OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

Gateway Science Suite

General Certificate of Secondary Education **J264**

OCR Report to Centres

January 2013

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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

Chemistry B (Gateway) (J264)

OCR REPORT TO CENTRES

Overview

This was the third session for the B741 examination papers. The majority of the candidates took the Higher Tier examination paper. There was evidence that a small but significant proportion of the candidates that took the Foundation Tier could have successfully taken the Higher Tier. Both examination papers allowed candidates to demonstrate positive achievement in GCSE Chemistry. There was no evidence that candidates did not have sufficient time to finish the examination papers.

Candidates found the six mark extended answer questions more accessible than in previous sessions. There was only a small proportion of candidates that left one or more of this type of question blank. These questions were marked using a level of response mark scheme that allowed candidates who attempted the question the opportunity to get some credit. Candidates found the six mark questions that focused on Assessment Objective 2 (Application) and Assessment Objective 3 (Analysis and Evaluation) much less challenging than those that focused on Assessment Objective 1 (Knowledge with Understanding).

Over the three sessions candidates have improved their ability to answer questions that address Assessment Objective 3. In this session candidates often made reasoned judgements and explained how experimental results supported a conclusion. Candidates had some difficulties with questions that addressed Assessment Objective 2 (Application) because these questions involved applying knowledge and understanding to contexts, rather than just recalling knowledge. However candidates often did not have the basic knowledge to answer some questions e.g. the formulae of certain compounds or the origin of some atmospheric pollutants.

The examination papers have a significant proportion of quantitative questions and, although these were often well-answered, candidates must be reminded of the need to be careful about the use of significant figures, decimal places and standard form.

Candidates found ionic equations demanding and they often failed to balance the charge. Candidates were much more confident balancing ‘normal’ symbol equations.

Candidates did not always use chemical terminology with precision, for example referring to bond breaking and bond making needing energy or stating which type of bond was broken when explaining the properties of giant molecules.

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

General Comments

It was clear that some candidates prepared well and were successful as a result. A significant number of candidates (about 10%) would have been better served by entry to the higher tier paper. These were candidates who scored over 50 marks. 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. 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 January 2012. Candidates understood the need to quote evidence to support conclusions.

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

Overall, examiners felt 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

Question 1

1(a) Most candidates were able to correctly link the food additives to their correct use. The most common incorrect response was to link the emulsifier with 'stops food going off'. There were a number of candidates who drew multiple lines to more than one job, which did not score.

1(b) About half of candidates correctly quoted 4 in part (i). 5 was the most common incorrect answer. About a quarter of candidates could recall the test for carbon dioxide in part (ii). There were a number of 'squeaky pop tests' quoted or candidates talking about 'cakes rising', which did not score.

Question 2

2(a) Most candidates scored 1 mark, usually for the idea that non-renewable fuels are finite. Fewer gained the second mark for taking a long time to form. The main error was candidates who stated 'it can't be used again'.

2(b) Most candidates correctly identified 'bitumen' and the majority gained the second mark for 'highest boiling range'. LPG was the most commonly quoted incorrect answer.

2(c) Part (i) was well answered by most candidates. Part (ii) differentiated well. Most candidates stated that hydrocarbons contain carbon and hydrogen for 1 mark. The addition of 'only' gained the second mark. The third mark was the most challenging, with candidates needing to state that alkanes contain single bonds **only**.

Question 3

3(a) This question was well-answered, with most candidates correctly identifying both cars.

3(b) Candidates can now construct word equations well. The most common errors were to write water rather than oxygen or to attempt to write a symbol equation. The correct formulae will score the mark but this was a rare occurrence.

3(c) This question was marked using a level of response approach. Most candidates stated that petrol burned in a car engine or that carbon monoxide was poisonous, thereby accessing Level 1. Level 2 required candidates to recall that incomplete combustion takes place and to give a problem associated with carbon monoxide or oxides of nitrogen. In addition, at Level 3 candidates needed to quote a problem associated with both carbon monoxide **and** oxides of nitrogen. Level 3 was only achieved by the best candidates.

Question 4

4(a) Most candidates scored 2 marks on this question, correctly interrogating the data to identify the best polymer for making a sports jacket.

4(b) About half of all candidates correctly named polyethene. 'Nylon', 'polystyrene' and 'polyethane' were the most common incorrect responses.

Question 5

A number of candidates could recall that thermochromic pigments change colour with temperature. Fewer recognised that this would show when the milk was at the correct temperature. The most common misconception was that thermochromic pigments insulated the bottle.

Section B

Question 6

6(a) Most candidates gained at least 1 mark on this question, with many gaining both marks. 'Magma' was often quoted instead of mantle.

6(b) This question was well-answered, with earthquakes, volcanoes and tsunamis being the most common correct responses. A number of candidates gave only one response. Candidates should be advised to check the mark allocation for each question, which is a guide to the number of scientific points required.

6(c) Candidates tended to score either both marks or zero. A common misconception included reference to rate of cooling related to crystal size.

Question 7

7(a) A number of candidates quoted the use of litmus rather than universal indicator and failed to score. Only the best candidates scored both marks.

7(b) This question produced a spread of marks and differentiated well. Most candidates correctly deduced magnesium oxide as the base. The production of sodium nitrate was less well known and the hydrochloric acid least well known. 'Chloric acid' was a common misconception.

7(c) The words 'formula' and 'product' were both emboldened in the question. In spite of this there were a number of names rather than formulae given and only a minority of candidates understood what was meant by a product.

7(d) Most candidates scored at least 1 mark with many gaining 2 marks. The loss of the first marking point was frequently due to vague answers such as 'helps plants grow' or 'make plants healthy'. Some candidates confused fertilisers with pesticides or made unqualified references to pollution which did not score.

Question 8

This question was targeted at data interpretation and justifying a conclusion (Assessment Objectives 2 and 3). Candidates were required to identify the properties needed by a metal to be used to make the wings and body of an aircraft. Most candidates correctly quoted strength as an important property. Fewer recognised the importance of low density (others thought that high density was necessary). High melting point was also credited. Those candidates who quoted metal D based on strength scored Level 2. Those who quoted metal B with a justification based on low density scored Level 3.

Question 9

9(a) The idea of a reversible reaction was well understood by about three quarters of candidates.
9(b) Most candidates could identify the conditions giving the highest yield in part (i). Only a minority could explain why these conditions were not used by reference to higher cost to generate high pressures or higher plant costs to withstand high pressures in part (ii).
9(c) Most candidates scored 1 mark and a number both marks. Labour costs and the cost of ethene were common correct answers.

Section C

Question 10

10(a) Most candidates could correctly calculate the relative formula mass of ethanol.
10(b) Just over half of all candidates could correctly work out the mass of carbon monoxide needed for the reaction.
10(c) The concept of atom economy is only well understood by the best candidates. Almost half of candidates omitted the question and others attempted to manipulate numbers with little understanding of the concept required.
10(d) Although better answered than part (d), a significant number of candidates omitted the question. Better candidates showed a good understanding of the ideas involved, scoring both marks.
10(e) Almost two thirds of all candidates understood the relationship between a ‘green’ process and atom economy.

Question 11

11(a) The word equation was well constructed by most candidates. Occasionally ‘water’ was added on the right hand side, losing the mark.
11(b) About a quarter of all candidates understood that an endothermic reaction takes in energy. A number confused endothermic with exothermic and a number thought that endothermic meant that the reaction was heated.
11(c) This level of response question differentiated well. At the simplest level a candidate who gave two correct ways to speed up this reaction, with no attempt to use the reacting particle model, scored Level 1. Use of a catalyst and heating the gases were common correct responses. To gain Level 2, an incomplete explanation was required in addition to the ways of speeding up the reaction. To gain Level 3, a full and correct particle level explanation and a range of methods of speeding up the reaction were required. Just over 10% of candidates omitted the question.

Question 12

12(a) A number of candidates scored 1 mark on this question with 2 marks being less common. Whereas 'hard' was a correct response, 'hard to break' and 'strong' were common incorrect responses.

12(b) About a third of candidates gained this mark, usually for stating that graphite is a good conductor of electricity. Responses such as 'inert' or 'insoluble in water' were also acceptable.

Question 13

13(a) Most candidates gained both marks for correctly completing the table. A number of weaker candidates stated that methanol had 5 atoms in its molecule and lost that mark.

13(b) This question assessed Assessment Objective 3 (analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence). Candidates needed to identify that pentanol was the odd result for the first mark and then give a correct explanation concerning the conclusion for the second mark.

Question 14

14(a) Just over half of candidates could state the difference between a batch process and a continuous process, usually in terms of 24/7 for a continuous process.

14(b) Most candidates scored at least 1 mark on this question, usually related to side-effects. Fewer gained both marks by also referring to pharmaceutical activity.

B741/02 Modules C1, C2, C3 (Higher 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 Q8 as they failed to read the question, only evaluating one metal of their choice.

The calculations on percentage yield were well answered. Many candidates failed to calculate the energy released by methanol correctly, using the mass of fuel (1 g) instead of the mass of water (100 g).

Eutrophication was well described in Q7(d). Too many candidates believed that energy is need to make bonds in an exothermic process in Q11(a).

Often candidates could not remember chemical formulae such as sodium hydrogencarbonate. The specification lists a number of formulae that candidates are expected to know and Centres need to continue to encourage candidates to learn these formulae.

Comments on individual questions

Question 1

This question focused on crude oil.

In (a) many candidates were able to explain the problems of not having sufficient crude oil in the future.

Many candidates could interpret the data in the table in (b).

Candidates were often able to write the molecular formula in (c)(i) and only a small proportion of the candidates used superscripts rather than subscripts. In (c)(ii) many candidates could explain why propane and butane are hydrocarbons but were often not able to explain why these hydrocarbons are alkanes. A common misconception was that the molecules had single bonds between molecules rather than between the carbon atoms. Other candidates gave imprecise answers and did not refer to the molecules only having single bonds.

Question 2

The candidates were able to use and evaluate the data given about the five polymers and often obtained maximum marks for this question.

Question 3

This question focused on the chemistry of ethene.

Many candidates recognised the importance of the double bond in (a).

Part questions (b)(i) and (ii) were challenging and only a small proportion of the candidates described the addition reaction and named the compound type correctly.

Many candidates in (c) correctly drew the displayed formula of poly(ethene). Common errors were drawing a double bond between the carbon bonds or omitting the open bonds at one or both ends of the monomer unit.

Question 4

Candidates often found this question about the preparation of esters challenging.

Many candidates knew the word equation, or the reactants, but some confused the acid with a mineral acid and the experiment with neutralisation by titration. A considerable number of candidates did not refer to making an ester at all. A common misconception was to describe the safety precautions associated with the use of perfumes rather than during the preparation of an ester.

Question 5

This question was about foods and food additives.

In (a) many candidates were able to describe how an emulsifier stops oil and water from separating

The candidates needed to refer to protein in (b) and credit was not given in the mark scheme for reference to enzymes or eggs being denatured.

Candidates found (c) a challenging question, and few candidates could recall the formula $NaHCO_3$, which made balancing the equation impossible.

Question 6

This question was about the structure of the Earth.

In (a) most candidates that were awarded a mark referred to the crust and upper mantle. A common misconception was to refer to the lithosphere as being between the mantle and the crust. Only a small proportion of the candidates mentioned tectonic plates or described the lithosphere as being cold/rigid.

Candidates were able to explain why scientists study volcanoes in (b).

Question 7

This question was about fertilisers.

In (a) many candidates were awarded the marks for sodium nitrate and magnesium oxide (or carbonate). Hydrochloric acid was less well known, with chloric acid being a common response.

In (b) candidates were able to balance the symbol equation, given the formulae. They found balancing the ionic equation in (c) more challenging.

Candidates often gave good answers to (d) but failed to note that bacteria use the oxygen in the water, so were not awarded maximum marks for this question.

Question 8

Candidates could often use the data in the table, but some candidates were confused over strengths and weaknesses – high density was often perceived as strength. Other candidates did not write about each of the metals but focused on the metal of their choice. C was the most common choice but some mixed choices for the wings and body were given.

Question 9

This question was about the manufacture of ethanol by the hydration of ethene.

In (a)(i) and (ii) most candidates could interpret the data in the table.

Part (b) was a challenging question and only a small proportion of candidates were able to explain why the temperature chosen was a compromise. Candidates were most likely to be awarded a mark for stating that the catalyst increased the rate of reaction or for the idea that a higher pressure will cost more money.

In (c) many candidates appreciated that fewer workers would be employed. However some stated that no workers would be needed, which was not allowed on the mark scheme.

Question 10

This question assessed various quantitative aspects of the specification.

In parts (a) and (b) both calculations differentiated well, with only the better candidates able to successfully attempt the question.

More candidates were able to calculate the percentage yield in (c) than mass of product made or atom economy in (a) and (b).

Many candidates did not understand the importance of either a high percentage yield or a high atom economy in (d)(i) and (ii). It was not sufficient to just state ‘so there is no waste’; the candidates had to refer to either the less waste products or less waste reactants.

Question 11

This question focused on the reaction between nitrogen and oxygen.

Part (a) was very challenging. A significant proportion of candidates referred to endothermic reactions as giving out energy. Other misconceptions included that both bond making and bond breaking were endothermic processes requiring energy, and that the reaction involved bond making or bond breaking, rather than both.

Many candidates gave detailed answers in (b) and gave answers in terms of either more frequent collisions for Level 3 or more collisions for Level 2. A common misconception was that pressure increases the speed of the nitrogen and oxygen molecules.

Question 12

This question assessed the ability of candidates to use their knowledge of diamond and graphite and apply it to the two different forms of boron nitride.

In (a) candidates often recognised the weak bonds between layers, but did not then state that this bond was easy to break.

Candidates in (b) did not always appreciate the importance of the giant structure, or that there are many strong covalent bonds that need to be broken.

Question 13

This question involved the interpretation of data obtained by calorimetry.

In (a) 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.

Candidates found (b) very challenging. Some candidates were about to identify the anomalous result. Others identified that there was a link between energy released and the temperature change.

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