OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry A

Twenty First Century Science Suite

General Certificate of Secondary Education **J634**

Reports on the Units

January 2010

J634/R/10J

Oxford Cambridge and RSA Examinations

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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 specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

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

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CONTENTS

GCSE Twenty First Century Science - Chemistry A (J634)

REPORTS ON THE UNITS

Introduction from the Chief Examiner

For the first time free response questions were included in these examination papers. It was expected that this change would make the papers more challenging for all candidates, and this assumption proved to be correct. Those who had good knowledge and understanding across the modules and a good grasp of the concepts involved performed well, but the free response questions exposed weaknesses in many candidates. Answers were often poorly expressed and many did not address the questions. Many of the less able candidates could not find direction, giving long but largely irrelevant answers. Weaker candidates also found difficulty in selecting relevant data and using it to present answers in a clear and logical manner. A significant number of candidates left some of the free response questions unanswered.

Performance in the objective questions was similar to previous sessions, and they discriminated well in both tiers and across all abilities. Few candidates left these questions unanswered or failed to follow the rubric.

Overall many candidates were well prepared for the examination papers and showed a good grasp of the chemistry modules, whilst the knowledge and understanding of weaker candidates was more shallow and patchy. All papers discriminated across the appropriate ability ranges, affording more able candidates the opportunity to score highly whilst allowing weaker candidates to score a reasonable number of marks. It was clear, however, that a number of candidates had been inappropriately entered for the higher tier papers.

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

General Comments

In general candidates found this a more challenging paper than that of the June session.

However, most were able to recognise patterns in graphs and link variables. They were also able to correctly indicate factors which may have an impact on experimental data. They need to be given more opportunities to calculate the mean when given a selection of results, and should be reminded to bring calculators to the examination in order to make this process easier.

Candidates demonstrated good knowledge of the Life Cycle Assessment of paper and plastic, also appreciating that cost overall for the suppliers may have an impact.

Questions regarding sustainability were the most challenging for the candidates. Very few were able to give correct definitions for "sustainable development" although there was some appreciation of this involving future impact.

Questions regarding the difference in methods between organic and intensive farming were answered well by many candidates.

Few candidates were able to correctly select all the information regarding the Food Standards Agency but most appreciated that they were protecting the health of the public.

Comments on Individual Questions

1 Part (a) - only about half the candidates were able to correctly choose all four answers here, and many found choosing the element the most difficult. Most candidates did choose at least two correct responses.

Part (b) was answered well and many candidates were able to appreciate that car exhausts and power stations were a source of nitrogen dioxide. Unfortunately, they were unable to articulate the way nitrogen dioxide is removed from the air, or its harmful effects. Many talked about "global warming" or "breathing difficulties" and it was common for marks to be lost because candidates repeated the question by stating "It's harmful."

2 Candidates were able to state patterns in data, and (b) (ii) was answered particularly well; candidates were able to see that some changes would have no impact on data collected during an experiment. They found it more difficult to explain why some data can not be used to prove a cause.

3 Part (a) was poorly answered as many candidates were unable to see that sometimes repeating tests is necessary due to the range of data being too large, but most were able to see which results should not be used to calculate means and explain the reason. They then struggled in calculating the mean (many completed hand-written calculations on their papers but the result was incorrect). It would have been beneficial for these to have access to calculators in their respective Centres.

Part (d) (i) proved that many candidates understood the process of vulcanisation and were able to appreciate how strong bonds increased the hardness of rubber. They were less secure in suggesting other reasons for rubber being harder.

4 Some parts were answered successfully; many candidates understood that there was a difference in the life cycles of plastic and paper. They were able to correctly state that plastic may be used because of its strength and also there may be cost considerations. However, many candidates were unable to answer question part (b) successfully. Candidates either mis-read the question and discussed the manufacture of plastics (as opposed to use), or they repeated information from the previous questions on biodegradability. A few of the strongest candidates answered this well and discussed the impact on future oil reserves indicating a good knowledge of the source of many plastics.

5 Candidates were successful in their linking of organic farming and synthetic farming with the correct methods. However, they found explaining the idea of sustainable development extremely challenging and many answers demonstrated no appreciation of the importance of sustainability.

6 Candidates were quick to appreciate the use of additives for prolonging shelf-life and were also able to understand the significance of E numbers. They did not, however, understand the role of the Food Standards Agency, other than it protects the public.

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

General Comments

This is the first time that free response questions have been set on this paper. As expected, these 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. More blank answer spaces were seen on this paper than previously, largely in the free response questions.

As in previous sessions, 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, while some showed a general weakness across all three modules.

The majority of candidates followed instructions carefully. However, a number of weaker candidates ticked an incorrect number of boxes to that stated in the rubric, sometimes ticking more and at other times less than the required number. This commonly occurred when the number of boxes to be chosen was different in adjacent questions.

Most candidates could interpret data well, but ideas about real difference between data sets were not fully appreciated even by most of the more able candidates. The effect of factors on the outcome of an experiment and the need to control all but the factor under investigation were poorly understood by many. Other areas of the specification which candidates found particularly challenging included nitrogen dioxide chemistry, Life Cycle Assessments, chance and consequence and the precautionary principle.

The overall spread of questions gave all candidates of appropriate ability for this paper the opportunity to demonstrate their expertise. Despite the inclusion of free response, 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.

Comments on Individual Questions

1 Only the more able candidates scored well in this question. Knowledge of the involvement of nitrogen dioxide in the formation of acid rain, and the consequences of this, was surprisingly poor.

(a) In part (i) the majority of candidates gained one mark, commonly for knowing that nitrogen monoxide reacts with oxygen in air to make nitrogen dioxide. Few candidates realised that both the nitrogen and oxygen that react to make nitrogen monoxide originate from air to obtain a second mark.

More able candidates gave answers to part (ii) that contained the term acid rain to gain one mark, but only the most able described its formation from nitrogen dioxide and water. A slightly higher number mentioned the action of acid rain in damaging buildings, harming plants or killing fish.

In part (iii) most candidates gained one mark, generally for the statement referring to decomposition of nitrogen dioxide. Only the more able realised that carbon monoxide is converted to carbon dioxide.

1 (b) Most of the more able candidates correctly calculated that 8 molecules of water are formed, but only the most able could also calculate that 11 molecules of oxygen are used.

2 Most candidates performed well in this question. Interpretation of the graph was particularly good.

(a) A large majority of candidates could describe the trend or report it as a positive correlation to gain this mark. Some weaker candidates referred to 'the heavier the goods vehicles' or 'the faster the goods vehicles' to lose this mark.

(b) Most candidates gained one mark in part (i), generally for the statement referring to diesel producing a smoky flame, but only the more able gained both marks.

In part (ii) a large majority of candidates gained both marks.

3 Only a very few candidates appreciated how to apply ideas about real difference to data, or could explain fully why all factors are controlled except the one being investigated.

(a) Only the more able candidates knew that a significant difference is indicated by the mean of one data set not being within the range of the other data set, though few of these chose both of the statements consistent with this idea. A common error was to choose the statement indicating that the ranges of the two data sets do not overlap, which they do.

(b) Many candidates could explain that a change in either temperature or equipment would cause results to be different, gaining one mark. Very few of even the most able realised that these factors were controlled so that the outcome was affected only by the factor being investigated.

(c) Almost all candidates realised that reaction of rubber with sulfur forms strong bonds between the polymer chains to gain the mark in part (i).

Fewer candidates realised that the action of the new process could be explained by an increase in polymer chain length in part (ii).

4 Many candidates still find Life Cycle Assessment questions challenging.

(a) The majority of candidates gained one mark by choosing two correct responses. More able candidates chose all three correct responses to gain both marks.

(b) Most candidates described the environmental problems caused by using plastic bags without any reference to any difference between ten years ago and now, or to how the attitude of people may have changed. These candidates scored no marks. Good answers referred to ideas such as people becoming more aware of environmental issues, increasing lack of space in landfill and oil reserves that supply raw material for manufacture running low. Weaker candidates often wrote vague answers that referred to how long it takes for plastic bags to degrade, pollution from disposal of plastic bags and made unqualified references to global warming, which scored no marks.

(c) The majority of candidates gained two marks, whilst many of the more able gained all three. There was no clear pattern in the incorrect responses chosen.

5 Most candidates showed a sound grasp of ideas concerning intensive and organic farming methods.

(a) A majority of candidates gained both marks for this question, with only a small proportion of the weakest failing to score at least one mark.

(b) More than a third of candidates gained one mark and almost half gained both marks for this question.

(c) Most candidates gained one mark, generally for either correct answer, whilst more able candidates chose both. A common error was to choose the statement indicating that intensively grown carrots contain fewer vitamins.

6 When given a free response opportunity to answer questions about risk and consequence and the precautionary principle, few candidates could frame sensible answers.

(a) A large majority of candidates scored both marks. All of the distracters were chosen without apparent pattern by weaker candidates.

(b) Most candidates gained one mark but few gained both. Many thought that sodium benzoate does not pose a significant health risk because it is found naturally in some fruits.

(c) Few candidates framed their answers to part (i) using ideas about chance and consequence. Many made vague references to how much sodium benzoate would cause harm, concentration in drinks and how much people might drink, gaining no marks. Only the most able realised that people would need to know the chance that sodium benzoate might cause them harm and, if it did, how serious this harm might be. Whilst many candidates scored one mark, few scored both.

Similarly, in part (ii) few candidates used the precautionary principle as the basis for their answers. Many made vague reference to risk or the harm that sodium benzoate would cause, gaining no marks. Only a few of the more able realised that it has not been clearly established that consuming drinks containing sodium benzoate will cause harm, and so it would be better to avoid them. Again many candidates scored one mark but few scored both.

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

General Comments

For the first time this paper included some free response questions. Whilst these enabled stronger candidates to show their grasp of the subject and their communication skills, they proved to be a problem area for weaker candidates. Many found difficulty in selecting relevant data from that supplied and then using this data to present answers in a clear and logical manner.

While the more able candidates showed a sound knowledge and understanding at this level across the three modules assessed in this paper, others showed both a shallow and a patchy appreciation of even the basic concepts involved.

Only a small number of candidates did not follow the rubric, for example ticking fewer or greater than the number of boxes required. Similarly, only a few of the least able candidates left a significant number of questions unanswered.

Despite the introduction of free response, the overall mix 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

1 Most candidates scored well on this question, which provided a gentle introduction to the paper.

(a) The majority of candidates gained this mark. Common errors were to reverse the answers to give period group instead of group period, and to give series instead of period for the second answer.

(b) A large majority of candidates correctly gave 2 for the group and 20 for the atomic number. The most common error was 40 for the atomic number.

(c) About half of the candidates correctly chose magnesium to gain the mark in part (i). Potassium was the most common incorrect answer.

In part (ii) a large majority of candidates chose the correct answer, carbon. There was no pattern to the incorrect responses.

2 Many candidates experienced difficulty in using the data provided to answer the questions. Only the more able candidates performed well.

(a) Only the more able gained a mark from this question, commonly for describing a trend in melting point or density. Very few candidates gained a second mark. A common error was to refer to the change in atomic number. Only a small number of candidates suggested that a value for the melting point or density of potassium would lie between the values for sodium and rubidium.

(b) Most of the more able candidates correctly described one pattern, and a small number described two. Again a common error was to refer to atomic number instead of melting point and density. Many candidates did not make clear that the trend they were describing was down the group.

(c) More able candidates scored at least one mark, and many scored both. The most common error amongst these was to put protons and neutrons the wrong way round. Many less able candidates gave randomly selected answers. Elements, ions and molecules were frequently chosen.

3 This question discriminated well, allowing weaker candidates to score some marks but stretching the more able.

(a) In part (i) more able candidates realised that the reaction involves both reduction and oxidation. All of the distracters were chosen with equal frequency by less able candidates.

Most candidates gained one mark in part (ii), generally for copper. Only a small number gained both marks. All of the distracters were frequently chosen.

(b) Only the most able candidates realised the correct reason to be that lithium is very reactive. There was no obvious pattern to the incorrect choices.

(c) This question discriminated well. All but the weakest candidates gained the first mark for melts, and most of the more able put negative and positive the correct way round to gain the third mark. Only a few of the most able knew that ions move for the second mark.

4 Again this question provided good discrimination across the ability range.

All but the weakest candidates identified the missing element as nitrogen. Hydrogen and helium were common incorrect answers. Most of the more able candidates could work out either that there were 7 nitrogen atoms in the molecule or that the percentage mass was 8. Few could manage all three correct answers.

5 Many candidates could not construct an answer that correctly described similarities and differences in the data.

(a) Most candidates gained at least one mark and many gained both. Only the weakest candidates failed to score. There was no obvious pattern to the incorrect answers.

(b) This question discriminated very well across the ability range. The majority of candidates gained one or two marks, generally for describing similarities between the two atmospheres. The most common correct answer referred to similar percentages of argon. More able candidates also gave good descriptions of differences. The weakest candidates often gave vague answers, some quoting figures from the table without any comment on them, and scored no marks.

(c) About half of the candidates gave a sensible suggestion to gain this mark. Correct answers were based either on the idea that there could be other gases present or that the results were not accurate.

6 This question discriminated well, giving opportunity for all candidates to gain marks.

(a) A small majority of candidates gave a correct answer in part (i), invariably 120 seconds. The most common incorrect answer was 150 seconds, though many others were seen. In part (ii) most candidates knew that the acid had been used up, though all of the distracters were often chosen by weaker candidates.

(b) A large majority of candidates knew the gas in part (i) to be carbon dioxide. The most common incorrect answer was carbon monoxide, though all of the other distracters were frequently chosen. More able candidates gained both marks in part (ii), with only the weakest candidates failing to score any marks. In part (iii) a large majority of candidates gained both marks.

7 Only the more able candidates performed well in this question.

(a) Approximately equal numbers of candidates gained one, two and three marks in this question. Common errors were 20 instead of 40 for the relative atomic mass of calcium and an incorrectly calculated relative formula mass for calcium chloride.

(b) Very few candidates knew that the ion always present in an alkaline solution is OH^-. The most common incorrect choice was H^+.

(c) Only a very small number of the most able candidates gave a correct equation to gain this mark. All of the incorrect choices from the list were seen, often in an order that made no sense. A significant number of candidates placed H^+ and H_2O in the correct boxes, but then included O^{2-} instead of OH^-.

8 Only the more able candidates realised or could relate what was happening in the flow chart.

(a) About half of the candidates realised that the mass would fall, to gain one mark, but only a tiny number of the most able realised that water was evaporated. Common incorrect answers referred to the solution being evaporated or to evaporation without any qualification.

(b) Many candidates realised that this would dry out the crystals, but weaker candidates gave a variety of incorrect answers, including speeding up the reaction and melting the crystals.

(c) More able candidates could work out the yield to gain this mark. There was a wide variety of incorrect responses.

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

General Comments

The paper was generally well attempted. Most candidates attempted all questions. Gaps were few, but where they were left it was commonly in questions that demanded that candidates write equations. This paper saw the first of the 'longer answer' type questions being introduced. Candidates attempted them with some enthusiasm, often writing longer answers than necessary around the borders of the page. Candidates should be encouraged to pause and think before they tackle the longer answers. It was clear that many candidates had jumbled their ideas and had contradicted themselves as they wrote. It is also very important that candidates read the stem of the questions very carefully, particularly where there is a large amount of information. It was common for candidates to miss important information that would have helped them to make their answer. For example, in question 2 many candidates did not refer to the data on the cards as they wrote their answers to 2a and 2b.

Comments on Individual Questions

1 Candidates usually score highly on the 'true / false' questions, but this question was challenging, because there were a lot of boxes to sort through, and candidates had to get three correct before they scored a mark. This meant that only about half the candidates gained both marks.

2(a) These longer answer responses are new to candidates. Most candidates made a good attempt at these questions. However, it is very important that candidates read the information they have been given. Many candidates did not use any of the information in their answers and gave vague responses such as 'potassium will be in between sodium and rubidium'. To score full marks they needed to discuss the data on the cards, such as melting point and density.

(b) This part was better answered than part (a). Most candidates were able to give at least one of the two trends correctly.

(c) (i) Almost all candidates correctly named lithium chloride.

(ii) Very few candidates were able to complete the equation. The specification lists common formulae that the candidates are expected to know. In this case, many did not give Cl_2 for chlorine, but gave Cl. Most did not write the formula for lithium chloride correctly. $LiCl_2$ was a common incorrect answer.

3(a) Most candidates gained at least one of the two available marks. Common errors included missing out either C or S from the formula.

(b) About half the candidates correctly identified that hydrogen is lighter than other elements.

4(a) Most candidates gained at least one mark, but surprisingly few were able to identify both important points about conduction by molten compounds.

(b) The appearances of the halogens are not well known by candidates. Over half did not score any marks here at all, implying that candidates have not learnt the colours and states.

(c) Most candidates gave the correct symbol and charge for the potassium ion in part (i), but most found the formula for copper bromide much more challenging. CuBr, Cu_2Br and Cu^2Br were common errors.

5(a) (i) Most candidates recognised an oxidation-reduction reaction. This is clearly well understood.

(ii) The metals that are extracted by heating with carbon were not as well known. Some candidates knew 'copper', and fewer identified 'zinc', but it was common to see aluminium and even potassium or sodium chosen.

(b) (i) This question is more challenging than it first appears because all the statements about lithium are true. Only about half the candidates correctly linked the high reactivity of lithium to the fact that it cannot be reduced by carbon.

(ii) This was one of the few questions that candidates sometimes left blank. Some candidates did not know that the ions accept or gain electrons and so wrote the formula for other ions in the boxes. Those candidates who correctly gave the addition of an electron to lithium in equation 1, often did not score in the calcium equation because they showed the electron with a double negative charge, such as e^{2-}.

(c) (i) Metallic structure is not well known. Many did not know that the '+' signs represent positive metal ions. Phrases such as 'positive metals' or 'the positives' were often seen. Many did not recognise the small particles as electrons, but thought that they were negative ions.

(ii) Again, this question revealed misconceptions about metal structure. Many thought that the metal conducts because 'the negative ions move' or 'the electrons pass the charge from one to another' or even 'the positive ions move'.

6(a) This was another situation where there was a large amount of information given at the start of the question. In such cases it is very important that candidates read the information carefully. Errors were often made in writing down incorrect interpretations of the table. It was common for candidates to say that the reaction 'increases then decreases'. Another common error was to say that 'the limestone is used up', despite the information clearly saying that large lumps of limestone were left at the end of the reaction. In many cases, it was clear that the candidate had not considered what they were about to write and the answer was very jumbled and contradictory. This is a new skill for candidates and they need to be encouraged to take time to order their responses before writing.

(b) The question clearly asked for 'two ways that...'. However, many candidates gave a single answer here. Some said that a higher concentration would make the reaction 'last longer' which implies a *slower* rate.

7(a) Another rather challenging 'true / false' here. The candidates needed to get two of the rows right to gain a single mark. Many were confused by the first statement that 'the mixture has a high pH at the start of the experiment'. Of course acids have a *low* pH.

(b) The process of making crystals is not well known by candidates. Many included the incorrect 'titrate' step in their sequence, and very few put the steps in the correct order.

(c) (i) It was very pleasing to see that most candidates had no trouble with this calculation and scored both marks.

(ii) Well over half the candidates correctly identified the ion that is present in an alkali.

(iii) This part question was not well attempted. The ionic equation for neutralisation is not well known, even by very able candidates.

8(a) In order to answer this question, the candidates had to link the idea of the graph to those reactants that would produce gases. This was very challenging and only the most able made the correct connection. Some used guesswork and gained a lucky mark.

(b) Few were able to link the idea of mass conservation to the fact that using a metal will mean the lowest mass of reactant to be used.

Grade Thresholds

General Certificate of Secondary Education
GCSE Twenty First Century Chemistry A (J634)
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
A321/01	Raw	42				22	18	14	10	6	0
	UMS	34				30	25	20	15	10	0
A321/02	Raw	42	28	23	19	15	10	7			0
	UMS	50	45	40	35	30	25	20			0
A322/01	Raw	42				23	19	15	12	9	0
	UMS	34				30	25	20	15	10	0
A322/02	Raw	42	31	24	18	12	8	6			0
	UMS	50	45	40	35	30	25	20			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
J634	300	270	240	210	180	150	120	90	60	0

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

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J634	0.0	50.0	50.0	50.0	100.0	100.0	100.0	100.0	100.0	2

88 candidates were entered for aggregation this series.

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

Statistics are correct at the time of publication.

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