Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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Pearson Edexcel International Advanced Level
In Chemistry (WCH16) Paper 01
Practical Skills in Chemistry II

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General Comments

This paper on experimental chemistry offered opportunities for candidates to demonstate both their knowledge of practical procedures and techniques and the application of this to new practical situations.

There was evidence of a lack of familiarity with some common practical procedures, including the Core Practicals.

Calculations, especially those of a standard nature, were often successfully tackled. The majority showed particular abilities in plotting graphs and subsequent data analysis.

There was very little evidence that learners experienced problems with having insufficient time.

The mean mark for this paper was 19.3

Question 1

1(a)(i) The identification of ammonia was almost always correct but many failed to appreciate that to score the marks available for identifying the three precipitates, the formula or name of a compound was required. It was disappointing to see marks lost for offering just “iodide” or “sulfate” for the products of tests 1 and 3. Many learners confused the red-brown precipitate of iron(III) hydroxide with that of manganese(II) hydroxide which is off-white and only darkens subsequently with aerial oxidation.

1(a)(ii) The result of the flame test was well known but, as the identity of **P** was required, those responses that just stated barium did not gain the mark.

1(a)(iii) Those learners who had incorrectly identified one of the ions as manganese(II) could score a TE mark for the formula of the salt provided they suggested a neutral compound using their identified ions.

1(b) A common incorrect answer was that either the presence of iron or manganese ions caused the change in the brown colour. This was variously ascribed to an oxidation of iron(II) or manganese(II) but that suggestion then led learners to suggest that aerial oxidation had occurred rather than a redox reaction between **P** and **Q.** Those that recognised that the oxidation of iodide ions was responsible for the change in colour were much more likely to score both marks.

Question 2

2(a)(i) This question proved more difficult than expected. Non-scoring suggestions included a pipette or a measuring cylinder which did not take into account the measurement of a 7.5 cm^3 in Mixture **4**. There was also some confusion between a burette and the biuret test for peptide bonds.

2(a)(ii) The colour of the end-point of the reaction was well known.

2(a)(iii) Many learners failed to appreciate that the relatively small amount of added thiosulfate ions was important for the measurement of the initial rate. Instead, they focussed on the problems arising from an excess of thiosulfate ions.

2(a)(iv) Those learners who considered what would happen if Reaction **2** was slower than Reaction **1** were more likely to produce clear answers which answered the question. Many responses just reiterated the colour change or had misunderstood the concept of a "clock" reaction.

2(b)(i) There was evidence that the majority of learners did not use the information given to find the iodide concentration in Mixture **3** using a simple calculation. Many resorted to using the data given for the other mixtures to plot the graph, obtain a straight line for b(ii) and then read off a value for the concentration in Mixture **3** from their graph. As the calculated value was slightly off the line of best fit, this strategem proved unsuccessful.

2(b)(ii) Many responses scored both marks. There were very few poor choices of scale but axes lacking appropriate labels and units were common errors.

2(b)(iii) Most candidates were awarded both marks for recognizing that a straight-line graph meant that the reaction was first order.

2(c)(i) Many correct answers were provided, although a significant number of learners stated that the concentrations needed to be the same or that the volume of the peroxydisulfate needed to change, both of which had been stated in the question.

2(c)(ii) This was often answered correctly with the omission of the rate constant being the most common error. Overall, the graphical treatment of kinetic data and its subsequent analysis was well known by learners.

2(d) Many attempted the calculation but incorrectly assumed that the constant in the equation was the rate constant. Sometimes values from the table were substituted into the two separate equations which produced two different values for the activation energy. Those that adopted the alternative method i.e. using the data to calculate a "gradient" were successful more often. Even when the correct numerical value for the activation energy was obtained sometimes the final mark was not awarded as incorrect units were stated such as not giving the answer ‘per mole’.

Question 3

3(a)(i) It was disappointing to see how many candidates seemed unfamiliar with making a standard solution. The use of deionized or distilled water to dissolve the solid was well known and this resulted in the only mark awarded for many.

Although using a volumetric flask was given by a few, addition of the washings was rarely given. Some responses confused washing any remaining solution from the beaker/weighing bottle with washing the organic layer in the preparation of aspirin which appeared on the June 2024 paper. In a similar vein making up to the mark was frequently stated but ensuring that a homogeneous solution was produced by mixing was omitted.

3(a)(ii) One mark was usually awarded for realising that a volumetric pipette is more accurate than a measuring cylinder. Although some candidates realised that sulfuric acid needed to be in excess so an accurate volume was not needed, many linked the use of equipment to the strength of the acids or the safety risk involved in their use.

3(a)(iii) The few candidates that gave detailed answers typically showed a clear understanding of what was happening at the endpoint. Although many candidates knew that the manganate(VII) ion is purple and manganese(II) is colourless, they didn’t have a clear understanding that the colour change at the endpoint was due to a small excess of the manganate(VII) ions and just referred to an incorrect colour change of pink/purple to colourless.

3(a)(iv) This question tested the knowledge of autocatalysis, but in the context of quantitative analysis rather than kinetics. Many responses lacked sufficient detail to gain all three marks available. Stating that the reaction was exothermic and thus generated heat was the mark awarded most often. The production of Mn^{2+} which then autocatalysed the reaction was recalled by some learners but few mentioned that the reaction was initially slow or that the activation energy was high.

3(a)(iv) This calculation was completed successfully by over a third of learners. A common error was using an incorrect reacting ratio for manganate and ethanedioate ions despite the balanced equation being given in the question.

Some ratios of manganate and hydrogen ions were seen. Another mistake was missing the aliquot and so not multiplying the moles by 10. Those learners who set out their working clearly facilitated the award of TE marks.

3(b) Many learners did not seem to recognise the practical technique of finding the K_a value for a weak acid. Some were confident that a titration was needed and could select an appropriate indicator but then placed a pH meter into the reaction mixture at the end point, when all the acid had been neutralised.

Some knew that the pH at the half equivalence point is equal to pKa but didn't explain how to find it practically. Detailed explanations of the calculations required were sometimes included, ignoring the instructions given in the question.

Question 4

4(a) Most candidates identified the corrosive and toxic symbols correctly. The third hazard symbol was linked with some negative health impact but comparatively few candidates recognised it as serious/carcinogenic.

4(b)(i) Generally this was one of the better answered questions. Most learners knew that the rate was too slow below zero and M2 was often scored with a statement about the formation of phenol. A common misconception was that the decomposition of phenylamine would occur at temperatures above five degrees.

4(b)(ii) Many learners had difficulty producing a recognisable diagram. The perforated base of the funnel was often omitted or appeared above the filter paper. A diagram for gravity filtration was not accepted. A drawing of the funnel and flask as one piece of apparatus was frequently seen. This would not work in practice but one mark was awarded if both components were correct.

4(b)(iii) Some learners did not pay sufficient attention to the wording of the question and described the purification of the sample by recrystallisation for which no marks were available. Those that attempted to describe a melting point determination showed a good knowledge of the required procedure, including the use of a Thiele tube. A minority thought that a water bath could be used to heat the sample, not noting that the highest temperature achievable would be 100^{o}C, whilst the melting point of the sample was 131^{o}C.

4(c) Many learners, rather than suggesting that the solubility increases with the introduction of an ionic side group, were non-committal on the change.

Paper Summary

Based on their performance on this paper, candidates should:

- Read the questions carefully and use the information provided to help you frame your answer.
- Set out calculations clearly and do not round intermediate values.
- Check the meanings and applications of technical words and phrases.
- Practise drawing apparatus used in practical experiments.

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