Examiners' Report
Principal Examiner Feedback

October 2017

Pearson Edexcel International Advanced Level In Chemistry (WCH02) Paper 1 Application Of Core Principles Of Chemistry

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General Information

Some students were clearly well prepared for this examination, scoring high marks. There were questions accessible students of all abilities. There were a number of questions which a good range of marks, effectively discriminating between students. There was little evidence that students suffered from a shortage of time, although some students left some of the answers blank, including some of the multiple choice questions.

Multiple Choice

The overall performance was similar to previous series, with an average score of 13.1 marks. Four questions were answered correctly over 80% of the time, with question 14 the highest scoring at 89%. Q18 proved the most often incorrectly answered item, at 38% correct.

Question 21

The structures and name of the alcohols in Q21(a)(i) – Q21(iii) were quite well understood, with Q21(i) proving most straightforward and the name of the isomer in Q21(iii) the most often incorrect. Some students lost marks in Q21(i) by not providing a displayed formula. The relevant part of the structure was very often identified in Q21(i), but rarely were students able to suggest comparing the spectra with those in a database to score the mark in Q21(ii). Some were able to score by using the fingerprint region to identify the alcohol present. Common incorrect suggestions focussed on different bonds producing different peaks. Some confused the IR spectrum with that of mass spectrometry and talked about fragmentation. In Q21(c) students scored well, with Q21(iv) being the most challenging, with some students using some of the more common reactions such as nucleophilic substitution or elimination as incorrect answers. The structure of butanone was a not uncommon incorrect answer found in Q21(iii).

Question 22

In Q22(a)(i) many students understood that ethanol was a solvent, but they needed to demonstrate that they knew that it would dissolve both reactants. Co-solvent was a term which some students were able to use to good effect. In Q21(ii) students should be encouraged to count the number of atoms of each type to ensure the equation is balanced. Some clearly knew the type of products being formed but gave the formula of propan-1-ol rather than butan-1-ol as the organic product and so lost the mark. In Q22(iv) there were many correct answers which was good to see, although commonly extra information, including whether the reaction was homo- or heterolytic, was included. Part Q22(v) proved both challenging and discriminating with a range of marks awarded. Many students tended to discuss the length of the carbon to halogen bond, which though not incorrect was less important than the strength of the bond, and thus the amount of energy needed to break it. Weaker responses focussed on the amount of time taken rather than the rate of hydrolysis, ionic bonding or discussion of intermolecular forces. Some also discussed the reactivity of the halogens rather than the haloalkanes. Some students did not understand the difference between time taken and rate. Whilst students were able to suggest that CFCs were able to produce chlorine free radicals which would deplete the ozone layer in (b)(i), few were able to explain why HFCs did not produce fluorine free radicals, so commonly only scored 1. Very few students considered the relative strength of the C-Cl and C-F bonds, with some clearly not recalling the structure of CFCs or HFCs. This resulted in answers focussing on, for example, the bond strength of H-X bonds. The presence of oxides of nitrogen was a common correct answer in Q22(b)(ii).

Question 23

It was quite unusual to see the correct answer in Q23(a), with many students thinking that an extremely vigorous or exothermic reaction between the metal hydroxide and water was the main reason for not adding the solid to water. Those who scored the mark did so most often for saying that the volume would be greater than 250 cm^3, though it could of course be less. Q23(b), however, was very commonly correct. In part Q23(c) many students knew an indicator with its colour changes but inaccuracies were found in all parts. Colours which are acceptable are to be found in mark schemes for similar questions in many past papers. Indicator spellings must be recognisable to score marks. Indicators suggested other than phenolphthalein and methyl orange included potassium manganate(VII), potassium dichromate(VI), litmus, starch and universal indicator. The calculation in Q23(d) discriminated well. Strong students scored full marks or forgot to subtract 17 in part Q23(v) and so thought the metal was sodium rather than lithium. Less able students made a number of mistakes and were clearly unsure how to approach the calculations. Many were able to answer Q23(i), and then use their answer correctly in Q23(ii), but some chose simply to transfer their answer in Q23(i) to Q23(ii). In Q23(iii) some students multiplied by 10, some others did not use their answer from Q23(ii) at all. In Q23(iv) many students correctly calculated using their answer from Q23(iii) so this mark scored well. Many of the common errors gave values in Q23(v) which were very close to answers for the group 1 elements, with answers which could realistically be interpreted as Li, Na, K, Rb and Cs all seen. However where answers were not the expected one they needed to demonstrate that they had subtracted the OH group if they were to score the final mark.

Question 24

Deduction of the bond angle in Q24(a) was done correctly by about half of students, with incorrect answers including 109.5° and 120°. Most knew that the strongest interaction between molecules would be hydrogen bonds, but fewer could produce a diagram to show how this would happen. The commonest mistake was not to consider the angles of the bonds around the hydrogen in the hydrogen bond, or to label a different bond or just the hydrogen bond as the 180° angle rather than the angle between the hydrogen bond and the covalent bond. Whilst partial charges were often shown, these were occasionally the wrong way around, or only the □+ or □- and not both were given. Similarly, at least one lone pair was required. Fewer were able to adequately explain why the boiling temperature of H_2S_2 was lower than H_2O_2 in Q24(c), with many confused answers suggesting breaking of bonds rather than intermolecular forces. Clarity of language was particularly important here. A number of students, presumably hurrying their answers, used shorthand notations, for example "S_2" and "O_2" instead of H_2S_2 or H_2O_2 or when referring to electronegativity. This is to be discouraged.

Question 25

Answers in Q25(a) lacked precision, with electrons commonly referred to as being found in the p-block or p-shell rather than p-subshell. Some students were able to get closer to the answer by referring to the correct orbitals or subshells but not saying that these were occupied by electrons. The physical states of bromine and iodine well known in Q25(b). In Q25(c)(i) very few students knew the correct states for the four components in the equation, with the bromine commonly seen as either liquid or gas but rarely as aqueous. The commonest mark awarded in this item was 1. The descriptions of what would be seen lacked detail and so often were not enough to score the mark, probably because of uncertainty about the reaction that was occurring or the states of the components. In Q25(c)(iii) most students recognised that a redox based answer was required, but some decided chlorine was a reducing agent, whilst others answered in terms of oxidation number rather than in terms of electrons as required by the question. Q25(d) proved challenging for some, particularly those who did not focus on the equilibrium as the question asked. Some tried to answer the question by explaining what a disproportionation is which was not required in the answer. Others who had not understood the questions properly discussed the types of reactions which might occur under conditions of high acidity. The equations in (e) proved very challenging with a wide range of marks being scored. Q25(i) was most commonly correct although the electrons were sometimes on the wrong side of the equation. Disappointingly marks were sometimes lost in Q25(ii) with electrons on the wrong side of the equation or no electrons in otherwise correct equations. Correct identification of the sulfate(VI) ion in this part was quite uncommon, with a number of different variations. Perhaps the best wrong answers with the sulfate(IV) ion and a sulfate ion, but with a 1- change. The final equation was only completely correct for the best students, although some were able to correctly score 2 marks here having lost both marks in Q25(i) and Q25(ii) due to incorrect or omitted electrons. Part Q25(f) proved much more accessible with just less than 4 marks the average score here. Students often knew the correct tests and results but missed out some detail, for example the concentration of the ammonia solution, or carried out the tests in the wrong order. Very few gave incorrect observations for these tests, suggesting they are well known and understood.

Paper Summary

In general the standard of the calculation and numerical questions was higher than the more descriptive answers. There were a number of questions where students had clearly not read the questions carefully enough and so did not answer the question properly. Many saw a question they thought they recognised and did not see guidance in the question as to how to approach it, for example Q25(c)(iii) and Q25(d). Clarity of expression in answers, particularly when using chemical terminology, is important and needs to be considered. Not all students appear to be as familiar as they should be with the practical aspects of the course, with practical activities vital to an understanding of the processes involved. Some areas, particularly ionic equations and structure, bonding and intermolecular forces are topics which would greatly benefit from further focus.

Advice to students

Based on their performance on this paper, students should:

- Do read the question very carefully and ensure that your answer matches its requirements.
- Practice drawing basic diagrams; a reasonable standard of accuracy is essential.
- Ensure that you have a clear idea of the precise meaning of mechanism curly arrows and that your drawings of mechanisms reflect this.

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