Examiners' Report/
Principal Examiner Feedback

Summer 2015

Pearson Edexcel International GCSE
in Chemistry (4CH0) Paper 2CR

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Question 1

There were many high scores in this question about atomic structure, with most candidates succeeding in parts (a), (b) (i) and (iii).

In (b) (ii), although most were able to state the number of protons in Z, far fewer were able to explain their choice - there were several references to the numbers of protons and electrons being equal, the number of protons increasing by 2, and some general statements about a connection between the number of protons in an atom and its position in the Periodic Table. What was needed was something more specific to X and Z, such as that Z was two groups to the right of X, or that X was in Group 3 but Z was in Group 5.

In (b) (iv), it was often the use of language that prevented marks from being scored. For example, for the similarity, 'the same number of outer shell electrons' scored but 'they have the same number of electrons in each shell' did not. In some answers, the stated difference was about the number of electrons rather than the electronic structure.

Question 2

This question, about the formation of ethene in cracking, was also high-scoring, with (b) (iii) causing the most problems. Some answers referred to the presence of impurities in the porous pot, while others referred to the formation of carbon dioxide and water, presumably by combustion rather than decomposition. Some of these answers identified the porous pot as a source of oxygen for the combustion. However, most answers mentioned something sensible, such as the presence of an alkane, or hydrogen; correct statements such as 'cracking always gives at least two products' and 'there is some water vapour present' were also accepted. A few wrote an equation to show the decomposition of decane, which was also accepted.

Question 3

Most candidates scored highly in this question about magnesium burning in air, with the flame and solid colours in (a) and (b) being white, although grey, black and lilac were among the incorrect colours seen.

It was pleasing to see many all-correct answers to the calculations in (c) and (d); the commonest error in (c) was the use of an incorrect percentage of oxygen (sometimes 16% - perhaps a confusion with relative atomic mass). Once again, candidates need training in setting out calculations, which gives them a much better chance of scoring some marks if the answer is incorrect. For example, in (c), an answer of 770 cm^3 is incorrect, and with a jumble of unexplained numbers, the result is a score of zero. If however, there is a clear statement that the % of oxygen in air is 23% (incorrect), then this would give 770 cm^3 consequentially, resulting in a mark of 1 out of 2.

Similarly in (d), an answer of 0.12 g is incorrect, but if it can be seen that this is the result of multiplying by 24 instead of 40 in the second step, then again 1 mark out of 2 may be scored. The use of 24 (the relative atomic mass of magnesium) was expected, but in some answers the working showed that 24 referred to the molar volume of a gas in dm^3.

Question 4

This question was about chlorine and its formation in the laboratory by the electrolysis of sodium chloride solution.

Part (a) caused the most problems, and candidates often found it hard to express what they were trying to say in (a) (i), and there were many incorrect or irrelevant statements seen, including 'both equations have 2 electrons' and 'there is a 2 in H_2 and Cl_2'. Examples of acceptable answers included 'when 2 electrons are used, one molecule of each gas forms' and 'there are equal volumes because the number of moles of each gas is the same'.

In (a) (ii), although some answers referred to the gas escaping, most realised that chlorine was partially soluble in water, or in sodium chloride solution; the reaction of chlorine with water, but not with sodium hydroxide, was also accepted, because the sodium hydroxide would be formed in the left-hand tube.

Many scores of 2 in (a) (iii) were seen, with a few referring to only one of the formation of hydroxide ions and the solution being alkaline; a small minority of candidates thought that the pink colour indicated acidity.

In part (b), most knew the final colour in the litmus (ideally white, but colourless and bleached were also accepted), although some did not go further than red; the result of the reaction with potassium chloride solution was less well known, with a range of unacceptable colours appearing, including green and purple, and also the formation of a white precipitate. The expectation was brown (or an intermediate colour such as orange or yellow), or from those who thought solid iodine might be formed, a reference to a black or grey solid.

Part (c) was generally well answered; the commonest wrong answers in (i) being 'to clean it', 'to remove impurities' and 'to purify it'. The expectation was a reference to sterilisation or disinfecting, or killing bacteria (or alternatives such as pathogens or microorganisms).

The equation in (c) (ii) was almost always correct, while in (c) (ii) a small minority of answers referred to cooling or condensing rather than to water.

Question 5

This question was about the temperature changes during neutralisation. Questions like part (a) have been set before, and there are often knee-jerk responses to them, only some of which were acceptable; in this case, 'volume of acid' and concentration of alkali' scored, but not 'volume of alkali' (as this was varied in different experiments) and not 'temperature' (as this changed during each experiment, although 'starting temperature' and 'temperature of room' were accepted).

Although part (b) was often correctly answered, a surprising number thought that a polystyrene cup would be a bad idea because it would react with the acid or make the thermometer readings harder to see; many of those who scored a mark for its insulating properties then only said that this would 'affect the results', without stating how.

In (c) (i) there were very few errors in the temperature values, but in (c) (ii) several answers stated only 'exothermic' without the necessary accompanying statement of how the temperature change indicated this; a disappointing number contained contradictions such as 'the temperature increases, so heat is being absorbed and therefore it is endothermic', while some contained correct links ('endothermic if the temperature decreases and exothermic if it increases') without stating what happened in this particular reaction.

Although some answers in part (d) scored full marks, it was disappointing to read very many that contained only mathematical descriptions (such as 'at first the temperature change is directly proportional to the volume') with no reference to the chemistry. The expectation was a reference to the temperature increasing as more acid was being neutralised, then some reference to the reaction being complete, or all the acid being neutralised, or the cooling effect of the excess alkali.

Question 6

In part (a), the gas was almost always identified as carbon monoxide, and in most cases a correct reason was given for its poisonous nature. The expectation of the specification is some correct reference to a decrease in the oxygen-carrying capacity of the blood. Explanations using knowledge from biology are very common, and acceptable if correct; however, answers such as 'stops the haemoglobin in the blood from circulating' and 'replaces the haemoglobin in the blood' are not correct. There were few errors in part (b).

Question 7

This question was about bromine and its compounds.

In part (a), most candidates correctly gave the state of bromine at room temperature, but the colour of iodine was often given as brown (acceptable for a solution, but not for a solid) or purple (this is the vapour), of blue-black (confusion with the starch-iodine complex). The dot-and-cross diagram for the unfamiliar compound PBr_3 was often correct, with the commonest error being the omission of the lone pairs of electrons on the bromines (although the one on phosphorus was often included).

The equation in (c) was often correct, although some candidates wrote an incorrect formula such as $P(Br_2)_3$ or P_4S_3 (the latter appeared in the previous question), while a small number did not attempt to balance an otherwise correct equation.

Question 8

This question was about different aspects of nickel metal.

In (a) (i), the commonest errors were imprecise statements such as 'loss of oxygen' or 'it loses oxygen'; as the question was about a specific reaction, a specific answer (such as 'nickel loses oxygen') was required. Answers in terms of electron gain were accepted if they referred to nickel ions.

Questions similar to that in (a) (ii) have been asked on a number of occasions before, and candidates continue to have difficulty in answering them. The reference to yield and the reversible arrow in the equation should have triggered an answer in terms of equilibrium - the expectation was recognition that low temperature and high yield indicated an exothermic reaction and the equilibrium position being shifted to the right. Candidates need to appreciate that answers in terms of reactions being favoured do not score marks; in this example, answers in terms of forward reaction being faster are clearly incorrect at low temperatures, and statements about more product being formed repeat the 'high yield' stated in the question.

Answers to (b) (i) were often disappointing, and it was clear that the word 'particles' in the question was misunderstood. There are some terms in chemistry that have different meanings, depending on context; in an atom, the protons, neutrons and electrons are sometimes referred to as sub-atomic particles, but here the reference to the bulk properties of melting point and conductivity should have indicated that it was the particles in the metal that should be considered. In the diagrams that scored some marks, an occasional unexpected feature was to show the electrons around the ions, but not in between them, in what looked like a protective coating. Many diagrams labelled the circles as nickel atoms rather than positive ions.

Answers to (b) (ii) were generally better, although with some familiar errors seen in previous sessions (answers should state that malleability is due to layers of positive ions, not electrons, sliding over each other, and that electrical conductivity is due to delocalised electrons, not just charged particles, flowing through the metal). Some candidates showed their lack of understanding of metallic bonding by adding a reference to intermolecular forces.

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