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GCSE

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Report on the Units

June 2009

J644/MS/R/09

Oxford Cambridge and RSA Examinations

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

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Chief Examiner's Report

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

The number of candidates that aggregated for the award of GCSE Chemistry has increased in comparison with June 2008 as some Centres introduce Triple Science provision. This increase in candidates was shown in all components of the specification. All the examination papers differentiated effectively and allowed candidates to demonstrate their knowledge and understanding of GCSE Chemistry.

The split of candidates taking the two different skills assessment routes (components B645 and B646) has not changed since June 2008. A slightly greater proportion of the candidates take the Can-Do and Science in the News route (B645) rather than the Data and Research Task route (B646). Although there was evidence that the candidates had been better prepared for the skills assessment, the grade thresholds for both components has reduced the percentage of candidates obtaining grades A and A*.

The entry policy by Centres has been very good and only a small proportion of the candidates were entered for the wrong tier of entry.

Candidates need to take much more care when using chemical formulae because these need to be totally correct. Candidates need to be advised to take care that upper and lower case letters are clearly differentiated for example $CuCO_3$ rather than $CuCo_3$. The examinations for this specification naturally include a significant number of word or symbol equations and candidates must avoid making the following errors and misconceptions:-

- including heat in a word or symbol equation
- writing a symbol equation or a formula when a word equation or name is required
- changing a formula that has already been given in the stem of a question
- using incorrect formulae for example O for O_2, Na_2 for Na or S_2 for S

Candidates found equations involving electrons the most difficult type to balance.

There has been a slight improvement with the way candidates cope with calculations, however, there are still many candidates that do not give any structure to their answers. Candidates should be advised to state the equation they are using (if appropriate), substitute in the numerical values and make certain that the final answer is clearly written at the end of the working out.

There has been an improvement in the way that candidates approach questions that involve extended answers. The use of bullet points and labelled diagrams would often pay dividends for candidates that find free-response answers difficult.

B641/01 Foundation Tier

General comments

The overall entry for this paper is relatively small but that is not surprising as most candidates taking the separate sciences are likely to be entered at Higher level. The paper performed well and the mean score increased slightly over last year. Scientific knowledge and understanding appears to be improving but candidates' power of expression is not. Longer answers are sometimes confused and contradictory. Answers can be vague and lack precision or correct terminology.

The paper was very accessible to the majority of candidates although very high scores were rarely seen.

All candidates appeared to have had enough time to complete the paper and there was little evidence of candidates finishing early. There was no evidence of misunderstanding the rubric or individual questions.

Comments on Individual Questions

SECTION A – MODULE C1

Question 1

(a) This scored well but a lot of candidates did not give an answer from the label as requested. They took the correct answer from the label and correctly identified it as food colouring from the table. This was credited. Common wrong answers were water or fat.

(b) This was well done with most candidates giving both of the possibilities.

(c) This was poorly answered. Common answers were: to stop it going off, to stop it going mouldy or to stop oxygen reaching it. Very few were able to say 'to stop it reacting with oxygen'.

Question 2

(a) Given that candidates were choosing from a list it was surprising how many got it wrong. The common wrong answer was carbon dioxide.

(b) This was very well answered with just the odd carbon dioxide being spotted.

Question 3

(a) **(i)** This was a common question and was reasonably well answered. Common errors were to put perfume in place of ester or to use a named mineral acid in place of the (organic) acid.

(ii) This was well answered.

(b) **(i)** Candidates still have great difficulty in understanding the word 'property' in its scientific sense even when examples of other properties are given. For that reason this question did not score well. Ester was a common wrong answer indicating that candidates were answering the question 'what is in a perfume?'.

(ii) This was also poorly answered with the common answer being smell cells. Another wrong answer was neurone.

Question 4

(a) **(i)** Most candidates were able to identify a reactant and some gave both reactants.

(ii) This was reasonably done. The common wrong answers were 2 or 4.

(iii) This was better answered than (a) (ii). Some candidates even named the elements.

(b) This was a common question. This was reasonably answered. However, to make sense it required more than a one word answer to indicate which way the energy was going and this may have confused some candidates.

Question 5

(a) This was well answered.

(b) This was not very well answered. Most of the answers were in terms of stopping the body from sweating or being able to breathe if it was over your face. The key to this answer is that Goretex allows the passage of gas or vapour but not significantly larger liquid drops or films. Even the better candidates had problems expressing this clearly.

(c) This was a common question. Once again many did not understand the term property and hood was a common answer. Insulation was another common response that was not credited.

Question 6

(a) This was a common question. There is a common misconception that heat rises in a fractionating tower so the highest temp is at the top. This is not the case but many answers were in terms of high rather than low boiling point.

(b) This was a common question. Many scored one mark for carbon and hydrogen but failed to score the second mark for 'only'.

(c) Expansion of the mark scheme to allow machinery or transportation fuelled by petrol made this much more accessible and most scored.

SECTION B – MODULE C2

Question 7

(a) A very long list of materials allowed most to score 2. The most common mistake was to give concrete or glass, which were already given in the question. Cement was not allowed as it is a constituent of concrete.

(b) **(i)** This was well answered.

(ii) This was not well answered. Adding metal was not enough to score. Some idea of bars or rods was required. Many candidates talked about adding more sand or using more layers or making it again.

(c) **(i)** This was a common question. It was reasonably well answered with common wrong answers being water or salt.

(ii) This was a common question. This was well answered. An interesting variation was to measure the angle in the diagram and calculate the answer from that. Depending on how the angle was measured this gave an answer of about 70.8 which was credited.

Question 8

(a) This was reasonably well done with salt being the common wrong answer.

(b) This was also reasonably well done with water being the common incorrect answer.

(c) This was a common question. This was very poorly answered. Those who gave the idea of a layer or coating then failed to explain how it stopped the aluminium corroding.

Question 9

(a) **(i)** This was well done.

(ii) This was a common question. This was not so well done. Many were able to give an acceptable numeric value but this on its own did not score. The most common explanation given was usually in terms of a trend in the table and these trends were often very poorly explained. Some were answered in terms of oxides of nitrogen rather than carbon dioxide.

(b) This was a common question and not well answered. A lot of answers were in terms of pollution or burning of fuel without any mention of which fuel, where or at what temperature.

(c) This was reasonably done but there was still a lot of reference to the ozone layer and unspecified pollution or killing things.

Question 10

(a) **(i)** Very well done.

(ii) Very well done.

(iii) This was not so well done. Most but not all correctly chose 40^{o}C but the mark was for the explanation rather than the number. Wrong answers were: stops first or makes more gas. Either of these answers with more detail could have gained credit.

(b) This was not very well done. Common answers were that all the gas was used up, the syringe was full or the calcium carbonate had dissolved.

(c) This was reasonably answered but a lot of candidates suggested adding more of one or both reactants.

SECTION C – MODULE C3

Question 11

This was well done. Hardly anyone failed to score. The common mistake was to get iodine and chlorine round the wrong way.

Question 12

(a) Most managed to select a transition metal but aluminium, tin, lead and the metals of Groups 1 and 2 all got a mention as well.

(b) Again the word properties was not well understood. Candidates gave strong, hard, heavy and durable as incorrect answers. They also gave uses rather than properties. When conduction was mentioned heat or electricity was seldom linked to it.

Question 13

All parts of this question were common.

(a) This was reasonably answered. Some confused atomic number with mass number and some counted neutrons rather than protons so incorrect answers of 6 and 11 were seen.

(b) See comments for Q13a. Incorrect answers were 5 or 6.

(c) **(i)** Groups 1, 2 and 3 all seemed to feature here in roughly equal amounts.

(ii) Periods 2 or 3 were given equally here.

Question 14

(a) This was fairly well answered but sodium (in the question) magnesium and calcium all got a mention.

(b) This was usually well answered.

(c) **(i)** This was a common question. It was reasonably answered but there were a lot of attempts to identify NaOH, some better than others, and gave that as the gas.

(ii) This was reasonably well answered but not all could name NaOH. A few answered that hydrogen is an alkaline solution.

Question 15

(a) This was not particularly well done. Some added the numbers or just gave 1.43 from the question. A lot could not take away correctly.

(b) This was well done. The common wrong answers were: changes colour or goes murky.

(c) This was not particularly well done with a lot of candidates using the word ‘decomposition’ which was in the question.

(d) **(i**) This was well done. A few gave Zinc as an incorrect answer.

(ii) Almost everybody got this correct.

B641/02 Higher Tier

Centres entry policy was very well targeted with only a small proportion of candidates whose performance suggested that they should have taken the Foundation examination paper.

The majority of candidates were able to attempt all the questions with only a small minority omitting more than one question.

A wide range of marks were seen, though there were many excellent papers with some candidates obtaining full marks.

A few candidates achieving marks below 10 would have been more suited to the foundation level.

Candidates took the examination very seriously, taking care over the presentation of their work, demonstrating to the best of their abilities what they knew and understood.

Future candidates should be informed that when writing word equations they should only include the names of the reactants and products. Too many candidates needlessly lose marks by writing plus heat after the reactants. In general the quality of presentation has been acceptable. More attention should, however, be given to the writing of formulae. Too many candidates lose marks by failing to show subscripts correctly and do not differentiate enough between capital and small letters.

Comments on Individual Questions

SECTION A – MODULE C1

Question 1

(a) Well answered with most knowing the word equation for esterification.

(b) Well answered. Many candidates knew that perfume had to evaporate to be smelt. Sent was a common wrong answer.

(c) This question differentiated very well with only the most able candidates able to score both marks. Weaker candidates stated that water and nail varnish would not mix or confused the process with the action of detergents mentioning hydrophobic/ hydrophilic.

Question 2

(a) A high proportion answered this correctly, with the disadvantages of incomplete combustion being well known. Some lost marks by saying ‘no harmful gases produced’ without further qualification.

(b) Most candidates realised that energy is transferred to the surroundings in an exothermic process. That breaking bonds is an endothermic process was not well known, with exothermic occurring very frequently.

Question 3

(a) The properties of Gore-Tex were well known with the most common correct responses being strength or lightweight. Incorrect responses tended to be linked to insulating properties, removal of sweat, heat or the coat being able to breathe.

(b) Most candidates were able to describe an idea relating to coping with perspiration, wetness or sweat. Incorrect responses tended to be linked to removal of body heat.

(c) Many candidates omitted a reference to holes or the size of the holes. Of those who realised the significance of the holes many then lost marks by saying sweat would pass through without referring to vapour or that 'water molecules couldn't pass through the tiny holes'.

Question 4

(a) The majority of candidates correctly stated that LPG had a low or the lowest boiling point.

(b) Most candidates appreciated that larger molecules have higher boiling points, but fewer could link this to the forces between the molecules and score the second mark.

(c) The majority of candidates realised that a hydrocarbon consists of hydrogen and carbon but a significant number did not score the second mark on omission of the word 'only'. Some candidates scored zero as they wrote about hydrogen and carbon molecules.

Question 5

(a) Almost all candidates were able to select B as the fuel which gave out most energy.

(b) Few candidates scored 2 marks, the majority substituting the mass of the fuel instead of water in the equation and obtaining 1 mark for the answer 252.

SECTION B – MODULE C2

Question 6

(a) **(i)** The majority of candidates correctly identified 'sand' as substance A on the pie chart.

(ii) Almost all candidates were able to calculate the percentage of substance A from the pie chart.

(b) The majority of candidates were able to write the word equation. Common errors were including the words energy, oxygen or heat in the body of the equation.

(c) Cement was correctly named as the building material by most candidates with the most common wrong answer being 'brick'.

(d) **(i)(ii)** A very well answered question. More candidates knew that limestone was a sedimentary rock than knew that granite was igneous.

Question 7

(a) The formation of a protective oxide layer on aluminium was well known with many candidates getting both marks. Almost all managed to get at least one mark, usually by reference to the oxide layer.

(b) **(i)** Many candidates lost marks here by not writing a comparison referring to low density and not just lower density. The most common way of obtaining the mark was by using the information from the table and referring to a lack of corrosion.

(ii) Many candidates lost marks by not writing a comparison e.g. 'not very strong'. 'Not as strong as iron' would be credited.

(c) Generally well answered, with most discussing landfill sites, disposal problems and conserving natural resources. A number of candidates did not score a mark by suggesting that recycling saves energy.

Question 8

(a) The majority of answers were correct. The explanation usually referred to the pattern of numbers rather than a scientific idea such as deforestation or increase in population.

(b) Many lost marks here by not referring to engines or exhausts although they realised where the gas had been produced. Incomplete combustion was another common incorrect response.

(c) Most candidates were able to write the equation with the aid of the symbols and formulae provided though few managed to balance it correctly.

Question 9

(a) Many candidates were able to interpret the graph and calculated the rate as 2.5. A number of candidates multiplied the volume by time.

(b) Almost all candidates knew that particles gained energy or heat at higher temperatures. A few negated that mark by referring to particles vibrating more. A number of candidates were able to score a second mark by referring to 'more successful collisions' or 'more likely collisions'. It was rare to see 3 marks being achieved, the frequency of collisions being the least given answer.

SECTION C – MODULE C3

Question 10

(a) **(i)** Potential grade A candidates were able to score a mark. Reference to losing and gaining electrons often lost marks.

(ii)(iii) How ionic compounds conducted electricity was not well known with many candidates giving an answer more appropriate to conduction through metals, relating the conduction process to electrons rather than ions. The word particle was often used instead of ion.

(b) A poor understanding of ionic bonding was also apparent in this question with very few candidates being able to correctly draw the diagrams and include the correct charge. Many ignored the charges, gave $^{+}$, or $^{-}$, or the oxidation states +2 and -2. A significant minority drew covalent bonding structures.

Question 11

(a) A question that did not differentiate very well. Too many candidates failed to give the obvious answer that X remained colourless. Many candidates referred to transition metals as being coloured not their compounds.

(c) A significant number of candidates were unable to correctly balance the ionic equation for the formation of iron(III)hydroxide. The most common errors were not balancing the OH^- or placing a 3 in front of $Fe(OH)_3$.

Question 12

(a) Very well answered, the majority of candidates correctly giving 11 as the atomic number.

(b) The majority of candidates gave 5 as the mass number.

(c) **(i)** A large number of candidates correctly assigned the element to Group 3.

(ii) Weaker candidates were unable to correctly assign the period as 2.

(d) A question that differentiated very well with all potential Grade A candidates able to score a mark. Large numbers of candidates just drew the same isotope.

Question 13

(a) **(i)** Well answered, the gas hydrogen correctly identified.

(ii) Well answered, sodium hydroxide identified as the alkaline solution.

(b) Candidates did not always make use of the stem of the question to aid them with their response to this question. Many omitted to include an observation, whilst a few wrote the equation correctly but called the product francium oxide or didn't name the products. Weaker candidates described Francium's reaction based on it being radioactive and unstable.

Question 14

Most candidates managed to obtain at least 1 mark, usually by reference to aluminium, though the majority thought sulfur was the product of electrolysis of sulfuric acid at the anode.

B642/01 Foundation Tier

As in previous sessions, there were only a small number of candidates entered for this component. The average mark for this examination paper was 28, and the marks achieved by the candidates ranged from 5 to 55. The vast majority of candidates were entered at the appropriate level.

All sections of the examination paper differentiated well and allowed candidates to demonstrate their knowledge and understanding of GCSE Chemistry.
Most questions were attempted by the candidates. All three sections of the examination paper proved to be equally demanding.

Comments on Individual Questions

SECTION A – MODULE C4

Question 1

This question was about precipitation reactions and chemical compounds.

(a) Many candidates were unaware that the total mass stays the same during a precipitation reaction. A common misconception was that the mass increases.

(b) Most candidates were able to correctly state the name of one of the products of the reaction in part (i). In part (ii), however, few candidates knew that the colour of the barium sulfate precipitate is white.

(c) The majority of candidates correctly identified $BaSO_4$ and Na_2SO_4 as compounds that contain three elements in part (i). In part (ii) the number of candidates who correctly calculated the relative formula mass of sodium sulfate as 142 was pleasing.

Question 2

This question focused on nanochemistry and was the most demanding question in Section A. This remains an area of the specification that is not well understood by candidates.

(a) Most candidates correctly named carbon as the element in Buckminster fullerene.

(b) Many candidates, despite identifying carbon in part (a), did not correctly identify Buckminster fullerene as a black solid. The most common misconception was that it is a colourless and clear solid.

(c) Only a very small proportion of candidates correctly explained that scientists join Buckminster fullerene molecules together to make nanotubes. Simply stating that molecules are put together was insufficient.

(d) Uses of nanotubes were not well known. Credit was not given for use in electrical wiring or to conduct electricity as this was given in the stem of the question. Candidates who answered this question correctly usually talked about the use in tennis rackets, although the mark was not awarded for use in tennis racket strings.

Question 3

This question focused on the use of solvents to clean clothes and was the least demanding question on the whole examination paper, with virtually all candidates gaining at least 3 marks.

(a) The majority of candidates stated that solvent B did not dissolve any of the stains.

(b) The majority of candidates stated that solvent D would dissolve paint.

(c) The majority of candidates stated that solvent D would be the most suitable for removing stains from clothes.

(d) Far fewer candidates knew that dry cleaning is a process used to clean clothes that does not involve water. Common misconceptions were that dry cleaning uses steam, uses no liquid or that the clothes don't get wet.

Question 4

This question was about manufacturing processes and ammonia.

(a) In part (i) many candidates correctly described a continuous process as a process that happens all the time, although a sizeable minority simply restated the question and failed to score. The meaning of a batch process in part (ii) was less well known and again many candidates gave vague responses such as 'when a product is made in batches' which did not gain credit.

(b) In order to gain full marks in this question, candidates had to write a correct word equation and then state two correct conditions for the Haber process. The majority of candidates were able to score a mark for a correct condition (450°C, high pressure or a catalyst) although weaker candidates tended to be imprecise stating simply 'warm', 'high temperature' or 'pressure'. Many candidates gained credit for the idea of recycling nitrogen and hydrogen back into the reaction container. A sizeable minority included unreacted nitrogen and hydrogen in the word equation and did not gain credit. Candidates who wrote a correct symbol equation, rather than a word equation, were credited.

(c) Many candidates correctly named another fertiliser made from ammonia in part (i), usually ammonium nitrate or ammonium sulfate. *Ammonia* nitrate or *ammonia* sulfate however remain common errors. In part (ii), only a very small proportion of candidates could correctly name phosphoric acid. Phosphorus was a common error.

SECTION B – MODULE C5

Question 5

This question involved the interpretation of information on food packaging.

(a) The majority of candidates recognised that niacin was in the greatest amount in 100g of cornflakes.

(b) Many candidates correctly calculated the mass of iron in 300g of cornflakes.

(c) This question discriminated well with only the most able candidates calculating the correct mass of cornflakes.

Question 6

This question about precipitation reactions was the most demanding question on the whole examination paper.

(a) Candidates were asked to select the colour of the silver iodide precipitate from a list. All three colours were seen in equal measure, indicating that many candidates were simply guessing.

(b) This question proved to be the most demanding question in Section B and a significant proportion of candidates did not attempt it. The vast majority of candidates who attempted the question simply described heating the lead iodide to dryness. Candidates were expected to describe filtering the insoluble precipitate, washing the residue with water and then putting the precipitate in an oven to dry or leaving it in the air to evaporate. Answers that did not include filtering did not score any marks.

Question 7

This question focused on the manufacture of sulfuric acid in the Contact Process.

(a) Although this was a low demand question, many candidates could not name the raw materials from which sulfur dioxide and oxygen are obtained. Sulfur, as the raw material for sulfur dioxide, was better known with oxygen a common error as the raw material from which oxygen is obtained.

(b) Most candidates correctly recognised the symbol for a reversible reaction.

(c) Only a small proportion of candidates were able to name the gas produced in the reaction between sulfur dioxide and oxygen.

Question 8

This question about titrations was the least demanding question in Section B.

(a) Although this was a low demand question, many candidates could not name apparatus **X** as a burette.

(b) In part (i) most candidates described that the pH value increases as more and more alkali is added to an acid. Many candidates correctly identified the correct pH value of 1.3 or 1.4 in part (ii), although 1.2 was a common error by those who misread the pH scale on the graph. In part (iii) most candidates correctly gave the volume of alkali needed to neutralise the acid as 30cm^3.

(c) The majority of candidates correctly chose universal indicator from the list.

Question 9

This question was about electrolysis.

(a) Very few candidates could explain what is meant by electrolysis, with many answering about making electricity or referring to electrolysis as a process for purifying metals. To be awarded the mark, candidates had to refer to the breakdown or decomposition of a substance using electricity.

(b) Approximately half the candidates correctly selected hydrogen from the list. Hydrogen chloride was a very common misconception or guess.

(c) Many candidates correctly selected the formula of a negative ion and the formula of a molecule from the list of particles given.

SECTION C – MODULE C6

Question 10

This question was about fuel cells.

(a) Many candidates correctly selected electrical energy from the list. Kinetic energy was a common distracter.

(b) The majority of candidates wrote a correct word equation for the reaction of hydrogen with oxygen. Some candidates still try to write a symbol equation when a word equation is all that is required. Although a correct, unbalanced, symbol equation was credited some candidates lost the mark for writing $H + O \rightarrow H_2O$.

(c) A significant proportion of candidates are still confused about the tests for gases. Some candidates did not gain credit as they talked simply about using a splint, without stating that the splint was lit, whilst others referred to a glowing splint. A sizeable minority of candidates wrote about using limewater, which would turn cloudy.

(d) The reasons why car makers may replace diesel or petrol engines with fuel cells were not well known. Many candidates gave vague answers in terms of fuel cells being more environmentally friendly/less damaging to the environment. These candidates did not gain credit.

Question 11

This question about calcium carbonate and hard water was the most demanding question in Section C.

(a) Very few candidates knew what hard water is in part (i), with most candidates describing water containing calcium carbonate or limescale. In part (ii) more candidates were able to state the total number of atoms in $CaCO_3$, although a sizeable minority attempted to calculate the formula mass.

(b) Acids was usually correct.

(c) Few candidates could describe a way in which hardness can be removed, with use of a water softener being the most common answer that failed to score.

Question 12

This question focused on the reactions of metals and was the least demanding question in Section C.

(a) The majority of candidates correctly named water and air/oxygen as the two substances needed for iron to go rusty.

(b) In part (i) although it was well known that oil or grease formed a protective barrier, many candidates did not include that the barrier prevented oxygen and/or water reaching the iron. Other methods of stopping iron from rusting were well known in part (ii).

(c) Many candidates wrote the correct order of reactivity of the metals. A common error was to write the metal salts.

Question 13

This question was about ethanol.

(a) Most candidates correctly chose distillation from the list.

(b) Although this was a low demand question, many candidates were unable to state a correct use of ethanol and a significant minority did not attempt the question. Common responses which were not credited included ‘alcohol’, ‘to make alcohol’ or ‘used as petrol’.

(c) Only an extremely small proportion of candidates correctly drew the displayed formula of ethanol. The displayed formula of ethene on the paper seemed to have confused, rather than helped, many candidates who included a double bond in the displayed formula.

(d) The majority of candidates did not know that the conversion of ethanol into ethene and water is a dehydration reaction.

B642/02 Higher Tier

The average mark for this examination paper was 35, and the range of marks obtained was from 1 to 59. As in the June 2008 session a small but significant number of candidates obtained marks which suggested they would have been better suited to the Foundation Tier examination paper rather than the Higher Tier.

All sections of the examination papers differentiated well and allowed candidates to demonstrate their knowledge and understanding of GCSE Chemistry. As in June 2008 candidates found Section C a little more accessible than the other two sections but there was some improvement in terms of the ability of candidates to tackle the quantitative problems in Sections A and B.

Comments on Individual Questions

SECTION A – MODULE C4

Question 1

This question was the least demanding in Section A and focussed on the precipitation reactions of aqueous barium chloride.

In (a) candidates needed to refer to the same number of atoms on both sides of the equation. Reference to 'the same amount of each element' was also allowed but 'there was the same number of each element' was not given credit. An extremely small proportion of candidates used relative formula masses to explain why there was a conservation of mass. If the calculations were correct these candidates were given credit. Many candidates gave answers that just referred to the lack of a gas being produced in order to explain why there is a conservation of mass.

In (b) only an extremely small proportion of candidates were not able to write the word equation. The use of ammonia chloride rather than ammonium chloride was not given credit.

Many candidates were able to deduce that the formula for ammonium sulfate contains 15 atoms in (c) (i) but fewer candidates could calculate the relative formula mass of iron(III) sulfate as 400 in (c) (ii).

Question 2

This question focussed on Buckminster fullerene and nanotubes and was the most demanding in Section A.

In (a) many candidates could recall the formula for Buckminster fullerene although there was a small proportion of candidates that thought it was a hydrocarbon rather than a form of carbon. The use of caged molecules as a drug delivery system was given by some candidates but a significant proportion of the candidates did not attempt this question.

In part (b) a significant proportion of candidates realised that nanotubes have a large surface area but far fewer candidates described that a catalyst could be attached to the surface of the nanotube. Common reasons for not giving credit included having a high melting point and good electrical conductivity. In (b) (ii) the most common use was in strengthening graphite or in tennis rackets.

Question 3

This question focussed on dry cleaning.
In (a) although a high proportion of candidates could suggest that dry cleaning does not involve water some candidates failed to mention water at all.

Question (b) was targeted at A and A* and good answers were often illustrated with labelled diagrams. Only a very small proportion of the candidates either referred to the non-polar nature of the solvent or that solvent molecules surround grease molecules. Many more candidates referred to the formation of intermolecular forces between solvent and grease molecules. A common misconception was to confuse the action of a solvent with that of detergent.

In (c) many candidates gave sensible advantages of using solid carbon dioxide. These included carbon dioxide was less harmful, non-toxic and that it does not damage the clothes.

Question 4

This question focussed on the manufacture of ammonia and the use of fertilisers.
In (a) many candidates were able to refer to the high demand for ammonia. A significant proportion of candidates referred to recycling of hydrogen and nitrogen rather than the demand for ammonia.

In (b) many candidates scored full marks, giving both the conditions and reasons for the conditions even though the reasons were not required. Candidates giving a symbol equation instead of the word equation often gave incorrect formulae e.g. H_3 or NH_4 and so were not given credit. Although candidates were awarded a mark by just referring to a high pressure a small proportion of candidates gave a numerical value without stating the units.

Phosphoric acid was well known in (c) although phosphorus acid was not given credit.

Many candidates in (d) had the misconception that nitrates, ammonia, ammonium salts and phosphates are essential elements. The specification clearly states that nitrogen, phosphorus and potassium are the essential elements. Candidates only had to refer to one of these essential elements to be awarded a mark. A significant proportion of candidates were able to make the link between nitrogen, nitrates, ammonia and ammonium ions in the production of protein within a plant. A common misconception was that fertilisers contain plant protein.

SECTION B – MODULE C5

Question 5

This question focussed on additives found in cornflakes and was the most demanding question in Section B.

In (a) a significant proportion of candidates could calculate that the mass was 200g. A common incorrect calculation involved multiplying 0.7 by 2.

In (b) (i) many candidates could determine the percentage as 30% however 33% was also a common answer. Question (ii) allowed candidates the scope to use a large variety of different methods to show that all the sodium came from salt. One of the most common methods used the percentage of sodium in sodium chloride. Other methods used the number of moles of sodium and the number of moles of sodium chloride in the sample. A significant proportion of the candidates did not attempt this calculation.

Question 6

This question was the least demanding in Section B and focused on the preparation of lead iodide.
In (a) many candidates appreciated that the reaction mixture had to be filtered but fewer could describe a suitable way of drying the sample and even fewer how to wash the sample. A common misconception was to describe crystallisation of lead iodide from the reaction mixture.
An extremely large proportion of candidates were able to balance the equation in (b). A small proportion of candidates failed to copy the correct formula or used lower case letters rather than capital letters for the symbol for nitrogen and for hydrogen.

Question 7

This question focussed on the titration of an acid by an alkali.
Most candidates were able to interpret the pH titration curve getting 1.4 in (a) (i) and 30 cm^3 in (a) (ii).

In (b) a greater proportion of candidates than in previous sessions could answer this type of question but it was still not well answered and a significant proportion of the candidates did not attempt the calculation. Full marks were awarded for the correct answer of 0.08 mol dm^{-3}. A significant proportion of candidates were not able to calculate the number of moles of sodium hydroxide often quoting 2 moles rather than 0.002 moles. An even larger proportion of candidates did not realise that the moles of sodium hydroxide was the same as the moles of hydrochloric acid. A significant proportion of candidates used the relationship between moles, molar mass and mass rather than moles, volume and concentration.

Question 8

This question focussed on the electrolysis of some aqueous solutions.
In (a) many candidates realised that hydrogen was made at the negative electrode although a significant proportion of candidates stated that the gas was nitrogen.
In (b) candidates had to recognise the importance of the hydrogen ion and what happens to the ion, many candidates just recognised that the hydrogen ion was important and did not mention the H^+ gaining electrons or being attracted to the cathode.
Many candidates in (c) appreciated that hydrochloric acid was a strong acid whereas ethanoic acid was a weak acid. Some of the explanations used focussed more on the difference between strong and weak acids rather than on the ability of mobile ions to transfer charge.

Question 9

Many candidates could not deduce or recall the two balanced symbol equations. The formula for sulfuric acid was not well known and the formula of sulfur was often given as S_2.

SECTION C – MODULE C6

Question 10

This question focussed on the hydrogen-oxygen fuel cell.

In (a) a significant proportion of candidates included + heat in the word equation, this was not given a mark. Candidates who wrote a symbol equation often included incorrect formulae and so were not awarded a mark.

The most common responses for (b) were that fuel cells produced only water or no carbon dioxide was made. A smaller proportion of candidates referred to the difference in energy efficiency. Candidates often did not make it clear whether their answer referred to petrol engines or fuel cells.

In (c) many candidates were not able to construct the equation. Typical misconceptions included having electrons on the wrong side of the equation and using the symbol e^+.

Almost all of the candidates were able to identify exothermic in (d).

Question 11

This question which focussed on rusting and rust prevention was the least demanding question in Section C.

In (a) (i) many candidates explained that oil acts as a protective barrier stopping oxygen or water from reaching the iron. Candidates were not given credit for stating that oil or grease does not react with oxygen or water. Although some candidates described sacrificial protection others only focused on zinc acting as a protective barrier. One common misconception was that zinc did not react with oxygen.

The majority of the candidates in (b) were able to recognise that the reaction was oxidation.

Question 12

This question focussed on two painkilling drugs.

In (a) many candidates correctly stated that the molecular formula was $C_8H_9O_2N$. Candidates could give any order of the elements. One mark was available for candidates that did not write a molecular formula but had the correct number of each type of atom.

Candidates in (b) often gave long-term effects of using aspirin rather than as an overdose.

Many candidates were awarded a mark in (c) but those that were not often failed to make a comparative statement e.g.' it is easier to take a solution' was awarded a mark but 'it is easy to take' was not.

Question 13

This question focussed on ethanol and was the most demanding in Section C.

Although in (a) (i) many candidates referred to the enzymes being denatured or yeast being killed candidates that muddled these ideas for example that enzymes are killed were not awarded a mark. In (ii) the majority of candidates repeated the information in the stem rather than attempt to explain why the reaction was slower. Only a very small proportion of candidates were able to use ideas about collision theory to explain why the reaction was very slow. In (iii) some candidates correctly referred to the formation of ethanoic acid or vinegar if oxygen was present. Two common misconceptions were that oxygen would kill the yeast or would react with the yeast.

In (b) although many candidates identified distillation as the correct method of separating ethanol and water, filtration was quite a strong distracter.

The displayed formula for ethanol was not well known in (c) and often included a carbon-carbon double bond and sometimes the order of the OH was reversed.

Many candidates in (d) could deduce the molecular formula of pentanol as $C_5H_{11}OH$.

B645 Report on Gateway Science Skills Assessment

A General Comments

Although this is for some teachers and moderators the third year of this form of skills assessment, some centres are still making the mistakes common in the first two years. It is pleasing to report that there are many candidates who now produce good considerations of the topic in their Science in the News report, looking for and against and then using their research to come to a considered decision. Unfortunately there are still centres that seem to regard this aspect of the specification as irrelevant, consequently not preparing candidates with the necessary skills. Science in the News reports are then produced which do not embrace the importance of candidates researching arguments for and against. The reports are sometimes merely essays on the topic with scant regard for matching the Qualities.
For Science skills assessment, there are two components Can-Do tasks and Science in the News.

A total of 104087 candidates entered either for Science B625 or separate Biology(B635), Chemistry(B645) and Physics(B655).
The table summarises the number of candidates in each specification.

Specification	Subject	Number of candidates
B625	Science	81244
B635	Biology	9336
B645	Chemistry	6914
B655	Physics	6593

It is pleasing to report that there is an increase in the number of candidates doing separate Sciences.
It is possible that candidates use the same piece of Science in the News for more than one specification. However, each specification is moderated separately so if the same piece of work is used it must be photocopied each time it is used. Marks cannot be just transferred from one specification to another. Some centres continue to ignore this important point. Failure to do this makes the Moderator's job more difficult.
Centres are reminded that if a piece of work is resubmitted in a following year, the Science in the News report cannot be added too, but new Can-Do tasks can be attempted. If the Science in the News report is not considered to represent the true standard of the candidate a new and different Science in the News task should be attempted.

B Administration matters

General

Teachers are required to supply, for each of the candidates chosen in the sample, a breakdown of the marks awarded for the Can-Do tasks together with the marks awarded for each of the six Qualities in the Science in the News Task which had been chosen for assessment. Despite the column on the form, dates for the Can-Do tasks are not essential. There were still some arithmetical errors in Can-Do tasks. If moderators find any mistakes in the sample, the centre will be asked to check the arithmetic of the whole sample. Centres must use the Can-Do tasks listed in the specification and on the Skills Assessment Record. They cannot devise their own. For a separate science, e.g. Chemistry, all the Can-Do tasks must be from the Chemistry list.

Selecting tasks for Science in the News

One of the strengths of Gateway Skills Assessment is that all of the materials which are required for each of the Science in the News tasks are provided by OCR and are available on the secure Interchange website. Some centres have not realised that new tasks have been added each year. Some centres still use unapproved and unsuitable tasks. If they do not fully match the requirements of a task, candidate marks will suffer. If a centre has a good idea for a task, it must be approved by OCR in advance of its use (see Science Support Booklet p27).
A task set for P1, for example, cannot be used for Biology and a task from P5 or P6 cannot be used for Science. Centres still disregard this instruction. Although the task about mobile phones in P5 may seem suitable for P1 because mobile phones are mentioned in P1d, candidates will not have covered the additional theory in P5.

There were some problems where centres were attempting to double enter from Entry Level but this was less significant this year.

Supervision of Skills Assessment

One of the strengths of Gateway Skills Assessment is that the assessed work is under the direct control of the teacher.
All Science in the News reports are to be written under controlled conditions where the teacher can sign the Centre Authentication Form (CSS160) with confidence.
The teacher should give the candidates the OCR stimulus material for a task after the topic has been studied so that they are fully equipped with background knowledge. The teacher must not give any opinion on the question for the task. However, they may read through the stimulus material and explain any scientific words.

OCR provides a writing frame which should only be used with lower-attaining candidates. Centres are allowed to use their own writing frames providing they are generic i.e. not specific to the task and is applicable for all tasks. There are still a few centres trying to use non-generic writing frames which provided too much help to candidates.

There is considerable evidence that candidates do their best when they are given independence to study the topic and look at both sides of the argument. It is common, in some centres, for candidates to be provided with a list of suitable sources. Even if they are fully referenced this does not automatically give the candidates 4 marks for Quality A. Sources must be used and not just quoted. It is not unusual to see 10 or more sources listed. This is totally unnecessary as no candidate can use all of these adequately in the report. Telling them which are for and which are against the argument is giving too much help.

Research time

Each Topic requires the candidates to undertake some research for themselves in a period of approximately one week. This research could be carried out in school, either in the laboratory or a computer facility or it could be done at home. It is emphasised that the candidates do not need to be supervised during this preliminary research and they do not necessarily need to work on their own. If the preliminary research is done in school, teachers can provide a range of materials from which the candidates can select to get started with their task. However, it was felt that in some centres the candidates had been provided with a complete list of source material for use thus removing the necessary element of choice and selection on the part of the candidate for relevant aspects. The best reports came where students had the freedom to investigate the question set selecting their own sources.
Where there are a large number of candidates in the sample it is reasonable to expect

- a range of source materials used
- different processing to be done in Quality B, for example, not all candidates having the same bar chart
- candidates answering the question in different ways.

Supervised session

The Science in the News report is written up under controlled conditions following the completion of the preliminary research. A time of 1 hour is suggested but the centre may extend or reduce the time if required. If more than one lesson is needed, the work must be collected in from the candidates at the end of the first lesson and stored securely until the second session. During the supervised session, candidates are required to work independently.

A limit of 400-800 words is also suggested in the specification.

Candidates can bring into the supervised session charts/graphs that they have completed as well as a completed bibliography, thus reducing wasted time during the session. They may not bring in word processed or hand written reports.

Some candidates are using word processors to produce their reports.
Centres are reminded this is acceptable providing the centre can ensure:

- that no complete or largely complete report is brought into the supervised session in any electronic format
- no completed report is taken out or e-mailed to another person
- the candidate cannot access websites electronically either from storage devices or the Internet. The Internet should not be accessible during the writing up session.

If these conditions cannot be guaranteed, it is not possible for the teacher to sign the Centre Authentication Form, and hand-written reports should be submitted.

It was an increasing trend, this year, to see word processed reports where almost the whole report had been pasted in electronically from websites without any acknowledgement as if it was the writing of the candidate. Awarding Quality F marks is impossible.

Under no circumstances should any Science in the News tasks be drafted, marked and subsequently redrafted. What is produced at the end of the supervised writing session has to be submitted. If there are deficiencies, candidates should be told how to improve next time and given another task to do. There was still clear evidence that drafting and redrafting, or teachers advising candidates to make additions, went on in a small minority of Centres. This is totally unacceptable.
Evidence of drafting and redrafting of candidates' reports or too much coaching will lead to the work not being accepted for moderation and being reported to the Malpractices committee.

C Can-Do Tasks

Can-Do tasks are an important part of the Gateway Science specification. They are motivational for students at all attainment levels. These tasks ensure that practical Science is an important aspect of teaching for this specification. Some of the tasks can also ensure that ICT is used appropriately.

They are not expected to differentiate candidates at Grade C and above.

The tasks can be used throughout KS3 and KS4 and candidates at an earlier stage will clearly benefit from having their positive achievements rewarded. All the teacher needs to do is to record the tasks each candidate achieves. For a task to be credited it must be carried out as individual work. Groups of candidates cannot work collectively to complete a task. All aspects of a task must be completed before credit is given and it is not possible to award 1 or 2 marks for a 3 mark task.

Centres are not expected to provide any evidence for the moderator to support the awarding of marks for Can-Do tasks.

It is pleasing to see that candidates are taking these seriously and centres are reporting the benefits of motivation of candidates at all levels but especially with lower-attaining candidates.

D Science in the News

Approach

Since Can-Do tasks will not differentiate at Grade C and above, it is essential that the necessary differentiation between the levels of attainment of candidates is obtained using Science in the News.

From September 2008 there were some slight changes to the mark descriptors. The use of these new mark descriptors caused no problems this year.
The mark descriptors must be applied hierarchically. They can only be awarded when the whole statement is fully matched. There are still some centres trying to use a ‘best-fit’ principle.

It has always been OCR policy to encourage teachers to annotate coursework. As candidates may attempt several Science in the News tasks, this represents a burden on teachers when, in reality, very little of the work will be seen by a moderator. It is recommended that the emphasis should be given to reporting back to students on their early tasks so they can improve for the final one. When the sample is requested by the moderator, a little time should be spent annotating the maximum 20 reports that have to be sent. In particular annotation should concentrate on why intermediate marks (i.e. 1, 3 and 5) have been awarded. The aim of annotation is to provide evidence that the moderator is able to accept in support of the marks awarded by the centre.

It is important that internal standardisation is carried out and the moderator informed of the way in which it has been done. Several centres had clearly not internally standardised the marks and consequently the rank order was not valid. In such cases the sample had to be returned to the centre. This is not desirable for the teachers at centres, for moderators or for OCR, if work has to be returned at the beginning of June to be re-marked. It is possible that the marks of a centre could be reduced if one or two teachers have over-marked and internal standardisation has not taken place.

Quality A (Approach to the Task)

Candidates who do not undertake any research of their own cannot be awarded a mark in Quality A since the use of the OCR source material does not count for research purposes. However, candidates who do not do any research for themselves are able to gain marks in the other five Qualities.
For 2 marks candidates only need to use one source - from a book, newspaper, Internet etc. The source does not have to be referenced.

For 4 marks, however a candidate must use more than one source. Two sources are sufficient and it helps later in their report if one source is for and one source is against the question posed. It is essential that each of the sources is fully referenced so that it can be checked. It is also essential that the source is clearly identified where it has been used in the report.
Without detailed referencing it is very difficult to support a match to 4 marks. A long list of sources, even if fully referenced, does not mean the award of 4 marks unless they are used.

For an award of 6 marks it has to be clear that the sources have been used correctly to produce a structured and balanced report. The candidate is expected to have looked at both sides of the issue. Centres are reminded that 6 marks is awarded for the quality of the research and how it is used to produce a balanced report, rather than the quantity of research which has been carried out. Again it is important to say that little credit can be given where large amounts from a website have just been pasted in but not used even if the work is fully referenced.

It is recommended that candidates attach their preliminary research to the back of the report which has been produced during the supervised session. This will assist the teacher in marking the report since it will save having to go back to the sources to check the information. This preliminary work does not have to be sent to the moderator.

Quality B (Analysis of the data)

The award of marks for this quality is dependent on the candidates actually processing the information/data which they have collected from their sources or the OCR stimulus material.

For 2 marks the candidate needs to identify a simple trend or pattern e.g. *'….more women get skin cancer than men…*'. It is not sufficient to quote just a fact e.g. *'…7000 women in England get skin cancer…'*. The trends quoted must be correct. Trends can come from the OCR source material or from the candidate's research. There are always ample trends and/or patterns within the OCR stimulus material.

There are still many examples of candidates carrying out processing, even quite advanced processing, without identifying any trend. This cannot be awarded 2 marks as the mark descriptors are hierarchical.

For 4 marks there must be evidence of more than one trend, although which is the main trend may not be obvious, and some processing done by the candidate. Processing could be drawing a graph, pie chart or bar chart from the data, calculating averages or percentages, or extracting and using data from a graph etc. All processing must be correct. A poorly drawn graph with incorrect scales or incorrect average calculations will not gain credit. Teachers are reminded that, for the sort of data obtained, bar charts are often more appropriate than line graphs.

Still few candidates progressed beyond 4 marks. This is not surprising considering the hierarchical nature of the mark descriptors. It is not sufficient just to pick out an apparent anomaly in data. To secure above 4 marks the candidate must do some **further** processing to identify some new information or to identify anomalies. In a few cases it was apparent that a candidate was told to take a particular approach to get 6 marks, however, they did not fully understand what they were trying to do. This is an increasing and unwanted trend where teachers are giving far too much direction to candidates to undertake processing which they don't understand.

The moderator does expect to see different approaches to the same task from different candidates within the centre.

Quality C (Evaluation of the data)

The accuracy, reliability and validity of data are important aspects of Science National Criteria and they are assessed in Science through the Science in the News task. There are still some reports where these are totally ignored and so a mark of zero has to be awarded.

For 2 marks the candidate needs to make some comment about the quality of the sources used or the data within them. This can be a very simple statement.

For 4 marks the candidate must compare the reliability of different sources and explain why one source is likely to be more reliable than another. To award more than 4 marks the candidate's judgement about reliability of sources must be sensible and supported. They must also consider the validity of the sources.

Quality D (Relating Data to the issues)

Again social, economic and environmental aspects of the topic are an important part of Science National Criteria. Some centres did not develop these aspects sufficiently with their candidates during the teaching process.

Not all Science in the News tasks provide the same opportunities for consideration of social, economic and environmental aspects and it is difficult to link all three of them in some tasks. Teachers should remember that the 2, 4 and 6 mark descriptors are loosely linked to performance at F, C and A respectively. So when awarding 2 marks teachers should ask whether the response matches the expectation from an F grade candidate. Similarly, performance at C and A can be the evidence for awarding 4 and 6 marks. It is not necessary to cover all three aspects even at 6 marks providing the approach to these aspects is at a suitably high level.

Often these social, economic and environmental aspects were diffused throughout reports rather than in a separate section. This does not affect the mark awarded but makes it more difficult for both the teacher and the moderator.

Quality E (Justifying a conclusion)

All of the tasks are posed as questions and therefore an answer must be given. Most candidates now are giving an answer and a reason which allows the award of 2 marks.

To award 4 marks the candidate needs to show that they came to their answer using what they have found out. That is why it is essential to refer back to sources although full references are not needed.

For 6 marks a candidate needs to decide which source is more significant in helping them to come to their answer. Few candidates do this.

Quality F (Quality of written communication)

Centres were quite good at assessing this Quality. However, the use of a scribe to write the report for the candidate could limit the mark that can be awarded.
For 2 marks there could be many mistakes but it would still be possible to read the report.
For 4 marks there should start to be the correct use of scientific vocabulary.
For 6 marks there are few errors and a good use of scientific and technical vocabulary.

The assessment should be made of what the candidate has written and so a report which is largely pasted in from websites will not score well.

E Summary Comments

The moderator does everything to support the decisions of centres. Providing the average marking is within plus or minus 4 marks no change is made as the centre is deemed to be 'within tolerance'. Where the marks are outside tolerance and adjustments have to be made, the work is always considered by at least two moderators. To summarise, if a centre is within plus or minus 4 marks no change is made but if the average is, for example 5 marks, 5 marks would have to be deducted.

Moderators are encouraged to provide useful reports for Centres. The moderation was accomplished efficiently and effectively. The team of moderators, team leaders and senior team leaders worked hard and efficiently to complete the process in the limited time available.

The importance of Cluster group meetings, attendance at OCR INSET meetings and meetings arranged in-house, all provided centres with an appropriate awareness and understanding of the new framework. Centres should have copies of the revised Science Support booklet (which is also available on Interchange).

Many Centres continue to use the free OCR Coursework Consultancy service. Each year a Centre can submit good quality photocopies of three marked Science in the News reports to OCR. They will then receive a written report from a senior moderator on the quality of the marking. This means centres can use this as part of their internal moderation and then enter candidates for moderation with some confidence.

F 2009 Grade Thresholds for B625

The distribution of marks for Science in 2009 was very similar to the distribution of marks for 2008 with a small increase in the mean mark.

Grade boundaries for 2009

	Grade threshold							
	Max. mark	A*	**A**	B	**C**	D	E	**F**
Can-Do tasks and SinN	60	55	**51**	46	**42**	37	32	**27**

Grade boundaries for 2008

	Grade threshold							
	Max. mark	A*	**A**	B	**C**	D	E	**F**
Can-Do tasks and SinN	60	53	**49**	44	**40**	35	30	**25**

Grade boundaries for 2007

	Grade threshold							
	Max. mark	A*	**A**	B	**C**	D	E	**F**
Can-Do tasks and SinN	60	55	**50**	45	**40**	35	30	**25**

Marks in bold were determined by consideration of the Grade Descriptions listed in Appendix A of the Science Specification, and also by the quality of the work submitted when compared with the work from last year and with A 219 (21st Century Science Skills Assessment).

Since the same work can be submitted for Science in the News for Science and separate sciences the same boundaries apply for B635, B645 and B655. Approximately 68% of the Biology candidates entered for B635 rather than B636, 57% of the Physics candidates entered for B655 rather than B656 and 55% of the Chemistry candidates entered for B645 rather than B646.A great deal of care was taken to ensure that performance by the two routes was comparable in each case.

The grade thresholds have been decided on the basis of the work that was presented for award in June 2009. The threshold marks will not necessarily be the same in subsequent awards. Some adjustments may be expected as experience with the mark descriptors grows.

B646 Report on Gateway Additional Science Skills Assessment

A General Comments

In this, the second year of this unit, the majority of centres coped well with the assessment tasks and applied the marking criteria accurately. There were however, some problems and a significant number of centres had to have their marks scaled, a few by a large amount. Other than over-generous marking, which is covered under the headings of the different components, the following caused problems in some centres.

- A mistaken choice of task. This occurred when a centre chose a task from modules 5 and 6 of a subject for use in Additional Science. These modules are not part of Additional Science and so this choice is forbidden. More seriously a few centres submitted a task for the wrong subject when entering for a separate science subject. This is the same as trying to use a result in a Biology examination to gain marks in Physics.
- Lack of internal moderation. If one teacher marks more generously than the others, it can result in the work of the whole centre being scaled down even those candidates whose work was correctly marked.
- Lack of annotation. Whilst annotation of students work is not compulsory, it is easier for a moderator to support a centres decision if the centre points out what the candidate has written which deserves that mark. This is particularly important if the decision is a borderline one.

B Administration

The paper work from most centres was in order and created no problems. There were, however, some centres where things did not go smoothly. These were the things which caused problems on more than one occasion.

- A missing candidate record sheet meaning that the mark for Practical Skills was unclear.
- Wrong addition of the marks for the three components, leading to a CW amend form being needed.
- Different marks entered on the candidates work and on the MS1 form with the same result.
- A copy of the MS1 form which was so faint as to be illegible.
- A missing centre authentication form. The lack of this form can result in results being withheld.

These problems delay the process of moderation and communication with centres was sometimes very difficult with many requests being needed to acquire the correct paperwork. It is a good idea if centres include, with their sample an Email address which enables the person responsible for the assessment to be contacted.

Supervision of Candidates

There is no need for close supervision for the gathering of information for the Research Study. Indeed this research may be done at home if desired. Nor is there any need for supervision of the collection of data for the Data Task, other than the normal precautions during practical work.

The supervised sessions, however, do have to be supervised. Whilst examination conditions are not necessary the supervising teacher must be confident that the work is the candidates' own to enable the Centre Authentication form to be signed.

The work does not have to be completed in one hour and, if necessary, it can be completed over two sessions. If work is completed over two sessions then work should be collected in and reissued for the second session. The work should not be marked or assessed in any way between sessions nor should candidates be given any other assistance.

Redrafting of work is forbidden and inappropriate assistance can be considered malpractice.

C Research Studies

It was good to see a wide range of Research Studies being used this year. Centres took advantage of the different studies available in each subject area.

The marking of these studies was usually reasonably accurate and nearly always within tolerance. Where there was generosity it was usually in the assessment of quality A.

This year the great majority of candidates produced their studies by answering the five questions separately. This is a more reliable way of ensuring that all the salient points are covered than answering the whole study in essay format.

Quality A: Collecting Information

It is important to remember that the sources used by candidates must be referenced in or at the end of the Study. Even an excellent piece of work answering all the questions in great detail can only score a maximum of 2 marks for this quality if no sources are referenced.

Sometimes marks of 6 were given by centres which presumably knew that their candidates had accessed suitable sources. However, if there is no evidence there can be no credit.

This was the least accurately marked of the four qualities even though it is the easiest to get right.

If sources are given in full in a bibliography at the end, then 4 marks can be scored provided it is clear that they have been used. If it is indicated, within each question, where the information came from then 6 marks can be scored. If sources are only linked to questions not to the information given then 5 marks is appropriate.

Quality B: Interpreting Information

The interpretation of the science involved in the study is key to this quality. Understanding is key to interpretation. It was noticeable, this year that many candidates were quoting from websites which effectively gave the answer to some of the more straightforward questions.

If the quote is directly relevant to the question, some understanding is implied and a mark of 4 would be a fair judgement. However, to gain a higher mark it must be clear that the student fully understands what they are writing. This would be demonstrated if the candidate were writing in their own words or if they added some relevant comment to a given quote from a website.
It was sometimes the case that candidates were given marks of 5 or 6 for answers which were demonstrably copied directly from websites.

It should be noted that, where not all questions have been answered or where questions have only been partially answered, marks of 5 and 6 are unlikely to be appropriate.

Quality C: Developing and using Scientific Ideas

Here we are looking for the ability of the candidate to go further than the requirements of the specification. It may be that some discussion of a current scientific debate is required or an explanation of a scientific idea at a greater depth than that required by the specification. Whatever is required, the response must fully answer the questions posed.

As above the student must demonstrate an understanding of the points being made. Quotes from or lists derived from sources are never worth the higher marks, scoring 4 at most. There was again a tendency in some centres to give high marks for quotes from websites which seemed to answer the question concerned but which didn't demonstrate the student's understanding of the points being made.

Quality D: Quality of Written Communication

As last year centres usually marked this reasonably accurately.

Where adjustment to marks was necessary, it was usually because the teacher marking the work had mistakenly credited the student with marks for the English copied from a source. When this language was compared to the students own English in different questions there was a clear mismatch.

Credit should only be given for the students own use of English. Where the work is almost entirely copied from the internet and other sources it is difficult to justify a mark of more than 2.

D Data Tasks

It was again good to see a wider range of Data Tasks used though not as wide a range as was the case with the Research Studies. The 'old favourites' such as Bouncing Balls still appeared regularly.

Where scaling was necessary it was usually because of over-marking of the Qualities assessed in the Data Task. In the case of large scalings this was almost universally the case. The Qualities which caused the greatest difficulties were Qualities B and C and to a lesser extent Quality E, though all Qualities were over-marked on occasion.

Quality A: Interpreting the Data

The graph should be the easiest thing to score marks on. In the majority of cases it was but in some centres the marks given were too high.

The main areas where candidates lost marks were:

- not drawing a suitable 'best fit' line (or curve)
- drawing a graph which was too small
- drawing a graph with axes the wrong way round
- plotting points inaccurately
- joining a graph to the origin where inappropriate.

Marks lower than 4 were rare but centres are reminded that; a best fit straight line should have an equal number of points on each side unless anomalies are being excluded; a graph should occupy at least half of an A4 grid; the controlled variable should always be on the 'x' axis; points should be plotted accurately; and it is not always appropriate to draw a graph going through the origin (it is sometimes actually wrong).

There were cases where the raw data was not included with the work. This meant that plotting could not be checked and limited the mark available.

Quality B: Analysis of the Data

Missing data was sometimes a problem with this skill too. The most usual 'processing' used to gain two marks is the averaging of three attempts at each value. If the data are not included then this mark can sometimes not be achieved. This means that, even with a complete description of the trends the maximum mark available is 3.

Marks of 4 were frequently gained in this skill but, equally, marks higher than 4 were often given without justification. Additional processing which leads nowhere should not be given credit, nor should the spotting of an anomaly where a point does not lie on a smooth curve.

The additional processing which is done needs to show something which is not immediately obvious from the raw data or it needs to show that what seems to be reliable data is in fact invalid in some way.

It was clear that some centres gave their candidates ideas as to what additional processing could be done. In most cases the candidates did not understand why they were doing it and made no use of the information which they could have obtained. They were, however, sometimes given credit for 'following instructions'.

This is a high order skill designed to discriminate between candidates of high ability. A candidate should see the opportunity for additional processing for themselves without assistance from the teacher. In good centres more able candidates succeeded in gaining 5 or 6 marks with no outside assistance.

Quality C: Evaluation of the Data

There are two strands to this Quality, the data and the experimental procedure. The attention of centres is drawn to the title and the word DATA which appears in it. Analysis of the data obtained should be the main aim of the candidate. If the reliability of data is not addressed then the maximum mark achievable is 3, no matter how thorough the treatment of weaknesses in the method.

It is not sufficient to say 'we used the fall back data and that must be reliable because it was provided by OCR (it is not even accurate to say that, as unreliable results are always built in to the fall back data). It is equally not sufficient to say we used a computer simulation and computers do not make mistakes.

A more common error was to say that the data must be reliable because we did three repeats and doing five would make it more reliable. Repeats may make the average more reliable, they do not make the raw data more reliable. Many candidates stated that their data was reliable when more than one values was clearly divergent. It was often the case that marks of 5 or 6 given by the centre had to be reduced to 3 or even 2.

Reliability of data is most easily addressed by comparing the results gained in the three repeats required in most data tasks. Where only one value is taken, proximity to a best fit line is an alternative. The data themselves must be discussed to gain marks of above 3.

Validity must be discussed to gain marks higher than 4. To be valid, data must first be reliable. If the data is reliable but does not give an expected conclusion then it is not valid. For example, a best fit line may not go through the origin as expected or a value calculated from the data may not agree with a known value. If data is not valid it must be due either to the method/apparatus or to 'operator error'. This gives the candidate the opportunity to discuss the procedure part of the task.

Quality D: Justifying a Conclusion

This was, in general, marked more accurately than the previous two Qualities though there were exceptions. A conclusion of sorts has been given in the form of the pattern described in Quality B. This quality involves justifying that conclusion.

Where candidates were marked too generously it was usually because they had written about the theory involved in the phenomenon observed but had not explicitly linked what they had written to the data which they had obtained. An examination of the criteria will reveal that, at each level, the word DATA is included. If neither the data themselves nor the pattern described in Quality B are referred to in this answer, then it is difficult to award high marks even if the science used is of high quality.

The problem seems to be that candidates learn the theory necessary before embarking on the Task and then regurgitate it (with greater or lesser accuracy) in answer to question 4. If it is correct, the centre awards it 6 marks even if no reference whatsoever is made to the data or to the pattern observed in the investigation.

To gain marks at the highest level in this skill it is necessary that the science used is correct, fully understood and explains the data obtained in the experiment completely.

Quality E: Planning further Work

The plan must be sufficiently detailed to allow another person to carry out the intended experiment. In all cases it is possible to use the investigation already carried out as a basis for the plan. It is, then, often not necessary to describe all the apparatus needed. What must be included is:

- the variables which to keep constant and which to vary
- how to ensure that variables are kept constant
- the range of values to be used for the controlled variable.

Only if there is sufficient detail in the method given, can marks in excess of 3 be obtained. Marks higher than 4 are achieved by considering the importance of the new information which would be obtained. There is usually a question to lead candidates in the right direction.

Where this skill was generously marked it was either because the method proposed did not give sufficient detail of the variables and their control or because the method wouldn't work.

E Practical Skills:

This is a mark given by the centre as a summary of the practical skills demonstrated by each candidate over the period of the course.

The intention is to gain a general impression rather than to have a snapshot of the skills on a particular occasion.

Many centres had a good range of marks but it was surprising to see how many centres had a complete cohort all scoring six marks.

F Separate Sciences

The problems and successes noticed in work submitted for the separate sciences were the same as for Additional Science in both Research Studies and Data Tasks.

The overall scores tended to be higher because, in general, candidates were of higher ability.

The tasks used were, in the main, those from modules 3 and 4 of each science but it was pleasing to note that some of the tasks from modules 5 and 6 were beginning to be used.

Many of these skills exercises provide interesting ways of delivering and enhancing the separate science units. I hope to see them used more next year.

G Other Matters

Centres are thanked for the diligent work which the vast majority put into the assessment of the work of their candidates. Where this is done moderators can support the decisions made by centres and the process runs smoothly

Where it is necessary to adjust the marks of a centre the work is looked at by at least two moderators.

If the adjustment is large it is looked at by at least three including the Principal Moderator.

Further guidance on assessment of skills can be found in the Additional Science Support Booklet which was sent to all centres and which is also available on Interchange and at www.gcse-science.com .

Next year a series of training courses will take place in different parts of the country details of these has been sent to centres and is also available on www.ocr.org.uk .

Centres can be part of a cluster. Cluster co-ordinators conduct meetings where centres can exchange ideas and experiences as well as receiving training.

Grade Boundaries

Grade	A*	A	B	C	D	E	F
Mark/60	54	49	43	38	32	26	20

Grade Thresholds

General Certificate of Secondary Education
Chemistry B (Specification Code J644)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B641/01	Raw	60	-	-	-	37	30	24	18	12	0
	UMS	69	-	-	-	60	50	40	30	20	0
B641/02	Raw	60	44	36	27	19	14	11	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B642/01	Raw	60	-	-	-	29	23	17	12	7	0
	UMS	69	-	-	-	60	50	40	30	20	0
B642/02	Raw	60	42	34	26	18	14	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B645/01	Raw	60	55	51	46	42	37	32	27	22	0
	UMS	100	90	80	70	60	50	40	30	20	0
B646/01	Raw	60	54	49	43	38	32	26	20	14	0
	UMS	100	90	80	70	60	50	40	30	20	0

B645 & B646 - The grade thresholds have been decided on the basis of the work that was presented for award in June 2009. The threshold marks will not necessarily be the same in subsequent awards.

Specification Aggregation Results

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

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J644	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
J644	21.3	52.2	79.6	94.2	98.3	99.5	99.8	99.9	100.0	11531

11630 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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