

UK Chemistry Olympiad 2022 Examiners' Report, Round 1

The 2022 UK Chemistry Olympiad Round 1 took place during another challenging year in education, with many schools still experiencing significant disruption due to Covid-19.

We were delighted to receive 8668 scores from 750 different schools across the UK, including 146 schools who took part for the first time. We were also pleased to see a good gender balance in the students taking the paper, and a high proportion of entries from state schools.

A growing trend in recent years has been for year 12 students to be entered for the paper. This year 60% of students were in year 12, 39% were in year 13 and 1% were in year 11 or younger. We very much encourage teachers to enter promising year 12 students and we hope that the paper provides an exciting challenge for them. It also provides good evidence of achievement for a UCAS application. However, it is important these students know beforehand that the paper is set at a level to distinguish between the strongest year 13 students and can draw on topics from the whole A-level syllabus and beyond.

Despite Covid-19, almost all students were able to sit the paper in school on the specified date. There were only a few students who took the paper remotely as they were isolating. We were convinced that this did not compromise the integrity of the paper.

The Round 1 paper is always challenging, but perhaps this year this was even more the case than usual. We felt that the paper did contain a reasonable number of accessible marks and the most accessible questions were at their usual level. Some of the more difficult questions (in particular question 4 and question 6) were more challenging than usual. We are aware that the current cohort of students have had two years of disrupted education and will have not had the practice in sitting public exams. Time management was a major issue, with many students not leaving enough time to finish, and likely missing out on easier marks later in the paper. We saw many multiple-choice questions left blank.

The level of difficulty of the paper is determined by the need to differentiate between the top scoring students for selection for further rounds. This year, a challenging paper, combined with the assumable disruption to education caused by Covid-19, led to significantly lower scores than in previous years. We set the grade boundaries based on the percentages of students scoring each mark, and these percentages are broadly in line with recent years. The boundaries for gold (26), silver (16), and bronze (9) are certainly the lowest for many years.

Question 1

The first parts of this question were generally well done. Common errors however, included M_r errors for ethanol and octane. Often in part (d) the value quoted was double the correct value, as the equation had not been scaled for one mole of reactant.

Question 2

This question was generally well answered, but often students put the hydrogen as attached to the nitrogen in the first part. In part (c) often shapes were not shown. In part (e) there were a lot of charges that were missing and nitrogens drawn with five bonds.

Question 3

We felt this was a question that was set at an optimal level. This question was quite differentiating, with many students able to get most of the marks, but many also finding it challenging. Part (a) was straightforward. Structure G was often correctly determined even if earlier parts were not done, highlighting the importance of students not giving up with questions. In structures Q, R, and T students needed to be careful that they included all the double bonds.

Question 4

This question was very difficult. Most students did not score marks other than in the first couple of parts. It was pleasing that students recognised that this was a buffer, and some realised that the buffer was used up by the amount of acid. After this the students struggled. In the scripts moderated by the working group, we did not see a fully correct solution to some of the more difficult sections such as part (f).

Question 5

This was another question we felt was pitched at a good level to differentiate between students. It also required skills across an array of chemical disciplines (organic, inorganic, analytical, and chemical topology) and so highlighted the importance of interdisciplinary work in modern chemistry. The early parts of the question were well done. However, the number of students unable to draw a nitronium ion correctly was surprising given how this features in core A-level material. The highest scoring students were able to determine the R group, although they often drew an isobutyl group instead of isopentyl. Quite a few students could determine that the metal was Fe(II), but were unable to determine the anion. There were various mistakes in the number of atoms coordinating, and many students guessed geometries that they almost certainly will have never encountered (hexagonal planar), over the common octahedral. At the end of the question the highest scoring students were able to determine which structures were made, although clearly some just guessed.

Question 6

Time pressure was a major factor, with many students not attempting this question. It was also very hard. Lots of students struggled with balancing the equations and a common mistake was to suggest ethane or ethene as one of the products in process 1. Many also did not draw a cycle for the Hess-type question and so got the answer with the incorrect sign, or an incorrect value. Part (d) was well answered if the student had persevered this far. Parts (e) and (f) were very challenging but were answered correctly by the highest scoring students. A few of the students that got as far as part (f) were able to eliminate one of the variables and derive the quadratic equation, but had insufficient time to find its roots. Some made errors when deriving the quadratic, typically writing one of the coefficients as $2A$ instead of A^2+A .

The distribution of scores for Round 1 of the UK Olympiad is shown below.

