RECOGNISING ACHIEVEMENT

GCE

Chemistry B (Salters)

Advanced GCE **A2 H435**

Advanced Subsidiary GCE **AS H035**

OCR Report to Centres

June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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

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

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

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OCR REPORT TO CENTRES

Overview

General Comments

This has been a good session, with reports of candidates being well-prepared for the units they took, especially at A2.
Basic factual knowledge was reported to be better in both F334 and F335.
Once again, the frequent absence of blank answer spaces indicated that candidates did not have time problems and also that Salters candidates were willing to attempt every part, however unusual or difficult it appeared.

At all levels, calculations were usually better presented, giving examiners the chance to look for 'error carried forward' when something went awry.

Longer answers still gave the most problems. Candidates must realise that Chemistry has a technical language that they are expected to use fluently. Logical expression of ideas is, of course, an important skill in itself, as well as ensuring that all the necessary points have been made. Candidates are once again advised to jot a few points in the margin before they embark on longer answers, remembering to cross through this rough work when they have finished. When the spelling of technical terms is mentioned in the rubric to a question, it would seem logical for those with untidy handwriting to take more trouble over that part so that the correct spelling can be identified.

Candidates still need to be briefed about the use of the Additional Answer Space at the back of the booklet. Examiners are very conscious that there might be answers there but candidates are still advised to indicate that they are continuing their answers on these pages. It is vital that the correct part number is given on the Additional page, which is not always the case. Invigilators should please be told that such pages usually exist for most units and that additional answer booklets are not required.

All in all, candidates and their teachers have a great deal to be proud of this session and it is to be hoped that all candidates have enjoyed studying their Chemistry in context.

Continuing Professional Development

This summer, OCR launched an A Level Chemistry conference at The Royal Institution. Sessions were given from a wide range of chemistry experts, and the day provided delegates with new ideas for practical work and ideas to enhance teaching of A Level Chemistry. Feedback from the sessions has been very positive, and OCR hopes to run a similar conference again in the future.

OCR also continues to provide feedback and training for teachers with materials available as part of the Professional Development Programme. For more information, see https://www.ocronlinetraining.org.uk/. Further feedback from June 2013 examinations series, and on the coursework units, will be available from this site in due course.

A level reform

In Autumn 2013, Ofqual announced that there would be no January A level examination session from 2014. AS and A2 examinations would be available only in the summer examination period. In the current specification, it will only be possible to resit an AS unit at the end of a two-year A level course. For the A level units, there will no opportunity for candidates to resit without entering a third year.

This marks a significant change in entry policy for centres. This arrangement is scheduled to run for the duration of the current specification.

Starting in September 2015, entirely new AS and A level specifications are scheduled to start. Centres will receive further information over the next two years.

September 2015 promises to be a significant month for exam reform of both A level and GCSE qualifications, with concurrent changes taking place for the National Curriculum. Further details of the timeline for examination reform are available from the OfQual website: http://ofqual.gov.uk.

GCSE and GCE/A level Science development, tell us your thoughts…
OCR is currently in the process of re-developing GCSE and GCE Science specifications for first teaching from September 2015. To assist with this work we would welcome your feedback regarding anything you would like to see changed or included as part of the new qualifications. If you have any comments/questions regarding GCSE or GCE Science developments please e-mail ScienceDevelopment@ocr.org.uk or join the OCR Community (www.social.ocr.org.uk) to be kept updated.

In summary,

GCSEs are being re-developed for first teaching from September 2015.

- The courses will be linear with separate Science (Biology, Chemistry and Physics) and a Double Award Science;
- There is no Single Award Science as part of the DfE Programme for Reformed GCSEs in Science.

For more details see http://www.ocr.org.uk/ocr-for/teachers/newsletters/agenda/, http://www.education.gov.uk/schools/teachingandlearning/qualifications/gcses/a00221366/gcse-reform and http://ofqual.gov.uk/news/ofqual-launches-consultation-on-gcse-reform/

GCE/A levels for Biology, Chemistry and Physics are also being revised for first teaching from September 2015. (Other Sciences will be developed in a later phase.)

- AS is to be a standalone qualification that does not count towards the A level, covering half the content of an A level and delivered over one or two years;
- The AS could be designed to be co-teachable;
- The standard of the AS is to remain broadly as it is now;
- A level is to be a fully linear, fully synoptic, two year course.

For more details see www.ofqual.gov.uk/news/ofqual-publishes-a-level-reform-correspondence/

Developers
During September, OCR will be advertising for Developers to assist with the drafting of new qualifications for Science. It is expected that adverts will be posted to the OCR website and TES and a notification will be posted on www.social.ocr.org.uk. Alternatively if you register your interest *via* e-mail to ScienceDevelopment@ocr.org.uk, we can send you more details when Developer roles are advertised.

F331 Chemistry for Life

General Comments

Marks ranged from zero to full marks on this paper and there was no evidence time was an issue.

The use of language, however, was responsible for a high proportion of lost marks, either in misunderstanding the demands of the question and consequently not answering the question asked, or by the use of vague, imprecise or incorrect terms in answers.

Comments on Individual Questions

Question 1

This question provided a fairly gentle start to 'settle' candidates down and indeed, of the four main questions on the paper, this proved the most accessible.

1(a)(i) – (iii) Generally well done, although methan-1-ol was not uncommon as the answer for (i).

1(b)(i) – (iii) These questions were also mainly correct. There were however in (b)(i) some instances of selecting the wrong structure or giving a structural formula or name instead of the molecular formula.

1(b)(iv) A significant number of candidates had misunderstood the demands of the question and answered in terms of rate of reaction and what a heterogeneous catalyst is.

Tip for Centres
It is worth students being shown examples of this sort of question, where there are different requirements for the answer depending on the specific context in the stem.
Other examples where the emphasis of a question differs often occur in questions on practical energetics e.g. reactions in solution or spirit burners and burning fuels.

1(c)(i) A significant minority forgot that there was an oxygen atom in the MTBE when balancing the equation.

1(c)(ii) The phrasing of the question required a comparative answer and only the more able candidates addressed this in their answer.

1(c)(iii) This question was well answered.

1(d)(i) and (ii) These questions were well attempted. In d(ii) some candidates spoiled an otherwise correct answer by choosing to put in the molecular formulae of ETBE and MTBE, but getting one of them wrong.

1(e) This question proved challenging for the majority of candidates, with lots of vague or unqualified terms; many did not specify the role of carbon dioxide and some thought burning biofuels produced no carbon dioxide at all.

Question 2

Overall this proved the most challenging question for candidates.

2(a) This question proved difficult for many candidates. Equations were often wrong, many did not know the formulae, or had not read in the stem that magnesium hydroxide was solid, getting this and other state symbols wrong.

2(b)(i) This question required a comparison to gain the mark. Answers in terms of the fragility of glass were not accepted.

2(b)(ii) This question is another example of where insufficient attention was paid to the information in the question, and a significant minority of answers were in terms of practical aspects of the experiment.

2(c) The answer needed to be in terms of hydroxide <u>ions</u>. Too many answers were imprecise, talking in terms of hydroxyl groups.

2(d)(i) Most candidates were able to score marks from this calculation; this was pleasing.

2(d)(ii) This question was solidly answered, although a small minority still talked in terms of the 'number of ways' <u>a</u> molecule could be arranged.

Question 3

3(a) Here there were very few wrong answers.

3(b) Perhaps surprisingly this data response question proved quite difficult for a significant number.

3(c)(i) This type of question has been asked many times and still the lack of clarity of language is mainly responsible for lost marks, despite many reports highlighting common errors e.g. bonds between molecules break.

3(c)(ii) This was very well answered.

3(c)(iii) This also was generally well done.

3(d)(i) Errors here included numbers to the right of the symbol, and occasionally the wrong symbol, but most scored both marks.

3(d)(ii) Only the minority of candidates got full marks; some thought that there were 4 half-lives and others did not appreciate that 6000 years elapsed for <u>every</u> half-life.

3(d)(iii) This proved a very challenging question for the majority of candidates. The key ideas of a constant level of C-14 in the atmosphere and no loss or gain of radioisotope were only occasionally mentioned.

Question 4

4(a)(i) Answers to this question were mostly correct

4(a)(ii) This was generally well done. Calculations and significant figures were correct in the majority of cases.

4(b) This proved straightforward for the vast majority of candidates.

4(c) Answers were variable, with some duplication of observations e.g. fizzing and a gas given off, and some incorrect terminology e.g. ‘cloudy solution’ or incorrect products, mostly CaO.

4(d)(i) This was usually correct.

4(d)(ii) This was often poorly answered, with rambling accounts trying to explain thermal stability, many having the trend down the group incorrect and few workable methods of showing it. The most able candidates however, were able to answer this question succinctly, showcasing their chemical language.

4(e)(i) This part was generally well done.

4(e)(ii) This was not well answered and those that had water often forgot the positive charge.

4(e)(iii) A very common accepted answer was O-20. Many suggested fragments and other elements.

F332 Chemistry of Natural Resources

General Comments

There was a wide range of marks achieved by candidates for the paper as a whole, covering most of the available mark range. A good proportion of candidates scored satisfactorily overall and in line with performances on previous papers. There was no indication that candidates had a problem with the length of the paper, with answer spaces that were left blank being uncommon and tending to indicate a lack of knowledge and understanding rather than an inadequate amount of time.

Good attempts were made at most of the calculation questions, where many candidates set out their answers in a clear and logical way, making it possible to see what was being calculated at each stage and allowing credit to be given under the 'error carried forward' rules if a mistake had been made. Questions requiring a chemical equation to be written were also well answered. Many candidates achieved good scores on question 5, showing they had used the pre-release article and prepared well for this part of the paper. Answers to the questions on organic chemistry were, on the whole, good. Literacy skills were generally sound, with responses for the long answer questions often being written in a logical order and candidates showing a sound grasp of most technical vocabulary.

Marks were generally much lower on questions that required candidates to write descriptions or explanations of chemical phenomena.

Comments on Individual Questions

Question 1

This was a lower scoring question for many candidates overall, although most gained a good proportion of the marks for the first few question parts.

1(a)(i) Most candidates scored this mark.

1(a)(ii) Fewer candidates scored here, with ester and ketone being common incorrect responses.

1(b)(i) Many candidates did not score at all here, but those who did often gained both marks. The most common incorrect responses had only one bromine atom being added to the structure for each double bond that was removed.

1(b)(ii) The majority of candidates scored both marks here.

1(b)(iii) Most candidates gained this mark.

1(c) Fewer candidates gained credit here, some because they gave two answers that contradicted each other – one correct and one incorrect.

1(d)(i) Most candidates gained this mark.

1(d)(ii) This was another high scoring question, showing a generally good grasp of the concept being tested.

1(d)(iii) Nearly all candidates scored here, even if they had failed to gain credit on the previous two parts of this question. Answers that followed correctly from an incorrect response to (i) were given credit here. Those scoring only one mark had often failed to comment on what they would see and just gave an explanation of why no changes occurred.

1(e)(i) Many scored both marks here. Those gaining only one mark had often miscalculated the number of hydrogen atoms.

1(e)(ii) Many scored this mark, but there were a lot of incorrect answers that gave organic compounds rather than something inorganic.

1(e)(iii) Most candidates gained this mark.

1(e)(iv) Many did not gain credit here, having redrawn the isomer that was given on the paper instead of the required answer.

1(f) Many candidates failed to score here. Some gained one mark for a partially correct answer, often for dimethyloctene, rather than the correct sequence of numbers.

Question 2

For many candidates, this was one of their highest scoring questions, with many scoring half marks or better.

2(a) Most candidates gained this mark.

2(b) Fewer candidates gained credit here, often because they gave an answer that was only partially correct.

2(c)(i) The majority of candidates gained some credit here, with many scoring both marks. Those gaining only one mark had often correctly commented on the lowering of the activation enthalpy.

2(c)(ii) Most candidates gained some credit here, with most giving correct partial charges. It was often the case that some marks could not be awarded because candidates had not been sufficiently careful about where the curly arrows they had drawn started and ended.

2(d)(i) Many candidates scored this mark, with common incorrect responses being photodissociation or photolysis.

2(d)(ii) Most candidates scored here, with many gaining both marks.

2(d)(iii) Marks here were also high. Those candidates scoring only two of the marks had often not written their answer to three significant figures, as had been asked for in the question.

2(d)(iv) Most candidates scored here. Some candidates gave well-worded answers that showed a good understanding of the topic and gained full credit. A number of candidates did not score both marks because they gave an incomplete explanation in their answer.

2(d)(v) Many candidates scored here.

2(e) Most candidates gained some credit here. A common error was not including numbers in the name.

2(f) Most candidates scored some marks here, with the most able candidates writing clear and concise accounts that gained full credit. Some candidates gaining lower marks had confused parts of the explanation for the greenhouse effect with the explanation of how ozone depletion occurs.

2(g) Few candidates scored this mark. Often those who did not score gave answers that lacked sufficient detail.

Question 3

As with question 2, this was a high scoring question for many candidates, with the majority scoring well over half marks.

3(a) The majority of candidates scored both marks here and few failed to gain any credit.

3(b)(i) Those failing to gain full credit had often left out the electrons or put them on the wrong side of the equation.

3(b)(ii) Most candidates scored here.

3(b)(iii) The majority of candidates scored at least one mark. Many responses that did not gain credit gave examples like 'in PVC' rather than 'in making PVC'.

3(b)(iv) A large majority of candidates gained full credit here.

3(c) Those not scoring had often forgotten to cancel out the oxide ions.

3(d)(i) The most common errors were failing to multiply the mass of sodium chloride by 1000 when calculating the moles and not dividing moles of sodium chloride by 2 to get moles of chlorine formed.

3(d)(ii) Many candidates failed to appreciate the significance of the statement in the stem of the question that all the products of the process were useful.

3(e)(i) Many candidates gained some credit here, often for a correct equation. The mark for the state symbols was gained less frequently. A large number showed no understanding of the concept of ionisation enthalpy on their responses.

3(e)(ii) The most common reasons for marks not being awarded were poorly drawn diagrams that had ions of the same charge in contact or incorrectly labelled ions.

Question 4

This was the lowest scoring question for a lot of candidates, with many scoring less than half marks.

4(a) This mark was awarded less frequently than has been the case on questions of this type in the past. Many candidates gave the repeat unit for poly(ethene) instead of poly(propene) or wrote the propene molecule as the repeat unit.

4(b) Most candidates scored this mark.

4(c) Most candidates gained credit here. Those who did not score had often not included the 'when heated' comment required to complete the description.

4(d) . The most able gave clearly worded responses with a logical order that showed a sound understanding of the concept of intermolecular bonds. Candidates scoring fewer marks often gave abbreviations, such as id-id, or left out part of the name of the intermolecular bond. Very few candidates scored full marks, with the mark most often not being scored being for 'intermolecular bonds must be broken for a liquid to boil'.

4(e)(i) Most candidates gained some credit here; with a good proportion of candidates going on to score both marks. Those gaining one mark only had often correctly commented on the change of direction of the equilibrium but then did not go on to describe the impact of this on the yield.

4(e)(i) Responses that did not score often had 'the reaction moving', rather than 'the position of equilibrium moving'.

4(f)(i) A large minority of candidates did not score marks here, having given answers that referred to changes in equilibrium, rather than factors influencing reaction rate.

4(f)(ii) Most candidates scored here.

Question 5

Most answers showed that candidates had used the article to help them to prepare for this question in advance of the exam.

5(a) Most candidates gained full credit here. A few did not score the second mark because they gave examples that were not in the article.

5(b)(i) The majority of candidates scored both marks here. Those who did not score often tried to draw a diagram that had the atoms bonded in the wrong order.

5(b)(ii) Most candidates gained some credit here, often for stating that the molecule is linear. Few went on to word their explanations clearly enough to gain full credit.

5(c)(i) The majority of candidates gained some credit here, with many going on to score full marks.

5(c)(ii) Very few candidates scored here. Most responses showed that the candidate had not taken into account that it was an ion they were being asked to name. The most common incorrect response was nitrogen dioxide.

5(d)(i) The majority of candidates scored this mark.

5(d)(ii) Most candidates scored here, with many gaining full credit.

Responses gave well-worded descriptions and explanations. Many candidates gained high marks and few failed to score at all. Lower marks often resulted from a failure to make the best use of the information in the article and candidates trying to use information they had gathered from their own research, but including information about the wrong oxides of nitrogen.

F333 Chemistry in Practice (Coursework)

Organisation of work

Given that this was the fifth year of this assessment component, most centres are now familiar with its general demands. However, before undertaking assessment of practical skills it is recommended that teachers familiarise themselves with the **Practical Skills Handbook**. This should help to avoid some of the mistakes that are still seen during the moderation process.

Candidates' work was usually well organised and labelled. Candidates may of course attempt more than one Task from each Skill with the best mark from each Skill being used to make up the overall mark. To help track candidate marks it is recommended that centres use the interactive Marks Spreadsheet that is available on Interchange, from the GCE Chemistry B (Salters) page. If used, centres should send a copy to the Moderator along with the Mark Sheet (MS1) and Centre Authentication Form (CCS160).

Centres should group the candidate's four best Tasks together loosely, e.g. with a treasury tag, and not put the work in plastic document wallets, when submitting work to the moderator. Attaching the Coursework Cover Sheet to the front of the candidates' four Tasks also greatly assists the process of moderation (although is not a requirement). Centres should also include a copy of the Skill I Competence Record Card (also available on Interchange). It should be noted that **only** the four best Tasks should be submitted for moderation and **not** all of the work that has been completed. Similarly if a candidate achieves the same score on two or three Tasks for a given Skill, the centre must choose which Task to submit for moderation and not simply submit all to the moderator. Where this does not happen the process of moderation is delayed.

Conduct of tasks

All Tasks used in the assessment of Skills II to V should be carried out under controlled conditions. Candidates are not allowed to modify or add to their answers after the Task has been handed in to their teacher. It should be rare, therefore, for candidates' work sent for moderation to include answers that have been crossed out and replaced.

Skill I

It is still the case that the expected documentation to support the award of marks for Skill I was not always included with the moderation sample. Centres should use the Competence Record Card available from OCR, or devise their own document, to show that the activities undertaken by candidates cover all of the six required types of practical work and to include marks or teacher comments noted during the year to help inform the award of marks.

The mark for Skill I should be the best fit integer (whole number) when judged against the marking descriptors, so that when doubled a mark out of 12 is generated that is an even number. Some centres are still giving a mark of say 5.5 and doubling this to give 11. This will give rise to a clerical error form being sent to the centre. Such a situation then causes a delay in the process of moderation.

The marks awarded to candidates by most centres for Skill I showed the expected good match with marks gained by candidates in Skill II and Skill IV Tasks. This suggests that centres are applying the descriptors for Skill I in an appropriate manner. This is of course to be expected since Skills I, II and IV all assess the ability of candidates to carry out practical work. However, some centres are still giving what appear to be inflated marks for Skill I when compared with Skills II and IV.

Skills II-V

The marks awarded to candidates by centres for Skills II to V represented a generally accurate application of Mark Schemes to candidates' work. There were, however, a number of cases where candidate answers were marked as correct even though they did not match the expected answers given in the Mark Scheme.

In Skill II Tasks, there were few problems. The Mark Schemes give very precise guidance about what is required in tables of recorded data and the marks available for candidate results when compared to the value obtained by the teacher. Occasionally marks were awarded that were not consistent with this guidance. The main problems here occurred where subtractions had not been checked, for example of initial from final titres in titrations, or initial from final temperatures in thermochemical experiments. It is important that the Additional Guidance is carefully followed in such cases to see whether or not a mark may be awarded (e.g. Tasks 1 and 3 (titrations), parts (d)–(h), and Task 2 (thermochemical), parts (d)–(g)). The Additional Guidance for Task 2, part (h) also requires very careful reading. Furthermore, when showing which readings have been used to calculate an average value for a titre, a tick must be placed against the readings used if that mark is to be awarded.

In Skill III Tasks, the Mark Schemes allow for candidate errors made in one part of the Task to be carried forward to subsequent parts to avoid penalising the candidate twice for the same error. Not all centres applied this idea effectively. Again the Additional Guidance helps with the award of marks. It should also be noted that in Task 2, part (e)(ii) the second mark depends upon the first, so without a reference to the addition of the catalyst the mark for the temperature rise cannot be obtained.

The Mark Schemes in Skill IV Tasks often include precise observations that are expected in order for candidates to be awarded marks. In some cases marks were awarded even though the expected observations were not included or were very vague. For example, if the Mark Scheme requires candidates to observe that a yellow precipitate is formed for 1 mark (Task 3, part (d)(i)), then both colour and an indication of solid will be expected. Similarly, if the Mark Scheme requires both a dissolving of a precipitate (on warming) and a reappearing (on cooling), with the second mark depending upon the first, then 'solid after cooling' does not score if the dissolving of the solid has not first been described (Task 3, part (d)(ii)). Again if the Mark Scheme requires candidates to identify the formation of two layers in a test tube (Task 1, parts (b) and (c), and Task 3, part (b)) then when it is specified that an upper and lower layer need to be identified to gain both marks, an answer that does not do this, even if the correct colours are correctly stated, cannot score both of these marks. So an answer to Task 1, part (b) such as 'orange at the top, colourless below' is not sufficient for both marks since this may result from inefficient mixing. An explicit reference to two layers must be made, for example 'two layers are formed, the top one being orange and the lower one being colourless'. However, 'layers' may be implied, for example by stating that 'mixture separates'. Also, when adding cyclohexane it is possible that a candidate may mistakenly identify the mixture as having three layers since the interface between the two layers can appear like this, but still correctly identify the colours in the upper and lower layers. In such cases the marks should be awarded, ignoring reference to the interface 'layer'. Again, it should be noted that 'clear' is not the same as 'colourless', and 'cloudy' is not usually an acceptable alternative to 'precipitate', unless specifically stated as such in the Mark Scheme. However, the word 'transparent' is acceptable in place of 'clear' (Task 3, part (c)(ii)). Where colours are required in an answer it is important to note the Additional Guidance of the Mark Scheme where the statement 'any combination of these colours but no other colours should be mentioned' is often stated.

As has been stated before, it remains particularly important in Skill IV that the centre carries out a trial run of the experiments in the Tasks before the Tasks are set to the candidates. This allows for any minor procedural modifications (of say solution concentrations) that may be necessary when using the chemicals in the centre in order that candidates may achieve the correct observations. This is essential because credit should not be given for observations that are not in the Mark Schemes. It is not acceptable to say 'my candidates saw X and so did I, so I am awarding the mark even though the Mark Scheme expected an observation of Y.' In such cases the centre is required to contact OCR using the e-mail address GCEScienceTasks@ocr.org.uk giving details about the observations made by the teacher. If OCR endorses this change then the answers of all of the candidates (or the relevant group of candidates, if appropriate) may be marked according to the centre observations only. A copy of the relevant communications must then be included with the sample of work for the moderator.

In Skill V Tasks, candidates are sometimes asked to explain reactions in terms of redox behaviour. In such a case it is necessary for candidates to link the type of behaviour to the correct species. For example in Task 3, part (a)(iii), the oxidation must be linked to the chloride ion, and not simply 'chlorine is oxidised'. That said, it must also be noted that the second mark does depend on the first, so correctly identifying the chloride ion would not score if reference had been made to reduction rather than oxidation. Also in Task 3, it should be noted that in part (b)(iii) and (iv), the Additional Guidance is particularly important in clarifying the role of cyclohexane. In a Task that considers organic reactions, where structures of organic functional groups are required, it is acceptable for candidates to include 'R' for alkyl groups or to use specific examples such as methyl or ethyl groups, for example Task 1, part (d). However, where candidates draw organic structures the number of bonds, especially about the carbon atoms of a double bond should be counted as a number of incorrect, pentavalent carbon atoms were seen. It should also be noted that where specific named reactions are required, such as 'dehydration' in Task 1, part (f), whilst 'elimination' is a correct alternative, 'loss of water', whilst it correctly describes what is happening should not be allowed since it is not a 'type' of reaction. Where equations are required, formulae must be written in the conventional way. This means that in Task 2, part (a), copper carbonate written as $Cu(CO_3)$ should not score. Also where an equation is required together with state symbols, for example in Task 3, part (c)(ii), and separate marks are awarded for the equation and the state symbols, the mark for the state symbols can be awarded, if the states are correct, even if the equation itself is incorrect.

If, after using one of the Tasks, a centre believes that an answer not included in the Mark Scheme should be marked as correct they should immediately check this with OCR using the e-mail address GCEScienceTasks@ocr.org.uk.

Clerical Errors

A number of centres sent in marks that contained clerical errors. Sometimes this arose from transcription errors made in transferring candidate marks from their work to a spreadsheet. On other occasions it arose because a candidate had carried out more than one Task in the same Skill and the highest scoring Task was not used to calculate the total mark. However, it also arose where centres had awarded a non-integer mark out of 6 for Skill I. The mark for Skill I should be the best fit whole number when judged against the marking descriptors so that when doubled to give a mark out of 12 it generates an even number. It is important that centres check marks carefully in order to avoid such errors in the future.

Security of Tasks

Distribution of the practical Tasks is limited to those candidates who are currently undertaking that Task. Task sheets should be photocopied and issued to candidates at the start of the Task. They must be counted out and in; numbering the documents may help to keep track of them. In no circumstances should practical Task assessment materials be posted to a website where they can be accessed by the public.

All unused Tasks and candidates' scripts must be collected after the assessment and stored securely or destroyed.

All F333 Tasks, Mark Schemes and Instructions are live assessment materials for the lifetime of the specification. These should be kept secure at all times, even if they are not valid for assessment in a particular year, as they may be reissued in subsequent years. Tasks must only be made available to candidates for them to complete under controlled conditions and the completed Tasks must be submitted to the teacher at the end of the lesson. Mark Schemes and Instructions must be kept securely and not made available to candidates.

Clarifications/modifications to Tasks and Mark Schemes

From time to time OCR may need to publish clarification for a Task in light of centre queries. Centres should ensure that they check Interchange before using a Task for assessment to ensure that no modifications have been posted and that a check is made before final submission of marks to OCR by 15 May.

An e-mail alerts service is available. To be notified by e-mail when changes are made to GCE Chemistry B (Salters) pages centres should e-mail GCEScienceTasks@ocr.org.uk including their centre number, centre name, a contact name and the subject line GCE Chemistry B (Salters). It is strongly recommended that all centres register for this service.

Re-submitting Tasks in future years

Only OCR Tasks from Interchange clearly marked with the current assessment year, *i.e.* 1 June 2013 to 14 May 2014, can be used for practical assessment during that period.

However, if a candidate wishes to improve their mark they could re-submit their best 1 June 2012 to 14 May 2013 Task(s), along with a new (from the 1 June 2013 to 14 May 2014 selection on Interchange) Task from the other Skill(s). However, the marks confirmed by the Moderator when the Task was first submitted cannot be 'carried forward'. Teachers will be able to re-mark the Task in light of any comments made by the original Moderator and it may be required by the moderator if the candidate is included in the requested sample. Up to three Skills Tasks per student may be re-submitted (for example a student may have performed well in their Skills II, III and IV in June 2013 and re-submit them for moderation with a new Skill V Task in June 2014 – chosen from the Skill V Tasks available for assessment in the June 2014 session).
Where a candidate wishes to improve their mark, their Skill I mark can be re-submitted (their Competence Record Card will need to be re-submitted for moderation) or, where they have fulfilled the assessment criteria, their Skill I can be re-assessed and their new mark, along with a new Competence Record Card, submitted for moderation.

F334 Chemistry of Materials

General Comments

Perhaps realising that the next paper would not be until June 2014, candidates of all abilities appeared to be better prepared for the examination; the candidates' knowledge of the basic factual material was usually accurate whilst calculations were more often than not carefully presented with clear and logical working out. There was a definite positive response to comments made in January about the need for careful reading of questions, checking formulae and balancing equations, providing adequate working out and planning extended writing. The additional pages were not used often and then usually when a prior response had been crossed out; many candidates took time to construct their answers. 'No response' answers were rare and time was not an issue.
Areas which need attention include selecting **relevant** IR information from the *Data Sheet* and linking it to actual spectral frequencies; spelling, particularly of technical terms – there were a myriad ways of writing 'burette' and even more for 'pipette'.

Comments on Individual Questions

Question 1

1(a) The idea that 'hydrogen bonds' hold polyester chains together was not infrequent whilst many could not spell 'instantaneous' so either gave up and crossed out the start of their answer and wrote either 'induced-induced dipoles' or 'Van der Waals'.

1(b) Most could describe reflux but knowing why reflux was used was more elusive. Good candidates obtained full marks in part (ii), clearly understanding the principles, using correct terminology and explaining the process logically. Others struggled to explain, often unable to distinguish between solute, solvent and solution and not really understanding how recrystallisation works.

1(c) Descriptions of IR were often too complex and involved electrons absorbing energy the falling down and emitting IR radiation or molecules absorbing radiation and the resulting vibrations emitting radiation producing the IR peaks/troughs.
Drawn structures were often inconsistent with the reasons given in part (ii). First the actual peaks/troughs in the spectrum need to be referred to by their actual frequencies; many could not identify these frequencies accurately. Then they should be able to link this data to appropriate information given in the *Data Sheet*. The third marking point referring to the lack of a 'broad' –OH peak was not often awarded.

1(d) Many failed to explain T_g adequately by stating the polymer became brittle 'at' rather than 'below' the T_g. Some just gave 'Glass Transition Temperature' for the meaning of T_g. In contrast most understood T_m and there were few references to 'charring', 'burning' or 'shattering'.

1(e) Explanations in part (i) were impressively clear, logical and accurate. Naming the diol was much better than expected, the usual error was to commence with 1,4-.

Question 2

2(a) Apart from knowing the type of bond (some ionic and permanent dipoles did appear), most had difficulty remembering to draw lone pairs and use arrows for the bonds. Some used the carbonyl Os to form bonds. There were lots of errors in constructing the formula of the complex involving ratios of atoms and charges. A number misread C_2 as Cr. The commonest responses for shape were surprisingly trigonal planar or bipyramidal.

2(b) Redox and electrode potentials were much better understood than in previous sessions. However expressing this understanding is still a problem area. It was not always clear which half reaction they are writing about.
The equation was well done though many decided to ignore the request for state symbols. Most were accurate in constructing electron arrangements for the iron(II) and iron(III) ions. There was less certainty when using the data in part (iv) where there was a lack of precision in use of terms such as orbital, sub shell and use of the 'd' and 's' notation.

2(c) Many candidates left out 'acid' and 'heat' showing they had not read the question properly. There was much confusion about the colour changes – many thought the end point occurred because Mn^{2+} is formed which is pink. Few correctly described the reason why an indicator is not necessary, simply saying manganate is purple or self-indicating or related it to this particular titration, repeating the endpoint observation. Omission of the use of a pipette was common as was using the pipette and burette the wrong way round.
The calculation was generally well answered. There were many fully correct answers, even by the weaker candidates. The most common errors were multiplying by 2/5 and omitting to multiply by 4.

2(d) The underlying problem for many was not realising that the curve's gradient represented the reaction rate. Consequently they discussed the question in terms of falling manganate(VII) concentrations, either slowly or quickly. The X to Y part was slightly better done, candidates being familiar with the catalyst. In fact immediately after Y the rate increases for a while which confused them. Some thought loss of Mn^{2+} was the reason. There was some use of activation enthalpy, and some of active sites and enzyme kinetics.
In the last part a variety of *explanations* rather than *observations* were common.

Question 3

3(a) The only problems here were confusing amides with amines and alcohols with phenols.

3(b) There were many correct answers, some describing the transfer of protons rather than resulting charge. A few showed phenol as charged as well.
Part (ii) was a good discriminator. Most students failed to recognise the phenol group in the molecule and gave the solution as neutral (by far the commonest answer). A few realised the solution would be acidic but gave their explanation as 'more donors than acceptors' rather than the more specific answer required.
In the final part, the phenol group often remained unionised and the amine group protonated.

3(c) The knowledge of active site/receptor activity was good but not realising that the isomers had different shapes was the problem here.

3(d) Optical isomerism caused little difficulty. However the last 2 marks were much more difficult to attain. Several introduced a double bond into the ring to explain non-rotation of the C-C bond. Only a few were able to draw the two isomers and even fewer could explain accurately enough to score the final mark. Many drew 1,2- and 1,4-diamino isomers. This was a good discriminator at the top end.

Question 4

4(a) The first two parts were good, the last much less so; only the top students understood the theory here and many, many answers were given in terms of rates and orders. A few on the right lines failed to connect the 2 molecules of water with the OH^- from the rate determining step.

4(b) Answers were mostly correct, sometimes marks were lost for writing formulae instead of names.

4(c) The facts were very well known. Only a few missed the third mark by giving ‘reflux’.

4(d) Most answers were excellent, there were just a few with the calculation the wrong way up or too few significant figures. Units were usually correct too.

F335 Chemistry by Design

General Comments

Candidates were well-prepared to answer questions on such things as organic structures and reagents. They wrote well about equilibrium, buffer solutions, colour, spectroscopy and the effect of structure on boiling point. Calculations were often well done, especially the final multi-step calculation on iodine number.

Occasionally, a lack of logical chemical phraseology let candidates down and this will be mentioned in the detailed discussion below.

Very few candidates seemed to have difficulty finishing the paper and all obviously tried hard to do their very best.

Comments on Individual Questions

Question 1

This was a question on a fairly familiar synoptic concept, designed to give candidates a gentle introduction to the paper.

1(a)(i) This question was usually answered correctly, with the number of lone pairs just tripping up a few candidates.

1(a)(ii) Many candidates wrote good carefully constructed answers to this synoptic part, saying clearly that there were two areas of electron density around the carbon atom that repelled each other as far apart as possible. Some omitted the ‘around the carbon atom’ and other talked about electrons repelling (rather than electron areas) which was not acceptable at A2.

1(a)(iii) There were many good answers describing oxygen’s greater electronegativity, the polarity of the bond and the fact that the dipoles cancelled. Just a few candidates mis-spelled ‘electronegativity’ while others’ handwriting made the deciphering of the word impossible. A few were let down by their ability to express their chemical understanding clearly and failed to indicate the polarity of the bond. A larger number talked about ‘charges cancelling’ or even ‘electronegativities cancelling’.

1(a)(iv) Another synoptic question where a good number scored full marks. The straight O–H–O and the delta minus on both the oxygens eluded some, while there was even a smattering of HO_2 molecules.

1(a)(v) There were some good answers to this part that scored both marks by simply saying ‘the hydrogen bonds between water molecules are stronger than those between water and carbon dioxide’. Others gave a more detailed answer in terms of bonds broken and made, though some contradicted themselves by implying that energy was needed both to make and break bonds. Some denied the existence of hydrogen bonds between carbon dioxide and water, strange even though they had just been answering the previous part.

1(b)(i) This question was the first of several about equilibrium. Here, some had the clarity of chemical expression to talk about the equilibrium **position** moving to the right, increasing the **concentration** of hydrogen ions. The words in bold were both required.

1(b)(ii) Many candidates could define a buffer solution in terms of its action, though fewer clearly stated the need for a high hydrogencarbonate concentration.

1(c) A small number of candidates correctly described the carbonate ion, but there were many other answers, the commonest misconception being carbon dioxide.

1(d) In this question it was necessary to understand the meaning of pH and of percentages. Many negotiated both hurdles correctly but more fell at the percentage fence than in working out the hydrogen ion concentrations.

1(e)(i) Another synoptic question requiring accuracy of chemical expression when it occurs at A2. Most mentioned the equilibria explicitly but then many were unable to describe the shells as ‘dissolving’ to score the third mark.

1(e)(ii) Most answered this question, another synoptic part, correctly. Just a few referred to carbon dioxide as a poisonous gas.

1(f) This was a synoptic calculation that many negotiated without mishap, the commonest error, as ever, being not giving the answer to two significant figures.

Question 2

This question was on a much more unfamiliar context than question 1 but candidates tackled it well.

2(a)(i) This question was usually correctly answered, with just a few ‘amines’ and the occasional ‘ketone’.

2(a)(ii) The correct answer to this unfamiliar situation was ‘acid-base’, but ‘elimination’ was allowed, to the satisfaction of many candidates.

2(a)(iii) An unfamiliar test of ‘curly arrows’ and many candidates showed prowess here, almost all scoring at least one mark.

2(b)(i) There were many correct answers. Most errors were on the isocyanate with RNCO and RNHCO appearing rather frequently.

2(b)(ii) In this synoptic part, many said ‘100% atom economy, therefore no waste’ and scored two marks. Others hedged with ‘high atom economy’ or ‘no *toxic* waste’ and did not score.

2(c)(i) There were many correct answers by candidates who said that carbaryl would harm mammals or humans. Some repeated the question (always ill-advised) and some implied that the carbaryl would certainly be fatal.

2(c)(ii) This question showed good understanding of enzyme inhibition by many candidates, who expressed themselves well. The point most often missed was that carbaryl has a similar *shape* to the substrate. Some candidates talked about carbaryl attaching elsewhere and changing the shape of the enzyme. This was ignored rather than penalised, even though those who had learned about non-competitive inhibition (not in the Specification) ought to have realised that such inhibition is not reversible.

2(d) Most candidates failed to be led astray in this part by the fact that the polymerisation superficially resembles condensation and went for addition. They then sometimes did not write carefully enough to score for the reason. For example, ‘two monomers joining to make a polymer’ is not sufficient, as it describes condensation polymerisation too.

2(e) This question required an unfamiliar equation but a large proportion of candidates took it in their stride, which is commendable.

2(f) The conditions and reagents were well-known.

Question 3

This question showed that candidates have a good understanding of acid–base and other equilibria.

3(a) Many candidates drew the structure correctly, though quite a number left out the O–H bond.

3(b)(i), (ii) and (iii) These parts were more successful with a good scoring rate.

3(b)(iv) Candidates have now learned how to solve questions like this part and the scoring rate was good. Most understood 'two decimal places'.

3(b)(v) This question was intended to be more testing and the fact that most candidates were able to write 'concentration of acid at start equals concentration at equilibrium' was impressive. Then the word 'numbers' in the stem was overlooked by many. Those who compared 8.25×10^{-4} with 4×10^{-3} usually scored.

3(c) Some candidates managed very creditably to negotiate the equation to score two marks. The formula of the salt with the two to one ratio and the 'missing' H in CHO_2^- often tripped candidates up and they had to fall back on the mark that credited the formation of CO_2.

3(d)(i) Often well done.

3(d)(ii) Only a few realised that the ratio of [acid] to [salt] was 1:3. Many more received partial credit for thinking that the ratio was 1:2.

3(e)(i) and (ii) These parts were usually well done, showing a sound understanding of elementary spectroscopy. Omitting the C–H peak was the commonest error in (ii).

3(f)(i) An *industrial* use was required, so just 'hydrogenation of alkenes' was not accepted. Fritz Haber might have been surprised at the number of variants of his surname that candidates suggested.

3(f)(ii) This question was a 'scene-setting' exercise, so there was a lot to write for one mark. Many candidates scored the mark, while some omitted the equation altogether and others wrote an arrow rather than an equilibrium sign.

3(f)(iii) Many candidates described the sign as positive, and then gave reasons in terms of 'more moles on the right, therefore more disorder'. The second part of this statement was sometimes omitted.

3(f)(iv) Most candidates scored here, especially the mark for realising the concentrations had to be equal.

3(f)(v) and the first two marks of 3(f)(vi) These were usually well done, with just a few candidates confusing left and right..

The second two marks of 3(f)(vi) These marks were much tougher and required a consideration of a possible small effect of temperature because ΔH was small and then a statement that the *energy* to create a high temperature was *costly.* Once again, answers using variants of 'economical' were not credited because the word appears in the question. Just the very occasional good answer in terms of entropy was seen.

Question 4

Some fairly familiar ideas were tested here under an unfamiliar context, and candidates responded well.

4(a) Most could cope well with the detail of a gas chromatograph. The weakest answers showed confusion of low- and high-boiling liquids in (ii).

4(b) This was a straightforward question on a mass spectrum. Most scored for '32' in (i), with just a few giving 31. This was usually because they thought that the 'highest' (base) peak was the mass peak. A few talked about 32 being a ^{13}C peak. This is not in the Specification, of course, and it was felt that anyone who knew about such things ought to have realised that, for such a simple molecule, the ^{13}C peak would not be so high. As a reason, it was necessary to nominate the 'peak of highest *m/z*' not just 'the molecular ion peak' as this did not explain how the candidate had arrived at their answer. Part (ii) and (iii) were usually well done, with plenty of plus charges in (ii).

4(c)(i) Many candidates were able to draw two good enantiomers which showed clearly the three-dimensional nature of the mirror-images, with due regards for where the bond connected with the atoms. The commonest error was 'straight lines not adjacent', though some candidates drew structures without any wedges or dashed lines.

4(c)(ii) Many candidates mentioned 'life' and scored, though it should be pointed out that amino acids do not necessarily come *from* proteins. Other candidates contradicted themselves by saying or implying that amino acids were the monomers for DNA.

4(d)(i) This was a synoptic re-visiting of radical reactions which many took in their stride. The commonest errors, from those who knew what they were doing, were to include '+ uv' in the equation or to form H^+ rather than a radical.

4(d)(ii) Most scored the mark for compound C and many correctly identified the dicarboxylic acid, though ethanedioc acid was prevalent.

Question 5

This was the highest-scoring question, even though it had a variety of unusual contexts.

5(a) The majority scored two marks, the commonest error being to omit the $3p^6$.

5(b) Scoring was again high, with just a few naming the compound as an anion.

5(c) This part was also well done.

5(d) A small number of candidates were able to score three marks by labeling the axes correctly and then sketching a curve starting low and ending high. Others lost marks by contradicting themselves by adding unnecessary detail such as wrong units for wavelength (e.g. cm^{-1}) or the colours the wrong way round.

5(e) Usually well done. A few candidates thought the splitting of the d subshell was *caused* by absorbing light. There are still a few who think that this is an emission phenomenon with electrons falling and emitting light.

5(f)(i) This part was very high-scoring, with just the very occasional 'ketone' or 'ether'.

5(f)(ii) One where careful use of words was needed, but most candidates did well and explained that it was *cis* because both *groups* (not just 'they') were on the same side of the double bond.

5(f)(iii) Many candidates said the chains were closer because they were straighter. They then correctly named the intermolecular bonds as instantaneous dipole–induce dipole and said they were stronger and thus required more energy to break. Errors were mainly of omission of the straightness of the chains, the type of intermolecular bond or, more rarely, of a comparative answer.

5(g)(i) Some candidates negotiated this part correctly, giving 'I_2' on the left-hand side and then adding the two iodine atoms correctly on a product. The commonest error was to put hydrogen atoms on the product.

5(g)(ii) A multi-step calculation is fairly unusual for this paper, but many candidates were able to calculate the moles of thiosulfate and hence iodine remaining, calculate the moles of iodine used, convert this into grams and scale this up from 0.2 g to 100 g. Of those who failed to score all five marks, many scored four for omitting just one of these steps.

F336 Chemistry Individual Investigation (Coursework)

General Comments

The work seen during moderation showed the best of what can be achieved from schools and colleges taking the Salters specification and showed the immense amount of time, effort and sheer hard work put in by students and teachers. In a few cases candidates needed to spend more time on their investigations to allow their ideas to develop and to collect sufficient results.

A range of investigation topics was chosen by candidates but unusual topics were less obvious this year. As usual, the work from some centres was limited to kinetics but even here there were a wide range of outcomes and formulaic approaches gave rise to a range of results. Clearly just carrying out a rate of reaction investigation does not guarantee a high mark. On the other hand there were centres where candidates had been given a free rein in choosing their investigation and the marks achieved were just as varied. Candidates may, however, have gained a lot more from the assessment activity.

A few candidates needed to choose more demanding topics to investigate. Investigations such as acid and thiosulfate and simple electrochemical cells do not allow candidates to develop their skills and understanding sufficiently. It appeared that some candidates treated their work as an extended experiment rather than an investigation. This led to formulaic reports that scored less well than might have been expected.

A few investigations were not appropriate. These included the investigation of the effect of a solid on rate of reaction such as in the reaction of magnesium with acids and a comparison of aspirin tablets bought at different suppliers or prices. Other candidates chose experimental methods that focussed too much on biology or physics and lacked the essential chemical component required by this assessment component.

It was clear that some centres provided candidates with checklists based on previous examiner reports and this certainly seemed to help them avoid the more obvious errors and omissions.

The extent to which candidates' work had been annotated varied between centres. Some centres tended to use general phrases such as 'describes a comprehensive range of chemical knowledge' rather than comments that were relevant to the specific candidates' work.

Many centres did not supply the required documentation to support the award of a mark for Skill G. Written evidence arising from direct teacher observation of candidates at work in the laboratory should be sent to the moderator with candidates work. This often takes the form of an aide–memoire in which the teacher adds comments several times during the course of investigations. Centres should ensure that they think ahead about how they are going to collect this evidence. In a small minority of cases investigation reports lacked cover sheets or candidate numbers.

Most candidates presented their investigation reports well with almost all work word processed. Most candidates seemed to benefit by dividing their report into distinct sections to cover theory, method, results, analysis and evaluation. Such a practice is highly recommended.

Work is best sent to moderators held together securely by, for example, a treasury tag. A few centres sent candidates work in large ring binders or with each Skill area in a separate plastic envelope which made the mechanics of moderating samples much more difficult.

OCR provides a free Coursework Consultancy service, which allows teachers at the centre to obtain guidance on their marking from the Principal Moderator before marks are submitted to OCR. In centres where there is a wide difference between the marks awarded by the centre and the marks achieved after moderation the use of the service is highly recommended. Details are to be found on Coursework Enquiry forms, available from Interchange.

Skill A

Many candidates carried out effective research to find the chemical theory required for this Skill area. In the better examples all the theory was relevant to the investigation undertaken. In less good examples the research was not linked to the actual investigation undertaken. In a kinetics investigation, for example, the actual reaction studied should be linked to the supporting theory.

Skill B

There were many examples of good practice in this Skill area where candidates provided sufficient detail about experimental methods so that another student could have used the account as a set of instructions to repeat the experiments. This is a good guideline to the amount of fine detail required. The account will normally include, for example, details about how solutions are measured and how they are diluted. In other less good cases candidates gave details about their first experiment but did not provide further details when several different conditions had been investigated.

Lists of standard apparatus are not expected. Drawings or photographs of standard equipment such as a burette or stop watch do not add to the report and are also not required.

A few candidates who investigated kinetic ‘clock’ reactions changed the concentration of sodium thiosulfate. This is not an appropriate choice and indicates that more teacher guidance is needed.

Skill C

The marks awarded in this section were sometimes a little higher than was merited. Candidates need to take care to link their risk assessment with the concentration of solution used in the investigation. Comments in the risk assessment about the dangers of broken glassware, Bunsen burners and long hair are not expected at this level. In some cases the risk assessment included incorrect information that had not been identified during marking.

In the best examples, candidates had looked up both written and electronic sources while carrying out research for their investigation. Some references to electronic resources lacked sufficient detail. The content of the resource must be clear. A short sentence describing their content works very well. A few candidates included many references to images rather than the more comprehensive sources they might have consulted.

Skill D

Whist many candidates produced sufficient high quality data some did not spend sufficient time in the laboratory to produce enough results. Others spent too much time on unnecessary repeats of experiments which limited the range of different experiments they were able to investigate. Centres need to allocate sufficient time in the laboratory to allow candidates to demonstrate their practical skills.

In investigations involving titrations it is expected that candidates will record all burette reading not just titres and will record volumes to two decimal places.

Skill E

Drawing high quality graphs proved an issue for some candidates. In some cases candidates used extremely small graphs incorporated into the main body of the text taking the view that such a computer generated graph was better than a full page hand drawn alternative when the reverse was usually true.

The ability to draw appropriate conclusions discriminated between candidates. Better candidates used the theory they had described in Skill A to explain what they could find out from their experimental results. Other candidates tended to simply describe their results rather than attempting to evaluate them. This was particularly evident in investigations that set out to analyse substances.

Skill F

When evaluating percentage errors it is expected that candidates will use the correct error for each particular piece of equipment, will calculate the percentage error for all types of measurement and will show their calculations clearly.

Comments on the limitations of experimental procedure can be quite brief and limited. Some candidates would benefit by developing this aspect of their report to ensure that key points relating to all of their experiments are included. It might prove helpful if they make a note of issues as they carry out the experiments rather than waiting until they have competed practical work.

Skill G

It is expected that there will be a range of marks for this Skill area submitted by centres to match the range of performance that is usually seen in marks for Skill D. Many centres need to check that the range of marks for their candidates in this Skill does cover an appropriate range since in some cases the award of maximum marks for the majority of candidates was clearly not appropriate. The use of a teacher checklist to monitor candidates' performance during the investigation helps ensure that the marks awarded are realistic.

Skill H

The award of marks in this section was more appropriate than in the past although there were still a number of centres where the marks awarded were too generous. As an example, a kinetics investigation in which the concentrations of reactants are changed in order to determine the orders of reaction and the temperature changed in order to determine the activation enthalpy via an Arrhenius plot should be awarded a mark of 3 out of 5.

Most centres appreciated that, to be awarded maximum marks, candidates need to show real flair in their ability to innovate and solve problems. This mark should not be awarded simply because the candidate has chosen to study a topic that is not in the specification.

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