Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

January 2025

Pearson Edexcel International Advanced Subsidiary Level in Chemistry (WCH12) Paper 01 Energetics, Group Chemistry, Halogenoalkanes and Alcohols

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Introduction

Many students were well prepared for this examination and were able to demonstrate that they had a sound knowledge of the practical aspects of the specification. The mean mark for the paper was 39. The full range of marks were seen and there were no reports of time pressure, the vast majority of candidates completed the final questions.

Section A

The mean mark for the multiple-choice questions was 13 out of 20. Those who gained an E grade achieved an average of 9 marks here while those who received an A grade usually scored a minimum of 15 marks. The questions candidates found easiest were Q14 (calculating concentration), Q13 (atom economy) and Q4 (flame colour of strontium). More challenging were Q3 (calculating solubility by precipitation) and Q2 (decomposition graph in Kelvin), where fewer than 25% of candidates gained the mark.

Section B

Question 17(a)

The vast majority of candidates gained at least one mark for (i) where there were identifying oxidation numbers. Far fewer candidates could write the half equations for the redox processes in (ii) and (iii), a common error was to omit the electrons. However, many candidates did not attempt these parts showing that candidates may need more practice formulating and understanding redox equations.

Question 17(b)(i)

Candidates answered this question well. Occasionally candidates were seen to draw the graph for (ii) and then work back to the answer for this part, but the main error seen was not formatting their answer to three significant figures to fit the rest of the table.

Question 17(b)(ii)

This graph had an atypical grid so the mark scheme was modified to allow for this. The data covered just under half of the axes in the majority of cases and so any candidate using over three large squares gained credit for suitable scales. This change was just in this unusual circumstance and should not be used to modify teaching. Candidates will be expected to fill over half of both axes with the data points in the future. Many candidates did not gain full marks on the graph, despite the relaxation of the scale mark scheme for the y-axis, common errors included omitting the units on the axes or the line of best fit and mis-plotting the points.

Question 17(a)(ii)

This question was not well answered, with many answers lacking detail. At A-level candidates should be able to use particle theory precisely, defining concentration in terms of volume and rate in terms of collisions over time. A rescue mark was available for those who answered with an appropriate lower-complexity answer.

Question 17(c)

Candidates found this question very difficult, and the mark scheme was amended to provide candidates with more opportunities to gain credit. Of the four marking points available, M1 was the most frequently awarded but over half of candidates failed to achieve any marks here. Given that the questions before and after relate to kinetics it is understandable that many candidates tried to describe a rates experiment.

Question 17(d)(i)

Only half of candidates gained credit here. Common errors here were the line ending too far up on the y-axis and not being asymptotic to the x-axis, the peak to far to the left and crossing the original line multiple times.

Question 17(d)(ii)

A third of candidates gained two of the three marks, which is less than anticipated. M2 was the most frequently awarded, with the omission of the word “kinetic” being the most frequent reason M1 wasn’t given. Candidates explanations for M3 were regularly missing “successful” or “per unit time” (or a refence to frequency).

Question 18(a)

Very few candidates gained all three marks, though the majority achieved one. This was usually awarded for labelling the dipoles. The bond angle of the hydrogen bond was very rarely labelled correctly, and lone pairs were often not part of the bond or omitted completely.

Question 18(b)

Candidates found this question difficult, with half of the cohort not gaining any credit for their answers. Most wrote about the intermolecular forces present in generic terms and didn’t refer to the data. A common error was referring to the M_r rather than the number of electrons when discussing the strength of London forces. Many did not appreciate that ammonia could form hydrogen bonds which limited their achievement on M2. Very few candidates scored the final mark as many compared the densities of water and ammonia rather than those for either compound at the temperatures.

Question 19(a)

Just over half of candidates scored the mark for naming the compound. Some candidates did not recognise the number of carbons in the skeletal structure (so gave names ending in ethane) but a more common reason for not gaining the mark was failing to put the prefixes in alphabetical order. Extra hyphens were common, along with incorrect numbers before the prefixes. Though the structure did not meet any of the criteria for geometric isomerism quite a few answers lost the mark for using E/Z/cis/trans at the start, and some also disappointingly used chloride/chlorine as part of the name.

Question 19(b)(i)

Over half of the cohort could name the type of reaction. The most common incorrect answer was nucleophilic substitution, though many reaction types were seen and some candidates gave multiple answers.

Question 19(b)(ii)

Any type of structure was allowed here but two thirds of candidates did not gain any credit. Common errors were including alcohol groups and chlorine atoms along with not realising that the isomers should be alkenes. Where candidates did draw one isomer the methyl group was often in the wrong place for the second isomer.

Question 19(c)(i)

On average, candidates gained half of the marks available for the mechanism. Though when inspecting scripts it was evident that many candidates gained full marks and an equal number gained very few. For those in between, a mark was often lost for omission of lone pairs or a charge, or an arrow that didn't start or end in the correct place.

Question 19(c)(ii)

Over half of candidates gained a mark for identifying the isomer with a faster rate, though many gave an incorrect reason. The incorrect reasons were often about the reactivity or size of the elements.

Question 19(d)

Many candidates could identify "nucleophile" for the role in (c) but far fewer got the mark for base. In fact, a good number of students wrote "nucleophile" on both of the available lines. While catalyst, electrophile, reducing agent were also common incorrect answers.

Question 20

The full range of marks were seen for this question, though just under a third of candidates did not achieve any of the marks. Candidates were expected to elucidate the peaks seen on each of the spectra and use it to support or exclude the three options. Candidates who worked out which compound was correct and just used the data to explain why could not gain all the marks (usually achieving IP1, IP4 and IP6). The most common IPs awarded were IP6 and IP1. It is important that wavelengths, or ranges from the data booklet, are identified when candidates link absorbances to bonds as this was a common reason when candidates did not achieve IP2 (and IP5). Weaker candidates identified the M^+ peak but then incorrectly calculated the M_r of the three compounds. Candidates may need more time in class to look at spectra of compounds as some answers identified "peaks" in the spectra that were not present.

Question 21(a)

The most common answer for this question was −276 (kJ mol^{-1}) that scored 2 marks. Only the best candidates remembered to divide this by two to get the answer per mole. Many other candidates lost marks by subtracting the bonds broken from bonds made, or adding the two values together.

Question 21(b)

This answer was poorly answered by candidates , with only three in twenty candidates achieving the mark. Many gave vague answers, relating to the state not changing and standard conditions. It is important that candidates use the word "element" when answering this type of question.

Question 21(c)

Over half of candidates did not gain any marks in this part. Many misinterpreted the question, or failed to read it carefully and assumed they were supposed to compare the data book value to an experimental value (as is often asked on WCH13 papers) unfortunately answers such as heat loss and incomplete combustion negated a mark here as they were not relevant to either data source. It is very important that candidates read the questions carefully to ensure they give a relevant answer.

Question 21(d)(i)

Almost two thirds of candidates gained credit here, with reaction mechanisms being the most commonly seen incorrect answers.

Question 21(d)(ii)

A vast array of reagents were seen for what was expected to be an easy question. M1 and M4 were most frequently awarded, with M2 often lost because candidates just added "acidified" in front of the dichromate and didn't state which acid would be used. The most common answer

for M3 was “reflux” and this did not score as the methanol would then be completely oxidised. Occasionally an incorrect oxidation number was given with dichromate and the colour change was reversed, both of these meant the mark was not awarded.

Question 21(e)(i)

Just under half the cohort scored 1 mark for this question. Many answers were too vague and did not relate to the information given. A wide range of answers were accepted on the mark scheme but candidates need to ensure their answers are sufficiently detailed. The marks most commonly awarded were lower temperature and faster rate.

Question 21(e)(ii)

Without the rescue mark many more would have scored zero for this part. Even so, it was common for answers to fail to refer to ‘alternative path’ or ‘lower activation energy’. Approximately a third of candidates gained credit for this answer, and only the very best scored two marks. The majority gave GCSE style statements about catalysts that were insufficient for a mark.

Question 21(e)(iii)

There were five marks available for this part of and the candidates were awarded marks pretty evenly from 0 to 4 with slightly fewer at 5. M5 was the least frequently awarded mark as many candidates just referred to the expense of increased pressure and not the reason. A minority of candidates referenced changing the concentration of methanol, ignoring the temperature given.

Summary

In order to improve their performance, students should:

- read the question carefully and make sure that they are answering the question that has been asked
- practise applying reaction conditions to different molecules
- ensure the axes labels are accurate and include units
- practice drawing tangents on rate graphs to calculate rates
- show all working for calculations and give final answers to an appropriate number of significant figures
- practise looking at spectra for different compounds, identifying the relevant wavelengths of the absorbances
- revise definitions from the specification
- ensure sufficient detail is given in written explanations
- reread questions and answers, where time permits, to avoid careless mistakes.

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