RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

Gateway Science Suite

General Certificate of Secondary Education **J264**

OCR Report to Centres

June 2012

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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

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OCR REPORT TO CENTRES

Overview

These new specification papers have offered different types and levels of challenge to those of the legacy specification. In this sitting, only the Unit 1 assessments were available (B741-01 foundation and B741-02 higher). There has been a noticeable shift in questioning techniques that Ofqual had insisted on and these were evident for centres to see in these papers.

The reports on the individual papers, along with their mark schemes will help guide candidates and centres toward the desired expectations for success. Also, prompting in longer questions with bullet points, which has proved very successful in the past, was not allowed in the setting of these papers. This led to answers that were often less focussed than we have been used to in the past. Some candidates highlighted the key information and points on the question paper. This level of thought often gave answers that were more focussed and successful.

Centres should remind candidates that scripts are scanned as black and white images, so the use of coloured pens or faint pencil is not recommended. Furthermore, if candidates' answers do not fit in the designated area, a sensible approach used by many candidates is to indicate part of the answer is elsewhere on the page. An arrow is often all that is needed to highlight this. This will then direct the marker to open up the whole page and mark accordingly. If no such indication is there then the answer may be missed.

The Principal Examiners' reports which follow indicate good advice for teachers and candidates alike. Heads of science are advised to use them with their colleagues so that in classroom situations they can routinely and purposefully advise their students.

B741/01 Modules C1, C2, C3 (Foundation 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 30, and the marks awarded covered a wide mark range.

Some of the new aspects of the examination papers proved difficult for many candidates. The 6 mark questions were marked using a level of response approach. Candidates attempted to answer the questions and therefore almost always gained some credit. Candidates need to address **all** aspects of the questions to gain access to the higher levels. Candidates also found the new style questions assessing Assessment Objective 3 (Analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence), challenging. Candidates need to quote specific examples of the data to support a conclusion, rather than make generalised statements. Question 10(a)(ii) is a good example of this.

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

Candidates used their knowledge and skills appropriately to respond to the questions on carbon compounds, air pollution and the structure of the Earth.

Candidates did not seem to have the knowledge required to respond to questions about polymerisation reactions, rates of reaction and acids and bases.

Comments on Individual Questions

SECTION A - MODULE C1

Question 1

This question tested ideas about carbon compounds and required candidates to interpret information and apply their knowledge.

(a) Most candidates made a good start to the paper, applying their knowledge of hydrocarbons to recognise either methane or ethene as an example of this type of compound.
(b) The number of atoms shown in the displayed formula was usually correct. When candidates did not gain the mark it was usually because they gave an answer of 3, being the number of different elements in the displayed formula.
(c) This part of the question differentiated well. A wide range of incorrect responses were seen.

Question 2

This question focused on fuels, with part (a) requiring candidates to evaluate evidence and draw conclusions.

(a) Of the questions on the paper testing Assessment Objective 3, this question was answered the best by candidates. Candidates were able to identify oil as the fuel that should be chosen for the house because it was easy to use and available to the house. When candidates did not gain full marks, it was usually because they also stated that oil was the cheapest fuel, which was not supported by the data.

(b) Most candidates scored at least one mark for stating a factor that needs to be considered when choosing a fuel for a house. When candidates did not gain credit it was usually because they gave factors stated in the question, or gave vague answers such as 'is the fuel environmentally friendly'.
(c) Most candidates wrote the correct word equation for the reaction of propane with oxygen. A few tried to write a symbol equation and because the formulae were incorrect, lost the mark.

Question 3

This question was about paint.

(a) Most candidates appreciated that the job of the pigment in paint is to give the paint its colour.
(b) Candidates needed to appreciate that paint Y would spread most easily on a wall because it contains more solvent. To score the second mark they were required to recall that solvent thins the paint.
(c) Good responses to this question used the data to suggest two reasons why the cheaper paint may not be the best paint to buy, e.g. the cheaper paint contains less pigment so may not be as brightly coloured, the cheaper paint has less additives so will not dry as quickly or the cheaper paint contains less binding medium so will not stick to the surface as well. When candidates did not get marks, it was usually because they did not use the data in the question, but merely gave vague answers relating low cost to poor quality.

Question 4

The question was about polymers.

(a) To gain the marks in this question, candidates were required to describe that in a polymerisation reaction, many small molecules or monomers bond together. When candidates did not gain credit, it was often because they confused polymerisation with cracking.
(b) D was usually correct.
(c) This part of the question differentiated well. To gain full marks candidates needed to address both parts of the question, writing about some of the ways of disposing of polymers and suggesting why chemists are developing new types of polymers to help with disposal problems. The first part of the question was usually well answered, with candidates recalling that polymers can be disposed of in landfill sites, by burning or by recycling. Candidates often failed to address the second part of the question.

Question 5

This question was about air pollutants and was targeted at all grades up to, and including, grade C. The question required candidates to analyse the data in order to describe **how** the levels of some air pollutants have changed and then to explain **why** the levels of pollutants have changed and why it is important that atmospheric pollution is controlled. At level 3 (5-6 marks) all aspects of the question needed to be addressed, with level 2 (3-4 marks), requiring a discussion of two aspects of the question and level 1 (1-2 marks), a discussion of one aspect of the question. Most answers seen were at level 2. Most candidates failed to appreciate the significance of the negative numbers for the percentage change in emission and therefore did not realise that levels of pollutants have decreased between 1990 and 2008. Credit was however given to candidates who gave a correct reason for an increase in air pollution, such as increased burning of fossil fuels due to increasing population or greater use of cars.

SECTION B - MODULE C2

Question 6

This question was about fertilisers.

(a) In part (i), candidates were required to apply their knowledge of essential elements needed for plant growth to identify nitrogen and phosphorus as the essential elements in ammonium phosphate. Both elements were required for the mark and when candidates did not gain the mark it was usually because they wrote nitrates instead of nitrogen. In part (ii), many candidates calculated the relative formula mass of ammonium phosphate or gave the number of different elements in the formula, rather than the total number of atoms.
(b) Good responses to this question described adding universal indicator to the solution and then comparing the colour to a pH chart or colour chart. This aspect of the specification, however, was not well known.
(c) In part (i), very few candidates correctly named apparatus A as a burette. Even fewer candidates correctly named potassium hydroxide as the alkali used to make potassium nitrate in part (ii).

Question 7

This question required candidates to interpret information and apply their knowledge about metals and alloys to suggest the properties that make solder useful for joining electrical wires. Most candidates appreciated that solder conducts electricity well, but fewer candidates described that solder has a low melting point, many stating the opposite.

Question 8

This question focused on the structure of the Earth.

(a) Good responses to this question explained that the crystals would be small because the lava cooled quickly. When candidates did not gain the mark it was usually because they simply stated that the crystals would be small, without explanation.
(b) The mark scheme gave credit for a wide variety of sensible reasons why some people choose to live near volcanoes. Most candidates that gained credit suggested that the soil near the volcano was fertile. When candidates did not gain the mark, it was usually because they gave an answer that was too vague, e.g. the soil is good.
(c) Plate tectonics was usually correct.

Question 9

This question was about the Haber process and other industrial processes.

(a) This 6 mark question was targeted at all grades up to, and including, grade C. As in question 5, at level 3 (5-6 marks), all aspects of the question needed to be addressed, i.e. candidates were required to describe two or more of the costs involved in making ammonia and to explain why some costs would change when using a lower pressure. It was the latter part, requiring candidates to apply their knowledge and understanding, which was usually omitted from candidates' responses. At level 2 (3-4 marks) candidates were required to describe two or more of the costs involved in making ammonia, whilst level 1 (1-2 marks), simply required one cost to be identified. Most answers seen were at level 2.
(b) This question required candidates to write a balanced symbol equation for the reaction of sulfur dioxide with oxygen. One mark was awarded for the correct reactants and products and one mark for the correct balancing. The balancing mark was dependent on the correct formulae, but one 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 sulfur trioxide, e.g. SO_4, or attempted to balance the equation by placing numbers within the formulae, e.g. $S2O_2$.

Question 10

This question focused on iron and aluminium.

(a) Fertiliser solution was usually correct in part (i). As mentioned in the General Comments, many candidates clearly knew the chemistry in part (ii) but were only able to get one mark for implying that without water there is no rust and without oxygen/air there is no rust. To achieve two marks, candidates were required to make specific reference to results of the investigation given in the question. There will be questions on future papers that require the skill of supporting a conclusion with evidence. Candidates will need to refer to specific aspects of the data to gain full marks. This skill is also likely to be assessed in Unit 2 papers as part of the new, content free, section D questions.

(b) This aspect of the specification was not well known. To gain credit candidates needed to recall that aluminium does not corrode because it is coated with an aluminium oxide layer.

(c) Good responses to this question described two advantages of recycling aluminium, with candidates usually stating that the aluminium can be used again, which saves money and/or natural resources. Credit was not given for vague references to the environment or reducing pollution.

SECTION C - MODULE C3

Question 11

This question tested ideas about rates of reaction.

(a) The word equation for the reaction of calcium carbonate with hydrochloric acid was usually correct.

(b) Most candidates interpreted the graph correctly and gained the mark for the volume of gas made by the end of the experiment in part (i). Good responses to part (ii) explained that the reaction stops because all the hydrochloric acid or calcium carbonate is used up. When candidates did not gain the mark, it was often because they wrote that no more gas was produced. Credit was not given for the idea that the calcium carbonate had all dissolved. In part (iii), most candidates gained at least one mark for correctly plotting the results for tablet Y on the graph. A significant proportion of candidates failed to score the second mark for the line of best fit as they joined the points either ‘dot to dot’ or with a curve that was not a single line.

(c) Good responses to this question, explained that tablet X contained less calcium carbonate because it gave off less gas. When candidates did not get the mark it was usually because they gave an explanation in terms of the time for the reaction to finish.

(d) Many candidates gained one mark for correctly stating one way that the reaction could be speeded up, usually by the use of a catalyst. Fewer candidates scored higher marks. The best responses described two ways of speeding up the reaction and explained, using the reacting particle model, why the rate of reaction is increased. As the question was targeted at standard demand, an explanation in terms of more collisions, without reference to collision frequency, was sufficient. When candidates did not gain credit it was usually because they wrote about using more concentrated hydrochloric acid (given in the stem of the question) or described adding more acid or calcium carbonate.

Question 12

This question tested ideas about batch and continuous processes and involved chemical calculations.

(a) Good responses to part (i) described that ammonia is needed in large amounts but drugs or medicines are made on a relatively small scale. Candidates often failed to gain credit as their responses simply re-stated the information in the question about the type of process used to make each chemical. Chromatography was not well known in part (ii), with neutralisation often given as the answer.

(b) The ability of candidates to perform percentage yield questions has improved over the years. However, part (i) required candidates to show that the percentage yield was 75% and this proved to be more challenging. Many candidates were unable to suggest why the yield was not 100% in part (ii).

(c) Many candidates failed to gain the mark for the balanced symbol equation in part (i), usually because they changed the formulae that were given to them in the question. The formula for water was not given in the question, but most candidates knew this. The principle of conservation of mass in part (ii) was not well understood. 12.1g (obtained by adding the three masses given in the question), was a common error.

Question 13

This question focused on the calorimetric method for comparing the energy transferred by different fuels and was aimed at grades E, F and G. Most candidates identified propanol as the best fuel to use, with a limited explanation, and gained credit at level 2 (3-4 marks). 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 describe the experiment done to obtain the results, so could not gain credit at higher than level 2.

B741/02 Modules C1, C2, C3 (Higher Tier)

General Comments

The examination paper allowed candidates of all abilities to show positive achievement. The mean mark for the paper was 36 and the marks covered almost the whole of the mark range. There was no evidence that candidates did not have enough time to finish the examination paper.

There were a small proportion of candidates that would have been better suited to taking the Foundation Tier examination paper instead of the Higher Tier.

All three six mark questions were answered well and candidates were able to construct clear answers. The quality of written communication was generally quite good, but at times candidates needed to have used the correct chemical terminology.

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

Candidates found the questions relating to application and to evaluation much more demanding than those that focused on knowledge and understanding.

Centres should remind candidates of the importance of organising their answers to quantitative questions to allow the award of error carried forward marks. Candidates are also uncertain about the use of significant figures.

Comments on Individual Questions:

Question 1

This question focused on the displayed formulae of organic compounds and was the most accessible question in section A.

In (a) many candidates appreciated that methane either had no double bonds or only had single bonds. Only a small proportion of candidates referred to the general formula for alkanes.

Many candidates recognised ethene in (b) as unsaturated, and could write the molecular formula of ethanoic acid in (c).

The majority of candidates were able to write the symbol equation in (d).

Question 2

This question focused on fuels.

Most candidates were able to evaluate the data provided and identify oil as the best fuel to choose in (a).

Although a significant proportion of candidates in (b) identified CO_2 and H_2O as the formulae of the product, many were not able to balance the equation.

Question 3

Some candidates did not attempt parts (a) and (c) in this question.

In (a), although many candidates referred to evaporation, the mark was only given if it referred to the solvent or water. Some candidates had other constituents of paint evaporating, which were not given credit in the mark scheme.

Most candidates recognised (b) as the correct pigment and were then able to link the importance of the colour change to its use on a kettle.

Candidates were not always able to fully explain why the pigment and liquid particles do not separate and often repeated information in the stem. Answers often did not refer to the size of the particles or use the term dispersed.

Question 4

This question, about air pollutants, also assessed the quality of written communication. Good answers were well organised and addressed both parts of the question. Such answers were illustrated with a symbol equation, often of the reactions that take place within a catalytic converter.

The effects of the pollutants shown in the graph were well known and often candidates also referred to other pollutants, such as CFCs. Only the most able candidates gave a detailed explanation of the working of a catalytic converter. Some candidates explained the changes in atmospheric pollutants, in terms of having more complete combustion, illustrating the answer with appropriate equations.

Question 5

This question focused on the properties of polymers.

In (a), almost all candidates were able to attempt the question, but common mistakes included missing out the free bonds or still including the double bond between the carbon atoms.

Candidates often referred in (b), to the insolubility of poly(chloroethene) or its water resistance, but because of the photograph in the question the idea of the polymer being strong was also accepted.

A large proportion of the candidates in (c) were unable to explain the properties of plastic **A** and **B**. Typically, candidates did not use the correct terminology and confused covalent, intermolecular and cross-links. Candidates needed to be clear exactly what force or bond was responsible for the properties described. In (i), candidates often did not address the second marking point in the mark scheme.

Question 6

This question focused on fertilisers and their preparation and was one of the least accessible questions in section **B**.

The specification refers to essential elements rather than nutrients, minerals or salts so in (a), the names or symbols of the three essential elements (NPK) were given credit, but nitrates, ammonium salts and phosphates were not given credit. To get full marks, the reason for the presence of the essential element was required. Most candidates awarded the second marking point, linked nitrogen with the production of plant proteins or amino acids; only a much smaller number of candidates referred to RNA or DNA synthesis.

In (b), although many candidates appreciated that the formula shows 20 atoms, other candidates calculated the relative formula mass instead.

Candidates found both parts of (c) very difficult and a significant proportion of the candidates did not attempt either part (i) or (ii). In (i), the most common answer was potassium rather than potassium hydroxide. The mark scheme allowed potassium carbonate and potassium hydrogencarbonate, but these answers were rarely given by candidates. In (ii), many candidates only referred to acid or alkali particles and did not recognise the importance of the hydrogen ion, and the hydroxide ion.

Question 7

Candidates found both parts of this question quite difficult and often gave imprecise and vague answers that were not given credit on the mark scheme.

In (a), candidates needed to explain why it was not possible to predict the eruptions rather than just stating it was difficult to predict. Candidates found (b) a little easier and could either answer the question by giving specific examples of evidence or by giving a general answer related to the way scientists work. Most candidates referred the specific pieces of evidence, e.g. similar fossils and ocean floor spreading.

Question 8

This question focused on reinforced concrete and also assessed quality of written communication. Good answers clearly explained both the nature of a composite material and explained the advantages of reinforced concrete. Many candidates were able to use the information given in the table and match this with their own knowledge and understanding.

Candidates often did not give a clear explanation as to why reinforced concrete was a composite material and answers often referred to steel rather than reinforced concrete.

Question 9

This question focused on the Contact Process.

In (a), many candidates could construct the balanced equation.

Most candidates could interpret the data in the table in (b)(i) and stated that the percentage yield decreased as the temperature increased. In (b)(ii), candidates often did not give very detailed answers and were only awarded a mark for realising that a catalyst increases the rate of reaction. The idea of compromise conditions was very rarely discussed by candidates and the answers for temperature and pressure were often included together. Only the most able candidates were able to score two or more marks in this question.

Question 10

A significant proportion of the candidates did not attempt (a) and/or (b) in this question on the electrolysis of concentrated sodium chloride.

In (a), many candidates included electrons on the wrong side of the equation or they used e^+ rather than e^-. A significant proportion of the candidates did not attempt this question.

Many candidates could not name sodium hydroxide in (b) and a significant proportion of candidates did not attempt this question.

Question 11

Many candidates could evaluate the information given in the table, but they did not always give comparative comments as required by some of the marking points.

Question 12

This question focussed on the reaction between an antacid tablet and hydrochloric acid.

In (a), candidates often could not recall the formula of hydrochloric acid and as a result could not construct the balanced equation. A common misconception was to have the formula as H_2Cl_2.

Many candidates were able to decide when the reaction had stopped in (b)(i), but a small proportion did not appreciate the significance of the units in the graph and the answer line and assumed that 5.40 minutes was 5 minutes and 40 seconds. This answer was not given credit because the acceptable answer was between 5.5 and 6.0 minutes. Some candidates were able to calculate the rate of reaction, but often gave the wrong units for the rate of reaction. The mark scheme required an answer of 15 cm^3/min, but many candidates gave the units as cm^3/m. A small number of candidates calculated the rate in cm^3/s with a numerical answer of 0.25, this was given full credit in the mark scheme. Candidates were often not sufficiently clear with their answers to (iii) and it was not possible for the examiner to decide if the answer referred to the first two minutes or the next two minutes.

Part (c) also assessed quality of written communication. Good answers used the correct model and collision frequency to explain the effect of concentration and crushing the tablet on the rate of reaction. Weaker answers only referred to the number of collisions. A common misconception was to refer to articles moving faster when the concentration was increased, rather than appreciating that the particles become more crowded.

Question 13

This question focused on the manufacture of fertilisers and medicines.

In (a)(i), many candidates did not make a statement about both medicines and fertilisers and so often got just one mark rather than two marks. In (ii), it was not sufficient just to refer about the need for testing for medicines because fertilisers also need to be tested. The candidates had to explain the degree of extra testing needed by a medicine to be credited with a mark.

Candidates had very little difficulty in (b)(i) with the calculation on percentage yield, although sometimes the steps involved where not clearly written. Centres should advise candidates to write the equation they will use and then substitute the correct numbers into this equation. Candidates often did not appreciate in (ii) that the higher the percentage yield, the more efficient the reaction and the less wastage of starting material.

Question 14

This question focused on the burning of liquid fuels.

In (a), most candidates appreciated that the mass of water was the same and that repeating the experiment would increase the confidence in Stephanie's results.

Candidates in (b) often did not use the correct mass in their calculation, using the mass of fuel to calculate the energy transferred. Even those candidates that used the correct mass often did not know how to take the calculation a stage further to calculate the energy transferred per gram. The correct answer was 17 500, but a significant proportion of the candidates gave an answer that was not to three significant figures or wrote 175 instead.

Most candidates did not use a quantitative approach to (c) and so were not awarded any marks in (c). Even those candidates that calculated energy transferred per gram did not consider the information about the cost of the fuel to explain their answer.

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