Examiners' Report/
Principal Examiner Feedback

October 2017

Pearson Edexcel International Advanced Level In Chemistry (WCH05) Paper 01 Transition Metals and Organic Nitrogen Chemistry

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Introduction

The paper seemed to be well received. There were some question parts where candidates struggled, but apart from them, all questions attracted the full range of marks. As usual, there were several question requiring candidates to apply their knowledge to novel situations.

As always, there were questions on practical areas of this unit. There were many excellent answers from centres where practical work is given the priority needed but there were also candidates who showed little experience of working in laboratories.

A particular problem area were questions where explanations were required. Here answers were often hampered by candidates lack of precision in expression, especially in the use of correct chemical terms.

There were more than the usual numbers of questions where candidates failed to read the question asked.

Multiple choice questions 1 – 14

The easiest question, beginning with the easiest, were:

Q9 – amino acids

Q1 – oxidation number

Q3 – ligand exchange

The hardest items, beginning with the hardest were:

Q5 – application of oxidation number

Q10 – optical isomers

Q12d – identification of ion fragments in mass spectroscopy

Question 15

Q15(a) Most students were aware that the number of protons increases across a Period. Only better students recognized that in Ti and Sc the 4s orbitals are screened by inner 3d electrons.

Q15(b) Here most students recognised the second electron removed from potassium came from an inner 3p shell. Better students recognised that in the other elements the electrons came from the same 4s sub-shell. There was some muddling of the terms shell, sub-shell and orbital. There were some other insufficiently explicit answers like in potassium the second electron is removed from another shell.

Q15(c) Though simple ideas were examined there were many incomplete answers focussing on just one of the two points in the question.

Q15(d) Weaker responses thought there were eight ligands in the structure. Many failed to show the bonds from water through the oxygen atoms. Quite a few omitted either the name of the bond angle or type.

Question 16
Q16(a)(i) Many students gave the correct electron configuration for manganese but thought d electrons were lost in ion formation.

Q16(a)(ii) Weaker students failed used terms incorrectly like the stability of a half-filled orbital.

Q16(b)(i) As usual a cell diagram was a challenge. Common omissions were the acid from the manganate(VII) half-cell, the temperature and/or the concentrations, the materials of the electrodes and an indication of an adequate level to the solutions.

Q16(b)(ii) Many gave the correct value with the incorrect sign.

Q16(b)(iii) Sometimes wrong signs were given or signs omitted from ions. Reverse equation were common, as was incorrect balancing and failure to combine the manganese ions on the right side of the equation (2Mn + 5Mn).

Q16(c)This was a very challenging question. Many did not read the question sufficiently carefully. So they omitted use the data from part (b) as instructed. Some used manganate(VII) in acid or alkali rather than manganese. Others used only vanadium compounds.

Q16(d)(i) Only about half the students gave this relatively simple ionic precipitation equation correctly. State symbols were often incorrect and there were many unbalanced equations.

Q16(d)(ii) Very few students knew the colour of manganese hydroxide, which is straight from the user guide.

Q16(d)(iii) Even less know that manganese dioxide formed. Some gave the name and the incorrect formula, or the correct formula with the wrong name.

Question 17
Q17(a)(i) A small number only read half the question so gave just the number of carbon atoms.

Q17(a)(ii) The catalyst was usually correct. The compound often had the wrong formula.

Q17(a)(iii) The equation for electrophile formation sometimes involved an alkane. Arrows failed to originate from the circle representing the delocalized bonds in benzene. The horseshoe in the Wheland intermediate was often incorrectly placed or the charge was outside the horseshoe. The final curly arrow often went from the hydrogen atom or no inorganic product was given.

Q17(a)(iv) About half the students just gave concentrated sulfuric acid which was insufficient.

Q17(a)(v) Again, about half of students omitted or gave incorrect bonds, like an S-H bond.

Q17(a)(vi) This was one of the easiest marks on the paper.

Q17(b)(i) Students failed to remember that in a solubility question it is necessary to mention the forces in each separate liquid and in the mixture. As a result forces for only one liquid were given. Those gaining credit usually gained the second mark for hydrogen bonds cannot form between the two substances.

Q17(b)(ii) Very few gained the first mark for recognising that an ionic group was present. Few gave the term ion-dipole force for the second mark. A mark could only be gained for hydrogen bonding if the atoms involved were specifically given.

Question 18
Q18(a)(i) Very few students were able to give the correct state symbols. Aqueous bromine was often used. There were many solid organic components.

Q18(a)(ii) Only the best students were able to do this correctly. Lack of balancing was the main problem.

Q18(a)(iii) Despite being well trodden ground less than half the students scored anything at all. Many failed to mention the lone pair of electrons or that the electrons are donated to the ring system.

Q18(b)(i) About half either gave the correct formula or the correct reaction type.

Q18(b)(ii) Very few recognised this simple acid-base reaction. There was was much confusion with diazotisation.

Q18(c) Very few could draw the structure of an amide. HBr was missed as the inorganic product.

Q18(d) The two equations were very poorly done. Few knew the formulae of both organic products and those who did failed to balance the equations. Reflux with ice was often seen for the condition.

Question 19
Q19(a) Virtually no students answered this question by starting from the different charges, though the mark scheme allowed this in the end. In future simply repeating past answers to questions of this type about colours in complexes may not be treated with such lenience.

Q19(b) All three parts were dead marks to most students. The reasons for highly charged cations instability were not known in Q19(b)(i). The two reactions in Q19(b)(ii) and Q19(b)(iii) should be well known but were not. In (ii) chromium hydroxides were common. In Q19(b)(iii) better students reacted dichromate(VI) with one mole of hydroxide to form chromate(VI) in and hydrogen ion, which is wrong for the hydrogen ion would immediately react to form water.

Q19(c)(i) Most students had the good sense to give some of the colours of the solutions of the ions involved. This was sufficient if they knew them. Most knew two colours correctly. Again this did not really answer the question – the key was the similarity of the colours of reactant and product ions.

Q19(c)(ii) Less than half realised refluxing was needed.

Q19(c)(iii) This was the only part of question 19 which gained any credit for most students.

Q19(c)(iv) – (vi) Here a total failure by students to read the question started students in the wrong place with18.60 x 0.015/1000. Very good students managed to gain marks for transferred errors form this but these wer few and far between. It is best to keep going in this situation even if you think you have made a mistake.

Q19(d) The application of knowledge of complexes to this situation was just too difficult for all but a very few students.
Some could have gained the second mark for a singly ringed oxygen atom if they had said six ligands per ion.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Paper Summary

- read the question twice.
- study and learn the work on transition metals more thoroughly, with particular reference to explanations of atom and ion size and electron arrangement.
- spend more time applying electrode potentials especially to predicting reactions and the practical set up for cells.
- study and learn the organic chemistry more thoroughly, particularly writing equations for reactions using all types of formulae.

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