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# A-LEVEL CHEMISTRY

7405/2 Organic and Physical Chemistry  
Report on the Examination

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7405  
Autumn 2021

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## **General Introduction to the Autumn Series**

This has been another 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 less than 5% of that seen in a normal summer series.

## **Comments on Individual Questions**

### **Question 1**

All aspects of this question differentiated very well. The extended calculation in question 01.3 attracted good responses with a third of the students gaining full marks and the majority able to access at least 1 or 2 marks. A common mistake was to assume that the oil was pure triester. In question 01.4 very few students appreciated that aqueous ethanol was used as a mutual solvent for both the oil and the potassium hydroxide.

### **Question 2**

In this question a surprisingly small proportion of students were able to state the meaning of the term fraction. In addition, very few were able to explain why C=O bonds in carbon dioxide absorb infrared radiation. A good range of answers was seen for the extended response question about the environmental impact of bioethanol as a fuel, but a significant number of students were unable to get started here.

### **Question 3**

The answers to question 03.1 were poor with a large majority of students unable to construct a good results table with clear headings including appropriate units. In question 03.2 significant numbers of students didn't score, with many focussing on potential breakage as a disadvantage of using a glass beaker. Questions 03.3 and 03.4 proved more accessible.

### **Question 4**

Question 04.1 gave a good range of scores and a third of students were able to score at least 2 marks. The common errors included multiplying the value of enthalpy of atomisation for hydrogen by 3 rather than 6. Question 04.3 required students to apply mechanistic ideas to structures that were provided. The vast majority of students were able to score some marks on this question and it also proved to be a very good discriminator.

**Question 5**

The algebraic approach needed in question 05.1 proved difficult for some but around half the students were able to score full marks here. The structure of the diester in question 05.2 was very poorly answered, but the familiar  $K_c$  calculation in question 05.3 proved very accessible and around two thirds of students scored all three marks.

**Question 6**

Answers to question 06.3 about the *E* and *Z* forms of a structure that shows both geometric and optical isomerism were very poor and over 70% of students failed to score either mark. Questions 06.2 and 06.4 proved more accessible.

**Question 7**

Over 75% of students scored the mark for question 07.1 and there was a good range of marks seen for question 07.2, with many able to score at least 1 mark here. Less than 20% of students scored 3 or more marks for question 07.3. The lack of a suitable explanation for splitting patterns and chemical shifts was the most common problem. That said, a significant number were able to score the mark for deducing the structure.

**Question 8**

Few students scored 3 or more marks on question 08.2. Both the reagents and equations proved very challenging, with over 50% either failing to score or not attempting this question. A very good range of marks was seen for question 08.3 and the question discriminated very well.

**Question 9**

Students scored poorly on question 09.2 and few appreciated that the breakage of the C-Cl bond was the key point. A high proportion of students scored well on question 09.3 about catalytic ozone decomposition. Many also scored good marks on question 09.4 by being able to derive equations for novel propagation steps.

**Question 10**

The idea of using an excess of  $\text{NaHCO}_3$  to quench the reaction was not well understood and few students scored both marks for question 10.1. Whilst some students were able to explain that the concentration of propanone was effectively constant in question 10.2, few were explicit enough about the concentration of propanone being much larger than the concentration of iodine. Question 10.3 was very straightforward and, as a result, did not differentiate well. Half the students scored at least some of the marks for the calculation in question 10.5 based on the Arrhenius equation.

**Concluding Remarks**

Overall the questions in this paper proved to be of a similar demand 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.

### **Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.