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# A-LEVEL CHEMISTRY

7405/3 Paper 3  
Report on the Examination

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7405  
Autumn 2021

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Version: 1.0

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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

Perhaps unsurprisingly given recent circumstances, there was evidence here of uncertainty with many of the questions testing practical skills, which form a key component of this paper. Marks, in general, were often missed through a lack of precision in answers and/or a failure to exactly match the answer to the actual question being asked. For example, questions 01.5 and 06.1 both asked for answers related specifically to safety but many answers were of a much more general nature in terms of suggested errors.

Relatively few students were able to access Level 3 in the Levels of Response question – usually due to a failure properly to analyse the ideas related to enthalpy change. Students are encouraged to be as organised as possible when answering the Levels of Response question and, although it is not really appropriate to lay out the answer as a list, students are encouraged to think about aiming to make a sequence of clear, precise, linked points to put across their ideas and to include as much of the indicative content as possible.

## Comments on Individual Questions

### Question 1

The start of this question was expected to give a relatively easy introduction to the paper but proved trickier than expected with considerable confusion about drawing the repeating unit of the polymer and a lack of specificity in answers to question 01.2; simply stating that polyesters are polar was not sufficient. An A-level standard answer requires more detail such as a specific reference to the polarity of the C=O bond. A significant number of students referred to C=C bonds in polyalkenes and overlooked the fact that it is the monomers that are unsaturated while the polymers are saturated.

The calculation in question 01.3 was quite well done with a majority of students scoring over half marks here.

Questions 01.4 to 01.7 revealed weaknesses in awareness of practical ideas although it was surprising that nearly a quarter of students were unable to draw the meniscus in the right place on the diagram of a pipette.

Surprisingly, only a quarter of students were able to give the correct colour change in question 01.6. Students should remember that, when a colour **change** is asked for, the colours before and after the end point should be given rather than just a single colour.

Most students were able to make a start on the Levels of Response question in 01.8 with about half of students able to access level 2 or above. Most students recognised that the entropy would increase and that a favourable reaction is indicated by a negative free energy change. Discussion of the fact that the enthalpy change would be close to zero because 6 Fe-O bonds are made and 6 Fe-O bonds are broken was often not expressed well.

### Question 2

This was generally answered well although a number of students failed to respond to the instruction to show their working in 02.1.

### Question 3

Two-thirds of students failed to score more than one mark in 03.1 with many very confused answers muddling up ideas of crystallisation with those of distillation and even solvent extraction. Students who were able to give a description of recrystallisation as the method of purifying the solid often overlooked the need to separate it from the reaction mixture first.

In question 03.2 many students did not read the question carefully and referred to HCN when they should have been referring to KCN, and vice versa.

The mechanism in question 03.3 was known quite well with a third of students scoring full marks here.

### Question 4

The equation in 04.1 was not correctly given by many students. The recommendation for this type of situation is not to try and memorise the overall equation but to remember the key aspects such as 'bromide is oxidised to bromine' and 'sulfate is reduced to SO<sub>2</sub>'. The overall equation can then be constructed from the appropriate half-equations.

Question 04.2 again showed weaknesses in awareness of ideas related to practical situations and in being able to give clear, concise explanations. The need to include ionic equations was also often overlooked.

### Question 5

Most students were able to make a start on this calculation and many earned two marks for simply converting pH to [H<sup>+</sup>] and pK<sub>a</sub> to K<sub>a</sub> even if they could not get any further. There was evidence of confusion between 'concentration' and 'amount' with a significant number of students converting the given concentration of methanoic acid into an amount and then trying to substitute that amount into the expression for K<sub>a</sub> instead of using the given concentration.

### Question 6

Practical weaknesses and insufficient precision in answers let many students down here.

Question 06.1 specifically asked for **safety** concerns related to the apparatus diagram, with the hope that students would recognise that the bung should not be present (as it would mean a sealed apparatus is being heated) and that the flask is not clamped. Vague references to 'the clamp being in the wrong place' were not sufficient because a more specific response was needed.

Many students referred to the direction of the water flow being wrong because it should enter at the bottom of the condenser – but this is not a safety concern so could not be credited here. However, if it was mentioned in 06.1 but not then mentioned in 06.3, credit was still allowed for 06.3.

In question 06.3 many students failed to recognise that the thermometer is not needed at all and got confused with distillation by suggesting that the thermometer needed to be higher up in the apparatus.

## **Section B**

The mean score on Section B was 17.7 out of 30 (59%).

The five most straightforward questions (answered correctly by more than 80% of students) proved to be B7, B10, B22, B23 and B28.

The five most challenging questions (answered correctly by fewer than 40% of students) were B12, B15, B25, B26 and B31.

Multiple-choice items that discriminated particularly well (i.e. there was a good correlation between performance on the item and overall performance on the paper) across the range of ability of the students were B8, B21, B29, B30, B33 and B34.

Multiple-choice items that did not discriminate very well at all were B12 and B15.

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

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