Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2015782125

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2024**

1 hour

You must answer on the question paper.

No additional materials are needed.

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.

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

1 A sample of rock salt contains sodium chloride, sand and mud.

Sodium chloride is soluble in water. Sand and mud are insoluble in water.

A student obtains dry crystals of pure sodium chloride from a lump of rock salt.

Fig. 1.1 shows some of the steps the student uses.

step 1
Grind the rock salt into smaller pieces.

step 2
Add the rock salt to water and heat while stirring with a glass rod.

step 3
Filter the mixture.

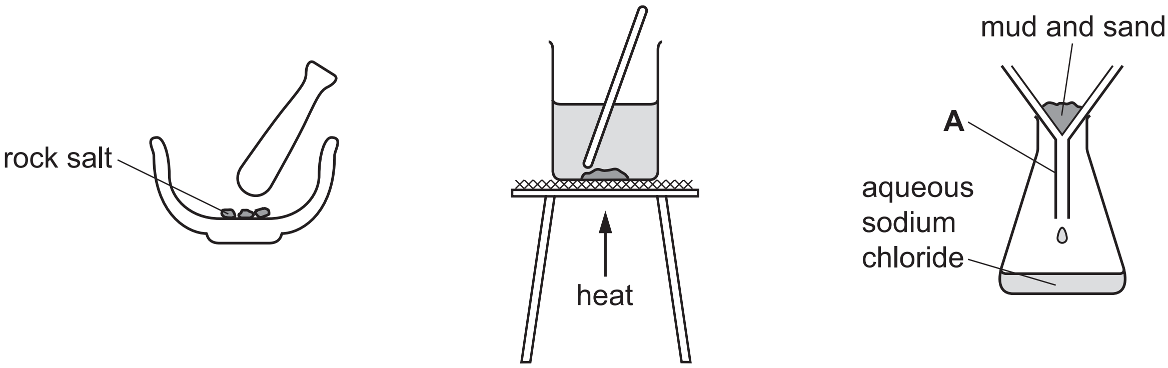


Fig. 1.1

(a) Explain why the rock salt is made into smaller pieces in **step 1**.

.... [1]

(b) Name an item of apparatus that can be used to heat the water in **step 2**.

.... [1]

(c) Name the apparatus labelled **A** in **step 3**.

.... [1]

(d) Describe what the student must do after **step 3** to obtain dry crystals of pure sodium chloride.

....

....

....

.... [3]

[Total: 6]

2 A student investigates the rate at which hydrogen gas is made when magnesium ribbon reacts with dilute ethanoic acid at two different temperatures.

Instructions

The student does two experiments using the apparatus shown in Fig. 2.1.

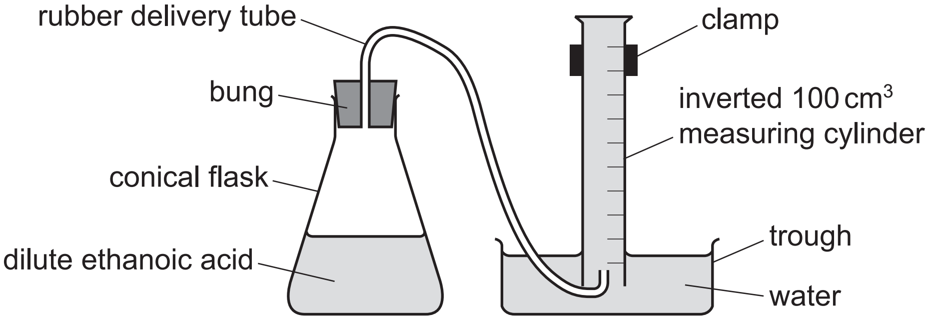


Fig. 2.1

Experiment 1

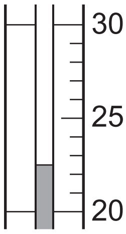
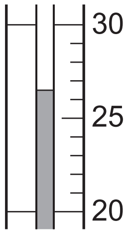
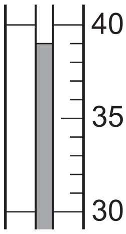
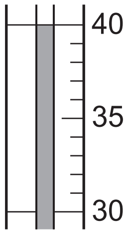
- Use a measuring cylinder to pour 50 cm^3 of dilute ethanoic acid into a conical flask.
- Use a thermometer to measure the initial temperature of the dilute ethanoic acid and record the initial temperature.
- Set the apparatus up as shown in Fig. 2.1, ensuring the inverted measuring cylinder is full of water.
- Remove the bung from the conical flask, ensuring the delivery tube remains in the measuring cylinder.
- Add a coil of magnesium ribbon to the conical flask, immediately put the bung back into the conical flask and start the timer. If the magnesium sticks to the side of the flask, gently shake the flask so that it is washed off the side.
- Measure the volume of gas collected in the inverted measuring cylinder every 15 seconds for 150 seconds. Record the volume of gas collected.
- Use the thermometer to measure the final temperature of the mixture in the conical flask and record the final temperature.
- Rinse out the conical flask with distilled water.

Experiment 2

- Repeat Experiment 1 but warm the acid by about 15 °C after it has been poured into the conical flask and before the initial temperature is measured and recorded.

(a) Use the thermometer diagrams to complete Table 2.1.

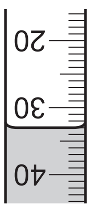
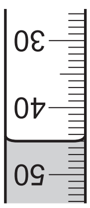
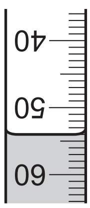
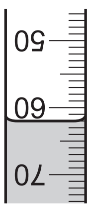
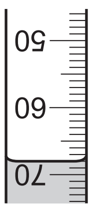
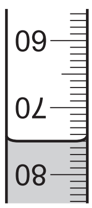
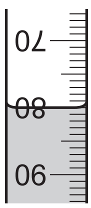
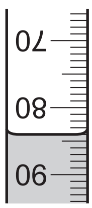
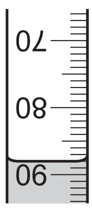
Table 2.1

	initial		final		
experiment	thermometer diagram	temperature / °C	thermometer diagram	temperature / °C	average temperature / °C
1					
2					

[3]

(b) Use the diagrams of the inverted measuring cylinders to complete Table 2.2.

Table 2.2

time / s	15	30	45	60	75	90	105	120	135	150
volume of gas collected in Experiment 1 / cm^3	12	22	31	37	43	48	52	56	59	62
diagram of inverted measuring cylinder in Experiment 2										
volume of gas collected in Experiment 2 / cm^3										

[2]

(c) Complete a suitable scale on the *y*-axis and plot the results for Experiments 1 and 2 on Fig. 2.2. Draw two lines of best fit. Both lines **must** start at (0,0). Label your lines.

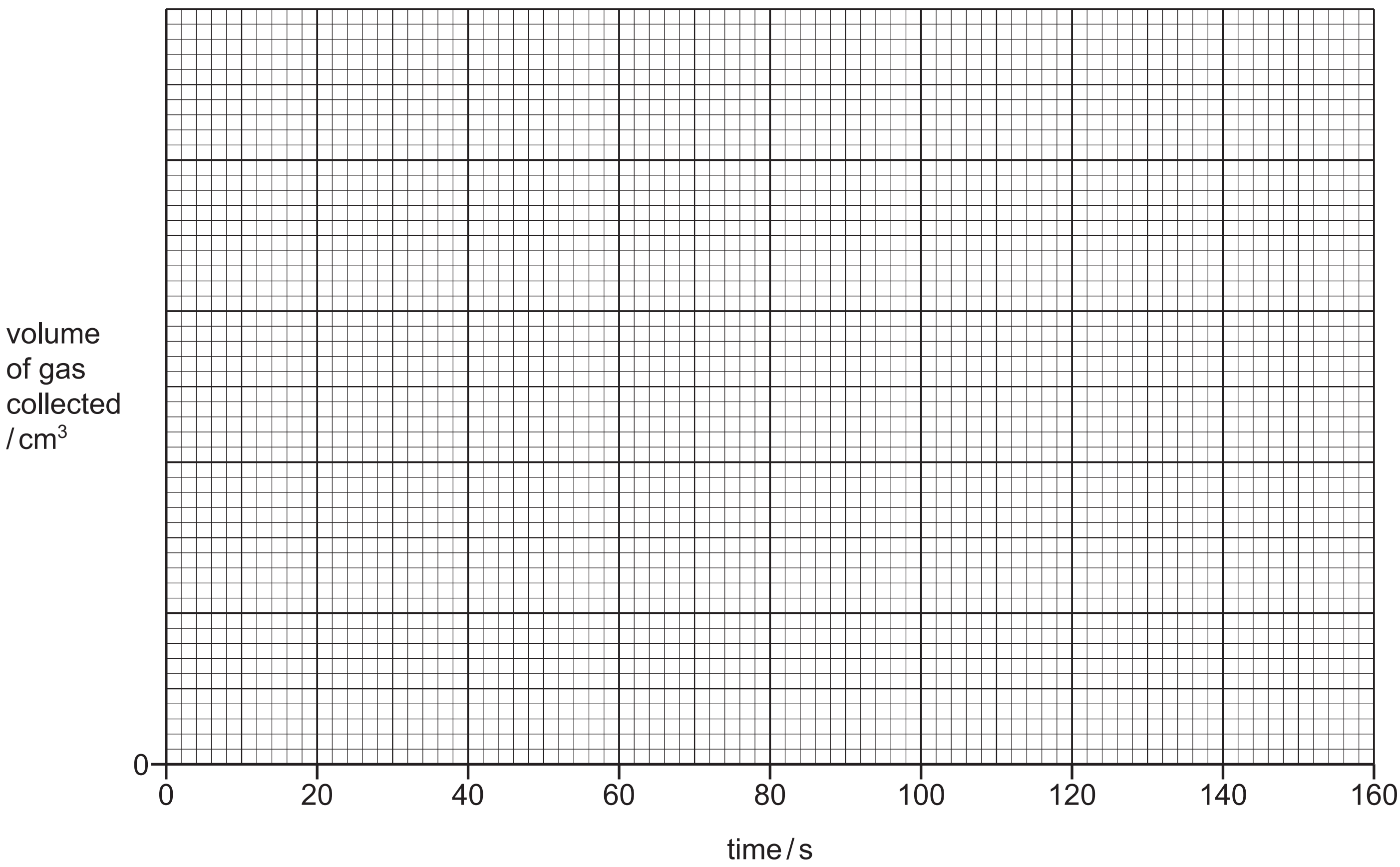


Fig. 2.2

[4]

(d) Deduce the volume of gas collected between 20 seconds and 40 seconds in Experiment 1. Show clearly on Fig. 2.2 how you worked out your answer.

volume of gas collected between 20 seconds and 40 seconds .... cm^3 [3]

(e) Use Fig. 2.2 to explain which experiment had the faster rate of reaction.

experiment with faster rate ....

explanation ....

.... [1]

(f) During Experiment 1, the temperature of the mixture in the conical flask changed.

(i) State how this change in temperature affects the rate of the reaction.

.... [1]

(ii) Describe how the apparatus could be altered to minimise the change in temperature.

....

.... [1]

(g) Some gas escapes in the short time between adding the magnesium ribbon to the conical flask and putting the bung back into the conical flask.

Explain how the apparatus could be altered so that no gas escapes and the results of the experiment are more accurate. You may draw a diagram to help explain your answer.

....

.... [2]

(h) Describe one **other** way in which the results of Experiments 1 and 2 could be made more accurate.

....

.... [1]

(i) Sketch on Fig. 2.2 the graph you would expect when Experiment 2 is repeated using ethanoic acid with a higher concentration.

Label your line **X**. [1]

[Total: 19]

3 A student tests two substances: solid **K** and solution **L**.

Tests on solid K

Solid **K** is copper(II) carbonate.

Complete the expected observations.

(a) The student adds about 5 cm^3 of dilute hydrochloric acid to solid **K**.

observations ....

.... [1]

The solution made in **(a)** is solution **M**. The student divides solution **M** into two portions.

(b) To the first portion of solution **M**, the student adds aqueous ammonia dropwise until it is in excess.

observations ....

....

.... [3]

(c) The student carries out a flame test on the second portion of solution **M**.

(i) State the colour the Bunsen burner flame becomes during the flame test.

.... [1]

(ii) Describe how the student should carry out the flame test.

....

....

.... [2]

Tests on solution L

Table 3.1 shows the tests and the student's observations for solution **L**.

Solution **L** was divided into two portions.

Table 3.1

tests	observations
test 1 To the first portion of solution **L**, add aqueous sodium hydroxide dropwise until in excess.	a white precipitate forms which is insoluble in excess
test 2 To the second portion of solution **L**, add 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate.	a cream precipitate forms

(d) Identify solution **L**.

....

.... [2]

[Total: 9]

4 Iron rusts slowly when exposed to water and air. There is an increase in mass when iron rusts as the insoluble solid hydrated iron(III) oxide forms.

Cast iron, mild steel and stainless steel are all alloys that contain iron.

Plan an experiment to find which of these three alloys rusts most quickly when exposed to water and air. Include in your answer how the results of the experiment will show which alloy rusts most quickly.

You are provided with powdered cast iron, powdered mild steel, powdered stainless steel and common laboratory apparatus.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

.... [6]

BLANK PAGE

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