WELSH JOINT EDUCATION COMMITTEE
CYD-BWYLLGOR ADDYSG CYMRU

General Certificate of Education | **Tystysgrif Addysg Gyffredinol**

EXAMINERS' REPORTS

JANUARY 2005

AS/Advanced Chemistry

WJEC
CBAC

Statistical Information

This booklet contains summary details for each unit: number entered; maximum mark available; mean mark achieved; grade ranges. *N.B. These refer to 'raw marks' used in the initial assessment, rather than to the uniform marks reported when results are issued.*

Annual Statistical Report

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

January 2005

Advanced Subsidiary/Advanced

Principal Examiner: E. Charles, B.Sc.
Assistant Head, Ysgol Rhydfelen

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	**Entry**	**Max Mark**	**Mean Mark**
CH1	1188	66	36.3

Grade Ranges

A	47
B	41
C	36
D	31
E	26

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

General Comments

For about two thirds of candidates, this was their first post 16 examination in Chemistry. It was felt that the paper gave plenty of opportunity for weaker candidates to show positive achievement. There was no evidence that the paper was too long, there were no dead marks and very few scripts contained blank pages.

The range of marks was again very wide, with 24 candidates scoring in single figures and 24 candidates gaining 60 or more out of 66. As with previous examination papers, the problem of candidates writing in pencil was evident on a number of occasions.

The standard of presentation of answers for many candidates was quite high and these papers were a pleasure to mark. However, as was the case in last year's report, for many candidates, answers that required detailed responses often lacked content in depth and were sometimes contradictory. This was particularly true in Question 10(a)(i) intermolecular bonding and Question 11(c) metallic bonding.

It was pleasing to note that most of the candidates performed very well in the calculation questions apart from Question 13(c), although attention to appropriate number of significant figures is still required for many. Also the use of chemical equations (Q8, 10b(ii)) and writing the formula of a compound (Q7), were better than in the past.

Atebion Cyfrwng Cymraeg

Safodd tua 10% o'r ymgeiswyr y papur trwy gyfrwng y Gymraeg. Roedd safon y Gymraeg yn uchel iawn gyda defnydd cywir o'r termau Cemegol, yn well nag yn y sgriptiau Saesneg hyd yn oed. Nid oedd iaith y cwestiynau wedi achosi unrhyw anhawster er efallai byddai 'adeiledd electronig' yn fwy adnabyddus na 'ffurfwedd electronig' yng nghwestiwn 9(a)(iii). Cafodd yr ymgeiswyr gwannaf fwy o drafferth gyda'r termau, ond fel yn y sgriptiau Saesneg diffyg gwybodaeth a dealltwriaeth oedd y rheswm am golli marciau.

Unit CH1

Section A

The candidates generally scored quite highly in this section, with the average mark being over 6 out of 10.

Q.1 Supposed to be an easy start and the vast majority of candidates managed to obtain at least a half mark but only about a quarter of the candidates obtained the full two marks. The main errors were stating that α-particles had 2 electrons and β-particles had –1 electron.

Q.2 Both parts were generally very well done, with about three quarters getting the marks. However, a wide range of answers was given in part (b).

Q.3 Only about a third gave the correct answer, **B**.

Q.4 Proved to be an easy question, with only a small number of candidates failing to answer correctly.

Q.5 Well answered; about two thirds answered correctly.

Q.6 Fairly well answered only. Despite 'chloride ion' being in bold, only about half the candidates gave the correct coordination number of 8. A significant number gave 8:8 as the answer and so lost a half mark.

Q.7 Well answered; about two thirds gave the correct formula.

Q.8 Fairly well answered only. About half the candidates gave the correct equation. The most common error was to give $Mg(OH)_2$ as a product instead of MgO.

Section B

Q.9 This was the most successfully answered question in this section.

(a) (i) Many excellent answers were seen, with about one in five gaining full marks. Generally, the sketch was well done, although a significant number thought that the ionisation energy decreased between the removal of the second and third electron. It was clear that some candidates saw the question as a periodic trend rather than the trend for a single atom. The main error in the explanation was to state that the nuclear charge increased with the removal of successive electrons instead of **the effective nuclear charge** increasing.

(ii) About two thirds of the candidates gave the correct value for the ionic radius. However, fewer obtained the explanation mark again, the main error being the mistaken belief that the decrease was due to an increase in nuclear charge.

(iii) Fairly well answered, with just over a half giving the correct ion configuration. Unfortunately, many candidates believed a fluoride ion to be positive, since they gave the configuration as $2p^4$.

(iv) Generally well answered. About two thirds obtained both marks and a significant number got one of the marks. However many candidates thought that electrons were shared in calcium fluoride, despite it stating in the question that it was ionic.

(b) (i) Most candidates knew how to do the calculation correctly, however, about a third mistakenly rounded the answer to 0.01 and so lost a half mark.

(ii) Same as for part (i) - many candidates lost a half mark for incorrectly giving the answer as 0.07.

(iii) About half the candidates correctly managed to use their answers to parts (i) and (ii) to give a value for **x**. Due to the errors in parts (i) and (ii) an answer of **x = 7** was not uncommon, but was not penalised either.

Q.10 This was the least successfully answered question in this section.

(a) (i) Although about a quarter of the candidates gained all three marks, over a third failed to score any mark. All too often, candidates failed to express themselves clearly or with enough precision, e.g. they failed to state that van der Waals forces are formed **between** molecules or were content to state that iodine was bigger than chlorine without mentioning anything about electrons.

(ii) The reasons for redox chemistry were a mystery to many, with fewer than a third of candidates obtaining both marks and about half failing to score any mark. Despite giving a correct equation (which was not asked for), many thought that chlorine lost electrons. Another common error was to state 'iodine' instead of **iodide** as the species that was oxidised.

(iii) I Generally well done, with about two thirds giving the correct observation, although the spelling of 'precipitate' was often incorrect.

II Disappointingly, only about half gave the correct description. Every candidate should have seen these two observations and they should be well known by all.

(b) (i) The vast majority managed to answer at least one answer correctly, but only a small number answered all four correctly. The formula of phosphorus oxide proved to be the most difficult to remember, while the natures of the oxides were best answered. However, one candidate must have thought that he was in a biology exam since he described aluminium oxide as being "amphibious"!

(ii) Generally very well done, with about three quarters giving the correct equation

(c) Easily the hardest section on the paper. All three parts were very poorly answered. Few students realised the connection between structure and melting points. Most thought that this was all about ionisation energies and went on to discuss the number of electrons in the outer shell as the reason for the difference in melting points e.g. "Na has only 1 electron in its outer shell Mg has 2. It is easier for Na to lose 1 electron than it is for Mg to lose 2."

Q.11 (a) (i) Surprisingly only just over half the candidates managed to give a correct explanation. The main errors were to state 'protons and electrons' instead of **protons** or to state 'in an element' instead of **in an atom**.

(ii) Very well answered. If candidates repeated the same error from (i), they were not penalised.

(b) Both parts, the mass spectrum and mass spectrometer, were well answered.

(c) This question about the bonding in a metal produced a wide range of answers. Many candidates managed to pick up one mark by mentioning 'sea of electrons' and a further mark by explaining how a metal conducts electricity. However, it proved more difficult to get another mark for describing metallic bonding and only the better candidates got the mark for explaining why a metal is malleable. Unfortunately, many answers were totally flawed and showed complete lack of knowledge, e.g. answers such as "magnesium has weak van der Waals bonding between molecules" and "magnesium forms ionic bonds in a giant structure and conducts electricity due to free ions" were only too common.

(d) Fairly well answered. About half the candidates scored both marks. Some candidates were able to get the right ratio, but not write the empirical formula correctly, while others did not have a clue, with one of the more bizarre answers being $Mg_{355}Cl_{526}O_{119}$.

(e) Generally well answered. A number of candidates got full marks and even the weakest candidates got one part correct, although it was clear that much guessing took place.
Part (v) was the most successfully answered, with over four in five candidates giving the correct answer. Part (iv) was the least successfully answered, with only about two in every five being correct. The commonest incorrect answer for part (iv) was Li.

Q.12 (a) (i) Disappointingly answered. Only about a third of the candidates gave the correct definition. Most failed to realise that electronegativity cannot be assessed until the atom is **covalently** bonded to another.

(ii) Extremely well answered. Most got all four polarities correct and almost every candidate got one correct.

(b) (i) Both parts were well answered, with about two thirds getting full marks.

(ii) While over four fifths of the candidates knew the shape of CH_4, just under two thirds knew the shape of H_2O and only just over a half knew the shape of NH_3.

(iii) Most candidates managed to obtain one mark for the shape of CO_2, and a significant number obtained another mark for the explanation of the shape of H_2O. However, far fewer could explain the significance of the different number of electron pairs/electron density regions around the central atom in CO_2 and H_2O.

(c) Very poorly answered. The most common incorrect answer was 1000 cm^3. Only about a quarter of the candidates correctly changed °C into Kelvin.

CHEMISTRY

General Certificate of Education

January 2005

Advanced Subsidiary/Advanced

Examiner: M. E. Anthoney, B.Sc., Ph.D

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
CH2	554	66	36.2

Grade Ranges

A	45
B	40
C	35
D	30
E	26

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

Unit CH2

General Comments

Over 98% of the candidates were resitting this module. Although there was a wide range of marks, as might be expected, there was a disproportionate number of weak candidates. The optimistic comment in the equivalent report for January 2004 regarding there being fewer poor papers than in recent examinations was not sustained this year. Very few candidates failed to complete the paper because of insufficient time.

The Organic Chemistry questions were reasonably well answered, suggesting that candidates may have benefited from extra work on the A level CH4 module since their first attempts at CH2.

The same could not be said of the Physical Chemistry questions, where the responses were of much lower quality. Many candidates lost marks due to ambiguous statements and inaccuracy arising from the careless use of terminology. More disappointing, however, was the frequent inability to recall basic definitions and explanations, particularly in the topics of equilibrium and acid-base chemistry. Such questions accounted for some 15% of the marks, and with sufficient revision should have provided a ready source of marks for weaker students.

Despite several similar comments in previous reports, many students continue to complete the examination paper in pencil.

Cyffredinol

Amrywiol oedd y safon ar y cyfan, gyda rhai sgriptiau da, llawer iawn yn ganolig a rhai gwael iawn.

Hoffwn dynnu sylw at lawysgrifen rhai myfyrwyr. Mae llawysgrifen o safon wael oherwydd fodd y geiriau'n amhosib i'w darllen.

Mae angen mwy o ofal gyda chromfachau sgwar a hefyd gydag unedau.

Dylid osgoi rhoi yr un ateb i ddau gwestiwn.

Section A

Q.1 Although a few candidates confused fractional distillation with cracking, there was a high proportion of correct answers.

Q.2 Most candidates gained the mark for this question, but again there was some confusion with cracking and far too many vague answers such as "important in industry" or "happens in burning oil" which gained no credit. Candidates could improve their marks by quickly checking their answers: surely those who described "the products of alkane combustion (CO_2 and H_2O) as useful fuels" knew the correct answer.

Q.3 Again the majority of answers were correct, but too many marks were lost due to incorrect formulae such as KC_2O_7 or $K_2Cr_2O_7^{2-}$.

Q.4 Many candidates arrived at the correct answer, A, by eliminating the other three possible responses. The most common mistake was to give response D as the answer.

Q.5 Vanadium (V) Oxide, V_2O_5, was well known. The answer "vanadium oxide" was not sufficient to identify the catalyst since there are several oxides of vanadium.

Q.6 It was pleasing to see the majority of candidates correctly identify statement D, suggesting the distinction between kinetic effects and equilibrium effects is becoming better known.

Q.7 Whilst the correct change of 90 kJ mol^{-1} was present in most answers, there was evidence that a significant number of candidates then simply guessed the sign for ΔH.

Q.8 Poorly answered, with a lot of blank spaces. Few students had made the effort to learn this definition. A common mistake was to include water, $[H_2O]$, in the expression for K_w. Although the units were marked consequentially when the expression for K_w was wrong, a general inability to handle indices led to very few correct answers.

Section B

Q.9 (a) The majority of answers were correct, with but-1-ene and but-2-ene accounting for most of the errors.

(b) This question was well answered. A few confused the reagents or tried to use gaseous bromine, but the most frustrating error was to equate "clear" with "colourless".

(c) (i) Again well answered, with marks lost only through silly errors, such as 2-bromopropane being given instead of 2-bromobutane.

(ii) Mention of the restricted rotation about the double bond was required to gain the mark. Many weaker candidates gave answers along the lines of "two different groups attached to each carbon".

(iii) Most candidates recognised the absence of a C=C bond in the product.

(iv) The addition mechanism was not drawn as well as expected, with relatively few candidates achieving full marks. Common errors included:

drawing the curly arrows, which should represent electron movement, in the wrong direction;

careless positioning of these arrows, so it was impossible to identify the source and destination of the electrons;

drawing the dipole as $H^{+} - Br^{-}$, omitting the δ.

It is suggested that students would benefit by practising writing out the mechanisms specified in the syllabus.

(v) The mechanism was usually identified as addition, but the attacking species caused some problems, with nucleophilic addition being the usual error.

(d) (i) Correctly answered by a majority of candidates, though the usual problems with signs were evident in a significant minority of answers.

(ii) Very few students achieved full marks in this question. Most problems arose from confusion between exothermic and endothermic or from a failure to appreciate that all three isomers must be included in the reasoning. Since the formation of trans-but-2-ene is exothermic from either of the other two isomers, it must be the most stable with the most negative ΔH^{o}_{f} value.

(iii) This was intended as a more difficult, discriminator question. In the light of this it was pleasing to find that a significant number of candidates recognised that geometric isomers contain the same numbers and types of bonds so that any calculation using average bond enthalpies to convert one geometric isomer to another must give a value of zero.

Q.10 (a) (i) A high proportion of candidates correctly read both values from the graph.

(ii) Candidates gained full marks by stating that concentration decreased with time, with the concentration halving every 280 minutes. Though not necessary to obtain full marks, some of the better candidates went on to mention the concept of half life. Credit was also given to those who recognised that, for the particular values used, doubling the time halved the concentration (though this is, of course, not generally true). Despite the graph clearly showing a non-linear relationship, a number of candidates claimed concentration was either directly or inversely proportional to time.

(iii) Though clear, neat curves were few and far between, most students gained some marks on this question. The most common mistake was to draw an exponentially increasing curve.

(b) Overlooking the instruction to state the trend in the rate of reaction with time, many weaker candidates launched into an imprecise description of Collision Theory. The connection between rate of reaction and the number of successful collisions per unit time was poorly understood.

(c) (i) Very few candidates gave both the effect on rate of reaction and the effect on position of equilibrium of using high temperature. Quite a number stated that "because the reaction is endothermic, heat is needed to start the reaction".

(ii) Not well answered. Even those who correctly applied Le Chatelier's Principle found it difficult to express their conclusions succinctly.

(iii) Surprisingly, many candidates failed to recognise this reaction as hydrogenation. Even more surprisingly, many more candidates gave nickel as the correct catalyst than gave the correct reagent as hydrogen.

(iv) Most students gained the mark for this question. The only significant errors were to leave in the double bond and to omit the chlorine.

Q.11 (a) (i) I Whilst the majority of students correctly gave proton donor as an answer, there were more incorrect answers than might be expected for such a fundamental question. The phrase "proton donator" was surprisingly common (but was allowed).

(i) II As with the previous question, there were more correct answers than incorrect ones, but not by a large margin. The explanation "a weak acid is one that does not *readily* donate its proton" is not acceptable since this implies a rate or energetic effect rather than an equilibrium one.

(ii) I A surprising number of candidates attempted to include OH^- ions in the equation, with disastrous consequences.

(ii) II Again a poor response, with water, $[H_2O]$, left in the expression, charges omitted from the ions, concentrations **added** instead of multiplied and round brackets used in place of the correct square brackets.

This completed a suite of four badly-answered but straightforward acid - base questions. One can only conclude that candidates had devoted insufficient time to learning this topic.

(b) (i) Few problems with this question. The link between K_a and acid strength was well understood.

(ii) Despite the good answers to (b)(i), few candidates could build on this to make the link between acid strength, H^+ concentration and pH.

(iii) Most candidates determined the empirical formula to be CHOCl, but many then failed to identify the chloro-acid. Chloromethanal was sometimes given as the unknown.

(iv) I Although most candidates calculated the acid concentration correctly, the presentation was often very poor, making it difficult to follow the individual steps. It was pleasing to find relatively few problems with significant figures.

(iv) II This question was marked consequentially for incorrect concentrations from (iv)I, but this proved of little benefit to candidates. Errors often arose from using the number of moles in the 25 cm^3 titration sample rather than the 1000 cm^3 sample specified.

(c) For a straightforward question, this was very badly answered. It was disturbing to find how many candidates associated the boiling process with the breaking of covalent bonds. Many others gave ambiguous answers, such as "increasing chain length means there are more bonds to be broken". Specific references to intermolecular bonding or van der Waals forces were rare.

Q.12 (a) (i) Another standard definition that was not well answered. Many candidates did not mention ***rate*** of reaction in their attempts.

(ii) Candidates were expected to apply the principle of dynamic equilibrium to the specific species in Reaction 1. However, a number of answers were couched in general terms. Needless to say, those who failed to explain dynamic equilibrium in the previous question fared no better here.

(iii) K_p was better known than dynamic equilibrium, but even so there were too many answers using square brackets, omitting the partial pressure symbol or **adding** partial pressures rather than multiplying them.

(iv) Since there were only two non-zero values involved, it was no surprise that the majority of candidates managed to calculate the correct value of 106.5 kJ mol^{-1} However, the sign for ΔH was more of a challenge.

(v) Most answers correctly gave 298 K (25 ^{o}C) temperature and 1atm (101 Pa) pressure as the relevant standard conditions, but there was a significant number giving 273 K or "atmospheric pressure".

(b) (i) This should have been an easy mark, but too many candidates failed to gain it because of imprecise phrases such as "free electrons", "lone electrons" or "unbonded electrons" instead of ***unpaired*** electrons.

(ii) Perhaps the worst answered question on the paper. Even some good students who, in the next part (c), correctly talked about Cl atoms acting as catalysts, in the breakdown of ozone, failed to recognise that as a catalyst, all the Cl species cancel out. Very few correct answers were seen.

(c) Nearly all candidates gave lengthy answers to this question, but sadly all too often the specified question on the role of CFCs in the depletion of the ozone layer was ignored in favour of a general discussion on atmospheric pollution including global warming, acid rain, etc. Even some good students could not resist including the greenhouse behaviour of CFCs in their answer. Hence a lot of material, some of it good chemistry, received no credit. It is a fundamental rule of examinations, which candidates should always remember, that once you stray from the question there are no marks to be gained.

CHEMISTRY

General Certificate of Education

January 2005

Advanced Subsidiary/Advanced

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

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
CH4	1042	75	41.3

Grade Ranges

A	55
B	48
C	41
D	35
E	29

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

Unit CH4

General Comments

This paper was mainly taken by candidates during the second year of their two year A level course.
Nearly all candidates were taking this module for the first time.

The range of marks gained by the candidates was again very wide, with twenty candidates scoring less than 10 out of 75. At the other end of the range, 3 candidates scored 70, in what is seen as a harder paper.

As has been common in recent papers, there were some questions that involved the application of organic principles to unfamiliar compounds. Although many candidates are now used to this type of question, others failed to realise that you should seek out the respective functional group and focus on how this reacts in the molecule as a whole. Questions always assume that each functional group behaves as a separate entity.

The examiners continue to emphasise that learning traditional organic chemistry requires real study out of school or college and the examiners felt that, as on previous occasions, this was sometimes not being done.

In the past, spectroscopy has been a mystery to many but in this paper, there was evidence of an increasing competency with both infrared and NMR spectroscopy.

As with past CH4 (and CH5 papers), there is still a reluctance to produce chemical equations, even when clearly requested. An equation should always be balanced and, for organic chemistry, this means including the non organic product too.

All questions were accessible, with no dead marks but a few candidates did not quite finish Question 5, although it was not clear whether they were short of time or could not attempt the latter part of this question.

Many candidates scored highly in those questions requiring calculations and it is clear that this is an improving area.

Section A

Q.1 (a) This was meant as an easy starter but, surprisingly, there were a number of candidates who were unaware of the numbers of hydrogen atoms present in the phenyl group.
A large number also gave the answer for the **molecular** formula of benzenecarboxylic acid as C_6H_5COOH. Textbooks indicate that the molecular formula should have all atoms of a particular element grouped together, i.e. $C_7H_6O_2$ in this case. Some credit was given for the formula C_6H_5COOH.

(b) Although the formula or the name of the reagent was acceptable, there were still some candidates who gave the formula of sodium carbonate as $NaCO_3$. 'Carbon dioxide is evolved' is not an observation; the examiners required 'effervescence/fizzing' or 'the gas turned lime water milky' as the correct response.

(c) (i) A few candidates believed that sodium tetrahydridoborate(III) was able to reduce a carboxylic acid, rather than the correct lithium tetrahydridoaluminate(III).

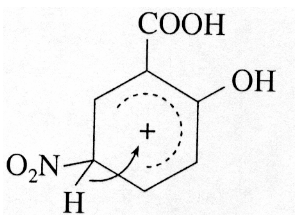
(ii) Many candidates clearly stated the difference in characteristic infrared absorptions between the two substances but did not always make it clear which was which.

(d) (i) The examiners felt that a number of candidates had learnt organic tests but were unable to state which test identified which functional group. It was disappointing to read that benzenecarboxylic acid decolourised bromine water or gave a white precipitate.

(ii) The question did not require the conditions used in industry but many gained full credit by giving these. Ethanoyl chloride was also an acceptable answer but room temperature would be required.

(e) (i) The question asked for the **species** responsible for nitration and not the reagents which produced it.

(ii) Mechanisms continue to cause trouble for a number of candidates. The examiners still saw many papers where the curly arrow started, sadly, from the electrophile. Perhaps this is a conclusion from the term 'electrophilic attack'.
Some nitrated benzenecarboxylic acid and not the acid requested.
The examiners were concerned about looseness in the drawing of the Wheland intermediate. The opening of the incomplete ring should face the carbon atom that bonded to both the hydrogen about to be removed as H^+ and the nitro group as shown below.



(iii) The most common reaction of benzene derivatives is electrophilic substitution.
This was not always given, even by those who gave the correct mechanism in (ii).

Q.2 (a) Although many correctly gave the name pentan-2-one, a surprising number gave pentan-3-one, pent-2-one or even butanone.

(b) The ideas behind cis-trans isomerism were part of a synoptic question and many were hazy about the reasons. There were too many loose answers such as 'the double bond cannot rotate'.

(c) Almost everybody correctly identified the chiral centre in **Compound A**.

(d) Many correctly gave the decolourisation of bromine as the answer in (i) but fewer could give a correct answer for the identification of an alcohol group. There were several acceptable answers but precise correct answers were not always provided.

(e) Although most candidates knew what was seen when the 2,4-dinitrophenylhydrazine reagent was added to **Compound B**, it was necessary in (ii) to state that the melting temperature of the product needed to be compared with known values to identify the original ketone.

(f) **Compounds B** and **C** could be distinguished by use of the iodoform reaction but many did not state the reactants, instead just stating 'the iodoform test' and giving the result. It was also necessary to identify which compound gave the yellow precipitate. This was not always done.

(g) The examiners felt that the ideas behind colour in organic compounds were better understood. A few candidates still stated that red is emitted instead of reflected or transmitted.

Q.3 (a) This was a discriminating question because candidates had to demonstrate a full understanding of the chemical processes in order to gain the marks. Sadly, this proved too onerous a task for many of the candidates and the result was an array of improbable products in which functional groups were placed almost at random along the carbon chain. The reactions of 'Vigabatrin' with nitric(III) acid and with ethanoyl chloride were particularly poorly done.

(b) (i) Some candidates were confused by the side chain in **Compound D** and could not apply the ideas used for the zwitterion ion form of glycine to this compound.

(ii) The hydrogenation of a carbon to carbon double bond was learnt for CH2 and it was disappointing to see that many candidates had neither the reagent nor the catalyst answered correctly. It was not unusual to see nickel spelt as 'nickle'.

(c) (i) Many candidates correctly produced the acid chloride from the carboxylic acid by using PCl_5 or $SOCl_2$. The commonest incorrect answers were ethanoyl chloride and HCl. In the second step, most answers showed that candidates knew that ammonia was used to produce an amide from an acid chloride.

(ii) The hydrolysis of an amide to its parent acid required the use of sodium hydroxide followed by acidification. Most candidates answered this correctly but a few used hydrochloric acid, even though the question stated that the products were subsequently acidified !

Section B

Q.4 (a) (i) There seemed to be confusion amongst candidates as to what was meant by a molecular formula and a graphic / full structural formula. The answered expected was $C_4H_8O_2$; this was not always given.
The examiners thought that the meaning of these terms should require more attention in some cases.

(ii) Many candidates correctly gave the graphic formula of methyl propanoate as the ester that gave methanol on hydrolysis.

(iii) It was common to see a correct equation for the preparation of ethyl ethanoate from ethanol and ethanoic acid but water was often omitted as a product.

(iv) Many candidates used the Data Sheet to identify propyl methanoate by its NMR spectrum and then went on to circle the proton responsible for the signal at 9.8δ

(b) The examiners were looking for the free radical bromination of pentane and the subsequent hydrolysis of 1-chloropentane as the correct route for this two stage synthesis. Unfortunately a number of candidates could not do the crucial first stage and then struggled. It was not uncommon to see pentane dehydrogenated to pent-1-ene followed by HBr addition or H_2SO_4 followed by hydrolysis. The examiners gave credit where they could in these cases.

(c) Questions about intermolecular bonding have often proved troublesome for many candidates and this question was no exception. The diagrams provided were often unlabelled and the polarities of bonds in water and the alcohol not shown. In some cases, hydrogen bonding was described between the alkyl hydrogen atoms and the oxygen atom of water. The non-polar nature of the longer alkyl group in pentan-1-ol was often omitted. However, some excellent answers were also seen where candidates had a very clear understanding of intermolecular forces.

(d) (i) The origin of the lines in the Balmer series was well known but the reasons why the lines converge as the frequency increases often proved difficult to express in a clear way.

(ii) Most candidates correctly gave 656 nm as the line with the lower frequency but a number then went on to state that this was because frequency = 1 / wavelength rather than frequency $\propto$ 1 / wavelength.

Q. 5 (a) (i) Although many candidates knew the reagents and conditions necessary for diazotisation, others clearly had no idea at all ! Sometimes nitric acid was used instead of nitric(III) acid; giving the formula would help the examiners in this type of response.

(ii) This part was the most poorly attempted in the whole paper. The question clearly state that chlorobenzene was a liquid but very many candidates assumed it was therefore a question about recrystallisation. Some credit was given for filtration but it was often not clear whether candidates were filtering off excess copper or 'solid' chlorobenzene. Some candidates then mentioned distillation in a vague way, presumably because the given boiling temperature of chlorobenzene was different from that of water. The examiners feel that separation techniques, for both solids and liquids (as, for example, in the recrystallisation of impure benezenecarboxylic acid and the purification of ethyl ethanoate obtained by esterification) are weak areas that need attention.

(iii) Many candidates gained full credit for the percentage yield calculation of chlorobenzene but some scripts were seen where candidates simply used the masses of the two different compounds given without recourse to moles or relative molecular masses.

(iv) The question gave the two molecular ion signals for chlorobenzene as 112 and 114, and asked for the origin of these numbers. The examiners were surprised that so many candidates described the **isomers** of chlorine rather than the isotopes. Marks were lost for not including the benzene ring fragment in their comments about the molecular ion values.

(b) (i) Nearly all candidates knew about the 'non reaction' of chlorobenzene with hot aqueous sodium hydroxide and the production of butan-1-ol from 1-chlorobutane using the same reagent. Some good explanations were seen in (ii) for the inability of chlorobenzene to react in this way but fewer candidates described why 1-chlorobutane was susceptible to alkaline hydrolysis.

(c) (i) Many very good answers were seen for this calculation and the subsequent use of NMR spectroscopy to determine the structure. A few candidates muddled the empirical formula section, which caused a suitable structure to be difficult to deduce.

(ii) Almost everybody knew of the problems causes by chlorofluorocarbons in the upper atmosphere.

Sylwadau ar y Papurau Cyfrwng Cymraeg

Roedd safon y Gymraeg ysgrifenedig yn dderbyniol uchel yn y papur hwn ac nid oedd tystiolaeth o unrhyw ddrysni oherwydd y termau na'r eirfa Gymraeg. Yr un ffaith a achosodd rhywfaint o bryder wrth farcio'r papurau cyfrwng Cymraeg oedd cynifer yr ymgeiswyr a ddaeth i'r arholiad heb baratoi'n ddigon trwyadl ac, o'r herwydd, yn gorfod gadael nifer o gwestiynau heb unrhyw ymdrech i gynnig atebion. Nid dieithrwch yr iaith oedd y rheswm dros hyn (yn wir roedd yr un ymgeiswyr yn union yn dangos cryn aeddfedrwydd wrth ateb cwestiynau a oedd wrth eu dant) ond diffyg adolygu a dysgu ffeithiau elfennol. Rhaid gochel rhag hyn. Rhaid gochel hefyd rhag y duedd i adael atebion yn ben-agored, h.y. gan ateb y rhan gyntaf o gwestiwn roedd rhai ymgeiswyr yn cymryd yn ganiataol fod y marcwyr yn deall beth oedd yn debygol o gael ei ddweud yn ail gymal yr un cwestiwn (e.e. Cwest 5(b)(ii)).

Yn olaf, fel ym mhob iaith rhaid i bawb sy'n ysgrifennu enwau cywir cyfansoddion organig wneud yn berffaith glir mai pentON a olygir ac nid PentAN. Nid pawb sydd mor ofalus ag y dylent fod wrth ysgrifennu, yn eu llawysgrifen y llafariaid holl-bwysig hyn ac ni ddylid disgwyl i'r marcwyr gymryd yr agwedd 'rwyn gwybod beth mae'r ymgeisydd yn ei feddwl'.

Translation

The standard of written Welsh was of an acceptably high standard and there was certainly no evidence of candidates not answering questions because of the complexity of the language used . The one fact which gave cause for concern when marking the Welsh Language papers was the disturbingly high number of candidates who came in to the examination having insufficiently prepared and, as a result having to omit quite substantial parts of questions. This was not due to any use of abstruse language or a failure to decode language patterns (indeed, many of the selfsame candidates showed high level language skills when answering questions that appealed to them) but only to a failure to revise and learn basic facts. Candidates must be wary of this. They must also be wary of leaving open-ended answers, i.e. by answering the first part of a question some candidates were assuming that the second part of the same question would, ipso facto be implied to be true. (e.g Q5(b)(ii))

Finally, as in all languages people who write the proper names of organic compounds must ensure that PentONE is written and not PentANE. Not all candidates are as careful as they should be in their handwriting of these vowels and it should not be the case that the markers take the attitude of 'It's not clear but I know what they mean'.

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