Examiners' Report
Principal Examiner Feedback

Ocotber 2022

Pearson Edexcel International Advanced Level In Chemistry (WCH13)
Paper 01: Practical Skills in Chemistry I

General Comment

Many students were well prepared for this examination and were able to demonstrate that they had a sound knowledge of the topics on the specification. Most papers were answered through to the last question indicating there was no difficulty with completing the paper in the time allowed, however, there were some blank responses seen for almost every question. The mean mark on the paper was 22.

Q1(a)(i)

This question was poorly answered. A common error was to state that the reaction needed neutralising. Of those who gained the mark, most mentioned removing carbonate ions. The expected answer (regarding removal of insoluble barium compounds other than barium sulfate) was very rarely seen by examiners. Many candidates had the vague idea of removing impurities, but this did not gain credit.

Q1(a)(ii)

Many scored Marking point 1 (M1) for this question but were unable to justify their answer. The most common correct answer was HCl , with HNO_3 and then, occasionally, ethanoic acid also seen. Some candidates gained M2 by stating that barium nitrate is soluble or that chloride ions are already in solution. Candidates regularly gave sulfuric acid as their answer - which was not awarded - along with the justification “to provide sulfate ions” demonstrating a complete lack of understanding of the chemical test. Where hydrochloric acid gained the first mark a common incorrect justification was “because it’s a strong acid” and some referred to a lack of reaction with barium chloride. Repeating the need for acidification given in the stem for Q1ai did not gain credit.

Q1(a)(iii)

Very few candidates gained M1 but more achieved the mark for M2 (white precipitate). The main reason for not scoring M1 was not mentioning dissolving or making an aqueous solution, adding the solid to water was not credited. The ideal answer of dissolving in distilled/deionised water was only seen a few times showing a lack of precision in candidates’ responses. The marks were independent here, which benefitted the vast majority of students.

Q1(b)(i)

Q1bi was well answered. Candidates often chose to describe the process of a flame test rather than to name it and were generally able to recall the correct colours. A common incorrect colour was red for barium. An average of two marks from three were awarded in this part.

Q1(b)(ii)

In Q01bii, M2 and M3 were dependent on M1 – the addition of acidified silver nitrate. Many omitted to acidify the solution but scored M2 and M3 as a near miss. A small minority gave an incorrect reagent, e.g. silver chloride, sodium hydroxide or ammonia, along with the observations expected for silver nitrate so could not score any marks. Answers referencing the effect of dilute ammonia on the precipitates could score M2 and M3 if the colours of the precipitates were omitted, and many candidates who had already been awarded the three marks gave this information as well. A common reason for the loss of M3 was to state the bromide precipitate would be yellow. Electrolysis was occasionally suggested, and described in detail, but this is not a common laboratory test so gained no credit.

A very small number candidates confused cations and anions and so did not score the marks for either Q1bi or Q1bii.

Q2(a)(i)

This question was very well answered, with almost all candidates' tables being completed correctly.

Q2(a)(ii)

Again, this question was very well answered. The rare incorrect answers usually included the rough (non-concordant) titre in the mean, while a few candidates only used two values from the table.

Q2(b)(i)

A surprisingly large number of candidates could not do this basic titration calculation. The most common error was to use the concentration of the acid added to the tablet (0.200 mol dm^{-3}) rather than that of the NaOH in the burette (0.025 mol dm^{-3}). Significant figures were sometimes an issue with M1, candidates should never round to 1SF. Many candidates did not use the stoichiometry of the reaction to gain M2, those who did mostly correctly divided by 2. M2 could also be awarded as a TE if candidates used the wrong values and did not score M1.

Q2(b)(ii)

This question was well answered. Most candidates gained a mark here, even those who used the incorrect values for Q2bi. Occasionally candidates failed to convert to dm^3.

Q2(b)(iii)

M1 was rarely achieved by candidates for the scaling up to the initial experiment, but transferred error (TE) marks were available throughout. M2 was more regularly awarded, though often as a TE for subtracting the answer to Q2bi from the answer to Q2bii. Most candidates gained M3 and M4, again by TE. Regularly the answer to Q2bii was multiplied by 84.3 (gaining M3 as a TE) and most candidates made a good attempt at the percentage calculation for M4. This meant that most candidates gained 2 or 3 marks for this 4 mark calculation. However, calculations were often laid out in a disorganised fashion with poor legibility of numbers in many cases. Candidates should be reminded to organise their working logically and emphasise their final answer.

Q2(c)(i)

This question was poorly answered by candidates. Many answers were too vague or referenced cleaning air bubbles from the burette, improving accuracy or ensuring the equipment worked. A lot of blank answers were seen for this question. All candidates should have experienced a titration during the course so they should have been able to formulate an answer to this question. All the correct answers on the mark scheme were seen.

Q2(c)(ii)

Many candidates scored one mark here by having the colours the wrong way round, having failed to consider that the alkali was in the burette. The mean mark was over one though, so a reasonable number of candidates did score both marks.

Q3(a)(i)

Most candidates scored M1 here, for the axes, though some used axes that were too small for the height of precipitate or omitted the units, and these candidates could still gain M2. Where candidates drew graphs with non-uniform axes they were unable to access M1 or M2.

M2 was sometimes lost when candidates failed to plot the sixth point at the origin, though if a best fit line passed through 0,0 this mark was still awarded. Candidates need to ensure they clearly mark their plotted points on the graph with an “x” as faint dots do not show on scanned scripts.

Q3(a)(ii)

This question was very poorly answered. Many candidates incorrectly identified the metal nitrate as being the limiting reactant or just stated that the reactants were used up. The most common correct answer was that “all KI had reacted,” some stated the nitrate would be in excess. The majority of candidates did not gain this mark.

Q3(b)(i)

Many candidates did not gain either mark here, though they were independent. Where candidates did not draw correct lines 12cm^3 (the volume on the table where the maximum was reached), followed by 5cm^3 (an obvious intersection on the graph) and 16 cm^3 (the highest point of the graph) were the most common incorrect answers. Few candidates drew two straight lines on the graph for M2, showing a lack of understanding of the experiment or a failure to read the stem of the question. Those that did draw the correct lines could usually read the volume of nitrate correctly for M2.

Q3(b)(ii)

This part was well answered; very occasionally the conversion to dm^3 was omitted.

Q3(b)(iii)

This mark was also regularly achieved successfully, but not quite as frequently as Q3bii. Some candidates began their answer to Q3biv here and received credit for this if it was annotated correctly.

Q3(b)(iv)

Most candidates scored 2 or 3 marks for this response. Many marks awarded for this part were gained via TE, using an incorrect value from Q3bi. Where candidates tried to use 12cm^3 or 16cm^3, their eventual answer was too large to score M4 as there are no elements in this A_r range. Most candidates were awarded M1 for the stoichiometry. M2 was rarely awarded but candidates could get a TE for M3. Some candidates used the alternative method. Candidates were not penalised for stating an incorrect element for the A_r given as the final answer. Again, many candidates did not present their work neatly or logically which presented a challenge for the examiners trying to award marks. Some candidates over-rounded their answers at every step of the calculation leading to poor accuracy in their final answer.

Q3(b)(v)

This question was poorly answered. Many candidates wrote a sensible equation but did not balance the iodide ions correctly, left-off the subscript two on the product, and/or omitted the charges or the state symbols. Only one mark was available, so any error meant that the mark was lost, but this response was left blank on many papers. A small number of candidates wrote half equations for the conversion of iodide ions into iodine, and another handful wrote other equations including nitrates. A wide variety of metal ions were seen here, which were allowed if they had a 2+ charge and were not alkali metals.

Q3(c)

Very few students gained the mark for this question. Most candidates thought there were some impurities involved, that the reaction had not finished, or that more reactants had been added than expected (despite the statement that there were no measurement errors). There was a small number of candidates gave the allowed answer that air bubbles or solution were trapped inside the precipitate. The experiment described was not a core practical and candidates did not spend enough time reading the stem of the question, as this should have prompted them to the answer. When further suggested practicals from the specification are included on papers there will always be more detail of the method given, as candidates are not expected to have personal experience of these experiments.

Q3(d)

Candidates had not been asked to draw a hazard symbol before, and a great variety of toxic symbols were seen. The most frequent incorrect answers were exclamation marks and crosses, but some corrosive, hazard to health or danger to the environment symbols were also seen. Some candidates drew a skull without crossbones and this was insufficient for the mark. Many candidates annotated their symbol which was not necessary but showed their understanding of hazard symbols.

Q4(a)

Many correct answers were seen here, though a minority of candidates gave the colours expected with $KMnO_4$. The mean mark here was one, and candidates could score this for the colours being the wrong way around – though the colours were less frequently inverted here than in Q2cii – and more often yellow was substituted for orange losing M1.

Q4(b)

Most candidates gained one or two marks for this response and a great variety of experimental set ups were seen. M1 was frequently awarded, though the labelling or drawing of a “conical flask” occasionally negated this. Some candidates omitted any kind of heat, though an unlabelled arrow or drawing or an electric heater or Bunsen burner was sufficient for the mark to be given. M2 was the most infrequently awarded mark, with many candidates completely omitting the anti-bumping granules. M1 and M2 could be awarded for a reflux set up and this was seen quite regularly, and limited the candidates achievement. M3 required the condenser to have the water direction labelled (even if it was only shown with arrows). A few candidates did not draw the water jacket on their condenser so could not gain M3. M4 was often lost as the apparatus was shown as closed on the right hand side (or occasionally open on the left hand side).

Q4(c)(i)
Fewer than half the candidates gained the mark here, with many stating that an electrical heater is used to better control the temperature. This comment did not gain the mark, nor did a vague statement relating to safety.

Q4(c)(ii)
Around 60% of candidates achieved this mark. A plethora of spellings of tertiary were seen and marking was very lenient in this respect, though descriptions of tertiary alcohols were not allowed without the word. A common error was to identify the molecule as a secondary alcohol or to state that there would be no reaction. A few references to tertiary carbocations were seen and not awarded.

Q4(c)(iii)
This mark was rarely awarded, with only 30% of candidates scoring here. Common errors were to only give two products or to just give the class of each molecule i.e. "aldehyde, ketone and carboxylic acid." Propene was an unexpected incorrect answer that was seen regularly, as were the incorrect names of propan-1-one and propan-2-al. Combustion products, such as H_2O and CO_2 were ignored here. Errors in this section inevitably led to problems in Q4civ.

Q4(c)(iv)
Many errors were seen in answers to this question. The mark most often awarded was M1 for the aldehyde test, though some candidates confused the results for Benedict's/Fehling's and Tollen's reagents. Where Fehling's was used some candidates just stated the reaction changed from blue to red and did not mention the precipitate so could not score M2. Candidates regularly gave Fehling's and Tollen's along with negative results as a test for ketones, and this did not negate any marks. Some suggested dichromate as a test for the aldehyde though this had already been mentioned on the paper and the question asked for a further chemical test.

Incorrect references to PCl_5 were often seen for M3, but where the carbonate or hydrogencarbonate test was used the candidates usually scored both M3 and M4. Reactive metal tests were seen, along with esters – though the acid catalyst was often omitted. Litmus was occasionally seen as a test for acid, along with attempts at neutralisation with NaOH, neither of these gained marks.

A few candidates failed to read the question properly and described how to oxidise the alcohol. Where candidates had come up with unusual reaction products to Q4ciii (e.g. propene, O_2, and H_2) these tests did not negate marks if both the test and result were correct for the molecule(s).