Examiners' Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel International GCSE
in Chemistry (4CH0) Paper 1CR

Pearson Edexcel International in
Science Double Award (4SC0) Paper 1CR

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Summer 2017
Publications Code 4CH0_1CR_1706_ER

Examiner's Report International GCSE Chemistry 4CH0 1CR June 2017

Question 1

In parts (a) (i) and (ii), the majority of candidates were able to recognise the correct formula of bromine and to state that the process occurring in the gas jar was diffusion. In part (b) there were two observations that required explaining. The first was that the volume of liquid bromine had decreased and the second was that the gas jar became full of bromine gas. Many candidates failed to make reference to the first observation; a simple statement that the liquid evaporates was all that was required. The second observation was best explained by referring to the random motion of the particles/molecules of bromine gas.

Question 2

Part (a) was generally well answered with the most common mistakes being hydrogen and nitrogen. Most candidates were able to select, from the list given in part (b), those methods of prevention of rusting most appropriate to protecting the items listed in the table. The most common incorrect answer was 'coating in plastic' for the car body. Similarly, in part (c), the use of zinc to galvanise iron was known by almost all candidates.

Question 3

Part (a) produced many excellent answers, with the majority of candidates scoring all four marks. Common mistakes were 'simple distillation' for obtaining ethanol from a mixture of ethanol and water, and 'crystallisation' to obtain sand from a mixture of sand and water.
The answers to parts (b)(i) and (b)(ii) describing chemical and physical tests for water were answered better than in previous papers. The majority of candidates, as expected, chose anhydrous copper(II) sulfate over cobalt chloride paper for the chemical test. Candidates lost marks in this test by not specifying **anhydrous** copper(II) sulfate, although both marks could still have been obtained if the correct colour change of white to blue was mentioned. In the physical test, some candidates failed to realise that the test itself, i.e. 'measure the boiling point of the liquid', needs to be stated alongside a statement that the boiling point of pure water is 100 °C.

Question 4

The majority of candidates had little difficulty in recognising, in parts (a)(i) and (a)(ii), that atomic number refers to the number of protons in an atom, and that elements in the same group of the Periodic Table have similar chemical properties because their atoms have the same number of electrons in the outer shell.
By contrast, part (b) was very poorly answered with many candidates failing to recognise that carbon has a high melting point and a giant structure. Many stated that lithium had a molecular structure, and some candidates failed to appreciate the trend in basic to acidic nature of the oxides of the elements across a period.

Question 5

Part (a)(i) proved to be a very demanding question with the majority of candidates failing to appreciate that the reactants need to be mixed together quickly so as little gas as possible escapes before the bung is replaced. If a burette is used to add the acid, the liquid will be added very slowly, hence the acid needs to be placed into the conical flask first and the magnesium added afterwards.
The correct answer to part (a)(ii) is that a burette has a better resolution than a measuring cylinder since it has finer graduations. Stating that the measurements will be more precise or are likely to be more accurate was accepted. The most common mistake was to state that the burette provides more control over the addition of the acid, a feature of the burette that was irrelevant to this experiment.
In general, the plotting and drawing of curves of lines of best fit, in part (b), were done well, with the majority of candidates scoring all four marks. Where marks were lost it was usually for drawing straight lines instead of curves, or for unevenness or changes of gradient, especially at the end of the curve.
In part (c), most recognised that acid Y had the greater concentration. Many then stated that this was because the gradient of the curve for acid Y was greater or that the curve was steeper. Of those who chose to explain this in terms of the volume of gas given off, many failed to link the volume to a common time interval so could not be awarded either mark since the first mark was dependent of the second being awarded. Some candidates correctly linked the steeper curve or more gas produced per unit time with greater concentration, but then failed to identify acid Y as having the greater concentration.
The reading from the graph in part (d) was done well by most candidates with the intercept clearly shown on the graph. The most common mistake in part (e) was to use the total volume of gas collected at the end of the experiment, i.e. 48 cm^3, instead of the total volume of gas collected after 30 s.

Question 6

Many candidates scored all three marks for the diagram in (a)(i). The four most common errors were drawing the circles representing the ions/atoms too far apart, labelling the circles incorrectly as protons or nuclei, failing to label the delocalised electrons and failing to place electrons in between, as well as outside of, the circles.
There were many good answers to (a)(ii), with most identifying the ability of the delocalised electrons to flow as the reason why a metal is a good conductor of electricity. A significant number of candidates referred to the electrons simply as ‘free’ electrons. ‘Free electrons’ is not an acceptable alternative to ‘delocalised electrons’.
Again, there were many good explanations in (a)(iii) for why metals have high melting points. The specification describes the particles present in a metal as positive ions and delocalised electrons, and so the strong electrostatic attraction between these particles, with the result that a large amount of energy being required to overcome them, is the obvious answer to why metals have high melting points. However, it is just as accurate, if not more so, for the particles present to be described as atoms and delocalised electrons, so candidates who described the forces of attraction as being between the nuclei of the atoms and the delocalised electrons were also given credit.
Part (b) was well answered with the main error being the omission of the word ‘precipitate’. However, candidates were awarded one mark for getting both colours correct.
Most candidates realised, in part (c)(i), that the lack of reactivity of copper was the reason it can be found naturally as a pure metal. In part (c)(ii), both equations in the

mark scheme were seen very often. There were many excellent answers to (c)(iii), with candidates recognising that the iron was reduced because of the loss of oxygen. Some did not read the question carefully and stated that iron(III) oxide was reduced, despite the question asking for the **element** that was reduced. Candidates should realise that in inorganic reactions, only elements can be oxidised and reduced. Teachers will be aware of this because only elements, and not compounds, can undergo a change of oxidation number. Some candidates chose to state that the iron(III) ion was reduced by the gain of electrons and this answer scored both marks. However, the less precise answer of iron reduced because it gains electrons was awarded only one mark.
There were some good answers to part (c)(iv), correctly describing the decomposition of calcium carbonate into calcium oxide and the subsequent reaction of the calcium oxide with silicon dioxide. However, there were many who seemed not to be aware of the chemistry involved.

Question 7

A number of candidates failed to score in part (a)(i) because they referred just to the lack of reactivity of silver, without specifically mentioning that it does not react with dilute sulfuric acid.
There were a lot of correct answers in (b)(i), most candidates choosing result 3 and many justifying their choice by noting it was **very much** lower than the other three values. Some candidates lost the mark by merely repeating the data in the table or failing to make reference to the magnitude of the difference.
In part (b)(ii), it was surprising that a considerable proportion of the candidates included the anomalous result in the calculation of their average volume, considering that the previous question had indicated that there was an anomalous result.
Most knew, in answer to (b)(iii), that repeating the experiment would increase the reliability or validity of the results, with only a few, incorrectly, citing increased accuracy or precision. Others correctly stated that repeats are necessary in order to identify any anomalous results.

Question 8

Part (a) was very answered well with the majority of candidates scoring both marks. The principal errors were using atomic numbers in place of relative atomic masses, upside-down division or not evaluating the ratios correctly.
The question in (b)(i) has been asked a number of times but candidates are still failing to be precise in their answers. Instead of 'the **rates** of the forward and backward reactions are equal', many still state 'the forward and backward reactions are equal'. Also, the statement that 'the amount of reactants and products are the same' still predominates over the required answer of 'the amounts/concentrations of the reactants and products **remain constant**'. Far too many candidates are still stating the conditions required for dynamic equilibrium to be established, namely the reaction is reversible and must be in a closed system, rather than quoting the features of a reaction that is in dynamic equilibrium.
Part (ii) was not answered well. The stem of the question gave information about the molecular nature of solid I_2Cl_6 and about the existence of ions in liquid I_2Cl_6. Despite this many candidates answered the question as if it was a straightforward comparison between a solid ionic compound and a molten ionic compound. Hence, there were very few answers recognising that solid I_2Cl_6 does not conduct because it does not contain any charged particles that can flow or alternatively that the molecules are not charged or that there are no delocalised electrons. In addition to this there was confusion for some between conduction in a liquid metal by the movement of delocalised electrons, and the conduction in a liquid containing ions by the movement of those ions.

Question 9

In answer to part (a)(i) many of the candidates seemed unaware that the prime function of a fume cupboard is to contain toxic gases or vapours. Of those who referred to toxic vapours, many failed to link this with the experiment in the question and so did not mention the halogen vapours that were being used.
In part (ii), the majority of candidates gave a clear indication of the order of reactivity of the three halogens and so scored the first mark. Most of those who were unsuccessful in obtaining the second mark for linking this to the observations in the table merely linked the reactivity to the order of the elements in the Periodic Table. Some candidates noted that the iron glowed brightest with chlorine, but then did not compare this with the observation for iodine, and so also failed to score the second mark.
There were a considerable number of misunderstandings about the requirement of the question in part (a)(iii). To answer the question it was first of all necessary to decide if the student's statement was valid, and then to give reasons why. Very few appreciated that all three halogens were used as vapours and, therefore, the reference to their physical states at room temperatures was irrelevant, making the student's statement incorrect.
In general, the chemical equation asked for in (b)(i) was written correctly, with a few incorrectly using the symbols H and or Br instead of the formulae H_2 and Br_2 respectively. There were also a few candidates who gave the formula of hydrogen bromide as HBr_2.
The vast majority managed to produce a correct dot-and-cross diagram for the hydrogen chloride molecule in part (b)(ii). Some added an extra electron into the outer shell of hydrogen and a few others drew a diagram containing two hydrogen atoms bonded to one chlorine atom.
Hydrochloric acid was given as a correct answer to (b)(iii) by the vast majority of candidates.

Question 10

In (a)(i), shiny or silver were common correct answers to the appearance of magnesium, although the incorrect answer of grey on its own was seen a number of times. Some also misread the question and described the appearance of the magnesium burning rather than the magnesium itself. Black, instead of white, was a common incorrect answer for the appearance of the solid magnesium oxide.
Most recognised, in (a)(ii), that the lid is lifted from time to time to allow oxygen, or air, to enter the crucible. The answer 'to allow the magnesium to react with oxygen' was also accepted, but 'to allow the magnesium to react with air' was not, since air is a mixture of gases. Very few candidates seemed to be aware that the lid needs to be replaced quickly otherwise the magnesium oxide will escape as a rising 'smoke'. The rather poor answers to this part of the question emphasises the need for candidates to both perform experiments **and** discuss the reasons for the methods employed. Answers such as 'to prevent heat from escaping', 'to prevent the air/oxygen from escaping' or 'to prevent the lid from getting dirty' were all too common.
There were many correct answers to the calculation in part (b). The most common errors were failure to divide the moles of magnesium by 2, or multiplying the moles of oxygen by 16 rather than by 32. Another common mistake was the failure to convert the mass of magnesium into moles and to simply divide 0.6 by 2 to arrive at answer of 0.3.
The equation for the synthesis of magnesium nitride in part (c) produced far more correct answers than when previously asked. The most common error was to write 2N rather than N_2 for nitrogen.

Question 11

In parts (a)(i) and (a)(ii), the general formula of the alkanes and of the cycloalkanes was correctly deduced by the vast majority of candidates. Most were also able to quote two features of a homologous series of compounds, although some failed to spot that 'same general formula' was given in the question so could not be used as an answer. A small number of candidates incorrectly stated that the members of a homologous series have the same or similar physical properties, rather than graded physical properties, or show a trend in physical properties.
When stating what is meant by the term saturated, part (b)(i), it is important to state that **all** of the carbon to carbon bonds in the molecules are single bonds, not just that the molecule contains carbon to carbon single bonds.
The displayed formula of ethane in (b)(ii) was invariably drawn correctly. In (b)(ii), there were a large number of correct displayed formulae drawn for cyclobutane. The most common mistake was to draw an extra bond between two of the four carbon atoms producing two pentavalent carbon atoms.
Most recognised, in (c)(i), that ultra violet radiation is required to bring about reaction between a saturated hydrocarbon, such as cyclopropane, and bromine. Part (c)(ii) was also answered well with most choosing to draw a mono-substituted product although, of course, any extent of substitution was accepted. The most common mistake was to add a bromine atom to an existing hydrogen atom, rather than substituting it.

Question 12

In part (a), nearly all of the candidates realised that filtration was required to bring about the required separation, but a high proportion failed to appreciate that water needed to be added to the solid mixture, in order to dissolve the soluble component, prior to filtration taking place. Some of those who did add water followed by filtration lost a mark by subsequently evaporating the water from the filtrate, thereby ending up with two solids rather than a solid and a solution as required by the question.
The two ions in (b)(i) were often correctly identified as the ammonium ion and the chloride ion. Of those that used formulae instead of the names, some incorrectly gave the formula of the ammonium ion as either NH_3^+ or NH^{4+}. Some gave both the name and the formula, in which case both had to be correct to be awarded the mark. Many correctly identified, in (b)(ii), that the gas given off was ammonia, although hydrogen was a fairly common mistake.
In part (c)(i), a majority of the candidates recognised that the gas evolved was carbon dioxide, and most of these then also stated that solid contains a carbonate ion. Unfortunately, a significant number of candidates lost the identification mark through giving an incorrect formula of CO_3^- for the carbonate ion. The majority of those who correctly stated that a flame test is required, in (c)(ii), to identify the calcium ion went on to give a correct colour of either orange-red or brick-red. Orange is not an acceptable colour for the flame test with calcium ions, even though the colour of the flame can sometimes appear orange with some samples of calcium compounds, because this is the result of a sodium impurity being present in the calcium compound. The most common incorrect colour given was yellow.

Question 13

In part (a), many candidates wasted time and effort at the start of their answers by describing the set-up from scratch, not seeing that this was already given in the diagram. Generally the technique of titration seems well understood, but descriptions varied in quality. There were many good answers demonstrating that candidates had practical experience of titrations. The common mistakes included: giving the wrong colour change for the indicator, failing to note burette readings at both the start and finish, and not actually mentioning the burette by name. A fair number of candidates confused burette with pipette. There were very few zero-scoring answers.
There were very few three mark scores in part (b). Many gave 25 °C as the starting temperature in (b)(i). Parts (b)(ii) and (b)(iii) required the candidates to interpret the graph as well as read from it. The neutralisation point is where the two lines intersect, giving a value of 17.5 cm^3 for the volume of acid added. An increase in temperature of 10 °C meant that the final temperature was 30 °C, producing readings of 10 cm^3 and 25 cm^3 respectively for the volumes of acid added. This combination was rarely seen, with the most common answers being 10 and 20 cm^3 or 5 and 15 cm^3.

Question 14

Part (a) was answered correctly with most candidates recognising that the cut surface of a freshly cut piece of is shiny and will go dull if left exposed to air.
The test for hydrogen, asked for in part (b)(i), is well known, with the most common mistake being to use a glowing, rather than a lit, spill. In (b)(ii), the formation of lithium hydroxide, or hydroxide ions, was quoted often, but many of those who did so failed to then state that it made the **solution** alkaline. The deduction of the formula of lithium oxide and the carbonate ion from the information given was successfully attempted by most. Common errors were LiO and Li_2O_2 for lithium oxide, and CO_3^- for the carbonate ion. In (d)(i), the majority of candidates were able to correctly deduce that the reaction of caesium with water would be more reactive that of lithium, and that a different compound would be produced. However, the chemical equation in (d)(ii) often had Cs_2O as the product, rather than CsOH. This mistake cost those candidates both marks.

Question 15

Many candidates scored all four marks in parts (a) and (b), showing mastery of the calculation procedure. The most common error in part (a) was to fail to convert the volume of acid to cubic decimetres, although this mistake did allow both marks to be obtained in part (b) by carrying forward the error. There was little confusion involving the units in part (b), with the answers 0.04 dm^3 and 40 cm^3 appearing equally as often as one another.
There were slightly fewer correct answers to part (c). The most common error, as in part (a), was failure to convert the volume of sodium hydroxide to cubic decimetres before multiplying by the concentration, and hence producing an answer of 6 mol instead of 0.006 mol. However, the second mark could still be obtained for an answer of 240 g by carrying forward this error.

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