acid (or hydrolic acid) as a salt needed to produce magnesium sulfate. Most achieved 1 mark in part (ii), but few achieved both marks and responses frequently included salts such as magnesium chloride to produce magnesium sulfate.

(b) There was greater success here than in part (a), as most candidates were able to choose “using acid that is more dilute” as the correct way to slow down the rate of reaction.

8 Most candidates showed good knowledge of pH and the meaning of the pH scale. The lower-attaining candidates chose random numbers, and a few mixed up acidity and alkalinity.

9 (a) Most candidates were able to label most of the scientific chemicals and equipment correctly, but many failed to achieve full marks because they could not identify a conical flask, labelling it as a “beaker”.

(b) Most candidates understood neutralisation.

(c) Although most candidates were able to work out the formula mass of NaOH in part (i), very few marks were achieved in part (c) (ii), identifying why a yield might be lower than expected. Most candidates chose “she used too much acid”, indicating that they had failed to read the question carefully.

A322/02 – Twenty First Century Chemistry A (C4, C5, C6) Higher Tier

General Comments

Candidates performed well on this paper. Very few left questions unanswered and most had clearly employed intelligent guesswork on questions that they were unsure about.

In general, questions that ask for a single choice, or a pair of choices (e.g. tick two boxes or join two boxes) are the most accessible questions. This has implications for teaching because it is these questions that earn most of the marks for the lower ability candidates taking the paper (for a higher tier paper, these candidates are the C and D grade candidates).

Questions such as question 8 (c) that ask for a separate decision to be made about every distracter (e.g. true/false or tick the correct column) are more challenging, and give a broader spread of marks. It follows that, for teaching purposes, these are the questions in which candidates need most practice before the examination.

Comments on Individual Questions

1 (a) Candidates find true-false questions difficult because they have to make a separate, independent decision on every line (in contrast to 'choose the correct box' type questions). In this case, few candidates scored both marks.

(b) Unexpectedly, candidates found it difficult to complete the symbol equation. Most did not write the correct formulae for lithium (Li) and oxygen (O_2). Common errors were "2O" and "Li_2". Of those candidates who knew the correct formulae, only a few could go on to correctly balance the left-hand side of the equation.

2 (a) Part (i) was a straight recall question of the colours of iodine solid and vapour. Not many candidates knew the colours correctly. Recognising the correct formula and stating the symbol for iodine solid and vapour was slightly better attempted in part (ii), but 'I(s)' was a common incorrect choice.

(b) In this question, candidates had to put two ideas together to form a single answer. About half of the candidates managed to do this successfully, implying strong interpretation skills.

3 (a) Most candidates knew that the Sun emits light due to being very hot. Fewer chose the correct explanation for why that light produces a line spectrum. The 'series of flashes' and 'shadows of planets' distractors were often chosen.

(b) Most candidates knew that the nucleus contains protons and neutrons. Fewer could work out the numbers of these particles from the element symbol. The electron arrangement was often correct, but often candidates showed 9 electrons around the atom.

4 This was the most accessible question on the paper. Candidates are very skilled at interpreting 3-dimensional representations of molecules.

(a) Almost all candidates correctly identified water.

(b) Almost all candidates correctly identified C and H in the formula, and most of those managed to count up the correct numbers to give a fully correct formula.

5 (a) Most candidates identified potassium iodide as an ionic compound, but fewer chose the correct explanation for its conductivity. 'Electrons move freely' was a common incorrect choice.

(b) Both lead (correct) and bromine (incorrect) were seen with almost equal frequency, implying confusion about which would be produced at the cathode. This question had a relatively high omit rate, suggesting candidates were not confident in making a guess.

(c) Few candidates could correctly complete the equation by inserting a single electron. Most inserted symbols for water, oxygen or bromine.

6 Candidates find processing data from tables straightforward. Despite the use of negative values and a large quantity of distracting data, many candidates gained the maximum three marks for parts (a) to (c).

(a) Almost all candidates identified the metal (**C**) from its conductivity data.

(b) Despite the use of a negative number, most candidates identified the liquid from its melting and boiling points.

(c) Fewer candidates could identify which chemical was silicon dioxide. To do this they needed to know the properties of silicon dioxide, which some may not have been able to recall.

(d) Most candidates knew that molecular compounds contain bonds formed by sharing electrons, but only the most able knew that the nuclei of the atoms attract the electrons.

(e) Writing the formula of magnesium fluoride was problematic for many candidates. Common errors were "Mg_2F2, "Mg^2F", "MgF^2" or formulae with the charges written alongside the symbols.

7 (a) In part (i), almost all candidates correctly named sulfuric acid. In part (ii), candidates usually identified magnesium carbonate as one of the possible solids to use, but appeared to operate on guesswork to identify the other. Few gained both marks.

(b) For part (i), most candidates knew that the acid is used up in the reaction. In part (ii), fewer knew why the solid is washed while in the filter paper. 'To remove impurities' was a common, incorrect choice. Again, the true-false type question in part (iii) proved difficult for candidates. Most gained one of the available two marks. Interestingly, many thought the solid would evaporate on further heating.

(c) Most candidates could identify the change that would result in the reaction rate slowing.

8 (a) Candidates found identifying the correct chemicals very difficult. Few candidates identified sodium hydroxide as having a high pH, and few could match the formula and name for sulfuric acid in part (ii).

(b) Candidates could usually identify one of the ions correctly, but only very able candidates correctly selected both.

(c) Another true-false question that discriminated between candidates. The detailed chemistry of the reactions of acids is not well known, and many candidates only selected two correct 'ticks' from the five statements.

A323/01 – Twenty First Century Chemistry A (Ideas in Context plus C7) Foundation Tier

General Comments

Many candidates made a good attempt at this paper. There was only a small entry of candidates but all appeared to be entered for the correct tier. There were many discriminating questions, giving a wide range of marks on the paper.

There was a good understanding of the pre-release material and many candidates had been well prepared for these questions. It was pleasing to see that knowledge of green chemistry had improved since last year.

Most candidates correctly followed instructions in the questions and gave answers that reflected the number of marks available. However, some lost marks by not reading the questions carefully enough.

The foundation tier paper is aimed at candidates working at grade C or below. Questions 1e, 2bii, 3b, 4b and c and 5ci were all shared with the higher tier and tested at grades C and D standard. Most of these questions allowed stronger candidates to show their knowledge and understanding of the subject.

Comments on Individual Questions

1 The first question was based on pre-release article about bioethanol in fuels.

(a) A straightforward start to the paper with most candidates scoring 2 marks. Those that failed to gain a mark in part (i) had not followed the instructions and gave wheat as one of the answers. In part (ii) a few candidates carelessly gave the answer as Australia rather than Austria.

(b) Again, most candidates scored full marks on this question. A few limited their marks by only giving one environmental benefit when asked for two.

(c) This question discriminated well. Many candidates scored 2 marks, while weaker candidates misunderstood the question. "Putting 5% biofuel into petrol reduces CO_2 released by 3.5%" was a common wrong answer to part (i). Only the weakest candidates failed to correctly calculate the area of wheat that needed to be grown in part (ii).

(d) Many candidates answered part (i) correctly but part (ii) was more difficult. Some candidates were able to give one of the reasons why using more fertilisers may harm the environment but few gave two reasons. Wrong answers included many where fertilisers were confused with pesticides. It was common to be told that fertilisers entered the food chain and harmed animals. Others thought that fertilisers damaged crops.

(e) Both parts of this question were overlap with the higher paper. Few understood what was involved in a Life Cycle Assessment – the use of energy and the environmental impact during the life of a product. It was common to find wrong answers that compared pollutants from petrol against those of biofuel. More understood why biofuels are more sustainable than petrol. This question was better answered than similar questions on

sustainability in last year's paper, though candidates often did not compare the two fuels and lost a mark.

2 (a) Very few candidates answered this question correctly, and wrong answers gave every combination of atoms and bonds for the carboxylic acid functional group.

(b) The first part of this question was answered well, with most candidates scoring marks. Some candidates tried to write symbol equations. They were given credit if they were correct but often errors in formulae led to the loss of marks. Candidates should always check the type of equation they are asked for. Part (ii) was an overlap question with the higher paper and very few foundation candidates knew the correct answer. Most described the reaction of calcium carbonate with acid rather than give the property of calcium methanoate. Part (iii) was a discriminating question with many candidates scoring marks. Some could correctly label the weak and strong acids but omitted to explain why one and not the other was used to remove limescale. Weaker candidates confused strong and weak acids as they thought only the strong acid could remove limescale. Almost all candidates who gave an answer to this question gained the spelling mark.

(c) This was also a discriminating question, with able candidates scoring 2 marks showing they had a good knowledge of structural formulae.

3 (a) This was supposed to be a straightforward question but many candidates misread it. Answers involving cooking with oil were common. Only about one fifth gave the correct answer of oil in seeds being an energy store.

(b) Both parts of this question were overlap with the higher tier. The specification statement being examined in part (i) was not known by foundation candidates. Most could recognise the reversible reaction sign in part (ii), but fewer knew that it indicated that reactants and products were in equilibrium.

(c) Many candidates scored marks for flavouring and smell. The most common wrong answer was that esters are used as preservatives.

4 (a) Only a few of the most able candidates were able to explain the meaning of retention time. Most thought it was the time taken for a reaction rather than the time taken from injection to detection in a glc.

(b) This was a discriminating question with many good candidates scoring full marks and most scoring 2 or 3. Parts ii and iii were overlap but were well answered on the foundation tier. Unfortunately weaker candidates easily mixed up propene and propane. It was common to find propene correctly used in one part of the question and propane incorrectly used in another part.

(c) This was an overlap question. Few candidates on the foundation tier gained marks in either part. In part (i) many candidates wrongly stated that alkanes did not react because they had strong bonds. As the alkene double bond is stronger than the alkane single bonds, candidates should be encouraged to use the term 'unreactive' rather than the terms 'strong' and 'weak' in this context. Part (ii) was difficult for foundation candidates. The most common misconception was that when alkanes burn the bonds break and that releases energy.

5 (a) This ordering question was well answered with most candidates scoring 2 or 3 marks. The main mistake was not realising that the procedure has to be repeated before the average and the degree of uncertainty in the result can be found. Many who scored 2 put 'repeat the procedure' at the end.

(b) In part (i), about half the candidates were able to name a measuring cylinder or pipette. Fewer were able to name a burette in part (ii). "Measuring jug" and "beaker" were common incorrect answers to both parts.

(c) Many good candidates were able to calculate the relative formula mass correctly. Fewer were able to substitute numbers into a given formula in part (ii). Common errors were not finding the value (23.5) of the volume of HCl or putting $(23.5)^3$ into the formula.

6 (a) The meaning of the term 'bulk chemical' had been tested in June 2008, but fewer candidates (about a third) knew the answer this series. Part (ii) was less well answered than the other questions on sustainability on this paper.

(b) Very few candidates gained marks on this question. In part (i) they did not recognise that if there is no use for a by-product it has to be disposed of and this costs money. In part (ii) although many knew that catalysts speed up reactions they did not understand why fine particles of solid catalyst are used.

(c) Most candidates scored the final mark. Those that did not tended to lose it by not following the instructions – they gave the hazards rather than giving the purpose of the regulations.

A323/02 – Twenty First Century Chemistry A (Ideas in Context plus C7) Higher Tier

General Comments

The majority of candidates could extract simple ideas and information from the article. Most of the more able candidates were also able to use their knowledge and understanding to process information from the article and formulate acceptable answers to some of the more complex questions. But for many of the weaker candidates anything beyond finding and copying a relevant part of the article was too difficult.

A number of the more able candidates successfully demonstrated sound knowledge and understanding of the extension material and the ability to use their skills in a variety of situations. For the majority, however, such knowledge and understanding was patchy.

This component is intended to assess candidates across the middle and upper levels of ability. Whilst many candidates could perform adequately in the more modest areas of this range, very few could consistently answer questions set nearer to the top end. It is expected that some questions will be answered well by only the more able candidates, but many of these struggled with calculations, the balancing of equations, practical techniques, and concepts such as dynamic equilibrium and sustainability. It was clear that many of the weakest candidates, would have been better suited to the Foundation paper. However, few candidates left many questions blank. There was also no evidence that candidates had insufficient time to complete the paper.

Comments on Individual Questions

1 Most candidates were able to extract relevant information from the article, but only the more able had the knowledge and understanding to use this information to answer more demanding questions. Many candidates found the calculation difficult. The question discriminated very well across the ability range.

(a) Most candidates realised that the production of bioethanol releases carbon dioxide and that this fuel gives less mileage than petrol to gain both marks. Many less able candidates presented only one of these ideas, but few gave neither. Some weaker candidates quoted irrelevant material from the article.

(b) The majority of candidates realised that this would involve using land now used for food production to produce bioethanol to gain the first mark. Others gained this mark for stating another ill effect such as lack of fertility or shortage of water. Many of these candidates also gained the second mark, most commonly given for realising that food prices would rise. Some weaker candidates gave irrelevant answers and scored neither mark.

(c) Answers based on the idea that these countries already have problems feeding their populations gained the first mark for most candidates. But few scored the second mark for suggesting how making bioethanol might increase these problems. Many of the weaker candidates again gave irrelevant answers, gaining no marks.

(d) Only the more able candidates calculated the mass of carbon dioxide correctly,

$(8 \times 44)/114 = 3.1$ (or 3.09) g

but few of these managed to work out the percentage increase correctly.

$100 \times (3.1-1.9)/1.9 = 63\%$ or $[(3.1/1.9) \times 100] - 100 = 63\%$

The majority of candidates presented a jumble of figures leading to an incorrect answer, gaining no marks. A few candidates guessed that the percentage would be exactly 60 and worked back to find the mass, but this was not given credit.

(e) In part (i) the most able candidates chose two sensible areas of an LCA that would apply to bioethanol but not petrol, e.g. growing the fuel crop and using fermentation. Weaker candidates generally gave only one valid example. A number of very weak candidates clearly did not understand the concept of an LCA and gave irrelevant answers. In part (ii) many candidates indicated either that petrol or crude oil is not renewable or that the crop used to make bioethanol can be grown continuously, but only the more able presented both ideas. Some candidates gained the second mark for a brief description of how the carbon cycle applies to bioethanol. Some weaker candidates again gave irrelevant answers.

2 Only a minority of candidates had the knowledge and understanding of the structure and properties of carboxylic acids to score well in this question, though all except the weakest candidates gained a reasonable number of marks.

(a) A majority of candidates correctly identified the functional group. Common errors amongst the weaker candidates included “OOH” and “OH”. A few candidates incorrectly gave the general formula for carboxylic acids.

(b) Though many candidates managed to write the correct formulae in part (i), only the more able could correctly balance the equation. Many weaker candidates copied the equation for the reaction of calcium carbonate with hydrochloric acid given in the question stem. In part (ii) very few candidates realised that calcium methanoate is soluble in water. Many candidates incorrectly thought that calcium methanoate is an acid. In part (iii) more able candidates realised that strong acids are completely ionised but weak acids are not, though some lost the first mark by suggesting that strong acids are almost completely ionised. Fewer candidates went on to describe the presence of a dynamic equilibrium in weak acids, and a number of these forfeited this mark by incorrectly suggesting that strong acids also have a dynamic equilibrium but ‘far to the right’. Weaker candidates had little idea of the chemistry involved, but most gained the spelling mark.

(c) Only the more able candidates gave the correct structural formula for butanoic acid. Many implausible arrangements of atoms were seen in the answers presented by weaker candidates.

3 Most candidates seemed to have little knowledge or even experience of common practical procedures, though the majority could recognise the sign for an equilibrium reaction. Only the more able scored well across the question, with the majority of candidates gaining only one or two mark overall.

(a) Only a few of the most able candidates knew that oils hydrolyse to produce glycerol and fatty acids to gain both marks in part (i). Some gained just one mark for glycerol. The most common incorrect answers included ethanol and ethanoic acid, though a wide variety of answers was seen. In part (ii) most candidates knew that this reaction is reversible, and many also indicated that it reaches equilibrium to gain both marks. Only the weakest candidates made irrelevant suggestions such as ‘it is exothermic’.

(b) Very few candidates could describe the purification stage, and even fewer could explain how it works. It was clear that many had not used or perhaps even seen a separating funnel. A slightly larger number of candidates gained one mark for realising that something was added to absorb water in the drying stage, but the majority of these could not give a correct description of what was added. The most common incorrect suggestion for a drying agent was anhydrous calcium carbonate, though many other

incorrect suggestions were seen. A number of weaker candidates suggested heating to evaporate the water.

4 Although most candidates could interpret the data correctly, many had insufficient knowledge or understanding of the processes involved to score well in the rest of the question.

(a) A large majority of candidates correctly identified propene in part (i), though all of the other gases in the table were seen. The most common incorrect response was propane. A similar number of candidates could also correctly explain in part (ii) that propene had the largest area under the peak, or more commonly simply the highest peak. A few candidates became confused and thought that propene had the highest retention time.

(b) Very few candidates could correctly use the three ideas given to them to explain the separation of components in the mixture of gases. A large majority gained no marks. Most candidates put the three ideas into sentences that had no merit and often made little sense. Some of the more able realised that the mixture is carried by the mobile phase to gain one mark. Few of these knew that there is a difference in amount of interaction of each component of the mixture with the mobile and with the stationary phases, or that this causes a difference in the speed with which the components moved. Even fewer could relate this to the position of the dynamic equilibrium that determines the amount of each component in each phase. Many weaker candidates based their answers on paper of thin layer chromatography.

(c) Very able candidates gained both marks by indicating that both C-C and C-H bonds are unreactive. Some gained one mark when they pointed out that all of the bonds are single or saturated, but the majority of candidates gained no marks. Weaker candidates often incorrectly used the term unsaturated to describe the bonding in alkanes, or wrote about H-H or O-H bonds. In part (ii) only the most able candidates could explain that bond making releases more energy than that taken in by bond breaking to gain both marks. Many candidates interposed the ideas, whilst others became confused by the language they were using and ended up with an answer indicating that both take in energy or both release energy. The majority of candidates gained no marks.

5 The calculations caused problems for many candidates, with only the most able performing well.

(a) In part (i) the majority of candidates could successfully work out the relative formula mass of magnesium hydroxide as 58. Many weaker candidates did not know what to do with the relative atomic mass values given in the question, using them in a variety of computations to obtain incorrect answers. A significant minority of candidates worked out the value 58 as an intermediate stage in their calculation and then carried out further computation to arrive at an incorrect final answer. In part (ii) most of the more able candidates could calculate the mass of hydrochloric acid correctly, though the incorrect answers 9.4, 94 and 940 were often seen.

$$40 \times 23.5/1000 = 0.94 \text{ g}$$

Very few candidates could use their values from parts (i) and (ii) to calculate the average mass of magnesium hydroxide in each tablet in part (iii).

$$58 \times 0.94/73 = 0.75 \text{ g}$$

Many able candidates used 36.5 instead of 73 in their calculation, whilst many weaker candidates randomly multiplied and divided values to obtain an unrealistically high or low answer.

(b) It was clear that some candidates had met and understood the term 'degree of uncertainty' whilst the majority had not. Answers that merely referred to reliability, accuracy or precision could not score the first mark, which required a statement indicating that the degree of uncertainty is small. A slightly larger number of candidates scored the second mark by describing, in a variety of ways, how the titration results have a small range, but the majority gained no marks.

6 Many candidates did not read, or understand, the stem of the two questions in part (a) and therefore did not compare sustainability in each case. The question discriminated well across the ability range.

(a) In part (i) very few candidates actually compared the sustainability of the old and new methods, which was required for the first mark. Some of the more able explained the finite nature of crude oil from which the feedstock is obtained to gain the second mark. A number of weaker candidates thought incorrectly that the two processes used different amounts of ethene. Again in part (ii) few candidates actually compared the sustainability of the old and new methods, but many correctly stated that the old method has a by-product whilst the new method does not to gain the second mark. Some candidates became confused about the two stages of the old method and the single stage of the new method, with many of these thinking that hydrogen chloride was a by-product of the old method and calcium chloride a by-product of the new method.

(b) Most of the more able candidates knew that a catalyst lowers the activation energy of a reaction but far fewer knew that it does this by allowing the reaction to follow an alternative route. Some candidates incorrectly thought that a catalyst supplies the activation energy. Common incorrect answers made by weaker candidates were based on a definition of a catalyst, described a change in collision rate or referred to the action of enzymes.

(c) More able candidates generally used the correct formulae, though many did not balance the equation. Common errors amongst weaker candidates were the use of "C_2H_6" as the formula for ethene and the inclusion of chlorine as a reactant.

A219, A220, A229, A230, A329, A330, A339, A340 – Skills Assessment

Specification	Unit Code	Skills Assessment
Science A	A219/01	Practical Data Analysis and Case Study
Additional Science A	A220/01	Practical Investigation
Biology A	Either A229/01	Practical Data Analysis and Case Study
	or A230/01	Practical Investigation
Chemistry A	Either A329/01	Practical Data Analysis and Case Study
	or A330/01	Practical Investigation
Physics A	Either A339/01	Practical Data Analysis and Case Study
	or A340/01	Practical Investigation

Introduction

The scale of the moderation operation continued to be very large this year with 1000 different Centres submitting work for more than 225 000 candidate entries across all specifications. It appears from discussions with people attending INSET that the Principal Moderator's Report for 2008 has not always been seen and read. This report will still be available online at www.ocr.org.uk and some of the comments and guidance have been repeated again in this report. The Skills Assessment component of each of the above specifications is weighted at 33%. With this in mind it did appear on occasions that Centres were not always giving sufficient time for their candidates to develop the necessary skills, knowledge and understanding of Ideas about Science to show what they could do under assessment conditions.

Structure of the Report

Vertical black lines in the margin throughout this report highlight important areas of concern, advice and guidance by the moderating team.

This report is divided into the following sections:

- Administrative Aspects
  - General Comments
  - Type and Context of Work appropriate for the Separate Sciences
  - Practical Work
  - Supervision and Management of Coursework
  - Assessment and Marking Framework
  - Marking Strands B and C in Case Studies
  - Marking Strands I and P in Data Analyses and Investigations
  - OCR Cover Sheet for Candidates' Work
- Data Analyses
- Case Studies
- Practical Investigations
- Final Comments

Administrative Aspects

General Comments

Communication between moderator and Centre is a very important part of the moderation process. This year, moderators sent an early introductory letter to Centres to establish an e-mail contact between the person responsible for the coursework sample and the moderator. A simple checklist was also provided to help Centres ensure that everything that was needed was included in the coursework package. These extra measures helped to improve the efficiency and effectiveness of the whole process for those Centres who responded appropriately. However, there were still a significant number of Centres who did not send the mark lists and the samples promptly, therefore slowing up the moderation procedure.

The best Centres followed this checklist but too many Centres still did not include any supporting material that had been given to candidates. In particular, details of how each of the tasks used for assessment had been introduced and presented to candidates were often not provided. This lack of information did, on occasions, have a significant effect on the marks that moderators could support, leading to mark adjustments in some cases.

A significant minority of Centres did not appear to give enough care and attention to administrative aspects to ensure that their candidates received the correct total marks and for the moderation to proceed smoothly. This caused numerous problems for the moderating team given the short timescale for the completion of the moderation process. For example, transcription errors, mark changes after internal moderation not being carried forward to the MS1 sheets, misunderstanding of how to calculate the Strand mark, poor annotation showing where the marks were awarded, and provision of little information about internal moderation procedures. Too often there was little or no indication of how marks had been awarded. The minimum notation acceptable is to use the assessment criteria codes, e.g. Ib)6, at the appropriate point in candidates' work. For Case Studies, the better Centres provided further commentary. Suitable annotation makes it more likely that the moderator will be able to support the mark awarded. Effective internal moderation ensures that candidates are placed in the appropriate order of merit. If the order is felt to be unsound because marking is erratic, the Centre may be required to re-mark all of the work.

Type and Context of Work appropriate for the Separate Sciences

Following guidance from the Joint Council for Qualifications (JCQ), coursework can be submitted for as many specifications as it is valid for. This means that it has to match both type (e.g. Data Analysis and Case Study or Practical Investigation) and context (i.e. Biology, Chemistry or Physics) as appropriate for the specification concerned. A 'Notice to Centres' was sent to all Centres in January 2008 and again in November 2008 explaining these requirements. It was disappointing that a number of Centres did not meet these requirements and alternative coursework had to be requested. If there was none available then a downward adjustment to the marks was applied. If the same piece of coursework is submitted for more than one specification then it must be photocopied and put into the appropriate coursework sample package to the moderator. Many Centres did not help the moderation process work efficiently in this way.

Practical Work

The Data Analysis and Investigation must involve candidates having personal first hand experience of collecting data in a practical experiment. Computer simulations or sole use of teacher demonstrations are not acceptable substitutes. **Coursework which does not fulfil this requirement cannot be submitted for assessment**.

In the Investigation, marks awarded for Strategy (S) and Collecting Evidence (C) Strands must be based on an individual's contribution and not on a shared approach or shared class data or data from other secondary sources. Those few Centres who did not follow these requirements put the marks of their candidates at severe risk.

In the Data Analysis, an individuals' data can be supplemented with additional data from secondary sources to enable assessment of Strands I and E.

Supervision and Administration of Coursework
There was evidence that some coursework from a minority of Centres had been reviewed and annotated by teachers giving candidates specific guidance about how to improve their marks. This is not acceptable practice. The Joint Council for Qualifications (JCQ) have published appropriate guidelines which are available in all schools

www.jcq.org.uk/attachments/published/315/ICE%20Coursework%202007%20FINAL.pdf

The following quotes are from this document:

"Teachers may review coursework before it is handed in for final assessment. Provided that advice remains at the general level, enabling the candidate to take the initiative in making amendments, there is no need to record this advice as assistance or to deduct marks. Generally one review would be expected to be sufficient to enable candidates to understand the demands of the assessment criteria."

"Having reviewed the candidate's coursework it is not acceptable for teachers to give, either to individual candidates or to groups, detailed advice and suggestions as to how the work may be improved in order to meet the assessment criteria. Examples of unacceptable assistance include detailed indication of errors or omissions, advice on specific improvements needed to meet the criteria, the provision of outlines, paragraph or section headings, or writing frames specific to the coursework task(s)."

"Once work is submitted for final assessment it may not be revised: in no circumstances are 'fair copies' of marked work allowed".

Those Centres who used detailed writing frames, whilst helpful for lower achieving candidates, appeared to restrict the opportunities for those higher achieving candidates.

Assessment and Marking Framework
The assessment framework is the same whether marking the Data Analysis, Case Study or Investigation. Skill areas are divided into Strands; within each Strand there are either two or three Aspects of performance represented as rows in the coursework cover sheet. Each Aspect of performance should be considered in turn, comparing the piece of work first against the lowest performance description, then each subsequent higher one in a **hierarchical** manner until the work no longer matches the performance description. Where performance significantly exceeds that required by one description, but does not sufficiently match the next higher one, the intermediate whole number mark should be given if available. Thus, the level of performance in each Aspect is decided.

For example in Strand E

Strand E				
Aspect of performance	**Marks**			
	2	**4**	**6**	**8**
(a) evaluation of procedures				
(b) reliability of evidence		Performance descriptions		
(c) reliability of conclusion				

There was a tendency for some Centres to award marks on the basis of candidates matching one high level performance description without ensuring that the underpinning descriptions had also been matched. A few Centres just counted the highest match for any Aspect to arrive at the

strand mark. Intermediate Aspect marks of 1, 3, 5 and 7 are awarded where performance exceeds that required by one statement, but does not adequately match that required by the next. Where it is not possible to support marks in a particular Aspect, a mark of zero must be awarded.

The Strand mark is determined by averaging the Aspect marks (including any zeros) and rounding to the nearest integer. A number of Centres are still not following this procedure and are being required to re-mark all their candidates' work.

E.g.

Marks for the three aspects in a strand	Formula to be applied	Mark to be awarded for the strand
(a) = 4, (b) = 4, (c) = 3	[(a)+(b)+(c)] / 3	= 3.66 round up = 4
(a) = 3, (b) = 4, (c) = 3	[(a)+(b)+(c)] / 3	= 3.33 round down = 3
(a) = 4, (b) = 3, (c) = 1	[(a)+(b)+(c)] / 3	= 2.66 round up = 3
(a) = 3, (b) = 3, (c) = 0	[(a)+(b)+(c)] / 3	= 2.0 = 2
(a) = 2, (b) = 3, (c) = 0	[(a)+(b)+(c)] / 3	=1.66 round up = 2

This approach provides a balanced consideration of each aspect of performance involved in each Strand and allows the marker to build up a profile of strengths and weaknesses in the work. Comparison of teacher and moderator judgements in each Aspect allows easy identification of where a Centre marks too severely, too leniently or where marking is inconsistent. This allows moderators to make far more constructive reports back to Centres.

Marking Strands B and C in Case Studies

There are only two Aspects in Strands B and C in the Case Studies and, in some cases, a professional judgement has to be made when arriving at the Strand mark, for example if 4 marks are awarded for B(a) and 3 marks for B(b). From experience in these cases, it is often best to consider both Strands B and C together when arriving at the final Strand mark for each. For example, if B(a) = 4, B(b) = 3 and C(a) = 4, C(b) = 3 are awarded, then it would be appropriate to award B = 4 by rounding up and C= 3 by rounding down (or vice vers(a) for a total of 7 marks for these two Strands taken together.

Marking strands I and P in Data Analyses and Investigations

In a few instances, dotted lines on the assessment scheme are used to indicate alternative ways of obtaining credit and a number of Centres, although fewer than last year, did not seem to appreciate what to do in these circumstances. Aspect (a) of Strand I and Aspect (b) of Strand P are sub-divided in this way. This has been done to allow increased flexibility, so that the scheme can be applied to a wider variety of different types of activity.

Strand I Aspect (a) involves awarding credit for processing the data which has been collected to display any patterns. This may be done either graphically or by numerical processing, whichever is most appropriate in a particular Data Analysis or Investigation. If there is some evidence for both approaches, then both should be marked and **the better of the two is counted but not both marks**. Some Centres counted both marks which produced an incorrect aggregate for the Strand.

E.g.

Strand	Aspect of performance	0	1	2	3	4	5	6	7	8	Strand mark
I	Graphical processing of data **or** Numerical processing data								✓		6
	Summary of evidence							✓			
	Explanations suggested							✓			

Strand P Aspect (b)

Strand P in Investigations is made up of three Aspects:

P(a) describing the work planned and carried out
P(b) recording of data
P(c) general quality of communication.

Aspect (b) is sub-divided into three sections to cover a variety of types of investigation.

	2	4	6	8
P(b)	Major experimental parameters are not recorded. Some data may be missing.	Most relevant data is recorded, but where repeats have been used, average values rather than raw data may be recorded.	All raw data, including repeat values, are recorded.	All relevant parameters and raw data including repeat values are recorded to an appropriate degree of accuracy.
	Labelling of tables is inadequate. Most units are absent or incorrect.	Labelling is unclear or incomplete. Some units may be absent or incorrect.	All quantities are identified, but some units may be omitted.	A substantial body of information is correctly recorded to an appropriate level of accuracy in well-organised ways.
	Observations are incomplete or sketchily recorded.	Recording of observations is adequate but lacks detail.	Observations are adequate and clearly recorded.	Observations are thorough and recorded in full detail.

The first row is concerned with recording quantitative data (e.g. times, voltages, volumes). The second row deals with the use of conventions and rules for showing units or for labelling in tables etc. The third row deals with the recording of qualitative data (e.g. colours, smells). Most investigations are of a quantitative nature and will provide evidence for the first and second rows. In these cases, the Aspect mark will be determined by averaging the mark in these two rows only, ignoring the third row completely. For those rare investigations which include qualitative evidence but no quantitative evidence, the mark for Aspect b should be based on the average of the second and third rows only. Where averaging results in half marks, professional judgement should be used to determine the best fit mark of the two alternatives. Once the mark for Aspect (b) has been decided, it can be combined with the marks for (a) and (c) to provide the average and so the best fit mark for the Strand.

For example, in an Investigation providing **quantitative** evidence

Aspect of performance			**Strand P mark**
P(a)	7	7	**6**
P(b)	(i) 6 (ii) 4 (i(ii) n/a	5	
P(c)	7	7	

Sub-dividing Aspect (b) in this way allows flexibility in marking the recording of data without allowing Aspect (b) to dominate the mark for the whole strand.

All marks are recorded on the OCR cover sheet which is attached to candidates' work. A number of Centres did not use the latest format of the OCR cover sheet or in a very few cases did not use a cover sheet at all. An example is shown below:

GCSE

OCR
RECOGNISING ACHIEVEMENT

Additional Science A

OCR GCSE J631 Twenty First Century Science Unit A220

Coursework Cover Sheet for Investigation

Centre No:		Centre Name:	
Candidate No:		Candidate Name:	

Put ticks in the boxes (one per row) to indicate the mark matched by the candidate's work for each aspect of performance. Record the mark awarded for each Strand and the final total mark. The remaining columns should be left blank.

Title (as shown on work): Rate of reaction thiosulfate and acid

Strand	Aspect	0	1	2	3	4	5	6	7	8	Strand Mark	Leave these columns blank for the moderator		
												Mod	T/L	Moderator comment
S	a								✓		6			
	b							✓						
	c						✓							
C	a								✓		7			
	b								✓					
	c									✓				
I	a									✓	5			
	b					✓								
	c					✓								
E	a						✓				4			
	b							✓						
	c	✓												
P	a							✓			6			
	b	n/a							✓					
	c							✓						
Total mark for the Investigation											28			***A completed copy of this form must be attached to the work of each candidate in the sample requested by the moderator.***
Mark difference (Moderator Total – Centre Total)														

Data Analysis

General Comments

The Data Analysis task provides the opportunity to assess candidates' understanding of Ideas about Science, particularly IaS 1, 2, and 3. Those candidates who understood and used the language and concepts related to IaS, such as 'correlation and cause', 'outliers', 'reliability', 'accuracy', 'best estimate', and 'real difference' found it easier to match the performance descriptions of the criteria and so gain higher marks.

The majority of Centres clearly understood that in the Data Analysis task **candidates must have personal firsthand experience of collecting data by performing a practical experiment.** The data that candidates collect can be supplemented by further data from, for example, incorporating a class set of results. Work which is based purely on teacher demonstrations, computer simulations, given sets of results etc. is not acceptable. Many Centres used whole class practical activities as a basis for Data Analysis exercises and this clearly worked well. Therefore it is very important that Centres include details of how the task was presented to their candidates, e.g. briefing sheets etc. The higher attaining candidates included a description of their experimental method, their own results table and the class data set which made the marks awarded for evaluation easier to support. It is most important that candidates record and present the data that they have collected and not just plot a graph or do numerical calculations without any reference to the original data.

The same Strand I and E assessment criteria are used in Investigations and the same marks for I and E from Investigations can be submitted for Data Analysis in another specification providing that the context is appropriate. If this is the case, Centres are required to indicate this on the appropriate coversheet and also include copies of the work in both samples which are sent to the moderator, if the same candidate is selected. Many Centres used this opportunity to obtain the best marks for their candidates.

Data Analysis Tasks

There was a continuing variety of Data Analysis tasks seen by moderators which was very encouraging. These included:

monitoring pollution;	pulse rates and exercise;
osmosis;	enzyme studies;
stopping distances of bicycles;	breaking strength of hair;
stretching materials under load;	impact strength of plastic bags;
comparing thermal insulators;	resistance of a wire;
viscosity experiments;	voltage of different batteries;
rates of reaction;	objects rolling down slopes

Centres are encouraged to be innovative but must consider the science that might be required to explain any conclusion drawn by the candidates. As in all assessments of this type, Centres should match the task to the ability and expectations of the candidates involved.

Strand I: Interpreting Data

Ia): Most candidates analysed their data using bar charts or graphs to illustrate and process the data that they had collected, rather than carry out a numerical analysis. Centres must recognise that to award 7 or 8 marks, an indication of the spread of data must be shown **in addition** to the requirements for 6 marks. Candidates generally either plotted the averages with the appropriate range bars, or plotted all their raw data with a suitable key.

The following guidelines might help to clarify the assessment of Aspect (a) but it is not intended to be comprehensive and to cover all eventualities.

- Ia) 4 simple charts, bar charts
- Ia) 5 a dot-to-dot graph, or axes not labelled, or incorrectly plotted point(s), or poor quality line of best fit

- Ia) 6 graph with a line of best fit, correctly plotted points, correctly labelled and scaled axes.
- Ia) 7/8 accurately plotted graph including a line of best fit and evidence of awareness of uncertainty in data, e.g. range bars or scatter graphs.

It was pleasing to see that the majority of candidates repeated their measurements and included range bars on their graphs. However, in many cases graphical work was not of suitable quality for the marks awarded. For example, poor care in general presentation, incorrectly labelled or scaled axes, incorrectly plotted points and poor accuracy of the best fit line. Some candidates included range bars when plotting bar charts and were wrongly awarded 8 marks. At best, this approach might merit 5 marks. The same standards apply when marking computer-generated graphs, e.g. they must be correctly sized and scaled with appropriately sized plotting points. It is generally better for candidates to hand draw their own line of best fit.

Centres are reminded that only one single mark must be used for Ia), either that for graphical or that for numerical work (not both), when determining the overall Strand I mark. Further information about the award of marks for numerical approaches is contained in the 2008 Report.

Ib): The match to Ib)4, 'identifying trends or general correlations in the data', was well appreciated and most candidates could summarise the patterns in their data with a suitable qualitative statement. However, candidates were often given 6 marks with little evidence to support this award. Many candidates referred to 'positive correlation' (this only merits 4 marks) when they should have said 'Y is directly proportional to X'. Candidates should describe a quantitative relationship to ensure a secure match with Ib)6. For example, using and quoting the data to show, 'as the concentration is doubled the rate doubles', 'double the length of wire double the resistance', or the candidate calculates slopes/gradients and then states some formal or quantitative relationship between them and the variable studied. In some experiments this might not be so easy because relationships are changing. For example, in a study of the effect of temperature on the enzyme-catalysed decomposition of hydrogen peroxide, candidates might record the amount of oxygen produced at different temperatures in a given time, convert the data into rates and make appropriate comparisons before and after the optimum temperature.

Very few candidates matched the requirements for Ib)8. Candidates should review any limitations to their conclusions by considering such things as the scatter in the data, overlapping range bars between data points, 'real differences' and values of the best estimate and whether the best fit line can be accurately defined. Candidates who have derived a quantitative relationship should consider what effect the position of the best fit line might have if the scatter in the data is taken into account.

Ic): Many candidates introduced their experiment by describing all aspects of the background theory even if it was not all relevant to the particular experiment they were doing. Candidates are better served if they connect their conclusion directly with their scientific explanation. Most candidates could secure a match to Ic)4 by explaining their conclusion using scientific ideas. However, there was some very generous marking when matching to Ic)6 and Ic)8 in terms of the detail and quality of the scientific knowledge and understanding shown. In general terms, 5/6 marks would be expected to be awarded to an explanation at about the grade C standard and that at 7/8 marks of the grade A standard. Those candidates who used diagrams to supplement their explanation found it easier to access the higher marks.

Strand E: Evaluation

An essential feature of this course is to encourage candidates to consider the accuracy and reliability of the data that they collect. However, the majority of candidates only achieved between 3 or 5 marks for this Strand. Those candidates who used the appropriate IaS vocabulary and the knowledge and understanding of IaS 1 invariably achieved higher marks. Those candidates who used sub-headings such as 'Evaluation of Procedures', 'Evaluation of

Data' and 'Confidence Level of Conclusion' were more likely to focus on each area in turn and be more successful in their overall evaluation.

E(a): Candidates are expected to comment on any limitations or problems in their procedures that they encountered during their practical work and to describe improvements or alternative ways to collect their data. In many cases, comments were limited to human error rather than systemic experimental ones. The E(a)4 performance description is really the 'gatekeeper' to access the higher marks. Many candidates suggested possible improvements although they were not always of sufficient quality to be creditworthy, e.g. 'do it with a computer', 'repeat my measurements more times' and 'be more careful next time I do the experiment', without any justification or explanation. References to such things as better temperature control using a thermostat-controlled water bath in a rates experiment, or including a variable resistor in the circuit to keep the current constant in an electrolysis experiment, were more suitable and creditable suggestions.

E(b): Some candidates mentioned outliers without any direct reference to what particular result they were referring to. However, the majority of candidates generally identified a data point as an outlier either in the table of results or on the graph, although it was not always clear why a candidate had selected a particular result as an outlier. More candidates this year considered the range in their repeat measurements to give an estimate of reliability but few considered the general pattern in their results and closeness of their data to the best fit line, for example, as a basis for assessing accuracy. Candidates' attempts to explain anomalous results were often generously marked and it is important to mark the **quality** of what has been written and not the fact that just **something** has been written.

Higher attaining candidates made a decision about whether unexplained outliers should be included in the data and in ranges of repeat readings by simple numerical calculations. Some candidates used simple statistics such as variations of the Q test procedure to try and be more objective when rejecting suspect observations and relating to confidence levels.

E(c): Marks were often rather generously awarded and this aspect was poorly addressed by many candidates, although there was perhaps a slight improvement on last year. Candidates often just discussed the reliability of their data without really linking it to their conclusion and saying whether the uncertainty in their data is sufficient to have any significant effect on the conclusion that they have made.
For the award of 6 marks, candidates should bring together a discussion of the accuracy and reliability of their data and the precision of the apparatus they have used to establish a level of confidence in their conclusion. Further support for this can come from awareness in Ib) about the limitations in the conclusion. In addition for 8 marks, weaknesses in the data should be identified (e.g. a limited range or not enough readings at certain values, or degree of scatter too large or variable) and suggestions made indicating what further data could be collected to make the conclusions more secure for the particular variable under investigation. Some candidates used other data from secondary sources to support (or challenge) their conclusion.

Case Studies

General Comments
The purpose of the Case Study is to encourage candidates to use their knowledge and understanding of the Ideas about Science, particularly IaS 4, 5 and 6, to make judgements when presented with controversial issues which have claims and opinions for both sides of the case. There is still a great deal of evidence that many candidates are not being taught to use these skills when approaching their Case Studies. Where candidates were able to use the language and concepts related to IaS, such as 'peer review', 'replication of evidence', 'correlation and cause' 'reasons why scientists disagree', 'precautionary principle', 'ALARA', 'risks and benefits', 'technical feasibility and values', they found it much easier to match the performance descriptions of the criteria and so gain higher marks.

Case Studies are always best formulated in terms of a question to provide a focus in an area of controversy. For example, 'is nuclear power the fuel of the future?' rather than just 'nuclear power'. A question will encourage candidates to look for different opinions and views, and to consider the evidence base for the various claims and the reliability of sources of information that are used. There were many examples of candidates presenting a report describing a topic which was not controversial, or at least was not phrased in such a way that there were two sides to consider and compare. For example, what was apparently a debate regarding whether the use of nuclear power should be expanded sometimes resulted in a simple review of methods of alternative energy generation. This severely limited the number of marks available. The Case Study is a critical analysis of a controversial issue firmly embedded in a scientific context so that candidates can use their scientific knowledge and understanding and their understanding of IaS to produce a balanced account.

Many Centres provided a short list of Case Study titles for their candidates to choose from, thus allowing them to select one which is the most appealing on an individual basis. Some more unusual and inappropriate titles were also seen, e.g. 'do ghosts exist?, 'is it ethical to clone cyborgs?' and 'should football goal mouths have video cameras?'. Teachers must closely monitor their candidates' choice to ensure that it is appropriate and firmly embedded in a scientific context. This was often not the case for some of the lower achieving candidates in particular. Surprisingly, many candidates did not make full use of the relevant information and material in textbooks, often preferring to use material from the internet only.

Some examples of Case Study titles included this year included:

Aspects of diet e.g. Is obesity inherited?
Food additives – are they good or bad?
Should GM crops be allowed?
Should human cloning be allowed?
Are mobile phones bad for your health?
Is nuclear power the answer to our energy needs?
Should we spend more on developing alternative energy resources?
Is the MMR jab safe?
Is global warming natural or man-made?
Could life exist on other planets?
Does motor traffic cause asthma?
Should animal testing be allowed?
What killed the dinosaurs?

Assessment

In general, candidates continued to perform better in Strands A and D compared to B and C. Higher achieving candidates described the relevant science needed to understand their chosen topics and produced high quality, clearly structured, well resourced and illustrated reports involving critical analysis and individual thought with considerable personal input. It was this latter aspect of personal analysis and evaluation which often differentiated candidates in terms of level of performance. Lower achieving candidates relied too heavily on copying and pasting information from sources without the appropriate level of individual analysis and evaluation. Those reports, which were often presented simply as PowerPoint printouts, almost always lacked sufficient detail to access the higher marks.

It would be most helpful for moderation if more annotation or commentary was provided for each candidate in the sample selected so that the moderator could more easily identify the evidence to support the Centre's marks. In many cases, only the final mark awarded was recorded.

Strand A: Quality of Selection and Use of Information

There was some evidence of improvement in the marks awarded for this Strand compared to last year.

A(a): Candidates must use sources of information to provide sufficient evidence for **both sides** of their Case Study. They must select relevant extracts to quote directly and then, in their own words, explain what its relevance and importance is to the developing arguments in the report. If no sources are credited then a maximum of 1 mark will be allowed by moderators, unless annotation confirms that a suitable range of sources were used. Higher marks require that sources represent a variety of different views or opinions, but there is not a 'magic number' of sources which distinguishes 3 marks from 2; relevance and quality is more important than quantity. Many candidates who were awarded 4 marks often made reference to reliability but did not explain why they thought their sources were reliable. There were far too many references just to the 'BBC or Wikipedia so it must be reliable'. Those candidates who used the language and ideas from IaS 4, e.g. ideas about peer review, the nature of the source or the status of the author, invariably achieved higher marks.

A(b): The majority of candidates included a bibliography of sources at the end of their reports. Candidates who identified their sources using incomplete references, e.g. website homepages such as www.bbc.co.uk, could be awarded 2 marks. If only one or two incomplete references were given then one mark could be awarded and, of course, if no references were given then zero marks were appropriate. For 3 marks, candidates should include complete references to the exact url address of the webpage and, when referencing books, the title, author and page references should be provided. For 4 marks, it is expected that candidates include some information about the nature, purpose or sponsorship of the site.

A(c): Candidates were still not very good at clearly showing where sections of text were directly quoted. The fact that this acknowledgement is missing does amount to malpractice. Quoting from the JCQ document, 'candidates must not include work copied directly from books, the internet or other sources without acknowledgement or attribution'. Use of quotation marks, use of a different font, or colour highlighting were some of the methods used by the higher attaining candidates for this purpose. The higher attaining candidates also included references or specific links within the text to show the source of particular information or opinions by using, for example, numerical superscripts linking to references in the bibliography. Credit is given, not so much for the quotation, as for the editorial comment to explain why it was chosen, and how the candidate thinks it contributes to the arguments being compared in the study.

Failure to discuss reliability of the sources, failure to fully indicate and reference quotations and failure to indicate the relevance of the quotations selected in the study prevented many candidates from being awarded 4 marks in this Strand.

Strand B: Quality of Understanding of the Case

B(a): This aspect assesses candidates' ability to describe and explain the underlying relevant science and to recognise and evaluate the scientific evidence on which any claims are based (IaS 1, 2 and 3). The majority of candidates in the introduction to their Case Studies described the relevant background science. However, it was only the most able who could either link their scientific knowledge and understanding to the claims and opinions reported in their studies or extend the scientific knowledge base to more advanced concepts. Reporting was too often still at the 'headline level', simply repeating claims without looking behind the headline for the underlying science. From an assessment point of view it is useful to look at the appropriate pages in supporting textbooks, including the specifications, about Science Explanations and Ideas about Science, to give an indication as to what to expect before marking candidates' work. The most successful Case Studies are usually closely related to topics in the course and it can be taken as a general guide that 6 marks requires all of the relevant science covered in the specification. The 7th and 8th marks will come either for applying and integrating this correctly to the case, or for finding and explaining some additional science related to their Case Study.

B(b): This Aspect focuses on candidates' ability to recognise and evaluate the scientific evidence that any claims and opinions are based on. Most candidates were able to recognise and extract relevant scientific content and data in their sources and were awarded 4 marks.

Candidates who were awarded 6 marks referred to the evidence base of the various claims and opinions, e.g. an experiment, a collection and review of existing data, a computer simulation etc. Candidates obtaining 7 or 8 marks looked more critically at the quality of the evidence. They used terms like 'reliability' and 'accuracy' when considering data, they looked at the design of experiments and the issue of sample size and they also compared the reliability of data between sources.

Strand C: Quality of Conclusions

Where Strand A allows credit for finding information and Strand B for describing the relevant science and the evidence base, Strand C awards credit for candidates who provide individual input comparing and evaluating the evidence, considering its significance, importance and reliability and using their own judgement to arrive at a suitable conclusion on a controversial issue. There was evidence that many candidates were not using and applying their Ideas about Science, particularly IaS 5, sufficiently to warrant the higher marks in this strand.

Most candidates could sort the information that they had gathered into views 'for and against' and were awarded 4 marks. Higher attaining candidates started to compare similar aspects in both their 'for and against' list and were awarded 6 marks. The best candidates began to analyse, compare and evaluate the claims and opinions, describing their own viewpoint or position in relation to the original question and justifying this by reference to the sources and to the evidence that the claims were based on. Far too often the conclusion was limited and too brief. Alternative conclusions should be considered where appropriate and recommendations for action in the future should also be included.

Several candidates scored less marks than they were probably capable of, particularly in Strand C, because they simply chose to report information about their topic, without any real analysis of the scientific evidence and incorporation of personal decision making.

Strand D: Quality of Presentation

D(a): The majority of reports included headings and/or sub-headings (2 marks) to provide the necessary structure. There was a definite improvement in this Aspect and the higher attaining candidates included a table of contents and numbered the pages in their report (3 marks) to help guide readers quickly to particular sections. Those candidates who, in addition, presented a report which had a coherent, logical and consistent style were awarded 4 marks.

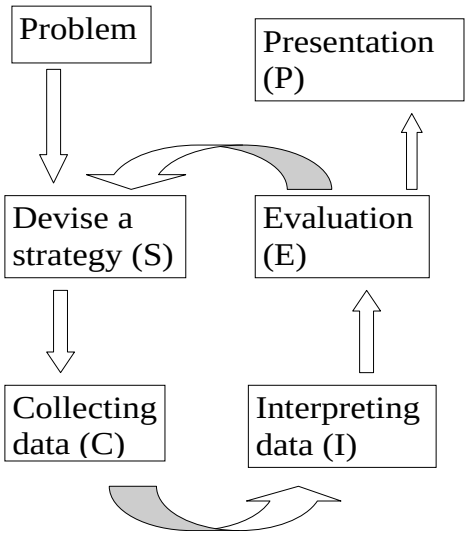
D(b): This aspect assesses candidates' ability to include suitable diagrams and graphics to clarify difficult scientific ideas and improve effective communication. However, too often the images were decorative rather than informative. If there are no decorative or informative images included, then zero marks is awarded. If one image is included, a decorative front cover or other low level attempt to add interest then 1 mark is appropriate. Two marks would be awarded for the inclusion of decorative images only or perhaps for the minimal use of informative images. Three marks would be given for including a variety of informative illustration, e.g. charts, tables, graphs, or schematic diagrams and 4 marks if this is fully integrated into the text, referred to and used. Too often downloaded images from the internet were not clear, too small and not referred to in the text.

D(c): The assessment of the use of scientific terminology and the level of spelling, punctuation and grammar was generally very fairly assessed by Centres.

Practical Investigations

There was more evidence this year that Centres were beginning to move away from the Sc1 approach to Investigations and develop a more open ended exploratory approach. The importance of candidates doing preliminary work was clearly being recognised and encouraged. However, information from Centres about how each investigation was introduced to candidates was very rarely provided in sufficient detail. This meant that moderators could not support some of the marks awarded leading to adjustments, particularly in Strands S and C.

A number of candidates, however, still followed the Sc1 Sc1 approach and used scientific knowledge to make predictions about the outcome of the investigation. The Twenty First Century Science model aims to give credit to candidates who process their results, look for patterns and then suggest explanations using their scientific knowledge and understanding. Very often candidates did not link their conclusions with their scientific explanations. Detailed explanations using relevant scientific theory are best left until they are needed in Strand I.



From an assessment point of view the 'performance descriptions' should be used to reflect the quality and performance of candidates' work rather than a formal/legalistic interpretation of particular words and phrases.

Rates of reaction, resistance of a wire and osmosis were still the most common investigations seen from Centres. However, there was evidence that other topics were beginning to be developed by the more innovative Centres, for example, stretching of plastics and other materials, exercise and fitness routines, efficiency of wind turbines, objects rolling down slopes or ski jumps, electrolysis and electromagnets.

Strand S: Strategy

Centres were generally matching candidates' work correctly up to the 6 mark performance description but higher marks were being very generously awarded.

The intention is to encourage a more independent approach to investigations and the mark awarded for the aspect, S(c), should reflect the 'value added' by the candidate, beyond the initial teacher stimulus. To justify high marks in S(c), candidates should show independent thinking in reviewing factors which might affect the investigation. Where candidates succeed in designing their own investigation, high marks can be awarded. Where some additional guidance is necessary, this should be annotated on the candidate's script and reflected in a lower mark. High marks cannot be supported by moderators unless the Centre has provided details of how the task was presented to candidates (e.g. copies of briefing sheets etc.) or comparison of different scripts in the sample shows clearly that candidates had freedom of choice between different approaches and apparatus. In too many cases moderators noted that candidates had identical ranges and values of the same variables, e.g. in the osmosis and resistance of a wire investigations the whole class used exactly the same number and values of concentration of solution or lengths of wire, without any further discussion or justification indicating that limited individual decision making had occurred, yet high marks were still being awarded. This necessitated a downward adjustment to the marks for S(c) in a number of Centres. If, for example, candidates were shown how to change the concentration of a solution they could then make up their own values rather than use the stock solutions which were often provided. Where candidates had been given the opportunity to show autonomy they performed well across many of the Strands. Some Centres opened up the rates of reaction investigation by allowing candidates freedom of choice between, for example, magnesium and acid, marble chips and acid, thiosulfate and acid, and, for methodology, collecting gases or measuring mass loss.

The importance of preliminary work cannot be over emphasised in the introductory phase of an Investigation and the appropriate amount of time must be given to this aspect. It is important for candidates to record their preliminary data and to use it to inform and develop the main experiment. Often preliminary work appeared to provide just a limited extra set of results and did not shape the Investigation in any way. Sometimes preliminary work was done but it was clear that candidates had not really understood why they were doing it.

Many candidates provided a list of appropriate apparatus for their Investigations but had not linked it to their preliminary work or indicated why it had been selected in preference to alternative apparatus. Those candidates who exerted some choice over the apparatus they used were in a better position to achieve higher marks in S(b) and also when evaluating their procedures and methods in E(a). Some candidates provided very simplistic explanations and Centres are reminded that it is quality of thought and response that is being rewarded and not just the fact that something has been written. Many Centres had provided a fixed, limited set of apparatus for candidates to choose from and this did not allow candidates the flexibility to try various approaches to obtain the best quality data set.

The complexity of a task, S(a), represents an overall judgement about the way a candidate has approached the task. Therefore two candidates doing the same Investigation might approach it differently and therefore achieve different marks. Complexity depends on such things such as the familiarity of the activity and method, the ease of observation or measurement (single or multi-step), the nature of the factors which are varied, controlled or taken into account, the precision of the measurements made and the range, accuracy and reliability of the data collected. Too often 7 or 8 marks were awarded for straightforward approaches to the task

Strand C: Collecting Data

It was pleasing to see that the majority of candidates used suitable ranges of the appropriate variable to study and appreciated the need to repeat their measurements to obtain a wide range of data. However, a discussion of the factors to control was often rather limited and only by inspection of the results table could any evidence be found. Higher attaining candidates described in detail how the factors had been controlled and monitored during the experiment. Weaker candidates often stated factors such as pH, surface area, current or temperature were kept the same but failed to explain how this was actually achieved or monitored.

Preliminary work is essential because if done properly it can allow candidates' access to the higher marks of 7 or 8 in Aspects (b) and (c). There was more evidence this year that candidates were doing preliminary work to establish the range of values of the appropriate variable to be used. However, some candidates did perform preliminary work but did not use the results to explain how it informed their main method. Centres are reminded again that it is the quality of response and its relevance that is rewarded and not just that preliminary work has been done, so 'jumping through hoops' is not sufficient criteria for success. Too often, candidates did not consider their results as they were being collected so that obvious outliers were either ignored, or included without comment in calculating average values. It was very rare to see a test repeated to check and obtain a more reliable result (C(b)).

From inspection of results tables and graphical work it was pleasing to see that candidates were taking more care and data was generally of good quality. There was little evidence of candidates performing preliminary work which involved making decisions about the type of apparatus, equipment and method to choose, to ensure the collection of the most accurate and reliable data (C(c)).

Strands I and E

In general candidates achieved their poorest marks in these two strands. There was a great deal of evidence to show that candidates did not link their conclusions sufficiently with their scientific explanations in Ic). For more details, see the comments in the Data Analysis section.

Strand P: Presentation

This Strand was generally fairly and accurately marked by Centres. Spelling, punctuation and grammar were sound and the majority of candidates' reports were well structured and organised. However, experimental methods were rather briefly described and lacked sufficient detail. Diagrams of apparatus were not always included and although data was generally accurately recorded and presented in appropriate tabular form, units were occasionally incorrect or missing.

The method of arriving at the mark for P(b) was often variable; more details can be found in the administrative section of this report.

Final Comments

All members of the moderating team recognise the considerable effort needed by Centres in assessing and presenting candidates' work for moderation. We would like to record our thanks and appreciation for a good job, thoroughly well done. However, there was a general feeling that there was an increase in errors seen in the transcription of marks and more care is necessary in this important area. Attending cluster group meetings and OCR INSET meetings both in- and out-of house, using the OCR consultancy service for checking marked scripts, and consulting and using the teacher guidance booklets on www.ocr.org.uk are all available methods to improve the awareness and understanding of the assessment procedure. It is highly advisable that staff have time during the year for internal standardisation meetings to share and develop expertise in the Science Department.

Grade Thresholds

General Certificate of Secondary Education
Chemistry A (Specification Code J634)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
A321/01	Raw	42	N/A	N/A	N/A	29	24	20	16	12	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A321/02	Raw	42	33	28	23	18	14	12	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A322/01	Raw	42	N/A	N/A	N/A	27	23	19	15	11	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A322/02	Raw	42	30	24	19	15	10	7	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A323/01	Raw	55	N/A	N/A	N/A	21	17	13	10	7	0
	UMS	100	N/A	N/A	N/A	60	50	40	30	20	0
A323/02	Raw	55	26	19	14	10	7	5	N/A	N/A	0
	UMS	100	90	80	70	60	50	45	N/A	N/A	0
A329	Raw	40	33	30	26	23	19	15	12	9	0
	UMS	100	90	80	70	60	50	40	30	20	0
A330	Raw	40	33	31	28	25	21	18	15	12	0
	UMS	100	90	80	70	60	50	40	30	20	0

A329/A330 (Coursework) - The grade thresholds have been determined on the basis of the work that was presented for award in June 2009. The threshold marks will not necessarily be the same in subsequent awards.

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J634	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J634	20.3	47.6	76.0	93.6	98.9	99.8	100.0	100.0	100.0	15121

15456 candidates were entered for aggregation this series

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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