

# **Chemistry A**

Advanced GCE A2 H434

Advanced Subsidiary GCE AS H034

## **Report on the Units**

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**June 2009**

**H034/H434/MS/R/09**

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This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

OCR will not enter into any discussion or correspondence in connection with this Report.

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Advanced Subsidiary GCE Chemistry (H034)

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# Chief Examiner's report

## General comments

This session saw the first aggregation for OCR's revised Chemistry AS specification H034. Performance in all units reflected a candidature having the full ability range. Some truly exceptional responses were seen to questions on the papers. At the other extreme, some candidates struggled with some very basic chemistry. It must be remembered that the chemical language of formulae and equations forms the basis for most of the chemistry that follows.

Nearly all candidates had been entered for unit F322, *Chains, Energy and Resources*, and unit F323, *Practical Skills in Chemistry 1*. Unit F321, *Atoms, Bonds and Groups*, also saw a large entry, but with more than half the candidates re-sitting the unit from January 2009.

In the new specification, F322, *Chains, Energy and Resources*, replaces two former shorter units: *Chains and Rings* and *How Far, How Fast?* The new unit *Chains, Energy and Resources* (F322) has also been modernised with the inclusion of chemical content that increases understanding of many current environmental issues. From candidates' responses, it seemed that some centres had concentrated on the older material with a significant number of candidates understanding little of this 'new' chemistry. Teachers in centres are well advised to dedicate lesson time to prepare their candidates for the 'new areas' in the specification.

F323, *Practical Skills in Chemistry 1*, assesses skills via practical tasks taken under controlled conditions. Centres have coped well with the demands of this unit. Evidence from Moderators suggests that the Mark Schemes allowed teachers to mark the Tasks both quickly and reliably. The use of OCR's secure Interchange portal for distribution of the Tasks and support materials worked well. An e-mail updates service is available to alert centres to changes on the Interchange pages. To be notified by e-mail when changes are made to **GCE Chemistry A** pages please e-mail [GCESciencetasks@ocr.org.uk](mailto:GCESciencetasks@ocr.org.uk) including your centre number, centre name, a contact name and the subject line **GCE Chemistry A. It is strongly recommended that all centres register for this service.**

Another on-line initiative introduced this session has been the automatic generation of a moderation sample, with e-mail notification of the sample to the Examinations Officer at the centre. Teachers are advised to check with their Examinations Officer that the e-mail address supplied to OCR is correct. If the e-mailed sample request does not reach the centre then a delay is inevitable. For authentication purposes any change to the e-mail address must be sent by fax to Centre Services on 01223 552646 on centre-headed paper.

A third on-line initiative has been the facility to submit practical marks electronically via Interchange (more details are in the Exams Officer Update, April 2009, Issue 14, p. 4; see [www.ocr.org.uk/Data/exams\\_officers/Exams\\_Officer\\_Update\\_Issue14.pdf](http://www.ocr.org.uk/Data/exams_officers/Exams_Officer_Update_Issue14.pdf)). There is no requirement to complete the old paper-based MS1 forms as an electronic iMS1 form is automatically produced; this can be printed out. Considerable time is saved in the generation of the moderation sample as the automated e-mail sample request is produced from the electronic data. Centres are advised to consider this option as an alternative to the old paper based MS1s. Details of the arrangements have been sent to Examinations Officers.

Finally, centres should be aware that a revised *Data Sheet for Chemistry* will be issued with future units from January 2010. The main difference from the old *Data Sheet* is the use of 'lozenges' to show chemical shift ranges for  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR spectra. A copy of the new *Data Sheet* can be downloaded from the public OCR web-site ([www.ocr.org.uk](http://www.ocr.org.uk)) and from the Chemistry A page on Interchange.

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## F321 Atoms, Bonds and Groups

### General comments

As was the case for the January session, the entry was pleasingly high and the responses given by candidates suggested they had been well prepared. The range of marks scored by candidates indicated a very wide range of abilities with scores ranging from the maximum of 60 down to zero, with the average score being just under 34 marks.

The majority of the cohort had prepared well and responses indicated that the level of ability was similar to that sitting the old *Foundation Chemistry* (2811) unit in previous June sessions.

Question 1 worked as a gradual introduction to the paper, enabling candidates to get off to a confident start.

Question 3 proved the most difficult. Rather worryingly, the difficulty arose as a result of a noticeable weak ability to write formulae. As chemists, we are all aware of the need to be able to write accurate formulae and construct chemical equations.

Question 5, part (d) indicated that many centres may not have taught the displacement reactions of halogens from a practical viewpoint.

### Comments upon individual questions

#### Question 1

- (a) (i) Nearly all candidates took the opportunity to secure a good start by scoring two straightforward marks. On the rare occasion that an error was made it usually took the form of giving the mass number for the number of neutrons.
- (ii) Again this question was very well answered. The majority of the candidates were able to execute the calculation successfully. A significant minority failed to address the question and did not round to four significant figures as asked. Others rounded unsuccessfully. A handful of very weak candidates muddled this calculation with ones involving elemental analysis calculations but such errors were relatively rare.
- (iii) This stock definition would not have come as a surprise to a candidate who had prepared for the exam. 40% of candidates scored all three marks. Where errors were made, they were of two types. Firstly the concept of a weighted mean mass of an atom was not referred to. Secondly the comparison to one-twelfth the mass of an atom of carbon-12 was confused by comparing from the atom level to the mole level. A response such as '*The weighted mean mass of an atom compared to the mass of one mole of carbon-12*' is a case in point.
- (b) (i) Most candidates identified magnesium as the element that was oxidised and were able to support this by assigning the correct oxidation numbers to magnesium in the metal and in magnesium sulfate. Some failed to pick up the second mark by referring to oxidation in terms of loss of electrons rather than using oxidation numbers as instructed in the question. A handful of candidates suggested that hydrogen had been oxidised, sometimes with an explanation involving a decrease in oxidation number.

- (ii) Most candidates identified that a gas would be evolved. The second mark was awarded for spotting that the magnesium would disappear or 'dissolve' and this was omitted by many.
- (c) (i) It was pleasing to see that the majority of candidates had little difficulty with this mole calculation. Candidates do need to be aware that the relative atomic masses of magnesium and sulfur shown on the *Data Sheet* are 24.3 and 32.1, respectively. Thus the relative formula mass of  $\text{MgSO}_4$  is 120.4, and not 120. In this instance, candidates did not lose credit as either value gave an answer that could be rounded to 0.013 mol. Whilst we were expecting an answer to three significant figures, a correctly rounded response to two significant figures was allowed; candidates who rounded to only one significant figure did not gain full credit.
- (ii) Again the majority of candidates were able to execute this calculation correctly.
- (iii) A whole number answer was expected but credit was given to any candidate who worked out a correct value of  $x$  (irrespective of significant figures) based upon their responses to parts (i) and (ii).

## Question 2

- (a) Essentially three responses were required. The first mark was for the idea of delocalised electrons, the second mark for the idea of a lattice of positive ions and the third mark for realising that the metallic bond was the attraction between these particles. Many candidates omitted the third point.

Candidates do need to be aware of the terminology. The lattice contains positive ions, not nuclei or protons.

- (b) (i) This question was answered well. The common errors were incorrect stoichiometry or using diatomic sodium metal,  $\text{Na}_2$ .
- (ii) Surprisingly, less than 50% scored the mark here. Many candidates could not be awarded the mark as they chose to describe the process of electron transfer which brings about the formation of the oppositely charged ions, rather than the resulting attraction between these particles.
- (iii) Over half the candidates picked up both marks here. It was pleasing to see that the number of responses involving arrows showing movement of electrons from sodium to oxygen had greatly diminished in comparison to previous sessions. Such diagrams are at best confusing and often lead candidates to draw the sodium electrons twice and so to drop a mark. Only a small minority chose to ignore the cue about ionic bonding given in the previous question and gave a covalent structure for  $\text{Na}_2\text{O}$ .
- (c) This question discriminated well. Candidates with a good knowledge of properties associated with structure and bonding scored well here. However, other candidates failed to address the question and consequently were not awarded full credit. The first marking point was for stating that the presence of delocalised electrons allows sodium to conduct as a solid and as a liquid.

Many candidates stated that solid sodium oxide does not conduct and the lack of mobility of its ions that was required to explain this property. 'Free' ions was not credited. The conductivity of liquid sodium oxide was described by many but then frequently incorrectly attributed to mobile electrons. Weaker candidates tended to describe aqueous sodium oxide rather than the liquid form and consequently received no credit for this.

### Question 3

- (a) (i) Most candidates were able to produce a correct answer here. Where there were errors they more often involved a mistake in using the stoichiometry of the equation to gain the correct number of moles of HCl. Most candidates were then able to manipulate the number of moles and concentration to evaluate the volume of the solution. Weak candidates confused the volume of solution with that of a gas and attempted calculations involving  $24\,000\text{ cm}^3$ .

In two stage calculations such as this, *i.e.* deducing the number of moles of HCl followed by a calculation of the volume HCl, candidates are strongly advised to show working. Candidates who did so frequently received partial credit.

- (ii) Surprisingly, only 40% of candidates scored this mark on what was felt to be a very straightforward calculation. Many did not give a response.
- (b) Two marks was the commonest score on this question. Occasionally the state symbols were omitted or else CaO was given as a gas. Weaker students involved oxygen as a reactant in the thermal decomposition and a few proposed the formation of calcium metal but such answers were pleasing few in number.
- (c) (i) This posed a much greater challenge to candidates than might have been expected and less than 50% scored the mark. Amongst the incorrect answers, CaOH was the most common.
- (ii) As expected, the formula of  $\text{Ca}(\text{NO}_3)_2$  proved to be more of a problem. Only 23% of candidates were able to produce the correct formula. In many ways this simple formula proved to be the hardest question on the paper. Answers were very wide ranging such as Ca(NO),  $\text{Ca}(\text{NO})_3$ ,  $\text{Ca}(\text{NH}_3)$  and CaN. This was disappointing as the formula of the nitrate ion is a stated Learning Outcome in the specification.

### Question 4

- (a) This was another stock definition of a stated Learning Outcome. 35% of candidates scored all three marks. Nearly all scored the first marking point for removal of an electron. Candidates then began to run into difficulty, often through poor use of terminology and poor appreciation of the need to refer to molar quantities.

During first ionisation, the electron is removed from an **atom** not an element. The electron is removed from **each atom** within a mole of atoms, not simply from a mole of atoms. Nearly all realised that the change took place in the gaseous state but often it was not **gaseous atoms** which were being referred to.

- (b) (i) The majority of students identified the role played by the increase in the number of protons as the Period is traversed. Many then scored a second mark for stating that the electrons were being accommodated in the same shell or for pointing out that a decrease in atomic radius would contribute to the trend.

Less than 20% scored all three marks.

- (ii) This familiar question was generally answered, but many candidates failed to capitalise on their knowledge through poor phraseology. In many cases the comparison of the key properties was not described. To state that sodium has large atomic radius would not secure a mark unless compared to lithium's smaller radius. Candidates who stated that sodium has an extra shell would have secured the mark. A second mark was available for a **comparison** of shielding between atoms of



lithium and sodium; a statement that '*the extra shell gave sodium shielding*' would be insufficient as a lithium atom also has shielding.

Another instance of candidates using poor, costly terminology was in describing the nuclear *charge* of sodium as being weaker than that of lithium: weaker *attraction* would have secured the mark.

- (c) (i) This question was relatively challenging and less than 40% were awarded the mark. Some gave the correct equation but ignored the question and omitted the state symbols. Weaker candidates used diatomic oxygen and were also tempted to show negative ion formation.
- (ii) This question taxed candidates. Weaker candidates erroneously assumed that the second electron is removed from a shell closer to the nucleus. Others believed that there was an increase in nuclear charge where one suspects they meant an increase in nuclear attraction. However, reasons for greater nuclear attraction was required, such as a simple statement that the same number of protons is acting upon one less electron or that the outer electron is closer to the nucleus.

### Question 5

- (a) (i) The mark for this question was awarded to over 85% of the cohort. The atomic number is the number of protons. Candidates need to be wary about writing phrases such as '*the number of protons and electrons*' as this implies that the two numbers may have been added together.
- (ii) Over 60% of candidates could work out the electron structure of a titanium atom although a large number fell into the trap of suggesting a configuration involving  $3d^4$ .
- (iii) The correct answer to this question was more elusive than might have been imagined with less than 40% scoring the mark. A large number of candidates did not count hydrogen and helium as the first period and so gave Tc as the element rather than Mn. When it came to identifying the block some candidates were content to put down 'transition metal' rather than 'd' as their answer.
- (b) (i) This question was relatively well answered. A score of three marks was the most common outcome seen here. The majority of candidates were able to produce a diagram that showed clearly the hydrogen bond between water molecules and also to indicate correctly the partial charges on the hydrogen and oxygen. The most common error was to stop at this point and not to show the involvement of the lone pair on the oxygen. This is a serious omission as it is important for candidates to realise that it is the involvement of this lone pair that makes hydrogen bonds more than simply a permanent dipole–permanent dipole interaction. It was pleasing to note that instances of  $HO_2$  were very much reduced on those seen in previous sessions.
- (ii) Many candidates went for the easiest explanation here and stated correctly that no hydrogen bonding occurs in hydrogen sulfide. A few failed to pick up the mark by only describing the intermolecular forces in  $H_2S$  without any comparison being drawn to those present in  $H_2O$ . A few incorrectly described  $H_2S$  as having no intermolecular forces or as having weaker hydrogen bonds.
- (c) The most common score on this seemingly straightforward question was zero. This was caused by candidates leaping in to describe the trend in reactivity of the halogens rather than the required physical trend. When candidates did attempt to address the question set, most realised that van der Waals' forces were responsible for the trend and that these

forces were dependent upon the number of electrons present. However, frequently, candidates did not state the direction of the trend in boiling points.

- (d) This question was based upon practical work carried out on halogens and their compounds. The one twist was that chlorine gas was used rather than the more familiar chlorine water. Very often, in parts (i) and (iv) the response seen was 'a colour change'. It was hard to know if this was a case of clutching at straws or candidates genuinely believing this to be an adequate response.

Candidates should be aware that in the few instances within the specification where observations may be asked for then it would be the colours seen rather than a generalisation of 'colour change' which will secure the mark.

- (i) The subsequent responses given in part (ii) indicated that 60% of candidates knew that iodine was produced but the answers appearing in part (i) indicated that only 25% were aware of the colour of aqueous iodine, suggesting that this familiar piece of practical work had not been carried out.
- (ii) Only 20% of candidates were able to write the ionic equation (there were many unbalanced attempts) to support their knowledge of the products formed.
- (iii) Less than half the candidates were able to give the required explanation based upon the greater reactivity of chlorine. Many thought it sufficient to respond in terms of displacement rather than identifying the reason why the displacement took place.
- (iv) As in part (i), many candidates were at a loss here and simply guessed at various answers. Some identified the solution as going colourless but did not go on to state that the organic layer would turn purple and so did not gain the mark. Some pointed out that there would be two layers without giving the colour of the organic layer whilst weaker candidates suggested the formation of white or yellow precipitates. Only 20% were able to provide the correct response.

## F322 Chains, Energy and Resources

### General comments

This was the first session that this unit had been examined. The examination included a significant proportion of questions that assessed topics new to the AS specification. There was some evidence that the candidates found these questions more demanding than traditional questions. There was little evidence that candidates did not have time to finish the examination.

The average mark for the examination was 52 out of 100 and candidates were awarded marks that covered the whole mark range. Statistics show that all of the questions and the paper as a whole differentiated well. It allowed candidates of all abilities to demonstrate positive achievement.

A significant proportion of candidates wrote incorrect equations and did not check that these were balanced. Many candidates also found questions requiring long answers quite demanding. These candidates often did not organise their answers by using information in the stem of the questions. Good answers to these types of questions were well organised and concise.

There were many instances of candidates' answers lacking detail and precision.

### Comments on individual questions

#### Question 1

This question focussed on the use and environmental impact of alkanes as fuels.

- (a) Most candidates could recall that the general formula for an alkane is  $C_nH_{2n+2}$ .
- (b)
  - (i) Many candidates could write the equation for the incomplete combustion of octane. Almost all of these candidates used one mole of octane in the equation.
  - (ii) Almost all candidates realised that incomplete combustion occurs as a result of a shortage of oxygen.
- (c)
  - (i) The equation for the reaction between NO and CO was written correctly by a small proportion of the candidates. A common misconception was to show nitrogen as N rather than  $N_2$ . Most candidates realised that  $CO_2$  was one of the products but often formulae involving N, O and/or C were included instead of  $N_2$ . There was a significant number of candidates who did not attempt this part.
  - (ii) Good answers typically used the terms adsorption and desorption but there was a significant proportion of candidates who referred to 'absorbtion' instead. Bond weakening after adsorption was often omitted from answers.
- (d) Most candidates were able to draw skeletal formulae and cyclooctane was the most commonly drawn cycloalkane. Some candidates drew the skeletal formula for octane because they did not realise that a branched alkane was required.
- (e) Candidates often found this question more difficult than the others in Question 1, possibly because of the content new to the AS specification.
  - (i) Candidates needed to refer to atmospheric concentration and to the ability to absorb IR radiation. It was insufficient to refer to the ability to absorb radiation. A large

proportion of the candidates gave examples of the sources of greenhouse gases rather than the required factors.

- (ii) A significant proportion of candidates did not attempt this part. The most common answer for CCS was to pump carbon dioxide into old oil wells. Other correct answers included storing deep under the sea or converting to limestone and storing underground. Common misconceptions included the use of artificial trees or using a catalyst to remove carbon dioxide from the emissions made by burning fossil fuels.

### Question 2

This question focussed on enthalpy changes.

- (a) Many candidates could give an accurate definition for the enthalpy change of combustion; however a small proportion of candidates referred to the energy required rather than the enthalpy change or energy released. Most errors resulted from omission, for example failing to refer to use of excess oxygen or complete combustion.
- (b) (i) Candidates had to get to 54.6 kJ but a small proportion of candidates forgot to convert joules to kilojoules. Another misconception was to use the mass of 1.76 g (the fuel) rather than 250 g (the water).
- (ii) Most candidates were able to calculate the number of moles as 0.020 although a small proportion of candidates were only awarded one mark as an error carried forward from an incorrectly calculated molar mass of pentan-1-ol.
- (iii) Many candidates were able to get to the correct numerical answer but failed to include the negative sign or to quote the answer to three significant figures. Full marks were given for an answer of  $-2820$  kJ. A significant proportion of candidates did not attempt this part.
- (c) (i) Standard conditions were allowed as 1 atmosphere, 101 kPa or 100000 Pa together with any stated temperature. Any reference to concentration was ignored. Room temperature and pressure was not credited.
- (ii) There was very little evidence that candidates had used the information about the melting and boiling point of hexane in order to determine its state symbol.
- (iii) Only a small proportion of candidates stated that other hydrocarbons may be made when carbon and hydrogen react with each other. Very few candidates referred to a high activation energy.
- (iv) Many candidates were able to get to either  $-203$  kJ mol<sup>-1</sup> (the correct answer) or to  $+203$  kJ mol<sup>-1</sup>.

### Question 3

This question focussed on the chemistry of alkenes and the concept of atom economy. This was the least demanding of all the questions on the paper.

- (a) Only a small proportion of candidates were not awarded a mark. These candidates often did not realise that the reactions involved addition and gave products that still included the carbon-carbon double bond. Some other candidates scored one, two or three marks because, although they realised that addition occurred, they changed the carbon skeleton giving answers that referred to the reaction of but-1-ene or but-2-ene rather than

methylpropene. A common misconception was to include nickel in the product of the hydrogenation reaction.

- (b) Candidates needed to take more care when drawing the electrophilic addition mechanism. Common errors included drawing a curly arrow from a carbon atom rather than from the double bond, showing the heterolytic fission of bromine by having the curly arrow starting from a bromine atom and failing to draw the positive charge on the carbocation.
- (c) (i) Most candidates were able to state the correct molecular formula for cyclohexene. The most common error was to give the formula as  $C_6H_{12}$ .  
(ii) Many candidates were able to calculate the percentage yield. Full marks were given for 35.0%.
- (d) (i) Very few candidates were able to give a definition of atom economy.  
(ii) Many candidates were able to explain why the addition reaction has a higher atom economy than the elimination reaction. A common misconception for atom economy was to refer to the number of moles rather than the formula masses.

#### Question 4

This question focussed on catalysts and the synthesis of methanol from carbon monoxide and hydrogen.

- (a) Good answers showed the link between the position of equilibrium and the changes of temperature and pressure. Other candidates failed to make a clear link, for example stating that the conditions moved the position of equilibrium to the right because the reaction was exothermic without referring to the low temperature.
- (b) Many candidates realised that a high pressure was likely to pose a safety risk or was expensive and that a low temperature gives a very slow reaction.
- (c) (i) Although a significant proportion of the candidates were often able to score at least two marks, choosing either the depletion of ozone by chlorine radicals or radical substitution of an alkane was still the hardest part in Question 4. In the case of radical substitution, candidates often included initiation and termination steps as well as the required propagation steps.  
(ii) A significant proportion of candidates did not include the activation energy but labelled the two energy profiles instead. The energy changes had to be represented by a line with the arrow pointing in the correct direction rather than a double-headed arrow. Only a very small proportion of candidates drew an energy profile diagram for an endothermic reaction.
- (d) Only a very small proportion of the candidates were able to score three or more marks on this new topic to the AS specification. Candidates often focused on a catalyst as being able to be reused and that the use of a catalyst would reduce the temperature needed and the energy requirement for the reaction. Only a small number of candidates considered enzyme-catalysed reactions and their ability to take place at room temperature and to be very specific. Slightly more candidates mentioned that catalysts could allow alternative synthetic routes to be carried out with better atom economy and less waste.

### Question 5

This question focussed on the chemistry of alcohols. It was the most demanding question on the examination paper.

- (a) Many candidates could recall the two methods of manufacturing ethanol but often the answers lacked the required detail in terms of the balanced equation and the name of the method. A significant proportion of candidates could not recall the formula for glucose. A common misconception was to refer to the hydrolysis rather than the hydration of ethene.
- (b)
  - (i) Only a small proportion of candidates were able to score both marks in this part. Often the product was drawn with an extra carbon atom,  $\text{CH}_3\text{CHOCH}_3$ , and the equation gave hydrogen as the other product rather than water.
  - (ii) The IR spectrum given for **C** in did not have a pronounced broad absorption for the O–H bond in a carboxylic acid and a significant proportion of the candidates identified **C** as propanal and stated that there was not an O–H bond present in the molecule. To score the reasoning marks candidates had to identify the wavenumber and the actual bond that causes the absorption. This was best done by writing on the actual IR spectrum.
- (c)
  - (i) Many candidates identified **D** as methylpropan-2-ol.
  - (ii) In comparison to (i), few candidates could identify that **E** was an ester.
  - (iii) The structure of an ester was not well known and a significant proportion of the candidates left this question blank.

### Question 6

This question focussed on halogenated compounds.

- (a)
  - (i) Both  $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$  mechanisms were allowed in the mark scheme. Candidates often were not awarded full marks because of a lack of care when drawing the mechanism. Typically the partial charges on the C–I bond were drawn correctly but the curly arrow representing the heterolytic fission of this bond often started from the carbon atom rather than the bond. There was no need to show the lone pair on the hydroxide ion provided that its negative charge was shown and candidates could draw the curly arrow from any part of the hydroxide ion.
  - (ii) The name of the mechanism was well known.
- (b) Candidates found this part the most difficult part in this question. The candidates were often imprecise and did not refer to the ease of breaking the C–Hal bond. For example, no marks were awarded for answers that stated that the bond enthalpy for 1-iodopropane was less than for 1-bromopropane.
- (c) Although some candidates often realised that CFCs are still present in the atmosphere, other candidates incorrectly referred to chlorine radicals having a long atmospheric lifetime. Other acceptable answers referred to other substances such as NO cause ozone depletion and that CFCs are still entering the atmosphere. A considerable proportion of candidates referred to the effects of ozone depletion which were not given credit.
- (d) Candidates could often get both marks for the structure of the polymer and monomer.
- (e) Candidates needed to be more detailed than just to state that polymers could be recycled. Candidates needed to refer to collecting and sorting plastics prior to recycling. Other

candidates referred to cracking of polymers or combustion of polymers for energy generation.

### Question 7

This question required the interpretation of data and had two marks associated with the assessment of Quality of Written Communication.

- (a) A significant proportion of candidates were unable to explain the meaning of the terms structural isomer and stereoisomer. Although many candidates recalled that structural isomers had the same molecular formula they often did not mention that they had different structural formulae. Candidates often realised that stereoisomers had a different arrangement in three dimensions but they rarely mentioned that the structural formula was the same. Candidates were often able to state that a carbon-carbon double bond does not rotate but could not explain with sufficient clarity that each carbon atom of the double bond has two different groups attached. To obtain the mark for the Quality of Written Communication, candidates had to explain, using the relative molecular mass, that the alkene had the formula  $C_5H_{10}$ . Once candidates had identified the alkene, they were usually able to draw the structures of some isomers. A small proportion of candidates drew branched alkenes rather than unbranched ones. Most candidates were able to identify the *E* and *Z* stereoisomers but the use of *cis* and *trans* was also allowed. More candidates could identify **F** and **G** than **H**, with **H** often being written as a branched skeleton. A small proportion of candidates gave structures that included fluorine atoms, presumably because candidates could find a fluorohydrocarbon with a relative molecular mass near to 70.
- (b) Candidates found this part much less demanding than (a). Most candidates were able to use the IR data to suggest that **J** was an alcohol, and to use the percentage composition data to determine the empirical formula. To obtain a mark for the Quality of Written Communication, the candidate had to explain carefully how the molecular ion peak could be used to confirm the molecular formula for **J**. It was insufficient just to state that the molecular formula was the same as the empirical formula. Although some candidates gave branched isomers, many were able to give the correct structures for hexan-1-ol, hexan-2-ol and hexan-3-ol.

## F323 Principal Moderator's report

### General comments

Centres coped very well with the demands of the new coursework unit and it was pleasing to see that comparatively few centres needed their marks to be adjusted. When mark adjustments were required these were mainly reductions although a number of centres did have their marks increased.

In most cases, marking was clear and accurate showing that many teachers had spent a great deal of time and effort preparing the work for moderation. It was also clear that many teachers had benefited from the training provided by OCR at the outset of the course and had studied both the administrative arrangements and the Practical Skills Handbook.

It was clear that many centres had prepared their candidates very well for the demands of this unit, their candidates having displayed high levels of proficiency with techniques, scoring particularly well in the Quantitative Tasks.

Further centre-specific advice has been included in the Moderation Report to Centre.

### Administration

The Moderators were concerned at the large number of clerical errors discovered in their samples, many of which had a significant effect on individual candidate's marks. In some cases the clerical errors amounted to the difference of one whole grade at AS level which is quite significant when considering the impact that this can have on a student's career.

Clerical errors resulted from:

- Incorrect totalling of marks within the Tasks
- Incorrect transfer of marks from the pages within a Task to the front cover
- Failure to mark a whole page or pages of a Task
- Incorrect addition of the three Task marks making up the total for the unit.

It must be emphasised that it is the centre's responsibility to ensure that the marks submitted reflect accurately the work of their candidates.

In most cases, requests to amend marks were actioned speedily by centres; however, in a minority of cases these requests were ignored, causing significant additional work both for the Moderators and for OCR. Centres are advised in future to carefully check the addition of marks within scripts and then to use the OCR 'Marks Spreadsheet' available from Interchange (from the Supporting Materials section of the GCE Chemistry A page) to identify and add the marks for the best Task in each category.

Centres should also note that when sending work to the Moderator a copy of the teacher/technician trial results (where required), the Centre Authentication Form (CCS160) and details of any correspondence with OCR should be included.

For the candidates selected for moderation, the centre should only send the highest scoring Task from each of the categories (Qualitative, Quantitative and Evaluative). Sending all nine Tasks for each candidate delays the moderation process and is likely to result in centres being asked to re-submit their samples according to the regulations set out in the Specification and in the Practical Skills Handbook.



Teachers in centres are advised to consult with the Practical Skills Handbook for Chemistry A, available on the OCR web-site and on Interchange.

### Update on the assessment model

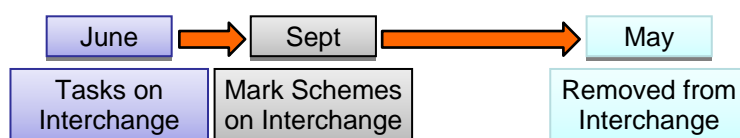
**Note that completed Tasks remain confidential and assessment material should not be returned to candidates.**

Only OCR Tasks from Interchange clearly marked with the current assessment year, e.g. 1 June 2009 to 14 May 2010, can be used for Practical assessment during that period. However, if a candidate wishes to improve their mark they could re-submit their best 1 June 2008 to 14 May 2009 Qualitative and Quantitative Tasks along with a new (from the 1 June 2009 to 14 May 2010 selection on Interchange) Evaluative Task. However, the marks confirmed by the Moderator when the Task was first submitted cannot be 'carried forward'. Teachers will be able to re-mark the Task in light of any comments made by the original Moderator (Archive Mark Schemes are provided on Interchange to facilitate this process) and it will be re-moderated when it is re-submitted. Up to two Tasks per student may be re-submitted (for example a student may have performed well in their Qualitative and Quantitative Tasks in June 2009 and re-submit them for Moderation with a new Evaluative Task in June 2010 – chosen from the Evaluative Tasks available for assessment in the June 2010 session).

Thus, centres should retain Tasks securely until such time as they are clear that candidates will not wish to re-submit work to OCR in future sessions. At this point the work should be securely destroyed.

### Availability of files on Interchange

Each year, Tasks (and Instructions for Teachers and Technicians) are available from 1 June, Mark Schemes are available from 1 September and all Tasks, Instructions and Mark Schemes are removed by 15 May in the following year.



A free e-mail updates service is available. To be notified by e-mail when changes are made to GCE Chemistry A pages please e-mail [GCEScienceTasks@ocr.org.uk](mailto:GCEScienceTasks@ocr.org.uk) including your centre number, centre name, a contact name and the subject line **GCE Chemistry A. It is strongly recommended that all centres register for this service.**

### Submission of marks

Centres should note that it is possible to submit candidate marks for this unit to OCR using Interchange (more details are in the Exams Officer Update, April 2009, Issue 14, p. 4; see [www.ocr.org.uk/Data/exams\\_officers/Exams\\_Officer\\_Update\\_Issue14.pdf](http://www.ocr.org.uk/Data/exams_officers/Exams_Officer_Update_Issue14.pdf)). This greatly accelerates the whole moderation process, allowing centres to receive details of the moderation sample much more quickly than by use of handwritten MS1 forms. Teachers may need to consult with the Examinations Officer to gain the relevant access rights.

During the moderation process, it was apparent that many e-mail addresses supplied by centres to OCR were incorrect. All sample requests are automated and it is vital that the supplied e-mail

address for the Examinations Officer is correct. Your Examinations Officer can check their details on Interchange by selecting 'Admin' and then 'View your centre details'. For authentication purposes any change to the e-mail address must be sent by fax to Centre Services on 01223 552646 on centre-headed paper.

## The Tasks

The Tasks proved effective in assessing the ability of the candidates sampled by the Moderators and the marks submitted by the vast majority of centres showed both an accurate interpretation of the marking schemes and a good degree of discrimination between candidates.

## Qualitative Tasks

The Qualitative Tasks proved to be challenging with many candidates being unable to express with clarity their observations.

Candidates should be made aware through class teaching the difference between a precipitate and a solution and be steered away from quoting exotic colours or mixtures of colours in their answers. Candidates should also be encouraged to follow instructions carefully and to record all of the required changes. Candidates frequently did not wait long enough when observing solids that were cooling to gain full credit for their observations.

All Tasks are trialled extensively prior to publication and it is unlikely that the results provided cannot be obtained. However, centres should trial all of the Tasks carefully and check that the centre results agree with the marking schemes before allowing candidates to attempt a Task. This allows for identification of centre-based problems such as the quality of the chemicals. In exceptional circumstances the advice below should be followed:

- If teachers are unable to obtain any of the marking points themselves having checked the solutions have been made up correctly, their observations should be submitted by e-mail to [GCEScienceTasks@ocr.org.uk](mailto:GCEScienceTasks@ocr.org.uk) at OCR for a decision as to whether these alternative responses can be credited.
- Once approval has been granted by OCR these observations become the observations by which all candidates in the centre must be judged. It is essential that copies of any correspondence must then be included with the work for moderation when submitted.

It is particularly important that measures are taken to prevent stock solutions being contaminated by candidates which could then have an effect on other candidates in the centre.

There were a number of issues with the marking of this skill area which requires comment and centres should take note of these for future submissions.

- Centres must ensure that marks are awarded in line with the marking points and marks should not be awarded for just part of a required answer. This was particularly the case when an answer such as '*blue precipitate*' was required with some centres crediting answers such as '*it turns blue*', without any mention of a solid being formed.
- Where an explanation of the chemistry involved in a reaction is required alternative wording can be accepted provided that it communicates the answer and does not include incorrect chemistry.
- Chemical equations should be balanced and contain state symbols when required in the marking scheme.

## **Quantitative Tasks**

On the whole the work of candidates was completed to a very high standard and it was clear that many candidates were proficient in both the performance of titrations and in the treatment of the results obtained from their practical work.

There were a number of issues which require comment and centres should take note of these for future submissions:

- In order to assess the accuracy of the candidates sampled, the Moderators require centre results including masses, titration data and temperatures to be included with the work submitted. In cases in which there is more than one group of candidates, it is essential that centres indicate which candidates have been assessed against which values. On Interchange, a look-up table is provided within the zip file for each Task against which candidate values can be easily compared against centre values to assess accuracy.
- The initial value for a titration reading should not be 50.00 cm<sup>3</sup>.
- Titration, mass and temperature readings must be quoted to the degree of precision given in the question and should be consistent.
- Calculations should be checked to ensure that the candidate has completed the Task correctly. The look-up table described above assists teachers to quickly check calculations.
- When stated in a mark scheme, the requirement to give an answer to a specified number of significant figures must be adhered to.

## **Evaluative Tasks**

This skill area discriminated well and proved to be the most difficult out of the three skill areas for candidates to score marks.

There were some excellent examples of work submitted by the most able candidates and it was encouraging to note that most candidates could make simple suggestions of how to improve what were often unfamiliar experiments.

It was clear that although some centres had spent time teaching how to evaluate errors in measurements, others had not. Teachers in centres are advised to consult the relevant Appendix of the Practical Skills Handbook for Chemistry A (available on the OCR web-site and on Interchange) which deals with the assessment of measurements and their associated errors.

There were a few areas in the marking of the Evaluative Tasks which were of concern to the Moderators. These included the following:

- In a number of cases marking schemes were interpreted quite leniently, particularly when questions asked for answers to be given to a specified number of significant figures. Some centres credited answers from 2 to 10 significant figures when the mark scheme requirement was to three significant figures only.
- In answers in which candidates could be awarded either one or two marks for their work, teachers often failed to read the Additional Guidance and awarded the wrong mark.

*Report on the units taken in June 2009*

One feature of the Evaluative Tasks is the presentation of unfamiliar situations. Although it is recognised that candidates must be prepared with the practical skills required before tackling a Task, this preparation must not include the coaching of specific marking points.

# Grade Thresholds

Advanced GCE (Chemistry A) (H034 H434)  
June 2009 Examination Series

## Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
F321	Raw	60	50	43	37	31	25	0
	UMS	90	72	63	54	45	36	0
F322	Raw	100	75	65	55	46	37	0
	UMS	150	120	105	90	75	60	0
F323	Raw	40	34	31	28	25	22	0
	UMS	60	48	42	36	30	24	0

## Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
H034	300	240	210	180	150	120	0

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

	A	B	C	D	E	U	Total Number of Candidates
H034	17.6	35.1	52.8	68.8	82.2	100.0	16327

## 16327 candidates aggregated this series

For a description of how UMS marks are calculated see:  
[http://www.ocr.org.uk/learners/ums\\_results.html](http://www.ocr.org.uk/learners/ums_results.html)

Statistics are correct at the time of publication.

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