Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER							CANDIDATE NUMBER					

4070489320

CHEMISTRY **5070/32**

Paper 3 Practical Test **May/June 2024**

1 hour 30 minutes

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
Total	

This document has **12** pages. Any blank pages are indicated.

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1 (a) (i) You are going to investigate the temperature change when a solid, **X**, is dissolved in water.

Read **all** the instructions below carefully before starting the experiment.

Instructions
You are going to do **one** experiment.

- Use a measuring cylinder to add 25 cm^3 of distilled water to a 100 cm^3 beaker.
- Use a thermometer to measure the initial temperature of the water in the beaker.
- Record this temperature to the nearest 0.5 °C in Table 1.1 at time 0 s.
- Add all the sample of solid **X** to the beaker and start the stopwatch.
  Do **not** stop the stopwatch until the whole experiment is complete.
- Carefully stir the mixture.
- Measure the temperature after approximately 30 s and again after approximately 60 s.
- Record the times, to the nearest second, and the temperatures, to the nearest 0.5 °C, in Table 1.1.
- Continue stirring the mixture.
- Measure the temperature at approximately 60 s intervals for a total of 300 s.
- Record the times, to the nearest second, and the temperatures, to the nearest 0.5 °C, in Table 1.1.

Table 1.1

time / s	temperature / °C

[5]

(ii) Describe the appearance of the mixture in the beaker at the end of the experiment.

....

.... [1]

(iii) Calculate the maximum temperature change in the experiment.

maximum temperature change .... °C [1]

(iv) Describe the trends shown in your results.

....

....

.... [2]

(v) Suggest the temperature of the mixture if it is left for 60 minutes.

Explain your answer

temperature after 60 minutes .... °C

explanation ....

....
[2]

(b) Describe the energy change when **X** dissolves in water.

Explain how the results in Table 1.1 support your answer.

description ....

explanation ....

....
[2]

(c) The maximum temperature change calculated is **not** the true value for this experiment.

This may be because the volume of water and the temperature are **not** measured precisely.

(i) Name a piece of equipment to measure the volume of water more precisely.

.... [1]

(ii) Explain how to obtain a more precise temperature measurement.

....

.... [1]

(d) The maximum temperature change calculated is less than the true value for this experiment.

Suggest a reason for this, other than the precision of measurements.

Describe an improvement to the method which reduces this error.

reason ....

....

improvement ....

....
[2]

[Total: 17]

2 You are provided with solution **R**.

You will do a series of experiments on **R**.

You should:

- record your observations and conclusions for each of these experiments
- test and name any gases evolved.

To prepare for the experiment in **(b)**, place 1 cm depth of **R** in a test-tube. Place a wooden splint into the test-tube and leave it while doing the experiments in **(a)**.

(a) **(i)** To 3 cm depth of **R** in a boiling tube, add 2 cm depth of dilute nitric acid. Keep this solution for use in **(a)(ii)** and **(a)(iii)**.

observations ....

....

....

conclusions ....

....

.... [4]

(ii) To 1 cm depth of the solution from **(a)(i)** in a test-tube, add 1 cm depth of aqueous barium nitrate.

observations ....

....

conclusions ....

.... [2]

(iii) To 1 cm depth of the solution from **(a)(i)** in a test-tube, add 1 cm depth of aqueous silver nitrate.

observations ....

....

conclusions ....

.... [2]

(b) (i) Place the end of the wooden splint which has been in **R** into the flame of a Bunsen burner with the air hole open. Record the first flame colour seen.

first flame colour seen ....

....

conclusions ....

....
[2]

(ii) Explain why the air hole on the Bunsen burner must be open when doing this flame test.

....

.... [1]

(c) Solution **R** is made from a mixture of two different ionic compounds.

Suggest the names of these **two** compounds.

....

.... [2]

(d) A student tests a different solution, **P**, and finds it difficult to decide whether the solution contains chloride ions or bromide ions.

The student also has aqueous potassium chloride and aqueous potassium bromide.

Suggest how the student could use the aqueous potassium chloride and aqueous potassium bromide to make it easier to decide whether **P** contains chloride ions or bromide ions.

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.... [2]

(e) The student adds dilute hydrochloric acid to another solution and a gas is produced. The gas is passed through limewater.

Describe how the gas can be passed through limewater.

You may draw a labelled diagram to help answer the question.

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....

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[2]

[Total: 17]

3 **You are not expected to do any experimental work for this question.**

Copper(II) carbonate reacts with dilute sulfuric acid at room temperature.

The word equation for the reaction is shown.

copper(II) carbonate + sulfuric acid $\rightarrow$ copper(II) sulfate + carbon dioxide + water

Plan an experiment to determine the volume of carbon dioxide formed when a known mass of copper(II) carbonate completely reacts with dilute sulfuric acid.

Your plan must include the use of common laboratory apparatus, dilute sulfuric acid and copper(II) carbonate. No other chemicals should be used.

Your plan must include:

- the apparatus needed
- the method to use and the measurements to take
- procedures to ensure that the volume measured is as accurate as possible.

You may draw a diagram to help answer the question.

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[6]

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Notes for use in qualitative analysis

Tests for anions

anion	test	test result
carbonate, CO_3^{2-}	add dilute acid, then test for carbon dioxide gas	effervescence, carbon dioxide produced
chloride, Cl^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide, Br^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
iodide, I^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate, NO_3^- [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate, SO_4^{2-} [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.
sulfite, SO_3^{2-}	add a small volume of acidified aqueous potassium manganate(VII)	the acidified aqueous potassium manganate(VII) changes colour from purple to colourless

Tests for aqueous cations

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
aluminium, Al^{3+}	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
ammonium, NH_4^+	ammonia produced on warming	–
calcium, Ca^{2+}	white ppt., insoluble in excess	no ppt. or very slight white ppt.
chromium(III), Cr^{3+}	green ppt., soluble in excess	green ppt., insoluble in excess
copper(II), Cu^{2+}	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II), Fe^{2+}	green ppt., insoluble in excess, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
iron(III), Fe^{3+}	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc, Zn^{2+}	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Tests for gases

gas	test and test result
ammonia, NH_3	turns damp red litmus paper blue
carbon dioxide, CO_2	turns limewater milky
chlorine, Cl_2	bleaches damp litmus paper
hydrogen, H_2	‘pops’ with a lighted splint
oxygen, O_2	relights a glowing splint
sulfur dioxide, SO_2	turns acidified aqueous potassium manganate(VII) from purple to colourless

Flame tests for metal ions

metal ion	flame colour
lithium, Li^+	red
sodium, Na^+	yellow
potassium, K^+	lilac
calcium, Ca^{2+}	orange-red
barium, Ba^{2+}	light green
copper(II), Cu^{2+}	blue-green