



GENERAL CERTIFICATE OF EDUCATION
TYSTYSGRIF ADDYSG GYFFREDINOL

EXAMINERS' REPORTS

AS/ADVANCED CHEMISTRY

SUMMER 2008

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Statistical Information

GCSE

The Examiners' Report may refer in general terms to statistical outcomes. Statistical information on candidates' performances in all examination components (whether internally or externally assessed) is provided when results are issued. As well as the marks achieved by individual candidates, the following information can be obtained from these printouts:

For each component: the maximum mark, aggregation factor, mean mark and standard deviation of marks obtained by *all* candidates entered for the examination.

For the subject or option: the total entry and the lowest mark needed for the award of each grade.

Annual Statistical Report

Other information on a centre basis is provided when results are issued. The annual *Statistical Report* (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

CHEMISTRY
General Certificate of Education
Summer 2008
Advanced Subsidiary/Advanced

Statistical Information

The following information is included in this report in order to provide centres with as full a picture as possible of the examination in each component. The statistics include all candidates entered for the unit, whether or not they 'cashed in' for an AS/A level award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of the paper and that differences will undoubtedly occur between one year and the next and also between subjects in the same year. Moreover, information is provisional in the sense that it does not take account of changes resulting from appeals.

Component	Entry	Max. Mark	Mean Mark	Grade	Raw Mark	Cumulative %
CH1	2277	66	32.1	A	42	24.8
				B	37	38.8
				C	32	52.4
				D	27	66.0
				E	22	79.9
CH2	2817	66	34.3	A	46	26.6
				B	40	39.6
				C	34	52.1
				D	28	65.1
				E	23	74.9
CH3a	2770	30	18.5	A	22	28.2
				E	13	88.4
CH3b	107	103	93.1	A	89	85.0
				E	67	100
CH3c	2620	103	86.2	A	89	48.7
				E	67	95.0

Advanced Level

Component	Entry	Max. Mark	Mean Mark	Grade	Raw Mark	Cumulative %
CH4	876	75	35.5	A	48	20.8
				B	42	34.9
				C	36	50.8
				D	30	65.8
				E	25	76.9
CH5	1403	75	40.2	A	52	23.1
				B	46	38.3
				C	40	54.4
				D	35	66.5
				E	30	75.7
CH6a	1399	50	26.5	A	35	18.7
				E	22	70.7
CH6b	66	103	83.3	A	89	39.4
				E	61	97.0
CH6c	1335	103	86.2	A	89	50.9
				E	61	96.7

N.B. The marks given above are raw marks and not uniform marks.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Subsidiary

Paper CH1

Principal Examiner: M. E. Anthony Ph.D.

General Comments

2277 candidates sat this paper, a slight increase on June 2007, with 1432 sitting the paper for the first time. 186 sat through the medium of Welsh.

The mean mark was 32.1, slightly higher than the means for the last three CH1 papers, with a standard deviation of 12.6. The highest mark was 64 (out of 66 maximum) and the lowest 1 mark.

Little seems to have changed over the past year. In June 2007's CH1 report I wrote ".....with the worst answers to be found in the questions on bonding A significant number of weaker candidates seemed to have learned the words but not the context in which to apply them. Sadly, the following answer was by no means atypical:

" Sodium chloride bonds by ionic bonding, the molecules of NaCl having strong intermolecular forces due to the molecules being polar".

The paper showed up large differences between centres in the preparedness of their candidates for this paper, a comment which has been made in previous reports. With some centres, none of the candidates had progressed much beyond GCSE level, while other centres had all their candidates scoring high marks across the whole syllabus. There seemed to be a number of weaker students who were very ill-prepared for AS level."

The same comments are equally appropriate for the June 2008 paper. By some distance the worst answered question was Q9, where in part (a) candidates were asked to relate melting temperature trends to structure and bonding; answers lacked content, depth and understanding from all except the very best candidates. Too many weak candidates used atom, molecule, lattice or crystal almost interchangeably.

The disparity between centres has, if anything, widened. It manifests itself not so much in the understanding of chemistry as in the learning of basic definitions and trends which are the vocabulary of chemistry.

Section A

- Q.1 There was a high proportion of correct answers. Confusion between protons and electrons led to 18 as the most frequent wrong answer.
- Q.2 Again, reasonably well answered. Some candidates lost marks by failing to read the question and not connecting the points as asked.
- Q.3 Patchy answers, with evidence of guesswork from some weaker candidates.

- Q.4 As in recent years, whenever questions on the mole have been set, many candidates seemed totally unaware of the correct definition, guessing at the answer or confusing it with relative molecular mass or Avogadro's number. In part (b), very few candidates succeeded in gaining the mark for this question and it appeared that many were simply guessing and not understanding the meaning of the formula or what the question was asking them to do.
- Q.5 Only about half of the candidates succeeded in gaining the mark for this question. Disappointingly, many thought that covalent bonding was the weakest of the choices given.
- Q.6 Although answers such as "figure of eight" were allowed, it was obvious that many candidates did not appreciate the three-dimensional nature of orbitals.
- Q.7 (a) Although most candidates described electronegativity as the ability of an atom to attract electrons, many failed to specify *bonding* electrons, which was required for the mark.
- (b) Only the weakest candidates, clearly not understanding the concept of electronegativity, got this question wrong. About three quarters of candidates were able to gain the mark.

Section B

- Q.8 (a) (i) Well answered, with very few candidates not giving the electron in one of its manifestations.
- (ii) Again well answered, with incorrect mass number the commonest error.
- (iii) The concept of half life was well known but some weaker students were let down by mathematical failings.
- (iv) The majority of candidates recognised the poor penetrating power of α -particles, but failed to relate this to the glass or luggage of the question. Instead, spurious arguments about "failing to penetrate the skin" or "being trapped inside the skin" were all too common. The second mark required candidates to refer to the ionising nature of the radiation within the body, but many gave very vague answers and so failed to gain this mark.
- (b) Most candidates recognised that PoCl_4 was covalently bonded but some lost credit by stating that it had a giant covalent structure.
- (c) (i)&(ii) This was generally well answered, with most candidates correctly identifying the two isotopes of chlorine and a significant number proceeding to explain the mass spectrum.
- (iii) For such a standard piece of learning and recall as the operation of the mass spectrometer, there was a surprisingly large number of very poor and muddled answers.
- Q.9 As mentioned in the introduction, this was by some distance the worst-answered question on the paper. Those that performed badly failed to grasp what each question was asking and they tended to generalise, using the same answers for each part of the question.

- (a)
 - (i) A disappointingly small number of candidates correctly identified all three non-solid elements.
 - (ii) Many candidates were able to recognise that the highest melting temperatures were due to a giant covalent structure but then failed to state that the strong bonds needed large amounts of energy for melting.
 - (iii) Only the best candidates gave a coherent answer. Too many talked about the inert chemical nature of the noble gases due to complete outer electron shells and there were far too many references to “noble gas *molecules*”.
 - (iv) Despite the reference in the question to metallic bonding, many answers were along the lines of atomic size and van der Waals forces, with only the best candidates giving correct, detailed answers.
 - (v) Weaker students too often repeated their arguments from (iv) about atomic size and van der Waals forces.
 - (vi) At the third attempt, when atomic size and van der Waals forces were actually relevant, many candidates spoiled their answers with repeated references to noble gas *molecules*.
- (b) Answers to this question varied from centre to centre. Standards on what was a straightforward source of recall marks were extremely variable, seeming to depend on whether the centre had covered the details of graphite structure required to answer the question.

Q.10 This question was generally well answered, with a pleasing number of candidates being successful with the calculations.

- (a) Most candidates were able to score some marks with this question, particularly those relating to the dipoles within water. Problems usually arose when candidates started talking about hydrogen bonding between ions.
- (b) Well answered, particularly by those candidates who used the flame test. Those that gave the sulphate test as an alternative were penalised if they failed to state that the salt had to be dissolved in water first.
- (c)
 - (i) A pleasingly high proportion of candidates correctly arrived at the formula $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$.
 - (ii) Some candidates lost marks here because they failed to give their answer to three significant figures.
 - (iii) The trend in solubility of Group 2 hydroxides was generally well known, though some candidates managed to get very confused between up and down!
- (d)
 - (i) This was one of the better-known definitions on the paper, though a disappointing number of candidates thought oxidising agents donated electrons.

- (ii) If they were able to give the correct answer to part (i), candidates generally recognised that chlorine was a stronger oxidising agent as it was more electronegative than bromine.
 - (iii) This question was well answered by about half of the candidates. Others were able to give a correct equation, but failed to refer to oxidation numbers in their explanations.
 - (iv) Despite the fact that nearly all candidates scored well on this question, a worryingly large number of second-year candidates still confused this with the hydrolysis of chloroalkanes and unnecessarily insisted on heating with sodium hydroxide as the first step. This was only penalised when the candidate failed to acidify the solution with nitric acid before continuing with the chloride test.
- Q.11
- (a) A large majority of candidates correctly gave the electron configuration of phosphorus, but a small minority seem stuck at the level of electron shells.
 - (b) The empirical formula of phosphorus(V) oxide was well known, but though most candidates were able to state that the bonding was covalent, only the best knew it was a simple molecular structure rather than a giant lattice.
 - (c) Surprisingly, this was the worst-answered of the calculations on the paper, with a significant number of candidates not even attempting it.
 - (d) Only a mere handful of candidates gave $\text{Ca}_3(\text{PO}_4)_2$ as the correct formula for calcium phosphate, but, in contrast, a large majority were able to give an example of its importance, with bones, teeth and fertilisers the most often quoted (in descending order of popularity).
 - (e)
 - (i) The dot-and-cross diagrams were well done, with only a few candidates losing marks by failing to include all the valence shell electrons on the chlorine atoms. A common error when explaining the term *lone pair of electrons* was a failure to specify that the term only applies to electrons in the valence shell (not to non-bonding electron pairs in completed inner shells).
 - (ii) The shapes of PCl_5 and PCl_3 molecules were reasonably well known, though the standard of diagrams was often very poor, in some cases making it impossible to ascertain whether the answer was correct or not. No marks can be awarded in such cases!
 - (iii) About half of the candidates were able to answer this question fully. Weaker candidates were unable to recognise the significance of the arrow and often stated that a reaction was going to completion rather than being reversible.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Subsidiary

Paper CH2

Principal Examiner: D.H.Ballard, B.Sc., Ph.D., C.Chem., F.R.S.C.
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General Comments

The number taking this unit in June continues to increase and this year was no exception. This paper produced a very wide range of marks; there were a number of excellent scripts but it was disappointing to note that there were more than 20 % of the candidates who could only score 20 marks or less out of a paper total of 66 and almost 60 % who could not obtain half marks.

One fault for a number of candidates in examinations is that they fail to read the question carefully enough and respond to what **they** think the question is about. In this examination many candidates read 'heterogeneous' for 'homogeneous' and exothermic' for 'endothermic'.

The overall standard of the paper was very similar to those seen in other June CH2 examinations and every question was accessible, with no dead marks.

The handling of calculation continues to improve and candidates are becoming more confident in handling small numbers using standard form. It is a pity that a number of candidates still muddle up plus and minus signs in ΔH calculations.

Section A

- Q.1 This was a straightforward starting question and only a few candidates did not correctly identify the alkene monomer.
- Q.2 (i) Sodium hydroxide was the most common correct answer. A few candidates gave aqueous sodium hydroxide even though the question stated that the reagent was used in alcoholic solution.
- (ii) A few people misinterpreted the question and thought that substitution was occurring.
- Q.3 (i) Most candidates correctly gave but-2-ene.
- (ii) The correct answer was 6 – sometimes this was credited from the correct equation.
- (iii) The correct physical states using standard conditions were sometimes given incorrectly or omitted. This seems to be a weaker area in the specification.
- Q.4 The examiners believe that acid rain is caused by oxides of sulphur or nitrogen but not by carbon dioxide. Unfortunately, a number of candidates based their answer on carbon dioxide. Some candidates failed to mention that it was sulphur in coal that was the source of sulphur dioxide emission.

Q.5 This was usually correct but a few candidates also included spectator ions and this was penalised.

Q.6 Nearly all candidates correctly chose statement C.

Section B

- Q.7 (a) (i) The spelling of heterogeneous was sometimes suspect.
- (ii) The Haber process was a popular choice here but the equation produced was sometimes incorrect.
- (b) (i) Many correct answers were seen but so too were the usual errors: use of square brackets inverted reactants and products, plus signs used instead of multiply, etc.
- (ii) Although the system was unfamiliar, it was based on Le Chatelier's principle. There are still a number of candidates who could not express their ideas clearly.
- (c) (i) Many correct formulae were seen. Some candidates used the incorrect number of carbon atoms or put both chlorine atoms on the same carbon atom.
- (ii) The majority gave silver nitrate to produce a white precipitate but fewer included sodium hydroxide for the hydrolysis. Many gave acidified nitric acid without specifying the acid used.
- (d) This was generally well done and some gave the complete mechanism. Free radicals require a 'dot' and this was not always seen. Those who gave H^\bullet were penalised.
- (e) Many candidates correctly identified ethane as the alkane. Not all candidates, however, explained that this was produced by the combination of two methyl radicals.
- (f) The correct answer, $-2217 \text{ kJ mol}^{-1}$, was often seen and gained both marks. Sadly, some candidates did not know the correct formula for propane.
- Q.8 (a) Fractional distillation and cracking were generally well understood. In cracking, the examiners thought that the emphasis should be on the need to produce compounds that were smaller **and** more useful.
- (b) These were an easy two marks for most candidates who could recall the concept of a homologous series.
- (c) (i) I. A curly arrow represents the movement of electrons – the mechanism showed the movement of an electron pair.
- II. Some candidates did not mention that the δ^+ and δ^- symbols represented **partial** charges rather than full charges.
- III. This was a discriminating question. There were some good comments about the stability of carbocations but there were equally a number of vague and unclear explanations. The examination paper had the bromine and hydrogen atoms in carbocation B in the wrong places but this seemed to have no effect on the responses, although the mark scheme was altered to take this into account.

- (ii) I. Most candidates correctly gave the required trans structure. The question asked for the graphic formula. A number of candidates drew structures showing the ethylenic carbon atom bonded to the hydrogen or bromine atoms of the CH₂Br group and this was penalised.
 - II. The explanation for geometrical isomerism is often difficult to state accurately. Statements such as 'it prevents the molecule rotating' are clearly wrong.
 - (iii) I./II. Many candidates gained full credit for these two questions.
 - III. Although a number of candidates gained two marks, there were a number of scripts that showed exothermic profiles. Some candidates gave a Maxwell-Boltzmann distribution curve as their answer.
- Q.9 (a) (i) The question asked for a reagent. The examiners did not accept that 'dichromate' was a reagent. If potassium manganate(VII) was used, the oxidation state needed to be correct.
- (ii) The colour change had to match the correct reagent in (i).
- (b) A number of candidates gave answers with the incorrect sign. This is a continuing problem with energy cycle calculations.
- (c) (i) Many candidates obtained the correct answer. The commonest error was in not taking the total mass of the solutions.
- (ii) This was a discriminating question. A number of sound calculations were seen with the negative sign omitted.
- (d) There were some poor explanations here. The stronger acid has a greater concentrations of hydrogen ions, or its pH is lower. This was not always made clear.
- (e) A number of candidates failed to mention hydrogen bonding in the first example, although most mentioned that larger molecules had greater intermolecular forces for pentan-1-ol and hexan-1-ol.
- (f) A number of poorly drawn structures were seen – these had hydrogen atoms missing from the primary alcohol group or too many carbon atoms in the main carbon chain.
- (g) Most candidates could explain why a molecular formula could not confirm that a compound was an acid.
- Q10. (i) This question was about the Haber process and the question stem indicated the details that were required. There were six marks available for this straightforward section of the specification. Many good scripts were seen but it was surprising how many candidates had failed to revise this section of the specification and consequently lost a number of easier marks.

- (ii) Most candidates gained at least one of these marks and many gained both marks. The examiners were willing to accept a wide range of answers in this section, which considered economic and technical factors in the siting of a plant.
- (iii) The question led on from the Haber process and tested candidates understanding of the mole concept via a titration calculation. Although most candidates gained some marks, consideration of appropriate dilution defeated many.
- (iv) Fertiliser **Z** had a molecular formula $\text{CH}_4\text{N}_2\text{O}$ and it was pleasing to see many candidates obtaining the three marks available for this question.

PAPUR ARHOLIAD CH2:

Marciwyd 27 o sgriptiau. Gyda sampl fechan mae'n hawdd cael yr argraff anghywir.

Serch hynny, gwelwyd rhai sgriptiau eithaf da ond roedd canran uchel o ymgeiswyr yn anaddas ar gyfer Safon Uwch.

Heblaw am y cwestiwn olaf, buasai marciau rhai o'r ymgeiswyr bod yn isel iawn.

Mae'n debyg fod safon y gwaith o'r T.G.A.U. i'r Safon Uwch yn ormod i rai myfyrwyr. Hefyd, mae diffyg dysgu ffeithiau cemegol yn golygu llawer o ddyfalu anghywir. Gwelwyd llawer o wallau mewn cyfrifiadau syml.

ADRAN A

Ar y cyfan roedd y safon yn isel iawn gyda'r mwyafrif o fyfyrwyr yn ennill ond ychydig o farciau.

Cw.3 Collwyd hanner marc am adael allan symbolau cyflwr. Roedd dryswch gyda hafaliau ffurfiad cylchobwtan.

Cw.4 Roedd 'rhai carbon deuocsid yn achosi glaw asid' yn boblogaidd.

Cw.5 a Cw.6 Boddhaol ar y cyfan.

ADRAN B

- Cw.7 (b) (i) Diffyg dealltwriaeth yn creu problem gyda K_p .
- (ii) Eglurhad o Le Chatelier yn eithaf da ar y cyfan.
- (c) (ii) Da gweld fod gwelliant ym manylder yr atebion. Efallai fod dilyniant i CH_3 yn gyfrifol am hyn.
- (dd) Mae digon o le i wella ar y math yma o gwestiwn eithaf syml.
- Cw.8 (a) a (b) Boddhaol ar y cyfan.
- (c) (i) I Ychydig iawn o atebion cywir a welwyd – llawer heb sôn am bâr o electronau.
- II Gormod o ddweud yr amlwg fel ' δ^+ ' a ' δ^- '.

- (ii) II Fe gospwyd bondio anghywir. $e.e = C - BrCH$ ac ati.
- (iii) I Ychydig iawn gafodd yr ateb cywir.
- III Ni roddwyd digon o sylw i'r gair endothermig ac nid oedd E_a yn ddigon clir gan rai.
- Cw.9 (a) a (b) Boddhaol.
- (c) (i) Roedd y mwyafrif wedi defnyddio 50g. yn lle 100g.
- (ii) Ni welwyd yr arwydd minws er bod 'gwres yn ei gynhyrchu' yn y cwestiwn.
- (ch) Boddhaol.
- (d) Mae'r math yma o gwestiwn yn dal i greu problemau. Ychydig iawn o atebion gyda 'bondiau hydrogen' a 'bondiau van der Waals' a welwyd.
- Cw.10 Dyma'r cwestiwn mwyaf poblogaidd, gyda atebion cynhwysfawr i ran (i). Roedd trefn dda i'r atebion a defnyddiwyd egwyddorion yn bwrpasol. Cafwyd tipyn o drafferth gyda rhan (iii). Rhan (iv) yn dda iawn. Nid oedd tystiolaeth o ddiffyg amser i gwblhau'r papur.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Subsidiary

Paper CH3a

Principal Examiner: P. G. Blake, B.Sc., D. Phil., Formerly Senior Lecturer in Chemistry
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This year marks the swansong of this short paper since split units are no longer permitted in the new specifications. The aim of the paper has been to attempt to encourage an integration of theory and practical aspects of chemistry to the benefit of both, particularly so that candidates have some understanding of what they are doing in coursework and do not follow the instructions blindly. Not surprisingly, success has been only partial since the aim is a difficult one but it is felt that the exercise has been well worthwhile. Questions relating theory to practice will continue to appear in the theory papers.

The most intractable area has been in that of titrations and stoichiometry where a real understanding of the amount of substance concept is difficult to acquire and, coupled with the algebraic manipulation required, proves too much for many under exam conditions. This contrasts with the identical operations in experiments 1 and 2, that given the time and guidance by the instruction sheets, are usually carried out correctly.

This year's paper reflected the three coursework themes of kinetics, thermochemistry and titrations and generally produced very satisfactory results.

Q.1 Candidates are usually well-trained in this area and produce good marks.

- (a) (i) There were few plotting errors, good scales were chosen but with some inversion of axes.
- (ii) Some lines were less than good; either a straight line or good curve is acceptable but the minimum requirement is that any line should pass through the origin and the first two points.
- (iii) Usually correct with two significant figures being needed for full marks and with occasional wayward units.

(b)&(c) Either a sampling and titration or a continuous colorimetric method fill the bill in (b) as does measuring rates at different iodide concentrations while all else remains the same.

(c). There was often a lack of clarity and general vagueness in the answers here.

(d) Almost invariably correct.

Q.2 (a) This year, perhaps for the first time, there was a surprising number of incorrect answers involving Bunsen burners, ice and the preparation of copper, suggesting that memory of GCSE experiments had displaced a thermochemistry experiment which surely all had carried out.

- (b) (i) Generally good with errors including failure to draw the lines, recording $T(\text{max})$ and not ΔT , extrapolating to zero time and not to the point of mixing. It must be admitted that extrapolating back using real data requires a certain amount of judgement and marking was therefore lenient.
- (ii) This was usually good and was marked consequentially on the candidate's value from (i). Errors involved incorrect sign and units. Interestingly, one candidate used a mass of 50.65g, i.e., including the zinc, which is totally logical, although incorrect. We always gloss over this point and the fact that the heat capacity of the salt solutions may not be exactly the same as that of water. However, errors are likely to be small with the heat capacity of zinc being around 20% of that of water. We gave the candidate the mark.
- (c) Usually correct but it is essential to state that the rate will be increased and not talk only about increased surface area or more collisions. This is an important point in all answers where the examiner sometimes feels that the candidate knows something but has only implied it and not spelled it out. The teacher's advice to the candidate must be "spell it out, leave no stone unturned, the examiner is an idiot"!

Q.3 Unsurprisingly, and as usual, this proved to be the most difficult question for the candidates who are often weak on calculations involving concentrations. However, many candidates obtained full marks or nearly so.

- (a) (i)&(ii) While probably a majority was successful in part (i), part (ii) proved to be a strong discriminator between those who understood what was going on and those who did not. All the information was provided so it came down to the AOs of understanding, application and calculation, which is the basic specification of the CH3a paper.
- (ii) was tackled in two ways;
 (A) mols HCl = $1.00 \times 22/1000 = 0.022$, mols for carbonate = 0.008;
 carbonate equivalent = 0.004 in 25 cm^3 , so carbonate concn = $0.004 \times 1000/25 = 0.16$
 (B) vol. HCl needed for carbonate = $22 - 14 = 8$ and 1 carbonate need 2 HCl so concn carbonate in the $25 \text{ cm}^3 = 1.00 \times (8/2)/25 = 0.16$.

(a)&(c) Usually correct.

- (b) The obvious way here was to follow equation (A) and weigh the carbonate; many added acid and measured the CO_2 evolved which was accepted.

Conclusion

We now say farewell to paper CH3a, wishing it a happy, if non-pensionable, retirement in the knowledge of a job fairly well done.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Subsidiary

Paper CH3b/c

Chief Examiner: P. G. Blake, B.Sc., D. Phil., Formerly Senior Lecturer in Chemistry
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This marks the final year of the current AS coursework system. The main changes in the Unit 3 coursework for next year and onwards are that each of the two pieces of work will be marked out of 30 rather than 50, that there will be small mark components in each exercise for questions relating to Assessment Objectives 1 and 2 and that one experiment can be chosen from any two of the areas thermochemistry, kinetics and titrations.

The main framework of each piece of work remains the same, with sections on Planning, Implementation, Analysis and Evaluation and much of the implementation sections being similar to the current ones. Consequently, most of the comments below about the operation of the 2008 run will be relevant in 2009.

Inevitably, much of what follows has been said before as each new cohort of students passes through but procedures that have been adversely commented upon still arise in a few centres, standing out against a background of generally high quality work.

General Problems

Paper clips are still falling off, coursework in paper packets arrives in tatters, old or a mixture of old and new pro formas are still being used and some teacher result sheets are incomplete or have manifest errors. Rough work and instruction sheets are sometimes incorrectly included and pages of the pro forma or graphs occasionally omitted. Candidates should be told to check this very carefully. Very seriously, some of the solids being used in the thermochemical experiments are not what they purport to be, giving $\Delta T/g$ values widely different from those given by pure, dry solids and being apparently damp or possibly even inhomogeneous. When an error of one degree can make a difference of 10 marks it is disturbing to think that the grade and possibly future progress of a student can be compromised by this unprofessional approach to the preparation of coursework.

However, these problems in a few centres must be set against the vast majority in which both the preparation for and presentation of the coursework is excellent.

General Comments on the sections

Planning

There is always a mark for an initial statement of the aim of the exercise that is often omitted, the plan should be a succinct statement of what is to be done that could be carried out by an experienced operator so that long descriptions of basic apparatus, etc., are unnecessary. There is no need for a separate results table in the plan; the mark is given on the results table.

Implementation and Analysis

These are dealt with individually

Evaluation

This is perhaps the most difficult section at AS but there is a definite improvement with significant figures gradually replacing decimal points, reasonable error estimates (which are all guesstimates anyway) and increasing ability to connect the percentage error to the number of significant figures that it is sensible to quote. Marking is based on the statement in Circular 67 in that half a mark is awarded for avoiding an excessive number of figures **in the final result** and one or one-half marks for avoiding excessive truncation depending on the severity. These apply once only per section. Normally three significant figures would be reasonable, i.e., at the 1% error level and four would be acceptable.

Individual Experiments

Expts 1A, 1B and 2

Generally good results; most candidates can titrate accurately, a few cannot and the marks reflect this. Marks were lost through preparing inadequate tables that did not have rows for final reading, initial reading and difference, for not reading the burette to 0.05 cm^3 and for writing 0 for the starting volume and not 0.00. Calculations were usually good with a few inversions of concentrations (check: if more A is needed than B then A has the lower concentration) and loss through significant figures or units.

Expts 3 and 4

The comments above on solid purity are the most important and typical good $\Delta T/g$ values are restated;

Mg 95+; MgO 15+; MgCO_3 2.5+; Na_2CO_3 2.7; NaHCO_3 -3.0;

Comments in Circular 67 clearly need to be repeated in a few cases in that a three-place balance is essential if 0.1g of Mg is to be weighed and that expt 4 must not be used if only 0.5° thermometers are available. Low ΔT values here are penalised.

Last year's comments about the graphical aspects are worth repeating.

Extrapolation can cause difficulties; these are reduced if insulation is good and mixing rapid when the extrapolated maximum should not be very different from the temperature reached fairly soon after mixing. Extrapolation must of course be back to the time of mixing and not to $t = 0$.

There is still some confusion over signs in two respects: first some candidates state that ΔT is negative if the temperature rises. All scientific measurements are final value minus initial value so that if the temperature rises $T(\text{final}) > T(\text{initial})$ and ΔT is positive. Secondly, and more understandably, candidates go wrong in relating the signs of ΔT and ΔH as required in the evaluation. All that is needed is to say that if ΔT is positive then ΔH is negative. Use of the words exothermic and endothermic appears only to confuse matters. The full understanding is subtle and not of course needed. What is happening is that the system of e.g., magnesium species and acid are reacting and losing energy to the surrounding liquid which heats up so that ΔH for the Mg system is negative while ΔT is positive for the surroundings.

Candidates should be very careful in measuring ΔT from their graphs; there are not infrequent errors that the examiners correct if they find them, but responsibility lies with the candidate.

Finally, full use should be made of the graph paper, not starting from $T = 0$, weighing masses within the range given and recording the masses to the precision of the balance. Even more finally, bomb calorimeters are not quite the thing for acid-base thermochemistry!

Expts 5 and 6

Results were usually good, with marks being lost through poor significant figures (5 cm^3 instead of 5.0 cm^3 , $1/t = 0.03$ when $t = 27\text{s}$ instead of 0.037 - this gives a crazy graph), unlabelled and inverted axes, untitled graphs, failure to use all the graph paper, too narrow a concentration range and not plotting four points on each graph in expt 6. A5 is worth its own sentence; candidates must state that the graphs show that the rate is directly proportional to the concentration. Statements including "1/time" and "volume" while strictly correct are incomplete and statements such as "rate increases with" are too vague.

Thus we say farewell to these old and faithful friends in the knowledge that we shall see them again in a slightly different reincarnation next year. This has been an excellent final year for CH3c and both candidates and teachers are to be congratulated on their efforts.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Level

Paper CH4

Chief Examiner: M.E. Anthoney, Ph.D.

General Comments

876 candidates sat this paper, of whom 89 sat through the medium of Welsh. The mean mark was 35.5, compared to 38.7 in June 2007 and 35.8 in June 2006, with standard deviation 14.0. The highest mark was 71 (maximum 75) and one candidate achieved zero marks. 52% of the candidates were resitting the paper.

It was pleasing to see many high scores on Q4 which required candidates to apply their knowledge and interpret data in a series of logical steps, but disappointing that several questions, Q2 in particular, revealed widespread weaknesses in the handling and drawing of basic organic structures. The recall of reagents and conditions for standard organic conversions was another area of significant weakness as shown in Q2b and d, Q4b and Q5d.

There was no evidence of candidates having insufficient time to attempt all the questions. Whilst some questions, particularly Q2 and parts of Q5, were challenging and discriminating, nearly all candidates were able to attempt most questions and there were no dead marks.

Detailed Comments

Section A

- Q.1 (a) Most candidates correctly identified carboxylic acid and amine functional groups, but amide was only given by a minority. "Carbonyl" was a frequent incorrect answer (C=O is not a functional group in its own right but a component of several groups such as aldehyde, ketone, carboxylic acid, amide or ester).
- (b) Again, answered correctly by a majority of candidates, though there were a lot of geometric/cis-trans answers and several quoting functional group isomerism.
- (c) Very poorly answered, with few correct answers. Many candidates who had correctly identified carboxylic acid and amine in (a) missed the bonding implications of an aminoacid. Instead, incorrect arguments based on hydrogen bonding abounded. Also, only rarely was the relation between high melting temperature and the high energy needed to overcome strong bonding mentioned.
- (d) A reasonable number of candidates gave the carboxylate ion formed from the carboxylic acid, but only the very best candidates considered the hydrolysis of the amide group as well.

- (e) (i) Generally well answered. Some candidates lost marks by only considering one of the two compounds and failing to specify a negative result for the other.
- (ii) A mixed bag of answers with many achieving full marks but also many giving electrophilic or nucleophilic addition and the repeating unit for the polymer was all too often shown with three carbons or a nitrogen in the chain.
- Q.2 As mentioned in the introduction, this question was poorly answered, demonstrating a lack of ability to handle basic organic structures.
- (a) Despite the strong guidance given by the examples provided, secondary and tertiary alcohol structures were commonly drawn. Worryingly, this included a significant number of candidates who correctly wrote on the script that **B** must be a primary alcohol because it oxidised to a carboxylic acid but then drew secondary or tertiary structures!
- (b) (i) Many correct answers, but some candidates failed to specify *concentrated* sulphuric acid as the dehydrating agent and LiAlH_4 was quoted too often for comfort!
- (ii) A disappointing number of correct structures were seen. The “branched alkenes” were often not branched - just drawn with a bend in the chain. Some candidates showed the alcohol or even a bromo derivative, but perhaps worst of all, a significant number of candidates believed cis and trans pent-2-enes were branched alkenes.
- (c) This question revealed a widespread inability to follow through a series of reactions. In particular, very few students appreciated that (apart from cracking, decarboxylation and cyanide addition/ substitution) the carbon skeleton remains constant in all ‘A’ level organic reactions. Many candidates gave answers where the chain length for **A**, **B** and **C** varied and the presence / position of branches was almost random.
- (d) Most candidates recognised the ester group. Conditions for esterification were well known, but marks were often lost by not specifying ethanoic acid as the carboxylic acid needed in this case.
- Q.3 (a) All three parts of this question were well answered, though some candidates failed to show two functional groups on each reactant molecule in part (iii).
- (b) Knowledge of ethanoylation seems to have slowly improved over recent years.
- (c) (i) Although questions similar to this have been set regularly, there is no sign of an improvement in candidates’ ability to answer them. As usual, candidates’ ideas on the quantisation of energy were often vague and ill-defined, and not many referred to light being *emitted*.
- (ii) There was evidence of a lot of guesswork in allocating red and violet to the spectrum.
- (iii) Surprisingly poorly answered. Most candidates seemed to have little understanding of a transition between *two* energy levels, with answers such as 1s or $n = \infty$ being all too common.

Section B

Q.4 Candidates responded well to this question and many really excellent answers were received.

- (a) (i) The carboxylic group in **P** was almost universally identified correctly. A majority also identified **Q** as a methylketone, though some stopped at “carbonyl” and a few confused the tests for aldehyde and ketone.
- (ii) Most answers were correct, though a significant minority insisted on summing the individual peak values to try and get relative molecular mass.
- (iii) Many good answers, though with a suspicion that some candidates guessed the answers and then worked backwards.
- (b) (i) Most candidates looked up the shift values correctly from the data sheet, though some confused R-CH₃ with CH₃CO-. The splitting patterns were much less well forecast, with only the strongest candidates gaining full marks. A few gave IR results or mass spectrum peaks.
- (ii) One mark out of two was the most common result for this question, reflecting many imprecise or vague answers; candidates showed a level of understanding, but not sufficient to gain full credit.
- (iii) Generally the standard of recall for important organic reagents and conditions was disappointing.

Q.5 Although there were a number of excellent scripts from the more able candidates, this question proved much more demanding than Q4 for the weaker students.

- (a) Though full marks were few and far between, most candidates scored well on the structure and bonding of benzene. It was disturbing, though, to still see some answers centred on the Kekule structure.
- (b) (i) Students now seem more at ease (or well-drilled?) with energy cycle calculations, and, despite the complexity of the numbers involved, there was a pleasing number of correct answers.
- (iii) In contrast to the previous question, both the explanation and calculation of the benzene delocalisation energy were poorly answered by most candidates.
- (c) Most candidates were reasonably well versed in the mechanism for the nitration of benzene, though the usual errors, such as having arrows in the wrong direction or the omission of charges, were still present sporadically.
- (d) (i) As in question 4b(iii), organic reagents and conditions had been very inadequately learned.
- (ii) Iron(III) chloride turning purple provided a nice two mark finale for nearly all candidates. The alternative bromination test for phenols was rarely quoted.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Level

Paper CH5

Chief Examiner: E.W. Charles, B.Sc.
Assistant Headteacher, Ysgol Gyfun Gartholwg

General Comments

There was a good spread of marks. Many good scripts and only a few very poor scripts were seen, with twice as many candidates obtaining over 80% as obtained under 20%. Sections A and B were both answered equally well. However, as was the case in last year's examination, a number of candidates lacked a basic knowledge of observations and trends in inorganic chemistry and the explanations for these.

The calculations, e.g., Q.3(c) (pH of a buffer solution), Q.4(b)(ii) (Born-Haber cycle) were well done, with only Q.2(c)(ii) (redox titration), which required some degree of manipulation, causing any major problems. There continued to be an improvement in the use of significant figures.

Although several candidates gave good answers, the quality of written communication was slightly disappointing on the whole and many candidates had difficulty in expressing chemical ideas and principles when required to write extended answers, e.g., Q.3(e) (buffer solutions) and Q.5(a) (Group IV chemistry).

The ability to write equations and simple chemical formulae again proved to be too demanding for many candidates. It is apparent that many have made little progress in understanding from GCSE level.

Papur Arholiad Cymraeg

Braf oedd gweld y nifer o bapurau cyfrwng Cymraeg eleni, a gwelwyd iaith raenus yn y mwyafrif. Yn anffodus roedd ambell ymgeisydd yn dangos diffyg hyder yn eu defnydd o dermeg Cymraeg, a gwelwyd defnydd o dermeg Saesneg yn eu hatebion hwy. Roedd hwn yn fwy amlwg ar gyfer termau o fywyd bob dydd, gydag atebion fel 'weedkiller' yn lle chwynladdwr fel ateb cywir i cwestiwn 2(b) a 'global warming' fel ateb anghywir i cwestiwn 1 (a) (iv). Yn ogystal gwelwyd amryw o wahanol ddulliau ar gyfer sillafu rai termau cyffredin fel cancr, starts a diemwnt, ac ar adegau roedd y camsillafu yn ei wneud yn galed i ddehongli os taw'r gair Cymraeg neu'r un Saesneg oedd yn cael ei ddefnyddio!

Ni welwyd unrhyw wahaniaeth sylweddol yn safon yr atebion rhwng ymgeiswyr cyfrwng Cymraeg a Saesneg, ac mae'n amlwg nid oedd iaith y cwestiynau wedi achosi unrhyw problemau i'r ymgeiswyr. Gwelwyd nifer o atebion ardderchog yn yr atebion hirach yn adran B, gyda ddefnydd cywir o lawer o dermau cemegol ond gwelwyd yr un problem o ddiffyg manwl gywirdeb iaith yn y Gymraeg a'r Saesneg. Roedd hwn yn amlwg yn enwedig yn y defnydd o'r term 'moleciwl' yn lle 'atom', ac 'atom' yn lle 'ion' ac mae rhai yn dal i gollu marciau yn ddiangen trwy gamddefnyddio'r termau hyn.

Section A

- Q.1 (a) (i) A fair start to the paper, with around two thirds of the candidates giving the correct expression. The most common error was to write $[2O_3]$ instead of $[O_3]$. However, the explanation of the order was not so well expressed, e.g., 'Order of reaction is the value obtained when the concentration of one reactant is changed, so for second order if concentration is doubled, rate is quadrupled.' Another error was omitting reference to concentration altogether.
- (ii) The calculation for the rate of reaction was well answered but the majority gave ' $\text{mol}^{-1} \text{dm}^3 \text{s}^{-1}$ ' as the unit, confusing it with the unit for the rate constant of a second order reaction.
- (iii) Well answered with over half the candidates obtaining both marks and the vast majority gaining at least one mark. Those who lost a mark generally stated a lower activation energy without reference to a different route.
- (iv) Fairly well answered, but too many gave global warming as an answer.
- (b) (i) Part I. was one of the best answered questions on the entire paper. Part II. was not so good. Many failed to calculate the gradients and a significant number confused rate with time, incorrectly stating that as concentration halved, time doubled.
- (ii) The half-life calculation was very well done, with about four fifths successful. However, surprisingly, part II. was poorly answered. Only around 3 in 10 candidates could write an equation for the radioactive decay of ^{14}C . If this question had been set on a CH1 paper there would have been far more correct answers. Candidates must be aware of the synoptic element in the CH5 paper.
- Q.2 (a) (i) Poorly answered. Despite being specifically stated in the specification, *topic 18.5*, and half the equation being given, less than 3 in 10 candidates could complete it.
- (ii) The half equation for the reduction of chlorine was fairly well done. Part II. easily proved to be the hardest part of the paper despite the formulae of the reactants and products being given. Although the question asked for a half equation, most candidates did not include electrons on the right hand side. Consequentially part III. was also very poorly answered.
- (iii) This was the best answered section in part (a). However, part I. was still poorly answered, with just under a half getting one oxidation change correct and only about 1 in 10 giving the correct change in oxidation number for sulphur in both equations. Part II. was marked independently of part I. and about half the candidates gave a correct explanation in terms of oxidation number or electron loss.
- (b) Most candidates could successfully give a large scale use of both sodium chloride and sodium chlorate(V).

- (c) (i) Poorly done. Only just over a quarter of candidates knew that starch was the indicator for this reaction. A random selection of acid-base indicators was given, with phenolphthalein being the most common incorrect answer.
- (ii) This was the trickiest calculation on the paper but over a third got at least 3 marks out of 4. The main errors were made in the stoichiometric ratio and dilution factor.
- (d) Very well answered, with many candidates obtaining both marks. However, a significant number heated the aqueous solution with sodium hydroxide (not penalised if acid added) prior to the addition of silver nitrate, which suggested confusion with the detection of halogens in halogenoalkanes.
- Q.3 (a) Extremely well answered, only a handful of candidates giving round brackets or gave a + sign between the ions.
- (b) Very well answered and most stated that $\text{pH} = -\log[\text{H}^+]$.
- (c) This pH calculation was well done and over half obtained all 3 marks. The most common mistake was to set $[\text{H}^+] = [\text{HCO}_3^-]$.
- (d) The vast majority could state the purpose of a buffer solution.
- (e) Only a minority could score the full 3 marks on this part. Correctly written equations were scarce, with the dissociation of sodium ethanoate often given as an equilibrium. The use of the vernacular was evident, with phrases such as 'mops up' being common. Imprecise terminology, such as "sodium ethanoate removes H^+ ", was also frequently used.

Section B

- Q.4 The best answered question on the whole paper.
- (a) (i) A good start to the section, with over half the candidates gaining both marks and a further quarter gaining one mark. The mark was usually lost because candidates thought that the electron was lost from the 3d orbital.
- (ii) It was pleasing to see many excellent answers. The vast majority of candidates knew both the shape and colour of the complexes. In part II., the vast majority knew that the bonding in the complexes was co-ordinate.
- (b) (i) Poorly answered. A lack of precision in the definition was the main reason for losing the mark. Many answers included phrases such as 'energy required' instead of energy change and 'a compound' instead of 1 mole of compound.
- (ii) The Born-Haber calculation was very well answered with over two thirds getting at least 3 out of 4. The main error was a failure to double the values for ΔH_{at} and E.A. for fluorine.
- (c) (i) Although the candidates were asked to name a solution, most gave H^+ which was accepted, so about two thirds of the candidates obtained this mark.
- (ii) Surprisingly poorly answered and only around 1 in 3 gave platinum as the electrode most gave iron.

- (iii) Almost all the candidates could identify the missing component as a salt bridge but its purpose was not so well described.
 - (iv) Despite most candidates knowing which way the electrons flowed along the wire, the reason given for the direction of the flow was often inadequate.
 - (v) Well answered.
- (d) Once again, imprecise descriptions caused a loss of marks. While over half the candidates gave a correct reason in terms of standard electrode potentials, a significant number gave 'iodine' as the reducing agent instead of 'iodide' and so lost a mark.
- Q.5 (a) This part required the candidates to write fluently about some of the chemistry of Group IV as stated in the specification, *topic 20.1.1*. Only the better candidates scored high marks in this part, with over 3 in 5 obtaining less than half marks. The poverty of language and lack of knowledge of many candidates were only too evident. A significant minority failed to get even one mark. After studying A' level for two years, these candidates could not even state that diamond is a giant covalent structure and that lead contains metallic bonding. Many candidates failed to give a full description of the bonding in lead, only referring loosely to a sea of electrons or even worse, thought that it exhibited ionic bonding. Some even confused lead with graphite, probably because 'lead' is found in pencils! Candidates should be advised to learn thoroughly those topics in the specifications that require no more than simple recall. Many more should have gained at least three marks in this question.
- (b) The majority of candidates knew the trend in stability and many were able to quote the reason due to the inert pair effect. However, suitable examples were thin on the ground.
 - (c) Very well answered. The vast majority could explain why the reactivity of Group I metals increases as the group is descended.
 - (d) There was a general lack of appreciation of what constitutes a description of an observation – an equation or naming products was not required. Also a numerical value for the pH was not always predicted.
 - (e) The trend in the bonding of chlorides was well known.
 - (f) Poorly answered. Only about 1 in 4 scored 3 or more out of 5. Many obtained a mark for stating that, after adding NaCl to water, the pH of the solution is 7 but the majority thought that HCl and NaOH formed and these two "cancelled each other out". The equation for PCl_3 and water was equally very poorly answered and as in part (d), a significant number did not give a value to the pH simply stating neutral for NaCl or acidic for PCl_3 . The explanation mark proved very elusive and only a minority of candidates stated that ionic chlorides generally dissolve in water, covalent chlorides react with water.
 - (g) Fewer than 4 in 10 could name an acidic oxide. Many candidates gave lithium oxide or magnesium oxide as their answer. Fewer than half could go on to give a correct formula for the reaction of the oxide with sodium hydroxide.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Subsidiary

Paper CH6a

Chief Examiner: D.H.Ballard, B.Sc., Ph.D., C.Chem., F.R.S.C.
Senior Lecturer in Science Education, Nottingham Trent University

General Comments

This is a synoptic paper in which questions are designed to reflect the whole of the specification.

The response by the candidates was very varied with some candidates scoring only in single figures, which contrasted with a number of excellent scripts where candidates scored 40 or more.

This paper attempted to explore as much of the specification as possible but of necessity some topics cannot be covered in a paper of only 50 marks.

The calculations were generally done quite well but some answers were seen where the answer must be clearly incorrect but little attempt had been made to try and remedy this situation.

A continuing weak area is in responses to simple qualitative inorganic chemistry. The examiners wondered sometimes whether the action of heat upon nitrates of Groups 1 and 2 was included in the specification, such was the poor standard of answers seen.

Question 4 (b) (ii), which required candidates to comment on the hydrogen / iodine / hydrogen iodide equilibrium, was often poorly done. There was scope here for a little extended writing but many of the answers were not well organised and expressed in a confusing way.

Section A

- Q.1 (a) (i) This question was about alpha emission from an isotope of polonium. Incorrect answers were seen in a surprising number of papers. The examiners wonder whether this is a case of 'modular mentality' – since radioactivity is in CH1, and often studied at the beginning of the course and then not revisited, until now!
- (ii) This half life calculation was generally done correctly, unlike (i).
- (b) (i) The question asked candidates to describe what is seen when sodium nitrate and hydrated calcium nitrate are heated and to name the products other than oxygen. It was uncommon to award full marks even though the mark scheme allowed for more answers than the maximum of four marks. Flame colours were often (incorrectly) given and many described seeing oxygen as a colourless gas. Few mentioned melting, bubbling or condensation as appropriate. The examiners felt that a number of candidates had not seen or performed these reactions. In some cases, sodium and calcium metals together with nitrogen gas were described as being produced.

- (ii) Most knew that this was a radical reaction but fewer described how the radicals were formed. The second part of this question was poorly answered, with many candidates referring to the bond strength of the compounds themselves instead of the individual bond strengths. Some used the strengths of the F – F and Cl – Cl bonds in their answer.
- (iii) Although many excellent, clearly worked answer were seen, it was obvious that a number of candidates cannot use molar volumes correctly. Candidates should ask themselves whether an alkene is likely to have many hundred (or greater) carbon to carbon double bonds present in each molecule of alkene. The correct answer was 3 – from a simple 3:1 molar ratio.

Section B

- Q.2
- (a) The examiners noted that the concept of oxidation state was well known. A few candidates used 4+ instead of +4 and a few believed that the oxidation state of chlorine had changed.
 - (b)
 - (i) Far too many candidates forgot to empty the 4s orbitals first when deducing the electronic configuration of the Ti^{3+} ion.
 - (ii) This was often answered well, although few candidates gained the full three marks. Many forgot to say that splitting was caused by the ligands. There were fewer candidates this time who thought that light was emitted. Perhaps candidates should read their answers and consider if they have omitted any essential steps.
 - (c) This did not prove to be as easy as the examiners thought. Many candidates gave green to orange, or colourless to purple. A few candidates still considered 'clear' to be a colour.
 - (d) Nearly all candidates stated that titanium(IV) chloride was tetrahedral but many did not explain the reasons for this.
 - (e) The question clearly stated that a homogeneous catalyst system was required but many candidates simply referred to iron in the Haber process or vanadium(V) oxide in the Contact process, which are heterogeneous systems. The commonest acceptable answer was sulphuric acid in esterification.
 - (f) Many correct answers were seen but incorrect balancing also occurred and also equations that gave chlorine as a product.
 - (g) Almost all candidates gained the correct answer from the graph but many could not then handle the dilution factor, giving them two out of the three marks allocated.
 - (h) This was an easy mark for nearly all candidates. A few referred to lead(II) iodide as a yellow solution.

Section C

- Q.3 (a) (i) Nearly all candidates gave bromine as the reagent and most knew that it went colourless. There were some who maintained that there was no colour change or that it went clear.
- (ii) Virtually every candidate correctly identified the chiral centre in octan-2-ol. Not every candidate then went on to state that in a racemic mixture there are equal 'amounts' of each of the enantiomers and there would be no net change on the position of the plane of polarised light.
- (b) Although most candidates correctly stated a meaning for the word 'amphoteric', it was rare to see both equations correct. Many incorrect formulae, for example, AlO , Al(OH)_2 and PbNO_3 were seen.
- (c) (i) Many candidates knew that diazotisation required a lower temperature but fewer gained full marks for stating that an alkaline solution of a phenol was used for coupling to the diazonium ion / salt.
- (ii) The test for a phenol was well known, with most using iron(III) chloride. A few used bromine water, which was acceptable, although the observation was not always correct.
- (d) Another well answered question with most candidates explaining the inverse relationship between frequency and wavelength. Some candidates stated that frequency = 1/wavelength.
- Q.4 (a) The responses to this question, were often weak. It is the reducing power of hydrogen iodide / iodide ion which enables sulphur dioxide and hydrogen sulphide to be formed. This was not often stated. A frequent answer was to state that iodine itself is a reducing agent in this reaction.
- (b) (i) The expression for K_c was usually correct. Some candidates did not state that the equilibrium constant had no units and were content to leave the unit line blank or put a line through it. This was deemed insufficient for a mark.
- (ii) The best answers were from those candidates who tackled the question logically, describing the change in concentration and rate of the reactant and then of the products, finishing off with the position at equilibrium. The question pointed out the features that the candidates should include in their answers but this was not always done and, even if it was, it was presented in a haphazard way. Some good answers were seen but the number gaining four or more marks (out of six) were relatively few. The haphazard nature of the answers given often made marking difficult.
- (c) This was a straightforward Hess's Law calculation and it was surprising that some candidates still provided any permutation of the given values except the correct one.
- (d) Only the stronger candidates realised that in ethane all the protons are in an equivalent environment. As a result, the proton NMR spectrum will show only a single peak, even at high resolution. Many scripts were seen where candidates described the spectrum as two quartets.

Adroddiad CH6a 2008

Roedd safon y Gymraeg ysgrifenedig yn dda ac nid oedd tystiolaeth o unrhyw ddryswch oherwydd y termau Cymraeg. Roedd y cryfderau a'r diffygion yn y papurau cyfrwng Cymraeg oedd yn debyg iawn i'r papurau cyfrwng Saesneg. Braff oedd gweld, ar y cyfan, safon dda mewn atebion mathemategol ac ysgrifennu hafaliadau.

Cafodd ymgeiswyr ychydig o anhawster gyda rhannau o'r cwestiwn cyntaf ac roedd yn amlwg bod rhai ymgeiswyr heb weld 'gwresogi'r nitradau' mewn gwersi ymarferol. Methodd rhai ymgeiswyr â chyfeirio at ofynion y cwestiwn e.e. cymharu 'egnon bond' yn 1.b) (ii) II.

Dangoswyd dealltwriaeth dda o gynnwys y darn 'Titaniwm' yn yr atebion, gyda llawer o eglurhad trylwyr o liw yr ïon cymhlyg ond roedd rhai ymgeiswyr yn dal i gymysgu 'trawsyrru gydag allyrru'. Prin oedd yr ymgeiswyr yn gallu enwi enghraifft o gatalydd homogenaidd, yr ateb mwyaf poblogaidd anghywir oedd 'y broses gyffwrdd'!

Yn gyffredinol atebwyd y cwestiwn 'organig' yn dda. Roedd rhan (b) (ii) yn y cwestiwn olaf a oedd yn gysylltiedig â'r graff 'newid yn y crynodiadau' wedi ei osod ychydig yn wahanol, ond llwyddodd ymgeiswyr oedd wedi dilyn y 'canllawiau' yn y cwestiwn i ennill marciau uwch.

Nid oes tystiolaeth na chafodd yr ymgeiswyr ddigon o amser i gwblhau'r papur.

CHEMISTRY

General Certificate of Education Summer 2008

Advanced Level

Paper CH6b/c

Chief Examiner: P. G. Blake, B.Sc., D. Phil., Formerly Senior Lecturer in Chemistry
University of Wales College of Cardiff.

The 2008 run of the A2 coursework appears to have proceeded smoothly without any serious problems and with much high quality work by the candidates. This is of course the penultimate year of this specific form of the coursework but it is felt that the changes required for the new unit 6 in 2010 will not be too disruptive. Probably the reduction in the large component of synoptic questions in some of the exercises will not be mourned.

General Comments

Once again the most popular exercises were I1, I3, O1 and O3 with I4, I5, O2 and O5 also being used.

Teacher result sheets were generally satisfactory and the work of the candidates was well-presented. Although it is more tricky for both the teacher and examiner if different candidates have different sets of unknowns in the problem experiments it is better for the integrity of the process that this is so. One compromise is for there to be, say, three different sets of compounds with the candidates not knowing which set they are in.

The fact that the quantitative inorganic experiments require at least three-place balances as written does not now need to be a serious limitation, although one centre this year attempted I2 with a two-place balance which was not a good idea.

Few cases of oxidation numbers being written as ionic charges (i.e., 2+) were seen but equation balancing as in O1 was sometimes poor. There is no penalty for balanced equations that are not cancelled out but the result does look untidy.

Minor marks were sometimes lost by not writing data to the full number of significant figures and specifically by not writing burette readings to 0.05 cm³ (see Circular 67).

Also with reference to this circular, poor organic yields are still occasionally encountered, probably owing to the use of excessive amounts of solvent during recrystallisation.

Individual Experiments

I1 This excellent experiment is quite popular and usually gives very good results. There is a tighter titration tolerance for the first, simpler, titration but high marks are normally obtained for both titrations. In Q1 the stability of the salt against both atmospheric oxidation (compared to other Fe(II) salts) and loss of water make it suitable. In Q2 the colour should be mentioned and the removal of water and volatility are the keys in Q3. In Q6, the higher activation energy for the oxalate should be mentioned.

- I2 Usually gives good results; the anhydrous salt and monohydrate are available and the hexahydrate can be prepared. The main problem, because of temperature and supersaturation effects, is to ensure that the candidates and the teacher have solutions at exactly the same concentration.
- I3 Runs well but needs a realistic plan, clear statements of colours of precipitates and balanced equations for tests with positive outcomes. These are sometimes omitted by the candidate with a consequent substantial loss of marks and equations for reactions that do not take place are also penalised.
- I4 Few attempted this quite difficult exercise.
- I5 This usually worked well. Sometimes the composition of the product was in doubt and it is suggested, although not in the instruction sheet, that the initial product be recrystallised from water to ensure that it is pure. It is noted again that the A titration must be held at 70°, that especial care should be taken not to overshoot this because of the 5:1 stoichiometry and that the iodide should be added to part B immediately before titration in order to avoid Mn(II)-catalysed air oxidation.
- O1 Mostly the A route. Once again it should be noted that the procedure must be followed carefully and patiently if good yields are to result. Last year's comments on the questions are worth repeating. Balancing the equations in Q1 and Q3 has been referred to above, Q7 requires both a description and an explanation of the two tests, not merely their names and Test 4, which has attracted some justified criticism, gives a buff precipitate of Fe benzoate that is decomposed by acid to leave a white precipitate of benzoic acid.
- O2 Appeared to work well.
- O3 This popular experiment provides a good workout in organic chemistry and was usually carried out well. A realistic plan of operation is needed and not just a list of organic reactions. Observations and inferences should be fully recorded and balanced equations given for tests with positive outcomes which should be specific to the reaction and not R-based. The failure to give equations is a common source of loss of marks. Physical properties provide worthwhile confirmatory evidence but the chemical results are of prime importance. The main problem area usually lies in the amide/ester /nitrile region where care and patience are needed. One feels that when candidates have successfully completed O3 they have done something to be proud of.
- O5 This causes no particular problems. A modified version of the 1A experiment that can be carried out at room temperature without Quickfit will be available in the new specification.

Conclusion

A solid year's work with many high-standard performances.



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