Examiners' Report
Principal Examiner Feedback

January 2023

Pearson Edexcel International GCSE

In Chemistry (4CH1) Paper 1C

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2023
Publications Code 4CH1_1C_ER_2301

Question 1

Drawing the arrangement of particles in a liquid proved difficult for many candidates in part (a)(i). A large majority realised that the arrangement was irregular but many lost the mark by drawing the particles close together but not actually touching each other. Some left large gaps between the particles. Parts (a)(ii) and (b) were answered correctly by almost all the candidates. In part (c) most candidates gained the first marking point by stating that the hot water had more energy but only a minority gained the second marking point. Some just said that the hot water's temperature was close to 100^{o}C, which was not creditworthy. Most just stated that the water evaporated more quickly which did not score as this was in the stem of the question. Candidates need to be aware that just repeating what is in the question is not creditworthy.

Question 2

A large majority of the candidates answered the multiple choice questions correctly. A few lost the mark in (c) by just stating distillation or simple distillation, but most knew fractional distillation. The majority scored at least 1 mark in (d)(iii) for potassium by knowing that it had a lilac flame, but only a small minority knew the test for sulfate, so this was not well known. Some just put potassium and did not identify the anion. Common answers included potassium chloride and potassium carbonate.

Question 3

In (a)(i) most knew argon but wrong answers included helium, neon and carbon dioxide and most knew nitrogen in (a)(ii). Many failed to score in (b)(i) as they just wrote iron oxide or gave the wrong oxidation state, usually iron(II). Others gave other answers such as oxidation, corrosion and galvanising. Most gave the preferred mark scheme answer in (b)(ii) but some just wrote noble gas or just said it was less reactive than oxygen, which did not score the mark. The calculation was well done by many candidates but some just divided 30 by 75 giving an answer of 40%, which was awarded 1 mark.

Question 4

Many good answers to (a) were seen. Most knew the two errors but did not always give a correct explanation as to why the water should not be above the baseline or why the baseline should not be drawn in ink. Surprisingly a fair number thought the water should be in line with the baseline and not below it. Some thought a lid was needed which was not creditworthy as water is not a volatile solvent. A few suggested a different solvent which was also not

creditworthy. Most scored 1 mark in (b)(i) for labelling the blue spot above the yellow spot, but many did not place the spots about a quarter and a half way up. A few put the spots in the correct position but failed to label them so lost the second mark. Many candidates put the spots either side of A rather than in a line with A but this was allowed if the spots were at the correct height on the paper. In (b)(ii) most candidates realised that the blue dye was more soluble, but many failed to score by just saying the blue dye travelled further up the paper. A few stated that it was because the blue dye was darker or denser or more concentrated, which was not creditworthy.

Question 5

A common uncreditworthy statement in (a)(ii) was to state that magnesium reacts with itself, rather than stating that magnesium does not displace itself. Others stated that magnesium did not react with magnesium sulfate which was an allowable answer. Surprisingly many candidates were unable to place the metals in the correct order in (b)(i) and scored 0. Quite a few candidates named the compounds rather than the metals. Those who scored 1 mark reversed the order of aluminium and metal X or gave the correct order but wrote copper(II) which implies Cu^{2+} ions and not the name of the metal. In (b)(ii) many gave a correct metal, namely zinc or iron. Common errors included calcium, an alkali metal, silver or gold. In (c) most candidates gained 1 mark for stating that magnesium was the reducing agent, but the majority lost the second mark for stating that aluminium gained electrons, rather than aluminium ions. Some didn't mention electrons at all even though they were asked to refer to electrons. A few thought magnesium gained electrons or that aluminium was the reducing agent.

Question 6

Many correct answers for (b). A common error was to miss out the extension bonds. A few candidates put a double bond in the structure showing a lack of understanding.

In (c) many candidates knew how to do the calculation. Some could not calculate the M_r with some forgetting the 3H's. Those who did the alternative methods did not make the final comparison e.g. 62.5 x 40,000 but then did not state that 2,500,000 was close to

2,490,000 or 62.25 was calculated but not compared to 62.5, so could not score both marks.

Most candidates were able to score 3 or 4 marks for (d). Burning was well known with most referring to greenhouse gases and global warming. A few

mentioned toxic gases as well. Quite a few candidates discussed general issues with landfill such as chemicals leaching into the soil, bad smell, poisoning wildlife and not appreciating that these problems are not caused by inert polymers. Fewer scored the first marking point but some mentioned that they were taking up too much space, which was an allowable answer. Many knew that polymers were inert or non-biodegradable. Part (e) was poorly answered by the majority. Many did not read the question carefully enough and attempted an empirical formula calculation by dividing by the relative atomic masses, usually giving an answer of $CH_{12}Cl$. These candidates failed to realise that this was an impossible formula, and just accepted the answer, showing a lack of common sense.

Question 7

Part (a) was well answered by most candidates. A small minority lost the mark for referring to oxygen molecules. In (d) many candidates gave the molecular formula, C_4H_8, rather than the structural formula. Many omitted the double bond but $CH_2CHCH_2CH_3$ was a common answer and scored the mark. In (e) the majority gave the mark scheme definition of isomers. Common errors included same empirical formula, same chemical formula, same general formula, but most of these scored the second marking point. A few stated the same structural formula but different displayed formula, which was a contradiction and scored 0. Most either scored 0 or 2 for (f)(i), as if they knew C_4H_9Br they usually completed the equation correctly. Occasionally they lost a mark by giving Br or 2Br and sometimes H_2 as the other product. Part (g) was poorly answered by the majority. Many candidates mis-understood the term sulphur-free and so discussed sulphur burning in oxygen to give SO_2, which dissolved in rain to form acid rain hence scoring 0. A small number discussed CO with oxygen forming CO_2 which then caused acid rain again scoring 0. Those that discussed nitrogen usually tended to gain all 3 marks. A small number thought nitrogen was either in the petrol or formed by the combustion of petrol.

Question 8

Nearly all candidates scored at least 1 mark in (a)(i) for NaCl. Many also understood how to work out the formulae and scored all 3 marks. Common errors included Mg_2Cl and Mg_2N_3 and surprisingly quite a few used Na instead of N in the formula of magnesium nitride. Nearly all candidates gained the marks for (a)(ii) and (a)(iii). Occasionally some lost the mark by incorrect spellings of magnesium. Part (b)(i) was answered well by the majority. The most common way candidates achieved the marks was to discuss losing and gaining electrons, with a smaller number discussing electronic configurations. A few mentioned sharing electrons which lost them both marks. Some very good answers seen for (b)(ii). Some missed the second marking point for not mentioning the oppositely

charged ions. A fair number ended up losing all 3 marks, usually for mention of intermolecular forces. Candidates need to be aware that intermolecular forces do not exist in ionic compounds and mentioning them often loses them marks.

Question 9

Some good mark scheme answers seen in (a). The most common error was the discussion of shared electrons rather than a shared pair. Nucleus was seen quite often rather than nuclei. Once again there was mention of intermolecular forces, which was not relevant to the definition of a covalent bond. Many candidates understood negative numbers and gained the first marking point in (b) for the boiling points increase down the group. Very many candidates discussed reactivity rather than boiling point. Some discussed the change in force between the nucleus and electrons as the size increased. Quite a few candidates confused intermolecular forces with bonding within the molecule and in this instance the idea of the intermolecular forces becoming stronger was rarely mentioned, however many gained the third marking point for increased mass, size or number of electron shells. Some did mention more energy needed but often referred to the bonds breaking rather than separating the molecules or breaking the intermolecular forces, which was not specific enough to score the fourth marking point. Part (c) was well answered by many candidates. Most knew that the structure was in layers and that they slid over each other. Some lost the second marking point for mentioning weak intermolecular forces, but they could still score all 5 marks. The idea of making three covalent bonds was also well known and many mentioned delocalised electrons, but did not always say that the electrons moved. A few just wrote about free electrons, which was not creditworthy.

Question 10

In (a) most gained the mark, usually for pipette or burette and not so often for the preferred answer of measuring cylinder. A few mentioned a gas syringe, which was not acceptable. Some had not appeared to have read the question properly and thermometer, beaker and test tube were seen several times. Others actually gave the name of a reagent. In (b)(i) if the equation $Q = mc\Delta T$ was correctly recalled then many scored 3 or 4 marks. Those who scored 3 marks either subtracted ΔT from 21 rather than adding it or thought that 13.7 was the final answer. A common error was to confuse ΔH and ΔT. Quite a few quoted the equation $Q = mc\Delta T$ but were then unable to rearrange the equation correctly. In (b)(ii) many knew that heat loss was responsible for the lower temperature value. A few mentioned energy loss with no mention of heat or thermal energy. Some thought the reaction was incomplete and others quoted experimental errors in taking the measurements, but none of these were

creditworthy. In (b)(iii) some fully correct answers seen, but a fair number only scored 2 marks as they omitted the minus sign. There seemed to be some confusion as to which value of Q to use. Most knew to divide by 1000, but some multiplied by 0.05 instead of dividing. Quite a few did not even try to attempt this question.

Question 11

Most scored the first marking point in (a)(i) for saying that all the acid reacted. A small number discussed using all of the magnesium. Very few scored the second marking point. Most common incorrect responses included to get a maximum yield of magnesium nitrate or to make a saturated solution. Hardly anyone said that the solution only contains magnesium nitrate. Those few candidates who scored the second marking point was for either filtering to remove the magnesium or that the nitric acid would contaminate the crystals. Most attempted (a)(ii) and many scored 2 of the 3 marks. A common error was not to refer to the equation and fail to divide the moles by two, but many went on to score 2 marks, allowing the error carried forward, giving an answer of 0.15g. Both methods were seen quite often. A few stopped at 0.3g and failed to subtract the 0.3 from 0.75. Those who stopped at 0.03125 did not score if they failed to subtract the first marking point. Many candidates missed the first marking point in (a)(iii) as they failed to filter off the magnesium. Most then went on to heat the solution to partially evaporate it and often scored 4 marks. Some failed to let the solution cool and some failed to filter off the excess liquid, but most picked up the drying mark. A few heated to evaporate all the water and consequently could only score the first marking point as crystals would not be produced. Part (b) found to be challenging for many as they did not realise they needed to draw a tangent. The majority picked up 1 mark by dividing 240 by 40 giving an answer of 6 cm^3/s. Those who did draw a tangent usually gained all 3 marks.

Question 12

In (a)(i) most either stated that to make sure all the water was evaporated or to make sure that the reaction was complete. Those who failed to score often just repeated what was in the stem of the question or just mentioned getting reliable results, which was not creditworthy. Parts (a)(ii-iv) were answered well by many candidates. Nearly all gave the correct answers to (ii) and (iii) but some did not know how to find x and either divided the wrong numbers or left it blank. Those who knew how to find the moles of $BaCl_2$ and H_2O usually went on to find x and scored all 3 marks in (iv). Part (b) was well answered and gave the correct boiling point or freezing point for pure water. Those who did not score either gave a chemical test or just assumed that if the pH was 7 it was pure water, not

appreciating that there would be many solutions which would have a pH of 7. A small number discussed evaporating and if nothing is left behind then it must be pure. A large majority recognised the sign for a reversible reaction in (c)(i). A small number just stated it was a reverse reaction or equilibrium which did not score. Some candidates were confused by the wording of the question in (c)(ii). Some candidates discussed anhydrous copper sulfate being white and hydrated copper sulfate being blue without mentioning the addition of water which limited them to 1 mark. Others just said that hydrated copper sulfate is blue with no mention of anhydrous copper sulfate or white copper sulfate, which was not creditworthy. Many however did describe the test correctly and gained both marks. A few just repeated the physical test to show that the water was pure. Only the minority of candidates scored both marks in (c)(iii) as many failed to multiply the moles by 5 giving an answer of 1.2×10^{22} which was awarded 1 mark. Others just multiplied Avogadro's number by 5 giving an answer of 3×10^{24} which also scored 1 mark. Others just gave up and left it blank. However, most candidates did understand how to give an answer in standard form.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom