GCSE

Chemistry A
Twenty First Century Science

General Certificate of Secondary Education **J634**

Report on the Units

June 2008

J634/MS/R/08

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

General Comments

In this component many candidates were able to show the breadth and depth of their knowledge at this level, and their ability to interpret and use the data provided. Other weaker candidates could show this in parts but not across the whole range of questions and specification areas. Some areas of the specification were clearly less well understood by the majority of candidates than others, for example: the interpretation of diagrams of molecules and the understanding of polymerisation. A few of the weakest candidates made no attempt at a large number of questions, but the majority attempted even those that they obviously found very difficult. Few candidates showed an obvious inability to follow the rubric, with only a small minority ticking the wrong number of boxes etc. All candidates seemed to have ample time to complete the paper.

Comments on Individual Questions

Question1

This opening question gave all candidates an opportunity to gain a few marks, but some parts discriminated well with only the more able candidate in this cohort scoring.

(a) Most candidates ticked the two correct boxes to gain the mark. Very few able candidates made errors, whilst some weak candidates substituted either box 1 or 3 by box 4. The most common incorrect response was boxes 3 and 4 ticked.

(b) Only the most able gained both marks and many weaker candidates did not score. Common errors were to put only one tick, or three ticks, instead of two on each horizontal line. Many candidates seemed to have placed ticks at random.

(c) Only the weakest candidates failed to gain this mark. The most common error was to choose nitrogen.

(d) Almost all candidates correctly chose Joe to gain the mark in (i).
In (ii) only the more able candidates chose both Eve and Liz to gain the mark. A common error was to choose Sab instead of one of the correct answers.

Question 2

Interpretation of diagrams of molecules proved difficult for many candidates.

(a) Most candidates scored at least one mark, with a small majority of candidates gaining both marks. The most common error was to reverse the correct order of oxygen and nitrogen. Many of the weaker candidates gave carbon instead of argon.

(b) All but a few candidates gained at least one mark in (i), with a little over half gaining both. The most common error was to tick boxes 1 and 4, so scoring only one mark.
In (ii) a large majority of candidates realised that the number of motor vehicles had risen to gain the mark.

(c) Less than a third of candidates gained the mark in (i). Most seemed to have chosen a molecule at random. Sometimes single atoms were ringed showing that candidates struggled to understand the difference between atoms and molecules.
In (ii) more candidates chose the correct molecule, but a small majority did not.

(d) About half of the candidates gained one mark, but only the more able scored both. Few candidates ticked less than three boxes, but many seemed to have chosen at random. The most common correct response chosen was plant photosynthesis. The most common correct response missed was dissolving in the sea.

(e) Most candidates gained one mark, for either correct answer, but few scored both. There was no pattern to the incorrect answers.

Question 3

Most candidates could interpret the data on rope properties, but that concerning tensile strength was less well understood.

(a) A large majority of candidates gained the mark in (i). The most common error was to choose hemp.
In (ii) almost all candidates gave the correct answer.
Most candidates gained one mark in (iii), but only a small minority gained both. The most common incorrect responses were boxes 1 and 5.

(b) In (i) most candidates gained one mark in (iii), but only a small minority gained both. The most common error was to choose 'to make it a fair test'.
The mark in (ii) was gained by about two thirds of the candidates. The most common incorrect answer was 800 to 1100.
Most candidates gained one mark in (iii) but only the most able gained both. A failure to identify outliers was incorrectly thought to be an answer by many candidates.

(c) A small majority of candidate chose the relevant properties of poly(propene) to gain this mark. There was no pattern to the incorrect answers.

Question 4

Interpretation of data in the table was generally carried out well, but fewer candidates showed a sound understanding of polymer chemistry.

(a) Most candidates correctly chose poly(ethene) to gain the mark in (i). There was no pattern to the incorrect answers.
In (ii) about two thirds of candidates chose both bakelite and melamine to gain the mark. Most incorrect answers included one correct choice of the two, with no obvious favour for the incorrect choice.

(b) The majority of candidates gained at least one mark, with the most able scoring both. Most who gained just one mark did so by knowing that poly(ethene) contains atoms of hydrogen and carbon. Far fewer candidates realised that the polymer is made from molecules extracted from crude oil. Many thought the origin to be natural fibres.

Question 5

Most candidates evidenced knowledge of the benefits of intensive farming.
Almost all candidates gained at least one mark, and a majority gained both. The most common partially correct response was to tick boxes 1 and 4 for one mark.

Question 6

Most candidates demonstrated an understanding of the uses of food additives.

(a) A large majority of candidates gained both marks, with very few failing to score any. Amongst the latter a common error was to think that emulsifier prevents the growth of microbes.

(b) Most candidates gained at least one mark, with many scoring both. A common error was to tick box 3 instead of 4.

Question 7

Whilst interpretation of the BMI data caused problems for few candidates, most had difficulty interpreting the statements about diabetes.

(a) Most candidates interpreted that data well, with a majority gaining both marks.

(b) Almost all candidates gained at least one mark, with only the most able in the cohort gaining all three. There was no pattern to the incorrect answers.

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

General Comments

Almost all candidates made a good attempt at all sections of this paper, with very few spaces left blank. Many candidates showed a good knowledge and understanding across the three Unit 1 topics.

When presented with a number of statements some candidates were not clear about the number they were required to choose. Where candidate failed to score marks in this situation it was generally for not selecting enough responses, but not always.

The overall spread of questions gave all candidates of the appropriate ability for this paper the opportunity to score plenty of marks. A number of questions clearly discriminated well, giving a good spread of marks across the ability range. There were a small number of candidates that would have gained a more fruitful experience from sitting the Foundation tier.

Comments on Individual Questions

Question 1

This question allowed all candidates the opportunity to score well.

(a) There were a small number of students who missed this part of the question as they hadn't read through the information at the beginning of the question. Where students did offer a response it was more than likely correct. The correct responses of statements were well chosen by the candidates.

(b) Students were able to correctly identify the diagram for water. There were some candidates who struggled to correctly identify carbon dioxide.

Question 2

This was a good discrimination question

(a) Almost all candidates could identify the correct statements.

(b) Most candidates could identity the problems associated with carbon particulates, however fewer candidates were able to identify the problems associated with the oxides of nitrogen. The most common error was the omission of the recognition that acid rain is a problem caused by this pollutant.

(c) This was a good discrimination part of the question.

(d) This was generally well answered, however the most common error was believing the statement made by Eve rather than appreciating that she had not given enough evidence for this to be true.

(e) This was answered well by the majority of candidates.

Question 3

This was again a good discrimination question.

(a) Candidates could identify the real difference in the figures and say why, however they did find identifying the correct statements relating to the properties of the rope more difficult to describe.

(b) Candidates could generally identify at least 1 of the 2 correct responses here. To make a fair test was a common wrong response given.

(c) The majority of candidates scored very well here.

Question 4

This was again a good discriminator question.

(a) This section was answered very well.

(b) The majority of candidates could identify at least one correct response, unfortunately this didn't score. The majority of candidates did manage to identify two of the three correct responses to score one mark.

Question 5

This was again a very good discriminator question.

(a) The majority of candidates scored well here.

(b) The majority of candidates scored at least one of the three marks available. The candidates failed to identify that both intensive farming and organic farming may still generate harmful chemicals.

Question 6

This question was poorly answered by a large number of candidates. Candidates showed a lack of understanding of the Nitrogen Cycle. Almost all possible combinations of responses was seen. This is clearly an area for development.

Question 7

Candidates demonstrated a sound understanding of the relationship between the BMI and the risk of developing type 2 diabetes. This question was again a good discriminator.

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

General Comments

It was pleasing to note that on this particular paper, most candidates made good attempts at all questions; this included tick-box style questions, and also those requiring a written response. There were few no-response answers by any candidates.

In addition, few candidates lost marks by ticking boxes, or providing more responses than those required by individual questions. This was clearly an improvement from January.

The overall spread of questions gave all candidates of appropriate ability for this paper the opportunity to achieve plenty of marks.

There was good discrimination in the paper and it was evident where pupils had good knowledge, such as the composition of air, and where knowledge was lacking, such as the properties of the halogens.

Most candidates read instructions carefully and used correct annotations such as X and ✓, and T or F. A minority still chose their own indications of correct and incorrect responses.

There was no indication that candidates were short of time or that they lost interest in the paper as the exam progressed.

All questions were equally well-attempted.

Comments on Individual Questions

Question 1

(a) Most candidates were able to correctly identify the symbols for both sodium and potassium. The weakest candidates chose S for sodium and Po for potassium.

(b) This question was answered well by most candidates, although some lost marks as they failed to choose both 2.8.1 and 2.1 for elements with one electron in the outside shell.

(c) **(i)** Few candidates were able to correctly link up halogens with their colours and states. Choices tended to be random, and many candidates chose more than one state of matter e.g. bromine and iodine as liquids.

(ii) Again there was a lack of knowledge with regard to chlorine's reaction with coloured dyes; few candidates correctly identified "colourless" as the change.

Question 2

(a) Many candidates understood the difference between elements and compounds, correctly choosing oxygen and nitrogen as elements. A few mixed up the choices and identified the two elements as compounds and vice versa.

(b) Most candidates were able to correctly identify the composition of components in air. Some even correctly wrote symbols and formulae, even though it was not required.

Question 3

(a) Roughly half of the candidates sitting the paper achieved full marks on this question. Some had little understanding of ionic crystals and made random choices such as “the bonds are all on the outside of the crystal”

(b) There was slightly more candidates achieving full marks on this question. Most were able to correctly identify that the bonds in sodium chloride are strong.

(c) Many candidates made the correct choices in this question. Weaker candidates held the misconception that “ions melt”.

Question 4

(a) This question was answered well by many candidates. Those that struggled did not grasp the term “abundant” and often chose randomly from the list.

(b) Although this question was set at a low level, many candidates struggled with identifying a compound correctly and the most common choice was “ore”.

(c) This proved a challenge for many candidates and only a minority were able to correctly pick out sandstone as the rock containing silicon dioxide. Most chose “limestone.”

(d) This question proved a success for most candidates and the knowledge that the “mantle” was part of the lithosphere was clear to most.

Question 5

There were many individuals who did not achieve full marks on this question, although most understood that there was more Helium in the Sun than on Earth. Choices tended to be random from the other people’s opinions.

Question 6

On this question, most candidates achieved at least one mark – many were under the misconception that “all substances work better if they are as pure as possible” and that “manufacturers can charge more for pure chemicals”.

Question 7

(a) This was answered well, as many candidates clearly understood the concept of neutralisation as a reaction between acid and alkali.

(b) This was a well-answered question and the majority of candidates achieved full marks, correctly identifying chemical formulae and linking with chemical names. Only the weakest candidates failed to achieve full three marks.

(c) Although few candidates received zero marks in this question, few achieved full marks. Many failed to tick “salt” as a response to both reactions. This was one of the few places where there were either too many responses, or too few.

(d) Many candidates were correctly able to state “magnesium sulphate” as the correct response to the reaction between magnesium oxide and sulphuric acid, many other struggled with identifying a chloride from the reaction with hydrochloric acid. Answers varied from repeating sulphate, to repeating reactants given in the question. A common response was “magnesium hydroxide.”

(e) Very few candidates were able to correctly identify the ions in acid and alkali. The most common answer given was H^+ and Cl^-

(f) Many candidates were successful in achieving full marks for this question. Almost all achieved at least one mark, usually for dissolving, correctly identifying techniques with descriptions.

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

General Comments

Candidates perform well on papers with this objective style. Very few left gaps and most had clearly employed intelligent guess work on questions that they were unsure about.

In general, questions that ask for a single choice, or a pair of choices (e.g. pick the correct 'talking head' or put a ring around or tick the correct box) are the most accessible questions – these questions have the highest statistical facility. 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 that ask for a separate decision to be made about every distractor e.g. true / false or tick the correct column (e.g. Q 3d) are more challenging, and give a broader spread of marks. For teaching purposes, this is interesting because it implies that these are the questions that candidates need most practice in before the examination.

Comments on Individual Questions

Question 1
Talking heads questions are very accessible. Most gained at least one mark for an easy start to the paper.

Question 2

(a) Again, most gave a correct response. The 'ions melt' distracter was commonly chosen.

(b) Writing formulae from ionic charges is difficult. Many correctly identified $MgCl_2$, but Mg_2Cl was a popular choice.

(c) Again, the correct answer was often seen, but LiN_3 was a tempting wrong answer for many candidates.

(d) This question asked for a separate choice to be made (true/false) about each statement. Most gained at least two of the three available marks. All but the most able candidates thought that crystals contain *molecules* of NaCl. In (ii), most worked out that bonding is strong and that there are a large number of bonds.

Question 3

(a) Many correctly identified the correct arrows to show increasing electrons.

(b) Interestingly, although many got (a) correct, this part question proved more difficult, with candidates choosing many of the other distracters, Few realised that arrow 1 is the only correct arrow.

(c) Candidates were confused between group 7 and 1 here, with the elements often mixed up. Very few could correctly identify the two that would react together most violently in (ii).

(d) This is another question which asks candidates to make a separate decision in each row. Most recognised metal properties. Fewer knew ionic and covalent properties.

Question 4
This was surprisingly well done. Most candidates could identify Periodic Table groups from electron arrangements.

Question 5
Most knew at least two reasons why medicines need to be pure.

Question 6

(a) Another talking heads question that candidates answered very well.

(b) Mass calculations are more challenging. This was a straightforward task, but nevertheless, many pupils found it difficult. This was one of the few areas on the paper where some candidates did not answer. Of course, they should be encouraged to guess sensibly rather than leave a nil response.

Question 7

(a) There were two key tasks to be completed here. Firstly, candidates had to outlaw the incorrect statement. Iron is not manufactured by electrolysis, so statement C needed to be rejected. Secondly, the other statements needed to go in the correct order. Very few managed both tasks, and many failed to score at all here.

(b) Electronic half equations are quite high level, and so only the most able correctly identified the correct choice. In (ii) almost all knew that the oxide ion would move to the anode. Some spoilt their answer by showing the arrow coming out of the surface of the liquid.

Question 8

(a) (Talking heads again!) A single choice needed to be made. Most candidates had no trouble with this.

(b) This was the only question on the paper where some candidates did not correctly follow the task. The question asked for candidates to draw **one** straight line. However, some candidates attempted to join all four boxes in the first column to boxes in the second. Candidates should be warned to watch out for ‘novel’ questions and to make sure they read instructions carefully.

Question 9

(a) Most gained at least one for at least partially balancing the equation.

(b) The rest of this question was quite challenging. Many did not know the ionic equation for neutralisation.

(c) This question was very demanding. Only the most able gained all three marks here. Many knew the composition of the mixture at the start and end point, but few realised that at neutralisation there is no acid or alkali.

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

General Comments

Many candidates made a good attempt at this paper though it was obvious that some aspects of the course were better known than others. There was a good range of marks and many questions discriminated well.

Candidates had a good knowledge and understanding of alcohols, carboxylic acids and esters, energy changes, reversible reactions and analysis. They were much weaker on green Chemistry with many blanks or incorrect answers to these questions. There are a number of links between green chemistry and Ideas about Science though candidates were unfamiliar with these. It is suggested that ideas about sustainability and health and safety risks are revisited through this course.

The Ideas in Context question was well answered showing that candidates had made an effort to understand the pre release material.

Some candidates did not answer questions fully. In this style of paper the number of points made for a complete answer is indicated by the number of marks.

The Foundation Tier paper is aimed at those candidates who are operating at grade C or below. Questions 1(d) (e) 2(b)(ii) (c) 4(a)(i) (c) and 5(d) were all shared with the higher tier and tested at grade C and D standard. These questions did allow stronger candidates to show the extent of their knowledge.

Comments on Individual Questions

Question 1

This was the 'Ideas in Context' question on the paper with a pre release article on the Periodic Table

(a) A straightforward first question with almost all candidates gaining 2 marks for identifying a triad. Fewer were able to describe properties of the triad. Some candidates did not understand the word 'property', often giving details of atomic structure whilst others gave too general an answer such as 'they are all metals'.

(b) This question was more discriminating with good candidates gaining 3 marks. Weaker candidates lost marks by not writing fully enough. Many just wrote that there were several major flaws without explaining what they were which limited them to 1 mark.

(c) This question was generally well answered with many correctly repeating the information they had given in part a. Again a few candidates lost marks by giving knowledge of atomic structure or linking structure with the periodic table.

(d) This was a common question with the higher tier. Many candidates at foundation level limited themselves to 1 mark by giving one of the two correct answers but omitting the second.

(e) Another question that was common with the higher tier but few foundation candidates gained any marks. They misunderstood what was required, often writing that the scientists had used different data or different properties when the stem of the question stated the opposite. Most of those candidates who gained a mark in this question gave the answer that scientists were reluctant to say that their answer was wrong.

Question 2

This was a question on the different methods of making ethanol. Factual information on this topic was not known by the majority of candidates and many did not perform well on this question.

(a) Very few candidates were able to give any correct information about fermentation in part i. Those who did usually mentioned warmth or to keep it at the right temperature. The latter gained the mark for correct use of scientific terms. The ideas of pH and anaerobic conditions were not mentioned. Some candidates tried to use part ii in the answer to part i saying incorrectly that distillation was an optimum condition. There were more correct answers to part ii but many candidates tried only to link it back to the production of bio-ethanol.

(b) Fewer candidates knew anything about the industrial method of making ethanol in part i. Many made no attempt to answer this question. Candidates only needed to know an outline of the method to gain marks but many had no memory of this. Part ii was a common question with the higher tier but it was not answered well by foundation candidates. Many answers were too general saying there was a difference in energy used but not specifying that fermentation uses less energy or mentioning transport costs rather than any argument based on use of energy in transportation.

(c) This question was targeted at C/D candidates and was well answered on the foundation paper. Strong candidates often gave completely correct answers. Weaker candidates were confused between energy released and energy absorbed and a few mixed up products and reactants.

Question 3

(a) Generally this was a well answered question. Those who answered incorrectly either did not understand the term molecular formulae or miscounted the number of atoms in the molecule. Almost all candidates who gave a molecular formula used correct symbols for elements and put numbers in as subscripts.

(b) Most candidates gave the correct answer for part i. Unfortunately some weaker candidates failed to use information given in the question with oxygen and carbon dioxide incorrectly written in the spaces. Less were able to give the job of the strong acid in part ii. Many showed their knowledge of acids by saying it changed the pH or donated hydrogen ions but failed to mention rates of reaction or catalyst. In part iii many candidates were able to write down two uses of esters though a few candidates gave properties of esters instead of uses.

(c) Part i was aimed at C candidates and was answered correctly by many. Those who did not gain the mark had not answered or made some comment about equation or equality. Almost all candidates gained marks for part ii. The most common mistakes were atoms instead of molecules and increasing instead of constant.

Question 4

This was a question about analysis.

(a) Part i was a common question with the higher tier and most candidates gained 2 of the 3 marks. Many candidates were uncertain where the statement about rinsing solution from the beaker should be placed but had little trouble with the other three statements. In part ii many candidates knew that Gemma shakes the flask to mix the contents but almost as many suggested incorrectly that it made the contents react.

(b) In part i few candidates were able to identify ethanoic acid / vinegar as the substance put in the conical flask. Most wrote sodium hydroxide or water or indicator showing lack of understanding of the basis of quantitative analysis. Many more candidates answered parts ii and iii correctly though some thought the indicator should be put in the burette. Hardly any candidates knew that a pipette filler was used for safety, many repeating their answer to part ii saying it helped measure more accurately.

(c) This question was aimed at C/D candidates. Weaker candidates were side tracked by the time element in the question saying it was warmer or that she worked better in the afternoon. Most gained 1 mark for making a correct comment about the range but only a few said this made the results more reliable. The word accurate was commonly misused in this context. Question 4 is a good one to use to stress the difference between accuracy (as in measuring with a pipette and not a measuring cylinder) and reliability (when repeated results have little variation).

Question 5

This was a question on the interpretation of information on the production of phosphoric acid and most candidates used the information to answer the questions.

(a) Many were able to explain why phosphoric acid is a bulk chemical though some thought it meant a solid.

(b) Most candidates gained some marks for this question though some did not realise most information needed was in the stem of the question. Many candidates lost the mark on the second part of this question as they did not understand the meaning of the word synthesis.

(c) Almost all candidates recognised that Beth tested the purity of the phosphoric acid but fewer were able to explain the link between Beth identifying chemicals and purity. Many just copied out Beth’s statement.

(d) This question was targeted at C/D candidates. Very few were able to list anything that affected the sustainability of a chemical manufacturing process. Answers were either too specific such as references to global warming or too general such as ‘the by-products’ without any comment on their nature or what happens to them.

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

General Comments

This is the first opportunity that candidates have had to attempt Chemistry papers that combine Ideas in Context with the additional material required for the separate science GCSE. Whilst a number of candidates showed both their ability to apply their chemical knowledge to the area covered by the insert and their grasp of the concepts covered in the additional material, many were clearly out of their depth at this level. Knowledge of the C7 topics was often patchy and sometimes very poor. A large minority of candidates would have obtained a better experience had they sat the foundation paper. Some areas, such as heating under reflux, seemed to be beyond the experience of almost all of the candidates, and few candidates could successfully complete the calculations or write balanced equations. In some cases candidates had misinterpreted questions, and would have benefited from reading through more than once. However, a number of more able candidates scored consistently throughout the paper, and some good scripts were seen.

Comments on Individual Questions

Question 1

Most candidates could extract relevant parts of the insert, but many were let down by a lack of basic chemistry knowledge. Errors also commonly resulted from poor understanding of the requirement of the question.

(a) Most candidates realised that these elements have one electron in the outer shell, gaining both marks. Some gave the wrong number of electrons but gained one mark for mention of the outer shell. Common errors were reference to protons instead of electrons, properties instead of electron arrangement and the total number of electrons instead of those in the outer shell.

(b) Many candidates were confused as to which elements to choose, with a wide variety of incorrect choices seen. A few chose elements outside the first 20. More able candidates chose three elements from the same group, with the most common correct choice being lithium, sodium and potassium. Most of these candidates correctly described properties common to the three elements.

(c) Many candidates realised that the accuracy of Mendeleev’s predictions when matched with the properties of these elements when they were discovered helped acceptance of his table. Only the most able realised that the fact that these new elements fitted into the gaps that he had left also helped.

(d) The idea that the same data can be interpreted in different ways was suggested by only the more able candidates. Very few suggested that scientists might prefer their own ideas rather than accepting someone else’s, to gain a second mark. Many simply referred to scientists having different ideas, which did not gain credit. A common error was to base an answer on the idea that not all elements had been discovered.

(e) In (i) more able candidates realised that Mendeleev based the order of elements in his table on their relative atomic masses, to gain one mark. Few of these went on to describe how this would place potassium and argon in groups with other elements with which they did not share common properties. Most simply reported that the order of proton number was the wrong way round or that proton number did not increase as with the rest of the table. These answers did not gain credit.

In (ii) most candidates realised that elements are in proton number order in the modern Periodic Table. A common error was order of electron number.

(f) Most candidates scored one mark, but many made statements about the properties of Group 1 without attempting to make a comparison with those of copper. Others referred to reactivity trends down Group 1 rather than relating their answer to copper. Some candidates gained a mark by comparing the number of electrons in the outer shell of copper and Group 1 elements.

Question 2

More able candidates scored well in this question, but few candidates could perform the calculation correctly.

(a) In (i) a large majority of candidates correctly balanced the equation. A few of the weaker candidates tried to balance by changing the formula of glucose.

Part (ii) was generally well answered. Most candidates demonstrated a sound understanding of the concepts, with the large majority scoring the QWC mark, usually for ‘denatured’. Candidates who wrote that enzymes are killed at high temperature did not receive credit. Many weaker candidates scored one mark for the idea that the reaction stops or slows down at a lower temperature.

In (iii) very few candidates realised that yeast is killed when the concentration of ethanol becomes too high. Many incorrectly referred to water being a product of the fermentation.

(b) Only the more able candidates could correctly calculate the mass of ethanol produced to gain both marks in (i), though many more gained just one mark for calculating the relative formula masses of ethene and ethanol.

RFMs C_2H_4 = 28 and C_2H_5OH = 46
mass ethanol = 46/28 = 1.64 tonne

In (ii) the response given by many candidates was insufficient in that they mentioned natural gas or crude oil as feedstock for the ethane process, but did not qualify it as finite or ‘one day running out’. Similarly for fermentation many said that the source is renewable, but did not mention that the source is from plants that can be grown. A few said that yeast is renewable, which did not gain credit. The idea of fermentation using renewable feedstock or the ethene process using non-renewable feedstock gained just one mark for many candidates. Some more able candidates gained both marks for the idea that the higher temperature needed for the ethane process uses more energy than the lower temperature required for fermentation.

(c) A large majority of candidates scored all three marks. Common errors from weaker candidates included ‘energy absorbed’ in the middle box, water in one of the higher two boxes and ethanol in one of the lower two boxes. Very few candidates failed to score at least one mark.

Question 3

Few candidates showed an understanding of dynamic equilibria as applied to weak acids, or realised that strong acids are completely ionised. Reflux was a mystery to most.

(a) Most candidates gained the mark in (i) for the idea of this being a reversible or equilibrium reaction.

In (ii) many candidates seemed to have some idea of dynamic equilibrium but most had difficulty in using the concept to explain the difference in strength of the two acids. Common errors were to refer to sulfuric acid as having almost completely ionised or having an equilibrium far to the right, neither of which gained credit. Few candidates mentioned a difference in the concentration of hydrogen ions. Only a small number of the more able candidates scored more than two marks, whilst the majority of candidates gained no marks.

(b) In (i) the half of candidates could copy down the formulae given and add that of water to gain this mark. Some tried to balance the equation and lost the mark in the process. A surprising number of weaker candidates copied the formula for ethyl ethanoate incorrectly. Another common error was to miss out the water.

In (ii) very few candidates realised that a catalyst is not used up during a reaction and so is only required in small quantity. Common incorrect answers referred to the acid being strong or concentrated, the activation energy being small or the reaction being quite fast without the catalyst. Many weaker candidates thought that more catalyst would make the reaction go too fast or not produce the correct product.

Answers to (iii) showed that very few candidates knew the apparatus used to heat reaction mixture under reflux. Many confused reflux with distillation. Some of the more able candidates gained one mark for the idea of liquid reactants not being lost because their vapour condensed and ran back into the mixture, but most scored zero. Only a handful described how heating under reflux is carried out.

Question 4

Few candidates made progress with the calculation in this question.

(a) Most candidates gained at least two marks, with about half gaining all three marks in (i). Common errors were to DCAEFB and DCEFAB. Some weaker candidates seem to have chosen letters at random.

In (ii) only the more able gave the correct answer of 4 g/dm^3. Common incorrect answers were 0.4 and 0.25, though a very wide variety of answers were seen.

(b) In (i) most candidates realised that the afternoon results had a smaller range than the morning results, so gaining one mark. Fewer mentioned that they were more reliable to gain the second mark, and many who did lost this mark by also suggesting that they were more accurate.
Only the most able candidates seemed to know how to begin the calculation in (ii), and few of these could complete it correctly to gain all three marks. The majority of candidates gave a jumble of figures with little or no apparent logic to score zero. Many did not attempt the calculation.

mass = 4.0 x (60/40) x (12.5/25)
= 4.0 x 1.5 x 0.5
= 3.0 g
or
mass NaOH in 12.5 cm^3 = 4.0 x 12.5/1000
= 0.05 (**allow** 1.0 x 12.5/250 = 0.05)
mass acid in 25 cm^3 = 0.005 x 60/40
= 0.075
mass in 1 dm^3 = 0.075 x 1000/25
= 3.0 g

Question 5

Only the more able candidates used the information given to formulate their answers.

(a) The majority of candidates could correctly copy the given formulae to complete the left side of the equation, gaining one mark. Only a few of the most able could give the correct formulae for the right side, and those who did generally balanced the equation correctly as well. Common formulae errors were Ca_3SO_4 and $Ca_3(SO_4)_3$. A number of weaker candidates did not successfully copy the formulae for the left side of the equation.

(b) Only a minority of candidates realised that the waste would be acidic and based answers to part (i) on this premise. Most gave vague references to environmental damage that gained no credit.

In part (ii) many candidates did not realise that the question asks only about concentration, and based answers on purity, gaining no marks. Other common incorrect answers referred to yield, checking if the reaction was complete or if the product had been formed. Only a minority gave correct answers related to consistency or quality control.

(c) Many candidates described one sensible precaution, such as leak-proof containers, non-corrodible materials, hazard warning signs to gain one mark, but few gained both marks. Many candidates gave answers that were too vague to score.

(d) Only the more able candidates clearly understood the concept of sustainability and how it applies in general to chemical manufacturing processes. Some candidates based answers on specific processes rather than giving ideas that could be applied generally, and did not gain credit. Other incorrect answers commonly referred to cost, temperature, pressure, amount of waste produced (rather than disposal issues), availability of raw materials (rather than whether they were renewable)

A329 – Twenty First Century Chemistry A (Practical Data Analysis and Case Study) A330 – Twenty First Century Chemistry A (Practical Investigation)

General Comments

This is the second year of the Practical Data Analysis and Case Study coursework. However, for many Centres this was the first year of presenting candidates' work for moderation. The scale of the assessment and moderation operation increased significantly this year. Last year some 200 Centres were involved in Practical Data Analysis and Case Studies. This year, 1000 Centres submitted work for more than 225,000 candidate entries across all the specifications within the Twenty First Century Science suite, representing a huge increase in the moderation required.

The moderation team had to be increased substantially and included a good mixture of experienced moderators from the legacy and Pilot specifications and new moderators with experience of teaching Twenty First Century Science.

In Biology A, there was approximately an equal number of candidate entries for the two different Skills Assessment routes, whereas in Chemistry A and Physics A there was approximately twice as many candidates opting for the Investigation route as compared to the Data Analysis and Case Study.

A substantial number of Centres made late (sometimes very late) entries for the Skills Assessment. One cause appeared to be lack of familiarity with UMS systems, so that Centres did not realise they needed to register candidates for coursework moderation as well as for the examination papers and subject aggregation. It is to be hoped that this will not occur again, as it put moderators under great time pressure to complete the work.

Considering the very large number of Centres involved, only a small proportion required mark adjustments to bring them into line with national standards which was very pleasing. However, there were a significant number of Centres that were very close to the tolerance allowed and will need to act on moderators' comments to ensure that there are no problems next year. The agreement between the moderator and Centre in the total marks awarded for each candidate's piece of work was generally quite close although the individual marks awarded for the strands and aspects in the assessment framework varied. Overall, teachers are to be congratulated on the very good transfer of assessment skills from the legacy to the new specifications.

It appears from discussions with people attending INSET that the Principal Moderator Report for 2007 had not always been seen and read. Therefore some of the comments and guidance has been repeated again in this report.

Structure of the report

This report is divided into the following sections:

- Administrative aspects
- Supervision and management of coursework
- Marking grids and best fit model of marking
- Marking strands B and C in case studies
- Marking strands I and P in data analyses and practical investigations
- Data Analysis
- Case Studies
- Investigations
- Grade Thresholds

Administrative aspects

Due to the large number of centres submitting coursework this year it was perhaps not surprising that there were a significant number of administrative problems. Moderators included in their request for the coursework sample a simple checklist for Centres to use to ensure that everything that was needed was included. This helped both centres and moderators to improve efficiency and effectiveness.

The best Centres followed this checklist and included:

- The MS1 sheet or other OCR approved method, clearly showing the total marks awarded
- A spreadsheet showing the rank order and teaching sets of candidates
- The centre authentication sheet (CCS160)
- Candidates work stapled in the left-hand corner with the appropriate OCR front cover showing the details of the mark breakdown
- Details of how each of the tasks used for assessment had been introduced and presented to candidates and any further supporting material
- Annotation on candidates' work in the sample showing where and why the marks were awarded
- Documentation with contact name, phone number and email address for the person responsible for administration of the sample of coursework
- Details of internal standardisation procedures. Some Centres marked the exemplar material provided at an OCR INSET session and discussed and noted good practice. and then selected work from within the Centre to cross-moderate.

However, 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 that moderation proceeded smoothly. This caused numerous problems for the team of moderators given the short timescale for the completion of the moderation process.

The following were the most common problems:

- Errors in transcription to the MS1 form
- The copy of the MS1 sent to the moderator showing the marks of each candidate was often not legible
- Mark changes to candidates' work at the internal moderation stage not being carried forward to the MS1 sheet
- Misunderstanding of the best-fit approach to awarding marks
- Missing front coversheet on candidates' work
- Poor annotation showing where the marks were awarded. In some cases the annotations did not match the mark on the coversheet. In the Practical Data Analysis, those Centres who used a simple coding, such as I(a) 4, helped considerably to identify where the evidence could be found to help moderators confirm Centres' judgements.
- Minimal description of how tasks were introduced to candidates
- Little information about internal moderation procedures.

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) and context (i.e. Biology, Chemistry or Physics) as appropriate for the specification concerned. A number of Centres did not follow these requirements with respect to context and this will not be acceptable next year. Furthermore, if the same piece of coursework is submitted for more than one specification then it must be photocopied and put into the appropriate sample. Many Centres did not help the moderation process work efficiently in this way.

Moderators also commented that there were a significant number of Centres that did not send the mark lists and samples promptly. On occasions it was difficult for moderators to make rapid contact with the person who was responsible for the administrative paperwork to sort out any problems and this slowed the moderation process. The position of half-term in many Centres in the middle of the moderating period was recognised as a contributing factor to some aspects of this problem.

Supervision and management 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. This can be downloaded through the internet, at the following link:

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

The following quotes are from this document:

"Candidates should be clear about the criteria they are expected to meet in their coursework… they may need some further explanation or interpretation before they fully understand the nature of the skills they are expected to demonstrate."

"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”.

Marking grids and best fit model of marking

The majority of Centres recorded their marking decisions on the OCR marking grids and used the completed grid as a coversheet for the work of each candidate as required. However, some Centres did not appreciate that in the best fit model of marking, **all** aspects of performance of a given strand must be assessed and then a ‘best fit’ mark selected. The award of marks is based on the professional judgement of the science teacher, working within a framework of descriptions of performance which are divided into **strands and aspects**. 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.

The single, overall, mark for the whole strand is then taken as the best fit to the level of performance shown. In the marking of the Data Analysis, each strand is divided into three aspects. Therefore the best fit strand mark would normally be the average of the marks judged for the individual aspects rounding to the nearest whole number. All aspects of that strand must be considered in arriving at the strand mark; if there is no evidence of achievement for an aspect, a mark of zero should be recorded and included in the calculation of the overall strand mark.

For example: E(a)5, E(b)4, E(c)6 Strand E = (5+4+6)/3 = 5 marks
E(a)6, E(b)4, E(c)6 Strand E = (6+4+6)/3 = 5 marks
E(a)7, E(b)4, E(c)6 Strand E = (7+4+6)/3 = 6 marks
E(a)7, E(b)6, E(c)2 Strand E = (7+6+2)/3 = 5 marks
E(a)7, E(b)6, E(c)0 Strand E = (7+6+0)/3 = 4 marks

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.
There was a tendency for some Centres to award marks on the basis of candidates matching one high level performance description rather than treating the descriptions in a hierarchical way and ensuring that the underpinning descriptions had been matched. A few Centres just counted the highest mark for any aspect to arrive at the strand mark.

Marking strands B and C in case studies

In the marking of the Case Study, strands A and D also have three aspects and a similar best fit procedure to that described above can be used.
However, in strands B and C there are only two aspects in each, and in some cases a professional judgement has to be made when arriving at the best fit strand mark from the average, 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 versa) for a total of 7 marks for these two strands taken together.

Marking strands I and P in data analyses and practical 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 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 allows increased flexibility, so that the scheme can be applied to a wider variety of different types of activity. This arrangement evolved gradually during the pilot stage of development of the specification and there are some documents with older versions of the assessment grid still in existence in some Centres. Centres should take care to use the version in the current specification, available on the web site www.ocr.org.uk.

Strand I aspect (a) involves awarding credit for processing the data which has been collected to display any patterns. This may be achieved either graphically or by numerical processing, whichever is most appropriate in a particular Data Analysis. If there is some evidence for both approaches, then both should be marked and the better of the two counted.

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

Strand P aspect (b)
Strand P in Data Analysis 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 allow it to cover a wider variety of different 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 of aspect (b) is concerned with recording quantitative data (e.g. times, voltages, volumes etc). The second row deals with the use of conventions and rules for showing units or for labelling in tables etc. The third row of aspect (b) deals with recording of qualitative data (e.g. colours, smells etc). Most Data Analysis assessments are of a quantitative nature and will provide evidence for the first and second rows; they should be considered together and a best fit mark given for aspect (b), ignoring the third row because it is not relevant in this case. For those rare Data Analysis assessments which do not include quantitative but only qualitative evidence, the mark for aspect (b) should be based on the second and third rows only. Once the 'best fit' 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 a Data Analysis providing quantitative evidence:

Aspect of performance				**Strand P mark**
P(a)		7	7	**6**
P(b)	(i)	6	5	
	(ii)	4		
	(iii)	not relevant		
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.

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 used the language and concepts related to IaS, such as 'correlation and cause', 'outliers', 'reliability', 'accuracy', 'best estimate', and 'real difference' found it much easier to match the performance descriptions of the criteria and gain higher marks.

The majority of Centres clearly understood the information included in the specification about the nature of the Data Analysis task that can be used for assessment purposes. **Candidates must have personal firsthand experience of collecting data by performing a practical experiment.** Candidates then analyse and evaluate this data and are assessed against the criteria in the specification. The data that they 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. Centres which do not fulfil this requirement will put the marks of their candidates in jeopardy. Therefore, it is very important that Centres include details of how the task was presented to their candidates. It is also 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 better Centres introduced their candidates to the data task and involved them in discussion of the procedures and apparatus rather than just presenting candidates with a detailed worksheet. The whole class situation allows interactive discussion of the experiment so that all candidates understand the reasons why particular methods or ranges of values were chosen. It also allows all candidates to have access to a substantial body of data to provide a firm basis for interpretation and evaluation.

The same Strand I and E assessment criteria are used in investigations in Additional Science and the same marks for I and E from investigations can be submitted for Data Analysis as well. A few Centres did not appear to appreciate this possibility and in a number of cases, on the advice of the moderator, the marks of their candidates had to be adjusted to produce a more favourable outcome.

Many candidates appeared to be better placed to make realistic evaluations of their procedures and data collected through an investigation, rather than through a standalone data analysis experiment. However, in the case of weaker candidates, the data collected was often poor in quality and quantity so that they found interpretation difficult. Therefore, in these cases data analysis activities involving whole class participation were generally the most successful.

In strand I, compared to the previous Sc1.2 criteria, there is an increased demand in the assessment of graphical/numerical skills and of the ability to summarise evidence. A similar, but less marked, effect occurs in strand E. This increased demand resulted in a greater spread of marks, reflecting the different abilities of candidates, and gave clearer differentiation and consequently more secure grading.

Data Analysis Tasks

There was a great variety of data tasks seen by moderators, which was very encouraging, such as:

monitoring pollution;
breaking strength of hair;
stretching materials under load;
impact strength of plastic bags;
viscosity experiments;
rates of reaction;

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

Strand I: Interpreting Data

I(a): Most candidates analysed their data using bar charts or graphs to illustrate and process the data that they had collected rather than carrying out a numerical analysis. However, some Centres did not appreciate the nature of the 'dotted line' dividing aspect (a) into two approaches, graphical or numerical. As explained in detail earlier in this report, candidates can be assessed on graphical **and/or** numerical processing of data as appropriate and the higher mark can be used in the assessment of this aspect. There is, of course, an inherent understanding that there must be a level of comparability in level of demand between these two routes when awarding similar marks.

It was pleasing to see that the majority of candidates repeated their measurements and included range bars on their graphs indicating the spread and scatter of the results. However, in many cases the graphical work presented by candidates 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. Computer-generated graphs are acceptable but it was noticeable that the best fit line was not always correctly produced and it was generally better for candidates to hand draw their own best fit line.

Some Centres were giving 7 or 8 marks for graphs which were not warranted. Centres must recognise that to be awarded 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:

- I(a) 7/8 - accurately plotted graph including a line of best fit and evidence of awareness of uncertainty in data, e.g. range bars, scatter graphs
- I(a) 6 - graph with a best fit line, correctly plotted points, correctly labelled and scaled axes
- I(a) 5 – a dot-to-dot graph, or axes not labelled, or incorrectly plotted point(s), or poor quality best fit line
- I(a) 4 - simple charts, bar charts

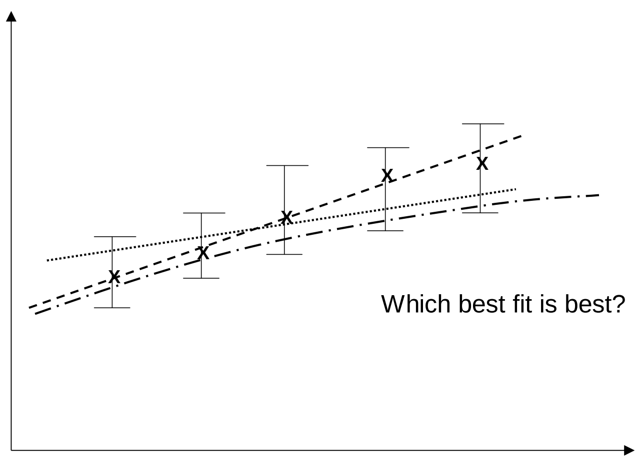
For the numerical approach it is expected that candidates will be able to correctly calculate averages from repeat readings for 4 marks, do more complex calculations such as calculate percentage differences for 6 marks and for 8 marks calculate gradients from graphs or use simple statistical methods such as box and whisker plots. There were cases when candidates used equations to process numerical data such as use of Ohm's Law, or energy change equations. The following guidelines might help when awarding marks but it must be stressed that level of complexity and demand must as always be taken into account.

- I(a) 6/7 – depending on complexity, a candidate substitutes appropriate measurements into an equation, correctly performs the appropriate calculation and excludes outliers when calculating
- I(a) 5/6 - depending on complexity, a candidate substitutes appropriate measurements into an equation, correctly performs the appropriate calculation but includes outliers when calculating averages or includes another minor error
- I(a) 4- a candidate substitutes appropriate measurements into an equation but does not calculate averages or calculates averages only.

I(b): The match to I(b)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 to match I(b)6 with little evidence to support this award. Many candidates referred to 'positive correlation' when they should have said 'Y is directly proportional to X'.

Candidates should consider the patterns and trends and use their data to derive a more formal or quantitative relationship to ensure a secure match with I(b)6. For example, using and quoting the data to show 'as the concentration is doubled the rate doubles', or calculating slopes/gradients and then stating some formal or quantitative relationship between them and the variable studied. Candidates appeared to find it easier to express relationships when dealing with continuous variables. In those experiments which only involved categoric or discrete variables, candidates generally made simple comparisons of arbitrarily chosen pairs of results without bringing out any overall conclusion.

Aspect (b) at the highest level, builds on and extends that found in the previous Sc1.2 model. It requires candidates to review any limitations to their conclusions by considering such things as the scatter in the data, what might happen outside the range of values studied, any overlapping range bars between data points, 'real differences' and values of the best estimate, and whether the best fit line be precisely 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.



I(c): In many cases candidates did not link their scientific knowledge and understanding to explain their particular conclusion, but related it to a more general situation. However, most candidates could secure a match to I(c)4 by explaining their conclusion using scientific ideas. Introducing scientific knowledge at this mark level is proving more demanding than the comparable level in the previous Sc1.2 model. However, there was some generous marking when matching to I(c)6 and I(c)8 in terms of the depth 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 7/8 marks at about the grade A standard.

Strand E: Evaluation

The importance of considering the accuracy and reliability of data and its consequent evaluation is an essential feature of this course. It is therefore of concern that the majority of candidates only achieved between 3 or 5 marks for this strand. Candidates should be encouraged to use the appropriate IaS (Ideas about Science) vocabulary and refer to ideas from IaS 1 when discussing the quality of their data.
In many evaluations, credit was given to candidates for describing what is human error rather than an experimental error.

E(a): Candidates are expected to comment on their procedures and to describe improvements or alternative ways to collect their data. Many candidates discussed improvements to their practical procedures, E(a)6, but failed to discuss the limitations of their procedures E(a)4. There was a tendency for some Centres to award marks on the basis of any hint of matching one performance description, rather than checking each level in a hierarchical way. The E(a)4 aspect of performance 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' without any justification or explanation, 'be more careful next time I do the experiment' etc. 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 the resistance of a wire experiment were more suitable and creditable suggestions.

E(b): 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. Few candidates considered the range in their repeat measurements to give an estimate of reliability and the general pattern in their results, closeness of 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.

Better candidates made a decision about whether unexplained outliers should be included in the data and in ranges of repeat readings. 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 candidates. 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 I(b), 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, together with detailed suggestions about what further data could be collected to make the conclusions more secure.

Some candidates recognised that their conclusion can only apply to the range of values that were studied because outside this range other, specific changes may occur. For example, rates of reaction are bound to slow down as one of the chemicals gets used up, rubber bands eventually break, more exercise cannot always mean that pulse rate continues to increase, etc. Many candidates provided further comment about the confidence level in their conclusions in terms of how close the agreement was to their predictions using scientific theory. Some candidates whilst investigating the effect of length on the resistance of a wire, plotted appropriate data, calculated resistivity and then compared this with data book values.

Case Studies

General comments

Case Studies continue to be a very successful aspect of the course and have drawn a most positive and enthusiastic response from candidates of all abilities. A number of comments made in last year's report are still appropriate and relevant this year. Case Studies are used to assess candidates' understanding of all aspects of 'Ideas about Science' (IaS), but particularly IaS 4, 5 and 6. The purpose of the Case Study is to encourage candidates to use their knowledge and understanding of the IaS 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', and 'technical feasibility and values' they found it much easier to match the performance descriptions of the criteria and 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, 'does air pollution cause asthma?' rather than just 'asthma'. A question will encourage candidates to look for different opinions and views, and to consider the evidence base for claims and the reliability of sources. Studies which were presented as questions to answer were always more effective than those which simply **described** a topic. The Case Study is not a report on a topic but a critical analysis of a controversial issue. Some topics are so uncontroversial that there are no valid opposing views.

In some Centres, all candidates were given the same topic title whereas in others a broader range of opportunities was given. In general, the latter approach was more successful. However, it is wise for teachers to closely monitor their candidates' choice and perhaps limit this to topics which have been covered in course modules. This means that candidates will have access to some basic explanatory science from their student book which will provide them with a good starting position for their study, and at least one book reference for their bibliography. However, whatever arrangements were adopted it was clear that students showed a sense of 'ownership' of the study, and even very weak students managed to produce sensible reports. The key point is that the Case Study question must invite debate and discussion of both sides of the case and be 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.

Choice of subjects for Case Studies

It was interesting to note that there appeared to be a slight shift in the popularity of subjects for Case Studies compared to last year, e.g. less on smoking and sunbathing issues but more on cloning and energy sources for the future. Case Studies will, and should, slightly shift and evolve as different issues arise in the news and also as new information and evidence is presented to change opinions and views. This will help to maintain motivation and enthusiasm.

Case Study titles included:

Food additives – are they good or bad?
Is global warming natural or man-made?
Does motor traffic cause asthma?

Some Centres used the film, 'The day after Tomorrow', as stimulus material for 'global warming'. Some centres picked on issues closer to home, e.g. 'dolphins caught in local fishing nets' as a stimulus for 'extinction' issues. There were some Case Studies which were founded on considerable ethical or moral viewpoints and limited science, and this made it difficult for candidates to access high marks in parts of Strands B and C.

Assessment

In general, candidates performed better in Strands A and D compared to B and C. The majority of candidates presented their work using good IT skills but the substance and quality of the work did not always match the high standard of presentation. However, many candidates did produce work which was quite outstanding and was a pleasure to read and moderate. The more successful 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 achieving 20 or more marks. Reports from the weakest candidates often consisted of perhaps two or three 'cut-and-paste' sections from a limited number of sources with minimal editorial comment from the candidate. Thus candidates in this group had selected relevant material from a source, made some attempt to link the facts together and present a report achieving perhaps 5 or 6 marks. Even middle-achieving candidates cut-and-pasted information from the internet and did not always comment on the information and interpret and analyse it sufficiently. The amount of added value in terms of analysis and evaluation by the candidate was often variable in these cases. This limited significantly the marks awarded in Strands B and C and also in D(c) where marks awarded for spelling, punctuation and grammar and the use of scientific vocabulary has to be decided on the words used by the candidate and not on the downloaded information.

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): The key aspect here is for candidates to use sources of information to provide evidence for **both sides** of their case study. Websites from the internet were by far the most common source but many candidates referred to their course textbook and their own class notes to collect information. The quality of extraction of information depends on careful selection of relevant extracts to quote directly, and the intelligent re-wording of content to bring out its relevance to the developing arguments in the study.

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 divides 3 marks from 2,; quality is more important than quantity. Only the better candidates, in addition to the requirements of 3 marks, attempted to assess their sources in terms of reliability in any rigorous and appropriate way.

For 4 marks it would be expected that candidates consider, for example, whether the source of information is from a 'respectable pressure group' or from the 'quality media' or a school textbook or science magazine, or a peer reviewed science journal or government report. Just saying' I think that the information is reliable because it is from the BBC' is not sufficient. The status of the author and the author's affiliation/institution should also be considered. Therefore if the source of information is a peer reviewed journal, written by a leading expert in the field who is based in a major university then it is more likely to be considered a reliable source. Those candidates who used the language and ideas from IaS 4 in discussing the reliability of sources such as ideas about peer review, the nature of the source or the status of the author, invariably achieved higher marks.

The further to the right, the more reliable the source is likely to be.

Publication	Website or newsletter of a private individual or a fringe group	Respectable pressure group website or newsletter	'Quality' media e.g. BBC, *The Times, The Independent, The Guardian, Daily Mail*	School textbook or science magazine e.g. New Scientist, Focus, Catalyst.	Peer reviewed science journal or government report
Nature of the data	Based on little or no data	Based on some data, but of questionable validity or reliability, e.g. small sample, not representative of population.	Based on just one study (or several small studies). Little information about sample, or procedures followed.	Valid and reliable method e.g. health study with large sample size, carried out over many years	Results repeated by different scientific studies, each using a valid and reliable method,
Science explanation	No support within the science community	New explanation, but with basis in accepted scientific ideas	One among several explanations discussed with the science community	Agreed by most, but not all, within the science community	Agreed by everyone within the science community
Status of the author	Someone who knows little or no science. Someone known to have a particular point of view	An inexperienced scientist or science student	A professional scientist whose expertise is in a different field	A professional scientist working in the area – though not regarded as a top expert by his/her peers	A recognised expert in this field of science
Author's affiliation or institution	A non-science institute	An scientific institute or company that represents particular views only	An scientific institute with a doubtful reputation	A recognised university or scientific institute	A leading university or scientific institute, or the research lab of a major company

A(b): The majority of candidates included a bibliography of sources at the end of their reports and most provided references to any websites that had been used. For 2 marks candidates identified their sources using incomplete references. In general, when applied to website addresses this meant that candidates referred to the homepages only e.g. www.bbc.co.uk. If only one or two incomplete references are given then one mark should be awarded and, of course, if no references are given then zero marks.
For 3 marks, candidates included complete references to the exact url address of the webpage which would allow direct access to the source of information. When referencing books, title, author and page references are required to match this mark. It was clear that more able candidates were including more detail, and this has begun to re-define the standard at 4 marks for 2009. Candidates working at this level included the date that the site was visited and also some information about the nature or sponsorship of the site. For example, a candidate presenting a Case Study on cloning included the following reference: *http://exchanges.state.gov/forum/journal* and went on to explain that it was the US Bureau of Educational and Cultural Affairs and included information from the Advances in Biotechnology journal to provide teachers with resources about breakthroughs in biotechnology.

A(c): Candidates were still not very good at clearly showing where sections of text were directly quoted. It should be made clear to candidates that they are expected to copy some, reasonably short, material from their sources but it is essential that they make this completely clear. Use of quotation marks, use of a different font or colour highlighting were some of the methods used by the better candidates. The better candidates included references or specific links within the text to show the source of particular information or opinions 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. If this referencing is not done, then candidates may also suffer in strand B, where they cannot easily show that they have recognised and evaluated the scientific content of particular sources, and in strand C, where they compare different opinions.

A number of candidates handed in full print-outs of their sources which was not necessary. Some candidates gathered information from self-constructed questionnaires which also added to the pool of material for their Case Study, but occasionally this distracted them from the underlying science and scientific evidence.

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 Studies

In simple terms, this strand assesses candidates' ability to consider the claims and opinions they have collected from their sources, to describe and explain the underlying relevant science, and to recognise and evaluate the scientific evidence on which the claims were based (IaS 1, 2 and 3). Those candidates who had clearly been taught IaS used the appropriate language and concepts, and achieved higher marks. However, there was some general improvement in this area compared to last year with more candidates including relevant KS3 and KS4 scientific ideas and targeting their report towards the suggested audience of intelligent Year 9 students.

B(a): The majority of candidates described in the introduction to their case studies the relevant background science, with the more able candidates going in to a greater depth and detail. However, most candidates did not go much further and it was only the most able who could link their scientific knowledge and understanding to the claims and opinions that they had found from their sources. Reporting was too often still at the 'headline level', simply repeating claims without looking beyond the headline for the underlying science.

For topics which are related to course modules, it can be taken as a general guide that 6 marks requires all that is available in available supporting text books. The 7^{th} or 8^{th} mark will come either for applying this correctly to the case, or for finding and explaining some more specialised knowledge (e.g. the way in which up to 8 mobile phones can "time-share" a single frequency to reduce total radiation loads and increase capacity).

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. For example, whether the evidence has been collected using a valid and reliable method, e.g. a health study with a large sample size over many years, or whether the results have been repeated by other people and the same conclusion drawn.
The information they find can be used towards credit for D(b) as well, if presented as graphs, charts or tables, or as informative schematic diagrams.

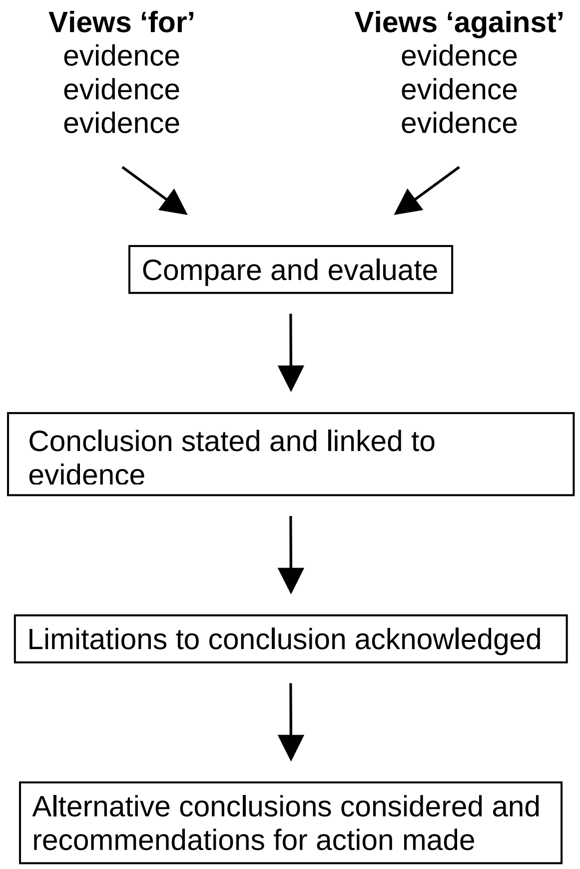
It was noted that in the Data Analysis component of this course, most candidates were able to some extent discuss and evaluate the data that they had personally collected in their practical experiments. However, in the context of the Case Study the vocabulary and use of terms from Ideas about Science were not used very frequently. Many candidates included tables/bar charts/graphs of relevant data but did not use or comment sufficiently on the information presented.

Strand C: quality of conclusions

In this strand, candidates should consider aspects of IaS 5 about actual and perceived risks and the ALARA principle and in IaS 6 about how society should respond. There was again evidence that candidates were not using and applying their 'Ideas about Science' sufficiently to warrant the higher marks in this strand.

The aspects for Strand C can be summarised in the following simple flowchart

Strand C:



Lower achieving candidates reported the information that they had collected without sorting it in any particular way and were awarded 2 marks. However, most candidates could sort the information that they had gathered into views 'for and against', sometimes in a tabular form if appropriate. Those who just listed it in this way were awarded 4 marks. Better candidates started to compare and balance arguments against one another 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. There should be evidence that the sources used have been compared to check for consistency and to identify areas of conflict or disagreement. In this way it is clear that B(b) and C(a) are closely linked. There should also be evidence that the underlying science has been used to try to resolve any differences. Alternative conclusions should be considered where appropriate and recommendations for 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 they were based on. Opinions from a variety of sources were often quoted but without reference to the source or to the evidence that the claims were based on. Although most candidates made an effort to give two different views in their studies, these were rarely compared, and conclusions often seemed to lack any clear basis in the evidence shown. This approach rarely leads to marks above 4 or 5. It was very rare indeed for even the better candidates to attempt any judgement of the quality or reliability of any of the scientific evidence offered by their sources. The best candidates will not simply state an answer to their own question ('I think mobile phones are dangerous', 'too much sun is bad for you') they will also use the evidence they have presented in their study as a basis for recommendations about what to do ('use a hands-free kit', 'text don't talk', 'avoid sunbathing at midday', 'wear sun screen' etc). Thus, the most successful titles were often questions where the answer would lead to some recommendations for action.

Strand D: quality of presentation

D(a): It was pleasing to see that the majority of reports included headings and/or sub-headings to provide the necessary structure. There was a definite improvement in this aspect and the better candidates included a table of contents and numbered the pages in their report to help guide readers quickly to particular sections. Those reports which were presented simply as PowerPoint printouts achieved good marks in this aspect but often lacked sufficient detail for high marks in the other strands. However, PowerPoint printouts which had notes to accompany each slide were much more successful in obtaining higher marks. It would be helpful for moderation purposes if these could be printed out in the format which gives one slide and the accompanying notes on a single A4 sheet. The slide can then concentrate on headings or visual impact, with the notes supplying the detail, references to sources, etc.

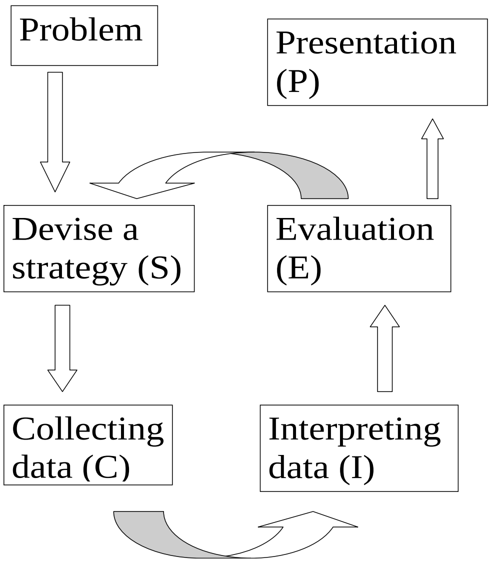
D(b): Suitable diagrams and graphics should be incorporated as appropriate to clarify difficult ideas and encourage effective communication, but in practice the visual impact was often variable. Too often images were decorative, rather than informative. Of course, many textbooks include decorative rather than always informative images and this may be a source of confusion for some candidates. A mixture of both is usually the best route to provide an interesting and informative report. Rather too little use was made of diagrams, charts, tables or graphs as compact ways of conveying large amounts of information, or to visualise difficult concepts. The best candidates always made good use of explanatory diagrams by referring to them and using the information that they contained. They integrated illustrations into their report, making comments about what was shown by the illustration, and how it was relevant to the study.

If there are no decorative or informative images included then zero marks is awarded. If one image is included, or a decorative front cover or other low level attempt to add interest is present, 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 illustrations, 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.

Some candidates included a useful glossary of scientific terms that had been used within the report.

Investigations

It was particularly noticeable that in this first year of the new specifications that require investigations many Centres continued to follow the previous Sc1 approach towards investigations. Many centres had not taken up the spirit and direction of Twenty First Century Science investigations and this made it difficult for candidates to access the higher marks.



The essential features of a scientific investigation have of course been maintained in this new model. However, the importance of candidates doing preliminary work, developing and exploring methods and techniques, and selecting appropriate apparatus rather than following a given or standard procedure are perhaps the key differences when developing a strategy.
Gathering initial data, making a preliminary analysis and evaluation to modify the initial method to obtain better and more reliable and accurate results, and informing the main method are key aspects which are essential for access to the higher marks.

Key differences between the Sc1 and the Twenty First Century Science model are

- more credit given for candidates who show innovation and imagination
- more credit given for the exploration and development of a strategy in terms of techniques and apparatus rather than following a standard/given technique
- less emphasis on candidates making predictions and knowing the answer before they start.
- more emphasis on rewarding the quality of the data collected
- a best fit approach to marking and assessment using a framework of performance descriptions
- uncoupling of ‘sub-skills’
- total marks from one investigation count (no cherry picking of marks for different strands from different investigations or using the I and/or E marks from a data analysis task)

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. Many candidates used scientific knowledge to make predictions about the outcome of the investigation at the beginning of the investigation (Sc1 style) whereas the C21 model aims to give credit for candidates who process their results, look for patterns and then suggest explanations using their scientific knowledge and understanding.

Familiar investigations such as 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 used, for example, stretching of plastics and other materials, exercise and fitness routines, efficiency of wind turbines, objects rolling down slopes or ski jumps, and which lemonade is best?

There was very often little information provided by Centres about how the investigation had been presented to candidates and this made it difficult to support the marks for S(c), the autonomy and independence aspect. This was particularly the case when it was clear that most of the candidates in the sample followed a very similar method and procedure.

Strand S: Strategy

Candidates who were awarded up to 6 marks were generally correctly marked. However, those candidates who were given higher marks were often not securely matched to the performance descriptions.

The intention is to encourage a more independent approach to investigation by candidates, and the mark awarded for the aspect, S(c), should reflect the ‘value added’ by the candidate, beyond the initial teacher stimulus. Most candidates developed their investigation from a more general brief provided by their teachers and this meant that few achieved higher than 6 marks for this aspect. It was noted that, in some cases, high marks were awarded even where candidates had identical ranges and values of the same variables, without any further discussion or justification. This indicated that limited individual decision making had occurred and consequently marks were adjusted downwards by the moderator putting the Centres concerned close to the tolerance limit or even beyond it.

In aspect (a), many candidates developed an investigation in a straightforward way and collected a good range of data, S(a)6, and used, but not necessarily selected, appropriate apparatus, S(b)6, from a general brief provided by their teachers, S(c)6. In aspect (b), whilst most candidates listed the apparatus and described the method they were going to use, only a few candidates described in sufficient depth and detail **why** they had selected the techniques and equipment used. For example, in the thiosulfate/acid investigation most candidates followed the familiar method of the ‘disappearing cross’ and measured the time when the cross could no longer been seen, obtaining 6 marks for this strand. Those candidates who were correctly awarded higher marks showed a more independent, thorough and rigorous approach. For example, candidates might consider what methods could be used to study the rate of this reaction such as measuring the volume of the sulphur dioxide gas, filtering off the sulphur and weighing it, measuring the pH of the solution or measuring any temperature change (etc). The candidate might consider each possible method and eliminate some and select the most appropriate method.

Candidates might directly suggest the disappearing cross technique from previous experience but they would need to perform preliminary work to find the best apparatus and the best conditions to produce accurate and reliable data e.g.

- a measuring cylinder to measure volumes +/- 1 cm^3
- a stop clock to measure to +/- 1 second
- a conical flask for shaking
- a thermometer to measure any change in temperature in the solutions
- use the same experimenter to ensure consistency of observation
- keep the depth of the solution the same to ensure consistency of observation
- experiment whether the solution should be left standing or shaken periodically
- experiment whether to change the concentration of the acid or the thiosulfate.

Therefore, even in what appears to be a straightforward investigation there are a number of possible routes that a good student could possibly explore. The complexity of a task represents an overall judgement about a number of things such as the familiarity of the activity and method, the ease of observation or measurement, 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. For candidates working at the high mark levels it would be expected that the candidate had some autonomy in deciding what preliminary work to do and in choosing the final technique and ranges used, so evidence related to S(b), S(c), C(b) and C(c) would all help to support the decisions in S(a).

Strand C: Collecting data

Many candidates generally achieved their best marks in this strand. Using suitable ranges of the appropriate variable to investigate and the need to repeat measurements were appreciated by the majority of candidates. However, in many cases the discussion about the identification and control of any interfering factors was surprisingly limited. Many candidates left it to be implicitly deduced from inspection of the table of results rather than any explicit discussion and comment about the need to control variables. Only those candidates who were awarded 7 or 8 marks provided further detail about how the factors had been monitored or controlled. In many cases when investigating rates, candidates stated that since the reaction had been carried out at room temperature the temperature had been controlled. In order to obtain a better match with the 8 mark criteria in aspect (a), candidates need to write much more fully about the context and purpose of their experiments and to discuss any factors which might interfere with the results.

Preliminary work is essential if candidates are to be awarded 7 or 8 marks in aspects (b) and (c). They must perform preliminary work to establish the range of values of the appropriate variable to be used in their investigation. Some candidates did perform preliminary work but did not use the results to explain how it informed their main method. Too often, candidates left consideration of reliability of their results until their evaluation, 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. The better candidates adapted and developed their initial work and modified their techniques accordingly to ensure that they produced data of the best quality.

Strands I and E.
In general candidates achieved their poorest marks in these two strands.
See the detailed 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 which would have helped many candidates who have language difficulties.
Data was generally accurately recorded and presented in appropriate tabular form, although the difficulty of recording 'time' in consistent and appropriate units was often seen. The allocation of marks for P(b) often proved problematic and more details can be found in the administrative section of this report.

Final comment

All members of the moderating team remarked on the care and effort put in by teachers to provide varied opportunities and motivating contexts for their candidates to achieve the best results in this new assessment framework. We would like to record our thanks and appreciation for a good job, thoroughly well done.
The importance of cluster group meetings, attendance at 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 this new assessment programme. It is highly advisable that staff have time during the year for internal standardisation meetings to share and develop expertise in the Science Department.

2008 Grade thresholds for Investigations

	Grade threshold								
Component	**Maximum mark**	**A***	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Data Analysis and Case Study	16 + 24 = 40	33	29	25	21	17	13	10	7
Investigations	40	33	30	26	23	19	16	13	10

The grade thresholds have been decided on the basis of the coursework that was presented for award in June 2008. It should be noted that this was the first cohort of candidates to submit 'Investigations' for assessment purposes. Thus, the threshold marks will not necessarily be the same in subsequent awards. Some adjustments may be expected as experience with the criteria grows, and a wider range of Centres becomes involved.

Grade Thresholds

General Certificate of Secondary Education
Chemistry A (Specification Code J634)
June 2008 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	25	21	17	13	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A321/02	Raw	42	34	30	25	21	16	13	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	28	25	22	19	16	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A322/02	Raw	42	34	29	23	17	12	9	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	24	19	15	11	7	0
	UMS	100	N/A	N/A	N/A	60	50	40	30	20	0
A323/02	Raw	55	28	22	16	10	6	4	N/A	N/A	0
	UMS	100	90	80	70	60	50	45	N/A	N/A	0
A329	Raw	40	33	29	25	21	17	13	10	7	0
	UMS	100	90	80	70	60	50	40	30	20	0
A330	Raw	40	33	30	26	23	19	16	13	10	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 2008. 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	17.6	50.1	80.8	95.0	98.6	99.6	99.9	100.0	100.0	10 392

11 008 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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