

**Chemistry A  
Twenty First Century Science**

General Certificate of Secondary Education **J634**

**Report on the Units**

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**January 2008**

**J634/PER/R/08**

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

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

## General Comments

All candidates made a good attempt at this paper and there was a high mean mark. Candidates used their time well and completed the paper. Their scripts were clear and easy to mark.

The level of difficulty was appropriate for the ability range and there was a good spread of marks over all the papers.

## Comments on Individual Questions

- Q1 This was a question about the effects of reducing the traffic on motorways.
- (a) A straightforward first question for the paper. Most candidates gained 2 marks for parts i and ii. Almost all candidates gained one mark for part iii by realising that car pool lanes would be freer flowing but less were able to say that the cost per person is less.
  - (b) This question was more discriminating with some candidates believing that only carbon dioxide would be reduced if there were fewer cars on the motorway and not linking other pollutants with the amount of fuel burned.
  - (c) Many candidates found this question challenging. It looked as if many had guessed at the answers although the information needed was given in the question.
  - (d) Most candidates knew that hydrocarbons were made up of carbon and hydrogen atoms only. Fewer were able to draw a diagram of a carbon dioxide molecule. The most common error was to draw the three atoms in a triangular shape with the oxygen atoms touching each other.
- Q2
- (a) Well answered by most candidates. A few only ticked one of the two correct boxes and a few others chose the two wrong answers.
  - (b) This was a common question with the higher paper. Most candidates were able to choose who had described a correlation (part i) and who had explained the removal of sulfur dioxide (part iii). Part ii proved more difficult. Whilst many weaker candidates realised that Josh suggested an explanation for the reduction in sulfur dioxide fewer picked Hannah.
- Q3 This was a question about linking properties of materials to their uses.
- (a) Many candidates did not seem to understand the property of flexibility. This gave them incorrect answers to both parts of the question.
  - (b) Many candidates thought making rocking horses from wood would be better for the environment because it is a natural material. Wood is renewable because it can be grown again. Whilst growing, it uses the same amount of carbon dioxide that it will make when it burns. This is why it is better for the environment.
  - (c) Most candidates gained the full three marks for this question.

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- Q4 This question was a common question with the higher tier.
- (a) Almost all candidates gained the mark for recognising the outlier though there was evidence that a few did not understand the word outlier. In part ii most candidates could pick out one of the two correct answers but not both. The most common wrong answer was that the point had been pressed with a larger force.
  - (b) A more difficult question, with many candidates thinking there were variations in values because it was not a fair test. It should be stressed to candidates that even when factors that might affect the outcome are controlled (a fair test) there will still be variations in values.
  - (c) Disappointingly few could correctly answer this question about the range of results. Many candidates did not attempt this question.
- Q5 This question was common with the higher tier and required candidates to understand and interpret an article relating to food colourings.
- (a) Some candidates thought that all artificial additives would harm children though most picked the correct answer that the colouring could make children hyperactive.
  - (b) Almost all gained a mark for this question.
  - (c) Most gained one mark for this question but not two which seemed to indicate guesswork rather than knowledge about food additives.
- Q6
- (a) Although most candidates gained marks for this question the order of processes by which field become less fertile was not well known. All variations of the order of the four sentences were seen on scripts.
  - (b) Most candidates gained two marks on this question.
  - (c) Again most candidates did well on this question. The most common wrong answers were mixing up the reasons for using manure with the reasons for rotating crops.
- Q7 An easy final question with most candidates gaining full marks.
- (a) Of the few wrong answers protein and measles - words picked from other areas of the twenty first century science specification - were the most common.
  - (b) Almost a completely correct response to this question with just a few misreading or not reading the question and ticking the two incorrect boxes.

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

## General Comments

Almost all candidates made a good attempt at this paper, with very few questions left blank. Many candidates showed good knowledge and understanding across the three Unit 1 topics and demonstrated a sound grasp of the concepts involved. A number, however, showed sound ability in some areas but weakness in others.

When presented with a number of statements some candidates were not clear about the number that they were required to choose. In some cases this number is stated, whilst in other questions it is not. For both of these styles, though more commonly for the latter, a number of candidates chose an incorrect number of responses.

The overall spread of questions gave all candidates of appropriate ability for this paper the opportunity to score plenty of marks. A number of questions clearly discriminated well, giving a good spread of mark totals across the ability range. It was clear that a small number of candidates would have gained a more fruitful experience from sitting the Foundation tier.

## Comments on Individual Questions

- Q1 Though most candidates could interpret information in the table well to gain marks in part (a), the remainder of this question discriminated well.
- (a) The majority of candidates were able to choose the correct statements in (i) with mainly only the weaker candidates making errors.  
In (ii) almost all candidates gained the mark.
  - (b) More able candidates realised that nitrogen monoxide is produced from nitrogen and oxygen in the air to gain the mark in (i). Many others thought that petrol reacts with nitrogen or oxygen.  
In (ii) the majority of the more able candidates realised that two of the responses are correct, but many others gave only one of the correct responses, so losing the mark. Only a minority gave neither correct response.
  - (c) Again many candidates gave only one of the two correct responses, but this time they gained one of the two marks available. The most common single correct response was 'Adding catalytic converters to car exhaust systems'. Only the more able candidates chose both correct responses to gain two marks. 'Using low sulphur fuel' was a common incorrect response for weaker candidates..
- Q2 The majority of candidates interpreted the information in the diagram to score very well in this question.
- (a) Almost all candidates correctly identified Dina as the person who described the correlation.
  - (b) The majority of candidates correctly identified Josh as one of the two people suggesting an explanation for the change, but far fewer correctly identified Hannah. The most common incorrect response was Rajid.
  - (c) Almost all candidates correctly identified Hannah as the person explaining how sulfur dioxide is removed from the air.

- Q3 This question discriminated very well, with most candidates gaining at least one mark, but with only the most able gaining full marks.
- (a) More able candidates chose both of the two correct responses to gain the mark. Many candidates chose only one response.
  - (b) Only the weakest candidates could not draw at least one correct molecular diagram in this question. The most common correctly completed diagram was for carbon dioxide. Many of the weaker candidates drew a water molecule with two oxygen atoms and one hydrogen atom. Only the more able realised that two carbon dioxide and two water molecules were needed, and so gained all three marks. Generally candidates used the key very well. This question discriminated well across the ability range.
- Q4 This question allowed most candidates to score a number of marks, but discriminated well.
- (a) In (i) the majority of candidates knew the raw material used to make polythene. The most common correct answer was crude oil, though ethene was also seen quite often. The most common incorrect answer was plastic, though many other incorrect suggestions were seen. Again in (ii) most candidates knew this process to be polymerisation. Weaker candidates gave a wide variety of incorrect suggestions.
  - (b) Many candidates gave only one of the two correct responses, and so lost this mark. A little over half realised that there were two correct responses.
  - (c) Most students correctly realised that another method of disposal for plastic bags is recycling. A common incorrect response was re-using. Weaker candidates gave a wide variety of incorrect suggestions.
  - (d) Although this question required two responses for one mark, many candidates did achieve this. Only a minority ticked just one box, but many gave one correct and one incorrect response to score no mark. This question discriminated well across the ability range.
  - (e) The majority of candidates gained this mark, but many others incorrectly thought that there is no need to take biodegradable bags to landfill.
- Q5 Parts of this question were answered well by the majority of candidates, but concepts such as 'real difference' and 'cross-linking' were clearly understood by only the more able.
- (a) Almost all candidate correctly identified sample 4 as the outlier to gain the mark in (i) In (ii) most candidates gave one correct answer, but only the more able gave both.
  - (b) A large majority of candidates realised that these differences were caused by variation in the samples of X. Some weaker candidates chose one of the distracters, but there was no pattern to these incorrect answers.
  - (c) More able candidates gave the correct answer of 7 to 12. Others gave the answer 5, which was given credit on this occasion. Some weaker candidates gave incorrect answers such as 8 to 12 or 4, showing some carelessness in manipulating the figures.
  - (d) A minority of candidates realised that Anna gave the correct explanation for concluding that there is a real difference between X and Y. For there to be a real difference the mean of X must be outside the range of Y, and the mean of Y must be outside the range of X. If the ranges do not overlap both of these must be true. All of the incorrect choices were seen many times, with Brett and Sam being more common.
  - (e) Most candidates scored marks in (i) and (ii), with slightly more gaining the mark in the former than in the latter. This probably resulted from the need to tick two correct boxes for the one mark in (ii). Despite the clear instruction, many weaker candidates ticked only one box.

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- Q6 This question was accessible to almost all candidates, with many scoring full marks.
- (a) All but the weakest candidates correctly interpreted the information give to gain this mark.
  - (b) A large majority of candidates correctly gave the best answer to gain this mark.
  - (c) Most candidates filled in the table correctly to gain both marks. Weaker candidates often made an error to gain only one mark, but very few scored zero.
- Q7 This question allowed candidates of all abilities to score marks, but still discriminated well.
- (a) The majority of candidates scored full marks for this question. Some weaker candidates became confused, and joined some boxes incorrectly, but few scored no marks.
  - (b) In (i) most candidates correctly chose the statement referring to the chances of diabetes occurring in overweight children to gain one mark, but only the most able also chose that referring to the consequences of contracting the disorder to gain the second mark. A number of weaker candidates ticked only one box. Laura was chosen by the majority of candidates to score one mark in (ii), but fewer correctly chose Andy, and only the more able gave both. All of the incorrect responses were suggested by large numbers of candidates.
- Q8 Few candidates evidenced a good understanding of the processes shown in the diagram.
- (a) Most students scored at least one of the two marks, with C being the most common correct answer. A few of the weaker students wrote descriptions of the processes instead of the letters.
  - (b) Candidates were told to tick two boxes, and most did. Unfortunately the most common answers were one correct box and one incorrect box, which scored no mark. The response 'Lightning' was rarely chosen. Most candidates clearly failed to understand the ways in which nitrification takes place.



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

## General Comments

Whilst many candidates made a good attempt at this paper, showing sound knowledge and understanding across the three Unit 2 topics at this level, others evidenced severe weakness in many areas. This disparity was most obvious in questions concerning atomic structure, relationship between structure and properties and calculations. Where questions required written answers, though many excellent answers were seen, the suggestions of some candidates showed a lack of even the most basic understanding.

When presented with a number of statements with tick boxes, weaker candidates frequently ticked fewer or greater than the number of boxes required. Many of the weakest candidates made no attempt to answer some tick box choices questions, where even a guess would have been more sensible than no response.

The overall spread of questions gave all candidates of appropriate ability for this paper the opportunity to score plenty of marks. A number of questions clearly discriminated well, giving a good spread of mark totals across the ability range.

## Comments on Individual Questions

- Q1 This question was answered well by a large majority of candidates. It gave even the weaker candidate an opportunity to score a number of marks. Part (b) discriminated well in the middle of the ability range.
- (a) All but the weaker candidates gained the mark in (i). The most common correct answer was 'increases' and 'increases' or words with similar meaning. A significant number of candidates combined 'increases' with 'decreases' to lose the mark. A variety of other incorrect answers were seen.  
In (ii) most candidates correctly chose 'gas'. The most common incorrect answer was 'liquid'  
The majority of candidates correctly chose 'black' in (iii), though many weaker candidates chose one of the other two colours.
- (b) More able candidates correctly chose 'chlorine bromine iodine' to gain the mark in (i). There was no pattern in the incorrect choices made by a number of weaker candidates.  
In (ii) again more able candidates chose the correct response 'chlorine, bromine and iodine'. All of the incorrect responses were regularly seen from weaker candidates.
- (c) All but the weakest candidate correctly identified the hazard symbol for harmful.

- Q2 This question discriminated well. The early parts gave most students an opportunity to gain some marks, but later part proved to be accessible only to the more able.
- (a) Most candidates correctly ticked the box for 'Li Na K' in (ii), though many weaker candidates ticked the box next to one of the incorrect combinations of symbols. There was no pattern to the incorrect responses.  
In (ii) fewer of the weaker candidates made the correct choice, perhaps indicating that they understood the concept of group better than that of period.
  - (b) Most candidates transferred this information from their copy of the Periodic Table without error to gain all three marks. A common error was to transpose the proton number and relative atomic mass. A wide variety of spellings for beryllium was seen from weaker candidates.
  - (c) Most of the more able, and many of the average candidates correctly drew four electrons in the outer shell to gain this mark. A wide variety of incorrect answers were seen, including many with additional shells added to the diagram. Many weaker candidates added electrons to the first shell. A significant number of candidates did not attempt this question.
  - (d) In (i) only a minority of the more able candidates realised that conduction of electricity by molten sodium chloride is evidence that the salt is made of ions. Many candidates thought the correct answer to be 'Sodium chloride is made of crystals'.  
Only the most able candidates gained marks from part (ii), which discriminated well at the upper end of the ability range. Many of these could give 2.8.8 for a chloride ion to gain one mark, but 2.8 for a sodium ion was less often seen. A wide variety of incorrect answers were seen from the majority of candidates. A number of candidates made no attempt.
- Q3 Another question that discriminated well. Most candidates scored some marks, but only the more able answered well throughout.
- (a) Many candidates did not write down the name of a salt, with 'chloride' and 'sulfate' being the most common incorrect attempts. A small majority gained the mark, most commonly for 'sodium chloride' with calcium carbonate a close second.
  - (b) A majority of candidates realised that ions are held together by attraction between opposite charge to gain this mark.
  - (c) Most candidates gained one of the two available marks, but few could choose both correct statements. Weaker candidates often chose the two incorrect statements. A few candidates ticked only one box or three boxes.
  - (d) Very few candidates gave the correct answer 'sodium chloride'. The most common incorrect answer was 'chloride', though many others were seen.
- Q4 This question was a severe test of the knowledge and understanding of most candidates. Few scored well.
- (a) For most candidates this proved to be a guessing game. Choices were made with little thought to the overall combination of ideas. A few of the most able candidates scored well, but most gained one or two marks, probably by chance.
  - (b) Many candidates made the correct choice of 'nitrogen' and 'oxygen' to gain the mark. Weaker candidates often made one correct choice and one incorrect. A significant number made only one choice.

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- Q5 More able candidates gained a number of marks from this question, but the majority found most parts too difficult.
- (a) Most of the more able candidates correctly chose 'carbon' to gain this mark. All of the other substances in the equation were seen as answers, and a number that were not in the equation.
  - (b) Most candidates gained at least one mark, choosing one correct and one incorrect metal. This was probably by chance. Only the most able chose the two correct metals.
  - (c) About half of the candidates knew the correct answer in (i) to be 'Aluminium is more reactive than carbon'. All of the incorrect answers were seen very often, with no clear pattern.  
In (ii) only a few of the most able gained the mark for 'electrolysis'. A wide variety of incorrect responses were seen from the majority, including 'filtration', 'heating' and 'melting'. A significant number of candidates gave no response.
- Q6 The majority of candidates found plenty to answer in this question, gaining a number of marks.
- (a) Most candidates realised that this is a neutralisation reaction to gain this mark. However, all of the incorrect choices were seen from weaker candidates.
  - (b) The majority of candidates made a good attempt at this question, with many scoring all three marks. Weaker candidate became confused, often drawing lines that included phosphoric acid or ammonium hydroxide, or two lines from or to one box. The question discriminated well at all but the top end of the ability range.
  - (c) Most candidates could identify 'H<sub>2</sub>' as the formula of hydrogen gas. The most common incorrect response was 'H', though '2H' was often seen.
- Q7 The inclusion of some simple calculations in this question proved too much for many candidates.
- (a) Only the more able candidates knew the correct technique to be filtration. Many incorrect suggestions were seen, including 'heat it', 'decomposition', 'oxidation' and 'sieving'.
  - (b) Though more able candidates gained one or both marks in (i), weaker candidates had little idea of how to perform these calculations.  
In (ii) the majority of candidates clearly did not understand the concept of percentage yield. Many quoted figures in excess of 100 or less than 1.0. Only a few of the most able could perform the calculation correctly.
  - (c) A small majority of candidates realised in (i) that each line finishing at the same volume of carbon dioxide indicated that the same mass of magnesium carbonate had been used for each. All of the incorrect responses were seen from weaker candidates.  
Whilst many candidates correctly chose line A as showing the fastest rate and line D the slowest in (ii), a large number inverted A and D in their answer. Clearly the latter realised that A and D included the fastest and slowest but could not interpret the graph correctly to determine which was which.  
The majority of candidates realised that increasing the temperature of the acid would increase the rate of reaction, gaining the mark in (iii).

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

## General Comments

This was the first time that these topics have been set as a chemistry paper though questions on the same content were set in Additional Science last June.

All candidates made a good attempt at this paper. They used the time well and completed the paper fully. Many candidates showed good knowledge of the topics and a clear understanding of all the concepts covered by this paper. Only a few would have been better suited to the foundation paper.

Whilst many papers were clear and easy to mark, some had extensive crossings out. Although examiners will look at a whole page to find the answer, judging the sequence of a candidate's writing to find the final answer is more difficult with scanned scripts.

## Comments on Individual Questions

- Q1 All candidates gained marks on this question on the halogens.
- (a) Many candidates gained full marks. Weaker candidates, who found it difficult to recall the states of the halogens, could not work them out from given melting points and boiling points. Almost all gained a mark for part ii which was a common question with the foundation paper.
  - (b) This was a discriminating question with able candidates gaining full marks. Many of the wrong answers gave the halogens in reverse order. Another common mistake was to mix up the names of halogens with halides. It was not unusual to see both –ide and –ine endings in the same answer. In spite of the mistakes in part i most candidates knew that fluorine displaced the other halogens in part ii.
  - (c) Most candidates worked out the charge on the strontium ion. Wrong answers gave a variety of charges; +1, -2 and -1 being the most frequent.
- Q2
- (a) Almost all gained marks for naming an element in the same group as neon and drawing the arrangement of electrons of argon. Candidates were unclear about an element in the same period as calcium often naming one in the same group. There were no problems linking the symbol to the name of the element.
  - (b) Only the best candidates were able to write a balanced equation for the reaction of sodium and chlorine. The most common error was to write  $Cl$  instead of  $Cl_2$ . Again this showed confusion in the chemistry of halogens. Some candidates who could correctly balance the equation omitted the state symbols so failed to pick up the third mark. Parts ii and iii were answered correctly by most candidates. In part iii a few candidates lost the mark because they moved an electron from chlorine to sodium.

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- Q3 Most candidates could interpret the information on ions dissolved in sea water. Some found it difficult to distinguish between atoms, molecules, ions and compounds.
- (a) There was no problem naming an ionic compound dissolved in sea water with only a few wrongly naming a single ion. In part ii many more candidates incorrectly gave the answer as chloride rather than sodium chloride.
  - (b) This part of the question was more challenging as there was no indication of the number of boxes to tick. Many chose one of the two correct explanations but not both.
  - (c) This was well answered with many candidates choosing all three correct words for the mark. The most common mistake was to call the particles in ionic solids atoms or molecules rather than ions.
  - (d) This question was a similar format to part b but the answers were better known. Sometimes the box next to low density was ticked instead of or as well as the correct answers.
- Q4
- (a) All candidates made a good attempt at this question and many gained full marks.
  - (b) Many candidates, including some of the most able, could not name the three elements, other than carbon, that made up living things.
- Q5 Both parts of this question discriminated well across the ability range with good candidates picking up all five marks.
- (a) Many candidates lost both marks by giving iron the formula Fe<sub>2</sub>. Candidates should be aware that when writing equations the balancing mark is not given if formulae of reactants and products are incorrect. A few candidates who were not confident in balancing equations gained a mark by using the information given in the question.
  - (b) Good candidates attempted this question and most gained at least one mark. Some misread the instructions and wrote the formula of iron oxide rather than calculating the formula mass. Very good candidates could work correctly through the whole calculation.
- Q6 This was a question about neutralisation reactions.
- (a) This was a common question with the foundation paper and most candidates gained full marks.
  - (b) Only good candidates could provide correct answers to this question. Many did not attempt the question. A few could write down either the formulae of the ions or the neutralisation equation but not both, showing the link between the two to be missed.
- Q7
- (a) Part i was a common question with the foundation paper and most candidates could correctly work out the percentage yield. Fewer could calculate the reacting mass of magnesium carbonate and some did not attempt this part of the question.
  - (b) Most candidates gained good marks on this question. Almost all understood the volume / time graph and interpreted it correctly. Many also showed an understanding of the concentration of solutions and gained full marks on part ii.

# Grade Thresholds

General Certificate of Secondary Education  
Chemistry A (Specification Code J634)  
January 2008 Examination Series

## Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
A321/01	Raw	42	N/A	N/A	N/A	33	28	23	19	15	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A321/02	Raw	42	36	32	27	22	16	13	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A322/01	Raw	42	N/A	N/A	N/A	25	21	17	14	11	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A322/02	Raw	42	35	28	21	14	8	5	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	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
<b>J634</b>	300	270	240	210	180	150	120	90	60	0

**No candidates were entered for aggregation this series. First aggregation opportunity is in June 2008.**

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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