Examiners' Report/
Principal Examiner Feedback

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

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

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Examiner's Report International GCSE Chemistry 4CH0 1CR

Question 1

As was expected, having been directed to use the Periodic table provided which included a "Key", this was answered well by most candidates. However, in part (b), possibly influenced by the word *number* in the question, some gave mass number instead of (relative) atomic mass as shown in the "Key". Another source of errors was in part (c) (v) which involved knowing what is different in isotopes of boron.

Question 2

In part (a) many did not appreciate that when ethene is converted to poly(ethene) the change of state is from gas to solid. In part (b) most scored at least one mark with the most common errors being to give HCl as (l) and $CaCl_2$ as (s). In part (c) most appreciated that the majority of elements exist as solids at room temperature.

Question 3

Candidates were required to select from four possible techniques, the most suitable one to obtain a named substance form a given mixture. As anticipated, this proved to be a very accessible question but it was evident there is some confusion about when to use simple and fractional distillation. It was also a little surprising that many did not seem to know that calcium carbonate is insoluble and that consequently filtration should have been chosen to obtain calcium carbonate from a mixture of it and water.

Question 4

In part (a) most knew the colour of chlorine but in part (b) it proved difficult to use the trend suggested in the question to predict a boiling point for iodine despite the wide range allowed. In part (c) the colour and especially the physical state of astatine were very well predicted although it should be noted that if grey was suggested as the colour, it had to be qualified with dark/darker. A very large majority knew why the Group 7 elements have similar chemical reactions and so selected the correct option in part (d) but part (e) proved more challenging. Candidates should be encouraged to read the question carefully and answer as instructed to; many did not heed the advice that three of the statements contained **one** incorrect word which should be put into the table along with the correct word to replace it. Despite not following these instructions, many candidates were allowed access to marks if it was clear that they were giving chemically correct answers. Some examples of these minor variations and alternatives which were allowed can be seen in the Mark Scheme.

Question 5

In part (a)(i) most suggested a sensible reason for the solvent level being below the spots although incorrect references to spots diffusing and spreading were quite common. Part (a)(ii) proved challenging with only the best candidates giving two problems preventable by using a lid. The most common correct answers mentioned evaporation or loss of solvent but there were also a lot of inappropriate references to preventing spillage, wind or air moving the paper, and many thought the purpose of the lid was in preventing substances entering the tank. In (b) most candidates scored all three marks but in (c)(i) it was surprising that many students were not able to measure the distance correctly but they usually gained a mark for correct answer using their value. Part (d) was well answered by many who realised the substance must be insoluble in the solvent but some incorrectly stated it was because it was partially soluble or not very soluble.

Question 6

Part (a) was usually correct and in (b) good candidates scored the first mark usually by correctly identifying weak intermolecular forces although some students just stated weak forces of attraction but forgot to mention between molecules. Others who failed to gain credit often discussed intramolecular forces or breaking bonds between hydrogen atoms. Some of those who scored the first mark did not quite gain the second mark as it required a mention of **energy**.

(c) The wording of the question made it slightly more difficult than it might have been by simply asking what a covalent bond is. Many managed to obtain one mark by mentioning a shared *pair* of electrons. Unfortunately, there were many poor descriptions such as atoms *share an electron* or *share one electron* or *share their electron(s)*.

Of those who scored the first mark, many also knew that the two atoms in a chlorine molecule are held together by the attraction between the shared pair of electrons and a nucleus. However only the best candidates mentioned that it was the attraction between the electrons and *both* nuclei which was necessary for the second mark.

In (d) the majority of dot and cross diagrams for a molecule of hydrogen chloride were correct. A few contained an extra electron on the H atom. Perhaps because of the balanced equation, some weaker candidates tried to show a diagram with two hydrogen atoms combined with two chlorine atoms.

Part (e) proved to be a very good discriminator between candidates of all abilities. Knowledge of ionisation/dissociation of hydrogen chloride in water and the H^+ ion and its role in acidity was well understood by the strongest candidates. Apart from very weak candidates, there was a good appreciation that (hydrochloric) acid/hydrogen ion is produced on dissolving hydrogen chloride gas in water, and so when magnesium is then added it effervesces. Fewer candidates realised that they should identify hydrogen as the cause of the effervescence. There was very much less understanding of the situation when dissolving hydrogen chloride gas in the organic solvent, methylbenzene. Some just stated magnesium does not react with methylbenzene whilst others thought methylbenzene was alkaline and so neutralised the hydrogen chloride/acid.

Question 7

In part (a) the term hydrocarbon was very well known with most candidates gaining both marks. Occasionally incorrect terms such as carbon and hydrogen *molecules* instead of atoms were seen but the word *only* was left out very rarely. In (b) most candidates clearly understood the meaning of unsaturated compounds and also correctly identified the required alkane in (c). However, in (d), despite the question clearly implying there were at least two compounds with empirical formula CH_2 many only gave one answer when there were three correct ones and all of them were needed to gain the two marks. Part (e) was well answered with the fact compound F had no double bond being the most common correct answer.

In part (f)(i) the majority of candidates showed they had a good understanding of how to approach an empirical formula calculation although they should be careful not to round numbers up too much. Those who could not cope with the question sometimes had the divisions inverted whilst other candidates use atomic numbers. Those who had successfully managed part (i) often also scored both marks in (ii) although some found the correct multiple of 2 but then failed to give the final answer.

Question 8

The vast majority could balance the equation in (a)(i) and gave both correct answers in (ii) although some omitted *fluoride* in both names. In (iii) most correctly gave *ionic* but significant numbers suggested *covalent* and occasionally *metallic*. Part (iv) was correctly answered by just over half of candidates. Weaker candidates suggested incorrect formulae such as NdO_2 or NdO and others used Nb or Ne as the symbol for neodymium although Nd was given in the question.

Part (b) required explanations for the malleability and conductivity of neodymium metal. Although it provided a good distribution of marks, it was pleasing to see an improvement on this type of question from previous years, with fewer candidates giving incorrect references to the type of particles or bonding present in a metal. However, some candidates just explained what malleable meant without any explanation. Common mistakes made were in not mentioning layers or the equivalent, and simply stating that delocalised electrons carry the charge.

Question 9

(a) Most gave a correct advantage of using a polystyrene cup although some confused conductors and insulators and some just suggested less likelihood of breakage. Part (b) was well answered by many but it is evident that some candidates either do not find reading values straightforward, or perhaps do not pay enough attention to the direction of the graduations on the diagram. Common errors were to be 0.1 ^{0}C out with 19.5 and 15.8 seen quite often. Others reversed the values.

In part (c) most candidates plotted the points correctly and drew the appropriate straight lines of best fit through the points. Clearly a small percentage of candidates did not have or use rulers despite the need for a ruler being stipulated on the front cover of the paper. There were a few instances of a curve being drawn to join two previously drawn straight lines. Some candidates would have benefited in (ii) from using a sharp pencil to draw their lines. Reading the volume scale correctly caused the most problems.

In (d) most students managed to correctly evaluate and use the temperature change, but many, (despite being told that 1.0 cm^3 of each solution had a mass of 1.0 g), did not add the volumes of the solutions and so used the wrong mass of solution in the calculation. However, because of consequential marking, many were still able to substitute their values in the equation and so score two of the three marks. (Although not required, the answer in the Mark Scheme is given correct to 2 significant figures as this is the least number of significant figures in the data values given).

Question 10

The calculation in part (a) proved to be challenging for many and seemed to differentiate between the best candidates and others. In (a)(i) strong candidates successfully calculated the number of moles of sodium thiosulfate from the volume and concentration, and used it to find the mass of sulfur dioxide formed. Weaker candidates often could not start the question although some scored a mark for finding the M*r* of sulfur dioxide.

Only the very best students approached part (a)(ii) correctly as most others didn't realise that they were meant to use their answer from part (i) to quantitatively answer part (ii). Instead the majority of candidates answered this question by writing either "*Yes, SO_2 will escape or No, SO_2 won't escape".* Of the two approaches shown in the Mark Scheme there were more of the second one. A few answers were based on the volume of solvent being 20cm^3 and these were able to score one mark.

Part (b) was answered very well by a majority of students probably indicating that they had carried out a similar experiment as part of their course. A common incorrect answer was *when the flask was placed on the cross* or the rather vague suggestion *when the solutions were mixed*. Part (c)(i) proved difficult with some confusion between the timer being started or stopped too early or too late. Weaker candidates simply suggested *human error* or referred to the concentrations or volumes of the solutions. As expected (c)(ii) proved straightforward for most.

(d)(i) proved difficult for most with very few giving two correct suggestions. The reaction being too/very fast or reaction times being (very) short was the most common correct answer. Many just suggested fast or faster reaction. Very few discussed heat loss, and those who did seldom mentioned that heat loss was greater at high temperatures. However, it was pleasing to see some candidates correctly discuss the difficulty of maintaining the high temperatures and so gain a mark. Unfortunately, there were many candidates who did not score any marks, with inappropriate answers about mistakes, incorrect timing and evaporation of acid. kinetic

In (d)(ii) many candidates just stated that particles moved faster or had more energy so there were more frequent collisions but this was the reason which was stated in the question so did not attract any credit. However, many did gain a mark for reference to *more successful collisions* but many failed to mention activation energy and of those that did, some incorrectly suggested that it was lowered. Others seemingly had not appreciated the question as they discussed the effect of changing the concentration on the rate of reaction.

All of the possible variables were seen in part (e) and many scored at least two marks. Temperature was the most common correct answer but unfortunately some candidates merely stated volume or concentration without specifying the reagent. Candidates should be advised to use the term *volume* where appropriate although *amount* was allowed.

Question 11

Most correctly balanced the equation in (a) although some inserted zero in front of the first three formulae. Part (b) involved equilibrium which as usual proved to be a topic which many find difficult which resulted in some responses to both parts (i) and (ii) containing little sensible argument. However there many good answers to (i) with an understanding of there being equal numbers of moles on both sides of the equation clearly shown, and this usually resulted in both marks being gained; but disappointingly some candidates, having given a correct argument about the numbers of moles, then omitted to state there would be no effect on the yield of hydrogen. Incorrect answers included discussions of increased rate of reaction at a higher pressure so more hydrogen would be formed.

In part (ii) many good candidates showed an excellent understanding and it is pleasing to note that there were many fewer references to Le Chatelier than in the past. Some weaker candidates incorrectly approached the question from a rate of reaction perspective and stated that a higher temperature meant a faster rate and that equated to a higher yield of hydrogen.

Part (c)(i) was often poorly answered with large numbers of candidates seeming to have little knowledge of this type of energy profile diagram, particularly as it showed a little bit more than just the energy level of the reactants. Of those that did seem to recognise the diagram, too few candidates appreciated that they had been given information with the equation in (b) indicating that Reaction 2 was exothermic. Hence many placed the products at an energy level higher than the reactants but pleasingly, because of consequential marking they were often able to gain the second mark. Sometimes, even when some products were shown in a correct position, they were either the incorrect products or the ΔH or line/arrow was missing or drawn incorrectly.

In (ii) many candidates referred to the effect of a catalyst on the rate of reaction or on the activation energy, rather than on the enthalpy change, and of those that did, many incorrectly thought the enthalpy change increased or decreased.

Part (iii) was generally well answered with many scoring both marks with a concise explanation of how a catalyst increases the rate of a reaction. Those that did not score full marks generally just missed out mentioning one of the two key points, usually the alternative pathway idea, rather than stating something incorrect. (It was interesting to note that activation energy seemed to be well understood here, yet was not mentioned by many in 10dii). Weaker candidates simply repeated the information in the question that a catalyst increases the rate of a reaction and sometimes they also stated that it is not used up in the reaction.

It was felt that part (d) required some knowledge slightly beyond the specification (although from many of the responses it was evident that many centres do teach definitions of oxidation and reduction in addition to those in the specification, and appropriate ones were credited where correct). Hence the Mark Scheme was adapted to take this into account and a large majority of candidates were able to score at least one mark. Reaction 4 was widely recognised as a redox reaction with many then going on to correctly refer to a gain of oxygen. The most common incorrect statements involved explanations in terms of electrons which were not appropriate given the substances in the reactions, and these references were ignored.

It seems that candidates are generally improving in their ability to tackle reacting mass calculations and there were many correct answers to part (d). Some made the odd error such as incorrectly calculating the M*r* for ammonium nitrate but were still able to score two marks. Inevitably of course, some still find calculations challenging and do not score many marks in them.

Question 12

In (a) many candidates identified the correct fractions in parts (i), (ii) and (iii) and in (b)(i) even more knew the catalyst used in cracking. Part (b)(ii) was well answered with many scoring both marks with a fully correct equation and the majority of others scoring one mark for giving one of the acceptable alternatives with C_8H_{16} , being the most common.

In 12(b)(iii) significant numbers of candidates tended to explain what cracking means rather than the reasons why the process is carried out. This inevitably cost them marks but many were able to score at least one of the first two marks concerning supply and demand. However, the last mark involving alkenes and their possible uses was less commonly awarded.

Part (c) proved to be surprisingly discriminating with only the better candidates picking up on the full consequence of the sulfur present. Some weaker candidates gave statements such as *the molecule was not a hydrocarbon*, *it would blow up or it was poisonous.* Good answers mentioned combustion to produce sulfur dioxide which then dissolved in clouds/rain to form acid rain but formation of acid rain was often seen without reference to sulfur dioxide.

As expected part (d) proved to be accessible only to the strongest candidates with the majority not recognising the monomer as propene and so giving chains of CH_2 as the part of the polymer.

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