RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

Gateway Science Suite

General Certificate of Secondary Education **J264**

OCR Report to Centres

June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS / A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching / training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

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

OCR will not enter into any discussion or correspondence in connection with this report.

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General Certificate of Secondary Education

Chemistry B (Gateway) (J264)

OCR REPORT TO CENTRES

Overview

This was the first series in which candidates could obtain a grade for GCSE Chemistry B, J264. It was also the first time that candidates could take the B742 and B743 components. As a result of the change in aggregation rules only a very small number of candidates took the B741 components while all of the candidates entered for GCSE Chemistry took B742 and B743.

The examination papers allowed candidates of all abilities to show positive achievement. There was a small proportion of candidates that would have been better suited to taking the Foundation Tier instead of the Higher Tier examination paper. There was no evidence that candidates ran out of time even with the longer 85 mark examination papers.

The performance of candidates in the six mark questions has improved considerably since the last June series. Many candidates wrote extensively and needed additional sheets to complete their answers. There was an improvement in the quality of written communication although some candidates did fail to use the correct chemical terminology. The best answers were extremely well organised often with bullet points and where appropriate the use of tables of information. There was a similar improvement in the ability of candidates to complete questions that involved analysis and evaluation. Candidates were able to cope with the new style Section D questions in the B742 papers. Candidates need to be aware of the importance of learning facts so they can answer the recall type questions with precision and accuracy.

All examination papers include a significant amount of quantitative work such as calculations, graphical work or analysing tables of numerical data. Centres should remind candidates of the importance of organising their answers to quantitative questions so that the working out is clearly shown. This will allow, where appropriate, the award of error carried forward marks. Candidates were often uncertain about the use of significant figures and decimal places.

There was significant evidence of candidates using mark schemes from previous series' to aid their revision but this can have its problems if the candidate does not read the question carefully. For example in question 8 in B742/02 candidates often answered a question about the optimum conditions of the Haber process rather than explaining the effects of changing temperature and pressure.

In terms of the new B743 controlled assessment component, candidates found the analysing and interpreting, evaluating and justifying the conclusion sections quite demanding. The Principal Moderator for this component notes in his report that some centres gave candidates too much guidance and that centres must ensure that the work submitted is the candidate's unaided work.

B741/01 Modules C1, C2, C3 (Foundation Tier)

General Comments

The paper gave the majority of candidates the opportunity to demonstrate their knowledge and understanding of chemistry in the modules tested.

The longer six mark questions were well answered. A number of candidates did not reach level 3 in question 4 by confusing fractional distillation with cracking.
Many candidates failed to calculate the energy released by a liquid fuel, using the mass of fuel (1 g) instead of the mass of water (100 g).
Given formulas, candidates were able to construct and balance equations. Few candidates were able to describe the test for chlorine gas.
Few candidates were able to identify 'carbon' as the element that diamond and graphite are made of. In the same question (q10) most candidates listed a number of uses for diamond instead of writing about its properties. The word property continues to be misunderstood by candidates.

Comments on Individual Questions

Section A
1 (a)(i) and (ii) were well answered.
1 (b) candidates knew that carbon monoxide was poisonous but few knew that it is made during incomplete combustion. The most prevalent answer referred to cars as being the source of carbon monoxide.
1 (c) very well answered although some candidates only scored one mark as they forgot to mention both smoke and sulfur dioxide.
1 (d) many candidates correctly named carbon monoxide as a pollutant removed by catalytic converters. A common incorrect answer was carbon dioxide.

2 (a) and (b) were well answered.
2 (c) candidates found it more difficult to identify the monomer that poly(chloroethene) is made from.
2 (d) the best answered question on the paper.

3 (a) and (b) were well answered. This time the candidates understood the meaning of the word property.
3 (c) (i) and (ii) were well answered.
4 many candidates could place the fractions in order of their boiling point and scored 4 marks. Fewer candidates considered the temperature gradient in the column and that the crude oil has to be heated.

Section B

5 (a) a number of candidates correctly gave the number of different elements in the fertiliser as 4 but far fewer could give the number of atoms. A number of candidates totaled the atomic masses of the atoms.
5 (b) and (c) were reasonably well answered.

6 credit was given to candidates who identified a metal then described and explained its properties although the question did ask for candidates to suggest what properties a metal should have to make overhead power lines before choosing an appropriate metal. This question was well answered.

7 (a) (i) was well answered but 7 (a) (ii) was not. An explanation of why the mass of the test tube and contents decreased was often attributed to evaporation. Change of state was another common answer.
7 (b) electrolysis was the most common correct answer. In 7 (c) few candidates scored 2 marks because they concentrated on how expensive it is to dig the ore up but forgot that recycling copper requires less energy.

8 (a) some candidates identified water as a molecule from the list but few candidates in (8b) knew how to test for chlorine.

9 all parts of this question were fairly well answered.

Section C

10 (a) and (b) both parts were found to be challenging. Most candidates in part (b), gave a list of uses of diamond, not its properties.

11 (a) word equation was correctly written down by most candidates.
11 (b) the points were well plotted but many candidates tried to draw a best fit straight through the points rather than a curve.
11 (c) many candidates assumed a reaction had finished because no more gas is given off, rather than one or other of the reactants had been used up.

12 (a) candidates were able to gain two marks for explaining the difference between a batch and a continuous process.
12 (b) many candidates were able to calculate the percentage yield as 75% and score 4 marks.

13 (a) and (b) (i) well answered. Part (b) (ii), in the energy calculation many candidates only scored a mark because they used the mass of the fuel not the water.

14 (a) the balanced symbol equation was correctly written down by a number of candidates. A number reversed the equation and put copper carbonate as the product scoring no marks.
14 (b)(i) was well answered but part (ii) required a deeper understanding of the figures and was found to be a difficult calculation.

B741/02 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 6 mark questions were marked using a level of response approach. Candidates attempted to answer these questions and therefore almost always gained some credit. A higher proportion of candidates than in previous series' appreciated the need to address **all** aspects of these questions to gain access to the higher levels. Questions addressing Assessment Objective 2 (apply skills, knowledge and understanding of science in practical and other contexts) and Assessment Objective 3 (analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence) were better answered than in June 2012. Candidates understood the need to quote evidence to support conclusions.

Candidates continue to perform well in calculations and most candidates took care when writing chemical formulae correctly (using the correct case and subscripts).

Overall, examiners felt that the question paper was appropriate to the ability range of candidates intended. There was no evidence of lack of time.

Comments on Individual Questions

Section A - Module C1

Question 1
This question tested ideas about gases in the air and part (c) required candidates to interpret information and apply their knowledge.

(a) Most candidates correctly identified nitrogen and oxygen as the missing gases in the table. When candidates did not gain full marks it was usually because they failed to correctly recall the percentage of carbon dioxide in the air. 1%, being the difference between the percentages quoted and 100%, was a common error.

(b) In part (i) most candidates were able to explain two reasons why it is important that atmospheric pollution is controlled. Many candidates understood that carbon monoxide is changed into carbon dioxide in part (ii). When candidates did not gain full credit it was usually because they could not construct the correct balanced symbol equation.

(c) This part of the question was well answered with candidates able to correctly interpret the graph and describe the relationship between the number of deaths and the concentrations of smoke and sulfur dioxide.

Question 2
This question was about compounds of carbon.

(a) Most candidates appreciated that compound F was not a hydrocarbon as it contained an oxygen atom.

(b) D was usually correct.

(c) E was usually correct.

(d) Many candidates drew the correct displayed formula for poly(ethene). To score the mark candidates needed to draw the basic covalent structure of the polymer, 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 bonds at the side 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 was about solvents with part (a) requiring candidates to evaluate evidence and draw conclusions.

(a) Good responses to this question used the data to identify the most suitable solvent as D and explained that it removed the majority of the stain without damaging the fabric. When candidates did not gain full credit it was usually because they simply quoted data from the table, rather than using the data to compare the solvents.

(b) Good responses to this question suggested, for example, repeating the experiment for each temperature and using a greater range of temperatures or different types of stains. Candidates who suggested testing on different fabrics did not gain credit as the question was specifically about finding the most suitable solvent for removing stains from cotton.

Question 4

The question was about fractional distillation.

(a) This 6 mark question was targeted at all grades up to, and including, grade A* and discriminated well. The question required candidates to analyse the data in order to list the fractions in the positions that they 'exit' the fractionating column and then to explain how fractional distillation separates crude oil into fractions. At level 3 (5-6 marks) all aspects of the question needed to be addressed and candidates were required to explain the process of fractional distillation in terms of molecular size, intermolecular forces and boiling points. Some candidates continue to confuse fractional distillation and cracking.

(b) This question required candidates to write a balanced symbol equation for the incomplete combustion of propane in oxygen. This was a challenging equation for candidates. One 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 wrote an incorrect formula for carbon monoxide, e.g. CO_2, or failed to balance the oxygen atoms on the left hand side of the equation.

Section B - Module C2

Question 5

This question was about fertilisers.

(a) The number of different elements shown in the displayed formula was usually correct.

(b) The number of atoms in the formula was usually correct. Where candidates did not gain the mark it was often because they gave an answer of 132, being the relative formula mass of ammonium sulfate.

(c) This question about making solid ammonium sulfate was targeted at high demand, i.e. grades B-A*. Most candidates knew the reactants needed, although sulfur was a common error for the acid required, as was ammonia hydroxide for the alkali. To gain credit at level 3 (5-6 marks), in addition to naming the reactants needed, candidates had to describe a neutralisation experiment, including how both a neutral solution and solid ammonium sulfate is obtained. It was the crystallisation stage of the experiment that was often omitted from candidates' answers.

Question 6

This question focused on reactions of copper compounds and the purification of copper.

(a) Candidates displayed a good understanding of thermal decomposition in part (i). Part (ii) required candidates to write a balanced symbol equation for the reaction of copper oxide with carbon. As in question 4(b), one 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. The majority of candidates gained both marks. When candidates did not gain marks it was often because they tried to balance the equation by altering the formula for copper oxide, i.e. CuO_2.

(b) Good responses to part (i) described the reaction at the anode as oxidation because electrons are lost and the reaction at the cathode as reduction because electrons are gained. One mark was awarded to candidates who described oxidation as electron loss and reduction as electron gain, without identification of the electrodes (or with incorrect identification of the electrodes). The aspect of the specification tested in part (ii) was not well known. To gain credit candidates were required to describe copper ions going into solution at the anode and then those copper ions gaining electrons and becoming copper at the cathode.

(c) Good responses to this question described an advantage and a disadvantage of recycling copper, with candidates usually stating that recycling saves natural resources but that copper is difficult to sort from other metals. Credit was not given for vague references to the environment or reducing pollution.

(d) This question, which required candidates to evaluate evidence and draw conclusions, was well answered with most candidates choosing aluminium because it has the lowest density and does not corrode. Credit was not given for references to aluminium being light.

Question 7

This question focused on the industrial process for making ethanol from ethene and water.

(a) Most candidates identified the conditions that give the highest percentage of ethanol.

(b) This was a challenging question and only a small proportion of candidates were able to suggest why these conditions are used, even though they do not give the highest percentage yield. Candidates were most likely to be awarded a mark for suggesting that the high temperature gives a high rate of reaction or that higher pressures are expensive to generate.

Question 8

This question was about the structure of the Earth.

(a) Good responses to this question used the data in the question to explain that the lithosphere has a lower density than the inner mantle.

(b) This question assessed the 'How Science Works' aspect of the specification and many candidates were able to give at least one explanation as to why developed theories are often more widely accepted.

Section C - Module C3

Question 9

This question focused on different forms of carbon.

(a) 'Isotopes' was a common error in this question.

(b) Candidates often recognised that graphite has weak forces between the layers. To gain the second mark candidates needed to compare graphite to graphene, which contains only one layer of carbon atoms and therefore only contains strong covalent bonds.

(c) Most candidates correctly interpreted the data in the table and explained that diamond is used to make cutting tools because it is hard and has a high melting point.

Question 10

This question focused on rates of reaction.

(a) Most candidates scored 2 marks for the correct balanced symbol equation. As before, one 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 tried to balance the equation by altering the formula for hydrochloric acid, i.e. H_2Cl_2.

(b) Most candidates were able to interpret the graph to determine how long it takes the reaction to stop in part (i). The rate of reaction was usually correctly calculated from the graph in part (ii). Good responses in part (iii) showed a curve drawn to the left of the original passing through the origin, with the second mark awarded for a line ending at the

same volume as the original. It was the second mark that about a quarter of candidates failed to score.

Question 11

This question tested ideas about the processes involved in making fertilisers.

(a) Good responses to this question described that pharmaceutical drugs are made in small quantities or on demand whereas fertilisers are made in large quantities or 24/7. When candidates did not gain marks it was often because they gave more generic answers about batch and continuous processes, e.g. a continuous process can be automated.

(b) This 6 mark question focused on the concept of atom economy and was targeted at high demand, i.e. grades B-A*. At the simplest level, a candidate who calculated the required formula masses of magnesium nitrate and water, or gave a reason why an industrial process should have as high an atom economy as possible, scored Level 1. It was usually the formula mass calculation that gained credit at this level. To gain Level 2 candidates needed to show clearly, by calculation, that the atom economy for the reaction is 89%. Alternatively candidates could give two reasons why an industrial process should have as high an atom economy as possible, although marks scored in this way were again rarer. As in the other 6 mark questions on the paper, candidates had to address all aspects of the question to gain credit at level 3 (5-6 marks). Many candidates did not explain why an industrial process needs to have as high an atom economy as possible so did not gain credit beyond Level 2.

Question 12

This question was about energy changes during chemical reactions.

(a) Candidates found this question very challenging. Good responses described that bond formation is exothermic and that more energy is given out during bond formation than is taken in during bond breaking. When candidates did not get marks, it was usually because they simply stated that the reaction in the cold pack is endothermic because endothermic reactions take in heat (which was given in the stem of the question) or gave an answer in terms of the number of bonds broken or made.

(b) In part (i) many candidates were able to gain two marks for calculating the energy released. A common misconception was to substitute the mass of the fuel burned, rather than the mass of water. Good responses to part (ii) analysed and evaluated the evidence to conclude that paraffin gives out the most energy per gram because it gives the highest temperature change for the least amount of fuel burnt. When candidates did not gain both marks in part (ii) it was often because they stated that paraffin had the highest temperature at the end.

B742/01 Modules C4, C5, C6 (Foundation Tier)

General Comments

The paper gave the majority of candidates the opportunity to demonstrate their knowledge and understanding of chemistry in the modules tested. Most candidates attempted all the questions. Section D was well attempted by most candidates.

The longer six mark questions were not well answered. Few candidates reached level 3 in any of the three six mark questions. In 3 (b) few candidates completed the word equation; in question 9 few candidates were able to explain equilibrium and in question 12 (c) few candidates were able to describe how ethanol is made.

Only half the candidates were able to describe the test for carbon dioxide and even fewer candidates could describe how to complete a titration.

The word property continues to be misunderstood by candidates with many suggesting in question 5 (c) the uses that metals are put to rather than their properties.
Graphs were well interpreted and many candidates were able to complete the questions involving calculations correctly.

Comments on Individual Questions

Section A

1(a)(b) Many correct answers. A few candidates repeated the electronic structure of the elements.

1(c)(d) Many correct answers except for a few candidates who mixed up “group” and “period”.

2(a) Almost everyone got a mark here, but very few got both. All the possible answers displayed in the mark scheme appeared about equally.

2(b) A majority were able to score here, but the use of language was difficult to follow in a lot of answers. The most common answer was that Rutherford stated that atoms could be split.

2(c) A significant proportion of candidates continue to think that electrons are positive.

3(a) Most candidates were able to score at least 1 mark for explaining that lithium reacts with water or air.

3(b) Most candidates were able to reach level 1 with either a product or an observation. Better candidates were able to reach level 2, but only a very few were able to give a correct word equation to get level 3. A common error was to state that lithium was more reactive.

4(a) Most candidates were able to interpret the data correctly to score 1 mark with some correctly linking the fall in mass to the gas being given off, for 2 marks.

4(b) The test for carbon dioxide was not well known. Some candidates described carbon dioxide putting out a flame. Many candidates described the test for hydrogen.

5(a)(b) Both data interpretation questions were well answered by the majority of candidates.

5(c) Not well answered. A lot of the candidates talked about metallic structure without mentioning any property, many others gave uses for metals.

Section B

6(a) Many poorly drawn diagrams suggesting that rulers were not used. Many candidates were not familiar with collecting gas over water or in a gas syringe.

6(b)(i) Many candidates correctly indicated when the reaction had stopped. The only common mistake was "37".

6(b)(ii) Many candidates could explain why the reaction had stopped. Common errors were to describe that magnesium dissolved or to comment that the hydrogen had run out.

7(a)(b)(c) These calculations were almost all completed correctly by the candidates.

8(a) The change in colour of phenolphthalein was not well known. Almost all the universal indicator colours were used.

8(b) Few candidates scored 3 marks for describing how to complete a titration. A large number did not read the question, and put more hydrochloric acid in the burette, others did not mention an indicator or a colour change.

8(c)(i) The average titre was calculated correctly by most candidates. A few incorrectly included 22.9 in the calculation.

8(c)(ii) Candidates were able to explain why the titration figure 22.9 was ignored in calculating the average.

9 The Haber process appeared to be fairly well known, but the principles behind it were not. Descriptions of reversible reactions were poor at best, and there were very few even partly correct descriptions of equilibrium. The better candidates were able to state the effect of changes in temperature and pressure in terms of the amount of ammonia.

10(a) Only the more able candidates were able to score here. Common wrong answers were 19.2% and 70%.

10(b) Some candidates misread the question and answered in terms of food types (proteins etc.).

Section C

11(a)(i) Generally well known, but a few gave "chloride" as their answer instead of chlorine.

11(a)(ii) Very few correct answers here. Common errors were to discuss moving electrons or that there is space for the electricity to get through the liquid.

11(b) Few candidates scored 2 marks here; many candidates were able to score a mark for explaining that as the time and current were increased, the mass of copper deposited increased.

12(a) This was well answered. A few candidates incorrectly wrote about the lack of a double bond.

12(b) Many candidates chose 'hydration' as the correct description of the reaction.

12(c) Very few candidates were able to describe how ethanol is made by fermentation of glucose. In previous years, fermentation experiments were often carried out by candidates. The need for yeast was not well known, and a number of candidates only scored at all as they stated that a catalyst was needed. The only condition which appeared to be well known was the temperature required. Only a very few knew that the ethanol was extracted by distillation.

13(a) Many candidates correctly gave the word equations. Many lost marks by adding extra things to the equation.

13(b) Almost all candidates correctly placed the metals in order of reactivity.

13(c) Candidates who scored two marks usually stated that silver was formed and copper nitrate produced.

14(a)(i) Only about half the candidates were able to identify the hardest water.
14(a)(ii) Poorly answered, a majority talked about chlorine sterilising water.
14(b) Few candidates were able to write about methods used to soften water. The most common answer which scored a mark was 'boiling'.

15(a) Almost all candidates scored at least 1 mark, usually for "skin cancer", and many scored both marks. The only common mistake was to mention global warming.
15(b) Few candidates scored a mark. A common mistake was to add up the atomic masses, or to give C_2HF_5 because it has 5 fluorine atoms or to give no explanation at all.

Section D

16(a) Almost all correct.
16(b) Mostly correct, but a few lost a mark by going outside the year range, or just stating "1990s".
16(c) About half the candidates answered this question correctly. A common wrong answer was "20 years" (1950 to 1970).
16(d) Many candidates lost marks because they were not able to draw a straight line along the "4" line on the graph and therefore selected the wrong year.
16(e) Generally well answered, the only common mistake was not to compare the two CFCs and only describe the shape of the graph.
16(f) A common error was to talk about how one of the gases changes as the distance from the South Pole increases. A second error was to forget that ozone is a gas.

B742/02 Modules C4, C5, C6 (Higher Tier)

General Comments

This was the first time this examination paper had been taken by candidates and included the first Section D data analysis question in GCSE Chemistry B. There was no evidence that candidates did not have enough time to finish the examination paper.

The mean mark for the paper was 43 and the marks covered almost the whole of the mark range. The examination paper allowed candidates of all abilities to show positive achievement. There was a small proportion of candidates that would have been better suited to taking the Foundation Tier instead of the Higher Tier examination paper.

All three six mark questions were well answered and candidates were able to construct clear answers. Many candidates wrote extensively and needed additional sheets to complete their answers. The quality of written communication was generally quite good but at times candidates failed to use the correct chemical terminology.

Candidates found Section A the least demanding section and found Section B the most demanding.

Candidates were often able to do the evaluation questions and in particular candidates did not find Section D too challenging.

Centres should remind candidates of the importance of organising their answers to quantitative questions so that the working out is clearly shown. This will allow, where appropriate, the award of error carried forward marks. Candidates were uncertain about the use of significant figures.

Comments on Individual Questions

Question One

This question focused on the structure of atoms.

(a) A small but significant proportion of the candidates left this question blank. Candidates often gave the element as sulfur rather than phosphorus and the number of electrons as 16 rather than 18.

(b) Many candidates could define the term isotopes and referred to atoms having the same atomic number but different number of neutrons.

(c) Candidates often appreciated that scientists publish their results so that their work could be checked. Candidates rarely used the term peer review but often described this in words. Candidates who were awarded two marks often went on to describe the idea of developing the scientific work or collecting more evidence.

Question Two

This question was about calcium, sodium and chlorine.

(a) The best answers appreciated that the electronic structure could be used to determine both the group number and the period number of an element. Other candidates realised that the number of electrons indicated the atomic number of the element. It was not sufficient just to mention that a calcium atom contains 20 electrons.

(b) Many candidates appreciated that there was a shared pair of electrons but some candidates did not draw any more electrons. Even though the required candidates to only draw the outer shell electrons a significant proportion of candidates did draw the inner shell electrons. The mark scheme ignored any inner shell electrons even if they were incorrect. Candidates must be careful to ensure that the electrons are clearly shown as being shared when they are part of a covalent bond.

(c) The best answers described how an electron is transferred from a sodium atom to a chlorine atom. Other good answers appreciated that a sodium ion had one less electron than protons and a chloride ion had one more electron than protons. A significant proportion of the candidates referred to the sodium ion losing electrons and/or the chloride ion gaining electrons, these answers were not given credit in the mark scheme.

(d) The concept of Oil Rig was well understood so many candidates referred to chlorine gaining electrons.

(e) Candidates found the balanced symbol equation very challenging. Many candidates were not able to recall the formula of potassium chloride or iodine. A typical error was to give the formula of iodine as I and of potassium chloride as KCl_2. A small number of candidates gave the ionic equation for this reaction which was given full credit in the mark scheme.

Question Three

This six mark question was often well answered by candidates.

The best answers gave the balanced equation for the reaction of caesium and water and then explained in terms of electron loss why caesium was more reactive than lithium. Candidates who did not know the symbol equation could get partial credit by writing the word equation. The production of hydrogen was well known but candidates were less likely to name caesium hydroxide as the other product.

Answers were often well constructed and many candidates needed extra space to complete their answers.

Question Four

This question focused on the analysis of an aqueous solution and was the most demanding question in Section A.

Many candidates could not recall the significance of using barium chloride and silver nitrate solution in terms of identifying the sulfate and the chloride ion. Although some candidates chose D as the mixture the explanations given were often based on restating the information in the stem rather than explaining its significance. The very best answers used the tests to state that the mixture contained iron(II) ions, chloride ions and sulfate ions and so it must be a mixture.

Question Five

This question focused on the melting points of metals.

(a) Most candidates could use the graph to link the melting point with the strength of metallic bonding, and as a result chose potassium.

(b) Most candidates could not describe metallic bonding and a significant proportion of candidates left this question blank. The best answers described the attraction between the delocalised electrons and positive ions however most candidates did not even appreciate that a metal has positive ions. Candidates often drew diagrams that were not labelled and did not show the positive ions in a closed packed arrangement. A small proportion of candidates tried to draw 'dot and cross' diagrams. Other candidates referred to ionic, covalent and intermolecular forces.

Question Six

This question focused on the reaction of acids with magnesium and was the least challenging question in Section B.

(a)(i) Candidates were often able to interpret the graph and get a volume of 68 cm^3, although some candidates misread the scale and got 64 cm^3.

(a)(ii) Candidates were often able to interpret the graph and appreciated that the reaction finished somewhere between 37 and 39 seconds.

(a)(iii) Some candidates missed out this question. Other candidates gave a final volume greater than 68 cm^3 which is incorrect but a significant proportion were able to sketch the correct curve.

(b) The concept of a limiting reagent was well understood and many candidates gave their answer in the context of the actual experiment described i.e. magnesium was a limiting reagent since when it runs out the reaction stops.

Question Seven

This question was focused on an acid-base titration.

(a) Candidates often appreciated that the first titration was a rough one. Other candidates analysed the data and explained that the titre was not consistent with the other titres.

(b) A small proportion of candidates left this question blank. Candidates often got three marks, with a correct answer of 0.08 mol/dm^3, or no marks. Candidates often did not organise their answers and the answer space was full of numbers and equations that made little sense. Candidates would be advised to calculate the moles of hydrochloric acid, then to state that this was the same as the moles of the alkali and finally calculate the concentration of the alkali. By organising their answer candidates will get the opportunity to be awarded marks for error carried forward.

(c) Although candidates often appreciated that there was a sudden colour change with phenolphthalein and a gradual colour change with universal indicator, many did not include the word colour in their answer.

Question Eight

This was a very challenging six mark question that involved data analysis and le Chatelier's principle. It was targeted up to grade A*.

Some candidates only described the trends shown in the two tables and found it very difficult to explain the trends. Other candidates contradicted themselves in terms of percentage yield and the position of equilibrium, incorrectly stating that with a low percentage yield the position of equilibrium is on the right. A significant proportion of candidates referred to changing the temperature and pressure but did not specify the direction of the change.

Candidates were more likely to be able to explain the effect of increasing temperature on the position of equilibrium rather than the effect of increasing the pressure. The best answers for increasing temperature referring to the reaction being exothermic or the reverse reaction being endothermic. The best answers for increasing pressure referred to the reaction moving to the side with the least number of moles.

A significant proportion of the candidates answered a completely different question to the one set, since they tried to explain the conditions used in the reaction and referred to optimum conditions and rate of reaction.

Question Nine

This question was about fat and salt in food.

(a) Candidates were often able to calculate the percentage as 27.4. In this question the value of 27 was also allowed in the mark scheme. A significant number of the candidates did not include the working out for this question.

(b)(i) Candidates were often able to calculate the mass as 0.46g. In this example the value of 0.5 was not allowed in the mark scheme since the answer had to be to two significant figures. A small proportion of the candidates did not answer this question.

(b)(ii) Many candidates referred to sodium being in other ingredients although they did not specifically state that sodium could come from other compounds or from ingredients other than salt. A common misconception was that the chloride ion had not been accounted for in the mass. A significant proportion of candidates did not answer this question.

Question Ten

This question was about strong and weak acids and was the most demanding question in Section B.

(a) Some candidates gave good definitions based in comparing the degree of ionisation. Good answers stated that hydrochloric acid fully dissociated and ethanoic acid only partially dissociated. Marks were not awarded for candidates who only referred to the number of hydrogen ions present or to differences in pH.

(b)(i) Candidates often failed to include sufficient collision theory to be awarded a mark. Candidates were more likely to state that there are fewer collisions with ethanoic acid but did not state that it was the decreased collision frequency that was important. The idea that the hydrogen ions were less crowded or that the pH was higher was seldom mentioned.

(b)(ii) Candidates often appreciated that the limiting reagent would run out but missed the idea that it was because there was the same mass of magnesium that was important. A significant proportion of candidates did not appreciate that magnesium was the limiting reagent and gave answers that stated there was the same amount of acid.

Question Eleven

This question focused on the electrolysis of different liquids.

(a)(i) Candidates found the electrode reaction challenging and often candidates had the electrons on the wrong side of the equation or had the formula of chlorine incorrect. A small proportion of candidates did not attempt this question.

(a)(ii) Candidates often appreciated that the charge carrier could not move in a solid but could move in a liquid, however most candidates referred to electrons rather than ions as the charge carrier.

(b) In this evaluation question many candidates could use the data to show that as current increases so does the mass and as the time increases so does the mass but were less confident at explaining why this indicated direct proportionality. Only the best answers referred to the experiment numbers in their explanations. Candidates did not always choose sets of experiments where only one variable changed and as a result did not justify the patterns they were describing.

Question Twelve

This question focused on different alcohols and was the least challenging question in Section C.

(a) Many candidates could write the correct word equation but some wrote ethane rather than ethene.

(b)(i) Candidates could use the general formula to calculate that the formula of propanol is C_3H_7OH.

(b)(ii) Some candidates could draw the displayed formula for butanol. Almost all displayed formula drawn were of the straight chain primary alcohol.

(c) In this six mark question candidates often gave a comprehensive discussion of the advantages and disadvantages of hydration and fermentation. A significant proportion of the candidates needed to use additional pages to complete their answers. Sometimes candidates forgot to make a choice at the end of their answer which limited the mark to level 2 and four marks. Either choice of hydration or fermentation was accepted in the

mark scheme provided the answer was justified. The best organised answers put their information in a table of advantages and disadvantages.

Question Thirteen

This question was about the oxidation of some metals.

(a) Although many candidates could construct the word equation a significant proportion wrote copper(II) rather than just copper.

(b) Most candidates used the concept of Oil Rig and were able to identify that iron is oxidised and oxygen is reduced. Only a small proportion of candidates did not give a reason for their choice.

Question Fourteen

This question focused on the hardness on water and was the most challenging question in Section C.

(a) Only the best candidates were able to deduce that the water had both temporary and permanent hardness. Many candidates misinterpreted the question and thought there were several different water samples rather than just tap water. Candidates also did not relate explanations to the volume of soap solutions needed and instead made comments about the temporary hardness being removed by boiling.

(b) Good answers were very concise and just mentioned that calcium ions are swapped for sodium ions. Other candidates used incorrect terminology and referred to sodium and calcium as elements or atoms rather than ions. Some candidates referred to the removal of chloride ions rather than magnesium or calcium ions. A small proportion of the candidates did not attempt this question.

Question Fifteen

This question focused on CFCs.

(a) Candidates often recognised that CFCs were linked with ozone depletion but many did not get the second marking point by referring to a greater risk of cataracts or skin cancer or that as a result of ozone depletion more UV would reach the surface of the Earth. It was not sufficient just to mention there is a risk of skin cancer or UV will reach the surface of the Earth.

(b) Most candidates selected the HFC from the list.

Question Sixteen

This question involved data analysis and evaluation of data about CFCs.

(a)(i) A significant proportion of the candidates just gave the answer of 2078 and did not show any working out. The best answers stated the value at 2003 and then halved this value – this allowed for a possible award of an error carried forward.

(a)(ii) The best answers did use the data to justify their answer while other candidates just gave an answer based upon CFCs being inert. Comments that did not use the data were not given credit in the mark scheme.

(a)(iii) The most common answers were linked to either future use of CFCs, CFCs still being emitted into the air or the idea that you cannot predict if new ways of removing CFCs from the atmosphere may be discovered.

(b) Some candidates gave the correct answer of 43 years often with no supporting working out. Candidates should ensure they show their working out since in this question one mark could be obtained from an error carried forward even if the final answer was incorrect. A small proportion of the candidates did not attempt this question.

(c)(i) Some candidates calculated the correct value of 2.2%. Some did not understand the question and gave an answer of 97.8 or 97%.

(c)(ii) Candidates had to compare tabulated data with graphical data but some candidates compared the same graph twice and as a result stated there was no difference. Candidates who were awarded marks appreciated that that the percentage of CFC11 went down before that of CFC12 and that there was a difference in the rate of decrease. Candidates had to refer to the correct CFC in order to be awarded a mark.

B743 Controlled Assessment

This was the first full year of assessment for Controlled Assessment. The number of centres entering candidates for the separate sciences was higher than in previous years following the national trend. Many centres had entries for all five specifications and these were, as far as possible, dealt with by the same moderator.

Most centres followed the procedures for carrying out assessment, submission of samples and application of marking criteria with little problem but there were, as always, exceptions. Problems faced by some centres are described below and centres should take care to avoid them when entering candidates next year.

Carrying out the assessment

The word 'Control' in Controlled Assessment refers to control of the candidates to ensure that the work completed is the candidate's own. Some centres gave candidates far too much guidance as to how plan, execute and write about the task. Centres should ensure that all of the work, not just the 'high control' part 3, is the candidate's unaided work.

For the same reason, writing frames are not permitted. This includes generic ones which do not refer directly to the task.

Candidates can work together in groups of no more than three but the plan produced by any candidate must be their own work not a copy of that of other members of the group. Plans within a group will, of course, be similar but examples were seen by moderators of plans which were identical. The same principle applies to tables of data and graphs.

Controlled Assessment tasks can only be used in the year printed on the front cover. They can be completed at any time but can only be submitted in that year. A 2012 task done in 2012 cannot be submitted in 2013 neither can a 2014 task done a year early. If a task is completed but not submitted in the appropriate year it cannot be used.

Some centres submitted tasks from 2012 and 2014 and some centres submitted a mixture of different years. Such mistakes are not without penalty.

Submission of samples

Many centres organised their samples of work very well whereas others adopted a rather more random arrangement which varied according to which teaching group the candidate was in. It is helpful to moderators if the work is arranged in order with the front page of the part 3 booklet at the front.

This page is what the moderator needs to look at first as it contains all of the essential information; year, specification, task name, candidate name, centre number, candidate number and the marks for each Skill quality. It is disappointing when this page is incomplete. In too many cases centre number and/or candidate number were missing. Sometimes the marks were not completed or were wrongly totalled.

Centres are asked to ensure next year that in the sample sent for moderation this sheet is at the front of the candidates' work and is correctly and completely filled in.

Application of the marking criteria

This is dealt with in detail below under the heading of the individual Skill qualities but a few general points follow:

The 'Additional guidance' given below the criteria in the Teacher Guidance for each task, should not be used as a mark scheme.

No other mark scheme, whether from the internet or generated by the centre should be used.

The only valid mark scheme is the marking criteria provided by OCR.

There have been issues in some centres this year where candidates were disadvantaged by centres using mark schemes other than the official marking criteria.

Guidance follows on how to apply the Criteria when marking a candidate's work.

Researching

It is the notes which the candidate makes on their original research which are assessed. The original research may not be the candidate's work as it may have been done at home or in a group. The original research need not and, indeed, should not be included in the sample nor may it be taken, by the candidate into the final (part 3) session.

To gain higher marks candidates must 'select' 'appropriate' information/sources. The only acceptable way to demonstrate this is to ensure that the information presented in the notes is relevant to the bullet points in Stimulus 2 and covers them thoroughly. In addition, there should be a reference in the text of the notes to show the information sources..

Moderators frequently saw the work of candidates who had wrongly been given high marks for extensive notes (often copied straight from sources) which were not focussed on or entirely pertinent to the questions posed in the Stimulus sheet.

Planning

Take care when deciding if a plan is repeatable. As a science teacher you will know what the candidate intends but to score 4 or more the plan should have sufficient detail for it to be carried out by a non-scientist. This includes how apparatus should be set up, a range of values to be investigated and the number of replicates. For the higher marks a more detailed treatment of variables, ensuring accuracy and avoidance of errors is needed.

A significant number of candidates explained the control of variables in great detail and explained how accuracy would be ensured and errors avoided but then let themselves down by writing a very sketchy plan. This work was not worthy of the high marks given because of the lack of sufficient detail to allow it to be repeated.

It should also be noted that a plan should not be written in the past tense. This gives the impression (sometimes justified) that the plan was written after the investigation had been carried out. This is not what the Controlled Assessment task demands.

In Additional Science and the separate sciences this Skill quality also involves the writing of a hypothesis. For higher marks, the hypothesis should be justified with correct science which is clearly understood by the candidate.

However, the hypothesis is only part of this skill quality and an excellent hypothesis with justification cannot, alone, lead to a high mark. Equally a poor, unjustified hypothesis does not necessarily mean a very poor mark.

Collecting data

This Skill quality should mean a high mark for most candidates if they have been properly instructed. It was sometimes under-marked in some centres. If data are tabulated with correct headings and units for columns and values are to an appropriate number of decimal places, there is no reason why a mark of 6 should not be given.

However, raw data should be recorded and this was not always the case. For example if a temperature change was being measured, the initial and final temperatures should be recorded not just the change. Mixed units e.g. minutes and seconds are also not appropriate. Time should be recorded as minutes or as seconds. Examples of both these types of error were seen this year.

Managing risk

Evidence for this skill should be found in the plan and also in the answer to question 4 in part 3. However, the first part of the statement in the criteria is only really addressed by a risk assessment in the plan. Only this is an analysis of the risk before activity starts.

A simple statement of general safety rules can, as clearly shown in the criteria, only be awarded 2 marks. If risks specific to the task are identified and suitable responses suggested then 3 or 4 marks are available. To gain the higher marks 'significant risks must be evaluated'. There should be mention of how likely it is that that risk will occur and of the consequences if it does together with appropriate procedures to avoid/minimise it.

If an activity is 'low risk' then this should be stated. Little credit can be given for risks which have been 'invented' so that the candidate has something to write about.

Processing data

Processing involves the use of 'mathematical techniques'; at least two for marks above 2. One of these may be a technique concerned with graphing (plotting or constructing an appropriate scale). It is, of course necessary for these techniques to be used accurately. Wrong averages, wrong plotting or scales which are too small or non-linear will not do.

There is no need for the candidate to undertake 'complex mathematical techniques' unless they form part of the task undertaken. However, for the highest marks some treatment of the uncertainty of data is essential (the easiest way to accomplish this is by the use of range bars).

A graph deserving of six marks should have axes labelled with quantities and units. Axes should be constructed so that the graph occupies at least half of the A4 sheet. A best fit straight line or curve as appropriate should complete the graph together if range bars if used.

Analysing and interpreting

Candidates should be informed that it scientific explanation of the trends is necessary and explicit in the criteria. Credit can be given for an explanation given later in the conclusion section. Centres sometimes gave lower marks than necessary for this skill quality because they did not take into account explanations which the candidate later gave in answer to the final two questions.

Where comparison with secondary data is merely a statement that data from other groups was much the same, little credit can be given. What is expected for higher marks is a comparison between two sets of data; the candidate's and those of another candidate. The secondary data used should be included as part of the sample. This was rarely seen in the samples moderated.

Evaluating

Evaluation is, perhaps, the most difficult Skill quality for candidates. Many candidates attempt this by explaining in some detail what they did and stating how successfully they followed their plan and how good their results were. This deserves very little credit especially when it is clear from their raw data and from their graph that their data was anything but good. The statement 'my data is good because it is primary data' was not uncommon.

Both the quality of the data in terms of accuracy and repeatability and the weaknesses in the method which led to any problems need to be addressed. Suggestions for improvement were often made but an explanation of why that would make the data better was seldom seen.

Candidates should be encouraged to start their evaluation by looking at their data to find any inconsistencies (there almost always are some) and then describe how the method could have led to these. Conclude by explaining how the method could be improved to get better data. Simply stating I would repeat it 5 times rather than 3 is worth little.

Justifying a conclusion

This Skill quality was usually marked accurately by centres. Candidates should be advised that some science is needed in answer to questions 5 and 6. In question 5 the words 'explain your answer' should be taken to mean reference to their data and the scientific explanation of the trend observed. In question 6 the requirement for science is stated more clearly and reference needs to be made to their research notes also.

Good candidates often find the space allowed in the answer booklet rather too small. Candidates can use continuation sheets if necessary. These should be clearly labelled with candidate name and number together with an indication of the question number.

Another, perhaps better, solution is for centres to create their own answer booklet. As long as the first page is kept and the wording of the questions is not changed this does not count as a writing frame. It allows centres to provide more space for their candidates to give answers to the questions posed.

There are a number of documents available to assist centres with the application and administration of these tasks.

- **The specifications for the Gateway Science Suite**
- **Gateway Science Suite Guide to Controlled Assessment**
- **Exemplar tasks with marked candidate's work on the OCR website**
- **Candidate guidelines for controlled assessment** (section H of the guide to controlled assessment) also available separately from the website. These guidelines may be used by candidates in all parts of the controlled assessment.
- **The assessment criteria**. These may be given to candidates but the wording may **not** be simplified or changed in any way. Issuing the additional guidance to candidates is strictly forbidden.

Centres are thanked for the many hours of work put into running the assessments, marking the assessments and preparing the sample for submission. In the majority of centres this work resulted in a moderation process which was accomplished without too much trouble.

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