

## UK Chemistry Olympiad 2016

### Examiners' Report, Round 1, 2016

The members of the Royal Society of Chemistry (RSC) Olympiad Working Group would again like to thank teachers for their hard work supporting students and the RSC to run Round 1 of the UK Chemistry Olympiad. The quality of marking on the sample of papers seen by the working group was very high. There was evidence on some scripts of internal moderation before scripts were submitted to the RSC, which was pleasing to see, and the annotations made by some teachers to show why marks had or had not been awarded were very helpful. The members of the working group were pleased to receive letters and emails from teachers about the administration, content and demand of the Round 1 paper and have taken on board this welcome feedback, including making some alterations to the versions of the paper and mark scheme that will be put online for future use.

This year we increased the total number of marks to 100. Whilst we did not feel the paper differed in length substantially from previous years, many candidates found managing their time very hard. This may have caused them to rush the final two questions, possibly missing accessible marks. This was certainly a challenging paper, as indicated by the thresholds required for Gold, Silver and Bronze certificates, which were only three or four marks higher than last year despite there being 25 more marks available. The greater number of marks was very helpful in spreading out the students at the very top end of the Gold certificates. The top performing student achieved a score of 93 /100!

There was a slight decrease in participation in 2016 with 5822 students' marks entered into the online score submission system. Approximately 44% of entries received were from Year 12 or equivalent students, with a small number (0.5%) of Year 11 or below participating. There were a number of excellent entries from lower sixth form students and it is hoped that these students would be strongly encouraged to enter the C3L6 written paper later in the summer. It was noted that many of the top scoring students had previously participated in the C3L6 lower sixth written paper and it was pleasing to see that they have continued to participate in chemistry competitions.

We were especially pleased to see that 67 schools had participated for the first time and we look forward to seeing them continue to participate in future years. The Royal Society of Chemistry will, as usual, be awarding the INEOS prize to the best performing new state school – the student who achieves the highest mark from an eligible school (not entered more than once in the past five years) has won £1000 for their school chemistry department to spend on enhanced equipment or materials to help promote chemistry. In addition a prize is awarded to the top performing student in the competition.



Whilst the paper has always been written with upper sixth form students in mind, we encourage ambitious lower sixth form students to enter if they have been able to cover the required topics in their independent study. The top scoring Year 12 chemist is also awarded a prize, scoring 67%.

We felt that 5-8 marks should be accessible to a good GCSE candidate and approximately 15 marks could be scored by a good A level candidate. A score of 18 or above was therefore felt to be a commendable achievement and worthy of a certificate.

### Question 1

This question was about thermodynamics including enthalpy, entropy, Gibbs free energy and equilibrium constants. The examiners felt that this was a fairly straightforward opening question although it was noted that a number of top students made trivial mistakes in part a). Their error was carried forward in subsequent parts of the question. Trivial mistakes made by students included not converting  $\text{kJmol}^{-1}$  to  $\text{Jmol}^{-1}$  where appropriate, and whilst most students changed the temperature in part a) (v),  $\Delta G$  was often not recalculated at this temperature. It was noted that candidates manipulated the stoichiometry and reaction equations well. We thank the teacher who pointed out an error in two of the values used in the question. This did not affect the ability of students to do the calculations. A corrected version of the paper and mark scheme is online.

### Question 2

The examiners noted that this question was generally well answered. A number of students incorrectly drew a square planar representation of  $\text{WO}_4^{2-}$ . This was sometimes credited by teachers marking the scripts. The balanced equations were well answered, although some more able students lost marks through trivial mistakes and students would be advised to check that their chemical equations balance. Part (iii) was found to be trickier for a lot of students, as was finding the number of atoms in the unit cell where some students did not notice that the number of different types of atoms within a unit cell was related through the formula.

### Question 3

This question was about Double Bond Equivalents and its link to NMR. The elucidation of structures proved to be very demanding for many students. Some of the structures were clearly straightforward and many candidates were able to determine these. With some of the much harder problems it was excellent to see that there were some students who scored full marks. Some of the structures required considerable attention when applying the mark scheme. It was interesting to see a



couple of new structures proposed that were consistent with the data and that the committee hadn't considered. These were given full credit in the moderation process and we have added them to the online mark scheme.

#### **Question 4**

It was very pleasing to see that many students correctly calculated the empirical formula of the compound, although the most common error was the omission of oxygen from the formula, with students not checking that the percentages added up to 100. Some students later corrected this error by working backwards from the target molecule. It was noted that students who attempted to draw the structures of the intermediates often scored some marks. Some students approached the question by working backwards from the final product which was pleasing as organic synthesis questions used in Round 1 are designed to give students a variety of access points into the question. It is always difficult to account for all possible ways of error carried forward in organic questions. In moderation of the top scripts we tried to be generous where there was clear evidence of correct chemical intuition.

#### **Question 5**

It was noted that some students were unable to finish the question paper due to the pressures of the time allowed, however, those students who did attempt this question scored well on parts a) and b). Balancing equations containing an 'n' term posed problems for many students. Solutions provided by students were often succinct and well logically presented.

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## UK Chemistry Olympiad Round 1 Scores 2016

