Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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

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Introduction

The paper had an emphasis on practical techniques, including qualitative analysis, titration and organic prepartions. There were many items that were accessible to studentss of all ability ranges, whilst still allowing the most able students to demonstrate their knowledge and undertanding. The more demanding questions were those which either required an evaluation of experimental methods and results or an application of knowledge in a slightly novel situation. The standard of mathematical calculations was generally very good and that there was no evidence of students running out of time to complete the paper.

Question 1

The question comparing pairs of liquids using qualitative tests was a straightforward start to the paper. In (a)(i) the idea that the addition of a coloured liquid to a colourless one would cause a change in colour without a chemical reaction taking place was rarely clearly expressed. Although many students knew the principle of this experiment, a significant proportion either thought that iodine solution is purple, or a purple vapour was formed did not score the second mark.

The identification of the sodium ion by a flame test in (a)(ii) was answered well by almost all students and in (b)(i) the majority successfully identified the white precipitate with sulfuric acid. The reaction of sulfuric acid with ammonium nitrate was less well described. Common wrong answers included the formation of a precipitate that dissolved, or a brown gas being given off.

The test for the ammonium ion in (b)(ii) was sometimes confused with the test for ammonia gas and many students did not make it clear that a gas was being tested with the damp red litmus paper.

In (c)(i) the oxidation of alcohols and colours of potassium dichromate were well known by most, but wrong observations (such as effervescence) did not score marks. In (c)(ii) the use of PCl_5 was the most common response and it scored particularly well. Likewise, the test for the double bond in (d) was well answered with a small minority getting the colours reversed.

Question 2

The calculation in (a) was generally answered well. In (a)(i) the most common mistake was not dividing by 10 and in (a)(ii) most correctly calculated the temperature change for marking point 1. The majority also appeared to know that $Q=mc\Delta T$, but a significant number used the mass of Mg (0.086g) instead of the mass of solution (50g) and so did not score marking point 2. A number of students

stopped their calculation here, but most were successful with the numerical equation in marking point 3. However, for marking point 4 many lost the mark due to too many significant figures, or the wrong sign; but incorrect units were only noticed rarely. Incorrect rounding was only penalised here and a number of students simply truncated numbers rather than correctly rounding them and so did not score marking point 4.

In (b)(i) the majority calculated the percentage uncertainly successfully. However, the mark was often lost for not multiplying by 2 as the students failed to appreciate the thermometer had to be used twice to get the temperature change. Despite the instructions in (b)(ii), a number of suggested changes to the apparatus which did not score marks. In contrast, students who related the question to the previous calculation performed much better. Many knew that a greater temperature change would reduce the uncertainty, but there were a number of conflicting answers on how to achieve this, such as adding more Mg **and** more acid.

In (c) most students appreciated that the question was about the relative heat loss of polystyrene cups and glass beakers. Marking point 1 was most frequently awarded for stating that the enthalpy change was smaller (an 'allow' on the mark scheme) rather than less negative or less exothermic and students should be encouraged to use the correct language when describing this sort of change. There was a wide range of correct answers to marking point 2, with the majority citing differences in heat energy loss, or absorption of heat by the glass beaker. A small minority wrongly associated a greater heat loss with a greater temperature change and a more exothermic enthalpy change.

Although most students understood that an oxide layer was present and it had to be removed in (d), many answers were too vague or poorly worded to score. A common response 'to remove impurities' was not sufficient for marking point 1. Similarly, for marking point 2, it was apparent that most students appreciated the Mg being weighed also contained MgO, however, few could explain the effect of this. The most common correct answer was (the removal of the MgO layer meant) only pure magnesium would be weighed.

Question 3

Although the colours of methyl orange indicator were generally well known in (a), a number of students thought red was the end-point colour, rather than orange and a small minority reversed the colours.

Completing the table in (b)(i) was done correctly by most students and the majority also calculated the mean titre properly. However, a few did not realise the importance of using concordant results. Whilst there were many clear, easy to follow and correct calculations in (b)(ii), a few answers showed little structure and sometimes contained multiple pathways with contradictory intermediates. The

most common errors were failing multiply by 10 and the occasional wrong molar mass calculation of Na_2CO_3.

Question 4

Whilst there were some excellent answers to the various parts of this question, it was apparent that many students were clearly not familiar with some the practical applications of the organic techniques in this question.

The responses in (a) were extremely varied and examples of those that did not score included:

- Reactions between sulfuric acid and other reactants, including potassium bromide
- Concern that the contents of the flask could spill out if the acid was added too quickly
- General comments about the vigorous nature of the reaction

Although many students realised the reaction was exothermic and scored a mark, few realised that this could cause the mixture to boil over.

Although almost all students were familiar with the distillation apparatus in (c)(i), the quality of the diagrams was wide ranging. Marking point 1 was commonly not scored due to as the source of heat having been omitted. Marking point 2 was usually scored, although some condensers were drawn without a separate sleeve for the water to flow through. Unfortunately, the overall functionality of the apparatus for M3, was still less well understood and it was not uncommon to see fully sealed apparatus or apparatus with gaping holes between the components.

The role of anti-bumping granules to prevent bumping in (c)(i) did not appear to be understood by many students. Whilst good answers referred to smooth boiling or a site to produce bubbles, many responses were too vague and mentioned things such as 'even heating' or 'absorbing heat energy'.

Deducing two physical properties of bromobutane from the separating funnel diagram in (d)(i) was well done by most students, with only a small minority thinking that the denser liquid would float on the top. Unfortunately, a few did not compare the density with water and simply said that bromobutane was dense, so did not score. The immiscibility or lack of solubility also scored well and a few achieved the mark via the bromobutane being a liquid option.

Although (d)(ii) was another well answered question, a number of responses incorrectly suggested simply decanting or pouring off the upper aqueous layer from the separating funnel. The use of a drying agent to absorb the water layer was also occasionally seen and, rather surprisingly, a small number of students thought that if they inverted the separating funnel the denser liquid would now float on top.

In (e) a number of students failed to appreciate the basic nature of the sodium hydrogencarbonate solution and so simply stated it was added to remove impurities, rather than neutralise the acid.

The identification of a suitable drying agent in (f)(i) was well known, but some students lost the mark by giving an incorrect formula in addition to the correct name. A few also gave a list of drying agents but included an incorrect one so did not score. Common wrong drying agents included copper sulfate and calcium carbonate.

There seemed to be a general lack of understanding of what a drying agent would do to the appearance of an organic liquid in (f)(ii). Many students thought there would be a colour change, but the more able students explained that the cloudy liquid became clear. Unfortunately, a number got confused with colourless and clear.

Paper Summary

Summary of advice to students:

- This is a practical paper so make sure you learn and understand the procedures in the core practicals, including the techniques in the preparation and purification of a liquid organic compound.

- Practise drawing diagrams of chemical apparatus ensuring that the apparatus would work.

- Always read the question carefully and follow the instructions which are given. Pay particular attention to bold text. If it helps, use a highlighter to indicate the key words.

- When carrying out calculations show your method and think carefully about units, significant figures and rounding.

- When answering enthalpy questions, use the appropriate chemical terms to describe enthalpy changes and think carefully about the sign.

- Practise evaluating practical work and try writing your own questions.

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