Examiners' Report

Principal Examiner Feedback

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

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Chemistry (KCH0) Paper 1C
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Examiner's Report International GCSE Chemistry 4CH0 1C

Question 1

Parts (a) and (b) were correctly answered by most candidates but in (c) it was surprising that only just over half candidates appreciated that simple distillation should be used to obtain water from a mixture of salt and water; filtration and crystallisation being the most common incorrect responses.

In part (d)(i) good responses were often seen but incorrect references to ensuring a fair test or to ensure being able to measure accurately were quite common.

In part (d)(ii) most candidates realised it was B but unfortunately, some, although they may have appreciated the reason, did not express themselves precisely enough, usually by not referring to a spot or equivalent word in their explanation. Answers such as "it reached the same height as ink P" fell into this category.

The majority of candidates correctly appreciated that ink D must be insoluble in (d)(iii) although many thought that it did not move as it only contained one dye or only consisted of one colour.

In (d)(iv) Good candidates had no difficulty in measuring the distance moved by the dye in ink A although some gave answers in cm rather than the required mm. Of those who gave values outside the acceptable range many were able to score a mark by dividing by 49 and correctly evaluating their answer. However, although any number of significant figures were allowed, many did not round up their answers correctly and so lost a mark. There was evidence that a few candidates did not have one or both of a ruler or calculator.

Most could give the correct formula to complete the equation in (e)(i) but only just over a quarter gave the correct state symbols in (ii).

Question 2

(a) Although the large majority drew an acceptable diagram, some lost the mark probably because of careless, rushed drawing rather than ignorance, leaving gaps not significantly smaller than those shown for a liquid on the question paper. Parts (b) and (c) proved very accessible as expected. In (d) about two thirds of candidates appreciated that the equation illustrated sublimation and in (e) many gave steam but water vapour was less commonly seen.

Question 3

Most correctly selected the displayed formula in (a) but there were more incorrect answers in (b) and particularly in (c) where many chose Y. In (d)(i) about three quarters of candidates correctly balanced both equations with the equation involving the incomplete combustion of ethene proving more difficult. In (ii) many very good answers were seen in terms of the decreased capacity of blood to carry oxygen as well as detailed descriptions involving haemoglobin.

Some weaker candidates just mentioned incomplete combustion, and others thought that carbon monoxide combines with oxygen in the blood. As expected, most named nitrogen and oxygen in (e)(i) but giving the formula of the acid formed in (ii) proved much more difficult. In part (iii) only half of candidates correctly named a building material damaged by the acid with iron and marble the most common answers. Incorrect answers included concrete and glass.

Question 4

In part (a)(i) many candidates identified A and B correctly and a statement that they contained the same number of protons and electrons was allowed to effectively cover both required aspects of the explanation. A common error was to choose A and E, but the majority who did this still gained one mark for their explanation. Some discussed A and B being isotopes with different numbers of neutrons which was correct but not relevant here.

Part (ii) proved much more testing and only strong candidates scored all three marks. Some chose different combinations of D, F, G and H and scored M3 for stating more electrons than protons. Others mentioned a gain of electrons but did not mention there were more electrons than protons, so did not score. Some failed to mention that they had equal numbers of protons so lost M2. Quite a few gave combinations of letters which did not both represent negative ions and hence did not gain any marks.

In part (iii) most scored one mark by identifying A as the atom with the lowest mass number, but a surprising number did not gain the second mark because they failed to give a correct reason for their choice. A large majority gave the correct configuration for E in (iv). It is worth noting that configurations in terms of orbitals should not be given at this level. Those candidates that knew how to do the calculation in (b) usually gained all three marks. However, a common mistake was to lose M3 by failing to give the answer to one decimal place as instructed. A few set out the calculation and multiplied the numbers correctly but then failed to divide their answer by 100 giving an A_r of 2432.7

Question 5

In part (a)(i) strong candidates answered correctly but unfortunately many candidates misinterpreted the question and gave descriptive answers instead of the actual numbers of the Periods. In part (ii) it was surprising that less than half of candidates identified argon as being the least reactive of the six elements. Of those who did answer correctly, most of these rightly suggested it was because it had a full outer shell of electrons, but some lost M2 by just stating argon was inert or a noble gas without referring to not easily gaining/losing/sharing electrons or to a full outer shell. Of those who did not give argon, silver was the most common incorrect answer but a few thought lithium or even rubidium was the least reactive.

(a)(iii) This was often well answered. However, some missed the point by just mentioning that Na and Ar are both in the same Period or that both have two electrons in the first shell and eight in the second. Part (a)(iv) was answered well by most candidates although many also gave extra unnecessary information before finally giving a correct explanation. Some simply stated that both are in Group 1 and so did not gain the mark. Part (v) proved a little more difficult than anticipated as significant numbers seemed to misread the question and gave answers about sodium being able to be cut with a knife or reacting with water. The most common correct answer was electrical conductivity with acceptable references to malleable and ductile also often seen.

In (b)(i) All the acceptable observations were seen in various combinations and most scored at least one mark. A significant minority misread the question and described the reactions with Li and K separately, frequently describing different observations for each and not scoring any marks. Other candidates compared the reactivity of the two metals rather than giving common observations, whilst others simply stated *vigorous reaction* or named the products, sometimes with an equation. Such answers possibly indicated a lack of understanding of the term *observations*. In (ii) a correct observation that would be seen with potassium only was given by just less than half of candidates, with mention of a flame being most common. Those who knew the products and their formulae usually had little difficulty with balancing the equation in (iii). Incorrect products which were often seen included lithium oxide, water and oxygen. Around two thirds of candidates gave the correct final colour of phenolphthalein indicator in (iv) but in (v) fewer could give the formula of the ion responsible for the colour change. It was quite common to see formulae of compounds particularly lithium hydroxide.

In (c) around 10% of candidates failed to calculate the mass of oxygen formed, but of those who did, it was pleasing to see the majority proceed to successfully determine the empirical formula of silver oxide. However, some candidates worked out the moles correctly but then failed to give the correct empirical formula, with AgO_2 being the most common error. A small minority did the calculations upside down or used atomic numbers.

<u>Question 6</u>

(a) This was not answered as well as expected, considering that it is a type of equation which is quite frequently seen. Many candidates were unaware that the halogens are diatomic, and the halides were often given as KCl_2 or KBr_2.

In (b) the full range of possible marks was seen. The majority of candidates knew that chlorine was more reactive than bromine. Many correctly identified that it was a displacement reaction. However, it was common to see, that even though many knew that bromine caused the final colour, they often gave the colour as brown or red-brown. They were not appreciating that the bromine was in an aqueous solution.

Some lost the mark by indicating the colour was caused by Br, which was ignored, or by bromide ions which is incorrect. A more surprising, but common error, was stating that the colour was green and caused by chlorine.

<u>Question 7</u>

Part (a)(i) proved to be very difficult and fully correct answers referring to the specific situation were rarely seen. In the main candidates suggested more general points such as safety glasses, lab coats, gloves or referred to acids being corrosive. Part (ii) proved much more accessible with most scoring at least one mark. Some suggested effervescence or an equivalent term, and gas given off as two separate answers and so only gained one mark. *White precipitate* was a fairly common incorrect answer and some named products, such as magnesium sulfate, rather than give observations. In (iii) only the stronger candidates gave a correct observation with some mentioning that water droplets would be seen. Unfortunately, although good numbers knew copper oxide was reduced to copper, they either did not give a colour change or thought it would become black or blue or white. Many give reactions of hydrogen such as popping. Part (iv) proved much easier, as expected. The completion of the word equations in (v) proved a good discriminator with an even spread of all marks. The first one was most frequently correct although water as a product was suggested by significant numbers. Copper hydroxide was a popular incorrect suggestion in the second equation and in the last one, many could not correctly name hydrated copper(II) sulfate with hydrous being a very common alternative. In (b) almost equal numbers scored two marks as scored zero, with a small number scoring one mark for just giving either the correct colour or referring to the acidic nature of the oxide of sulfur. Just less than half of candidates gave a correct formula in (c).

<u>Question 8</u>

(a)(i) This free response answer proved to be a good discriminator, especially in allowing good candidates to show their knowledge and ability. It also highlighted those who seemingly had not had direct experience of doing a titration themselves.

The first issue was in realising that an alkali, sodium hydroxide (sodium carbonate was acceptable) was required to neutralise the sulfuric acid. Those who did appreciate the need for an alkali often went on to give good or excellent answers. However, too many candidates failed to recognise that the alkali needed was sodium hydroxide or indeed did not use either a base or an alkali. The most common error was to use sodium sulfate. However, despite this, some of these candidates did go on to add acid from the burette and use a suitable indicator giving a correct colour change. Pleasingly, only a few used universal indicator which is not suitable for titrations. Some candidates started well by pipetting sodium hydroxide into the conical flask, but then forgot to add an indicator when they did the titration. A few incorrectly put the acid in the flask and the alkali in the burette.

A number of candidates mentioned the titration briefly, perhaps scoring one or two marks, but then focused their answer on the production of the sodium sulfate crystals which did not gain any further credit.

It is disappointing and surprising given how often they are seen in papers, that only just over a quarter of candidates scored full marks in part (ii) involving burette readings. Despite the advice in the question, many were penalised for a missing trailing zero. Some, possibly because of a lack of experience of using a burette, or perhaps just through carelessness, did not realise the numbers decrease going up the burette. Some rounded 3.55 to 3.6 and a minority added the readings together rather than subtracting them.

Part (b) required another descriptive answer to a practical situation and rather like part (a)(i) produced the full range of marks. Only the best candidates suggested a suitable reagent to add to the sulfuric acid. The most common errors were to use either barium metal or very frequently, barium sulfate, as a reactant. Many did gain a mark at some point for filtering but then failed to indicate what they were washing so were not awarded M4. A suitable method of drying was often given so enabling many to score M5.

Regrettably many gave descriptions which were indicative of the method for preparing soluble salts, often describing crystallisation of a filtrate, and some described a titration again as in the earlier part of the question.

<u>Question 9</u>

The mole calculation in (a)(i) was answered well by most candidates, although some used an incorrect value for the M_r and some lost a mark by writing the answer as 0.07

Part (a)(ii) proved a little more difficult. Some just did not attempt it or repeated their answer to (i) whilst others failed to divide by 1000 and so scored 1 mark for 57.2

Although there were many good answers to part (iii), the majority did not gain the mark. Common incorrect answers referred to obtaining the maximum yield or making sure the reaction was complete. It was surprising that less than half of candidates could produce the required sketch of a filter funnel and paper to remove the excess solid copper(II) oxide in part (iv). In (b) the most common error was to work out the M_r incorrectly, but the majority who did this went on to score M2 as they multiplied their value by 0.12 and correctly evaluated the answer.

<u>Question 10</u>

Part (a) was very poorly answered. It seemed the majority either did not read the question carefully or did not understand it. Most simply gave the highest reading on the graph of 240g.

Those who did read the solubility correctly from the graph sadly often forgot to divide by 2 as only 50g water was being used. Part (b)(i) proved a difficult graph to plot with fewer candidates than is usual on a graph question scoring full marks. In particular, the points at 22.2 and 16.9 were quite often significantly incorrectly plotted and had to be penalised. Quite a lot of candidates just joined the points dot to dot, or failed to use a ruler, and hence did not gain the mark for the line of best fit. In (b)(ii) most had obviously misinterpreted the question, and just read off the mass at 10^0C rather than finding the mass needed to produce a temperature *change* of 10^0C. In (b)(iii) most recognised that the temperature was decreasing and many related this to an endothermic change. Only the best candidates completed the energy level diagram successfully by including a correct label. It was regrettably quite common to see potassium hydroxide and nitric acid suggested as the products. Part (c) was answered well with most candidates gaining at least one mark. However, despite being clearly stated in the question that *m* was the mass of water, significant numbers lost a mark by using 65g instead of 50g as the mass. Some unaccountably subtracted the 15g of KNO_3 from the 50g mass of water, and so used a mass of 35g in the equation so failed to gain any credit. A small number of candidates carelessly used 13 as the temperature change so lost a mark.

Question 11

Part (a) was often poorly answered. Most gained a mark for referring to heating, but many candidates seem to confuse industrial fractional distillation with the laboratory demonstration of the separation of crude oil into fractions, by suggesting that the different fractions are collected as they boil off, in order of volatility, as opposed to collecting them as they condense out from the vapour state. Many answers were often given in general terms without any specific reference as to how fractional distillation produces fuel oil from crude oil. The idea of temperature gradient was sometimes mentioned, but few candidates correctly used other crucial terms and ideas such as vapour rising up the column, or the significance of the link between *boiling point* and when a gaseous fraction undergoes *condensation* or *condenses*. A relatively small, but nonetheless significant minority described cracking.

In (b)(i) many gave a correct catalyst but others were suggested – most commonly iron with a few mentions of phosphoric acid and vanadium(v) oxide. A large majority correctly completed the equation for cracking in (ii) and in (iii) similar numbers gave a correct explanation of the term *hydrocarbon*, although a few forgot the key word *only*. Some lost marks through the careless use of terms such as *molecule*, *element, bond* and *compound*. In part (iv) many correctly explained the term *saturated* in terms of not containing double bonds but others just stated they had single bonds without saying *only*. This is a key point as unsaturated compounds such as ethene also contain single bonds.

In (c) about half of candidates correctly found the molecular formula and so scored both marks. Some correctly calculated the Empirical Formula mass as 47, and gave 94/47 = 2, but then put $2CH_3S$ as the molecular formula and were awarded one mark. Most candidates selected the correct formula of the product of the reaction between propene and bromine in (d) but (e)(i) was less well answered with the most common error being a failure to fully display the hydrogens in the methyl group. As usual, there were also a few pentavalent and trivalent carbon atoms. In (ii) only the better candidates drew a completely correct structure. As ever, the most common error was to give a chain of three carbons with two hydrogens on each. A few gave structures containing double bonds.

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