Examiners' Report

Principal Examiner Feedback

Summer 2017

Pearson Edexcel International GCSE in
Chemistry (4CH0) Paper 1C
Science Double Award (4SC0) Paper 1C

Pearson Edexcel Level 1/Level 2 Certificate in
Chemistry (KCH0) Paper 1C
Science (Double Award) (KSC0) Paper 1C

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Question 1

As expected most candidates performed well in this question although some suggested more than three protons would be present in an isotope of the element.

Question 2

In part (d)(i) the test for chloride ions was well known by many, but often only silver nitrate was mentioned. Candidates should be advised to name the acid required, in this case *nitric acid*, rather than just state "*acidified silver nitrate*". For the result of the test, some did not gain credit as they just referred to the solution "*going white*" without a precipitate being mentioned. It was surprising to see significant number of students giving a test for chlorine gas instead of chloride ions.

Question 3

The early parts of the question were well answered although some suggested hydrogen in (b)(ii). In (b)(iii) the most commonly awarded mark was for candidates knowing that zinc was more reactive than iron. However, some did not gain credit as they referred to the ions rather than the metals and gave statements such as *Zn^{2+} is more reactive than Fe^{2+}*.

Some gained a second mark as they correctly described zinc losing electrons forming Zn^{2+} ions or gave a correct ionic half-equation for the process.

The third mark proved challenging but it was pleasing to see candidates gain it, some by giving a correct relevant statement involving Fe^{2+} and Fe, whilst others used an ionic half-equation in their explanations.

Question 4

In (a) it was disappointing to see that many candidates were unable to give correct formulae of ionic compounds when provided with the formulae of the ions although the majority correctly gave $CuCl_2$. In (d)(ii) most students received the mark for sodium sulfate but many failed to include the (III) in the iron(III) hydroxide. A common incorrect answer was iron oxide and some gave formulae instead of names. In (d)(iii) strong candidates gave good answers referring to carbonates, but many suggested adding acid was to *remove impurities* or to *make the solution acidic*. Occasionally the wrong colour, usually brown, or no colour was given for the precipitate in (iv). Some gave the correct answer but lost the mark by mentioning another incorrect observation, usually bubbling or fizzing. In (e) most candidates correctly suggested adding an acid, usually hydrochloric acid, although a few added sodium hydroxide instead of an acid. Some candidates, although they knew the test for carbon dioxide involved limewater, did not mention that you need to bubble or pass the gas into the limewater and often suggested adding the limewater to copper carbonate or to a mixture of acid and carbonate.

Question 5

The purpose of the reactions in (a) were not well known with many simply giving the products of the equations by suggesting the reasons were to produce carbon dioxide in part (i) which could then be used in part (ii) to produce carbon monoxide. Often no convincing purpose for the carbon monoxide was provided. In (b) the first equation was often correct although incorrect formulae for calcium carbonate were sometimes given and calcium silicate was thought to be $CaSiO_2$ by many. In (c) many gave good generic answers but did not link their knowledge of oxidation and reduction to the reaction in the question. Others got confused between what was being oxidised and what was being reduced, and a few mentioned oxidising agent and reducing agent to no purpose. Answers in terms of electron loss and gain are not suitable in reactions such as this.

Question 6

Most knew the general formula for alkenes in (c)(i) with only a few giving the general formula for alkanes instead, and some giving the formula of a specific hydrocarbon. In part (iii) a small number were confused by the meaning of saturated in the question and gave the structure of ethene; others gave the structure of butane and a few gave two alternative answers, one with a double bond and one without. In part (iv) many candidates managed to score both marks; however, some just redrew the branched structure that had been given, but as a rotation or a mirror image of the original. Others lost marks for drawing five bonds around a carbon atom or for drawing the same correct isomer twice. Many candidates seemed to think that drawing the carbon chain with a right-angled bend in it produces a different isomer. It should be noted that, although credit was given for cyclobutane and for the cis-trans isomers, these are not expected to be taught.

In part (d) the question required differences between the reactant and the product. The idea of the answer being a comparative one, with references to both reactant and product being required to be successful, was unfortunately lost on some, and they wrote many lines without gaining credit. The most succinct answers were often the best. Common errors included confusing which were products and reactants, thinking that ethene or poly(ethene) are liquids, and unfortunately several answers referred to cracking rather than polymerisation.

Question 7

Many stated that using iron powder was to increase the surface area without saying what effect this would have on the rate of the reaction, and some candidates incorrectly referred to the rate of the iron powder dissolving in the water rather than the rate of the reaction. In (b) many answers were not specific enough and candidates failed to mention rusting or the rate of reaction so did not gain credit. Many incorrect references were given to the iron dissolving and a solution being formed. There were generally few mistakes in (c) although some gave the answers 70, 20, 50 as they rounded to the nearest $10cm^3$ rather than the nearest $1cm^3$, and others gave the answers 70.1, 10.6, 59.5 as they read the scale incorrectly. Part (e) proved challenging with the majority of incorrect answers stating that the student should divide by 250 rather than 340, as they failed to account for the air present in the syringe. Another common mistake was to use the syringe reading at the end (20) rather than the volume of oxygen reacting (70).

Question 8

In part (a) most candidates gained the mark for correctly drawing the energy profile for the reaction with a catalyst. However there needs to be more precision in labelling, as arrows showing the changes were sometimes sloppy, often starting or finishing short of where they should have been. Activation energy was often labelled at the top of the energy peak, rather than being shown as a difference between the level of the reactants and the peak of the curve. Part (b)(i) was usually correct although some had misread the information about the temperature change. In part (ii), of those who correctly identified an increase in the yield of hydrogen iodide, the second mark was often missed because, although they correctly stated that the *equilibrium position shifts to the right or in the forward direction*, there was no mention of this being an exothermic reaction/direction. Some explanations often involved references to Le Chatelier and what reactions *want to do* – without giving enough information for the second mark to be awarded. The reduction in pressure in part (c) caused more problems both in the effect on the rate in (i) and on the yield in (ii) with many candidates stating that a decrease in pressure, produced a decrease in yield due to a reduction of collisions. However, it was pleasing to see good explanations correctly discussing equal numbers of moles on both sides of the equation.

Question 9

It was disappointing that (b) was generally not answered well. Many candidates gave the incorrect formula for either iodine and/or potassium iodide so $K + I \rightarrow KI$ and $K + I_2 \rightarrow KI_2$ were common incorrect answers. Others gave correct formulae but then failed to balance the equation. In (c) many gave the state symbol for hydrochloric acid as (l).

Part (d) proved challenging to score high marks for all but strong candidates. Many knew that effervescence occurred but then added other extra, incorrect observations such as a white precipitate, a bright white flame (stating it was caused by *magnesium reacting with oxygen in the water*), and colour changes, often to red. Perhaps some confused methylbenzene with methyl orange or were trying to answer this question using answers from similar questions in previous papers. Many others thought it was magnesium reacting with the water in a similar way to an alkali metal so there were often references to moving and floating. However, many candidates knew that in water, hydrogen chloride forms H^+ ions/hydrochloric acid but some who did gain this mark did not give an observation or explain that the magnesium reacts to form hydrogen or magnesium chloride.

In (e) although the use of precise chemical language, especially the correct use of the endings *-ine* and *-ide* can be testing for candidates, the reasoning seemed to be somewhat better than in similar questions in previous years. *Chlorine does not react with chloride ions* and *chlorine cannot displace itself* were the most common correct answers. In (f) the ionic equations were not well understood and the overall equation in (i) was often given in reverse.

In recognition of the difficulty of use of precise chemical language in (ii) the incorrect use of *astatine* for *astatide* was only penalised once, and this helped candidates to gain credit in their explanations of the redox reaction in terms of gain and loss of electrons.

Question 10

In (a) many correctly pointed out that the protons should have been electrons in the diagram. However, the other mark was less frequently scored as some suggested the error was that the ions should be closer together and others that the electrons should be round all sides and not in the middle. Unfortunately, some candidates who correctly stated that the charges should all be positive, then negated the mark by suggesting these particles were protons or nuclei. Part (b) produced a number of very good answers, worth three or four marks. The mark most often missed was that for naming the particles present in the layers that slide over each other. Sometimes a good answer was spoiled with a reference to intermolecular forces. Conduction explanations frequently scored both marks, although some candidates incorrectly described delocalised ions.

In (c)(i) most gained the first mark for bright white light or flame but fewer candidates scored the second mark, often because they did not include the colour of the solid or because they just named the product. Others used the term precipitate, which is not suitable in this instance and a few gave incorrect observations such as fizzing. Part (d)(i) was often poorly answered with *to speed up the reaction* or answers which stated or suggested that it was to evaporate all the water being common. The second part was sometimes better answered with candidates suggesting the rod was to see if crystals form. Some of these candidates then went on to gain the second mark by explaining this indicates that crystallisation point has been reached or that it indicates when to stop heating or if there is a need to continue heating. Weaker candidates gave a variety of answers, including ideas that the rod was being used to stir or cool the solution or as a thermometer. Part (d)(iii) was usually well answered although some put the formulae of ions such as Mg^{2+} and SO_4^{2-} and others gave the names rather than the required formulae of the compounds.

The calculation of x in the formula $MgSO_4.xH_20$ in (e) produced the anticipated spectrum of quality in the responses. Although the expectation was for students to compare moles of anhydrous salt and moles of water as shown in the Mark Scheme, some mathematically minded students used a method which found the Mr of the hydrated salt, from which they took 120 and divided by 18 to find x. Methods such as these were given full credit. Inevitably weaker candidates found the question challenging but many managed to make a start by doing a subtraction to find the mass of water and so gained at least one mark.

Question 11

The mass calculation in (a)(i) was generally well done with most correct numerical answers also including the correct units. The most common mistake was to use the Mr for calcium hydroxide rather than calcium oxide. Many correct answers were seen to (a)(ii), but many candidates just stated that calcium hydroxide is a base with no reference to carbon dioxide being acidic so just scored one mark. A few got the acid-base nature the wrong way around whilst others did not refer to the substances at all, just simply stating that the products were a salt and water.

In (b) the majority of candidates gained full marks for plotting the points and drawing a suitable curve of best fit. Surprisingly however, some just missed out the point at (49,24) and others the one at (56,14). Candidates should be encouraged to check the accuracy of their plotting. Tolerance is given in the quality of the curve as it should be drawn freehand, but some joined the points with straight lines using a ruler and so did not gain the mark for the curve. Some, despite having plotted the points correctly, then did not draw their curve through these points.

Answers to (c) were often disappointing with many believing that it was the calcium carbide particles or even the product ethyne particles having more energy which was the key factor. Statements about more collisions or particles have energy equal to or greater than the required activation energy were given only by a few candidates.

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