GCSE

# Chemistry B (Gateway) J644

**Gateway Science Suite**

General Certificate of Secondary Education

# Reports on the Units

# January 2010

**J644/R/10J**

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.

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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

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### GCSE Chemistry B Gateway (J644)

### REPORTS ON THE UNITS

# B641/01 Foundation Tier

### General Comments

The paper produced a wide range of marks. Few candidates scored more than 48 marks and few less than 20. The mean mark was 32.9 marks. The paper gave candidates the opportunity to show what they know, understand and can do. The paper was set at an appropriate level of difficulty. Most candidates could access the paper and very few questions were omitted. There was no evidence of lack of time.

The paper differentiated well. 35 marks were required for grade C and 16 for grade F.

### Comments on Individual Questions

### Question 1

1(a) This question was answered correctly by about 40% of candidates (a higher proportion than in previous years). The most common incorrect answer continues to be 'it can't be used again'. Allowable answers included 'it takes a long time to make' and 'used up faster than it is formed'.

1(b) Virtually all candidates correctly identified crude oil.

1(c) Only about 40% of candidates correctly stated fractional distillation.

'Cracking' was the most common incorrect answer.

### Question 2

Parts (a) and (d) were well answered. Polymers and alkenes were less well known in parts (b) and (c), often being inverted.

### Question 3

3(a) About 90% of candidates correctly identified 'meat'. 'Carrots' was the most frequent incorrect answer.

3(b) Parts (i) and (ii) were well answered. In part (ii) most candidates referred to killing bacteria. Part (iii) was answered correctly by about a third of candidates. Correct answers referred to new substances made or irreversibility. Frequent incorrect responses included references to colour change.

### Question 4

4(a) Almost all candidates could correctly identify 'thermometer', although there were some interesting spellings.

4(b) Again almost all candidates calculated the temperature change correctly in part (i). Only better candidates understood exothermic reactions. A number of candidates thought that exothermic reactions give off a gas.

**Question 5**

5(a) About half correctly identified ‘antioxidants’. The other constituents were quoted in roughly equal amounts. This idea is not well understood.

5(b) About a third of candidates scored on this question. The mark scheme required ‘help oil and water to mix’ or ‘oil and water will not separate out’. Many candidates made no reference to oil and water and made vague statements such as ‘mix the ingredients’ or ‘binds the ingredients together’ and failed to score.

5(c) Less than 20% of candidates scored this mark. The mark scheme required the idea of ‘stop food reacting with oxygen’. Most candidates gave vague answers such as ‘keeps food fresh’ or ‘stops food going off’ and failed to score.

**Question 6**

6(a) About ⅔ of candidates understood the term non-biodegradable. Incorrect answers often confused it with not being able to recycle or talked about ‘does not rust’ or ‘does not disintegrate’ which did not score.

6(b) Most candidates scored at least 1 mark for reference to recycling. Better candidates scored the second mark for reference to burning or land fill sites. There were some answers which went into great detail about the use of coloured bins in recycling.

**Section B**

**Question 7**

7(a) Most candidates scored at least 1 mark for reference to noise or dust or loss of habitat. A number scored both marks. Incorrect responses included reference to people falling into the quarry.

7(b) Only about a third of candidates understood thermal decomposition. Many thought ‘gives off a gas’ and failed to score.

7(c) Part (i) was very poorly answered with large numbers of candidates quoting evaporation of the calcium carbonate and failing to score. Most candidates correctly calculated 0.49g in part (ii).

**Question 8**

8(a) This word equation was well answered by over 70% of candidates.

8(b) Parts (i) and (ii) were well answered with the idea of a need for a comparison well understood in part (i). Part (iii) was less well answered with a number of candidates scoring 1 mark, usually for ‘catalyst stays the same colour’ or ‘same mass of catalyst at start and end’. Fewer gained the second mark for recognising that the reaction was speeded up.

**Question 9**

9(a) Significant numbers of candidates scored both marks on this question. Incorrect offerings included ‘carbon dioxide’, ‘acid’ and ‘salt’.

9(b) Disappointingly, only about a third of candidates correctly indentified solder as an alloy. ‘Lead’ and ‘tin’ were the main incorrect answers.

9(c) Many of the properties offered did not relate to the use of a drinks can. Answers referring to melting point or conductivity did not score.

**Question 10**

10(a) Almost all candidates correctly identified ‘binder’ for 1 mark.

10(b) This was also well answered with most answers referring to colour.

10(c) The role of the solvent in a paint was poorly understood. The mark scheme required reference to thinning the paint, dissolving the ingredients or making it easier to spread the paint. Incorrect responses included references to paint drying or mixing it together.

10(d) Most candidates scored 2 marks on this question.

**Section C**

**Question 11**

Over half of all candidates scored the marks in parts (a) and (b). A number confused periods and groups or gave the same answer for both parts. Part (c) was less well answered with group 1 metals featuring prominently as incorrect answers.

**Question 12**

12(a) Most candidates scored 1 mark, often for reference to ‘strong’. Only better candidates gained 2 or 3 marks. In this case some clear and technically correct answers were stated, eg good electrical conductors.

12(b) Few candidates scored both marks in part (i). The colour of copper hydroxide (blue) was better known than the colour of iron(III) hydroxide.

Approximately half could identify copper nitrate as having 6 oxygen atoms in its formula in part (ii). Iron(III) nitrate was a common incorrect answer.

12(c) About ⅔ of candidates gained the mark. In many cases only one solid was correct with potassium carbonate being the most common incorrect answer.

**Question 13**

13(a) Most candidates could identify another halogen in part (i), although bromine was often incorrectly quoted. In part (ii) the relationship between atomic number and density was well recognised.

13(b) Most candidates correctly quoted cleaning water in swimming pools.

13(c) This was very poorly answered by all but a very small proportion of candidates. Most answers referred to melting point or atomic radius. Those that did talk about reactivity stated that the reactivity increases as the atomic number increases and failed to score.

13(d) This was the least well answered question on the paper. Less than 10% of candidates scored the mark. The idea of isotopes does not appear to be understood.

**Question 14**

14(a) Only about a third of candidates could recall the flame colour of sodium in part (i). 'Red' and 'blue' were common responses. Given the performance on part (i), it is not surprising that part (ii) was even worse. 'Copper' was a frequent incorrect response. A number named a compound instead of a metal, eg calcium carbonate instead of calcium, and did not score.

14(b) This was not well answered by the majority of candidates. Some wrote $K^+$ with no explanation and did not score. Others quoted $Cl^-$.

14(c) Only about half of all candidates scored both marks on this question.

'Squeaky pop test' with no further detail scored 1 mark. A significant number of candidates used limewater and, again, failed to score.

# B641/02 Higher Tier

**1 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 even. A number of candidates scored in excess of 50 marks.

Centres need to remind candidates that covalent bonding requires shared pairs of electrons not just shared electrons. It was pleasing to see many candidates able to explain why cooking food is a chemical change. Exothermic changes are now well understood by the majority of candidates.

Candidates continue to find questions about the properties of plastics difficult to answer. They find it hard to understand that it is the bonds between the polymer chains that influence the ability of the plastic to be stretched.

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

Question 9 (d) did not score well because candidates fall into the trap of being non-committal. Answers like less dangerous and less harmful were prevalent. Centres may wish to guide their candidates towards questioning why these materials are dangerous.

Candidates are increasingly able to balance ionic equations, as demonstrated by their answers to question 11 (a) (iii). Some candidates failed to gain marks after trying to reinvent the given formulae.

The concept of ionic solids conducting electricity when molten or in solution remains poorly understood. Most candidates believe only electrons can carry charge.

**2 Comments on Individual Questions:**

1 (a) Usually correct with C as the most common incorrect answer.

1 (b) Usually correct with D as the most common incorrect answer.

1 (c) Few candidates scored both marks for this question. Many candidates demonstrated knowledge of atoms filling shells by bonding but did not go on to say how this was achieved. Most candidates were aware that something was shared by the atoms but it wasn’t always electrons; sharing atoms featured quite a few times. The most common answer indicated an electron was shared but few referred to the sharing of an electron pair. A very small number of candidates mistakenly described ionic bonding.

2 (a) Most candidates correctly identified ‘meat’ as a protein.

2 (b) (i) Killing microbes/bacteria was by far the most common answer, with very few references to germs seen. Candidates found this question easy.

2 (b) (ii)Answers often referred to change in taste/texture. Denaturing of proteins and enzymes was seen a few times but many candidates wrote about the denaturing of food. References to irreversible were the most common route to a mark in this question.

3 (a) (i) The most common mistake was to use the mass of fuel, 1g, in the equation instead of the mass of water, 25g. The use of an incorrect number for the temperature rise was very rare. Candidates who showed their working out occasionally didn't go on to give the correct numerical answer.

3 (a) (ii) This was usually correct even if the candidate failed to score in part (i).

3 (b) Generally well known. A few educated guesses revolved around the idea of burning on the outside. References to bond breaking/making were seen in the answers of candidates who went on to score well but a few made references to bond breaking causing the release of energy.

4 (a) The part of the question on burning plastics produced bland answers referring to harmful gases or pollution. Problems associated with landfill appeared to be very well known; 'non-biodegradable' was a popular answer.

4 (b) Many answers just referred to covalent bonds without distinguishing between those between atoms and those between molecules. Very many responses indicated that the intermolecular and intramolecular bonds were jointly responsible for the inability to stretch. Only the highest overall scoring candidates scored 3 marks here.

5 (a) Almost all candidates scored 1 mark. Fractional distillation appeared to be the best known process.

5 (b) Most candidates were able to write the correct word equation.

6 (a) Generally well known but some candidates just used the word decompose to describe thermal decomposition.

6 (b) Usually correct with failures often due to lack of knowledge of the formula for calcium oxide, $CaO_2$. A common erroneous formula was $Ca0_3$.

6 (c) That limestone is a sedimentary rock was well known but few candidates who described the rock instead of naming it scored a mark. The metamorphic nature of marble was generally well know but many candidates who had correctly stated metamorphic went on to describe its production from cooling magma/lava and consequentially lost the mark. A number of candidates believed marble is man-made whereas limestone is mined.

7 (a) Mostly correct. The most common errors were writing sulfate instead of iron sulfate or omitting the + sign.

7 (b) Most scored well here but some were obviously hoping that no change in mass and no change in colour counted as two separate marking points. A few candidates based their answer on the data given for copper sulfate instead of copper.

7 (c) A common misconception appeared to be that the iron block needed time to break up into small pieces before it could start reacting. Many candidates still just talked about more collisions rather than indicating an increase in the frequency of collisions and only scored one mark.

8 (a) Generally well known but too many candidates thought steel was cheaper and less dense than iron.

8 (b) The majority of candidates scored 1 for correctly naming oxygen. The second mark was lost in many cases by omitting "hydrated" from the second part of the answer or by using the common name rust. It was pleasing to see a number of candidates correctly naming hydrated iron(III) oxide as a product.

8 (c) Only about a third of the candidates knew that solder is an alloy of tin and lead. Every random combination of two metals from the list was seen as an answer here.

8 (d) Cost was seen by many to be a property of metals. Many described properties of metals that did relate to the question, eg metals are good conductors of heat and electricity.

9 (a) The majority of candidates were able to correctly interpret the data.

9 (b) Candidates found this question to be very difficult. Few candidates understood that the size of the particle was responsible for its inability to sink. Many answers referred to density/weight of the particles. A number of candidates thought that the emulsifier was responsible.

9 (c) 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.

9 (d) References to safety were the most common type of answer. Answers on the connection between radiation and cancer were rarely seen.

10 (a) Usually correct with Li being the most prevalent incorrect response.

10 (b) Usually correct.

10 (c) Not as well answered as the other two parts but nearly 7 out of 10 candidates were successful.

11 (a) (i) Many candidates seemed to assume that the choice of colours was restricted to blue or green. A number offered pink as the answer for copper nitrate, presumably because they had picked this up from question 7 (b) when copper was being tested as a catalyst. Most candidates were able to score a mark for blue, however. Red and yellow were common answers for iron(III) nitrate.

11 (a) (ii) Usually correct but iron(II) nitrate featured on a number of occasions, presumably because 3 + 3 =6.

11 (a) (iii) Quite a number of candidates failed to score 2 marks here and it wasn't just balancing which let them down. Some included charges in $Cu(OH)_2$, even though the formula was given in the question. Even more surprising was the number of candidates who didn't believe the information in the question and proceeded to give the formula of copper hydroxide as CuOH. Others include ions on the left-hand side, usually $Cl^-$. Nearly half the candidates were able to score two marks.

11 (b) This was a disappointing question in which less than half of the candidates were successful. Calcium carbonate was given as a product of heating copper carbonate are rather surprising number of times.

12 (a) Most candidates followed the trends correctly in both (i) and (ii) but some gave answers outside the allowable ranges.

12 (b) The majority of candidates appeared to think the question was asking, “Why is there a change in reactivity as atomic number increases?” They answered this by explaining how the distance from the nucleus to the outermost shell changes as the atomic number increases or by explaining the shielding effect of extra shells. Significant numbers of candidates talked about the effect on the melting point or boiling point. The simple answer ‘decrease’ was all that was expected.

12 (c) A difficult question, answered well by the more able candidates. The incorrect answer fluorine iodide was seen a number of times. Iodide was also given instead of iodine.

12 (d) Many candidates seem to have had some idea of what an isotope is but lacked clarity of thought or expression. Of these, most realised that the number of some component of the atom had changed, however the specifics eluded them. Suggestions included changes to electron or proton number and unequal numbers of protons and neutrons. An isotope being a different element with a different mass number was also proposed. Finally, some wrote that the word isotope describes an atom with a higher mass number than normal, eg carbon-14 would be an isotope but carbon-12 would not.

13 (a) Most understood how to do the experiment but many suggested the use of tongs or a spatula instead of a flame test wire. Others proposed heating the metal rather than the powder. Some candidates also indicated that the sample should be heated in a crucible or test tube and a few referred to placing the sample in a trough of water.

13 (b) Candidates found this question to be the most difficult on the paper. Many only think of the conduction of electricity in terms of electron movement. Reasons for lack of conduction included references to a lack of space between atoms for the electricity to get through.

# B642/01 Foundation Tier

**B642/01 Unit 2: Modules C4, C5 and 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 2009. The average mark for this examination paper was 30, and the range of marks obtained was from 3 to 47. There were a significant proportion of candidates who did not attempt many of the questions.

As in January 2009 candidates found Section A much more accessible than the other two Sections.

**Comments on Individual Questions**

**SECTION A - MODULE C4**

**Question 1**

This question about carbon chemistry was the most demanding question in Section A.

(a) A large number of candidates chose an incorrect molecular formula for Buckminster Fullerene.

(b) Many candidates correctly identified diamond or graphite as another form of carbon, although carbon dioxide was a common misconception.

(c) In part (i) many candidates correctly stated that nanotubes were strong but in part (ii) a use for nanotubes was less well known. Some candidates failed to read the question and stated that nanotubes are used in tennis rackets, whilst electrical wires was another common answer which did not gain credit. A significant proportion of candidates failed to attempt part (ii).

**Question 2**

This question focused on fertilisers.

(a) Almost all the candidates were able to use the information given in the table to identify ammonium phosphate and potassium phosphate as the two fertilisers that contained phosphorus.

(b) This question also presented little difficulty for candidates, with the vast majority correctly choosing potassium phosphate as the fertiliser that contained the greatest percentage by mass of potassium.

(c) This question proved to be more demanding than part (b) as only a small proportion of candidates were able to explain that the mixture was better because it contained all three essential elements.

(d) The majority of candidates correctly identified that the roots of a plant absorb fertilisers.

(e) In contrast, candidates often failed to identify nitric acid in this question. Hydrochloric acid, sulphuric acid and nitrogen were frequently given as incorrect answers.

(f) The number of candidates who correctly calculated the relative formula mass of urea as 60 was pleasing.

**Question 3**

This question was about manufacturing processes and methanol and was the least demanding question in Section A.

(a) Only a very small proportion of candidates were able to give a correct definition of a solvent. There was frequent confusion of the terms solute and solution and some answers described solvent abuse.

(b) The majority of candidates used the information in the flow chart to write the correct word equation for the making of methanol in part (i). A sizeable minority of candidates wrote a correct symbol equation and were awarded the mark. In part (ii), the costs involved in a manufacturing process, such as making methanol, were very 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.

(c) A pleasing number of candidates correctly interpreted the data in the question and identified that method 2 was cheaper because it used less energy/lower pressure/lower temperature.

(d) In part (i) the majority of candidates correctly described a continuous process as a process that happens all the time, although a sizeable minority simply restated the question and failed to score. Many were also able to name a chemical that is made in a continuous process in part (ii). Ammonia and ethanol were the most common correct answers.

**Question 4**

This question focused on the thermal decomposition of copper carbonate.

(a) Only a minority of candidates suggested a correct reason why the reaction did not produce a 100% yield, usually stating that the copper carbonate was not heated for long enough. Many candidates attributed the 90% yield of copper oxide to the fact that carbon dioxide had escaped from the tube.

(b) In contrast, the vast majority of candidates appreciated that if the experiment was repeated using more copper carbonate, the mass of copper oxide made would increase.

**SECTION B - MODULE C5**

**Question 5**

This question about precipitation reactions was the least demanding question in Section B.

(a) Many candidates were able to use the state symbols in the equation to identify that $PbI_2$ was a solid. Candidates who wrote the name of the product, lead iodide, gained credit as they had correctly identified the product that is a solid.

(b) The colours of the precipitates when silver nitrate solution reacts with halide ions were well known.

(c) This question discriminated well. The most able candidates explained that in solids the ions cannot move, so there are no collisions between ions and scored 2 marks, whereas weaker candidates usually only gained the mark relating to the fixed nature of the ions.

**Question 6**

This question focused on acids.

(a) Many candidates started the question well, correctly predicting a pH value higher than 1 and lower than 7 for ethanoic acid. They were also usually able to give at least one correct observation for the reaction between calcium carbonate powder and dilute hydrochloric acid, ie bubbles rapidly, to make carbon dioxide.

(b) Although this was a low demand question, many candidates did not identify hydrogen as the gas made at the negative electrode.

(c) The majority of candidates did not appreciate that hydrochloric acid has a greater concentration of ions than ethanoic acid.

**Question 7**

This question focused on the decomposition of hydrogen peroxide and was the most demanding in Section B.

(a) Only a minority of candidates appreciated that the mass of the contents of the conical flask decreases because a gas is given off.

(b) A common misconception was that the reaction stops because the catalyst is used up, with only a minority of candidates realising that the reactant, hydrogen peroxide, runs out.

(c) The majority of candidates failed to gain credit. Candidates who realised that a gas syringe, or upturned burette/measuring cylinder, was needed to collect and measure the volume of gas made, often failed to score the second mark as their apparatus would not have worked in practice due to leaks and/or blockages.

**Question 8**

This question was about acid-base titrations.

(a) A minority of candidates correctly chose a 10.0 $cm^3$ pipette. The 100 $cm^3$ beaker was the most commonly chosen distracter.

(b) A tiny minority of candidates knew that phenolphthalein is colourless in acid and pink in alkali.

(c) Despite being a low demand question, a surprisingly large proportion of candidates could not write down the name of another acid-base indicator. Iodine was a common misconception. This question had a high omit rate.

(d) The majority of candidates could calculate the titre as 25.5 $cm^3$ in part (i). In part (ii), many candidates were also able to calculate the average titre of 25 $cm^3$.

(e) Only a very small proportion of candidates could explain that the pH value of the acid increases because it is neutralised. A significant proportion of candidates thought that potassium hydroxide is an acid.

**SECTION C - MODULE C6**

**Question 9**

This question was about the electrolysis of concentrated sodium chloride solution.

(a) This question discriminated well with only the most able candidates identifying hydrogen as the other gas made during the electrolysis. Carbon dioxide and nitrogen were both common distracters.

(b) Only a very small proportion of candidates knew a use for chlorine. Weaker candidates tended to be imprecise stating simply ‘in swimming pools’ or ‘for cleaning’ and failed to score.

**Question 10**

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

(a) A tiny minority of candidates knew that glucose/sugar solution is used to make ethanol. A significant proportion of candidates did not attempt this question.

(b) Carbon dioxide was known by more able candidates.

(c) Very few candidates could identify two conditions needed for fermentation. They usually just stated ‘warm’ or ‘high temperature’ and ‘high pressure’.

(d) The molecular formula for ethanol was well known. Marks were awarded for $C_2H_5OH$ or $C_2H_6O$ and credit was given for the atoms in any order.

**Question 11**

This question was about rusting.

(a) Only a small minority of candidates wrote the correct word equation for the rusting of iron. The most common error was the omission of iron as a reactant, ie oxygen + water $\rightarrow$ hydrated iron(III) oxide. Another frequent error was the formation of ‘hydrated iron(III)’.

(b) Many candidates correctly chose redox from the list.

(c) Methods of preventing rusting were well known.

**Question 12**

This question focused on fuel cells and was the least demanding in Section C.

(a) The majority of candidates were able to use the word equation to name hydrogen and oxygen as the gases used in the fuel cell.

(b) It was pleasing that the benefits of using a fuel cell instead of a petrol engine were much better known than in June 2009. Vague answers in terms of fuel cells being more environmentally friendly/less damaging to the environment, which did not gain credit, were less common. Many candidates gave a correct explanation in terms of less or no greenhouse gases/carbon dioxide being produced or water being the only waste product.

**Question 13**

This question was about hardness in water.

(a) Candidates usually responded correctly.

(b) Very few candidates could successfully interpret the results to explain that tap water contains both temporary and permanent hardness because distilled water required less soap to form a lather than boiled tap water.

(c) Although this was a low demand question, only a tiny proportion of candidates described that temporary hardness is destroyed when tap water is boiled.

(d) The majority of candidates correctly identified at least one of calcium and magnesium from the list.

**Question 14**

This was a good end to the paper for the vast majority candidates, who were able to give usually one, and often two, reasons why people take aspirin. Pain relief, lowering body temperature and reducing the risk of blood clots were the most common correct answers.

# B642/02 Higher Tier

**1 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 2009. The average mark for this examination paper was 32, and the range of marks obtained was from 3 to 58. Only a small number of candidates would have been more suited to take the Foundation Tier examination.

The examination paper discriminated very well and allowed candidates to demonstrate their knowledge and understanding of GCSE Chemistry. Candidates found Section A more accessible than Sections B and C.

**2 Comments on Individual Questions**

**Question 1**

This question focussed on the structure and properties of Fullerenes and graphite.

In (a) most candidates were able to recall the formula for Buckminster Fullerene, however a smaller proportion of the candidates could recall a use for fullerenes in (b). The most frequent correct responses were as a catalyst or as a drug delivery system. Candidates were not given credit for vague references to use in medicines.

In part (b) there was some improvement over past performance in terms of relating properties to structure of bonding. Candidates often referred to weak intermolecular forces between layers however there were still references to strong intermolecular forces between carbon atoms. The relationship between strong bonds and high melting point was well understood but only the best answers referred to the large amount of energy needed to break strong covalent bonds.

**Question 2**

This question focussed on fertilisers and percentage by mass composition.

In (a) most candidates just repeated the information given in the stem rather than linking nitrogen to making the plant protein needed for growth; or phosphorus needed to make RNA; or DNA needed for protein synthesis.

Most candidates were able to calculate the correct relative formula mass in (b) as 60 but a much lower proportion of the candidates could calculate the percentage by mass of nitrogen in (c) as 35%. Weaker candidates tended to quote one of the numbers from the table in the stem of the question.

In (d) many candidates referred to the roots' absorption of minerals in solution. Good answers also referred to transport of soluble materials within the plant although it was not needed by the mark scheme.

Although nitric acid was the most common response in (e) a significant proportion of candidates gave hydrochloric acid. A very small proportion of candidates gave elements or salts rather than nitric acid.

**Question 3**

This question used the decomposition of copper carbonate to assess aspects of quantitative chemistry.

In (a) the majority of candidates were able to show that the sum of the relative formula masses of the products was equal to the relative formula mass of the reactant. Only an extremely small proportion of candidates demonstrated that there was the same number of each type of atom on the left and right hand side of the equation, this type of answer was given full marks. A small number of candidates calculated the relative formula mass using the relative atomic mass of copper as 63.5, these candidates showed that 123.5 g equalled 79.5 g + 44 g.

In (b) a large proportion of the candidates found the percentage yield calculation straight forward. The candidates often quoted the formula for calculating the percentage yield and/or showed the working out. The correct answer of 90% was given full marks even if no working out was shown by the candidate. A small but significant proportion of the candidates gave an answer of 89% because they rounded 89.97% down to 89%. These candidates were given one mark.

Very few candidates in (c) used the mole concept to calculate the correct answer of 4.0g; most candidates appeared to use a ratio approach. Only the most able candidates were able to calculate the correct answer and often they did not show any working out.

**Question 4**

This question was about the manufacture of methanol and was the most accessible in Section A.

In (a) a very high proportion of the candidates was able to construct the correct word equation. The most common misconception was to include the catalyst in the equation.

Most candidates in (b) appreciated that a catalyst made the reaction go faster.

In (c) most candidates referred to the lower temperature and the lower pressure for method 2. Candidates who just referred to a low pressure or a low temperature were not given credit.

**Question 5**

This question was about precipitation reactions and was the most accessible in Section B.

To get full marks in (a) candidates had to refer to filtration and often this aspect of the answer was omitted. A common misconception was that the precipitate was crystallised rather than filtered off. A common answer was filtration and evaporation which was only given one mark. A small but significant proportion of the candidates did not attempt this part question.

Many candidates were able to construct the correct word equation in (b) but a common error was to give only one of the products.

In (c) most candidates realised the importance of the collisions between the ions and either stated that in a solid there were no collisions or there were more collisions in a solution. Most candidates realised that ions moved in a solution or were fixed in position in a solid.

**Question 6**

This question involved the properties of dilute hydrochloric acid and dilute ethanoic acid and was the least accessible question in Section B.

Only the most able candidates got full marks in (a) and many failed to score any marks. Candidates often scored either the mark for the equilibrium sign or the mark for the equation. A common misconception was to give the products of the equation as $H^+$ and $OH^-$. Other candidates gave $CH_3COO$ as the product and neglected to put the negative sign.

In (b) candidates rarely mentioned that there were more crowded hydrogen ions and as a result there were more collisions per second. It was not sufficient to state that there were more hydrogen ions present. The candidates often got one mark for stating there were more collisions, which was a 'catch' mark.

Although some candidates referred to collision theory in (c) the majority of candidates did refer to the greater number of ions present in the hydrochloric acid.

**Question 7**

This question was about the decomposition of aqueous hydrogen peroxide.

The correct answer for (a)(i) was 0.003125 and because this was a two stage calculation 0.003 was also allowed. The correct answer for (a)(ii) was 0.060 $dm^3$. Candidates found the calculation in (a)(ii) harder than the calculation in (a)(ii).

Although many candidates were able to get both the marks available for (b) other candidates drew diagrams that were not gas tight and so were only awarded one mark. The most popular answer involved the use of a gas syringe but some candidates did use displacement of water using either an upturned burette or a measuring cylinder.

**Question 8**

This question involved neutralisation and calculations involved in acid-base titrations.

In (a) most candidates referred to the results being more consistent or more reliable. A small number of candidates referred to the burette readings rather than the titres.

There was no evidence that the reference to volume of acid used in the table (it should have read volume of alkali used) disadvantaged candidates in (b). A significant proportion of the candidates used the bullet points effectively to ensure that they showed the working out. Many candidates calculated the mean titre as 25.05 $cm^3$, but fewer candidates could calculate the number of moles of hydrochloric acid as 0.002. A common error was not converting volumes into $dm^3$. The relative formula masses were sometimes used rather than moles, volume and concentration. A small but significant proportion of candidates did not attempt the question.

In (c) many candidates referred to neutralisation and other candidates referred to potassium hydroxide having a pH above 7. A small proportion of candidates referred to the reaction between hydroxide ions and hydrogen ions reducing the hydrogen ion concentration.

**Question 9**

Candidates often only gave one correct gas and a significant proportion did not link the name of the gas with the correct electrode. Oxygen was the most common incorrect response.

**Question 10**

This question was about fermentation and ethanol.

A small but significant proportion of candidates did not attempt (a). A common error was to use ethene rather than glucose.

In (b), although carbon dioxide was the most popular answer it appeared that other candidates chose gases from the list given for question 9.

Candidates found (c) quite difficult and often did not give detailed answers, referring only to the conditions being most suitable or optimum. Common mistakes included stating that yeast will denature above the quoted temperature range or that enzymes are killed. Although many candidates realised that the presence of oxygen was linked to oxidation some expressed their answer poorly and stated that the absence of oxygen resulted in the formation of ethanoic acid or vinegar.

In (d) candidates gave all possible orders for carbon, hydrogen and oxygen in the molecular formula for example $C_2OH_6$, all of these were given full credit. Although $C_2H_5OH$ is really a structural formula it was given full credit.

**Question 11**

This question was about the rusting of iron and was the most accessible question in Section C.

This was the second word equation on the examination paper where the reactants and products were given in the stem, however the performance of the candidates in 11(a) was much reduced compared to 4(a). Many candidates forgot to include iron in the word equation and others did not include the full name for rust. The mark scheme allowed hydrated iron oxide instead of hydrated iron(III) oxide.

In (b), redox was the most popular choice from the list given with displacement being the best distracter.

**Question 12**

This question was about fuel cells.

In (a) most candidates scored either 0 marks or 2 marks, as those candidates who knew the correct formulae could balance the equation. A common error was to give the formulae of the diatomic molecules oxygen and hydrogen as O or H.

In (b) candidates often referred to the efficiency of a fuel cell, referring to the direct energy transfer from chemical energy to electrical energy. Candidates also cited either the renewable or sustainable nature of the raw material for a fuel cell. References to density and flammability of the fuel were not given credit.

**Question 13**

This question involved hardness in water and how it can be removed.

Candidates found (a) difficult to explain. A Common misconception was that tap water needed the greatest volume of soap to form a lather so it must have permanent and temporary hardness. The best answers referred both to the reduction in volume of soap needed to form a lather after tap water had been boiled and to boiled tap water still needing more soap than distilled water.

In (b) candidates only had to state that acid reacts with or dissolves the limescale to be awarded a mark, although a small proportion of candidates went further and explained that the weak acid reacted with the limescale and did not react with the kettle itself. A small proportion of candidates did not attempt this question.

A significant proportion of candidates did not attempt (c). Among those who did respond, a common misconception was that calcium is displaced by sodium because sodium is reactive. Good answers mentioned the exchange of sodium with calcium or magnesium ions so that the calcium and magnesium ions were attached to the ion-exchange column.

**Question 14**

This question was about unsaturated fats and oils and was the least accessible in Section C.

The reason why unsaturated fats and oils are healthier required in part (a) was not well known. Common mistakes made reference to the ease of digestion of unsaturated fats rather than the link between saturated fats and atherosclerosis.

In (b) although it was well known that unsaturated fats will decolourise bromine few candidates could explain why. Candidates that referred to bromine going clear were not given credit. Good answers referred to the breaking of the carbon-double bond and/or bromine reacting with the double bond. A significant proportion of the candidates did not attempt this question.

# Grade Thresholds

**General Certificate of Secondary Education**
**Chemistry B (Specification Code J644)**
**January 2010 Examination Series**

**Unit Threshold Marks**

| Unit | | Maximum Mark | A* | A | B | C | D | E | F | G | U |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B641/01** | Raw | 60 | - | - | - | 35 | 28 | 22 | 16 | 10 | 0 |
| | UMS | 69 | - | - | - | 60 | 50 | 40 | 30 | 20 | 0 |
| **B641/02** | Raw | 60 | 43 | 36 | 28 | 21 | 15 | 12 | - | - | 0 |
| | UMS | 100 | 90 | 80 | 70 | 60 | 50 | 45 | - | - | 0 |
| **B642/01** | Raw | 60 | - | - | - | 33 | 28 | 23 | 18 | 13 | 0 |
| | UMS | 69 | - | - | - | 60 | 50 | 40 | 30 | 20 | 0 |
| **B642/02** | Raw | 60 | 42 | 35 | 27 | 19 | 14 | 11 | - | - | 0 |
| | UMS | 100 | 90 | 80 | 70 | 60 | 50 | 45 | - | - | 0 |

**Specification Aggregation Results**

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

| | Maximum Mark | A* | A | B | C | D | E | F | G | U |
|---|---|---|---|---|---|---|---|---|---|---|
| **J644** | 300 | 270 | 240 | 210 | 180 | 150 | 120 | 90 | 60 | 0 |

The cumulative percentage of candidates awarded each grade was as follows:

| | A* | A | B | C | D | E | F | G | U | Total No. of Cands |
|---|---|---|---|---|---|---|---|---|---|---|
| **J644** | 0.0 | 14.29 | 38.1 | 52.4 | 85.7 | 100.0 | 100.0 | 100.0 | 100.0 | 21 |

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums/index.html

Statistics are correct at the time of publication.

**OCR (Oxford Cambridge and RSA Examinations)**
**1 Hills Road**
**Cambridge**
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