Examiners’ Report
Principal Examiner Feedback

October 2017

Pearson Edexcel International Advanced Level In Chemistry (WCH04) Paper 1 Rates, Equilibria and Further

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General Information

This paper was a reasonable balance of standard and higher demand questions, the latter often requiring students to apply their knowledge and understanding in unfamiliar situations. It was similar in style and standard to previous and parallel Unit 4 papers of this specification and a range of skills and knowledge was assessed and the levels of difficulty allowed good discrimination between the different grades, while allowing well-prepared students at all levels to demonstrate their abilities. Although this was A2 and therefore had a synoptic element, for the most part, students seemed far better prepared for the straightforward type of question. Many students lost marks as a consequence of failure to answer the question that was actually set.

Multiple Choice Section (Questions Q1–Q16)

This was the highest scoring section of the paper with a mean score across all students of 53.6%. Over 80% of students gave the correct answers to Q8 and Q14(c), while less than 30% of students gave the correct answer to Q3, Q5 and Q10 and Q12. The lowest scoring question was 3 for which 22% of students gave the correct response.

Question 17

Students at E grade and above gave the correct rate equation, the common incorrect answers being the equilibrium constant expression or an equation involving the products. Most students seemed aware of the type of apparatus required but the precision of the drawing, particularly the gas syringe, left much to be desired. Students frequently failed to mention that the volume of oxygen needed to be measured at various times during the course of the reaction. Part Q17(b)(i) tested students understanding of reaction half-life and the full range of marks was awarded. In part Q17(b)(ii) the need to plot a graph was often omitted and when it was included students still failed to mention that the gradient at a particular concentration was required. The calculation of the rate constant was well understood as was the reaction profile for the catalysed reaction, with about half the students who scored on this question appreciating the significance of the intermediate.

Question 18

Most students could write the equilibrium constant expression. There were many correct or near correct calculations of the notional K_p value. Some students omitted one or both of the steps required to calculate the partial pressures while others attempted the calculation by assuming that they were expected to calculate the equilibrium partial pressures from the amounts given. While there were some excellent answers to Q18(b)(ii) and Q18(b)(iii), for the most part these were not well understood; many students tried to use Le Chatelier's Principle to predict the direction that the system would move and (for Q18(b)(iii)) the entropy change. The idea that operating industrial plant incurs additional costs was generally appreciated but the second mark for Q18(c) was rarely awarded.

Question 19

The reagents and conditions for this oxidation were well-known but a mark was often lost by writing a formula rather than a name or omitting one of the conditions. Part Q19(a)(ii) was surprisingly low scoring with many students suggesting that it was an addition reaction. The idea that free radicals are indiscriminate in their point of attack was only appreciated by the better students and there was much reliance on generalised answers, such as side reactions occurring or the reaction not going to completion, for which there was no credit. There was a wide range of suggestions for the identity of reagent T and of those students who realised that a strong acid was required, few could explain its purpose. While the general outline of the nucleophilic substitution mechanism was well-known, the essential detail was not. The precise location of curly arrows and lone pairs and the appropriate use of partial and complete charges are essential in drawing a mechanism. In Q19(b)(ii) the rate equations were often correct but the explanations often mentioned only one of the mechanisms or failed to note the significance of the rate determining step. The rotation of the plane of plane-polarised light was known by most students but Q19(c)(ii) was often carelessly answered, with students failing to label the chiral centre or to use one of the two specified molecules. Q19(c)(iii) produced many responses about the formation of a racemic mixture by an S_N1 mechanism while those students who answered the question that was actually set usually scored just the first two marks. Part Q19(d) proved quite discriminating. The common errors were the failure to realise that both compounds had an alcohol OH group, giving the aldehyde C=O range, quoting no wavenumbers and quoting only wavenumbers.

Question 20

Most students were able to score well on this question. The common errors were omission of the branched ketone, giving an aldehyde as the third structure, the failure to make two distinct points when considering the chemical tests and the failure to clearly link the molecular ion either to a molar mass or a molecular formula.

Question 21

In part Q21(a) marks were frequently lost when students described the intermolecular forces between soap or detergent molecules rather than between the lipophilic part and the grease molecule. Even when London forces were correctly identified, accurate descriptions of the forces were rare. In Q21(b) most students scored marks for the 'allow' of hydrogen bonds and for the associated diagram rather than preferred ion-dipole force. Part Q21(c)(i) is certainly a challenging question on a topic that students find difficult and there was little evidence of a clear understanding of the forces involved when an organic molecule with a polar functional group dissolves in water. There were many correct equations in Q21(c)(ii), the mark most often being lost for state errors, and the majority of students were able to write the K_a expression. While most students were able to complete the pH calculation, many omitted the calculation of the acid concentration, using 0.34 as the molar concentration. There were some excellent titration curves for Q21(c)(v) and marks were available even if the graph showed the addition of alkali. Some students omitted the calculation of the alkali pH and a number of the diagrams showed definite maxima or minima. The energy changes required in Q21(d) were reasonably well-known but giving lattice energy (rather than –LE) was a common error. Some students gave the equation linking the three energy changes but few were able to provide an explanation of the differences in solubility.

Paper Summary

Based on their performance on this paper, student 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.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

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