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Paper 2 7405/2 Organic and Physical Chemistry
Report on the Examination

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General Introduction to the November Series

This has been an unusual exam series in many ways. Entry patterns have been very different from those normally seen in the summer, and students had a very different experience in preparation for these exams. It is therefore more difficult to make meaningful comparisons between the range of student responses seen in this series and those seen in a normal summer series. The smaller entry also means that there is less evidence available for examiners to comment on.

In this report, senior examiners will summarise the performance of students in this series in a way that is as helpful as possible to teachers preparing future cohorts while taking into account the unusual circumstances and limited evidence available.

Overview of Entry

The entry was around 5% of the number in a typical series.

Comments on Individual Questions

Question 1

The majority of the question was well done. Many of the students scored well on 01.1 and 01.5. Students found it hard to express the relationship between initial concentration and reaction time in 01.2 but most were able to deduce the order from the data given. Apparatus diagrams were very varied and it was clear that some students were unable to draw a cross-sectional diagram well.

Question 2

The chiral centre in 02.1 proved very accessible to students but a surprising number were unable, in 02.2, to identify the functional groups present. The most common wrong answers showed that students thought that the molecule had a ketone functional group. Others failed to recognise that the prilocaine contained an amine functional group. 02.3 proved very challenging and many students struggled to access these marks, with many unable to identify the amide link as the site where hydrolysis would take place. 02.4 was well answered but only the best students were able to link the idea of an active site to stereo specificity.

Question 3

A common problem in this question was being unable to identify common features that linked some of the isomers. As such, many included isomers that did not fit the demand in each of the first three parts of the question. The expected observations for test tube reactions in 03.1 and 03.2 were well known. 03.3 proved more difficult with students finding it hard to identify neutralisation of excess acid as the reason why the esterification reaction mixture was poured into $NaHCO_3$ solution. 03.4 was very well known. Large numbers of students could identify infrared absorptions that could be used to distinguish isomers in 03.5, but far fewer appreciated that the fingerprint region should be used to distinguish those that had common absorptions above 1500 cm^{-1}.

Question 4

This question covered the skills learned in completing required practical 10 but a surprising number of students were unable to suggest re-weighing the weighing boat as the missing step in the method for 04.1. Few students appreciated the need to state an appropriate size for the apparatus to be used to measure out the ethanoic anhydride in 04.2. The calculation in 04.5 was very well answered. Students were often able to identify that impurities lower the melting point of a sample in 04.6 but far fewer appreciated that impurities also broaden the range of temperatures over which the impure sample melts. In 04.7, many students were able to suggest keeping the mixture away from naked flames but far fewer identified that keeping the mixture below the boiling point of ethanol would also be an appropriate precaution to take. 04.8 proved difficult and only the best students explained that washing the aspirin with cold ethanol would be done to remove soluble impurities. 04.9 was well answered.

Question 5

05.1 was well known and the majority of students gave good answers. Around half the students scored all the marks for the mechanism in 05.2 and over 70% got at least 3 of the 4 marks. However, 05.3 proved much more difficult and less than 10% of students scored both marks here. The significance of the halogenoalkane being in large excess was poorly understood.

Question 6

06.1 was reasonably well answered but few students were able to identify suitable conditions for this acylation reaction. 06.2 also proved to be quite a low scoring question despite the familiarity of this reaction in many previous exams. The dehydration mechanism in 06.3 was poorly answered compared to other mechanism questions in the paper.

Question 7

07.1 was marked with a levels of response mark scheme and required students to communicate their answers coherently with logical progression. The role of $Si(CH_3)_4$ in NMR was quite well understood but few students knew that $CDCl_3$ and CCl_4 are used as solvents. This lack of knowledge meant the highest level was hard to access. Only the very best students were able to explain the link between solvent chosen and the polarity of the sample. Around 43% of students scored at least 3 marks here but less than 10% scored 5 or 6 marks. Students were good at identifying at least some of the splitting patterns required in 07.2, but 07.3 proved very challenging. 07.4 required students to deduce structures for isomers based on the number of singlet peaks and integration ratios in the ^1H NMR spectra, but responses often failed to fit with these requirements.

Question 8

Fewer than 10% of students scored 4 or 5 marks for the calculation in 08.1, but the first three marks proved much more accessible. Students were often unable to link the amount in moles of CO_2 produced in combustion to the amount of carbon in the original sample. Even fewer were able to do this to determine the amount in moles of hydrogen from the amount of water produced. 08.2 proved more accessible and many students scored both marks, with a variety of methods used. 08.3 was well answered but 08.4 was only scored by around 40% of students.

Question 9

The first two parts of the question were very well answered and students often scored high marks. 09.3 was much less well answered, with fewer than 20% of students able to suggest that the concentration of water being effectively constant is the reason why the equilibrium expression can be written without including it. 09.4 was another calculation where many students got started but few were able to access the highest marks. Only the very best identified that an algebraic approach was needed to calculate the required equilibrium concentration. 09.5 required students to apply their understanding of standard mechanistic ideas to a novel mechanism. Most students were able to score at least some of the marks and a good number (44.3%) scored all three marks. Full marks proved far more difficult in 09.6 but students often gained some credit for recognising that the alkyl group would be electron donating.

Concluding Remarks

Overall the questions in this paper proved to be of a similar standard to those in previous series. The paper differentiated well, and students were able to complete the questions in the time available. All questions were correctly answered by a good number of students apart from 07.3 which was the most difficult question on the paper.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.