OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry (Salters)

Advanced GCE **A2 7887**

Advanced Subsidiary GCE **AS 3887**

Report on the Units

June 2009

3887/7887/MS/R/09

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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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REPORTS ON THE UNITS

3887/7887 Chief Examiner's Report

The AS units 2850, 2848, 2852/01 and 2852/02 were taken by re-sit candidates only and this was reflected in the higher standards achieved in these papers compared with previous years.

The A2 papers were, of course, taken by the whole cohort for the last time in their current formats. In 2010, these papers will be available for candidates re-sitting the examinations. As changes to the written papers will be relatively minor in moving to F334 and F335, much of the content of the reports here will be relevant to the new units.

The Principal examiners' have reported on many positive aspects of the candidates' knowledge and understanding, including an increased ability to perform calculations and to set these out more clearly. This, of course, represents a great deal of effort on the part of their teachers. Work is now needed on candidates' ability to express themselves clearly in long answer questions.

It is pleasing to see the Principal Moderator for 2855, the Individual Investigation, reporting that the standard of candidates' work showed a distinct improvement this year. This again is the result of a lot of hard work by the teachers. It is to be hoped that this improvement will be carried into the new Investigation F336 in the form of more imaginative Investigations that the new mark-scheme will encourage.

2848 Chemistry of Natural Resources

General Comments

A wide range of marks was evident for this paper. It was clear from a number of scripts that some candidates were well versed in their response to questions that were similar to those asked in recent papers. However, there were questions on this paper that required further application of the candidate's knowledge and these tended to discriminate the better candidates from the average candidates. Numerical questions were answered well. However, a small number of candidates did not show clear working and as a consequence did not have the opportunity to gain marks using the 'error carried forward' rule. Centres should advise their candidates to cross through anything that they do not wish to be marked rather than attempt to erase mistakes.

Comments on individual questions

Question 1

In the main, this was a relatively straightforward question with plenty of opportunities for candidates to gain marks.

a) Generally well-answered –popular answers were Teflon and polyethyne, the most common incorrect answer was polypropene.

b) Most candidates scored 1 mark and this was usually for the melting point, other popular answers were flexibility, a good number of candidates referred to the strength of the polymer rather than the tensile strength and hence did not score.

c) (i) Generally well answered, dehydration was frequently seen. Condensation was the most common incorrect answer.
(ii) This was answered better than in previous sessions.

d) Usually correct, occasionally the half equation was reversed and therefore did not score. Most candidates scored at least 1 mark.

e) (i) Often correct, where errors occurred this was usually because the candidate had shown the repeating unit in the polymer chain.
(ii) Often correct

f) (i) Usually correct, common errors were "it contains a lone pair "or it is a lone electron.
(ii) Often correct, photodissociation was the most common incorrect answer this was ignored.
(iii) Often correct few incorrect answers were seen.
(iv) Candidates most commonly scored the mark for particles having less kinetic energy. The most common answer that did not score was that particles do not have enough energy to react. Few candidates made it clear in their answer that "on collision" was a very important aspect of the answer.
QWC This was usually scored. However, candidates should be advised to include the in their sentences!

g) (i) Usually correct.
(ii) Poorly answered, only the better candidates scored. Hydrogen bonding was the most common incorrect answer.

h) This was exceedingly disappointingly answered, most candidates seemed to be influenced by the way the molecule was drawn with many showing the bond between the carbon on the methyl group on one chain to the oxygen of the carbonyl group on the other chain. Very few completely correct answers were seen.

Question 2

a) Very few candidates were able to explain Le Chatelier's Principle very clearly. In previous papers, candidates often made reference to Le Chatelier's Principle but had not scored as they had not applied it to the question that had been asked. By structuring the question this way it was hoped that the candidates would be able to score more of the available marks. Most managed to score 1 mark. There were some good attempts at the explanation from the better candidates but weaker candidates often referred to amounts of hydroxide ions rather than concentration.

b) Generally well answered.

c) (i) Frequent incorrect answers of 0.05% as the percentage impurity were seen. Many candidates were unable to convert their answer to parts per million. Most simply multiplied by 1000,000

(ii) Usually 2 out of the 3 marks were scored often for air or oxygen and the product, sulphur dioxide.

d) (i) Many correct answers were seen.

(ii) Often correct. Common errors that did not score were the silver gains an electron, rather than the ion. Some candidates negated a correct answer with "loses oxygen".

e) (i) Often correct. Those that did not score for the equation often scored a mark for the indication of precipitation using appropriate state symbols.

(ii) Often correct although creamy /white was also seen, this did not score.

(iii) The silver ion was frequently shown as the larger of the 2 ions which did not score the first marking point. The second mark was for drawing a layer of the crystal with a 4:4 arrangement. A good number of did not read the question and drew a 3 – dimensional structure showing a limited number of ions which unfortunately did not allow them to score.

(iv) Most candidates scored at least 2 marks for the diagram , common errors were blockages through parts of the apparatus or missing labels for example on the filter paper or to the vacuum pump.

(v) Very poorly answered – only the very best candidates scored 2 marks. Many candidates appeared to have no comprehension of the process taking place and that the production of silver was responsible for the darkening process in the sunglasses.

Question 3

a) The name of this structure proved elusive often to even good candidates. Few scored 2 marks; those that scored 1 often achieved this by naming tetrafluoroethane.

b) (i) A mixed bag of answers were seen for this; the most common correct answer was for the reaction of the chlorine radical with the ozone molecule. Common errors were C*l*O reacting with ozone.

(ii) This was quite poorly answered; partly because the candidates were not specific with their answers. There were often vague responses regarding holding onto electrons more strongly. Size of the fluorine molecule was often referred to rather than the atom itself, many incorrect answers often referred electronegativity or polarity.

(iii) Very well answered by the majority of candidates. For those that scored 1 mark conversion to joules was the issue.
(iv) Many gained full marks with the error carried forward rule. Few no responses were seen. Few of those candidates who attempted a calculation did not achieve an error carried forward mark. Many gained the significant figure mark.

c) There were a wide variety of answers, the majority of candidates threw everything they knew about atmospheric chemistry at this answer including the breaking down of ozone. The better candidates gave very coherent answers and this question was an excellent discriminator with very good candidates picking up a least 4 marks and weaker candidates picking up 1 or at best 2 marks.

Question 4

This appeared to be the most difficult for the weaker candidates. Most candidates made a good attempt at the calculation.

a) (i) A variety of answers were evident. Those that managed to draw the cis isomer scored 2 as per the markscheme. Many attempted a mirror image, which did not score.
(ii) Very good candidates were able to gain 2 marks reasonably easily but weaker candidates found the explanation of geometrical isomerism difficult. Those that did score often gained the mark for recognising that there was not free rotation around the double bond.

b) (i) well answered
(ii) Generally well answered many did not comprehend that they were being asked for bromine liquid as opposed to bromine water.
(iii) Good candidates scored a straightforward 2 but 1 was often scored by weaker candidates.

c) Not well answered. Bromine atoms were seen at a variety of positions. Many tried to react bromine instead of hydrogen bromide.

d) Usually correct. Candidates were familiar with this answer from previous sessions.

e) Well answered few incorrect responses were seen and this was usually redox.

f) (i) Well answered.
(ii) Well answered.
(iii) Many scored 1 but often the rationale eluded many candidates. Better candidates scored full marks.

2849 Chemistry of Materials

General Comments

The paper gave a wide spread of marks and the majority of candidates were able to tackle the paper reasonably competently; weaker candidates with a basic level of knowledge and understanding were able to score enough marks to achieve pass grades, whilst the brighter candidates showed a good depth of understanding and excellent resourcefulness in tackling the higher level questions.

It was pleasing to see that many Centres had really made a good effort with respect to the perennial problems with the teaching of such topics as electrode potentials and acidity; as result candidates were able to construct more logical responses using correct technical language, though perhaps not the correct spelling.

The overall quality of written communication and answer presentation, including legibility by many candidates, including some of the more able, is often poor and makes assessment that much more difficult. Both spelling and grammar need attention and there is still little evidence of planning for the longer answers, as seen in their muddled responses to 'how to use a colorimeter' and 'how to perform paper chromatography'; statements and comments often appear in a random order.

The recent improvement in the candidates' ability to tackle calculations continues; candidates across the whole ability range were able to manipulate the correct equations, give some idea of their working and use appropriate significant figures more effectively. The teachers at many Centres have clearly drilled their candidates well in this area

General knowledge of chemical reactions was improved and many are appreciating the need for more detail in giving conditions rather than stating a vague 'heat' or 'add water'. Balancing equations under examination conditions remains a problem area; many candidates lose marks for not checking the formulae and stoichiometry used.

Comments on Individual Questions

Question 1

(a) Chirality was well understood but the ability to draw accurate three-dimensional structures remains very poor for most candidates. Many strange and obscure methods were used and the tetrahedral bond angle is clearly out of fashion. Candidates need practice here.

(b) The usual problem of confusing 'thin-layer' and 'paper' chromatography is still prevalent as is the wrong idea that spots of separated amino-acids can be located using iodine or UV radiation. It was also clear that a number did not read the question carefully enough to assess what they were asked to draw. Many diagrams failed to address the need to sketch a chromatogram but instead drew a picture of the apparatus used. Perhaps they had done too many past questions on this topic.

(c) Many only focused on the command 'give' though they failed to use the data sheet effectively enough to accurately identify the appropriate chemical shifts. Only the better candidates realised that 'explain' meant that 'peaks' had to be related to 'proton environments'.

(d) The dipeptide structure was usually fine but the peptide link itself was not circled.

(e) The knowledge of structure and bonding in proteins was good and the drawing of hydrogen bonds much improved. The commonest error was in thinking that permanent-dipole forces were involved in the formation of the tertiary structure.

(f) The construction of an expression for Kc and corresponding units is much better this year. The main problem candidates had with the calculation was in converting equilibrium moles into concentrations. Most were able to deduce the correct orders of reaction from the data given.

Question 2

(a) Naming the group as a carboxylic acid was usually fine; counting the correct number of carbon atoms was a problem for some.

(b) Most identified the numbers of C and H atoms in the fragment correctly, though the charge was often missing or incorrect.

(c) The iron(III) chloride test for a phenol was well known but some failed to link their knowledge to the command words of the question: 'describe and explain'.

(d) Some excellent answers but there were many having the necessary understanding who failed to convert it into full marks. They failed to begin at the logical point of stating 'what an acid is' in terms of protons. Many wrote about loss of H atoms. Others failed to explain the difference in acidity of a phenol and a carboxylic acid.

(e) The ethanoylation reaction was well understood by a wide ability range of candidates and most knew that HCl was a product. The weaker candidates had more difficulty with drawing the ester.

(f) Generally fine though some attached the hydroxyl group to the carbon chain as -HO instead of -OH.

Question 3

(a) The ability of most candidates to draw electron structures was very poor; initially the number of electrons added for Cu was incorrect (the Data Sheet may not have been consulted) and the 4s orbital often had two electrons. More correct answers were seen for the Cu(III) ion than Cu, even so the 4s electrons were often left in the structure. The recall knowledge of what constitutes a transition metal was unknown to most so few were able to link 'ion' to 'incomplete' d shell.

(b) Although dative was the commonest type of bonding given, many suggested ionic, just covalent or hydrogen.
Many had difficulty with the concept of a bidentate ligand, though a few Centres had obviously taught this topic really well. Electrons were referred to rather loosely rather than as lone pairs being donated.
The relationship between shape and coordination number was not really understood and particularly so for bidentate ligands. Numbers from 2-6 were all seen and common incorrect shapes were linear, trigonal planar and tetrahedral.

(c) From some Centres, answers were very clear with excellent use of technical terms and given in a logical format, showing that they had obviously done such an experiment. However far too many had little idea of the practicalities of the technique and wrote about the relationship between absorbance and concentration. Many did not bother to make a series of known concentrations by dilution but just comparing the unknown with the concentration given.

(d) Most found it quite difficult to interpret the data given, referring in their answers to metabolism issues and testing for side effects.

Question 4

(a) A much better understanding of electrode potential data was shown by all abilities, Most recognised that Al(III) ions were formed but gave confusing descriptions of the redox processes involved, usually involving oxidation by Fe rather than Fe(III). The equation was usually correctly given.

(b) Ionic equations are still problematic; the commonest errors were the formula of aluminium hydroxide and using correct state symbols.

(c) The standard emf of the cell was usually calculated correctly and most successfully went down the 'standard conditions' route in explaining the unlikelyhood of the 'lasagne cell' having this value.

(d) Many good textbook answers for the cell diagram, but largely Centre dependent. The commonest error was to draw the left hand cell as Al/Al(III).

Question 5

(a) A good number thought the polymerisation was a condensation usually with the comment 'because water is produced'! Some did not give an explanation for stating addition so failed to score.

(b) Most used acid rather than alkali as the reagent so consequently got the carboxyl group correct.
Most candidates made excellent use of the infrared spectral information given on the Data Sheet for Chemistry (Salters). They were noticeably much more detailed in their answers than in previous examinations.

(c) Too many focused their answers on the crystallinity and amorphous properties of polymers rather than on the behaviour of polymer chains, thus missing the two marks for explaining why a polymer sample can snap at a low temperature.

(d) Hydrogen bonding was often confused with the permanent dipole forces present in PCL, which then was followed up by the suggestion that permanent dipole forces not instantaneous dipole-induced dipole forces are present in poly(ethene)

2850 Chemistry for Life

General Comments

This 75 mark paper was the final examination of the 2850 specification. The candidates scored well with very few single figure marks and many 70+; this is, perhaps, to be expected with a legacy paper.

Time did not appear to be an issue for most of the candidates; the number of 'no response' was very low.

It was pleasing to see how many candidates showed their working and thus were awarded error carried forward marks, this point needs to be made to all candidates. Numerical questions were well attempted and the issue of significant figures was less of a problem. Most candidates seem to have understood the layout of the papers and stayed within the marking area.

Most of the questions were answered well, although question 4ei which required recall of a definition proved difficult as did others where the difference between intra and inter molecular was important. A more precise use of language is needed to describe where bonds are being broken or made, see also 1ciii for changes during catalysis.

Candidates need to identify and learn some of the standard definitions.

Comments on Individual Questions

Question 1

A straightforward start to the paper, parts a and b(i) being answered well, part b(ii) proved to be less well answered with the structural formula not always explained well 1b(iii) had some skeletal formulae, c(i) and c(ii) caused few problems, c(iii) was answered well, adsorbed species was missed by some and the point that intra molecular bonds break was not always described. Sections d(i) and (ii) allowed all candidates to score, d(iii) many scored 1 mark but failed to make the point needed to compare moles of reactants. Sections d(iv) and (v) were answered well but the confusion of ether and ester still remains.

Question 2

This question allowed candidates to score well, but Examiners were surprised to see many score less than 5 in 2a. 2b(i) generally scored well, but some candidates had beta capture with very few other decay processes suggested. The symbols were not always correct Th often being given for Tl despite the question having Tl. 2b(ii) answered very well. 2c, Examiners were looking for the concept of extreme/very high temperature and pressures, this was missed by many candidates. Credit was given for clear detail about the equipment which would be needed.

Question 3

3a(i) The recall of the mass spectrometer parts was done well, although many candidates confused the electric and magnetic fields. In 3a(ii) most candidates had the correct process and most the correct answer. It was pleasing to see clear working, candidates who had the wrong answer often gained process marks and the significant figure mark, where some working was necessary.

3a(iii) was very well answered. Where candidates failed to gain marks this was usually due to a lack of knowledge rather than mathematical problems. 3b many candidates scored 1 mark and many completed the calculation, error carried forward applied to the first calculation. 3c(i) the structure of metals is well understood, but common errors are the failure to label electrons as delocalised and to label the positive particle as the nucleus. The structure mark was usually scored. 3c(ii) again answered well with many candidates understanding that the flow of current is the movement of charge/electrons, confusion occurs for those who think electrons pass the charge from one to another. 3d had a wide range of scores, the main point being missed was the reactivity and the link to number of outer shell electrons lost. The reasons for changes in reactivity down the group are well understood.

Numerical answers: 3a(ii) 207.3, 3b 40.5g

Question 4

4a scored well, some candidates missed the state symbols. Formulae had to be correct for last two marks. 4b many scored the dative bond and most knew the electrons came from the oxygen. 4c(i) the first two marks were for formulae and balancing, many had the correct formulae, fewer had the balancing correct. The candidates who showed working tended to score well either because they had the correct answer or Examiners were able to follow through any error carried forward marks. A significant number of candidates still fail to give a sign with the numerical answer. 4c(ii) some candidates missed the first mark because they referred to atoms or particles; this did not affect the second mark. 4d some candidates calculated the number of moles of calcium hydroxide using 148 rather than 74, but gained error carried forward marks. 4e(i) allowed candidates who had learned definitions to score well. 4e(ii) the inter and intra molecular confusion was found in this question, candidates need to say that it is bonds within the molecule which break, and say which bonds/type of bonds break.

Numerical answer: 4d 323.4 (with a range of other values allowing for rounding etc.)

2852/01 Open Book Paper

General Comments

This year, the candidates were presented with two articles about the use of hydrocarbons in cars. The chemistry discussed in the reports linked directly to familiar concepts covered in the AS course, for example intermolecular forces.

The standard of reports seen this year was generally lower than that of previous years. This can be attributed to the cohort of candidates entered; all candidates were resitting the paper.

Comments on Individual Questions

Bullet point 1
The first bullet offered the candidates the opportunity to discuss the chemistry involved in combustion reactions. A range of marking points were available, covering enthalpy changes and energy transfers. Most candidates discussed enthalpy change in terms of bond making and breaking but few stated clearly that bond breaking requires the input of energy while bond making generates an output. More able candidates showed the energy changes involved by calculation. The evaluation of the energy changes earned easy marks, but some veered too far off the point by including extensive detail about the operation of four stroke engines.
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Bullet point 2
Most attempted this bullet very well and earned a large number of evaluation marks by discussing the meaning and measurement of a fuel's octane number. Good use of Chemical Storylines as a resource was evident in most answers.

Bullet point 3
This bullet was more poorly answered. Common errors were to include large extracts from article 2 about hydrogen bonding or permanent dipole interactions. The question specifically asked about hydrocarbons. Many candidates showed poor structure in their responses by not clearly addressing the main thrust of bullet 3: to explain the effects of intermolecular forces on volatility and viscosity. This lack of focus cost chemistry marks.

Bullet point 4
Candidates generally showed good planning and organisation skills by leaving enough words to address this bullet point effectively. In previous years, the last bullet point has sometimes been omitted by candidates. This year it was well attempted.

Research
Common reasons for not scoring all five marks here were ...

- Failing to list the articles in the bibliography.
- Failing to include detail such as page numbers in the bibliography.
- Failing to annotate text to cross link to the listed sources.

Summary
The four marks available are for making four clear chemical points, but were very rarely scored. Most scored between zero and two. The commonest two reasons for failing to score were either to outline the areas that they report would cover in too general terms (ie rewriting the bullet points) or by listing points from the evaluation section of their report.

Communication (marking points C1 to C4)

This area gave a spread of marks across the candidates. Those who were careful to check their reports for spelling and technical accuracy, and who included formulae, equations and diagrams scored high marks. Examiners again commented that some reports had clearly been submitted without a spell check being carried out. Candidates need to allow enough time to thoroughly check their reports before submission. Again, the lack of care shown by some candidates implies that they consider this area less important than the main report. However, these 10 marks give almost a quarter of the total score of the paper. Common errors and omissions included…

1. For C2a, spelling and punctuation marks are deducted for two errors. Hence, mis-spelling or typos of two words leads to 1 mark being lost (4 errors = no marks!). Many candidates spell words that are given in the report wrongly, many of which would be identified if the candidate ran a spell check.
2. Technical errors in equations often lost both C2b marks. It was relatively common for formulae to have errors in the use of subscripts or equations to have balancing errors. Again, candidates need to check that they copy structures carefully. Reports that failed to include equations or structures did not score C2b marks as not enough evidence was available to award the two marks.
4. A surprising number of candidates did not use enough equations or diagrams to score the easy C3 and C4 marks.

2852/02 Experimental skills

General Comments

The overall standard of candidates' work was similar to last year.

Nearly all Centres used assessment activities chosen from the OCR coursework guidance booklet. The most popular of these were 'Finding out how much acid is in a solution', and 'Comparing the enthalpy of combustion of different alcohols'.

For many candidates, work from a single activity was submitted for moderation.

A number of Centres used check lists, based on the current mark schemes, as a basis for the award of marks in all skill areas. This usually avoided many of the issues of over generous and inappropriate mark allocation.

There were very few instances where annotation was brief or absent.

Comments on Individual Questions

Planning

There were two areas which many Centres failed to mark correctly:-

Risk assessments - these should be relevant to the concentrations of the solutions actually used in the assessment activity. In the acid rain activity for example, both sulphuric acid and sodium carbonate must be described as irritant to meet the descriptors at level 8. It this is not done then the maximum mark available for this skill area is 7. In the enthalpy change of combustion experiment it is expected that candidates will indicate that all alcohols are highly flammable.

References - where written documents were used, they should include detail such as page number and Hazcards should indicate the chemical they refer to. Where an internet source is used, brief details of the site should be included. At least two appropriate references, one of which includes detail, are required to meet the descriptors at level 8 and three references, two of which include detail, are required to meet the descriptors at level 11.

Implementing

Some Centres awarded marks which did not accurately match the descriptor requirements for the recording strand of this skill area, because they were solely based on the manipulation strand.

In the 'Acid rain' activity, candidates should record all burette readings, not just titres, and should record their readings to two decimal places, where the second figure may be a 0 or 5, in order to access the higher mark levels. Where no units are included the maximum mark available for this section is 4. It is expected that candidates will show zero as 0.00 . Where this has not been included a maximum mark of 10 is available for this skill area. Candidates must record appropriate readings to find the mass of sodium carbonate, or the tared reading, in order to meet the descriptors at level 8. This was frequently missed out which meant that the maximum mark available for this skill area was 7.

In the activity, 'Comparing the enthalpy change of combustion of different alcohols', it is expected that candidates will record all temperature measurements and not simply the temperature change. To reach level 11b all the temperature readings need to be recorded to one decimal place.

Analysis

In a titration candidates should calculate an average titre and not just choose one. They should clearly show how they do this by writing down and adding together all of the appropriate titres and dividing this total by the number of titres.

Candidates must calculate the concentration of both solutions in the activities involving a titration. Often one of the concentrations was assumed instead of being calculated. This meant the maximum mark was 7.

Candidates are required to clearly describe the outcome of their calculations rather than assuming that this is evident from the figures within a calculation.

Evaluation

Overall, candidates tended to do less well in this skill area than in the other three. Marks awarded by Centres did not always reflect this and the application of the coursework descriptors was often rather generous.
The main reason continues to be that candidates include insufficient information about limitations of the experimental process or about those features of the procedure that were important in ensuring accurate and reliable data. Candidates were expected to include comment on at least one relevant point to achieve a mark of 2, two relevant comments to achieve a mark of 5, 3 comments for a mark of 8 and 4 comments for a mark of 11. Some Centres gave higher marks than was appropriate for few or irrelevant or trivial comments on limitations of experimental procedure.

It is expected that candidates will include a correct calculation of the uncertainty associated with two types of measurement at level 8 and three types of measurements at level 11

2854 Chemistry by Design

General Comments

This is the last major session for 2854 but its successor F335 will be similar, so many of these comments may be carried forward as advice to candidates sitting that unit.

Candidates performed to an expected level on most questions with weaker ones accessing some marks on most and the more able doing very well. There seemed to be sufficient questions which differentiated between the very able and the weaker candidates. There were few very low scores and it was clear that the vast majority of weaker candidates had made an effort to revise and were able to gain some marks.

Basic understanding of fundamental concepts was shown by the majority of candidates, for example equilibria, entropy, spectroscopy, chemical reactions and colour chemistry.
It was pleasing to note that many marks were scored on calculations with a substantial number gaining almost full credit and few gaining none.

There seemed to be few areas where candidates were unsure of what was being asked, or did not read the question properly.

There was little evidence of lack of time. Only a very few candidates failed to find the last page.

The major concept that was poorly understood was the relationship between solubility and intermolecular forces, 4bii. Another was the choice of the yellow form of methyl red on the back page. A smaller area was the way in which the glc instrument should be calibrated, 1eiii, where hardly any scored any marks.

Question 1

Much of this question was done well, with many candidates scoring full marks on the first page. The commonest error was just giving ‘aldehyde’ as the answer to part 1(a)(iii), which did not quite answer the question. In part 1(c), there was some confusion over whether an O-H or a C-H bond was being described. Those who correctly chose the latter then often missed the point that O-H bonds were present in water vapour which is always in the breath. Part 1(d) was usually done well. Part 1(e)(i) and (ii) were usually correct. Part 1(e)(iii) was the lowest scoring on the paper. The expected answer was that a known concentration of ethanol should be used and the ratio of the peak areas should be measured. The first mark was scored occasionally, the second very seldom.

Numerical answer: 1(d)(i) 3.48 x 10–5

Question 2

This was the highest scoring question, with marks in the twenties (out of 28) being common. This is most encouraging, as some important chemical ideas are examined here. Most did well on the oxidation states in part 2(a)(i) and almost all could name vanadium(V) oxide in part 2(a)(ii). Part 2(b)(i) was answered well. A small number confused rate and equilibrium and the least frequently scored mark required a statement of ‘more frequent collisions’, rather than just ‘more collisions’. A variety of answers were accepted in 2(b)(ii) and some scored for the ‘higher’ point that there might well be a good rate and yield at pressures just above atmospheric. Those who talked about cost sometimes failed to give details of what would be expensive.

Part (c) was well done, with probably the commonest error being the significant figure mark. Part 2(d) was also well done. In part 2(d)(iii), some lost marks for not making it clear that ΔHsurr was positive or that ΔHsys was negative. In part 2(d)(iv), many fell into the 'kilojoule trap'. They were awarded one mark for 1.03 K, even though this answer does not sound very reasonable. In part (e), the ratios caught out quite a number. There were also a few who used the Mr value for sulphur trioxide.

Numerical answers: 2(c)(ii) 0.14; 2(d)(ii) –191; 2(e) 15.3

Question 3

There were many good answers to this question.
In 3(a)(i) many candidates gave the electron configurations for the atoms rather than the ions. In 3(a)(ii), relatively few said why the extra shells made the potassium ion larger. Part (b)(i) was almost invariably correct and most were able to inspect the data and come up with the correct answer and reasoning for 3(b)(ii). In part 3(c)(i) there were some good answers and some that showed little understanding. In the former, the most common error was not to indicate that the hydration enthalpies were for both ions. Part (b)(ii) was usually correct, though there were occasional outbreaks of HO2. Part (d) was usually correct, with the occasional carelessness over state symbols or charges in the labels. In part (d)(iii), those who did not get the correct answer scored best when they had followed the instructions to 'show their working on the diagram', as this enabled error carried forward to be decided for partial credit.

Numerical answers: 3(b)(i) 111.4; 3(d)(iii) –1701

Question 4

This question was often less well done.
Part 4(a) was usually quite a good start, with many missing 'reduction' for part (ii) ('substitution' was also allowed) and some circling atoms on the benzene rings of the compounds to lose marks in part (iii). Part 4(b)(i) was seldom completely correct. Those who avoided the hazard of covalently bonding the Cl– to the molecule, often failed to show the extra hydrogen on the nitrogen and few showed the charge on the N rather than the H. In part 4(b)(ii), many failed to state clearly and unambiguously that the salt was ionic and so it would form ion-dipole forces with water. These were strong enough to compensate for the hydrogen bonds broken in the water (or the ion-ion forces in the salt, hardly ever mentioned). The fourth mark was for a range of possible answers to do with the molecule methamphetamine, including just a statement that it was non-polar. Many candidates wrote mainly about the intermolecular forces between molecules (including salt 'molecules') and failed to realise that the forces between water and the dissolving particles were the important thing here. Part 4b(iii) was often correct and part 4(c) was usually correct. Part 4(d)(i) was disappointing, with most candidates failing to realise that the methyl groups represented the main difference between the methamphetamine and the dopamine structures. Many scored two marks on part 4(d)(ii), the major reason for the loss of a mark being the examiners' not allowing just 'specific' as opposed to 'specific shape'. Part 4(e) was usually correct as was part 4(f).

Numerical answer: 4(e)(i) 149

Question 5

This was a long question, mostly from ‘Colour by Design’ which was quite well answered. Most scored for part 5(a). ‘Carboxyl’ was allowed in part 5(a)(ii) but not ‘carboxylic’on its own. Part 5(b)(i) was often right, as was part 5(b)(ii), though a few still added a group where the reaction occurred. Some did not know ‘coupling’ in part 5(b)(iii), and ‘substitution’ (if written here) was allowed as the answer to part 5(b)(iv). Part 5(c) was variably done. Most described how the electrons were arranged (sometimes with diagrams which were helpful in interpreting vague English) but fewer said clearly where the electrons came from, especially missing the ‘carbon forms three bonds’ mark. Questions like part 5(c)(ii) have been set frequently and candidates are getting better at answering them. A significant few described the absorbtion of energy well and then finish along the lines of: ‘when the electrons drop back, they emit the radiation which we see’. This limited them to two marks. For those who understood about the light being absorbed rather than emitted, the points sometimes missed were that there is more delocalisation in methyl red than benzene and thus the energy levels are closer together. Almost everyone scored two marks for ‘quality of written communication’. In part 5(d)(i), most could draw the right formula but fewer could name the group. Part 5(d)(ii) was quite well remembered, as was part 5(d)(iii), with some flexibility allowed on the spelling. Part 5(d)(iv) was usually well done.
The question changed tack over the page. Part 5(e)(i) was poorly answered. No mark was awarded for just ‘In–‘ (which is a 50/50) and the reasons (OH– reacts with H+ pulling the position of equilibrium to the right) were seldom seen. Part 5(e)(ii) was often well done, as was part 5(f), the commonest error being to take the square root of the Ka value.

Numerical answer: 5(f) 5.1

2855 Individual Investigation

General Comments

The standard of candidates' work showed a distinct improvement over previous years with many examples of high quality investigation reports and relatively few poor quality pieces of work. Candidates seem to have a much clearer idea of what they have to do to match the higher level descriptors.

In a small number of Centres most candidates chose from a small number of topics and spent the minimum time on the investigations. This usually led to low scoring investigations and tended to particularly disadvantage the weaker, less organised candidates.

Investigation topics

Investigations covered a range of topics but reaction kinetic studies continue to be the most dominant group, both overall and within many Centres. Over three quarters of the investigations seen during moderation explored this area of chemistry.

Investigations into aspirin, Vitamin C and wine were again popular and analysis topics such as methods of determining the concentration of a copper sulphate solution were also well represented.

Unusual topics included the solubility of borax, the enthalpy and entropy of ligand substitution and the kinetics of the rusting of steel.

Organic preparations tended to score rather low marks as did investigations based on electrode potentials.

The standard of marking generally showed a much greater appreciation of how to apply the coursework marking descriptors. This was particularly evident in large and medium size Centres, whereas Centres with six or fewer candidates were often less confident in the application of the descriptors and sometimes tended to award over generous marks.

An increasing number of Centres 'cut and pasted' sections of descriptors to devise check lists to help them mark candidates' work. Most Centres also provided written explanations to support the award of marks, but only a minority explained why higher marks had not been awarded.

Planning

The account of experimental methods was usually well written although a number of candidates planned to use measuring cylinders to measure critical volumes of solution. Background chemical ideas were not as fully developed and the marks awarded did not always reflect this.

Extent of the investigation

Some candidates limited the mark available to them by planning insufficient experimental work. It is expected, for example, that in a typical kinetics investigation a candidate will explore the effect of changing the concentration of all of the reactants as well as carrying out the reaction at different temperatures in order to find the activation enthalpy.

In the best examples of risk assessments candidates linked hazards to the specific concentrations they were using and also included hazards of products where appropriate. Less good examples included hazards that were not relevant to the materials actually used in the investigation.

Good examples of references include written material as well as web sites. Too often candidates relied heavily on electronic sources of information when reference to books and other printed material would have provided a richer blend of information.

Implementing

The marks awarded for this section were usually higher then in other parts of the investigation.

When using titrations, some candidates recorded only titres rather than the expected burette start and end readings and did not re-investigate with modified solutions titrations that produced low titres.

In good examples of results tables, candidates' provided clear headings to explain what was being changed and included the changing concentrations of solutions rather than simply changing volumes. In less good examples of results tables, headings such as 'table 3' were used. This made them difficult to understand without reference to other parts of the report.

All candidates should include their results in the main body of the report and not as an appendix at the end.

Analysing

There were some excellent analysis of results with graphs and calculations clearly linked to underpinning scientific knowledge. However a minority of candidates did not show the steps in their calculations, making it difficult to see where the final figures came from. In a few cases the number of significant figures was wildly inappropriate.

In a good number of cases the quality of graphs did not match the quality of calculations. A blunt pencil was sometimes used, headings and labels missed off and initial gradients were not always taken at the appropriate place. Computer generated graphs that were integrated into the main body of the text were rarely big enough to make them useful in drawing conclusions. These limitations were not always reflected in the marks awarded by Centres for this skill area.

Graphs should also be included in the main body of the report and not as an appendix at the end.

The quality of the conclusions did not always match the quality of data manipulation. Many investigation reports would have benefited from explaining results in terms of background chemical ideas described in the planning section. Some Centres seemed to award the mark for this skill area based largely on the manipulation of data and did not take sufficient account of the quality of the conclusions.

Evaluating

This section continues to be the least well tackled skill area for many candidates.

The calculation of percentage uncertainties associated will different types of measurement has generally improved but it is common for the error associated with timing in a kinetic investigation to be missed out. Some candidates could work out the percentage errors but did not go on to use this information to comment on the relative significance of these errors and so were not able to achieve maximum marks.

Comments on limitations of experimental procedures is the area that is in most need of development. Very trivial and irrelevant procedural errors such as dropping solid when weighing or incorrectly reading glassware graduations were sometimes counted. It is expected that a candidate will refer to ay least five different limitations to achieve maximum marks in this skill area. A few Centres, however, seemed to apply the descriptors in this section quite harshly and did not give sufficient credit to candidates work.

Grade Thresholds

Advanced GCE Chemistry (Salters) (3887/7887)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2848	Raw	90	63	55	48	41	34	0
	UMS	120	96	84	72	60	48	0
2849	Raw	90	72	65	58	51	44	0
	UMS	90	72	63	54	45	36	0
2850	Raw	75	63	56	50	44	38	0
	UMS	90	72	63	54	45	36	0
2852A	Raw	90	73	67	61	55	49	0
	UMS	90	72	63	54	45	36	0
2852B	Raw	90	73	67	61	55	49	0
	UMS	90	72	63	54	45	36	0
2854	Raw	120	88	79	70	61	53	0
	UMS	120	96	84	72	60	48	0
2855	Raw	90	76	68	60	52	44	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

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

	Maximum Mark	A	B	C	D	E	U
3887	300	240	210	180	150	120	0
7887	600	480	420	360	300	240	0

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

	A	B	C	D	E	U	Total Number of Candidates
3887	21.4	47.7	70.4	85.9	97.2	100.0	1325
7887	30.9	54.7	73.8	88.4	97.1	100.0	7080

8405 candidates aggregated this series

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

Statistics are correct at the time of publication.

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