Feedback on Questions
Question 1 gave us the opportunity to teach the concept of "double bond equivalents" (DBE) and illustrate a few of the applications of this useful concept in organic chemistry. The start of the question was similar to an earlier question written for the UK Chemistry Olympiad in 2016, but whereas in that question NMR spectroscopy was used to identify structures, in this question IR spectroscopy was used. Question 2 about interesting aluminium chemistry came about from our reading about the simple diatomic Al–Cl, which led us down various paths that we thought would be fun and instructive.

Question 1

This started with a brief description of the concept of DBE and the early parts explored this knowledge which we expected to be new to many candidates. Part (a) was answered very well but the marks began to dwindle somewhat through parts (b) and (c). Once the fused ring systems were introduced, only the very best candidates could spot how to tackle the questions and this contributed to the distribution of marks across the paper. Part (f) proved to be very accessible but the filling of the table proved to throw up problems for both students and markers! The students' responses were either very good or very poor and we had to moderate a good number of high-scoring scripts in both directions as the markers wrestled with the mark scheme. When it came to the IR spectra, unfortunately a large number of students gave the names of functional groups for part (i) rather than the structures that were required. Overall, we were very happy with the range of responses we encountered: all of the marks were achieved by someone.

Question 2

As with question 1, it was hoped that the ramping of difficulty through this question on aluminium would give us a good distribution of marks, and so it proved. The early parts were answered well by the majority of candidates but by part (c)(iii), there were too many Al-Al bonds creeping in to candidates structured for Al_2Cl_6. We took the opportunity to introduce phase diagrams which most students seemed to cope with. We were rather strict with the marking of (d)(iii): we insisted that candidates mentioned that the three phases were in *equilibrium* for full credit. The enthalpy cycles proved much more difficult for all candidates, and we would strongly encourage all students at this level to include state symbols in their cycles as this helps to keep track of chemical species and enthalpy terms. Part (j) proved to be the toughest question on the paper: the combination of complexity and the fact that it came at the end of the paper meant that only the very best students were able to keep their head and score all of the marks. Part (j)(i) didn't require any particular chemical knowledge beyond what is normally needed for a standard empirical formula calculation, but students needed to keep careful track of their elements, recognising that the heating of the compound was done in a vacuum, and so all of the elements in the decomposition products had their origin in the original mineral. Again, a few excellent students managed to work through this problem to the end. Interestingly, a number of students correctly found the formula of mellitic anhydride in part (j)(iv), but then didn't calculate the DBE correctly, which was a shame. We had thought that this would nicely draw the two questions on this year's paper together!

In terms of the mark profile, this year's paper was slightly more difficult than the 2021 version, but the highest scoring students managed to perform excellently across all parts. Well done!