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Examiners' Report
January 2010

GCE Chemistry 6CH07_01

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Publications Code US022682

Introduction

The examiners were privileged to see some candidates who had been very well prepared by their centres. Both teachers and candidates are deserving of commendation. Of course there were, as always, candidates who had not prepared sufficiently and performance was often weakened by failure to read the question.

Question 1

Candidates were led to determine the identity of an inorganic salt.

In part (a)(i) the best candidates named nichrome or platinum as the material for the wire, and went on to suggest the reason for use as the material's unreactivity. Other reasons were acceptable, but physical properties like high melting temperature should not be given if a chemical property is available.

(i) Name a material from which the wire is made.

Suggest ONE reason why this material is used.

(2)

Name nichrome wire

Reason because it will not react with the acid

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Examiner Comments

This is a good answer.

In (a)(ii) the name sodium or the formula Na^+ was needed. Notice that the single positive charge on the sodium ion was required.

In (b) the first part was usually correctly answered as silver bromide. In (b)(ii) some did not read the question fully and gave AgBr, rather than Br^-. The darkening of the precipitate in sunlight was not well known, despite its importance in photography.

(b) When aqueous silver nitrate solution is added to a solution of compound **A**, a cream precipitate forms. The cream precipitate dissolves in concentrated aqueous ammonia solution.

(i) **Name** the cream precipitate formed when aqueous silver nitrate is added to the solution of compound **A**.

AgBr

(ii) Give the **formula** of the anion in compound **A**.

Br^{-1}

(iii) Describe what you would see if the cream precipitate in (b)(i) was left in sunlight.

(1)

it will change to dark gray, because of the reaction of light with silver.

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Examiner Comments

This is a good answer scoring full marks.

Part (c)(i) was usually correctly answered. Hydrogen was the common wrong answer.

The test expected in (c)(ii) was ammonia solution on a glass rod, or the stopper from an ammonia bottle, forming dense smoke. This is a good test for a hydrogen halide. It was important that a result of a test can be seen, so ammonium bromide forms is insufficient.

By far the most popular response was moist blue litmus paper turning red, which is only a test for an acidic gas, so only gained 1 mark.

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Examiner Tip

In giving a test try to give a test which will either uniquely identify the product, or as in this case, with ammonia, limit the identification to as small a group as possible (in this case the hydrogen halides).

(ii) Describe a further test you could carry out to confirm the identity of the steamy fumes. Give the result of your test.

(2)

Test: React it with ammonia.

Result: NH_4Br is formed.

Bromine was usually given correctly in (c)(iii). It was pleasing to see most candidates naming sulfur dioxide in (c)(iv) and recognising that it was formed in a reduction reaction. It was acceptable to classify the reaction as oxidation if the answer made it clear that bromide ion or hydrogen bromide was oxidized.

Question 2

Candidates were faced with two organic unknowns. This was well within the ability of most. Most seemed to know the tests for the products of alcohol oxidations. Nearly everyone gave the displayed formula of propanal in part (a), though structural formulae were accepted on this occasion. Naming the alcohols proved more challenging. Candidates are advised to make their letters and numbers clear. There were many examples of indistinguishable 'a' from an 'o' at the end of their name. Similarly '1's and '2's must be quite clear. One candidate made it totally clear by drawing a line to the '1' saying this is a one! Part (b) was similarly accessible, with similar problems of writing the names. A minority of candidates did not read or take into account the molar mass, so gave other consistent combinations of carbonyls and alcohols and could gain 1 of the 2 marks.

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Examiner Comments

The first is an example of a good answer. The second example shows where the candidate has given a consistent wrong answer so on this occasion scored 1 mark.

Liquid C .... 2 - propanone

Alcohol Y .... 2- propanol

Liquid C .... ~~Pentanone~~ Pentan-2-one

Alcohol Y .... ~~Butan~~ Pentan-2-ol

Question 3

In part (a) some misread the question and thought they were making a standard solution using a graduated or volumetric flask.

(2)

Weigh x g of calcium hydroxide (solid). ~~using~~ Pour it into a beaker. Pour y cm³ ~~50cm³~~ of distilled water into the same beaker. Use a glass rod to stir the solution. Add more calcium hydroxide into the beaker until $Ca(OH)_2$ can no longer dissolve. Use a filter funnel with filter paper to filter off the excess residue.

In (b)(i) most gave pipette some including the 10 cm^3 as a prefix. In (ii) most selected an appropriate titration indicator, avoiding litmus and universal indicator which do not work as they have no sharp end point colour change. However the colour change was often not known or the alkaline and acid colours were confused. Answers like methyl orange from yellow to colourless, and phenolphthalein from colourless to pink were very common.

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Examiner Tip

It is a good idea to state the conditions for the colours of acid base indicators like 'from pink in alkali colourless in acid'.

(ii) Suggest a suitable indicator for this titration and state the colour change you would expect to see at the end-point.

(2)

Indicator: Phenolphthalein

Colour change from: colourless to: pink

Part (c) was generally done successfully. Very few could not get the subtraction right in (c)(i). There were a number of acceptable answers to (c)(ii). The most popular was the results were outside the 0-.2 cm^3 range of the accurate titrations. Despite getting this right some still averaged all three results in (c)(iii). A few weaker candidates forgot the factor of 1000 in (c)(iv). Most divided their answer to (c)(iv) by two in (c)(v) and went on to multiply by 1000 divided by 10 in (c)(vi). Part (c)(vii) proved the most taxing but was still correctly or consistently answered by the majority. Candidates were only penalised once per error, so there were many transferred errors from earlier parts keeping the examiners busy on their calculators.

Some candidates have problems with significant figures. As a general rule it is best to work to three unless otherwise instructed. One significant figure is usually unacceptable.

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Examiner Comments

This candidate chose to give answers to two significant figures, which was not penalised on this occasion, but they failed to give the correct rounding in part (v) which should be 0.00023.

(iii) Calculate the mean titre.

(1)

Mean titre = $\frac{8.85 + 8.95}{2}$

= 8.90 cm^3

8.90 cm^3

(iv) Calculate the number of moles of hydrochloric acid in the mean titre.

(1)

n = MV

Moles of HCl = 0.05 × $\frac{8.90}{1000}$

= 0.00045 mol

(v) The equation for the reaction is

$$Ca(OH)_2(aq) + 2HCl(aq) \rightarrow CaCl_2(aq) + 2H_2O(l)$$

Calculate the number of moles of calcium hydroxide in a 10.0 cm^3 portion of the saturated solution.

(1)

Moles of $Ca(OH)_2$ = $\frac{0.00045}{2}$

= 0.00022 mol

In (d)(i) the energy was usually correctly calculated, by realising that the volume of the solution in cm^3 is equal to the mass in g.

To find the enthalpy change it was necessary to divide by the number of moles, 0.0100 mol which were given in the question, and at this stage get the sign right.

Common errors were to divide by another amount, omit the sign or omit the units.

Combining uncertainties by addition for each reading was less well known in (d)(iii). Some found the error in each separate reading rather than the temperature change.

The last three parts of the question were more demanding. The best candidates realised that the reactions were the same neutralisation of oxonium ions by hydroxide ions in (d)(iv). Failure to read the question lost the mark in (d)(v) when candidates answered the temperature change increases, when asked to predict the temperature change which requires a numerical response. The answer to (d)(v) made different answers acceptable in (d)(vi) providing the reasoning was correct but there were many feeble answers in terms of heat losses. A lower temperature change would give rise to a greater error, a higher change to a lower error, and the same change would give the reaction with the greater volume a lower error in volume measurement.

(vi) Which of the experiments in (iv) and (v) gave the least error in the temperature change? Justify your answer.

(1)

The experiments in (iv). Because a larger volume will produce a lower percentage error.

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Examiner Comments

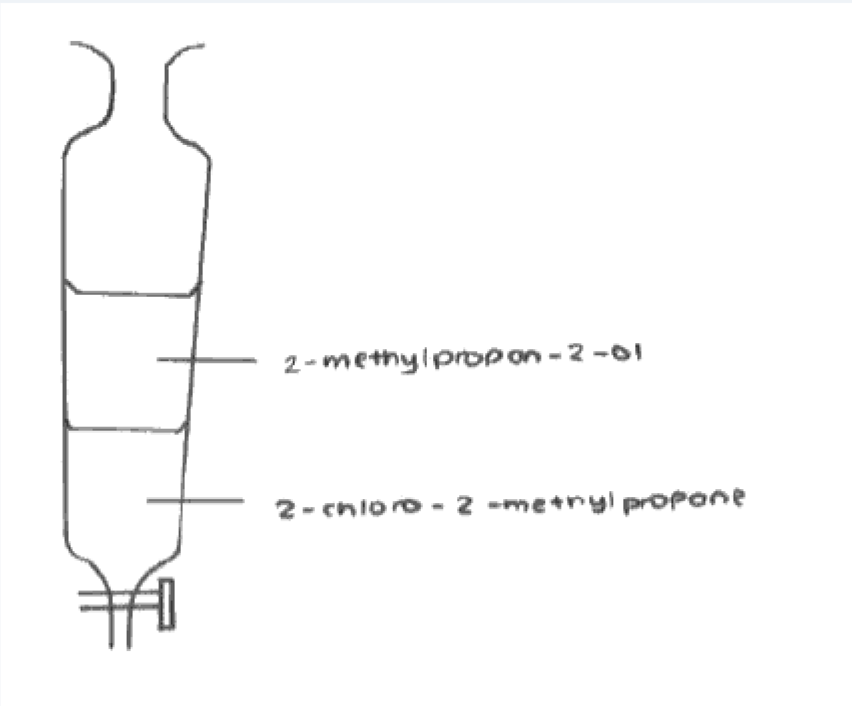
This got the mark.

Question 4

Candidates seemed to understand the principles involved in the preparation of an organic liquid examined in question 4.

Calculation of the volume of a liquid from the number of moles and the density was achieved by most in (a).

Separating funnels in (b) were also familiar though some omitted an opening top and/or a tap. The density data was needed to label the layer correctly see example below.



The reason for washing with sodium hydrogen carbonate was less well known. To remove 2-methylpropan-2-ol was a common mistake in (c)(i). Though the lack of gas coming off was usually recognised in part (ii).

Good candidates gave an appropriate anhydrous salt (calcium chloride, sodium sulfate or magnesium sulfate) in (d). The word 'anhydrous' is important and may be required in future.

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Examiner Comments

This is an example of a good answer.

(d) Suggest a suitable drying agent to dry the 2-chloro-2-methylpropane (step 6).

(1)

~~Anhydrous $CaCl_2$~~ Anhydrous $CaCl_2$

There were many good diagrams in (e). Common errors were to use a flat bottomed flask for heating, to wrongly position the thermometer bulb, to leave an air gap round the thermometer, to fail to draw a jacket around the condenser, and to seal the apparatus at the collection vessel.

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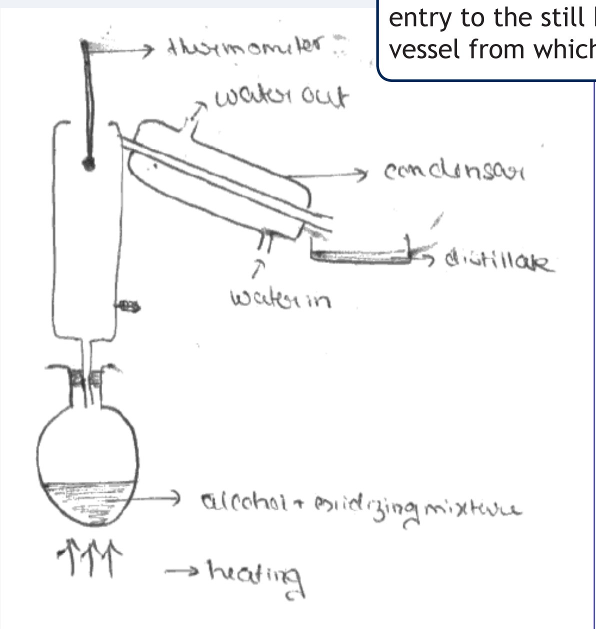
Examiner Comments

Notice the wrong position of the thermometer bulb and the air gap around its entry to the still head. Also see how a Petri dish appears to be the collecting vessel from which the halogenoalkane would quickly evaporate.



In (f) though other methods give the correct answer, the best method of calculating yield is:

actual amount of product in moles divided by expected amount of product in moles multiplied by 100.

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Examiner Comments

The candidate could not manage the calculation but has gained half the marks by showing that they know how to get to the key part.

percentage yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

$\frac{18.7}{18.8}$ = 99.5 %

In the last section, (g), the role of ethanol was not always clear, 'to make the reaction work' was not sufficient. The formation of a white precipitate was well known in part (ii) though some did not give an observable result saying silver chloride would form.

Advice to candidates

- **RTQ³** Read the question three times, twice before you answer it and once after to make sure you have answered it.
- Be familiar with the various practical preparation techniques you have used in the course:

  preparation of a standard solution

  preparation of a saturated solution

  preparation of dry crystals of a salt

  preparation and purification of an organic liquid.
- Be familiar with titrations from the course including knowledge of appropriate indicators and their colour changes.
- Practise calculations involving moles and masses, volumes of liquids, volumes of gases, volumes of solutions of known concentration and yields of reactions.
- Know the tests for common cations and anions in the course.
- For the organic chemicals you have met in the course, know their tests, and the tests for the products formed in their reactions.

Grade boundaries for GCE 08 Chemistry – 6CH07

6CH07/01

Grade	Max. Mark	A	B	C	D	E
Raw boundary mark	50	32	27	23	19	15
Uniform boundary mark	60	48	42	36	30	24

Maximum Mark (Raw): the mark corresponding to the sum total of the marks shown on the mark scheme.

Boundary Mark: the minimum mark required by a candidate to qualify for a given grade.

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