OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

Gateway Science Suite

General Certificate of Secondary Education **J644**

Examiners' Reports

June 2011

J644/R/11

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General Certificate of Secondary Education

Chemistry B (Gateway) (J644)

EXAMINERS' REPORTS

Chief Examiner's Report

The number of entries of candidates for this session is greater than in June 2011. This increase in candidates was shown in almost all the written components and in the skills assessment components of the specification. The entry policy by Centres has been very good and only a small proportion of the candidates were entered for the inappropriate tier.

All the examination papers differentiated effectively and allowed candidates to demonstrate their knowledge and understanding of GCSE Chemistry.

Candidates need to take much more care when using chemical formulae as these need to be entirely correct. There were several examples in the written components where candidates used a formula when asked for a name and got the formula wrong, thereby foregoing the mark.

In this session there was an improvement in the writing of both word and symbol equations, however candidates still found equations involving electrons the most difficult type to balance.

Candidates often found the recall of knowledge and understanding more difficult than analysis or application and there were several examples in the written components where simple knowledge was not recalled by many candidates.

Although there has been an improvement in quantitative work, candidates still do not show their working out in a clear and logical fashion, making it difficult to award error carried forward marks.

Candidates in this session found qualitative longer answer questions quite demanding. Candidates often do not structure their answers and are sloppy with their use of language.

In terms of the skills assessment components the majority of candidates take B645 rather than B646. There was an improvement in the work presented by candidates in both of these components over the June 2010 session.

B641/01 Modules C1, C2, C3 (Foundation Tier)

General Comments

The paper produced a mean mark of 32.4 which was slightly higher than the June 2010 performance. The paper gave candidates the opportunity to show what they know understand and can do. Marks ranged from 55 to 8 with a standard deviation of 7.2. Centres' entry policies were appropriate as very few candidates would have been better served by entry to the higher tier paper. Assistant examiners and team leaders thought that the level of difficulty of the paper was appropriate. Most candidates could access the paper with very few questions omitted. There was no evidence of lack of time. Performance on numerical questions was generally good, even by weaker candidates.

The paper differentiated well with 34 marks required for grade C and 18 for grade F.

Section A – Module C1

1(a) This question was well answered by over two thirds of candidates. The idea that the ingredients are listed in order of quantity is better understood than in previous years. Common incorrect answers were 'water' and 'salt'.

1(b) Again this question was well answered, with most candidates gaining at least 1 mark. Weaker candidates often wrote specific foods such as sugar.

1(c) This question was correctly answered by three quarters of candidates. 'Carbon dioxide' and 'nitrogen' were the most common incorrect answers.

2(a) About one third of candidates could state that non-renewable fuels take a long time to form or that they are used up faster than they are formed. The majority of incorrect answers stated that non-renewable fuels 'cannot be used again'. This is a long held misconception.

2(b) Only one third of candidates could explain that LPG comes out of the top of the fractionating column because it has the **lowest** boiling point. A large number, including some of the best candidates, thought that LPG had the highest boiling point and failed to score.

2(c) This question was well answered.

2(d) Most candidates correctly identified paraffin in part (i) but fewer selected two correct statements in part (ii). There was some confusion between cracking and fractional distillation. A number of candidates ticked only one box, having possibly not read the question thoroughly.

3(a) Over two thirds of candidates correctly identified carbon and hydrogen. The most common erroneous answer was 'carbon dioxide'.

3(b) The vast majority of candidates correctly identified compound C.

3(c) Again, this question was well answered. Very few candidates lost the mark because of incorrect subscripts.

3(d) Just under a third of all candidates correctly stated polythene. Common incorrect answers included 'nylon', 'plastic', 'polystyrene', 'ethane', and 'ethene'.

4(a) Most candidates could identify an advantage (that the combustion product of hydrogen is water and there is no carbon dioxide produced). Very few gave a valid disadvantage of hydrogen (either availability or storage problems). Most wrote that hydrogen was expensive for the disadvantage, which was not creditworthy.

4(b) Half of candidates wrote a correct word equation. Common errors included using 'hydrocarbon' rather than 'octane', reversing the equation and including '+ heat' in the equation itself rather than above the arrow.

5(a) Over two thirds of candidates correctly wrote down 'waterproof' and scored the mark. A common incorrect answer was 'strong'.

5(b) This question was poorly answered in general. A number of candidates misunderstood what was required and wrote about why non-biodegradable polymers should not be used to make outdoor coats. Better candidates wrote about disposal problems in terms of landfill and non-biodegradability and scored well.

Section B – Module C2

6(a) About one third of candidates gave the correct order of hardness for the three materials. The order 'limestone, granite, marble' was a frequent incorrect answer.

6(b) This was well answered by almost all candidates.

6(c) Only the best candidates scored this mark for realising that large crystals are formed if the magma cools slowly. There were frequent references to cooling which were not sufficiently precise.

7(a) Many candidates scored 1 mark for a disadvantage e.g. aluminium is more expensive or less strong than steel. A significant number scored both marks for correctly recognising that aluminium does not corrode. A number simply re-stated the example given in the question and did not gain the advantage mark.

7(b) Most candidates correctly calculated the mass of carbon monoxide in part (i). Very few candidates stated that the nitrogen in the oxides of nitrogen came from the air in part (ii). Common incorrect answers were 'the engine' or 'the fuel'.

8(a) Disappointingly, only a quarter of all candidates could correctly define an alloy. Metals were frequently mixed with a range of unacceptable materials including compounds.

8(b) This part was better answered with about two thirds of candidates realising that solder was better because it had a lower melting point than lead or tin. A minority of candidates wrote about boiling point and did not score.

8(c) Even with the prompt of having two examples, this question was not well answered. Only better candidates correctly identified amalgam and steel as alloys and copper as a metallic element. Frequently candidates scored zero.

9(a) Reactants and products, which forms part of the Fundamental Chemical Concepts item, continue to be poorly understood. About a fifth of candidates scored this mark. Frequently names were given when the question clearly asked for a formula. A number of candidates hedged their bets by writing all the formulae from the equation or the entire equation but in reverse order.

9(b) Most candidates correctly identified line A in part (i) but only just over half selected 0 – 30 seconds as the period when the reaction was at its fastest in part (ii).

9(c) This question, as in previous years, was poorly answered. The mark scheme required 'acid runs out' but less than a fifth of candidates gave this answer. Some omitted the question and others referred to marble chips running out or 'losing their power'.

9(d) This question was surprisingly poorly answered by all but the best candidates. Marks were allowed for correct explanations of why a particular method increased the rate of reaction e.g. 'increase the temperature (1) because the particles have more energy (1)'. Increasing the temperature was the most common correct answer. Most incorrect answers referred to changes to the flask or the marble chips.

10 Most candidates scored at least one mark, usually for 'pigment'. 'Solution' proved to be a good distractor for both solvent and binding medium.

Section C – Module C3

11(a) Almost all candidates could use their Periodic Table to correctly identify potassium.

11(b) Just under a third of candidates could recognise iron as a transition element. 'Neon' was a common incorrect response.

11(c) Most candidates could identify bromine as a Group 7 element. A few wrote halogens, which is not in the list and therefore was not credited.

11(d) Again, only a minority of candidates could identify either sulfur or aluminium as being in the same period as magnesium. 'Beryllium' was the most common incorrect response, presumably due to confusion between periods and groups.

12(a) Just under half of candidates could identify the electron as a negatively charged particle in part (i) and the mass number of the atom in part (ii). 'Proton' and 'neutron' were common incorrect answers in part (i) and '6' and '5' in part (ii).

12(b) About a third of candidates understood that isotopes have the same number of protons, shown by giving the answer 5.

13(a) Approximately three quarters of candidates could recall the colour of bromine and the mark scheme made provision for a wide variety of answers. There were occasional references to 'blue' or 'green' which failed to score.

13(b) Less than 5% of candidates could write the word equation for this displacement reaction. Most could put chlorine, sodium iodide and iodine into an equation, but only a tiny proportion realised that sodium chloride was the other product. Where there was a second product, it was often 'water'.

13(c) Disappointingly, only about a quarter of candidates could recall the correct order of reactivity of the halogens. Frequently the order was reversed.

14(a) The results of the test for carbon dioxide using limewater were well known by most candidates.

14(b) Thermal decomposition appeared to be better understood than in previous years, partially because the question was of the objective variety involving recognition rather than recall.

14(c) Parts (i) and (ii) were almost universally correct. Candidates can interpret data well. In part (iii) about two thirds of candidates could explain the choice of aluminium for making power lines in terms of electrical conductivity and density. Some candidates quoted strength or malleability which did not gain credit.

15(a) Only better candidates could identify H+ as a cation. All three distractors featured as incorrect answers but the most common of these was OH-.

15(b) Under a third of candidates could identify the gas as oxygen. 'Carbon dioxide' and 'hydrogen' were frequently quoted.

15(c) Most candidates who attempted it scored at least 1 mark on this question. There was some confusion about the test for oxygen. 'The squeaky pop test' scored 1 mark. About a fifth of candidates omitted this question.

B641/02 Modules C1, C2, C3 (Higher Tier)

General Comments

The paper differentiated well and performance across the three sections of the paper appeared to be fairly consistent, allowing candidates to demonstrate their knowledge and understanding of chemistry. The average mark for this examination paper was 37, and the marks awarded covered almost the entire mark range.

Candidates performed well on questions that involved analysis and interpretation. In some questions candidates needed to have a more secure knowledge of aspects of the specification.

The candidates used their knowledge and skills appropriately to respond to the questions on energy changes in chemical reactions (including the energy calculation), building materials / rock, rates of reaction and elements in the Periodic Table.

Candidates did not seem to have the knowledge required to respond to questions about the displayed formula of a polymer, reactions of the halogens and extraction of aluminium by electrolysis.

Comments on Individual Questions

SECTION A – MODULE C1

Question 1
This question was about crude oil and fossil fuels.

(a) Most candidates made a good start to the paper by scoring the mark for the fact that LPG comes out of the top of the fractionating column because it has the lowest boiling point.
(b) In part (i) candidates correctly identified paraffin as the fraction for which the supply matched the demand. To score the marks in part (ii), candidates needed to explain that cracking converts large hydrocarbons into smaller ones and that fractions in excess are converted into those in demand. Good use was often made of the data given in the question to illustrate this latter point. Answers that confused cracking with fractional distillation were not creditworthy.
(c) To gain the mark in this question, candidates needed to explain that a hydrocarbon contains only carbon and hydrogen. When candidates did not gain the mark it was usually because they missed the exclusive limit to the composition or described a hydrocarbon as a mixture of hydrogen and carbon or a compound containing carbon and hydrogen molecules only.

Question 2
This question was about hydrocarbons.

(a) Most candidates correctly identified compound B as having a molecule with 13 covalent bonds.
(b) Again, most candidates could correctly write a molecular formula, having been given the displayed formula, with the mark scheme giving credit for the symbols in any order. Common errors remain C4H10 and C^4H^{10}.
(c) In part (i), many candidates correctly explained that ethene is unsaturated because it contains a double bond. Explanations in terms of ethene not containing the maximum number of hydrogens did not score marks. Part (ii) differentiated well. To score both marks candidates needed to draw the basic covalent structure of the polymer poly(ethene), including the correct use of brackets and 'n' to indicate many repeat units. Credit was also

given to candidates who drew 2 or more repeat units. Candidates need to ensure that they include the hydrogen atoms in the polymer structure to gain credit. Structures containing double bonds or only 3 bonds on carbon atoms did not gain marks.

Question 3
This question tested ideas about combustion of fuels and required candidates to interpret information.

(a) Good responses to this question described an advantage of choosing hydrogen as fuel in terms of water being the only combustion product or no carbon dioxide being produced. Others needed to develop their answers beyond superficial references to hydrogen producing no harmful gases or being more environmentally friendly. Candidates usually then went on to explain that hydrogen is a gas, which means it is difficult to store. Simply stating that hydrogen is a gas was insufficient without the link to storage.
(b) The word equation for the combustion of octane was well done by candidates. Omitting oxygen/air as a reactant or inclusion of '+ heat' in the equation were the most common errors.

Question 4
This question about energy changes was very well answered.

(a) Candidates showed a sound understanding of endothermic reactions.
(b) Many candidates scored both marks for 6300J. One mark was awarded to candidates who used the mass of fuel, instead of the mass of water, or who used the combined mass of the water and the fuel.

Question 5
This question was about the polymers nylon and GORE-TEX®.

(a) To gain marks, candidates had to be precise in their use of scientific terminology. Lightweight or low density was creditworthy. Answers that described nylon simply as light did not get marks. Candidates who gave two descriptions of the same property only gained 1 mark.
(b) Candidates needed to appreciate that the holes in the polymer membrane are too small to allow (liquid) water to pass through, but big enough to allow water vapour or evaporated sweat to pass through. When candidates did not get marks it was because they referred merely to water molecules in the first part of their answer and/or did not refer to water in the vapour state.

SECTION B – MODULE C2

Question 6
This question focused on building materials / rocks.

(a) Most candidates correctly wrote down the 3 rocks – limestone, marble and granite – in order or increasing hardness in part (i). In part (ii) candidates were required to explain the differences in hardness of the rocks in terms of rock types. Answers that described the relative hardness of sedimentary, metamorphic and igneous rocks, without relating the rock types to limestone, marble and granite did not gain marks.
(b) The idea of slow cooling of magma producing large crystals was well understood by many candidates. Although this was sufficient for the mark, some candidates went further and demonstrated a sound understanding of the difference between intrusive and extrusive igneous rocks.

Question 7
This question was about the use of aluminium and steel in car manufacture.

(a) Good responses described the low density of aluminium conferring an advantage over steel because it gives better fuel economy. Answers in terms of fuel efficiency required further explanation.
(b) Many candidates scored at least 1 mark in this question, with the disadvantage mark the more commonly scored. When candidates did not score the advantage mark it was usually because they stated that the car would be lighter, which was given in the stem of the question for part (a).
(c) Most candidates correctly calculated the mass of carbon dioxide made on the journey in part (i). Part (ii) was a challenging question. Candidates needed to provide an explanation either in terms of increased rate of reaction at higher temperature or incomplete combustion happening at the start of the journey. In part (iii), 1 mark was awarded for the correct reactants and products and 1 mark for the correct balancing. The balancing mark was dependent on the correct formulae, but 1 mark was allowed for a balanced equation with a minor error in subscripts or formulae. When candidates did not gain marks it was often because they attempted to balance the equation by placing numbers within the formulae, e.g. 2C2O.

Question 8
This question focused on alloys.

(a) For 2 marks candidates were required to complete the table to show the composition of all 3 alloys. The composition of solder was usually correct. Brass and amalgam were less well known.
(b) Many candidates showed a good understanding of 'shape memory', particularly in the context of spectacle frames. In order to gain 2 marks answers had to then compare the properties of nitinol and steel.

Question 9
This question tested ideas about rates of reaction.

(a) Most candidates interpreted the graph correctly and gained marks in both part (i) and part (ii). In part (ii), 30 – 60 seconds was the most common error. Part (iii) differentiated well, with 30 ÷ 15 = 2 being a common error.
(b) Most candidates correctly explained why the reaction was faster at a higher temperature, either in terms of particles moving faster / having more energy or more collisions occurring.

SECTION C – MODULE C3

Question 10
This question was about elements in the Periodic Table.

(a) Potassium was usually chosen by candidates. Common errors were lithium and neon.
(b) Most candidates correctly choose fluorine. Nitrogen was a common error.
(c) Calcium was chosen by most candidates, with beryllium the most common error.

Question 11
This question was about atomic structure.

(a) The mass number of boron was usually correct.
(b) A very common error was 6.

Question 12
This question focused on the halogens.

(a) This question discriminated well. Candidates needed to appreciate that sodium chloride was also a product of the reaction to gain the mark.
(b) Many candidates gave one of the allowable colours for bromine. Green was a common error.
(c) This part of Q12 also discriminated well. As in Q7(c)(iii), 1 mark was awarded for the correct reactants and products and 1 mark for the correct balancing. The balancing mark was dependent on the correct formulae, but 1 mark was allowed for a balanced equation with a minor error in subscripts or formulae. When candidates did not gain marks it was often because they attempted to balance the equation by placing numbers within the formulae, e.g. Na2Cl, or by changing a formula, e.g. $NaCl_2$.
(d) Most candidates correctly chose covalent in part (i). Many excellent 'dot and cross' diagrams were seen in part (ii), showing a clear understanding of the covalent bonding in chlorine. An ionic bonding type diagram, showing positive and negative ions, was the usual error.

Question 13
This question was about metals.

(a) Good responses used the data given in the question to identify the low density and high relative electrical conductivity of aluminium as the properties that explain why this metal is used for making power lines. As in Q5(a), to gain marks candidates had to be precise in their use of scientific terminology. Answers which described aluminium as light did not gain credit.
(b) Candidates needed to understand that metals contain delocalised or free electrons and then to explain that these delocalised or free electrons can move. Candidates who scored 1 mark usually did so for the idea of 'electrons moving'. A common misconception was that the metal ions moved and carried the electric charge.

Question 14
This was a challenging question about the extraction of aluminium by electrolysis.

(a) Candidates needed to identify the substance made at both the anode and the cathode to gain the mark in part (i). When candidates did not score the mark it was because they got the products at the electrodes the wrong way round, named the material the electrodes were made from or confused this process with the purification of copper. In part (ii), answers needed to refer to the anodes being worn away or oxidised. A common error, as in part (i), was confusion with the purification of copper and responses talked about an accumulation of sludge under the electrode.
(b) This question discriminated well. To score both marks candidates had to describe that cryolite reduces the melting point of the aluminium oxide and that, as a result, less energy or electricity is required for the extraction. Use of scientific terminology was not always accurate, with some candidates referring to cryolite reducing the melting point of aluminium. A common error was also to suggest that the role of cryolite was that of a catalyst.

B642/01 Modules C4, C5, C6 (Foundation Tier)

General Comments:

Candidates in general found the paper accessible. Most attempted all questions; there were few blank responses. Few candidates, however, scored in excess of 50 marks.

It was very pleasing to see that candidates are able to write molecular formulae and count the number of atoms in a formula.

Two questions, 8 and Q 11(b) (ii), were found to be too demanding at this level with only one or two correct responses. The Contact Process was a mystery to most candidates. Few candidates knew the test for unsaturation or that silver nitrate is used to test for chloride ions. It was disappointing to realise how few candidates were able to identify a burette.

Most pupils had a good idea about the science behind each topic but vague answers were still apparent. It was clear that in some cases candidates knew the correct answer but were unable to express it in clear scientific terms, e.g. explaining the difference between a batch and continuous process. Many candidates wrote 'in swimming pools' as a use of chlorine but omitting the word 'sterilise'. Other candidates should be encouraged to read the question more carefully; some answers that candidates gave to Question 7 (b) like 'iron' and 'steel' did not seem possible. Candidates should also be encouraged to write more clearly.

Candidates are increasingly able to complete calculations accurately and interpret graphs. Some candidates, however, fail to score marks on calculations because they do not have access to a calculator.

Comments on Individual Questions:

Section A

Question 1 was well answered by most candidates
Q1 (a) (ii) The most common incorrect answer for the job of bleach in a washing powder was 'to kill bacteria'.
Q1 (b) Most candidates scored 1 mark for 'as the mass increases the stain is removed more quickly' but were not able to either recognise, or in some cases express, the idea of optimum temperature, instead putting 'the higher the temperature the faster the stains were removed.' Stronger candidates using the term optimum.
Q1 (c) 'Saving money' was frequently seen

Q2 (a) Most candidates were able to recognise 'sodium' as the most prevalent positive ion in sea water.
Q2 (b) Few candidates knew that silver nitrate is used to test for chloride ions.
Q2 (c) Similarly, few candidates knew that the colour of a precipitate of barium sulphate is white; the most commonly chosen answer was pale yellow.
Q2 (d) Many candidates were able to complete the word equation for 2 marks.
Q2 (e) A number of candidates missed the point of the question focussing on the use of clean water for washing and hydration, ignoring the fact that clean water is hopefully free of deadly microorganisms. The best answers came from candidates who knew about cholera e.t.c.

Question 3 was well answered except for part (c). Few candidates could explain how to extract chemicals from a plant. Some managed a mark for stating that the plant has to be crushed.
Q3 (b) Candidates should be congratulated with their good answers to this question. Many candidates were able to list two costs of making hydrogen peroxide. The cost of waste disposal was a common response.

Q4 (a) Disappointingly, fewer candidates then expected identified the presence of one essential element in the fertiliser. Some candidates counted the number of nitrogen atoms in the formula.
Qs 4 (b), (c) (i) and (ii). All these questions were well attempted. It is pleasing to see many candidates recognising that a pH of 5.5 is acid.
Q4 (d) The answer to the calculation, 60, was given by about a third of the candidates. A number of candidates multiplied the atomic massed rather than adding them.

Section B

Q5 (a) (i) The identification of the salt in the reaction proved difficult. Some candidates lost a mark because they failed to complete the formula of the salt, writing CH_3 or COOK instead of CH_3COOK.
Q5 (a) (ii) Many candidates correctly chose (aq) as the correct state symbol.
Q5 (b) Only about a third of the candidates were able to recognise a burette. Answers ranged from test-tube to drip tube to measuring cylinder.
Q5 (c) (i) (ii) These graph interpretation questions were well answered by the candidates.
Q5 (d) Few candidates knew the colour of the indicator phenolphthalein in acid and alkali.

Q6 (a) Over half the candidates were able to deduce the molecular formula of oxalic acid.
Q6 (b) Few candidates knew that in water H^+ is one of the ions made.
Q6 (c) The word property continues to confuse candidates. The mark scheme did enable a number of candidates to score a mark.
Q6 (d) (i) A number of candidates correctly remembered that carbon dioxide is made in the reaction and are to be congratulated. There were a number of peculiar answers like 'ethanoic carbonate'.
Q6 (d) (ii) Many candidates thought that hydrochloric acid did not react with calcium carbonate. There were some good answers such as 'as it is too strong and also reacts with metal'.

Q7 (a) (i) Most candidates knew that the negative electrode is called the cathode.
Q7 (a) (ii) With two ions to choose from a number of candidates were able to score a mark for this question.
Q7 (b) This question was well answered, however marks were lost by some candidates putting 'chloride' instead of chlorine. There were also some strange answers like iron and oxygen.

Q8 Few candidates knew the chemistry of the Contact Process. Most candidates looked at the formula of sulfuric acid and wrote down the reactants as sulfur, hydrogen and oxygen. There was also a good description of the Haber process among the answers.

Q9 A calculation which was reasonably well done with the majority of candidates getting 24g.

Section C

Q10 (a) (i) and (ii) Both questions were done well.
Q10 (b) Fewer candidates than expected were able to put the metals in order of reactivity.
Q10 (c) Few candidates were able to write down two ways to prevent the rusting of iron. Many scored one mark for the answer 'paint the iron'. Too many candidates tried to keep the iron away from water or oxygen, candidates putting such things as 'keep it dry' or keep it away from air'.

Q11 (a) A great many candidates who got this wrong and put 'fats melt but oils don't'. Some candidates failed to give the comparison, just putting 'fats are solid' or 'one is solid' but nothing about the other one.
Q11 (b) (i) Many candidates identified the double bond but 'less hydrogens' was often seen. The double bond was often referred to incorrectly as an equals sign.
Q11 (b) (ii) Only a handful of candidates knew the test for unsaturation. Many wrong answers were so far off the mark that they suggested this hadn't been taught.
Q11 (c) Many candidates were able to recognise the type of mixture as an emulsion.

Q12 (a) Most candidates were able to score one mark for hydrogen but few got the other mark.
Q12 (b) Very few candidates were able to write down one large-scale use of chlorine gas. A very common mistake was just putting 'swimming pools' not to sterilise swimming pools or for cleaning pools / water.

Q13 (a) (i) This question was well answered.
Q13 (a) (ii) About half the candidates were able to count the number of atoms in a molecule.
Q13 (a) (iii) The displayed formula was often attempted, but a common mistake was leaving the double bond in the molecule. Few candidates scored a mark on this question.
Q13 (b) Hydration was seen on a number of scripts.

Q14 (a) Surprisingly few candidates realised that a fuel cell produces electrical energy. Heat was a common misconception.
Q14 (b) A number of candidates lost a mark confusing the greenhouse effect and depletion of the ozone layer.
Q14 (c) Most candidates scored a mark on the last question.

B642/02 Modules C4, C5, C6 (Higher Tier)

General Comments

The marks for the paper covered the complete mark range from 0 to 60 and the mean mark for the paper was slightly down (to 34.5) compared to the same component in June 2010. There was a small but significant number of candidates who would have been better entered for the Foundation Tier examination paper.

Overall the paper differentiated well and allowed candidates of all abilities to demonstrate knowledge and understanding of GCSE Chemistry.

There was no evidence that candidates did not have enough time to complete the examination paper.

Candidates found Section A the most accessible and Section B the least accessible. Candidates often found the qualitative questions more demanding and often could not adequately explain their answers.

Comments on Individual Questions:

Question One

This question focused on detergents and washing powders.

In (a), many candidates were able to state one advantage of a low temperature wash. The most common response was that it used less energy although other correct responses included preventing the enzymes in biological washing powders from denaturing and that it stopped damage to delicate fabrics.

In (b)(i), many candidates could draw and label a detergent molecule. Only a small proportion of the candidates reversed the labels for a detergent molecule. In (b)(ii), although many candidates drew labelled diagrams they were more likely to gain marks from their written answers, especially since many candidates only referred to intermolecular forces in their written answers. However a significant number of candidates did not mention intermolecular forces or attraction to oil or water molecules and just wrote about the hydrophobic end being surrounded by oil and the hydrophilic end being surrounded by water.

Many candidates appreciated that dry cleaning does not involve water as a solvent.

Question Two

This question focused on water and testing water for dissolved ions.

Only the most able candidates could give the correct formula for sodium sulfate in (a). Many candidates gave $NaSO_4$ or $NaSO_4^-$.

In (b), the most able candidates realised that sea water contains chloride ions or sodium chloride. Only an extremely small number of candidates appreciated that the white precipitate was silver chloride. A significant number of candidates did not attempt this question.

Most candidates could construct the word equation for the precipitation reaction in (c).

In (d)(i), a significant number of the candidates referred to the large amount of heat or energy needed to distil the water. Other candidates mentioned that a large amount of apparatus is

needed (which was not given credit in the mark scheme). A significant proportion of the candidates in (d)(ii) referred to specific water-borne diseases such as cholera. Some candidates just referred to bacteria present in dirty water rather than suggesting that they were harmful. Other candidates failed to specify whether their answers referred to clean or dirty water.

Question Three

This question on the manufacture of chemicals was the most accessible in Section A.

Most candidates in (a)(i) appreciated that a catalyst speeds up a chemical reaction, although a common misconception was that a catalyst increases the percentage yield. The best answers stated that as a result less energy is needed. Many candidates appreciated in (a)(ii) that a continuous process would mean that fewer workers would be needed or that it was easier to automate the process. Other candidates referred to the problems of having to start and stop batch processes. A common misconception was that it is not possible to recycle unreacted reactants in a batch process, although the mark scheme did allow that it was easier to recycle unreacted reactants. Many candidates were able to use the data provided in (a)(iii) to give another reason why method two was cheaper. Most candidates chose either that the starting materials were easier to obtain or that it had a higher percentage yield.

In (b), many candidates could describe ways of extracting chemicals from plants, although a significant number of candidates did not attempt this question. The most common answers involved using a solvent, crushing or using chromatography.

Question Four

This question on fertilisers was the least accessible in Section A.

Candidates found the calculation on the percentage by mass of nitrogen in (a) more difficult than in previous years. In this year the relative formula mass was given in the question and as a result many candidates gave 17.5% instead of the correct 35%.

Good answers to (b) stated that the fertiliser provided nitrogen that was used to make plant protein. Often these candidates linked the plant protein with increased growth. Other candidates failed to state that nitrogen was the essential element in ammonium nitrate and often described the presence of all three essential elements. A common misconception was that fertilisers provide or supply plant protein.

Phosphoric acid was not well known to most candidates in (c) and many candidates stated that the acid needed was phosphorus acid rather than phosphoric acid. Ammonia, ammonium hydroxide and ammonium carbonate were all allowed in the mark scheme but a significant number of candidates gave ammonium and this was not awarded a mark.

Many candidates could calculate the relative formula mass of urea as 60 in (d).

Question Five

This question focused on titration and the use of indicators.

In (a) a significant number of candidates identified CH_3COOK as the salt. Candidates that gave the name instead of the formula were not given credit in the mark scheme.

Most candidates could use the information from the graph to get pH3.7 in (b)(i) and 24 cm^3 in (b)(ii).

Candidates found (c) very demanding and often wrote answers that were contradicted by the data in the stem of the question. Any reference to pH values had to be correct and a common

misconception was to state that methyl orange changed colour at pH4 when the data indicates it has already changed by pH4. Candidates made a similar misconception involving pH at which phenolphthalein changed colour. Other candidates focused on the ease of seeing the colour change rather than at what pH the colour change occurred. Good answers appreciated that methyl orange was yellow when the acid was neutralised but phenolphthalein changed colour immediately after the acid had been neutralised.

Question Six

This question on strong and weak acids was the most accessible in Section B.

In (a) many candidates could write the molecular formula $C_2H_2O_4$ but a significant number of candidates gave structural formulae instead e.g. $C_2H_2O_2(OH)_2$.

Many candidates could identify the hydrogen ion in (b) but OH^- was an effective distractor for candidates.

Most candidates in (c) appreciated that hydrochloric acid was a strong acid but a common misconception was that hydrochloric acid could not be used because it will not react with limescale.

Question Seven

This question on the Contact Process was one of the least accessible questions in Section B.

Most candidates in (a) could not explain what was meant by the term 'the position of equilibrium is on the right'. Candidates rarely stated that the concentration of sulfur trioxide is greater than that of sulfur dioxide. A common misconception was that more sulphur trioxide was being made but at equilibrium the same amount of sulfur trioxide and sulfur dioxide is being made.

Good answers to (b) explained that 450^{o}C was used to have a reasonable rate of reaction without shifting the position of equilibrium to the left. Other candidates referred to 450^{o}C being a compromise or an optimum temperature without any real explanation involving rate or equilibrium. Candidates often gave a statement without referring to any temperature or change in temperature and it was difficult to award any marks for this type of answer.

The use of vanadium(V) oxide in (c) was known by over half of the candidates with manganese(IV) oxide being the next most popular response.

Although many candidates could write the word equation in (d) a significant number used sulfur oxide and oxygen to make sulphur dioxide rather than sulfur and oxygen. Only a small number of candidates used the symbol equation. A small but significant number of candidates did not attempt this question.

Question Eight

This question on electrolysis was one of the least accessible questions in Section B.

Only the most able candidates could construct the electrode reaction in (a). A common misconception involved adding electrons to the left hand side of the equation.

Many candidates could describe the effect of increasing the time and the current on the amount of oxygen produced in (b)(i) and (ii). In (ii), some candidates related the increase in current to the rate of production of oxygen rather than to the amount of oxygen being made.

Many candidates in (c) calculated the amount of oxygen to be 3000 moles. A significant number of these candidates gave no working out and just wrote the answer.

Candidates found (d) quite demanding and were often unable to use the ratio of reacting masses to calculate the correct mass of 24g. Only an extremely small number of candidates used an approach based on moles. A significant number of candidates did not answer this question.

Question Nine

This question on rusting was one of the less accessible questions in Section C.

In (a), good answers referred to zinc being oxidised instead of iron. Weaker answers suggested that zinc was acting like aluminium and reacted with oxygen to form a protective oxide layer. Other candidates referred to zinc rusting instead of iron; this was not given credit as only ferrous metals rust.

High ability candidates had little difficulty in (b) writing the equation to show the oxidation of iron atoms to give iron(II) ions. Weaker candidates often had the electrons being gained rather than lost and did not balance the equations in terms of charge.

Almost all the candidates were able to write the word equation in (c) for the displacement reaction.

Question Ten

This question focused on the chemistry of alcohols.

In (a), a significant number of candidates could not draw the displayed formula for ethanol. Either double bonds were included within the structure or the hydrogen and oxygen atoms where reversed so that the hydrogen atom had two covalent bonds attached and oxygen only one. A small but significant number of candidates did not attempt this question.

Many candidates in (b) could use the general formula for an alcohol to write C_4H_9OH.

Candidates found (c) quite difficult and often could only give one reason for using hydration to make ethanol in the UK. Most candidates gave answers that related to the availability of crude oil or the lack of availability of sugar cane. A common misconception was to refer to the availability of water rather than the ethene or crude oil.

Many candidates in (d) could write the symbol equation for hydration.

Question Eleven

This question on fats was the most accessible in Section C.

In (a)(i) many candidates recognised that the presence of a double bond made the fat unsaturated. The mark scheme just required a double bond but candidates should be reminded that it really needs a carbon-carbon double bond. Part (ii) differentiated very well although a significant proportion of the candidates did not attempt the question. Only the most able were able to give both the name of the reagent, bromine, and the result of the test. It was not sufficient to write that the bromine went clear candidates had to state either that it went colourless or that it was decolourised.

Most candidates recognised saponification in (b).

Although a significant proportion of candidates in (c) could draw the correct diagram, many drew a diagram with both the water and the fat shown as droplets. Some candidates did not attempt to answer the question.

Question Twelve

This question on fuel cells was one of the least accessible questions in Section C.

Most candidates chose exothermic in (a).

The most able candidates could complete the reaction profile diagram in (b), but a significant number of the other candidates did not attempt the question. The most common error was to put down the wrong formulae, for example O and H. Candidates must be reminded that when they use formulae rather than words the formulae must be entirely correct.

In (c), candidates had to be very precise with their answers and needed to identify and explain the oxidation and the reduction reaction. Many candidates just stated that both oxidation and reduction took place but this was not sufficient. The importance of the electrons being gained and lost also had to be included in the answer. A small but significant number of the candidates did not attempt this question.

Many candidates in (d) did not refer to the context of the use of fuel cells, i.e. the spacecraft. It was not sufficient to give a list of advantages and disadvantages – the advantages and disadvantages had to refer to the use within a spacecraft.

B645 Can-Do tasks and report on Science in the News

General Comments

For teachers and moderators, Science Skills assessment is now well established. However, it is not possible to report any improvements in the average performance of candidates though there is some evidence that the expectations of teachers and centres are higher.

For Science Skills assessment, there are two components: Can-Do Tasks and Science in the News.

The aim of Science in the News is to get candidates to research a scientific issue, looking fairly at both sides, before reporting and finally coming up with a reasoned answer to the question. In some centres candidates do this, but in some it is no more than an essay on the topic giving few opportunities for matching the assessment criteria. Too often this year centres have awarded 6 marks routinely for Qualities A and F with little regard for the hierarchical criteria.

It is possible for 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.

It is disappointing that an increasing number of candidates score 24 for the Can Do tasks and nothing for Science in the News. The skills claimed to be shown in completing Can Do tasks are valuable in the Science in the News task.

Centres are reminded that, if a piece of work is resubmitted in a following year, the Science in the News report cannot be added to 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.

Administration matters

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. For the first time this year the sample was chosen by OCR's Moderation Manager and not the Moderator.

Administration matters – 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 are been added each year and it is a pity that over 90% of candidates complete one of the tasks which were in the original batch. It is of little surprise that candidates say the data is out of date.

Centres completing the same task year after year may give the impression that there is only one scientific issue worth discussing. It is worth noting that for the new Gateway specifications, the Controlled Assessment tasks, still set by OCR, will change each year. Teachers sometimes

argue that they use the same task because they have set up mark schemes for the task, but all marking should be against the published generic criteria and so changing the task should not matter.

Administration matters – 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. This is a good precursor for the new Controlled Assessments which begin in 2012.

All Science in the News tasks are written under controlled conditions so that the teacher can sign the Centre Authentication Form (CSS160) with confidence. Unfortunately, there is sometimes evidence of teachers advising candidates of improvements that should be made before the work is submitted. This is not permitted. Also, candidates cannot bring into the session summaries they have written. They can bring in their research, a bibliography and any graph that they have prepared.

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 the background to the task. The teacher may read through the stimulus material and explain any scientific words but they must not give any opinion.

Centres are allowed to use their own writing frames providing they are generic i.e. not specific to the task and the same writing frame must be used for all tasks. There are still a few centres using non-generic writing frames.

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. 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 candidates which are for and which are against the argument is giving too much assistance.

Administration matters – research time

Each Topic requires the candidates to undertake some research for themselves in a period of approximately one week This research could be done in school, either in the laboratory or a computer facility, or it could be done at home, and 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 some materials to get the candidates started with their task. However, in some centres the candidates are provided with a complete list of source material for use and the necessary element of choice and selection on the part of the candidate for relevant aspects had therefore been removed.

Administration matters – supervised session

When the preliminary research has been completed, the Science in the News tasks are written up under controlled conditions in the classroom/laboratory. Candidates are required to work independently and, although a time of 1 hour is suggested, the centre may use more or less time as required. If it extends beyond one lesson, the work should be collected in between the sessions and stored securely.

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

Increasing numbers of candidates use word processors to produce their reports.

Centres are reminded that this is acceptable, providing the centre can ensure

- that no complete or largely complete report is brought into the writing session on a USB storage pen or in any other electronic format;
- no competed 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 be off 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 used.

Moderators continue to see word processed reports in which the whole report has been pasted in electronically from websites without any acknowledgement, as if it was the writing of the candidate. Quality F marks can only be assessed against work the candidate has written, even if the source is fully referenced.

Evidence of drafting and redrafting of candidates' reports or too much coaching leads to the work not being accepted for moderation and reported to the OCR Malpractice Committee.

Can-Do tasks

Can-Do tasks are an important part of the Gateway Science specification. Carried out well they are motivational for students at all attainment levels. The Tasks ensure that practical science is an important aspect of the course and they can also ensure that ICT is used appropriately.

They are not expected to differentiate candidates above Grade C.

These tasks must be credited for individual work and not for a group of candidates collectively completing 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.

Science in the News

Approach

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

The marking criteria 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 the need to report back to students so they can improve in the future. When the sample is requested by the moderator, a little time should be spent checking the annotation of the maximum of 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. This year several centres had clearly not internally standardised the marks and consequently the rank order was not valid. In such cases the sample has to be returned to the centre, and it is not desirable for teachers, 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. Many candidates try to use it as a source. However, candidates who do not do any research for themselves, but rely on the OCR source material alone, 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 e.t.c. 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 not only that each of the sources is fully referenced so that it can be checked, but also that it is clearly identified where it has been used in the report.
Without detailed referencing it is impossible 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 equally 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 done
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.

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…'*. 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 source material. The trends quoted must be correct.
There are still many examples of candidates carrying out processing, even quite advanced processing, without identifying any trend. This is not worth even 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 should done by the candidate, at a standard approximating to GCSE grade C level. This could be by drawing a graph, pie chart or bar chart

from the data, calculating averages or percentages, or extracting and using data from a graph e.t.c.. It is important that the processing is correct. A poorly drawn graph with incorrect scales or incorrect average calculations should not gain credit. Teachers are reminded that, for the sort of data obtained, bar charts are often more appropriate than line graphs.

Few candidates progress 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 but did not fully understand what they were trying to do.

Quality C (Evaluation of the data)

There are still some reports where the quality of the data is 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 likely reliability of different sources and explain why one source is likely to be more reliable than another. It is common for candidates to write that the OCR source material must be reliable as it comes from an examinations board. This is not true because, in writing the source material, unreliable sources are used along with reliable ones. The candidate must go back to the reliability of the original sources.

To go above 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)

Social, economic and environmental aspects of the topic are an important part of the assessment and some Centres did not develop these areas sufficiently with their candidates during the teaching process.

Different Science in the News tasks provide different 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. For the award of 6 marks, the information must be accompanied by correct science.

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. There is some evidence that teachers have been more generous in marking this Quality.

Quality E (Justifying a conclusion)

All of the tasks are posed as questions and therefore need an answer. No marks can be awarded where no decision is reached. The aim is that candidates come to a decision as a result of their studies.

For 2 marks the candidate needs to decide *'yes'* or *'no'* and then give a reason. The use of the word *'….because…..'* in the candidate's response is useful but not essential.

For a match to 4 marks, the candidate does need to link clearly their choice to two particular sources.

For 6 marks a candidate needs to decide which source is more significant. Few candidates can do this. It is here that researching sources with different viewpoints becomes helpful.

Quality F (Quality of written communication)

There was some generosity in Centres in awarding marks for this Quality. 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. Some reports lack scientific vocabulary or it is merely pasted in without understanding. This makes 4 marks insecure.

For 6 marks, there are few errors and a good use of scientific vocabulary.

Some reports had been word-processed and a spell-checker obviously used. Such reports need to be near faultless and to contain scientific vocabulary to award 6 marks.

Summary Comments

The job of moderators is to try to support the decisions of centres whenever possible. Providing the marking is within plus or minus 4 marks of the moderator, no changes are made as the centre is deemed to be 'within tolerance'. Where the marks are outside tolerance and adjustments have to be made, moderators will provide useful reports for centres.

Since the same work can be submitted for Science in the News for Science and separate sciences, the same grade boundaries apply for B635, B645 and B655. Approximately two thirds of the separate science cohorts used Science Skills assessments rather than Additional Science Skills assessments.

B646 Research Study, Data Task and Practical Skills

General Comments

It is pleasing to note in this, the penultimate report on this specification, that the majority of centres applied the criteria sufficiently accurately as to make any scaling of their marks unnecessary.

Those centres are thanked for their attention to detail and their compliance with the administrative procedures.

There were, however, a significant number of centres where problems still arose and it is to those centres that the following remarks are chiefly directed.

Centres are reminded that it is the job of a moderator to support the decisions of the teachers in a centre wherever possible. Annotation of the work in the sample submitted, to show where and why marks were awarded, greatly facilitates this process. Too often it is not clear to a moderator on what basis a particular mark is decided upon.

Administration

Most centres coped well with the change to the system of sampling. It is hoped that next year the process will run more smoothly for all centres.

Whilst moderators no longer need the MS1 sheets in order to select a sample it is still helpful if these sheets are sent to the moderator either early or with the sample of work (see comments in the section on internal moderation). Along with the MS1 sheets it is essential that the Centre authentication sheet (CCS160) is included. If this sheet is not supplied then marks for the skills assessment have to be withheld.

Each sample of work should have the Skills Assessment Record sheet attached to the front. This is the only way a moderator has of knowing the mark awarded for Practical Skills.

There were too many cases where the marks on the record sheet had been wrongly totalled or where the mark had been wrongly transferred from this sheet to the MS1 mark sheet. Errors like this delay the process of moderation and cause additional work for both the moderator and the centre.

Supervision of candidates

Centres are reminded that, although close supervision is not necessary in the research phase of the Research Study or during the practical part of the Data Task, it is obligatory for the sessions where the written work is done.

Centres have to fill in a Centre Authentication Form. By completing this form a centre certifies that candidates have been supervised as instructed in the board's regulations and that they are satisfied that the work is the candidates' own.

There has been more than one occasion, this year, where two identical pieces of work have been present in the sample requested. There were also a good number of cases where different pieces of work had similarities which seemed to go beyond what could have occurred by coincidence.

Where this occurs and plagiarism has clearly taken place, neither candidate's work will be credited.

If candidates are supervised properly, according to the board's regulations, this should not occur. Please note:

- Candidates are NOT allowed access to the internet during either of the supervised sessions.
- Candidates may not bring any electronic media into a supervised session.
- In the Research Study session candidates may have access to their rough notes and print outs of their research but nothing else.
- In the Data Task session candidates should have access only to their results and the instruction and question sheet for the task.
- Redrafting (producing a second version of the work after teacher correction) is strictly prohibited.

Comments on the assessment of the different qualities

Research Studies

The Research Study assesses the candidate's ability to research a topic and to use the results of that research to answer the questions posed.

Candidates should not be taught the information needed to complete the task. This obviates the need for research and results in very similar answers from all candidates. Marks are rarely very good and candidates frequently do poorly by miss-remembering what they have been taught.

Candidates should write answers to each question separately not write an essay on the whole topic. Candidates following this structure are likely to answer each question thoroughly.

High marks cannot be scored if questions are answered incompletely.

Quality A: Collecting information

There are two common errors in assigning marks for this quality.

Sometimes a candidate is given zero marks because they have given no references. Wrong! They can have two marks if it is clear from their answers that they have done some research.

Sometimes a candidate is given six marks because they have a large number of fully referenced sources in their bibliography. Wrong! This is only worth four marks. For higher marks the sources must be referenced in the text of the study. If sources are linked to the questions five marks are available, if they are linked to items of information within the answers six marks can be awarded.

In summary, it is not necessary to have a long list of sources to gain high marks but it must be clear how the sources have been used.

Quality B: Interpreting information

The key word for this quality is 'information'. Some Research Studies involve the drawing of graphs or other interpretation of data. Doing this, even when correct, does not merit 6 marks.

It is the information in the candidate's research which must be interpreted. Their understanding of the information discovered must be clear from their answers to the questions. Higher marks will be gained from the understanding (interpretation) shown in answers to the later, more open ended questions.

Good answers to early questions followed by poor answers to later questions do not deserve six marks.

Answers copied from internet sites are worth some credit and can be given a maximum of four marks if they are relevant and answer the question completely and appropriately. However, for six marks candidates must demonstrate their understanding by use of their own words.

Quality C: Developing and using scientific ideas

The 'scientific ideas' involved here depend on the topic of the study. Topics are either an extension of an idea which is part of the specification or from an area outside the specification with clear links to science taught in the course.

Whichever is the case, more is expected than a reiteration of what has been taught. There should be evidence that some research has been done and the results should be correctly applied to answer the questions posed. Wrong answers should not be given credit.

It is chiefly in this quality that candidates who have been taught the necessary information usually fail to perform as well as they should.

As in quality B, credit (up to a maximum of four) can be given for text copied from sources, as long as it is relevant and fully answers the question.

Quality D: Quality of written communication

The criteria for this quality are reasonably clear and centres usually get the level about right. However, it should be noted that the consistent and correct use of scientific and technical vocabulary is more important than minor grammatical errors. A perfect piece of English with few if any examples of appropriate vocabulary is worth four. Whereas, a piece of work which is clearly science with appropriate vocabulary, is worth six even if there is the occasional spelling mistake.

Candidates are often given too much credit for the words which originate from a website. Only their own words can be given credit in quality D.

Data Tasks

It is intended that candidates actually carry out the investigation described. Fallback data is provided for candidates who have been absent for the practical session, or whose results make it difficult to detect patterns and so come to a valid conclusion.

Candidates who use fallback data for the second of these reasons should also include their own results. They should use their own results for answering Q3 (evaluation) but the fall back data for their other answers.

All candidates should include a table of results, even if they are using the fallback data. Moderators need to see evidence of the 'simple processing' (usually averaging) before they can give marks for quality B. They also need to check the accuracy of the plotting in the graph.

If a candidate does not perform the investigation they are disadvantaged, especially in answering questions 3 and 5 (skills C and E)

Quality A: Interpreting the Data

Candidates' graph drawing skills are generally quite good and marks of less than four for this skill are rare. Where marks are low it is usually due to small, poorly drawn graphs, inaccurately

plotted points and wrongly scaled axes. Any two or more of these factors is likely to result in a lower mark.

Candidates were sometimes given six marks for graphs which were not of sufficient quality. The graph line should be well drawn and not too thick. It should be drawn with a ruler if straight or be smooth if a curve. Graphs should be accurately plotted and on axes with sensible scales. The scale should allow the graph (not just the grid) to occupy at least half of the available A4 space.

A best fit line should ignore 'outliers' but should then have an approximately equal number of points on each side of the line. A best fit line does not always have to go through the origin, indeed sometimes it should not.

Quality B: Analysis of the Data

Most candidates managed to score four marks for this quality but 'real' marks higher than this were rare. Simple processing (e.g. averaging) and a description of the observed trend are all that is required for 4 marks and this was usually accomplished. Thankfully the use of an unqualified 'positive correlation' was not frequently seen (it is certainly not worth any credit).

Gaining higher marks proved difficult. A significant number of centres attempted to provide guidance to their candidates on what 'additional processing' to attempt but, in addition to being too much help, this rarely resulted in any additional marks as candidates didn't understand why they were doing the required task and so did not use the results. Simply spotting an anomaly will not do. Both the additional information and the detected anomalies must depend on the processing which has taken place. Simply spotting a point which is off the line or a measurement which is an outlier will not do as it can be seen from the raw data and/or the graph.

The most fertile area towards which candidates can be directed is showing whether their data is or is not valid. No guidance on how to approach this should be given. This is a high order skill which is designed to discriminate between the most able candidates.

Quality C: Evaluation of the Data

There are two strands to this skill and where candidates concentrated on only one aspect they were often marked overly generously. Since the assessment criteria are hierarchical the maximum mark is two where only one strand is addressed.

Candidates should discuss the methods used and how it relates to the reliability of the data. The reliability of the data is most easily accessed by considering the consistency of repeat values or, in the few tasks where there are no repeats, the proximity of points to the best fit line.

Candidates scoring 4 marks were not uncommon though 3 was sometimes more appropriate. To gain higher marks the validity of the data needs to be discussed. The concept rather than the word is important. Does the data from the experiment correctly represent what should have been obtained? The most straightforward way to approach this is to compare two data sets (another candidate's data is likely to provide a better comparison than the fall back data) or to use the graph to work out a quantity for which the value is known (this is only possible in some of the tasks).

Quality D: Justifying a conclusion

A significant number of candidates wrote a conclusion which, whilst it contained some science, was not directly related to the data obtained. Even for two marks it is necessary to relate the conclusion to the data.

The difficulty arises where the candidates have, understandably, been taught the necessary theory before the task is attempted. Weaker candidates then regurgitate this information with sometimes less than perfect recall and omit any mention of the data obtained in the experiment.

To score well in this quality the link to the data needs to be plain and the explanation needs to use appropriate and correct science which is clearly understood.

Having said that, most centres marked this quality with reasonable accuracy.

Quality E: Planning further work

Candidates in some centres clearly paid more attention to the criteria than to the question posed. These candidates (sometimes a whole centre) suggested further work which bore no relation to the problem posed in question 5. Such answers deserve no credit as the question has not been answered.

Some candidates gave a good answer to the second part of question 5 but, since their plan was insufficiently detailed, could score no more than three marks.

A detailed plan does not have to be pages long. It is intended that the investigation which they have just completed should be use as a basis. It is, therefore, not necessary to give great detail. 'The investigation just completed was repeated but…' is an acceptable way to start. After the 'but' should come;

- A description of the variables, which to control which to vary and which to measure.
- An account of how the variables are to be held constant and controlled.
- A range of values for the controlled variable.

This amount of detail would allow a third part to perform the intended investigation.

The most frequently omitted part of this description is the range of values to use. This omission limits the mark for quality E to three.

Internal Moderation

It is a requirement of the board that internal moderation of the work in a centre should take place. This is necessary unless all of the work is assessed by the same teacher.

Moderators have to judge whether the centre as a whole is marking to the same standard as other centres. A moderator is not permitted to change the rank order of the candidates in the centre. This means that if standards vary across different groups and if scaling of marks is required, unfairness to candidates can arise. Candidates who were marked generously will benefit as their marks will be reduced by a smaller margin than is appropriate, however candidates who were marked accurately will have their marks reduced to below what they deserve.

Where the problem is serious a centre will be asked to remark the work of all candidates and to resubmit their marks for moderation.

If MS1 sheets are sent which include the set of each candidate this can ease the problem. If only one teacher's marking is out of tolerance then the centre can be requested to remark the work of just that teacher. This reduces the workload of the centre and maintains fairness for the candidates.

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.

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