

Examiners' Report/ Principal Examiner Feedback

March 2011

GCSE

360Science

GCSE Additional Science
Structured Paper C2 (5018H/1H)
Higher Tier

GCSE Chemistry
Structured Paper C2 (5038H/1H)
Higher Tier

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March 2011

Publications Code UG026866

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5018H Additional Science/ 5038H Chemistry (C2) Examiners' Report

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This paper consisted of four questions, the first of which was common with the foundation tier paper, 5018F/1F.

Question 1

The table was completed very well, with half of the candidates achieving full marks. The most common errors were: the omission of the continuation bonds in the repeating unit for poly(propene), no double bond in ethene's structure, and the use of polypropene rather than poly(propene).

Only half of candidates defined unsaturated correctly, but the use of 'spare bonds' or 'free bonds' again cropped up and was not credited. Some candidates referred to the idea that the carbon atoms 'haven't bonded to the maximum / not holding as much hydrogen as they can', but the examiners are just looking for a simple explanation of double or multiple bonds.

The bromine water test for unsaturation was well known, but examiners still saw responses giving 'turns clear' or 'transparent' or 'becomes discoloured'. Clear and colourless are not the same. In some cases candidates just mentioned that a colour change would occur, which is not an adequate response. 60% got this mark.

Cracking was well described by most but some used unfortunate expressions such as 'a (large) chain of molecules...' which read as if they were describing the separation of one chain from another i.e. melting. Too many un-chemical synonyms for 'breaking up' appeared when the correct terminology very often led straightforwardly to the mark.

The polymer use part of question one penalised those candidates who did not carefully read the question, and therefore gave uses that did not depend on **both** properties (this is, after all, a higher tier paper). The most common correct answers referred to food packaging, cling film and pram covers. (Note that the examiners looked for a reasonable suggestion based on the properties, the specification does not require recall of specific uses). Only 23% scored the mark. The most common incorrect answers referred to plastic bags (which do not need to be transparent), or more vaguely 'plastic(s)' and also 'waterproof clothing'.

In the disposal of plastics, 74% of responses gained at least one mark for polymers not rotting or not biodegradable. The second mark was more elusive, with a decent minority (21%) gaining this mark by indicating that landfills quickly filled up or harmed animals. A very low number of responses covered point 4 in the mark scheme. Incorrect answers referred to 'toxic gases', 'gases from decomposition or incineration (causing global warming)', or vaguely mentioned 'causes pollution'.

Question 2

Two thirds of candidates identified that both atoms have one outer electron. However, many answers referred to the fact that the elements were in 'the same group' or are 'alkali metals' without mentioning the electronic configuration as the question required. Other common errors included reference to the same number of 'atoms' on the outer shell or even just the same number of electrons.

The ion was correctly defined by less than half, particularly as a charged atom or an atom which has gained or lost electrons. However, in many cases an 'element that has lost or gained electrons' was stated and even 'positively charged electrons'. Perhaps inevitably some definitions were for isotopes and descriptions of ionic bonding were given without reference to ions. 73% - perhaps surprisingly low - got the formula K^+ . Note that K^+ was not accepted.

The examiners noticed that about half of candidates can now link high melting point to strong bonds (about 30%), most commonly coupled with "a large amount of energy needed" or simply "strong ionic bonds" to gain 2 marks (about another 20%). However, a very large number of answers were often unable to score or scored on the third marking point only, since they discussed strong bonding and intermolecular forces together, or strong bond between the atoms, or strong covalent bonds. Often, covalent bonds or intermolecular forces are mentioned in conjunction with ionic bonds. There does continue to be a lack of precision about the difference between heat and temperature.

The formula of sodium sulphate was poorly answered. 15% scored the mark. Many answered $NaSO_4$ (with or without added charges), as well as $2NaSO_4$ and Na^2SO_4 . It was noted that many candidates have a poor grasp of working out the formulae, although occasionally that there were batches of correct answers, suggesting that this has been emphasised by some centres.

Question 3

The calculation, as ever, stumps many candidates. It is worth candidates learning a standard algorithm. For example, copying the equation and writing underneath the relative formula masses \times number of moles in equation usually gets one mark. Quite a few were able to gain 1 mark for either '170' or ' $28 \rightarrow 34$ ' or very occasionally ' $280/28 = 10$ '. Sadly, many appeared to have no idea how to attempt the calculation (60%).

In a straightforward percentage the most common error was i.e. inverting the ratio. Some candidates still thought an answer in excess of 100% could be correct. 42% got this correct.

The equilibrium application was poorly done. Only a very small number mentioned equilibrium. Most talked about reaction rates, commonly saying that 'higher pressure means particles are closer together, hence more collisions hence faster reaction'. Very few candidates scored marks on this part of the question. However, in the next part more good answers were seen, where either plant costs or energy costs or risks of explosion were often discussed at some length. Sadly, some who mentioned that there could be an expense and/or risk in such a process failed to specify the particular expense / risk and thus were unable to score. Some candidates believed that increasing pressure would have poor effects on yield or equilibrium position. Discussion occurred on how the molecules would break down (or be 'damaged') under this high pressure.

Question 4

One would hope that on a higher tier paper this equation would be tackled well. Unfortunately few scored both marks (23%), and many failed to recall the correct formula for oxygen as O_2 and simply put O or 2 O on the product side, thus scoring 0 marks. Occasionally, oxygen was omitted altogether.

In contrast, more good dot and cross diagrams were seen, 38% scoring both marks. Commonly seen errors resulted from carelessness in regard to incorrect positioning of bonding pairs, showing too many or too few non-bonding electrons and in many cases putting HO_2 as the formula. Some candidates put themselves at a disadvantage by drawing sloppy diagrams that do not clearly show where the

electrons are situated in the molecule. Those candidates who draw dot and cross diagrams without rings need to take care that the hydrogen atoms are shown to be sharing a pair of electrons.

The straightforward part (c) was answered 'catalyst' by most (66%). In many cases, but clearly not required, candidates went further and correctly discussed 'lowering of activation energy' or impressively discussed adsorption / catalytic effect. Incorrect answers discussed the effect of an increased surface area (of the silver powder) on rate and not the catalytic effect, and in many weaker responses, it was suggested that it was because 'silver is a reactive metal or a good conductor'.

There was a good understanding of the term exothermic, 86% correct, with most answers saying 'heat given out', the incorrect responses were mostly mixing up exothermic with endothermic.

The last part of this question proved challenging. Very few candidates scored full marks (13%) (for which only two of the three possible correct points were required). One mnemonic suggested by an examiner is BENDOMEX = B(breaking bonds is) ENDO(thermic) M(making bonds is) EX(othermic). Many contradicted themselves, namely discussing bond breaking as both endothermic and then exothermic, or got the energy changes the wrong way round.

Revision tips

- Consider the uses of plastics in relation to their uses
- Get clear the distinction between ionic and covalent bonding and all of the relevant terms
- Practise writing formulae when given the ions
- Practice mass-mass calculations
- Draw dot and cross diagrams carefully to show shared pairs
- Learn why some reactions are endothermic and some are exothermic.

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