RECOGNISING ACHIEVEMENT

GCSE

# Chemistry A

Twenty First Century Science Suite

General Certificate of Secondary Education **J634**

# OCR Report to Centres

# January 2012

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, 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 A (Twenty First Century) (J634)

## OCR REPORT TO CENTRES

# Overview

Candidates who had good knowledge and understanding across the modules and a good grasp of the concepts involved performed well. Some very good answers were seen, though overall the cohort contained a smaller proportion of more able candidates.

There were again encouraging signs of improvement in performance on free response questions. Few candidates left these questions unanswered and most attempted to address what was being asked, though long and vague answers were common. Where two or three marks were available it was common for candidates to express only one idea, hence scoring only one mark. Many candidates repeated part of the question at the beginning of their answers. Others expressed the same idea several times in the same answer.

Performance in the objective questions was similar to previous sessions. Few candidates left these questions unanswered most followed the rubric relating to the number of ticks required and the linking of pieces of information. Overall these questions gave all candidates an opportunity to show their knowledge and understanding and discriminated well in both tiers and across all abilities.

All papers discriminated across their target ability ranges, affording more able candidates the opportunity to score highly whilst allowing weaker candidates to score a reasonable number of marks. It was again clear, however, that a significant number of candidates had been inappropriately entered for the higher tier papers.

Examination papers are now scanned and marked online. It is vital that candidates use legible handwriting. Candidates who write outside of designated areas are at risk of their answers not being fully marked. Candidates would be well advised to ensure that they use the appropriate answer lines and spaces in which to write their responses. This is often exacerbated by candidates crossing out initial incorrect responses, and then cramming the answer into a much smaller space. Candidates should think carefully before beginning to write their answer to the question.

# A321/01 Twenty First Century Science Chemistry A (C1, C2, C3) Foundation Tier

## General Comments

The candidates engaged well with the majority of the paper and the time allocation was suitable. Candidates seemed better prepared to retrieve information from the tables of data and they could identify reasons to increase the amount of data collected. They also seemed more aware of the ideas of range, best estimate and outliers.

Identifying properties remained a challenge for many candidates, particularly when faced with free response questions which involved relating properties to polymers.

Balancing of chemical equations in terms of atoms appeared to be a challenge for a large number of candidates.

Foundation tier candidates found the 'explain' and 'describe' free response questions difficult to answer. Answers were often jumbled and some candidates simply repeated information from the stem of the question rather than offering new information.

## Comments on Individual Questions

**1** **(a)** **(i)** The majority of candidates could successfully identify an outlier as a value 'well outside the range of other measurements'.

**(ii)** Most candidates scored both marks on this question.

**(b)** **(i)** It was encouraging to see that most candidates could correctly identify the range of the data given.

**(ii)** Again it was very encouraging to see that candidates could correctly calculate the best estimate for the values given. Only a small proportion of candidates failed to score some marks here.

**(c)** A high proportion of candidates scored 2 marks out of a possible 3 marks on this question, as most could identify the key pieces of data to quote. The candidates struggled to express their ideas of correlation in a clear and coherent manner to allow marks to be awarded. Few candidates attempted any explanation of correlation; they simply described the observations from the data to gain the first and second marking points. Where candidates did attempt a coherent answer their response often repeated the stem of the question.

**2** **(a)** Many Candidates scored 2 marks on this question because they could identify the number of 'molecules' present.

**(b)** Considering how well Q2a was answered, it was surprising to see such a large number of 'no responses' to this question. The difference in responses between asking the candidates to count up the number of molecules compared to the number of atoms was surprising. Very few candidates scored this mark. This is a definite area for development in the future.

**(c)** Very few candidates scored this mark. Many candidates could identify the formation of carbon monoxide but they failed to also recognise the formation of carbon particulates as a product of incomplete combustion.

**3** **(a)** The majority of candidates could identify that only 'carbon' and 'hydrogen' were present in hydrocarbon.

**(b)** **(i)** Most candidates could identify 'polymerisation' as the correct term used to describe the formation of a polymer.

**(ii)** This was a very poorly answered question and it remains a topic for further development within Centres. The majority of candidates failed to achieve any of the marks available. Where the candidates did gain credit, it tended to be for identifying the idea of a lengthening chain or that some small molecule had to bond or join to another molecule. The keyword 'monomer' was rarely seen.

**(c)** **(i)** Candidates found this question difficult. A large number of candidates failed to score and a significant number of 'no responses' were seen. When candidates did attempt the free response question, the suggested material for the 'new material' was often 'polymer' or 'plastic' rather than a specific and named material such as 'poly(e)thene'.

**(ii)** A 'no response' in Q3ci made it difficult to score marks on this part. It was expected that the properties given here were consistent with the old and new materials given in Q3ci.

**4** **(a)** **(i)** It was pleasing to see the correct number of lines attached to the boxes with most candidates scoring all 3 marks.

**(ii)** This question was poorly answered with responses often showing confusion regarding the deterioration of food. Candidates regularly discussed preventing bacteria/mould growing rather than the prevention of a reaction taking place. Although a small number of the more able candidates could identify the need to prevent a reaction with oxygen, they failed to identify that these antioxidants would be found in fatty based foods such as milk and cheese.

**(b)** This question was answered well with a large number of candidates gaining 2 marks.

**5** **(a)** Few Candidates scored more than 1 of the 2 marks available here. Misconceptions often revolved around creating a barrier from the pests rather than killing pests, as a method of stopping them attacking the crops.

**(b)(i), (b)(ii)** and **(b)(iii)** were all generally well answered. Ideas about risk and safety appear to have improved from one examination session to the next.

**6** **(a)** A large number of candidates scored both marks here by identifying the correct values from the table of data.

**(b)** Ideas about sustainability have improved. This was demonstrated here with almost all candidates scoring at least 1 of the 2 marks available.

**(c)** The forces of attraction between the polymer chains remains an area for future development as candidates struggled to score marks on this question.

# A321/02 Twenty First Century Science Chemistry A (C1, C2, C3) Higher Tier

## General Comments

Since the new Unit 1 paper A171/02 was offered this year, the number of candidates entered for this paper was much lower than last year. The proportion of more able candidates seemed to be lower.

As in previous years, the free response questions proved to be challenging to all but the most able candidates. Without the choice of statements to guide them, many candidates could not find direction and gave vague, rambling answers that scored few marks.

The more able candidates showed a broad knowledge and understanding of modules C1, C2 and C3. The most able could apply this knowledge and understanding successfully to the majority of questions on the paper, including the free response questions. Many weaker candidates, however, showed sound ability in some areas but weakness in others, whilst some showed a general weakness across all three modules.

The majority of candidates followed instructions carefully. Most candidates could interpret simple data well, but many lacked the necessary precision in handling more complex data. Other areas of the specification which many candidates found particularly challenging included the concept of conservation of atoms, products from crude oil and harmful chemicals in food.

The overall spread of questions gave all candidates the opportunity to demonstrate their expertise. Most questions discriminated well, giving a good spread of marks across the ability range. It was clear, however, that a small number of candidates would have gained a more fruitful experience from sitting the Foundation tier paper.

## Comments on Individual Questions:

**1** This question discriminated well. Many candidates found difficulty in finding the necessary precision when using data.

**(a)** In (i) more able candidates omitted the outlier and calculated the mean (average) of 12 as the best estimate for two marks. Many candidates included the value for sample 6 to calculate a mean (average) of 14 for one mark. A number of weaker candidates did not calculate either value.

Most candidates gained at least one mark in (ii), commonly for recognising that the values had a small range or had no outliers. Fewer gained the second mark for relating this to the reliability of the data.

In (iii) more able candidates gained both marks for ticks in boxes 2 and 6. Most candidates gained at least one mark. There was no pattern to the incorrect answers.

**(b)** Most candidates related the difference in the number of cars in the two town centres to the difference in particulate concentration to gain two marks. Many candidates wrote about the difference in cars or particulates but not both, gaining one mark. A number of weaker candidates did not relate their answers to the two towns. Few of the more able candidates wrote about correlation or causal link to gain the third mark.

**2** The numerical answers were beyond the ability of most candidates.

**(a)** Only a few of the most able could give the correct answer 1 5 3 4. A very wide variety of incorrect answers was seen.

**(b)** Only a few of the most able candidates could give the correct answers 3 8 10 (atoms in reactants)and 3 8 10 (atoms in products), but many candidates did get the same three numbers for both answers to gain one mark. A very wide variety of incorrect answers were seen

**(c)** A majority of candidates gave one correct answer, more commonly carbon monoxide, but few gave both. Common incorrect answers were sulfur dioxide and nitrogen dioxide.

**3** Apart from part (c) most candidates answered this question well.

**(a)** The majority of candidates gained both marks for ticks in boxes 2 and 5.

**(b)** Most candidates knew that crude oil is made of carbon and hydrogen. Only the weakest candidates lost this mark, commonly for adding oxygen to the list.

**(c)** Few candidates followed the lead in the stem and correctly gave lubricants and raw materials for chemical synthesis as the two other types of useful product.

**4** Poor interpretation of data lost marks for many candidates.

**(a)** Most gained one or two marks for the idea that wood is better and also giving at least two points in its favour from the data. Fewer added at least one point favouring uPVC. Many weaker candidates did not make it clear which material was favoured overall. Some of the more able candidates gained the fourth mark, usually for commenting on the finite nature of crude oil.

**(b)** A large majority of candidates gained both marks by ticking boxes 3 and 5.

**(c)** Only the more able candidates gained this mark by ticking box 3.

**(d)** About half of the candidates gained at least one mark, commonly for a decrease in chain length or cross linking. Only the more able candidates gained both. Many candidates lost marks by giving answers such as 'chain length' or 'cross linking' without saying whether it should be increased or decreased.

**5** Few candidates maintained a consistent level of scoring through this question.

**(a)** In (a) more able candidates gave the correct pattern of true and false answers to gain two marks. Most candidates gained at least one mark.

In (ii) most candidates realised that antioxidants prolong shelf life, but fewer realised they prevent reaction with oxygen or could name a type of food that has antioxidants added to it. Many thought that antioxidants prevent the food rotting.

**(b)** Most candidates gained both marks by ticking boxes 1 and 5.

**(c)** Very few candidates could explain why organic food might contain harmful chemicals. Most based their answers incorrectly on the idea of contamination by pesticides or herbicides.

**6** Some good risk and benefit arguments were seen.

**(a)** Most candidates gained at least one mark, with the more able gaining both. Many candidates recognised that the risk was low and tied it to benefits outweighing risk or the cheapness of treated food. References to testing and being unaware of risk were reasonably common. Many weaker candidates were sidetracked into arguments about people not wanting insects on their food.

**(b)** Only the weakest candidates failed to score a mark, and more able candidate scored both for ticking boxes 2 and 5.

# A322/01 Twenty First Century Science Chemistry A (C4, C5, C6) Foundation Tier

## General Comments

There were no big changes to the way that candidates responded to the question paper. Few questions were omitted altogether and most tried to make good attempts throughout the paper. Candidates were able to identify elements and give correct symbols. They were also good at identifying changes in the patterns of reactivity of group 1 elements. They also understood state symbols used in equations and were able to correctly select these from given lists.

Many candidates responded well to the question on rates of reaction; some also volunteered responses which included collision theory with valid ideas about how rates are affected by changing different variables.

Candidates were less secure in the correct formulae for common reactants such as sulfuric acid and hydrogen. Even when the correct names were offered, it was rare that candidates gave the correct formulae for these substances. It would perhaps be advisable for Centres to ensure candidates learn a list of common formulae used in reactions.

Many candidates struggled to identify similarities and differences between compounds when the structures were offered. It was common to see letters given ie C, H and O as opposed to identifying the specific elements as required.

## Comments on Individual Questions

**1** **(a)** This was answered correctly by most. Most common incorrect response referred to rate of burning

**(b)** **(i)** This was answered well by more able candidates who tended to refer to lines. Weaker candidates scored marks for different colours but many candidates referred to flame/reactivity or even pH/alkali or height of spectrum.

**(ii)** The better candidates scored well. Weaker ones referred to compounds and flames and therefore lost marks even though they appreciated that there were features of both elements in the spectrum.

**(c)** Many candidates scored both marks but the electron configuration was the part which was not well answered .

**2** **(a)** **(i)** Many candidates selected the correct response here.

**(ii)** Candidates who used words as requested scored well. Many chose to write formulae, often getting oxygen wrong, but the correct formula for the oxide was unknown.

**(b)** **(i)** This was generally answered well. The bottom box was nearly always correct, but "lithium sinks" was proved a distractor to the top box. There were a number of candidates who lost potential marks as they only ticked one box.

**(ii)** Disappointingly many candidates selected carbon dioxide as the gas produced when lithium reacts with water.

**(c)** **(i)** This was answered well; candidates were good at looking for patterns in the melting points of elements in group 1.

**(ii)** Although many candidates were able to identify lithium as the element to react most slowly in water; a significant number incorrectly stated potassium.

**3** **(a)** Candidates responded well to this question; many achieved the full four marks and were clearly able to select the different constituent parts of the earth.

**(b)** Most scored 1 mark but the good and better candidates scored 2. Only the better candidates knew that there are weak forces of attraction between molecules in the air.

**4** Candidates struggled to achieve more than one mark here; they often scored the carbon/hydrogen/oxygen similarity together with the nitrogen/sulfur difference. Weaker candidates used letters (demonstrating a lack of understanding of the meaning of the letters themselves) and brought in concepts of weak/strong bonding. Few candidates referred to chain/branched structures. Good responses from the strongest candidates included reference to “fewer hydrogen atoms in the amino acid” or occasionally “they both have covalent bonds.”

**5** **(a)** Candidates often failed to use the information, incorrectly selecting the top two boxes.

**(b)** Aluminium was more commonly correct than copper in this question, but few candidates scored both marks. A significant number of candidates drew 2 lines from each metal even though the rubric states one reason.

**6** **(a)** **(i)** Candidates rarely scored on this question. Few mentioned sulfuric acid and very few of these could give the correct formula. Sulfur itself was a common answer.

**(ii)** Of those candidates who named hydrogen, many gave just H as the formula and so lost the mark. Many tried writing equations for the reaction and clearly did not grasp the term “formula.”

**(b)** **(i)** Candidates generally scored well on this question; there were many very good responses which stated clear changes of rate. The weakest candidates penalised themselves by referring to more zinc/acid or stating the rate would change without specifying in which direction.

**(ii)** Candidates struggled on this question. There were many vague comments here such as “you would time it” without explaining what needed to be timed. Better candidates referred to amount of gas and timing at intervals, such as “You would measure the volume of gas every 20 seconds”. Weaker candidates misunderstood the question and referred to changing variables such as concentration and temperature rather than the actual measurements to monitor rate.

**(c)** Most candidates were able to score one mark but relatively few managed both. A significant number only circled one name rather than the three specified, and so losing potential marks. It was clear that many candidates were not clear about the differences between the chemicals – salt was frequently selected.

**7** **(a)** Most candidates were able to correctly select “corrosive” as the response required.

**(b)** This was answered well and many candidates obtained full marks for the correct state symbols.

**(c)** When given formulae from which to select the names of acids, many candidates were able to achieve both marks.

**(d)** Although many candidates understood that the reaction between an acid and an alkali was neutralisation, there were a significant number that selected oxidation or combustion.

# A322/02 Twenty First Century Science Chemistry A (C4, C5, C6) Higher Tier

## General Comments

Candidates were generally appropriately entered for the higher tier, with most candidates attempting all questions.

Very few blanks were left in the questions which involved recognition or choice. Typically, most marks were scored from the objective questions, with candidates finding the longer answers more challenging.

When candidates answer longer questions, some failed to gain higher marks because they repeated the question rather than adding to the information given and giving a true explanation. All of the longer questions gave a very broad spread of marks. Some excellent answers were seen and in each question a significant number of candidates did not score any marks at all.

## Comments on individual questions

**1** **(a)** Almost all knew what Ben would see during a flame test.

**(b)** Many candidates gained all four marks for this longer answer, but a full spread of marks were seen. The commonest reason for a partial score was that some candidates rewrote the question rather than adding to the information. Answers such as 'the results show potassium but not sodium' did not score. As a minimum, candidates needed to refer to spectra or, ideally, discuss the position of lines to show the presence or absence of the elements.

**(c)** The symbols and electron arrangements of Group 1 elements were very well known and understood by higher tier candidates.

**2** **(a)** **(i)** Most candidates knew what happens to Group 1 elements when they are exposed to air. Some thought that the surface would bubble and fizz.

**(ii)** The formulae proved challenging for candidates. $LiO_2$ was a common incorrect formula for lithium oxide. Many candidates gave either the wrong charge or the wrong number of oxygen atoms in the formula for the carbonate ion.

**(b)** **(i)** About nine out of ten candidates correctly identified hydrogen. Carbon dioxide was the common incorrect choice.

**(ii)** Over half of the candidates knew that sodium hydroxide was the alkali that forms.

**(c)** **(i)** Most gained at least partial credit by identifying most of the true statements about caesium and lithium. Commonly, errors were either in choosing 'true' for the statement about melting points or for thinking that the number of protons is the same in both atoms.

**(ii)** Almost all candidates gained a mark for identifying both of the correct statements about the increased reactivity of caesium.

**3** **(a)** Almost all candidates identified that A has metallic bonding, and most correctly identified the type of bonding in the other two chemicals.

**(b)** This question gave a broad spread of marks, implying that knowledge of the properties of ionic and covalent compounds are only partly understood by the candidates. The statement about the attraction of the nuclei proved the most difficult for candidates to allocate correctly.

**4** **(a)** Again, a full spread of marks was seen for this longer answer. About a fifth of candidates gained no marks. Candidates need to make sure that their answers are of an appropriate level for a chemistry GCSE paper. Answers such as 'they both have Cs' gained no marks. As a minimum, examiners looked for an understanding that the formulae represent atoms in a molecule. Better answers discussed the numbers and types of *atoms*. Some very good answers which discussed covalent bonding and shapes of molecules were seen.

**(b)** This question was usually correct, but some candidates missed out one of the elements, usually N or S.

**5** **(a)** Most candidates correctly found the atomic mass of copper from the Periodic Table and used this correctly to calculate the mass of tenorite. Where errors were made, it was usually that the candidate used the proton number as the atomic mass for copper.

**(b)** Most candidates gained at least one of the two available marks, but some only correctly identified one of the yields.

**(c)** Almost all candidates knew that reduction involves the removal of oxygen.

**6** **(a)** **(i)** About two thirds of candidates did not know the name and formula for sulfuric acid. Of those who correctly gave the name, most did not know the formula. Both were needed for a single mark.

**(ii)** Less than half of the candidates knew that hydrogen is formed in the reaction between zinc and an acid. Of those who did know, not all knew the formula of hydrogen. The commonest incorrect answer was carbon dioxide.

**(b)** **(i)** About nine out of ten candidates correctly identified the lowest concentration of acid from the data about rate.

**(ii)** Most candidates gained a single mark, usually for identifying that rate increases with concentration. Fewer gave an explanation that used data from the table. For two marks the candidate needed to both describe the pattern and give evidence in terms of time taken from the results in the table.

**(iii)** Over half of candidates did not score any marks for this part question. There were several common errors. Firstly, some confused concentration with temperature and discussed particles moving faster or particles having more energy. Secondly, while most appreciated that there would be 'more collisions' few gave a high enough level of answer to score. The collisions idea depended on the candidate discussing frequency of collisions or rate of collisions. 'More' alone did not score. Very few candidates discussed increased concentration in terms of the particles being closer together or there being more particles per unit volume. This idea is not well understood.

**(c)** All distracters were often chosen, implying that candidates were not sure which compounds can be used to make a zinc salt from the reaction with an acid. At least two correct choices were needed for one mark. Most candidates gained at least a single mark.

**7** **(a)** **(i)** Only about half the candidates correctly read the pH values from the graph. Some guessed the pH values from previous knowledge, for example giving the pH of potassium hydroxide as 14, some reversed the values, and some gave values that were not shown on the graph at all.

**(ii)** About two thirds of candidates correctly read the end point from the graph.

**(b)** Just over half of the candidates correctly processed the titration results to work out that A is more concentrated than B.

**(c)** This equation was not well known. Less than half the candidates knew the equation. Most attempted to show the formation of sodium hydroxide.

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

**OCR Customer Contact Centre**

**Education and Learning**
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**