OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

Gateway Science Suite

General Certificate of Secondary Education **J644**

Examiners' Reports

January 2011

J644/R/11J

Oxford Cambridge and RSA Examinations

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, 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.

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

CONTENTS

General Certificate of Secondary Education

Chemistry B (Gateway) (J644)

EXAMINERS' REPORTS

Content	Page
Chief Examiner's Report	1
B641/01 Modules C1, C2, C3 (Foundation Tier)	2
B641/02 Modules C1, C2, C3 (Higher Tier)	6
B642/01 Modules C4, C5, C6 (Foundation Tier)	11
B642/02 Modules C4, C5, C6 (Higher Tier)	15

Chief Examiner's Report

The entry of candidates for this session has increased over January 2010. This increase in candidates was shown in all the written components of the specification. The entry policy by Centres has been very good and only a small proportion of the candidates were entered for the wrong tier of entry.

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

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

- including heat in a word or symbol equation
- writing a symbol equation or a formula when a word equation or name is required
- changing a formula that has already been given in the stem of a question
- using incorrect formulae for example O for O_2, Na_2 for Na or H_2 for H.

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

Candidates often found the recall of knowledge and understanding more difficult than analysis or application.

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

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

General Comments

A larger number of candidates sat this component than the same time last year, but it is still a small number compared to June 2010.

The average mark for this examination paper was 31, and the range of marks obtained was from 0 to 51. Only a small number of candidates would have been more suited to the Higher Tier component.

The examination paper discriminated very well and allowed candidates to demonstrate their knowledge and understanding of chemistry.

Candidates found Section A more accessible than Sections B and C.

Candidates tended to find the questions that relied on knowledge difficult but the candidates found the questions that involved analysis and interpretation much easier.

Comments on Individual Questions

Question One

This question focused on food additives.

1(a) In (a) many candidates were able to write potato the correct place on the label. A small proportion of candidates included potato in all three spaces and this was not given credit.

1(b) Many candidates in (b) gave correct reasons for putting food additives in food, the common answers focused on improving flavour, taste and texture.

1(c) Many candidates, in (c)(i) did not recognise the self-cooling drinks can as an example of active packaging. The most popular incorrect answer was the sensor to tell when it was ripe. In (c)(ii) candidates were often able to recognise that ethane was an alkene, but candidates need to be reminded to write the name alkene clearly so it can be distinguished from alkane.

Question Two

This question focused on combustion of fuels.

2(a) Oxygen was well known by many candidates in (a).

2(b) Candidates had to choose either oil or propane and then give two suitable reasons to get full marks. Most candidates who chose these two fuels gave at least two acceptable reasons, however a significant proportion of candidates choose coal or natural gas and these candidates were not given any credit.

2(c) In (i) a spirit burner was not well known by candidates and many candidates left this question unanswered. A common misconception was to call the apparatus a Bunsen burner or a candle. In (c)(ii) many candidates could recall that carbon monoxide was a poisonous gas. A small proportion of candidates gave answers in terms of the action of carbon monoxide on haemoglobin and this was given credit.

2(d) Most candidates found both parts of (d) straightforward. The correct temperature change in (i) was 19^{o}C and the correct fuel was **B** in (ii).

Question Three

3(a) The majority of candidates could recall that coal was a fossil fuel but a common misconception was to include the names of fractions of crude oil.

3(b) Many candidates correctly identified the three fractions and only a small proportion of candidates got all three fractions incorrect.

3(c) Many candidates found (c) quite difficult and often confused cracking with fractional distillation. Good answers were typified by the correct conditions and a reference to breaking large hydrocarbon molecules into smaller ones. Other candidates got a mark by reference to either a catalyst or a high temperature in answers that were often very confused. A significant proportion of candidates did not attempt this question.

Question Four

This question focused on solvents and ethyl ethanoate and was the most accessible question in the examination paper.

4(a) Almost all candidates could match at least one term with its correct definitions and the majority matched all three terms. Candidates were more likely to match insoluble with a substance that does not dissolve than any of the other terms.

4(b) Candidates were also able to count the atoms in the formula of ethyl ethanoate in (b).

Question Five

5(a) Most candidates could not recall that marble was a form of limestone.

5(b) Candidates often mentioned destroying habitats which was given credit but only a small proportion of candidates mentioned both noise and dust pollution. No credit was given for mentioning increased pollution without qualification e.g. the machinery produces pollution.

Question Six

6(a)&(b) The knowledge that solder was an alloy was not well known in (a), but almost all candidates could interpret the data in the table to write that lead was the most dense metal in the table in (b).

6(c) Candidates often referred to electrical conductivity but this was ignored and the mark was given for reference to the low melting point.

6(d) Candidates were also able to link the property of low density with aeroplane manufacture, although candidates were not given credit for referring to aluminium being a light metal.

6(e) Candidates were not able to give a suitable advantage for recycling copper. Answers often referred to cost which was given in the stem of the question or gave uses for recycled metals. Only a small proportion of candidates referred to ideas about saving the finite resource of copper ore.

Question Seven

7(a) Candidates rarely referred to a solvent thinning out paint or allowing the paint to be spread easily. Marks were also awarded for the idea that the solvent helps the paint to mix. A common misconception was that the solvent helped the paint to dry.

7(b) Although many candidates in realised that thermochromic paints were changed by temperature not all referred to a change of colour which was required in the mark scheme. A few candidates confused thermochromic with phosphorescent.

7(c) Many candidates could not recall the properties of a colloid. Only a very small proportion of candidates got both responses correct.

Question Eight

8(a) Although a significant proportion of the candidates were able to interpret the graph and get an answer of 50 seconds, a common misconception was to give 180 seconds which corresponded to the end of the graph.

8(b) Most candidates were unable to use collision theory to explain why concentrated acid reacts faster than dilute acid. Candidates rarely mentioned an increase in the number of collisions and were more likely to state that the particles were closer together. The most common misconception was to mention particles having more energy or moving faster having used the explanation for temperature. A significant proportion of candidates did not attempt this question.

8(c) Almost all candidates stated that the rate of reaction increases. A few candidates referred to faster or quicker reaction times. Centres should advise candidates that a reaction time can only get bigger or smaller and not faster or slower.

8(d) Many candidates could recall that changing the temperature, adding a catalyst or stirring a mixture could change the rate of reaction.

Question Nine

This question focused on atmospheric pollutants and was the least accessible question in the examination paper.

9(a) Many candidates could not recall a problem caused by oxides of nitrogen and left the question blank. Both acid rain and effects of acid rain were allowed on the mark scheme. Only a very small proportion of candidates referred to photochemical smog.

9(b) Most candidates were able to recall one consequence of acid rain often related to killing animals. Erosion of marble and corrosion of metals were also given credit in the mark scheme.

Question Ten

Most candidates could match at least two substances with its correct use. Many candidates appreciated that copper was used to make electrical wires and iron was used to make bridges but were confused with the uses of sodium chloride and chlorine.

Question Eleven

This question was about the Group 1 elements.

11(a) Many candidates could name another Group 1 element.

11(b) Many candidates got one mark but often failed to mention the sodium reacting with both water and air. Some candidates referred to the lack of reaction of oil with sodium but this was not given credit in the mark scheme.

11(c) The products of the reaction of sodium with water were not well known. More candidates could recall hydrogen in (i) than sodium hydroxide in (ii). Carbon dioxide or carbon monoxide was the most common incorrect answer for (i). Many candidates were able to give the correct order of reactivity in (iii).

Question Twelve

This question was about the Periodic Table.

12(a) The number of elements in the Periodic Table was well known.

12(b) Many candidates could use the Periodic Table to get the atomic number of copper. Only a very small proportion of candidates gave the relative atomic mass.

12(c) A significant proportion of the candidates gave elements from the same group rather than the same period.

12(d) Candidates chose a large variety of transition elements but some gave the atomic number rather than the symbol and this was not given credit.

12(e) Although the nucleus was well known some candidates stated a neutron instead.

12(f) The charge on a proton was well known but the relative mass of a neutron was often incorrect. A common misconception was to quote either 1.0005 or 0.9995 as the relative mass of a neutron. A small but significant proportion of candidates gave the relative mass as -1 this was not given credit.

Question Thirteen

This question was about the extraction of aluminium.

13(a)&(b) Many candidates recognised electrolysis but very few candidates could recall the name bauxite in (b). A significant proportion of the candidates did not attempt (b).

13(c) Candidates were often able to construct the word equation but a common misconception was to write an equation showing the formation of aluminium oxide.

13(d) Many candidates recognised the anode or the positive electrode.

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

General Comments

There was a significant increase in the entry for this January paper compared to previous years. Few candidates scored less than 15 marks suggesting that most candidates had been entered for the appropriate tier.

The paper differentiated well and performance across the three sections of the paper appeared to be fairly consistent. A number of candidates scored in excess of 50 marks, with the average mark for the paper being 34.

Candidates continue to find questions about active packaging difficult to answer. They tend to give vague answers in terms of keeping food fresh for longer, rather than focusing on the science of why this is the case. It was pleasing to see that exothermic reactions are now well understood by the majority of candidates, with candidates also coping well with energy transfer calculations. Far fewer candidates than in previous sessions incorrectly used the mass of the fuel instead of the mass of water when calculating the energy transferred by a fuel.

In the question on rates of reaction many candidates still did not understand the difference between 'more collisions' and 'more collisions per second'.

Question 9 about tectonic plates did not score well and this is an area of the specification Centres may wish to reinforce with their candidates, particularly focusing on the use of key terminology.

The extraction of aluminium was well understood, and candidates are increasingly able to balance ionic equations, as illustrated by their answers to question 12(c). Some candidates failed to gain marks after trying to reinvent the given formulae.

The concept of how metals conduct electricity remains poorly understood. Most candidates either believed that the ions move and carry the charge or described thermal conduction.

Comments on Individual Questions

SECTION A – MODULE C1

Question 1

This question about food additives and packaging was the most demanding question in Section A.

1(a) Most candidates made a good start to the paper scoring the mark in this question, with the majority of answers focusing on improving the taste/colour or preserving the food. Answers in terms of making the food last longer or keeping the food fresh were insufficient.

1(b) Less candidates successfully identified the self-cooling drinks can as an example of active packaging in (i), with 'packet with a sensor to tell when fruit is ripe' as the most common incorrect answer. Very few candidates scored both marks in (ii). Answers usually focused on the idea of making it more difficult for bacteria or mould to grow, but failed to link that to the idea of improving the quality or safety of the product. A significant minority of candidates talked simplistically of water making the food go 'soggy' or just saw the packaging as a barrier, which keeps out bacteria. Some candidates simply repeated the information in the question about extending the shelf life of the food.

Question 2

This question was about fuels.

2(a) The marks in this question were awarded for the explanation of the choice of fuel. The vast majority of candidates chose propane, correctly explaining that it is easy to light and has a high energy value. 'Stored in small cylinders' was insufficient unless it was linked to the idea of portability or convenience. An alternative answer was oil because it is a liquid, has a high energy value, is easy to light and can be stored easily. No marks were available for candidates who chose coal or natural gas.

2(b) A pleasing number of candidates scored both marks for 7980J in (i). One mark was awarded for candidates who used the mass of fuel, instead of the mass of water. In (ii), many candidates were able to calculate the energy transferred by 1.0g of fuel C as 2800J. A significant number of candidates who failed to gain credit calculated 1.0 (mass of fuel) x 4.2 x 10 (temperature change).

2(c) This question was more challenging, with only the most able candidates knowing that in an exothermic reaction more energy is given out during bond making than is taken in during bond breaking.

Question 3

This question tested ideas about esters and hydrocarbons.

3(a) Most candidates correctly selected 'solvent' from the list.

3(b) $C_4H_8O_2$ in (i) was usually correct, with the mark scheme giving credit for the symbols in any order. It is pleasing that comments in previous reports about careful writing of formulae, including subscripts, have obviously been noted. Part (ii) was a familiar question, and many candidates scored the mark. A common error was the omission of the idea that a hydrocarbon '*only'* contains hydrogen and carbon. Other common misconceptions continue to be '*mixture* of carbon and hydrogen only' or 'a compound containing carbon and hydrogen *molecules* only'. Weaker candidates suggested that ethyl ethanoate was not a hydrocarbon because it contains a double bond.

Question 4

This question about crude oil was the least demanding on the whole examination paper.

4(a) Fractions X, Y and Z were usually correctly identified as petrol, diesel and bitumen.

4(b) Credit was given in this question for candidates who chose their answers from the diagram of the fractionating column or those who selected from the fractions they had identified as X, Y and Z in part (a). Most candidates identified LPG (or fraction X) as the fraction with the lowest boiling temperature and bitumen (fraction Z) as the fraction containing the largest molecules.

Question 5

This question was about compounds that contain carbon.

5(a) Most candidates knew that propane contains single bonds (rather than double bonds), but many failed on indicate that ***only*** single bonds were present.

5(b) The majority of candidates scored one mark for writing the correct formulae for the reactants and products, but many found balancing this particular equation challenging. There are still instances where candidates attempt to balance equations by placing numbers within the formulae, eg $CH_3$2OH, or by changing the formulae given in the question, e.g. $CH_3(OH)_2$.

SECTION B – MODULE C2

Question 6

This question focused on metals.

6(a) Most candidates correctly identified that solder has a low melting point/melts easily. The mark scheme ignored references to electrical conductivity.

6(b) Again, most candidates identified the correct property, stating that aluminium has a low density. Weaker candidates still use the word 'light' instead of 'lightweight' in this type of question and fail to gain credit.

6(c) Two marks were rare in this question, as candidates did not explain how correctly identified properties were an advantage, or a disadvantage, in the manufacture of car bodies. One mark was awarded for one correct advantage and one correct disadvantage without any explanation. A significant minority of candidates failed to read the question and compared aluminium to all the other metals in the table, rather than just to iron.

Question 7

This question about paints was the least demanding on Section B.

7(a) Uses of thermochromic pigments were well known, although a minority of candidates continue to confuse thermochromic pigments with phosphorescent pigments.

7(b) The majority of more able candidates were able to give the answer 'oxidation'. Most candidates did not have any idea, often referring to the paint sticking or binding to the surface.

7(c) Despite the instruction in the question to put ticks next to the **two** correct sentences, many candidates only ticked one box. In general, candidates were more aware that in a colloid the 'particles are mixed and dispersed throughout the liquid' than that the 'solid particles are suspended in a liquid'.

Question 8

This question focused on rates of reaction. Despite the fact that questions of this type appear every year, many candidates remain confused or unclear about why different factors affect rates of reaction and about collision theory.

8(a) The majority if candidates gave a time within the accepted range (16 – 19 seconds). A common error, however, was reading the graph to the nearest gridline and giving an answer of 15 or 20 seconds. A significant number of candidates gave an answer of 180 seconds, being the highest reaction time shown by the curve.

8(b) Many candidates just scored the mark for 'more collisions' as the idea of more crowded particles was not at all well known. 'More particles' was insufficient to gain credit. A significant proportion of candidates still think that increasing the concentration gives the particles more energy.

8(c) Many candidates knew that smaller pieces have a larger surface area, but then failed to gain the second mark because they simply referred to 'more collisions' or 'more successful' collisions rather than collision frequency. 'Faster collisions' also remains a common misconception.

8(d) Candidates found this equation easier than the symbol equation in question 5(b), with over two thirds of the candidates scoring two marks. It is pleasing that comments in previous reports about careful writing of formulae, including subscripts, have obviously been noted. 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.

Question 9

This question about tectonic plates was the most demanding in Section B. Candidates either knew this section of the specification well, or they did not.

9(a) The continental plate was usually correct, although a significant minority named a specific plate rather than the ***type*** of tectonic plate.

9(b) Approximately 50% of candidates knew that tectonic plates are less dense than the mantle, whilst 50% did not. As in question 6(b), some candidates lost the mark by using the word 'light' when what they really meant was 'lightweight'.

9(c) 'Convection currents' was known by more able candidates.

9(d) This question had a high 'omit rate' and subduction was not well known.

9(e) Again, only the most able candidates knew what was meant by the lithosphere.

SECTION C – MODULE C3

Question 10

This question was about atomic structure.

10(a) The charge on a proton and the relative mass of a neutron were well known. Candidates who only scored one mark usually gave an incorrect relative mass for a neutron, often '-1'.

10(b) Approximately 50% of candidates knew what is meant by mass number in (i). Incorrect responses involved every possible combination of sub-atomic particles, including being the number of protons, neutrons and electrons in an atom. Part (ii) was well answered with candidates gaining credit for either '2.8.2' or a diagram of the electronic structure of magnesium. Again, as in part (i) all the combinations of protons, neutrons and electrons were seen in answer to (iii). There were a significant number of candidates who did not score the mark because, although they had implied that the charges balance, they had not specified that the atom contained ***equal numbers*** of protons and electrons.

Question 11

This question was about Group 1 metals.

11(a) Hydrogen gas was well known, although carbon dioxide was a common misconception.

11(b) In comparison to (a), only a minority of candidates knew that sodium hydroxide is the substance that makes the solution alkaline. 'Hydroxide' on its own did not gain credit. Water was the most common incorrect response.

11(c) Lilac or purple was usually correct.

11(d) Most candidates scored both marks on this question. Candidates who only scored one either failed to give an estimate of the reaction time or only gave one observation (when two were required for the second mark).

Question 12

This question about the extraction of aluminium was the least demanding in Section C.

12(a) The vast majority of candidates were able to write the word equation for this reaction. Common errors were the inclusion of 'graphite' or 'anode' on the left hand side of the equation. A small number of candidates attempted to give a symbol equation and, whilst a correct unbalanced symbol equation would have gained credit, almost always the formula for aluminium oxide was incorrect. It would be worth Centres stressing to candidates that if a question asks for a word equation, it is best to do just that and not to attempt a symbol equation.

12(b) Anode or positive electrode was usually correct.

12(c) As stated in the general comments, answers to this question were pleasing. Some candidates failed to balance the equation and only scored one mark. Common errors were $Al^{3+} - 3e^{-} \rightarrow Al$ and $Al^{3+} + e^{3-} \rightarrow Al$.

Question 13

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

13(a) The most able candidates knew that sodium chloride conducts electricity when molten. 'Low melting point' was a common misconception.

13(b) Most candidates were unable to explain how metals conduct electricity. Those candidates who scored one mark usually did so for the idea of 'electrons moving' but had failed to appreciate the delocalised nature of the electrons. Many candidates thought that the metal ions moved and carried the electric charge. There was also confusion with the idea of conduction of heat, with answers describing particles touching and passing on vibrations.

13(c) The idea of transfer of electrons in ionic bonding was not well known.

13(d) Candidates who gained credit in this question usually only scored one mark for showing one shared pair of electrons. Only the most able candidates drew the rest of the 'dot and cross' diagram correctly. Some candidates only drew one carbon and one oxygen atom, but were still able to gain the first marking point.

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

General Comments

A slightly larger number of candidates sat this component than the same time last year, but it was still a small number compared to June 2010. The average mark for this examination paper was 32, and the range of marks obtained was from 4 to 52. A small number of candidates scored very high marks suggesting that they would have been better served by entry at higher tier. There were also a number of candidates who did not attempt many of the questions.

As in January 2010, candidates found Section A more accessible than the other two sections.

The responses to a couple of questions were disappointing, suggesting that Centres may not have given their candidates the opportunity to do the relevant practical work.

Question 3(e)(iii) asked candidates to suggest why the method used to make barium sulfate does not give 100% yield. Very few candidates were aware of the reasons for this.

A disappointing number of candidates did not know what a gas syringe was, suggesting that they had not seen one used in collecting a gas. Most candidates thought a beaker was appropriate for measuring a volume of acid during a titration. Many candidates thought that litmus was a suitable indicator for finding the pH of a solution.

Comments on Individual Questions

SECTION A – MODULE C4

Question 1

1(a) The majority of candidates correctly described a continuous process as a process that happens all the time, although a minority simply restated the question and failed to score.

1(b) The vast majority of candidates used the information in the flow chart to write the correct word equation for the manufacture of ethanoic acid in (i). In part (ii), the costs involved in a manufacturing process, such as making ethanoic acid, were also well known. Candidates usually referred to the cost of energy, raw materials and labour. References to transport, packaging, advertising and storage did not gain credit, as they are not costs involved in actually making methanol.

1(c) A very pleasing number of candidates correctly interpreted the data in the question to identify the effects of increasing pressure and temperature on the percentage yield.

Question 2

Carbon chemistry was very well known as this proved to be the most well answered question on the whole examination paper.

2(a) Graphite was almost always correct.

2(b) Buckminster fullerene was usually correct. Diamond was the most common erroneous answer.

2(c) The majority of candidates correctly matched each form of carbon with its correct properties.

Question 3

3(a) Only a small proportion of candidates correctly stated that there are 9 atoms in the formula for lead(II) nitrate. Common errors were 3 (the number of different types of element), 5 (omitting to take into account the 2 outside the bracket) and 331 (the relative formula mass).

3(b) Few candidates knew that potassium iodide reacts with silver nitrate to give a yellow precipitate.

3(c) Most candidates did not identify that potassium nitrate contains ***both*** the essential elements nitrogen and potassium, usually only giving one of these elements.

3(d) It was pleasing that over 50% of candidates were able to calculate molar masses correctly. The correct answer was 101.

3(e) In (i) the colour of the barium sulfate precipitate was not well known. Many candidates correctly calculated the percentage yield as 75% in (ii). There were very few arithmetic errors. In part (iii) it was disappointing that only a very few candidates could suggest reasons why the method used to make barium sulfate does not give 100% yield.

SECTION B – MODULE C5

Question 4

4(a) It was disappointing that only about half the candidates were able to identify the (gas) syringe.

4(b) 30 seconds and 64 cm^3 were usually correct in parts (i) and (ii). 62 cm^3 was a common error, due to inaccurate reading of the y-axis scale. All possible incorrect responses were seen in (iii), although the majority correctly chose 0 to 3 seconds.

4(c) This low demand question was answered poorly, with relatively few candidates grasping the idea that one of the reactants had run out. 'The nitrogen has run out' was a common misconception.

4(d) No candidates scored both marks on this question, and only a minority scored one, usually for the fact that a weak acid has a pH between 3 to 6.99. The concept that a weak acid does not completely dissociate was simply not known by candidates.

Question 5

5(a) 0.23g was usually correct. Some candidates lost the mark by writing 23g.

5(b) A more difficult question that part (a) with some candidates understanding that the anode gets smaller and the cathode gets bigger.

5(c) The most able candidates knew that OH^- or SO_4^{2-} would be attracted to the anode.

Question 6

6(a) Fewer candidates than expected knew that a pipette or measuring cylinder should be used to measure out the volume of acid. A beaker was a common misconception.

6(b) Many realised that the pH of the acid solution would increase as the alkali was added. Typical responses, not worthy of credit, were 'it goes neutral' or 'it goes to pH 7' (with no indication whether it started above or below 7).

6(c) Many candidates thought that litmus was a suitable indicator for measuring the pH of a solution. Candidates who correctly identified the use of universal indicator often failed to score the second mark for the idea of matching the colour against a colour chart.

Question 7

7(a) Only about a third of the candidates correctly identified NaO as the empirical formula of sodium peroxide. All possible incorrect responses were seen, but Na_4O_4 was the most common.

7(b) A very well answered question, with the vast majority of candidates correctly matching the compounds to their physical states.

7(c) This question (targeted at Grade C) proved challenging for many foundation tier candidates. More able candidates correctly calculated the mass of oxygen as 0.4g, whilst other candidates performed a range of completely erroneous calculations. The question had a high 'omit rate'.

SECTION C – MODULE C6

Question 8

This question on hardness of water proved to be the most challenging on the whole examination paper.

8(a) Relatively few candidates knew that calcium hydrogencarbonate causes temporary hardness in water.

8(b) A very small proportion of candidates knew that the chemical name for limescale is calcium carbonate. Many candidates did not attempt the question, and those that did often selected an answer from the list in part (a).

Question 9

9(a) A surprisingly small proportion of candidates were able to write down a correct use for ethanol. 'Petrol' was a very common incorrect answer.

9(b) Most candidates scored at least one mark, although judging by the range of incorrect answers it appears many candidates guessed.

9(c) The word equation in (i) was usually correct, although 'ethane' instead of 'ethene' was a common careless error. In part (ii) less than half the candidates knew that hydration was the process used to make ethanol from ethene.

Question 10

10(a) Most candidates correctly identified why the nails in tubes 2 and 3 were not rusty, although a significant number of candidates stated that tube 2 contains no oxygen.

10(b) Methods of preventing rusting were well known.

10(c) Only a minority of candidates knew that redox is a reaction that involves both oxidation and reduction. Many candidates did not attempt the question.

Question 11

11(a) This question discriminated well, with only the most able candidates gaining three marks. About a third of candidates scored two for the molecular formula of paracetamol, although counting errors were common usually resulting in the award of one mark. The correct displayed formula of ethanol was rarely seen, with 'C-H-O' being the most common error. This question also had a high 'omit rate'.

11(b) The vast majority of candidates, however, knew that analgesic drugs reduce pain and were able to name another analgesic drug other than paracetamol.

Question 12

12(a) Chlorine was usually correct. The most common error was 'chloride'.

12(b) Almost all candidates identified that there are three atoms in a molecule of ozone.

12(c) Again, almost all candidates were able to write down a medical problem associated with an increase in UV light, usually skin cancer. A significant proportion of those not gaining this mark simply wrote 'cancer', which was insufficient.

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

General Comments

A much larger number of candidates sat this component than the same time last year, but it is still a small number compared to June 2010. The average mark for this examination paper was 33, and the marks awarded covered almost all of the mark range. Only a small number of candidates would have been more suited to the Foundation Tier component.

The examination paper discriminated very well and allowed candidates to demonstrate their knowledge and understanding of chemistry.

Candidates found Section B less accessible than Sections A and C.

Comments on Individual Questions

Question 1

This question focused on the manufacture of ethanoic acid. It was the most accessible question in the examination paper.

1(a) Almost all of the candidates were able to construct the word equation. The most common error was to put oxygen on the right and to use carbon dioxide on the left of the equation.

1(b) Many candidates were able to get two marks often by referring to recycling reactants and catalyst. Candidates referred to compromise conditions being chosen but in the context of this question it was not awarded a mark.

1(c) Candidates found the data interpretation in (c)(i) and (ii) straight forward. The most common misconception was to refer to rate of reaction rather than the percentage yield.

Question 2

This question focused on formulae and chemical calculations.

2(a) Many candidates correctly identified the number of atoms as 9. A common misconception was to give the number of different elements rather than the number of atoms.

2(b) Most candidates could calculate the relative formula mass as 149 in (b)(i) but a smaller proportion of candidates could use the relative formula mass to calculate the percentage of phosphorus as 20.8% in (ii). A small number of candidates obtained an error carried forward mark from an incorrect relative formula mass.

2(c) Many candidates could construct the balanced equation but a common misconception was to use N as the symbol for nitrate.

2(d) Many candidates got the percentage yield calculation correct and obtained the answer 75%. Other candidates used the mass of barium chloride rather than barium sulfate in their calculation. Centres should advise their candidates to write the formulae for percentage yield and then substitute in the correct values. In this way the candidates will have a better chance of being awarded one mark for the correct formula.

Question 3

This question was about the fertiliser ammonium phosphate.

3(a) Many candidates did not appreciate they had to choose the fertilisers that contain nitrogen. As a result a significant proportion of the candidates wrote down 'both potassium salts' or 'both phosphates'.

3(b) Many candidates got at least one mark, often by swapping statement 4 with statement 5.

3(c) Many candidates found (c) very difficult and a significant proportion of the candidates did not attempt this question. The first mark was for the correct acid and the correct base. Although ammonia or ammonium hydroxide was quite well known some candidates used ammonium salts such as ammonium chloride instead. Phosphoric acid was much less well known and quite often phosphorus itself was used as the acid. Other candidates gave nitric or hydrochloric acid instead. Significantly more candidates were able to describe titration, often aided by a diagram, than could give the names of the reactants. Only a very small proportion of the candidates appreciated the importance of using an indicator. Although references to methyl orange, litmus or phenolphthalein were all made, many candidates used universal indicator instead. Most candidates did not appreciate that the indicator changes colour at the end-point.

Question 4

This question was about silicon carbide. This was a very demanding question and many candidates were not awarded a mark.

4(a) The most common misconception in (a) was to refer to strong intermolecular forces or to refer to layers of atoms. Although some candidates appreciated that the bonds were covalent they did not indicate that there were many of these bonds so that lots of energy was needed to break them.

4(b) A significant proportion of the candidates appreciated that silicon carbide must be hard but candidates still confuse hard with strong.

Question 5

This question focused on sodium peroxide to test aspects of chemical calculations.

5(a) The most able candidates appreciated that the empirical formula was NaO. The most common errors were Na4O4 and Na2O.

5(b) The calculation was performed in a variety of ways and often candidates ended up with the correct answer of 0.4g. Centres should advise candidates that the working out in a calculation needs to be clear so that either working out or error carried forward marks can be awarded.

5(c) The sentence completion gave all possible answers but the majority of candidates did recognise carbon-12.

Question 6

This question focused on the reaction between sulfamic acid and sodium nitrite.

6(a) In part (i) most candidates were able to interpret the graph and read-off the value of 64 cm3. A common misconception was to get 62 cm3. Candidates had to use the graph and use the concept of molar volume in (ii) to calculate the amount in moles as 0.00167. Many candidates found this question extremely difficult. Some candidates were not able to convert cm3 into dm3 and as a result ended up with a result of 1.67. Candidates had to round up their answers correctly to be awarded the second mark, but many candidates did not do this.

6(b) Candidates understood the idea of a limiting reagent but often were very imprecise or inaccurate with their descriptions. The best answers indicated that the sodium nitrite was the reagent that was used up first of all.

6(c) The idea that a weak acid only partially ionises was not well known by candidates in (c) but many candidates were awarded a mark by reference to either the presence of hydrogen ions or a suitable pH value.

Question 7

This question focused the electrolysis of copper sulfate solution.

7(a) Candidates found (i) much more difficult than (ii) and (iii). The correct answer for (i) was 0.88 g but many candidates failed to correctly interpret the data. The most common misconception in (i) and (ii) was to refer to rate rather than the mass change.

7(b) Only the most able candidates were able to construct the correct equation. The most common errors were to put the Cu2+ or e- on the left hand side of the equation or to use e2- rather than 2e-.

Question 8

This question was about the neutralisation of nitric acid using titration.

8(a) Many candidates appreciate that the pH increases and goes from a value below 7 to a value above 7. Only the most able candidates could draw the correct shape of the pH titration curve.

8(b) Candidates found the calculation to be very difficult and a significant proportion of the candidates did not attempt the question. Many candidates did not change the volume into dm3 and others were not able to cope with the mathematics. The correct answer was 0.00375 but correct rounding up was allowed up to 1 significant figure. Many candidates did not know the relationship between moles, volume and concentration.

8(c) Many candidates in (i) did not appreciate the importance of the sudden change in colour of the litmus indicator. The colour change of litmus was not well known and a common misconception was that litmus went green. More candidates were able to give a correct explanation in (ii) and often mentioned the lack of a sudden colour change with universal indicator.

Question 9

This question was about the manufacture of ethanol.

9(a) In (i) only the most able candidates appreciated that ethanoic acid or vinegar would be formed if oxygen was present. A common misconception was to stop oxygen reacting with the yeast. In (ii) many candidates did not use the correct terminology for example stated that yeast was denatured rather than the enzyme is denatured or that at low temperature the enzymes die. The best answers referred to the yeast being inactive at low temperature and the enzyme being denatured at high temperature.

9(b) Most candidates could construct the word equation.

Question 10

This question was about rusting.

10(a) Many candidates recognised that the reaction was redox. The most common incorrect answer was oxidation.

10(b) Good answers to (b) referred to both the protective barrier and the sacrificial protection offered by the layer of zinc. Common misconceptions referred to zinc losing ions rather than electrons. Other candidates did not mention that the zinc acted as a barrier to oxygen and/or water.

Question 11

This question was about aspirin and displayed formulae.

11(a) Only a very small proportion of candidates were able to draw the displayed formula for ethanol. The most common misconception was to have a C—H—O bond rather than a C—O—H bond. Other candidates invented more exotic formulae such as the one for methoxymethane. Candidates found deducing the molecular formula for aspirin easier than the displayed formula for ethanol. The correct formula was C8H9NO2 but the mark scheme allowed any order of the atoms. The most common error was to miss out the nitrogen atom from the formula.

11(b) Only a very small proportion of candidates were able to answer (b) and a significant proportion did not attempt the question. The best answers annotated the structure of aspirin and showed the formation of a sodium salt. Other candidates referred to replacing the hydrogen atom with a sodium atom rather than an ion. The most common misconception was that the double bonds had to be removed.

11(c) Many candidates recognised salicylic acid as the starting material in (c).

Question 12

12 Many candidates recognised calcium hydrogencarbonate but they often wrote the answer as calciumhydrocarbonate. The most common error was calcium sulfate.

Question 13

This question was about the electrolysis of sodium chloride solution.

13(a) In (i) many candidates gave oxygen as the product rather than chlorine. Candidates found the equation for the electrode reaction in (ii) easier than the previous equation. However candidates made similar errors involving e2- and having the electron on the wrong side of the equation.

13(b) Most candidates recognised the type of reaction as exothermic in (b).

Question 14

This question was about oils and fats.

14(a) Although many candidates identified bromine as the reagent in (a) their descriptions were often not correct. Candidates had to refer to bromine being decolourised or colourless rather than referring to discoloured, transparent or clear. A common misconception was that saturated fats turned bromine colourless. Other candidates chose sodium hydroxide or barium chloride as the reagent. A significant proportion of the candidates did not attempt this question.

14(b) Most candidates recognised the type of reaction as saponification.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553