Cambridge Assessment International Education

Specimen Paper Answers

Paper 3: Practical Test

Cambridge O Level Chemistry

5070

For examination from 2023

Version 1

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Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge O Level Chemistry 5070, and to show examples of very good answers.

In this booklet, we have provided answers for all questions with examiner comments. These exercises require candidates to answer questions on experimental skills and candidates are awarded maximum of 40 marks for this paper and the mark scheme provides the answers required to gain the marks.

Each question and answer is followed by an examiner comment on the candidates answer. Additionally, the examiner has set out a number of common mistakes that occur when candidates answer the questions. In this way, it is possible to understand what candidates have done to gain their marks and how they could improve their answers and avoid errors.

The mark schemes for the Specimen Papers are available to download from the School Support Hub at **www.cambridgeinternational.org./support**

2023 Specimen Paper 3 Mark Scheme

2023 Specimen Paper 3 Confidential Instructions

Past exam resources and other teaching and learning resources are available on the School Support Hub www.cambridgeinternational.org/support

Assessment at a glance

The syllabus for Cambridge O Level Chemistry 5070 is available at www.cambridgeinternational.org

All candidates take three papers. Candidates will be eligible for grades A* to E.

Paper 1: Multiple Choice			Paper 2: Theory	
1 hour 40 Marks 40 four-option multiple-choice questions Externally assessed	30%	**And**	1 hour 45 minutes 80 Marks Short-answer and structured questions Externally assessed	50%

Practical assessment

Paper 3: Practical Test			Paper 4: Alternative to Practical	
1 hour 30 minutes 40 Marks Questions will be based on the experimental skills in Section 4 Externally assessed	20%	**Or**	1 hour 40 Marks Questions will be based on the experimental skills in Section 4 Externally assessed	20%

Question 1

Question 1(a)

1 You are going to investigate the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid labelled solution **A** and solution **B**.

Read all the instructions carefully before starting the experiments.

Instructions
You are going to do **three** experiments.

(a) Experiment 1

- Use a volumetric pipette to add 25.0 cm^3 of aqueous sodium carbonate to a conical flask.
- Add ten drops of thymolphthalein indicator to the conical flask.
- Fill the burette with solution **A**.
- Record the initial burette reading in Table 1.1.
- Add solution **A** from the burette to the conical flask while swirling the flask, until the solution turns colourless.
- Record the final burette reading in Table 1.1.

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Repeat the method in Experiment 1 with methyl orange indicator instead of thymolphthalein indicator.

Complete Table 1.1 with the volume used in each experiment.

Table 1.1

	Experiment 1	Experiment 2
final burette reading / cm^3	12.1	32.9
initial burette reading / cm^3	3.1	12.1
volume used / cm^3	9.0	20.8

[4]

Mark awarded = 4 out of 4

Examiner comment

Candidates must take the time to read through all the instructions carefully to ensure they do not make mistakes, such as using the incorrect solutions in the incorrect piece of apparatus, or using the incorrect indicators.

Candidates must also take their time during the titration, ensuring they employ a drop-wise addition so that they can become aware as soon as a colour change starts to take place in the conical flask. This ensures more accurate results are obtained.

The candidate neatly records all readings to one decimal place. They enter each reading into the correct cell of the table and correctly calculate the simple subtraction required. Readings to one decimal place are sufficiently accurate at this level. Note that as all readings are to one decimal place, this must also be true for any integer values recorded; the candidate correctly records 9.0 rather than just 9. It is important that candidates write as clearly as possible so that their recorded values are easy to read.

Common mistakes

- Candidates sometimes place the initial and final readings in the wrong rows of the table.
- Candidates sometimes make simple subtraction errors; they should make use of their calculator to avoid this kind of error.
- Some candidates struggle to spot the end-point of the titration, as this can be difficult initially when using methyl orange. Candidates could add a few drops of methyl orange to a little of the solution from the burette in a test-tube before they start, in order to see the final colour they are looking for.

Question 1(b)

(b) Experiment 3

- Empty the conical flask and rinse it with distilled water.
- Empty the burette.
- Repeat the method in Experiment 1 with solution **B** instead of solution **A**. Use thymolphthalein indicator.
- Record the initial and final burette readings for Experiment 3 in Table 1.2.
- Complete Table 1.2 with the volume used in Experiment 3.

Table 1.2

	Experiment 3
final burette reading / cm^3	27.6
initial burette reading / cm^3	23.1
volume used / cm^3	4.5

[2]

Mark awarded = 2 out of 2

Examiner comment

Candidates must be familiar with taking readings from common pieces of apparatus. All readings are neatly recorded to one decimal place, and are entered into the correct cell of the table. The simple subtraction required has been done correctly.

Common mistakes

Candidates do not always record measurements to the required number of decimal places.

Question 1(c)

(c) State the colour change observed in Experiment 2.

from ..... yellow ..... to ..... red ✓ ..... [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate has stated both colours in the correct order, paying attention to which experiment the question is related to.

Common mistakes

The candidates will have completed three experiments by the time they come to this question, so some will not read the question carefully and write down the colour change for the wrong experiment.

Question 1(d)

(d) State **one** observation, other than colour change, during the reaction in Experiment 2.

The solution fizzed. ✓ ..... [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate has correctly stated an observation they saw from the gas produced. Bubbling/bubbles/effervescence are also appropriate alternatives.

Candidates are advised to read through the whole question before attempting it, so they are more aware of any subsequent questions about experiments they conduct.

Common mistakes

Statements such as 'I saw a gas' would not score a mark as it is not the gas that is observed but the effect of the evolution of gas on the solution. Candidates must write what they see i.e. bubbles /fizzing /effervescence.

Question 1(e)

(e) Complete the sentence.

Experiment ..*2* ✓.. uses the largest volume of dilute hydrochloric acid to change the colour of the indicator. [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate needs to look at the results in their tables to determine the answer. There is no trick to this question and the candidates should be confident in their answer after reading the question.

Question 1(f)

(f) State the effect on the volume of solution **B** used in Experiment 3 if the aqueous sodium carbonate is warmed before adding solution **B**.

Give a reason for your answer.

effect on volume used ..*None* ✓.....

reason ..*the concentration of the sodium carbonate is unchanged.* ✓.....

[2]

Mark awarded = 2 out of 2

Examiner comment

The candidate realises the question is asking about the volume of hydrochloric acid used, and not about the effect of the temperature increase on the rate of reaction; while the rate of the reaction would increase due to an increase in temperature, the quantities involved remain the same.

As there is only one line for the answer, it also suggests that an extended, over-complicated answer is not required.

Acceptable alternatives for the reason would be:

- The moles of sodium carbonate are unchanged.
- The original volume of sodium carbonate is unchanged.

Common mistakes

Some candidates will misinterpret the stem of the question and provide an extended answer relating to the effect of temperature change on the rate of reaction.

Question 1(g)(i)

(g) (i) Calculate the simplest whole number ratio of volume of solution **A** used in Experiment 1 : volume of solution **B** used in Experiment 3.

2:1 ✓ ..... [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate has simply written the correct whole number ratio from their experiments.

Common mistakes

If the candidate is not careful about what they do, they could use the results from the wrong experiments or in the wrong order.

Question 1(g)(ii)

(ii) Calculate the simplest whole number ratio of concentration of solution **A** : concentration of solution **B**.

1:2 ✓ ..... [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate realises that they need to use their answer to 1(g)(i) along with their knowledge that concentration is mol/volume, in order to deduce that twice the volume must have half the concentration, therefore obtaining the correct ratio. The candidate appreciates that there is only one line for the answer and so a complicated mole calculation is not required.

Common mistakes

Some candidates will not make the connection to the relationship between concentration and volume even though both are mentioned in the stems of both parts of question 1(g).

Question 1(h)

(h) The burette is emptied and re-used in Experiment 3.

Suggest an additional step after emptying the burette which would improve the accuracy of the results.

The burette should be rinsed ✓ with solution B ✓ before starting the titration.

[2]

Mark awarded = 2 out of 2

Examiner comment

Alternatives to 'rinse', such as 'wash' the burette would also be acceptable. If the candidate has carried out titrations in practical lessons, they will immediately be able to relate their experiences to the question being asked.

Question 1(i)

(i) Titrations often give inaccurate results if done only once.

Suggest how repeating each experiment several times produces more accurate values.

Repeat the titrations until concordant results are obtained. ✓

Use concordant results to calculate a mean volume used. ✓

[2]

Mark awarded = 2 out of 2

Examiner comment

Alternative words to concordant, such as similar, would be acceptable.

Common mistakes

Some candidates will simply repeat the stem of the question, e.g. 'repeat the experiments to make them more accurate' which does not answer the question.

Total mark awarded = 17 out of 17

Question 2

Question 2(a)

2 You are provided with two solids, solid **C** and solid **D**.

Do the following tests on solid **C** and solid **D**, recording all of your observations at each stage.

(a) State the colour of each solid.

solid **C** Green ✓

solid **D** White ✓

[1]

Mark awarded = 2 out of 2

Examiner comment

The answer is quite straight forward and should not be over-complicated.

Question 2(b)

tests on solid C

(b) Place a spatula measure of solid **C** in a hard-glass test-tube. Heat the solid gently until no further changes are observed.

Record your observations.

The solid appeared to move about. ✓ Condensation formed ✓ on the inside of the test-tube. The solid turned black.✓ [2]

Mark awarded = 2 out of 2

Examiner comment

The candidate writes down exactly what they observe. It is possible from their observation (the colour change) to know that they have also correctly followed the instructions of heating until no further change occurs.

As the original colour of the solid was stated in 2(a), the candidate does not need to include this colour in their response, the final colour is sufficient.

Common mistakes

Some candidates will only provide one observation, not appreciating that there are two marks available for the answer. Candidates should not ignore any observations because they think they might be incorrect or irrelevant and instead should list exactly what they see.

Question 2(c)(i)

(c) **(i)** Place a spatula measure of solid **C** in a test-tube and add approximately 2 cm depth of dilute sulfuric acid.

Test the gas given off. Keep the mixture in the test-tube for use in **(c)(ii)**.

Record your observations.

The mixture fizzed ✓ and the solution changed colour from colourless to pale blue. ✓ No precipitate was observed. The gas evolved turned limewater milky ✓ proving it was carbon dioxide. [3]

Mark awarded = 3 out of 3

Examiner comment

The candidate has written clear observations for all parts of the question as required.

Based on their knowledge of the syllabus content about acid reactions, candidates could make an educated guess that the gas evolved is carbon dioxide, however the marks here are awarded for the test/observations rather than the identification of the gas.

Common mistakes

Some candidates do not read the question carefully and do not notice that the gas should be tested.

Question 2(c)(ii)

(ii) Transfer the contents of the test-tube from **(c)(i)** to a boiling tube.

To this boiling tube, add aqueous ammonia dropwise and then in excess.

Record your observations.

A pale blue ✓ precipitate was formed. ✓ This dissolved in excess aqueous ammonia and a deep blue solution formed. ✓

[3]

Mark awarded = 3 out of 3

Examiner comment

The candidate appreciates there are three marks available and provides three observations in a concise and sequenced answer. It is possible from the candidate's answer to determine that they followed the instructions to add the aqueous ammonia slowly, as they were able to observe the precipitate before it dissolved.

Common mistakes

- Some candidates will miss observations and therefore marks because they:
  - do not use a drop-wise addition of the ammonia
  - do not shake the test-tube, preventing the reagents to thoroughly mix.
- Some candidates will state only that 'a precipitate was formed' or that 'the solution went blue'. **Both** the colour and the presence of a precipitate should be included for full marks.

Question 2(d)

(d) Do a flame test on solid **C**.

Record your observations.

A blue-green flame was observed. ✓ [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate states the flame colour, which is all that is required from a flame test observation.

Common mistakes

- Candidates do not repeat the flame test when they are unsure of the colour produced.
- Candidates do not make use of the *Notes for use in qualitative analysis* provided at the back of the question paper.

Question 2(e)

(e) Identify solid **C**.

Copper ✓ carbonate ✓ [2]

Mark awarded = 2 out of 2

Examiner comment

The candidate uses their observations and the *Notes for qualitative analysis* to accurately identify the solid.

Common mistakes

- Some candidates will not attempt to answer this part when they're not sure of the complete compound name. However, they should still suggest either part of the compound, if they are able to, based on some of their observations as they might score one of the two available marks; there is one mark available for 'copper' and one for 'carbonate'.

  For example, even if the candidate is not able to identify that carbon dioxide was evolved in 2c(i), and therefore conclude that the compound was a carbonate, they should still be able to state that the compound contained copper from their observation of the flame test. The same applies if they could not complete the flame test but realise the compound was a carbonate.

- Candidates often do not make use of the *Notes for qualitative analysis* provided at the back of the question paper.

Question 2(f)(i)

tests on solid D

Place approximately half of solid **D** in a test-tube. Add approximately 4 cm depth of distilled water and shake the test-tube until solid **D** completely dissolves to form solution **D**.

Divide solution **D** into two equal portions in two test-tubes and test as instructed.

(f) (i) To the first portion of solution **D**, add aqueous sodium hydroxide dropwise and then in excess.

Record your observations.

No change observed ✓ [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate has simply stated their correct observation.

Common mistakes

Some candidates may 'invent' observations that did not occur as they believe something should have happened, this should not be the case. If nothing was observed, then that is what candidates should write down.

Question 2(f)(ii)

(ii) To the second portion of solution **D**, add 1 cm depth of nitric acid followed by a few drops of aqueous silver nitrate.

Record your observations.

A yellow precipitate was formed. ✓ [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate has correctly recorded the observation. The candidate also appreciates the importance of accurately stating the precipitate colour, as well as the presence of a precipitate.

Common mistakes

- Some candidates may simply state 'a precipitate was formed' or 'the solution went yellow'. These responses would be insufficient. Both the colour and precipitate are required.
- Some candidates do not make use of the *Notes for use in qualitative analysis*.

Question 2(g)

(g) Do a flame test on solid **D**.

Record your observations.

A lilac flame was observed. ✓ [1]

Mark awarded = 1 out of 1

Examiner comment

The candidate has simply stated the flame colour which is all that is required from a flame test observation.

Common mistakes

- Candidates do not repeat the flame test when they are unsure of the colour produced.
- Candidates do not make use of the *Notes for use in qualitative analysis* provided at the back of the question paper.

Question 2(h)

(h) Identify solid **D**.

Potassium ✓ iodide ✓ [2]

Mark awarded = 2 out of 2

Examiner comment

The candidate has used their observations and the *Notes for qualitative analysis* to accurately identify the solid.

Common mistakes

Some candidates will not attempt to answer this part when they are not sure of the complete compound name. However, they should still suggest either part of the compound, if they are able to, based on some of their observations as they might score one of the two available marks; there is one mark available for 'potassium' and one for 'iodide'.

Total mark awarded = 17 out of 17

Question 3

Question 3

3 Plant leaves contain a mixture of coloured substances.

Plan an experiment to find the R_f values of the coloured substances present in plant leaves.

Your plan should describe the use of common laboratory apparatus, plant leaves, sand, ethanol as the solvent and absorbent paper.

You may draw a diagram to help answer the question.

Rf values can be obtained by chromatography. ✓

Grind the leaves up with some sand and ethanol using a pestle and mortar. ✓

Filter the mixture and keep the filtrate. ✓

Draw a line in pencil 2cm above the bottom of a piece of absorbent paper. ✓

Place a small dot of the liquid mixture on the pencil line. ✓

Place the paper into a beaker of ethanol ensuring the pencil line is above the level of the ethanol. ✓

Put a lid on the beaker.

When the ethanol nears the top of the paper, ✓ remove the paper and mark the solvent front with a pencil. ✓

Use a ruler to measure the distance the pigment travelled and the distance the solvent travelled.

Rf = distance pigment travelled / distance solvent travelled. ✓

[6]

Mark awarded = 6 out of 6

Examiner comment

The candidate provides a clear, logical and correctly ordered series of steps in a method that includes the apparatus used and any measurements that are taken.

The candidate states the type of process that is taking place i.e. chromatography.

The candidate has clearly read the question and uses the information provided in their answer. They appreciate items such as ‘sand’ are suggested for a reason.

The candidate realises that six marks are available for the question so a comprehensive response, with at least six different points, is required.

Common mistakes

- Some candidates who struggle to express themselves in writing do not take the opportunity to draw a labelled diagram that could help them to express their plan; a bulleted list or similar with key ideas can also help.
- Candidates frequently state measurements that should be taken but do not mention the piece of apparatus that should be used to take the measurement.

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