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Moderators' Report/ Principal Moderator Feedback

Summer 2016

Pearson Edexcel GCE in Chemistry (6CH02) Application of Core Principles of Chemistry

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General

The paper seemed to be well received. There was no evidence of candidates having insufficient time to complete the paper. All questions attracted the full range of marks. There were a number of questions on areas of the specification which were less familiar to the candidates. There were also several questions requiring candidates to apply their knowledge to novel situations.

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

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

Multiple choice questions 1 – 12

The most accessible questions were:

2d – molecular structure

4a – ketone identification

5 – Maxwell-Boltmann curve

The most challenging items were:

10b – uncertainties in titration readings

12 – boiling temperature trends for Group 5 hydrides

10a – concentration of a salt formed by neutralization

1 – isotopic molecular ion peaks in mass spectroscopy

Question 13

This question was about the electronic structures and shapes of some fluorides of elements of the first short period. Some of these were familiar but some required application of general principles to less familiar molecules.

(a)(i) The shape and bond angle for boron trifluoride were well known. A few thought it was a triangular pyramid.

(ii) The shape needed to be drawn in a recognisable way. It is easiest to represent it as a 'three legged stool' with a 'saw-tooth' convention drawing, with a thickening line showing a bond coming out of the paper and a dotted line for a bond going into the paper.
The bond angle accepted was from 106 – 108º, along with the true value, which turns out to be 102º!

(iii) It is usual to represent a dative covalent bond by an arrow, here from the nitrogen to the boron. Dot and cross diagrams were also acceptable, but for them it is best to make clear where the electrons in the dative covalent bond are

coming from by using different symbols for electrons from boron, fluorine and nitrogen.

(b)(i) It is usual for the sign to precede an oxidation number, although on this occasion this was not penalised. Less able candidates omitted the positive sign.

(ii) The common incorrect answer was to give the product as H_2F_2. It seems reasonable that candidates should be able to extend their knowledge of hydrogen halide formulae to hydrogen fluoride.

(c) Less able candidates gave double or even three electron bonds between the oxygen atoms in what was a fairly straightforward application of the octet rule to bond formation.

Question 14

Much of this question was centred the reaction of halogenoalkanes with water containing dissolved silver nitrate, 2.10 2diii in the specification. Reactions which the specification explicitly states should be 'carried out', 2.10 2e. Responses seemed to indicate that many candidates were unfamiliar with these experiments, their results and the significance of the results.

(a)(i) Less than half the candidates were successful. It is important to consider the reasons for each practical procedure. Good candidates recognised that halogenoalkanes are immiscible with water but soluble in ethanol.

(ii) Only weak candidates did not give the appropriate alcohol as the organic product, some giving an alkene.

(iii) The colour of the precipitate most commonly given was 'cream', though 'pale yellow' and 'off white' were allowed.
The ionic equation was more challenging. Even those getting to something recognisable as an ionic equation made errors like divalent or trivalent silver, or incorrect states for the product or the reactants.

(iv) Only about half the candidates knew that **concentrated** ammonia solution is required. The term 'solution' was often omitted but not penalised on this occasion.

(v) Sadly, again, only about half the candidates remembered this result correctly.

(vi) After the mistakes in part (v), it was probably inevitable that the same candidates would struggle with the explanation of the results. There was much discussion of steric hindrance, which, while true, missed the main point of the question. The key factor is the ease of breaking of the carbon bromine bond.

(b)(i) It is unfortunate that the three approved text books do not describe this reaction to produce the gaseous organic product. It is a well tried experiment and it is important that candidates should be familiar with both this and the method for obtaining a liquid alkene.
Many candidates gained the second mark for the collection, although they usually collected the gas in a gas syringe, which is not really suitable.

(ii) A large number of incorrect responses gave butan-1-ol as the product, which was deemed insufficient for a transferred error for the formula. Again the carrying out of this reaction is clearly stated in the specification.

(c)(i) The type and mechanism for this reaction are well understood, but were often given the wrong way round.

(ii) Though clearly mentioned in the specification, only half the candidates were able to give the name correctly.

Question 15

This was another question on based on the candidates' practical experience, results of an experiment and the interpretation of those results.

(a) This is a good example of a question based on the significance of the results of an experiment. Here, the results were given, in case they were not recalled. The majority of candidates responded that the compound had 'melted' in Stage 1, losing the first mark.
Though it was sufficient to mention water boiling, good candidates also mentioned it condensing at the cooler mouth of the test-tube.
The idea that the anhydrous magnesium nitrate solidified was rarely given. Common incorrect responses were to identify the solid as magnesium oxide or magnesium nitrite.

(b)(i) Consequent on part (a) magnesium oxide was the common incorrect product in Stage 7.

(ii) There were a wide variety of incorrect products in the equation, including hydrogen or nitric oxide, NO. The water proved too difficult for those who doubled the equation to avoid half a mole of oxygen gas as a product.

(c)(i) As has happened in the past there is confusion between the flame test for a magnesium compound and burning magnesium. Magnesium salts have no flame colour.

(ii) This question was generally done well, referring to heat promoting electrons to higher levels, electrons falling back of ideally electrons 'relaxing' to lower levels and light or ideally electromagnetic radiation emitted.

A few weaker candidates thought light was emitted as electrons gained energy. Others thought light was absorbed.

(iii) This was more challenging but good candidates referred to electrons rising to different energy levels and emitting different frequencies of light as they fell.

Question 16

(a)(i) A very few candidates placed chlorine atoms on both carbon atoms.

(ii) There were a number of ways of gaining credit as the mark scheme makes clear. The best answered discussed relevant intermolecular forces in both 1,1,1-trichloroethane and hexane.

(iii) The key problem is that it does deplete the ozone layer. Incorrect answers classified it as a CFC or said that chlorine formed. Of course it was possible to

mention the formation of chlorine radicals provided this was linked to ozone layer depletion.

(b)(i) Incorrect answers often discussed negative chloride ions attacking the double bond.

(ii) Some only added iodine or chlorine, rather than both. The two hydrogen atoms were also ignored or lost.

(iii) Answers based on just 'light', rather than sunlight or UV were deemed insufficient.

(iv) The oxidation numbers were rarely incorrect but the equation proved more challenging. Many gave chlorine as a product.

(c) A surprising number of candidates gave an acid-base indicator.

Many muddled the colour change, giving it the wrong way round.

(d) In spite of this being an unfamiliar titration, this calculation was well done, with the numerical parts usually correct.

Some halved or doubled their answer to (iii) to get their answer (iv).

Some realised a negative answer could not be possible in (v) and reversed the subtraction.

Some failed to remember iodine is I_2 in part (vii).

By far the least well done part was part (ii). The formula of the tetrathionate ion is not well known.

(e) This was the most difficult part of the paper. Candidates struggled to understand that less double bonds would lead to a higher sample titre and hence a lower iodine value.

Advice to candidates

- Carry out the experiments, considering why a procedures are being used and how they work
- Learn results of experiments
- Learn the significance of experimental results.
- Practice calculations to find volumes, concentrations, and masses of reactants and products for familiar and unfamiliar reactions

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