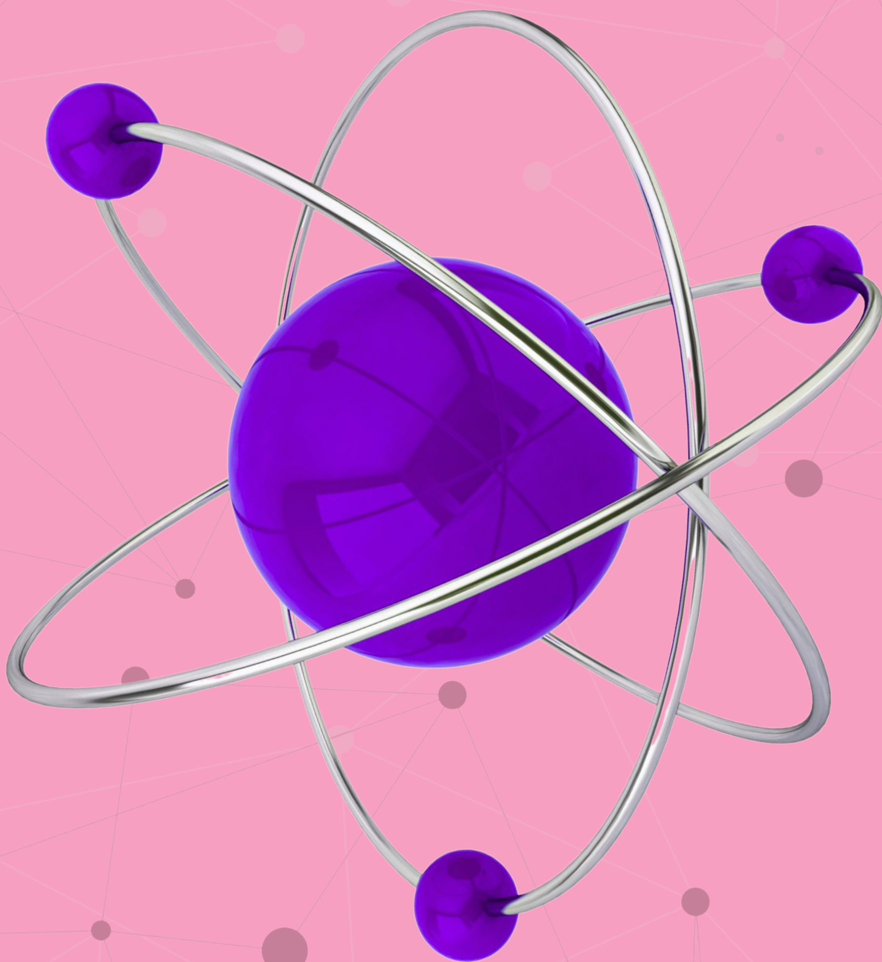
Cambridge IGCSE Chemistry



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Paper 6

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CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **February/March 2023**

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 **16** pages. Any blank pages are indicated.

1 Long-chain alkanes can be broken down into shorter chain alkanes and gaseous alkenes. Vapour from a long-chain alkane is passed over a very hot catalyst and the gases formed are collected over water. The apparatus used is shown in Fig. 1.1.

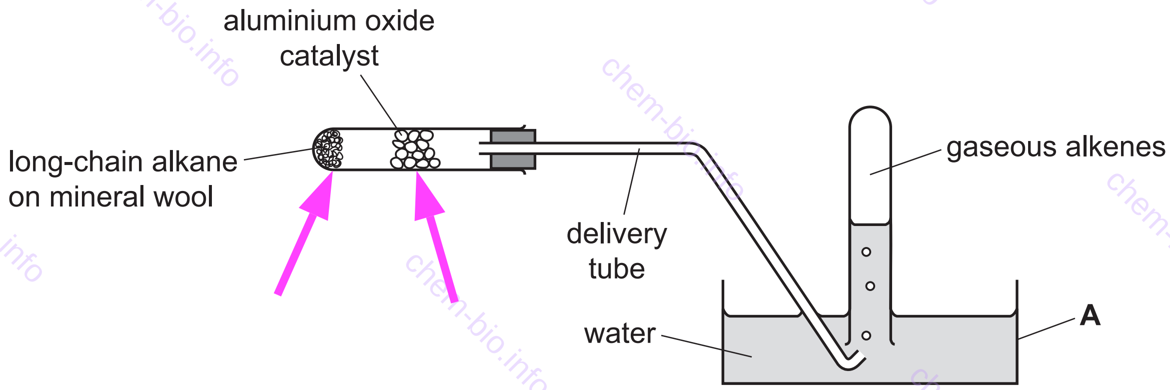


Fig. 1.1

(a) Name the item of apparatus labelled **A** in Fig. 1.1.

trough

.... [1]

(b) The catalyst is small pieces of aluminium oxide.

Explain why several small pieces of aluminium oxide speed up the reaction more than one large piece of aluminium oxide.

Larger surface area so more collisions per unit time

....

.... [1]

(c) **(i)** Name the item of apparatus that can be used to heat the long-chain alkane and catalyst.

Bunsen burner

.... [1]

(ii) Add **two** arrows to Fig. 1.1 to show where the apparatus should be heated. [1]

(d) The gas collected is tested using aqueous bromine. Alkenes turn aqueous bromine from orange to colourless.
When the first few bubbles of gas collected are tested, the aqueous bromine does **not** change colour.

Explain why the aqueous bromine does **not** change colour.

the first few bubbles are composed of air that was initially found in the test-tube ..... [1]

(e) As soon as the experiment is over and the heating is stopped, the delivery tube must be removed from the water.

Explain what happens if the delivery tube is **not** removed from the water as soon as the heating is stopped.

The test-tube would break because the water will be sucked back into the test-tube ..... [2]

[Total: 7]

2 A student investigates the solubility of ammonium chloride in water at different temperatures.

The student does five experiments using the following instructions.

Experiment 1

- Fill a burette with distilled water.
- Run some of the water out of the burette so that the level of the water is on the burette scale.
- Use the burette to add 8.0 cm^3 of distilled water to a 5.25 g sample of ammonium chloride in a boiling tube.
- Clamp the boiling tube at an angle, as shown in Fig. 2.1.

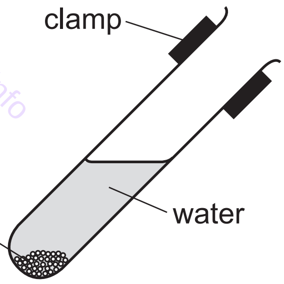


Fig. 2.1

- Gently heat the bottom of the boiling tube while stirring the contents with a thermometer.
- Stop heating as soon as all the solid has dissolved.
- Continuously stir the solution with the thermometer while it cools.
- Measure the temperature of the solution as soon as the solution becomes cloudy and a solid starts to form.

Experiment 2

- Use the burette to add 0.5 cm^3 of distilled water to the mixture in the boiling tube from the previous experiment.
- Clamp the boiling tube as shown in Fig. 2.1.
- Gently heat the bottom of the boiling tube while stirring the contents with a thermometer.
- Stop heating as soon as all the solid has dissolved.
- Continuously stir the solution with the thermometer while it cools.
- Measure the temperature of the solution as soon as the solution becomes cloudy and a solid starts to form.

Experiment 3

- Repeat Experiment 2.

Experiment 4

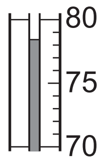
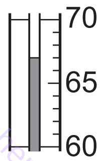
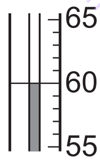
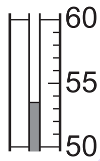
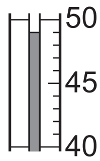
- Repeat Experiment 2.

Experiment 5

- Repeat Experiment 2.

(a) Use the information in the description of the experiments and the thermometer diagrams to complete Table 2.1.

Table 2.1

experiment	mass of ammonium chloride/g	total volume of water/cm^3	thermometer diagram when a solid starts to form	temperature when a solid starts to form/°C
1	5.25	8.0		78.5
2	5.25	8.5		67.0
3	5.25	9.0		60.0
4	5.25	9.5		53.5
5	5.25	10.0		49.0

[4]

(b) Complete a suitable scale on the *y*-axis of Fig. 2.2 and plot your results from Experiments 1 to 5 on Fig. 2.2.

Draw a line of best fit through your points.

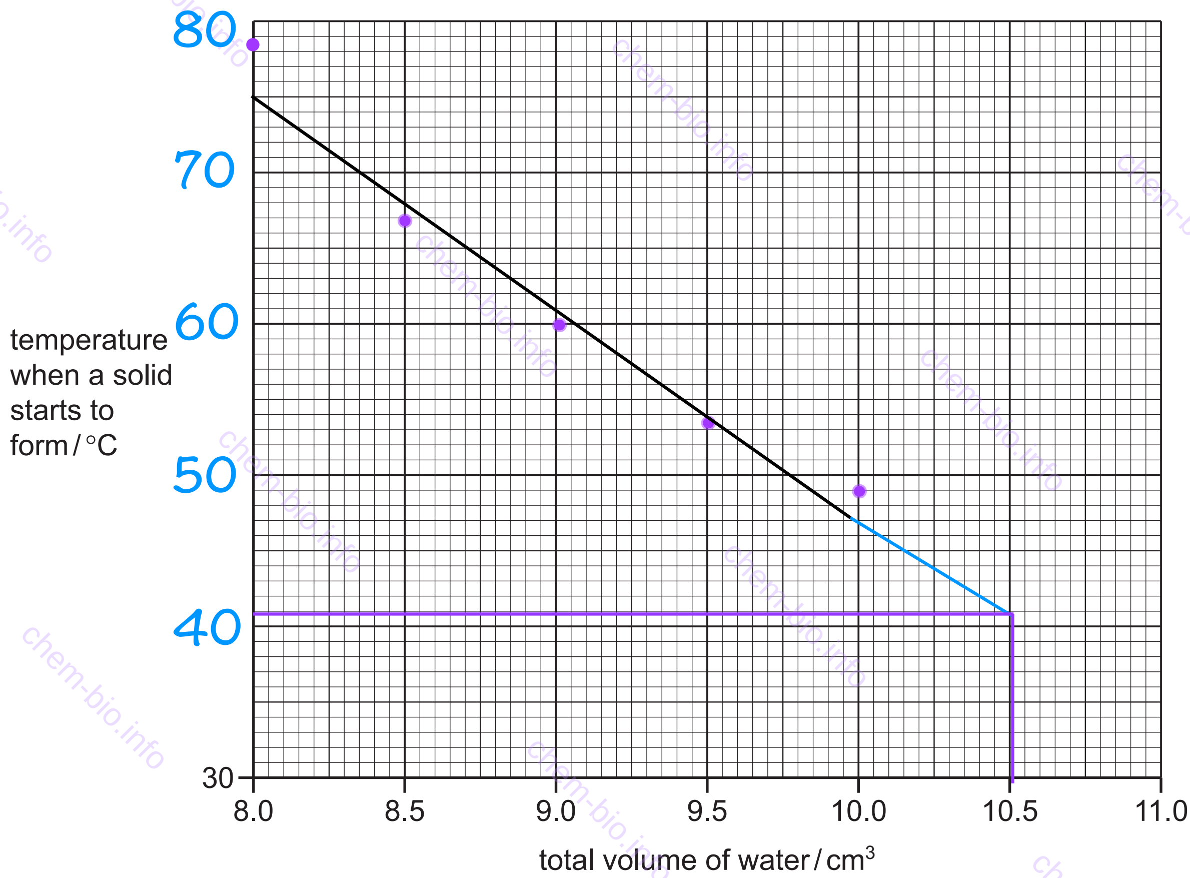


Fig. 2.2

[4]

(c) Extrapolate the line on your graph and deduce the temperature when a solid starts to form when a total volume of 10.5 cm^3 of water is used.

Show clearly **on Fig. 2.2** how you worked out your answer.

temperature when a solid starts to form = ...41.......... °C [3]

(d) Solubility, in g / 100 cm^3 of water, is calculated using the equation shown.

$$\text{solubility} = \frac{\text{mass of solid dissolved} \times 100}{\text{volume of water used}}$$

Use this equation to calculate the solubility of ammonium chloride in Experiment 1.

5.25 x 100 ÷ 8

solubility = ...65.6.......... g / 100 cm^3 of water [1]

(e) Describe how the solubility of ammonium chloride changes as the temperature changes.

as the temperature increases the solubility also increases

[1]

(f) In this experiment the volume of water was measured using a burette.

(i) State the advantage of using a burette rather than a measuring cylinder to measure the volume of water.

The burette is more accurate

[1]

(ii) State the advantage of using a burette rather than a volumetric pipette to measure the volume of water.

Burettes can measure variable volumes

/ pipettes only measure fixed volume [1]

(g) A total volume of 2.0 cm^3 of water was added to the original 8.0 cm^3 of water.

Explain the disadvantages of adding the 2.0 cm^3 of water in 1.0 cm^3 portions rather than 0.5 cm^3 portions.

this produces fewer results

so the graph would not be less accurate [2]

(h) Suggest why it would **not** be possible to use 6.0 cm^3 of water instead of 8.0 cm^3 of water in Experiment 1.

Not all of the ammonium chloride will dissolve

/ the temperature to dissolve ammonium chloride in little [1]

water will be greater than 100 oC (boiling point of water) [Total: 18]

3 A student tests two solutions: solution **C** and solution **D**.

Tests on solution C

Solution **C** is aqueous calcium nitrate.

Complete the expected observations.

The student divides solution **C** into three portions.

(a) The student carries out a flame test on the first portion of solution **C**.

observations ...orange-red... [1]

(b) To the second portion of solution **C**, the student adds aqueous sodium hydroxide dropwise until it is in excess.

observations adding dropwise ...white precipitate...

observations in excess ...the white precipitate remains insoluble...

[2]

(c) To the product from **(b)**, the student adds a piece of aluminium foil and warms the mixture gently. Any gas produced is tested.

observations ...damp red litmus paper turns blue...

... [1]

(d) To the third portion of solution **C**, the student adds about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.

observations ...no precipitate...

... [1]

tests on solution D

Table 3.1 shows the tests and the student's observations for solution **D**. The student divides solution **D** into four portions.

Table 3.1

tests	observations
test 1 Use a glass rod to transfer one drop of the first portion of solution **D** onto a piece of universal indicator paper.	the universal indicator paper turns red
test 2 To the second portion of solution **D**, add solid sodium carbonate. Test any gas produced.	the solid sodium carbonate disappears and there is effervescence the gas turns limewater milky
test 3 To the third portion of solution **D**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.	no change
test 4 To the fourth portion of solution **D**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.	white precipitate

(e) Deduce the pH of solution **D**.

pH = 1 / 2 / 3 [1]

(f) Identify the gas made when sodium carbonate is added to solution **D**.

carbon dioxide [1]

(g) Identify the **two** ions in solution **D**.

hydrogen ion & sulfate ion

[2]

[Total: 9]

4 Cadmium, cobalt and vanadium are all metals. They react with dilute hydrochloric acid to form hydrogen gas. These reactions are exothermic.

Plan an investigation to find the order of reactivity of the three metals.

Your plan must make it clear how your investigation will be a fair test and how you will use your results to place the metals in order of reactivity.

You are provided with powdered samples of each metal, dilute hydrochloric acid and common laboratory apparatus.

Measure a fixed mass of the first metal cadmium using a balance
Using a pipette measure 25 cm3 of HCl
Add the metal to the acid
measure the time it takes until all the metal powder disappears
repeat 5x and calculate the average time
repeat for the other two metals
Conclusion the metal that takes the least time to dissolve is the most reactive one

Measure a fixed mass of the first metal cadmium using a balance
Using a pipette measure 25 cm3 of HCl
Add the metal to the acid
using a gas syringe measure the volume of gas produced per min
repeat 5x and calculate the average volume per min
repeat for the other two metals
Conclusion the metal that produces more gas per min is the most reactive one

Measure a fixed mass of the first metal cadmium using a balance
Using a pipette measure 25 cm3 of HCl
Add the metal to the acid
using a thermometer measure the initial temperature of the acid
mix the metal with the acid and measure the maximum temperature
repeat 5x and calculate the average temperature [6]
repeat for the other two metals
the metal that produces that highest change in temperature is most reactive

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CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2020**

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.
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INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

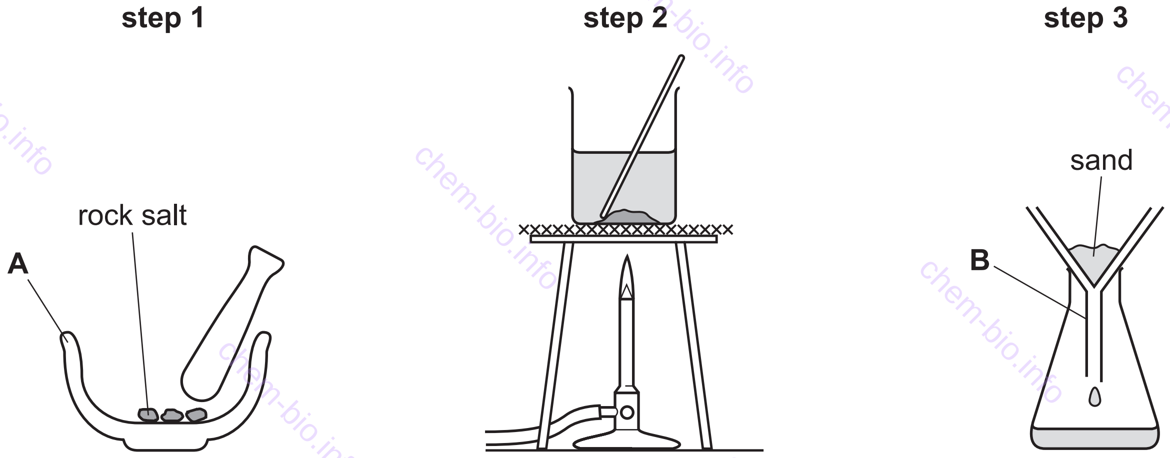
This document has **12** pages. Blank pages are indicated.

IB20 06_0620_63/3RP

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

Sodium chloride is soluble in water. Sand is insoluble in water.

A student obtained dry crystals of pure sodium chloride from a lump of rock salt.
These are some of the steps the student used.



grind the rock salt into smaller pieces

add the rock salt to water and heat while stirring with a glass rod

filter the mixture

(a) Name the apparatus labelled **A** in **step 1**.

Mortar [1]

(b) Explain why the mixture is heated and stirred in **step 2**.

To speed up dissolving [1]

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

Funnel [1]

(ii) State the scientific term for the sand left on the filter paper in **step 3**.

Residue [1]

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

Place the filtrate in an evaporating dish

Heat until crystallisation point

Cool and filter the crystals

Dry the crystals between two filter papers [3]

[Total: 7]

2 A student investigated the temperature change when aqueous sodium hydroxide neutralises dilute hydrochloric acid. The equation for the reaction is shown.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Eight experiments were done.

Experiment 1

- A polystyrene cup was placed into a 250 cm^3 beaker for support.
- Using a measuring cylinder, 5 cm^3 of aqueous sodium hydroxide was poured into the polystyrene cup.
- Using a measuring cylinder, 45 cm^3 of dilute hydrochloric acid was poured into the polystyrene cup.
- The mixture was stirred and the maximum temperature reached was measured using a thermometer.
- The polystyrene cup was rinsed with distilled water.

Experiment 2

- Experiment 1 was repeated using 10 cm^3 of aqueous sodium hydroxide and 40 cm^3 of dilute hydrochloric acid.

Experiment 3

- Experiment 1 was repeated using 15 cm^3 of aqueous sodium hydroxide and 35 cm^3 of dilute hydrochloric acid.

Experiment 4

- Experiment 1 was repeated using 20 cm^3 of aqueous sodium hydroxide and 30 cm^3 of dilute hydrochloric acid.

Experiment 5

- Experiment 1 was repeated using 30 cm^3 of aqueous sodium hydroxide and 20 cm^3 of dilute hydrochloric acid.

Experiment 6

- Experiment 1 was repeated using 35 cm^3 of aqueous sodium hydroxide and 15 cm^3 of dilute hydrochloric acid.

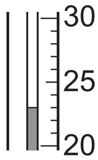
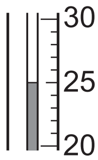
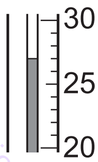
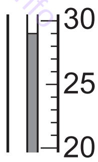
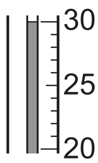
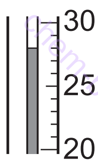
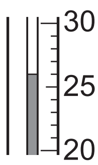
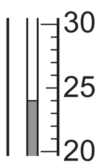
Experiment 7

- Experiment 1 was repeated using 40 cm^3 of aqueous sodium hydroxide and 10 cm^3 of dilute hydrochloric acid.

Experiment 8

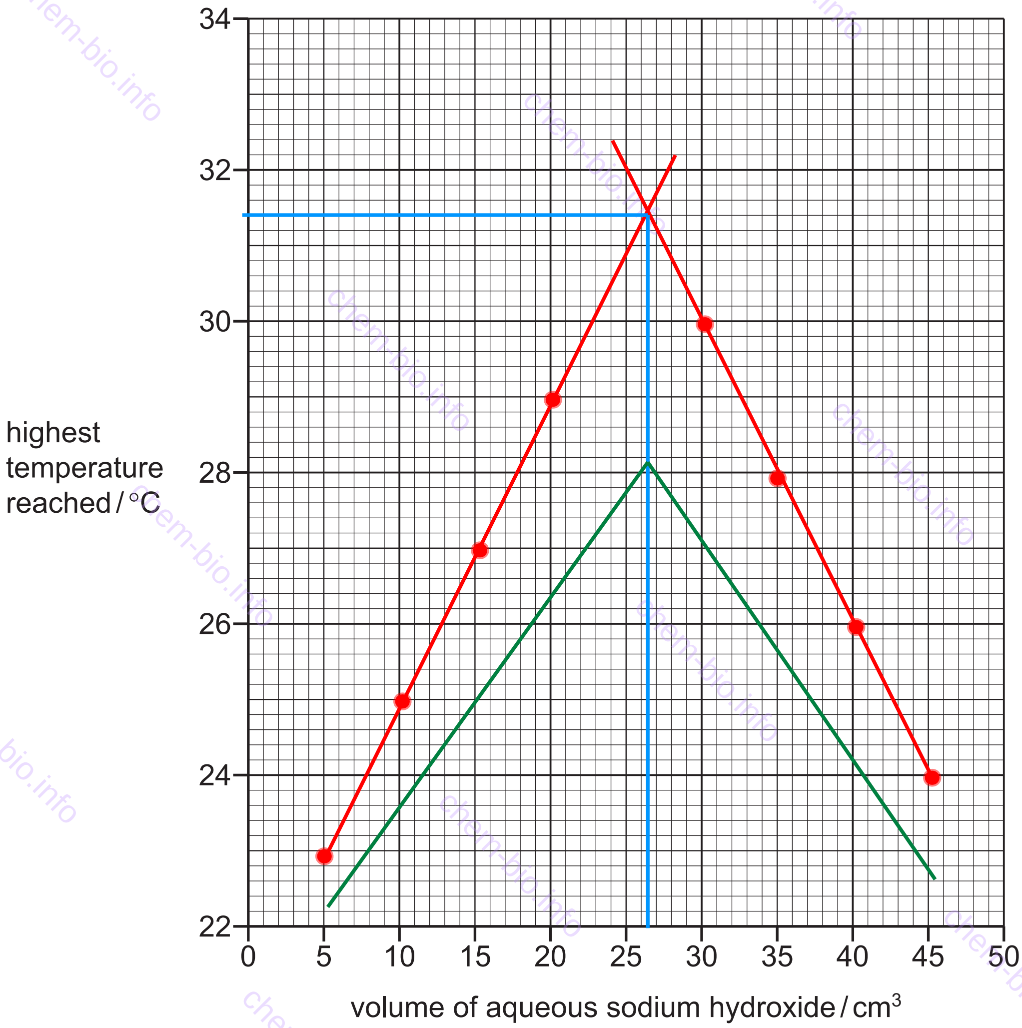
- Experiment 1 was repeated using 45 cm^3 of aqueous sodium hydroxide and 5 cm^3 of dilute hydrochloric acid.

(a) Use the information in the description of the experiments and the thermometer diagrams to complete the table.

experiment	volume of aqueous sodium hydroxide / cm^3	volume of dilute hydrochloric acid / cm^3	thermometer diagram	highest temperature reached / °C
1	5	45		23
2	10	40		25
3	15	35		27
4	20	30		29
5	30	20		30
6	35	15		28
7	40	10		26
8	45	5		24

[4]

(b) Plot the results from Experiments 1 to 8 on the grid. Draw **two** straight lines through the points. Extend your straight lines so that they cross.



[4]

(c) The point on the graph where the two straight lines cross is where all of the aqueous sodium hydroxide reacts with all of the dilute hydrochloric acid to form a neutral solution.

(i) **Use your graph** to deduce the volume of aqueous sodium hydroxide and the volume of dilute hydrochloric acid that react together to produce a neutral solution.
Show your working **on the grid**.

50 - 26.5

volume of aqueous sodium hydroxide = 26.5 cm^3

volume of dilute hydrochloric acid = 23.5 cm^3

[3]

(ii) **Use your graph** to determine the highest temperature reached if the volumes in **(c)(i)** were mixed together.

highest temperature reached = 31.4 oC [2]

(iii) Which solution, aqueous sodium hydroxide or dilute hydrochloric acid, was the most concentrated?
Use your answer to **(c)(i)** to explain why.

most concentrated solution ...HCl...

explanation ...as volume less than sodium hydroxide...

.... [1]

(d) **On the graph**, sketch the lines you would expect to obtain if a copper can was used instead of a polystyrene cup. [2]

(e) Give **one** advantage and **one** disadvantage of using a burette, instead of a measuring cylinder, to add the dilute hydrochloric acid directly into the polystyrene cup.

advantage ...more accurate...

....

disadvantage ...slower...

.... [2]

(f) How could the reliability of the results of this investigation be checked?

...Repeat and compare the results...

.... [1]

[Total: 19]

3 Two solids, solid **N** and solid **P**, were analysed.
Tests were done on each solid.

tests on solid N

Tests were done and the following observations made.

tests on solid **N**	observations
Solid **N** was dissolved in distilled water to produce solution **N**. The solution was divided into three equal portions in three boiling tubes. **test 1** Aqueous sodium hydroxide was added slowly until in excess to the first portion of solution **N**.	white precipitate formed, the precipitate dissolved in excess aqueous sodium hydroxide forming a colourless solution
test 2 Aqueous ammonia was added slowly until in excess to the second portion of solution **N**.	white precipitate formed, the precipitate dissolved in excess aqueous ammonia forming a colourless solution
test 3 Aluminium foil and aqueous sodium hydroxide were added to the third portion of solution **N**. The mixture was heated using a Bunsen burner. Any gas produced was tested with damp red litmus paper.	effervescence was seen, the damp red litmus paper turned blue

(a) Name the gas given off in **test 3**.

Ammonia .... [1]

(b) Identify solid **N**.

Zinc nitrate ....

.... [2]

tests on solid P

Solid **P** was potassium iodide.

Complete the expected observations.

(c) Describe the appearance of solid **P**.

White crystals .... [1]

(d) A flame test was done on solid **P**.

observations Lilac .... [1]

(e) Solid **P** was dissolved in distilled water to produce solution **P**. Solution **P** was divided into three equal portions in three test-tubes.

(i) About 1 cm depth of dilute nitric acid and a few drops of aqueous silver nitrate were added to the first portion of solution **P**.

observations Yellow precipitate ....

.... [1]

(ii) About 1 cm depth of dilute nitric acid and a few drops of aqueous barium nitrate were added to the second portion of solution **P**.

observations No observation ....

.... [1]

(iii) A few drops of aqueous bromine were added to the third portion of solution **P**.

observations Brown solution forms ....

.... [1]

[Total: 8]

4 Stayclean and Brightwhite are two brands of washing powder. Both contain sodium carbonate. Sodium carbonate is soluble in water and reacts with dilute sulfuric acid to produce carbon dioxide gas.

Plan an investigation to determine which of the two washing powders, Stayclean or Brightwhite, contains the greatest percentage of sodium carbonate.

You are provided with samples of the two washing powders and common laboratory apparatus and chemicals.

Weigh 100 grams of 1st washing powder using a balance

Add excess sulfuric acid

Filter the remaining solid

Dry the residue

Weigh the the solid

Repeat with the other washing powder [6]

Compare the final mass of the solid, the one that has the most drop in mass is the one that has the largest amount of sodium carbonate

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CENTRE NUMBER	
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* 8 9 7 7 0 5 1 0 0 1 *

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **February/March 2016**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **9** printed pages and **3** blank pages.

IB16 03_0620_62/5RP

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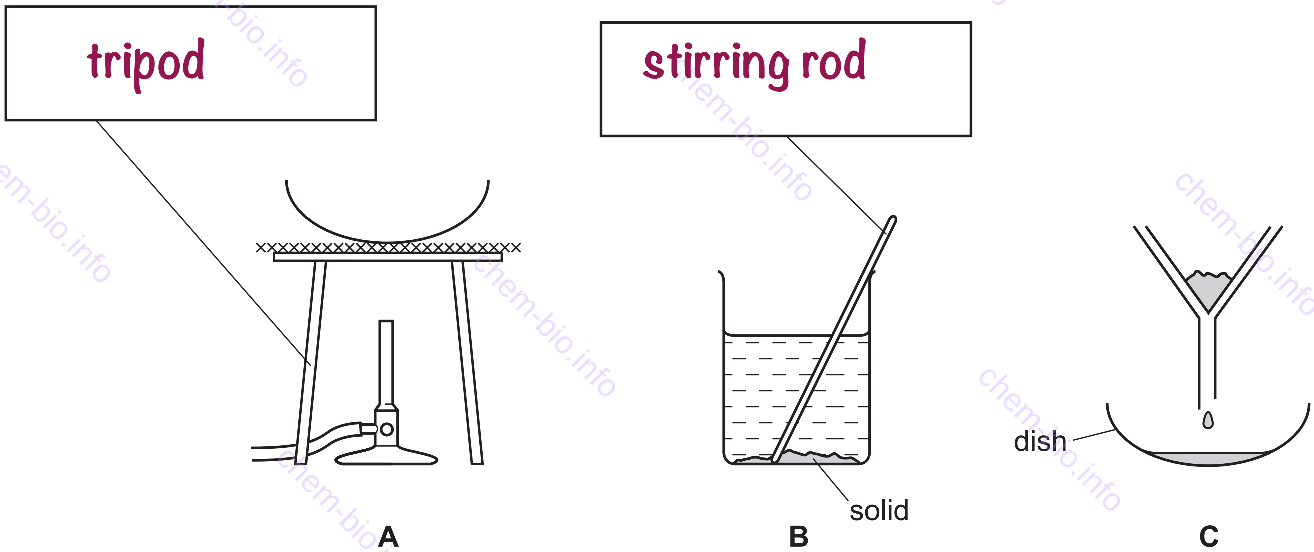
1 The diagrams show the apparatus used to obtain crystals of calcium chloride from a mixture of solid calcium chloride and solid calcium carbonate.
Calcium chloride is soluble in water and calcium carbonate is insoluble in water.



(a) Complete the boxes to name the apparatus. [2]

(b) (i) Write down the order in which the apparatus should be used in this experiment.

B C A .... [1]

(ii) Name the separation process in **C**.

Filtration .... [1]

(c) (i) What has been added to the mixture in **B**?

calcium carbonate .... [1]

(ii) What is the general name given to the liquid in the dish in **C**?

filtrate .... [1]

(d) How would you know when to stop heating the dish in **A**?

crystals start to from on the edge of the dish ....

.... [1]

[Total: 7]

2 A teacher investigated the rate of a reaction between two solutions, **J** and **K**, and sulfuric acid at different temperatures.

Four experiments were carried out.

(a) *Experiment 1*

A large measuring cylinder was used to pour 50 cm^3 of distilled water and 40 cm^3 of sulfuric acid into a 250 cm^3 conical flask.
A small measuring cylinder was used to add 2 cm^3 of methyl orange and 5 cm^3 of solution **J** to the mixture in the conical flask. The temperature of the mixture was measured.
The reaction was started by adding 5 cm^3 of solution **K** to the conical flask, immediately starting the timer and swirling the mixture.
The time taken for the mixture to turn pale yellow was measured. The final temperature of the mixture was measured.

Experiment 2

Experiment 1 was repeated but the mixture in the conical flask was heated to about 30 °C **before** adding the solution **K**. The temperature of the mixture was measured.
5 cm^3 of solution **K** was added to the conical flask. The timer was started and the mixture swirled.
The time taken for the mixture to turn pale yellow was measured. The final temperature of the mixture was measured.

Experiment 3

Experiment 1 was repeated but the mixture in the conical flask was heated to about 40 °C before adding the solution **K** to the flask. The same measurements were taken.

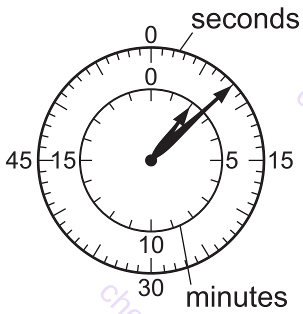
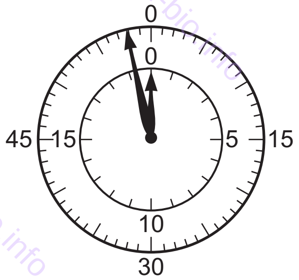
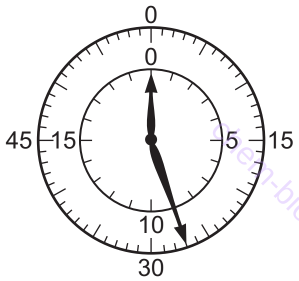
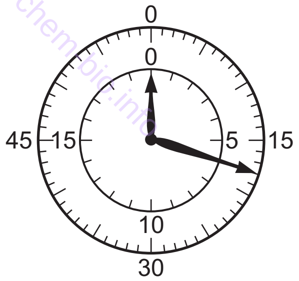
Experiment 4

Experiment 1 was repeated but the mixture in the conical flask was heated to about 50 °C before adding the solution **K** to the flask. The same measurements were taken.

Stop-clock diagrams for these experiments are on page 4.

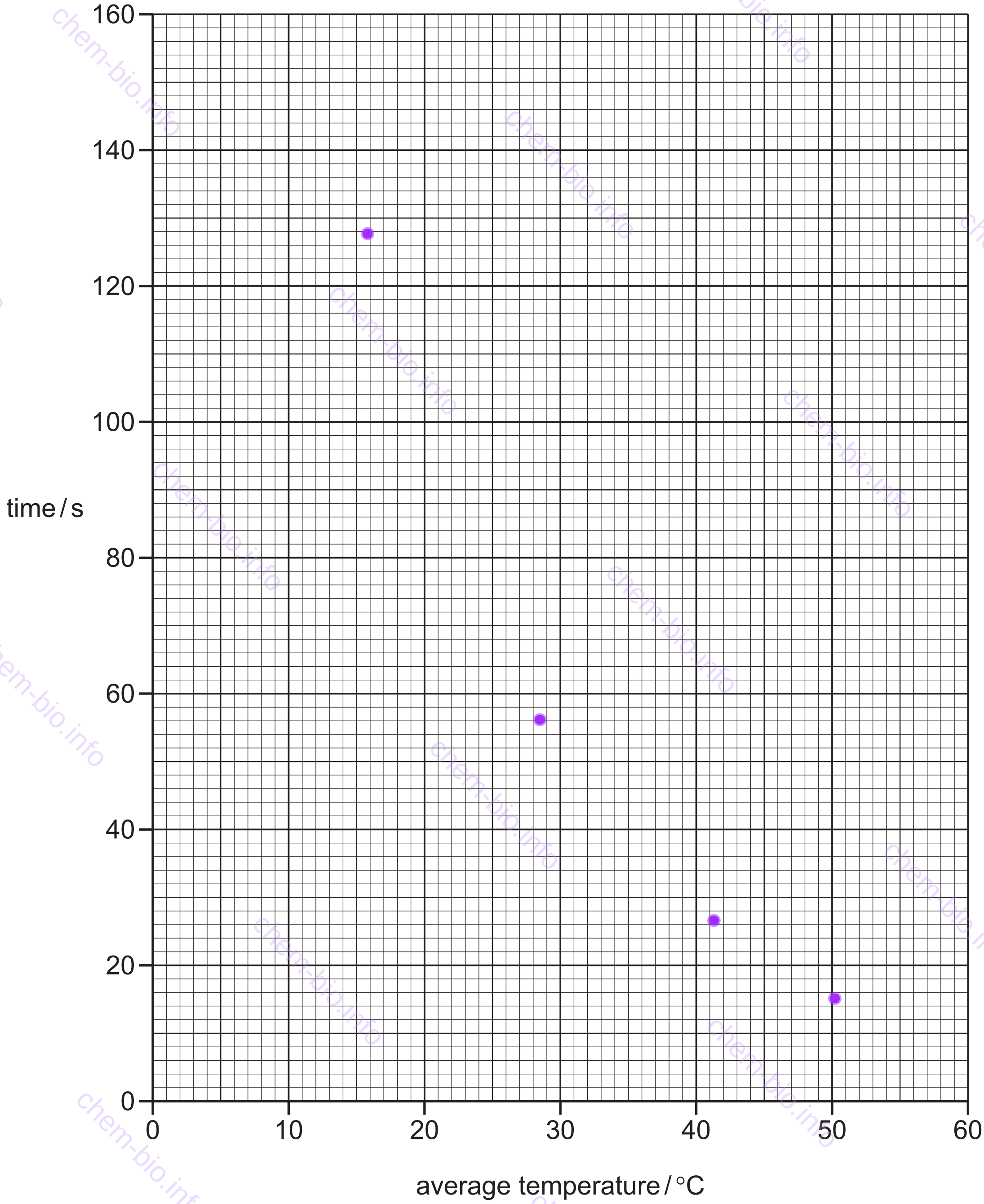
Use the stop-clock diagrams to record the times in the table.

Work out the average temperatures to complete the table.

experiment	stop-clock diagram	time taken for mixture to turn pale yellow / s	initial temperature / °C	final temperature / °C	average temperature / °C
1		128	17	15	16
2		58	28	26	27
3		27	42	40	41
4		18	51	49	50

[4]

(b) Plot the results on the grid and draw a smooth line graph.



[4]

(c) **From your graph** deduce the time taken for the mixture to turn pale yellow if Experiment 1 was repeated at an average temperature of 60 °C.
Show clearly **on the grid** how you worked out your answer.

12 - 13s [2]

(d) (i) In which experiment was the rate of reaction greatest?

experiment 4 .... [1]

(ii) Explain why the rate of reaction was greatest in this experiment.

high temperature

so more kinetic energy

and more chance for collisions .... [2]

(e) (i) Suggest and explain the effect **on the results** of using a burette to measure the volume of solution **J**.

more accurate

than a measuring cylinder .... [2]

(ii) Suggest and explain one **other** improvement to these experiments.

use a polystyrene cup with a lid for

insulation / repeat to find average time .... [2]

/ use a digital thermometer

[Total: 17]

3 Two solids, **L** and **M**, were analysed. Solid **L** was copper(II) chloride and solid **M** was a different salt.
The tests on the solids, and some of the observations, are shown.

tests on solid L

(a) Describe the appearance of solid **L**.

observation blue crystals [1]

(b) Distilled water was added to solid **L** and shaken to dissolve.

The solution was divided into four equal portions in four test-tubes and the following tests carried out.

(i) Drops of aqueous ammonia were added to the first portion of the solution.

Excess ammonia solution was then added to the mixture and shaken.

observation blue precipitate

dissolve in excess water

to form a dark blue solution [4]

(ii) Excess aqueous sodium hydroxide was added to the second portion of the solution.

observation blue precipitate

which is insoluble in excess [1]

(iii) Dilute nitric acid was added to the third portion of the solution followed by aqueous silver nitrate.

observation white precipitate [1]

(iv) Dilute nitric acid was added to the fourth portion of the solution followed by aqueous barium nitrate.

observation no observation [1]

tests on solid M

Tests are carried out and the following observations made.

tests on solid **M**	observations
Appearance of the solid.	white crystals
The solid was heated and the gas given off was tested with damp red litmus paper.	a sublimate formed on the sides of the test-tube litmus paper turned blue
Solid **M** was dissolved in water to form a solution. Aqueous sodium hydroxide was added to the solution and the mixture heated. The gas given off was tested.	pungent gas evolved pH paper showed pH 10
Dilute nitric acid was added to the solution followed by aqueous silver nitrate.	yellow precipitate

(c) Identify solid **M**.

ammonium iodide

.... [2]

[Total: 10]

4 The label on a bottle of orange drink stated 'contains no artificial colours'. A scientist thought that the orange colour in the drink was a mixture of two artificial colours:

- Sunset Yellow E110
- Allura Red E129

Plan an investigation to show that the orange colour in the drink did **not** contain these two artificial colours.
You are provided with samples of E110, E129 and the orange colouring from the drink. You are also provided with common laboratory apparatus.
You may draw a diagram to help answer the question.

use chromatography
draw a base line with a pencil on the chromatogram
put all three colours on the base line
put the paper in a solvent
compare the Rf values of all three colours
if the orange colour does not contain yellow or red
colours then they should have different Rf values

[6]

[Total: 6]

Cambridge International Examinations
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CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

* 9 4 4 8 3 5 3 4 4 1 *

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2016**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
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This document consists of **9** printed pages and **3** blank pages.

IB16 06_0620_63/4RP

CAMBRIDGE
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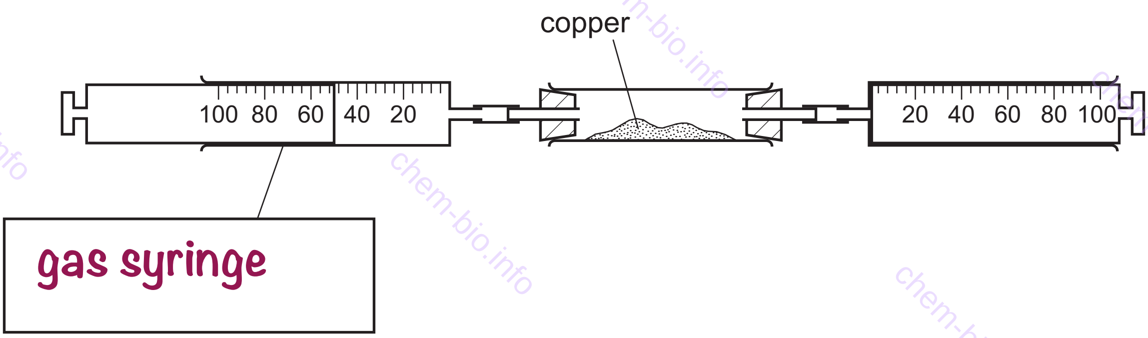
1 Air is a mixture of gases. The diagram shows the apparatus used to find the percentage of oxygen in air.
50 cm^3 of air were passed backwards and forwards over excess heated copper until there was no further change. The apparatus was left to cool and the volume of gas remaining was 40 cm^3.



(a) Complete the box to name the apparatus. [1]

(b) Use an arrow to indicate where heat is applied. [1]

(c) The colour of the copper changed from ....orange....... to ....black....... . [2]

(d) From the results, work out the percentage of oxygen in the air.

.... % [2]

[Total: 6]

2 A student investigated what happens when dilute hydrochloric acid and copper(II) sulfate solution react with different metals.

Five experiments were carried out.

(a) *Experiment 1*

A measuring cylinder was used to pour 10 cm^3 of dilute hydrochloric acid into a boiling tube.
The temperature of the hydrochloric acid was measured.
1 g of zinc was added to the boiling tube and the mixture stirred with a thermometer.
The maximum temperature reached by the mixture was measured.

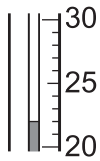
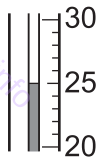
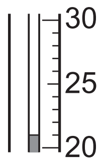
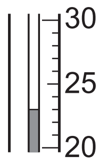
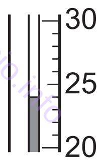
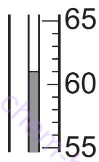
Experiment 2

Experiment 1 was repeated using 1 g of iron instead of zinc.

Experiment 3

Experiment 1 was repeated using 1 g of magnesium instead of zinc.

Use the thermometer diagrams to record the results in the table. Complete the final column in the table.

experiment	thermometer diagram	initial temperature of acid / °C	thermometer diagram	maximum temperature reached / °C	temperature rise / °C
1		22		25	3
2		21		23	2
3		24		61	37

[3]

(b) The gas produced in experiment 3 was tested with a lighted splint and the result recorded below.

test ...lighted splint...

result ...popped...

Name the gas given off in experiment 3.

hydrogen .... [1]

(c) *Experiment 4*

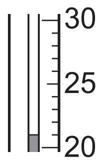
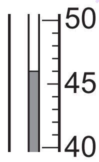
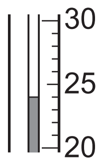
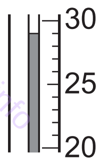
A measuring cylinder was used to pour 10 cm^3 of copper(II) sulfate solution into a boiling tube. The temperature of the solution was measured.
1 g of magnesium was added to the boiling tube and the mixture stirred with a thermometer. The maximum temperature reached by the mixture was measured.

Experiment 5

Experiment 4 was repeated using 1 g of iron instead of magnesium.
The observation was recorded below.

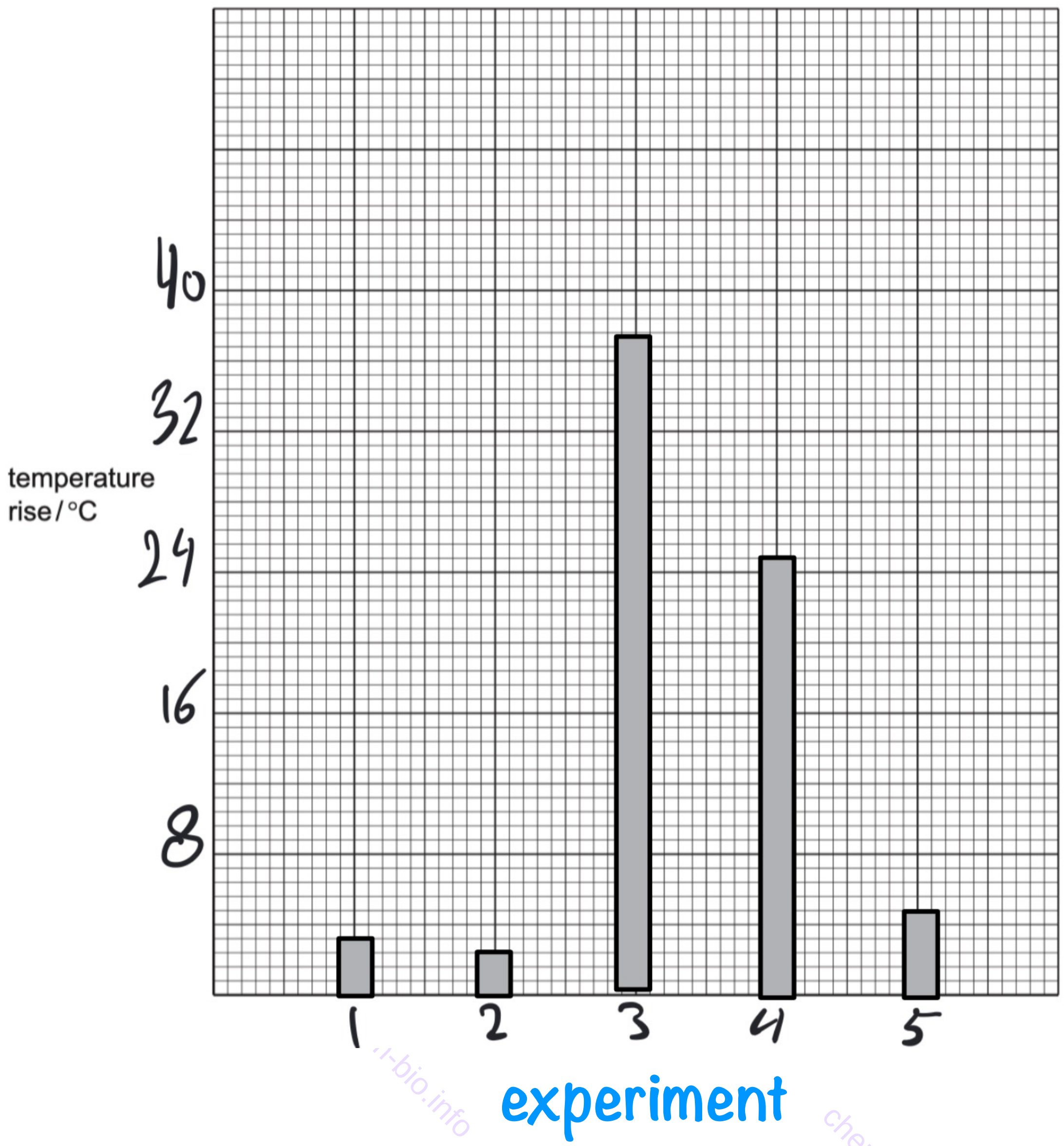
......The solution turned colourless and a brown deposit formed......

Use the thermometer diagrams to record the results in the table. Complete the final column in the table.

experiment	thermometer diagram	initial temperature of acid / °C	thermometer diagram	maximum temperature reached / °C	temperature rise / °C
4		21		46	25
5		24		29	5

[2]

(d) Draw a labelled bar chart for the results of experiments 1, 2, 3, 4 and 5 on the grid below.



[3]

(e) Use the results for experiments 1, 2 and 3 to answer the following questions.

(i) Which experiment, 1, 2 or 3, produced the largest temperature rise?

experiment 3 .... [1]

(ii) Suggest why this experiment produced the largest temperature rise.

magnesium is more reactive than Zn and Fe ....

.... [1]

(f) Explain the observations in experiment 5.

copper forms

iron is more reactive it displaces / reduces copper

[2]

(g) Suggest why potassium was **not** used as one of the metals in these experiments.

potassium is too reactive / dangerous [1]

(h) Give **one** advantage of using a measuring cylinder to add the hydrochloric acid to the boiling tube.

quick / easy to use [1]

(i) Suggest and explain **one** improvement to increase the accuracy of these experiments.

use a pipette instead of the measuring cylinder

use a polystyrene cup for insulation [2]

[Total: 17]

3 A mixture of two solids, **G** and **H**, was analysed. Solid **G** was zinc nitrate, which is water soluble, and solid **H** is insoluble in water.
The tests on the mixture, and some of the observations, are shown.

Distilled water was added to the mixture in a boiling tube and shaken. The contents of the boiling tube were filtered keeping the filtrate and the residue.

tests on filtrate

(a) The filtrate was divided into four test-tubes and the following tests carried out.

(i) Drops of aqueous sodium hydroxide were added to the first portion of the solution. Excess aqueous sodium hydroxide was then added to the test-tube.

observations white precipitate dissolve in excess water

[3]

(ii) Using the second portion of the solution, the test in **(a)(i)** was repeated using aqueous ammonia instead of aqueous sodium hydroxide.

observations white precipitate dissolve in excess water

[2]

(iii) Dilute nitric acid was added to the third portion of the solution followed by aqueous silver nitrate.

observations no observation [1]

(iv) Aqueous sodium hydroxide and aluminium foil were added to the fourth portion of the solution.
The mixture was warmed and the gas given off was tested.

observations red litmus paper turns blue / pungent smell

effervescence

[3]

tests on residue

Two tests are carried out and the following observations made.

tests	observations
A spatula was used to transfer some of the residue into a test-tube. Dilute hydrochloric acid was added to the residue. The gas given off was tested.	rapid effervescence, limewater turned milky
A flame test was carried out on the residue.	red flame colour

(b) Identify solid **H**.

lithium carbonate

....

.... [2]

[Total: 11]

4 Nickel sulfate-6-water, $NiSO_4.6H_2O$, is a blue crystalline salt.

Plan an experiment to obtain a sample of pure water from this salt. Your answer should include a diagram of the apparatus, any expected observations and a test to show the presence of pure water.
You are provided with common laboratory apparatus.

heat the salt

condense the water vapour

until colour of the salt changes

test the water, its boiling point should be 100 oC

[6]

[Total: 6]

Cambridge IGCSE

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CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

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CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **May/June 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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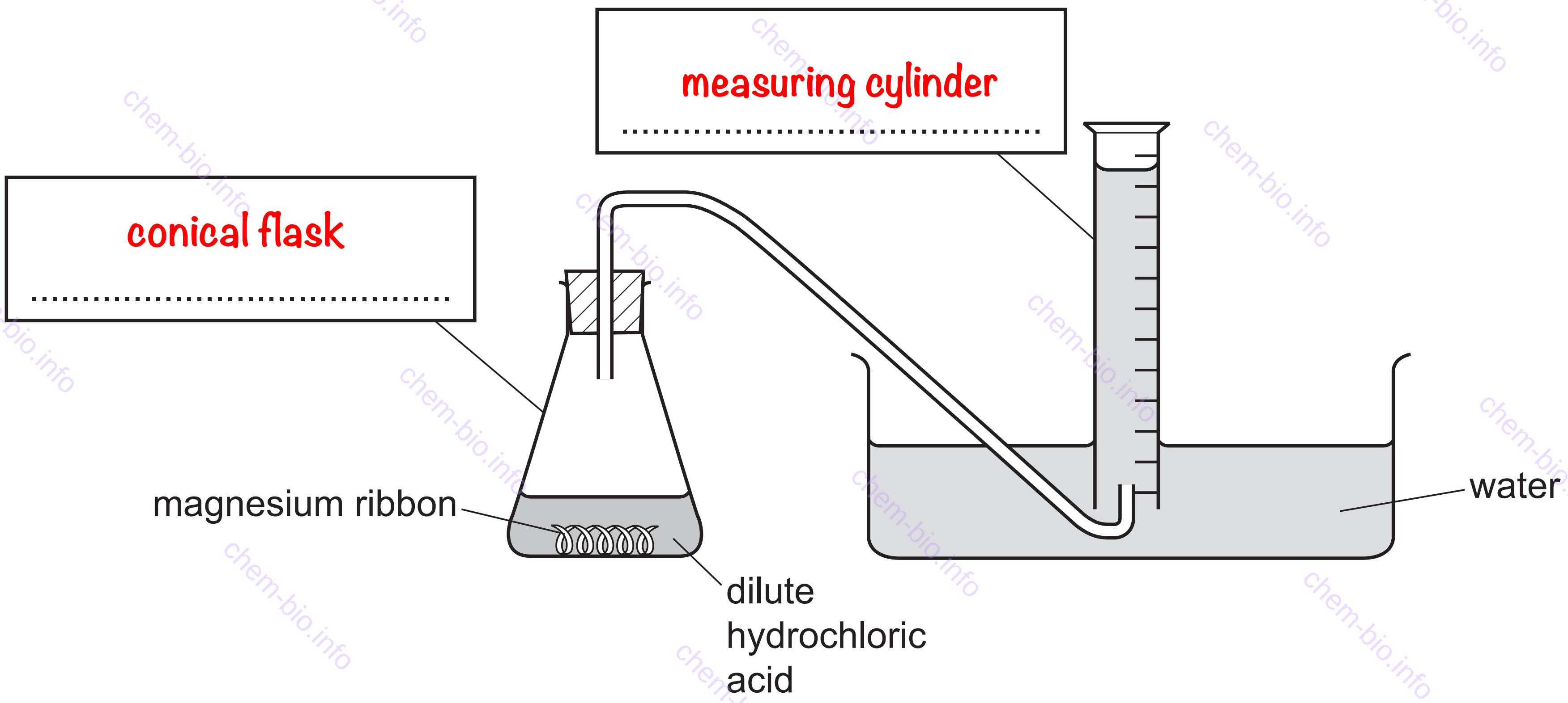
IB17 06_0620_62/FP

CAMBRIDGE
International Examinations

1 A student investigated the rate of reaction between an excess of dilute hydrochloric acid and magnesium ribbon. The apparatus is shown.



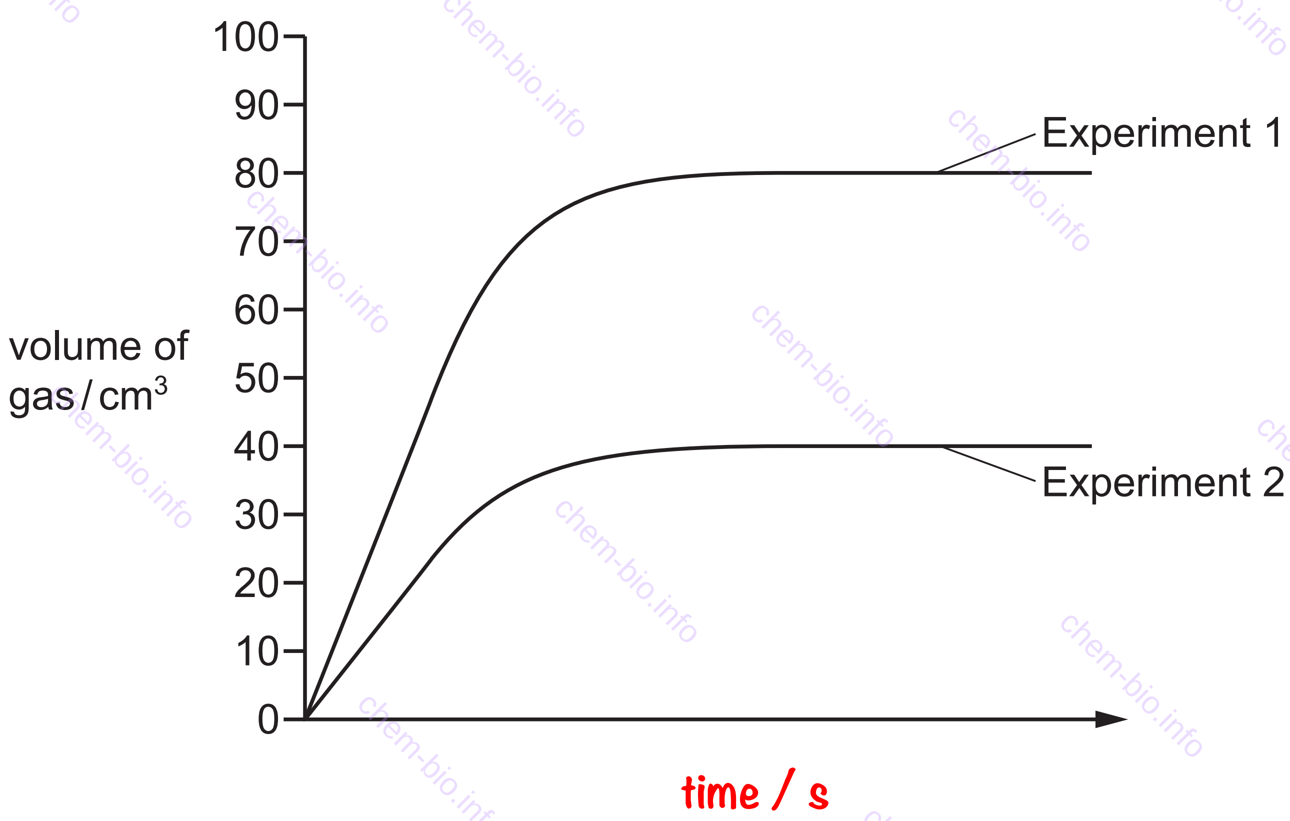
Two experiments were carried out. The temperature was the same in each case.

(a) Complete the boxes to identify the apparatus. [2]

(b) Give **one** observation expected during this reaction.

bubbles / fizz / effervescence .... [1]

Graphs were drawn from the results for each experiment as shown.



(c) Label the *x*-axis of the graph. [2]

(d) **(i)** Give the volumes of gas at which the **two** graphs level out and compare these values.

experiment I 80 cm3 & experiment 2 40 cm3

experiment I is 2x more than experiment I

[2]

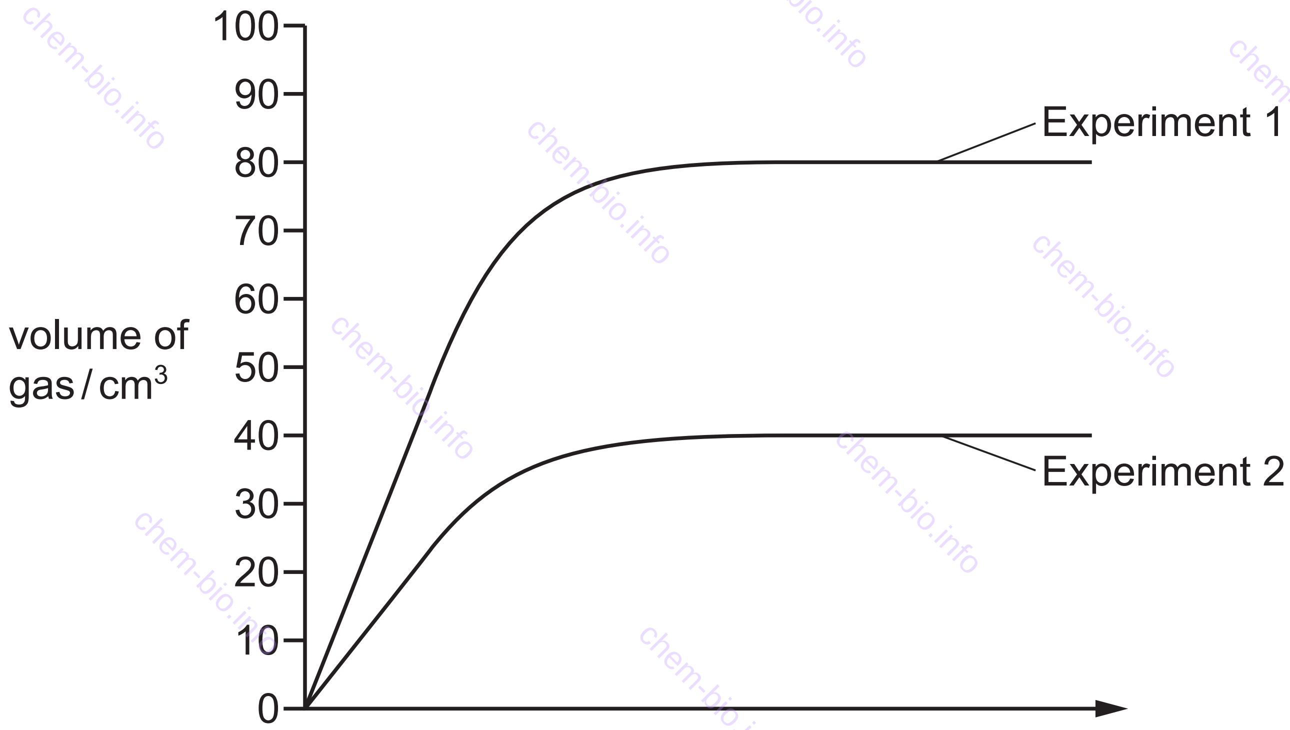
(ii) Suggest why the graphs level out at different volumes.

2x more mass of Mg in experiment I than 2

[1]

(iii) The graph has been drawn again.

Draw the curve expected if Experiment 1 were repeated using the same mass of magnesium powder instead of magnesium ribbon.



[2]

[Total: 10]

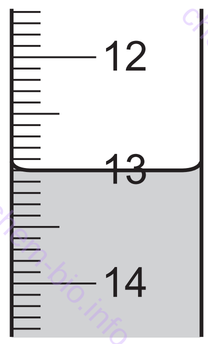
2 A student investigated the reaction between aqueous potassium manganate(VII), solution **A**, and two solutions of iron(II) sulfate, solution **B** and solution **C**, of different concentrations.

Two experiments were carried out.

Experiment 1

- A burette was filled with solution **A** to the 0.0 cm^3 mark.
- A measuring cylinder was used to pour 25 cm^3 of solution **B** into a conical flask.
- Solution **A** was added to the flask, while the flask was swirled, until the mixture just turned permanently pink. The burette reading was recorded.

(a) Use the burette diagram to record the reading in the table and complete the table.



potassium manganate

final reading

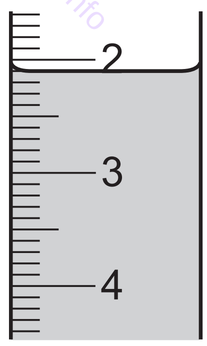
final burette reading / cm^3	13.0
initial burette reading / cm^3	0.0
difference / cm^3	13.0

[2]

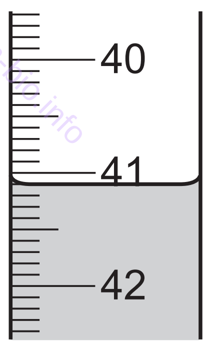
Experiment 2

- Experiment 1 was repeated using 25 cm^3 of solution **C** instead of solution **B**. In Experiment 2 the burette was not filled to the 0.0 cm^3 mark.

(b) Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

final burette reading / cm^3	41.1
initial burette reading / cm^3	2.1
difference / cm^3	39.0

[2]

(c) Why is an indicator **not** added to the conical flask?

potassium manganate changes its colour at the end point [1]

(d) (i) Which solution of iron(II) sulfate, solution **B** or solution **C**, is the more concentrated? Explain your answer.

solution C, a greater volume of potassium manganate was needed

[2]

(ii) How many times more concentrated is this solution of iron(II) sulfate?

solution C is 3x more concentrated than solution B [1]

(e) (i) If Experiment 2 were repeated using 50 cm^3 of solution **C**, what volume of solution **A** would be needed? Explain your answer.

50 cm3 require 2x the volume of solution A than the original 25 cm3

So, 2 x 39 = 78 cm3 [2]

(ii) Suggest a practical problem that using 50 cm^3 of solution **C** in this investigation would cause. Suggest a practical solution to the problem.

problem volume of the burette is limited to 50 cm3, while we'll need 78 cm3

solution refill the burette at the end of the first titration

[2]

(f) Give **one** advantage and **one** disadvantage of using a measuring cylinder instead of a 25 cm^3 pipette for solution **B**.

advantage easy / quick to be used

disadvantage no accurate

[2]

(g) How would the results be improved by taking repeated measurements?

we can spot anomalies and cancel them

we can find the average [1]

improve reliability

[Total: 15]

3 Two solids, **E** and **F**, which are both salts, were analysed. Solid **F** was lithium chloride.
Tests were carried out on each solid.
Some of the tests and observations are shown.

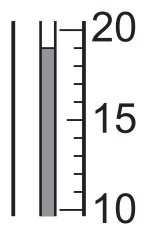
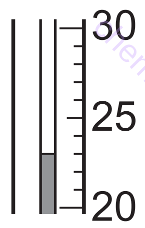
tests on solid E

tests on solid **E**	observations
test 1 A flame test was carried out on solid **E**.	yellow colour

test 2

$10\,cm^3$ of distilled water were poured into a boiling tube. The initial temperature of the water was measured.
Solid **E** was added to the boiling tube and the boiling tube was shaken to dissolve solid **E**. The temperature of the solution was measured after 1 minute.

(a) Use the thermometer diagrams in the table to record the temperatures and complete the table.

<table>
<tr><td>temperature of the solution after 1 minute / °C</td><td>
</td><td>19</td></tr>
<tr><td>initial temperature of the water / °C</td><td>
</td><td>23</td></tr>
<tr><td colspan="2">temperature difference / °C</td><td>4</td></tr>
</table>

[2]

The solution was divided into two equal portions in two test-tubes and the following tests carried out.

tests on solid **E**	observations
test 3 Dilute hydrochloric acid was added to the first portion of the solution. The gas given off was tested with filter paper dipped into acidified aqueous potassium manganate(VII).	filter paper turned from purple to colourless
test 4 An excess of aqueous sodium hydroxide was added to the second portion of the solution.	no change

(b) What does the temperature change tell you about the process occurring in **test 2**?

reaction is endothermic

.... [1]

(c) Name the gas given off in **test 3**.

sulfur dioxide

.... [1]

(d) Identify solid **E**.

sodium sulfite

.... [2]

tests on solid F

Complete the expected observations.

(e) A flame test was carried out on solid **F**.

observations red .... [1]

Solid **F** was added to distilled water in a test-tube and the test-tube shaken to dissolve solid **F**.

(f) Dilute nitric acid and aqueous silver nitrate were added to the solution.

observations white precipitate .... [2]

[Total: 9]

4 Calcium carbonate and kaolinite are both white solids found in sedimentary rocks.

Calcium carbonate reacts with dilute hydrochloric acid to form aqueous calcium chloride. Kaolinite does **not** react with dilute acids.

You are provided with a mixture of calcium carbonate and kaolinite and access to dilute hydrochloric acid.

Plan an experiment to determine the percentage by mass of calcium carbonate in the mixture.

weigh 100 grams of the mixture using a balance

add excess acid

filter substance K

wash the residue with distilled water

dry in an oven

weigh the residue

conclusion: % of calcium carbonate = 100 - mass of residue

[6]

[Total: 6]

Cambridge IGCSE

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6879205020

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

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CAMBRIDGE
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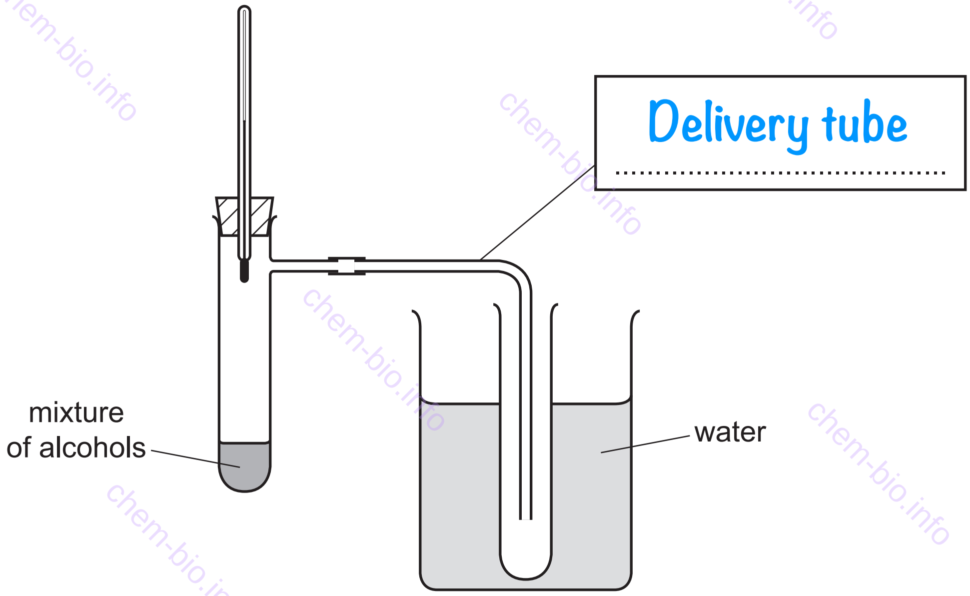
1 A mixture of alcohols can be separated by fractional distillation. The apparatus shown was used to separate ethanol from the mixture.



(a) (i) Complete the box to identify the apparatus. [1]

(ii) Indicate with an arrow where heat is applied. [1]

(b) What is the purpose of the water?

to cool down the gases produced and condense them into liquids

[2]

(c) Why is the thermometer bulb placed as shown and **not** in the mixture of alcohols?

to measure the temperature of the vapour

/ temperature of liquid would not be constant [1]

(d) Use the letter **E** to indicate on the diagram where ethanol would collect. [1]

(e) (i) Suggest a simple chemical test to show that the liquid collected is ethanol and **not** water.

test the alcohol by using a flame / [1]

test water using cobalt(II) chloride

(ii) Give a physical test to identify pure ethanol.

measure its boiling point / melting point [1]

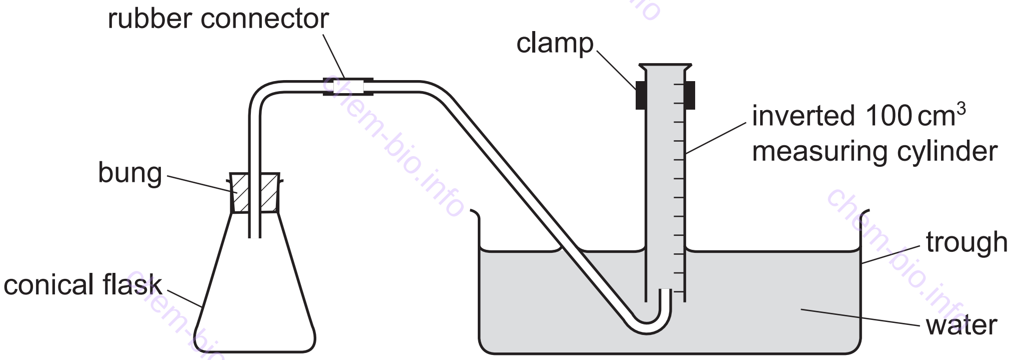
[Total: 8]

2 A student investigated the rate of reaction between magnesium ribbon and two different solutions of dilute sulfuric acid, solution **G** and solution **H**. The acid was in excess in both experiments.

Two experiments were carried out.

Experiment 1

- The apparatus was set up as shown in the diagram.

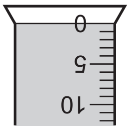
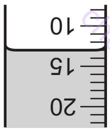
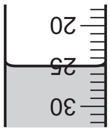
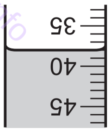
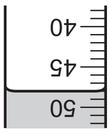
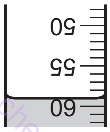
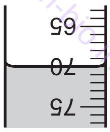
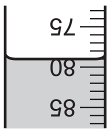
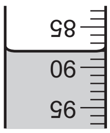
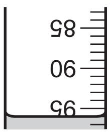


- Using a measuring cylinder, 50 cm^3 of solution **G** were poured into the conical flask. A piece of magnesium ribbon was added to the conical flask and the bung replaced.
- The timer was started immediately and the total volume of gas collected in the measuring cylinder was measured every 20 seconds for 180 seconds (3 minutes).

Experiment 2

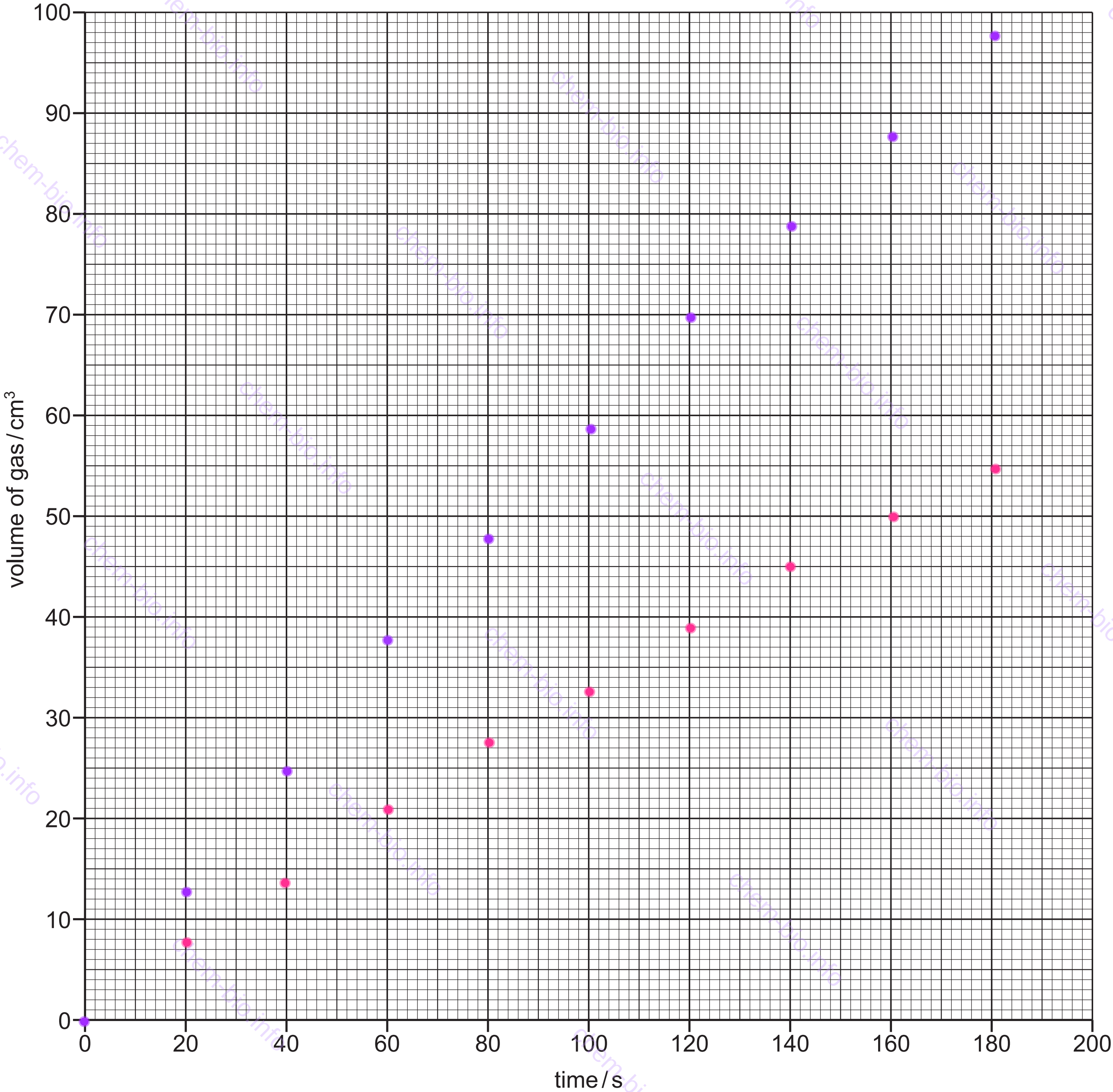
- Experiment 1 was repeated using 50 cm^3 of solution **H** instead of solution **G**.

(a) Use the measuring cylinder diagrams to record the volumes of gas collected in Experiment 1.

	Experiment 1		Experiment 2
time / s	measuring cylinder diagram	volume of gas / cm^3	volume of gas / cm^3
0		0	0
20		13	8
40		25	14
60		38	21
80		48	27
100		59	33
120		70	39
140		79	45
160		88	50
180		96	55

[3]

(b) Plot the results for Experiments 1 and 2 on the grid and draw **two** smooth line graphs. Clearly label your graphs.



[4]

(c) Which experiment had the faster rate of reaction? Suggest a reason why the rate was faster in this experiment.

Experiment 1

more concentrated acid [2]

(d) The average rate of this reaction can be calculated using the equation shown.

$$\text{average rate} = \frac{\text{volume of gas} / \text{cm}^3}{\text{time taken} / \text{s}}$$

For Experiment 1, calculate the average rate of reaction for the first 30 seconds of the reaction. Include the units.

30 cm3

30 ÷ 30

rate = 1

units = cm3/s

[3]

(e) Why, eventually, will no more gas be produced?

all Mg is reacted [1]

(f) Suggest the effect on the rate of reaction of using the same mass of magnesium powder instead of magnesium ribbon. Explain your answer.

faster reaction rate

magnesium powder has a higher surface area

[2]

(g) Give **one** advantage and **one** disadvantage of using a measuring cylinder to measure the volumes of solution **G** and solution **H**.

advantage quick / easy to use

disadvantage not accurate

[2]

(h) Suggest **one** improvement to these experiments.

use a gas syringe instead of measuring cylinder

use a pipette / burette to measure volume of acid [1]

measure the mass of Mg using a balance

Clean the Mg using sand paper to remove oxide layer

[Total: 18]

3 Two substances, solid **J** and solution **K**, were analysed. Solution **K** was hydrogen peroxide.
Tests on each substance were carried out. The observations are shown.

tests	observations
tests on solid J Appearance of solid **J**.	black solid
test 1 Dilute hydrochloric acid was added to solid **J**. The mixture was heated and the gas given off was tested with damp litmus paper.	blue litmus turned white
tests on solution K Solution **K** was divided into two equal portions in two test-tubes. **test 2** Iron(II) sulfate crystals were added to the first portion of the solution. The mixture was shaken and aqueous sodium hydroxide was added to the mixture.	red-brown precipitate formed
test 3 Solid **J** was added to the second portion of the solution. The gas given off was tested with a splint.	glowing splint relit solid **J** was unchanged

(a) Name the gas given off in **test 1**.

chlorine .... [1]

(b) (i) Name the precipitate formed in **test 2**.

Iron(III) hydroxide .... [2]

(ii) A new **test 2** was carried out. Iron(II) sulfate crystals were added to **water**, the mixture was shaken and then aqueous sodium hydroxide was added.

What would be observed?

green precipitate .... [2]

(c) Name the gas given off in **test 3**.

oxygen

.... [1]

(d) What conclusions can you draw about solid **J**?

catalyst / transition metal

.... [2]

[Total: 8]

4 Cassiterite is a naturally occurring form of tin oxide.

Describe how you would

- obtain a sample of tin from a large lump of cassiterite in the laboratory,
- determine the percentage by mass of tin present in cassiterite.

Tin is similar in reactivity to iron.

Your answer should include any apparatus and chemicals used and the conditions required.

Weigh the sample using a balance

Crush the lumps using pestle & mortar

Heat in a crucible with carbon

Weigh the tin

calculate %

.... [6]

[Total: 6]

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CHEMISTRY **0620/61**

Paper 6 Alternative to Practical **May/June 2020**

1 hour

You must answer on the question paper.

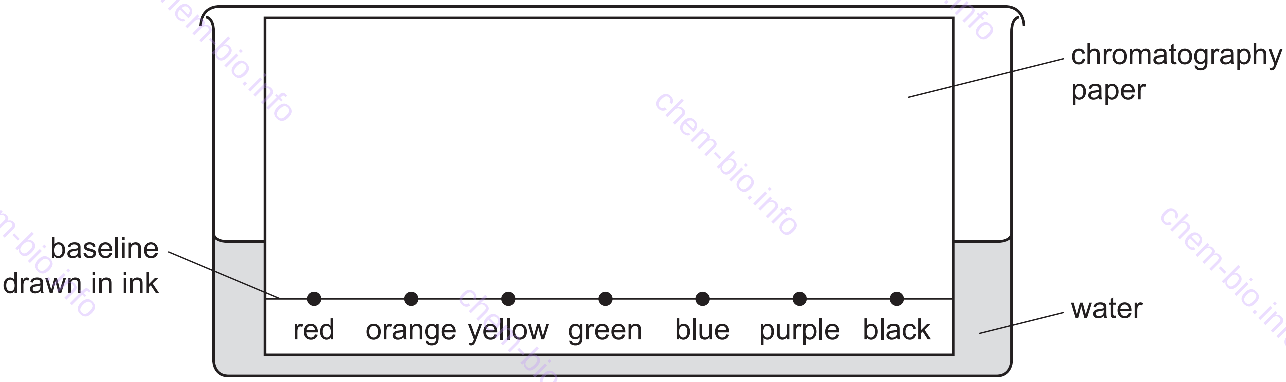
No additional materials are needed.

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 [ ].

This document has **8** pages. Blank pages are indicated.

1 A student investigated the dyes contained in different coloured inks using chromatography. Water was the solvent. The diagram shows how the student set up the apparatus.



(a) Identify **two** errors in the way the student set up the apparatus.

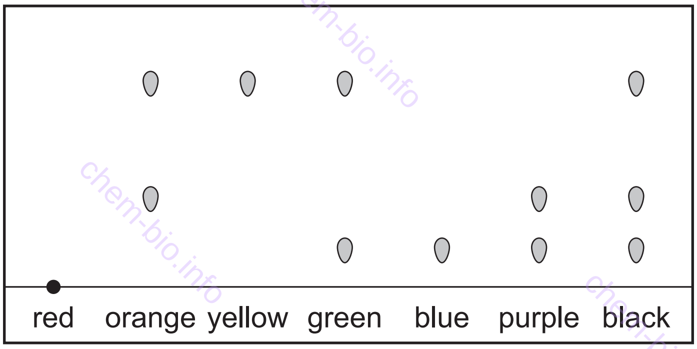
1 spots / baseline is below the level of the solvent

2 baseline is drawn in ink

[2]

(b) The student then carried out the chromatography correctly.

The diagram shows the results.



(i) Which ink contains the greatest number of soluble dyes?

black [1]

(ii) Which **two** inks are made of a single soluble dye?

blue and yellow

[1]

(iii) From the chromatogram it is **not** possible to tell if the red ink contains different dyes.

Suggest how the experiment could be changed to find out if the red ink contains different dyes.

use another solvent / organic [1]

[Total: 5]

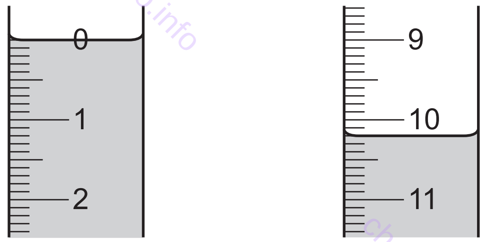
2 A student investigated the reaction between dilute hydrochloric acid and two different aqueous solutions of sodium carbonate, solution **E** and solution **F**.

Three experiments were done.

(a) *Experiment 1*

- A burette was filled up to the 0.0 cm^3 mark with dilute hydrochloric acid.
- Using a measuring cylinder, 25 cm^3 of solution **E** was poured into a conical flask.
- Five drops of thymolphthalein indicator were added to the conical flask.
- Dilute hydrochloric acid was slowly added from the burette to the conical flask, while the flask was swirled, until the solution just changed colour.

Use the burette diagrams to complete the table for Experiment 1.



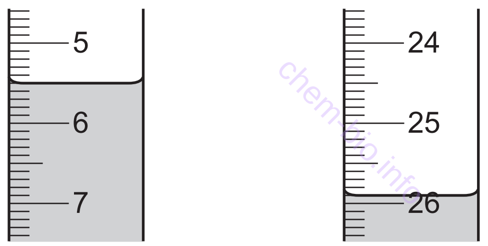
initial reading   final reading

final burette reading / cm^3	10.2
initial burette reading / cm^3	0
volume of dilute hydrochloric acid added / cm^3	10.2

Experiment 2

- The conical flask was emptied and rinsed with distilled water.
- The burette was refilled with dilute hydrochloric acid.
- Experiment 1 was repeated using five drops of methyl orange indicator instead of thymolphthalein indicator.

Use the burette diagrams to complete the table for Experiment 2.



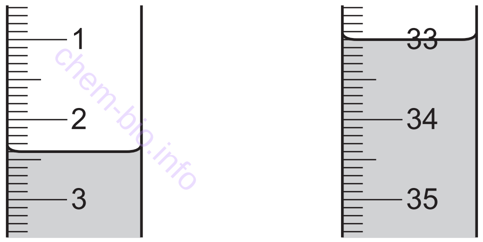
initial reading   final reading

final burette reading / cm^3	25.9
initial burette reading / cm^3	5.5
volume of dilute hydrochloric acid added / cm^3	20.4

Experiment 3

- The conical flask was emptied and rinsed with distilled water.
- The burette was refilled with dilute hydrochloric acid.
- Using a measuring cylinder, 25 cm^3 of solution **F** was poured into the conical flask.
- Five drops of methyl orange indicator were added to the conical flask.
- Dilute hydrochloric acid was slowly added from the burette to the conical flask, while the flask was swirled, until the solution just changed colour.

Use the burette diagrams to complete the table for Experiment 3.



final burette reading / cm^3	33
initial burette reading / cm^3	2.4
volume of dilute hydrochloric acid added / cm^3	30.6

[5]

(b) What colour change was observed in the conical flask in Experiment 2?

from ......yellow...... to ......orange / red......

[2]

(c) Compare the volumes of dilute hydrochloric acid added in Experiment 2 and Experiment 3. Explain any difference.

it is 30.6 ÷ 20.4 = 1.5x greater

this shows that solution F is 1.5x more concentrated than E [2]

(d) Determine the simplest whole number ratio of volumes of dilute hydrochloric acid used in Experiments 1 and 2.

ratio Experiment 1 : Experiment 2 = ...1:2...... [1]

(e) What volume of dilute hydrochloric acid would be required if Experiment 3 was repeated using thymolphthalein indicator instead of methyl orange indicator?

volume = ...15.3 cm3...... [2]

(f) The conical flask was rinsed with distilled water between each experiment.

(i) Why was the conical flask rinsed?

to remove residue from previous experiment

[1]

(ii) Why does it **not** matter if a little distilled water is left in the flask after it has been rinsed?

volume of solution in the flask is already measured

so a little water wouldn't change the volume [1]

(g) State **two** sources of error in the experiments. For each error suggest an improvement that would reduce the error.

source of error 1 the use of a measuring cylinder

improvement 1 use a pipette

source of error 2 no repeat

improvement 2 repeat and find the mean

[4]

[Total: 18]

3 Two solids, solid **G** and solid **H**, were analysed. Solid **G** was copper(II) carbonate.
Tests were done on each solid.

tests on solid G

Complete the expected observations.

(a) Solid **G** was placed in a boiling tube. An excess of dilute sulfuric acid was added to the boiling tube. Any gas produced was tested.

observations ......white precipitate......

......bubbles......

......blue solution forms...... [3]

(b) Identify the gas produced in **(a)**.

......carbon dioxide...... [1]

(c) Aqueous ammonia was added slowly until in excess to the solution produced in **(a)**.

observations ......blue precipitate......

......dissolves in excess ammonia......

......dark blue solution forms......

...... [3]

tests on solid H

Tests were done and the following observations were made.

tests on solid **H**	observations
test 1 Flame test	yellow flame
test 2 Some of solid **H** was placed in a boiling tube. The boiling tube was heated strongly.	condensation appeared near the mouth of the boiling tube
Solid **H** was dissolved in distilled water. The solution was divided into two equal portions. **test 3** About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the first portion of the solution.	the solution remained colourless
test 4 About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate were added to the second portion of the solution.	white precipitate

(d) What conclusion can be made from the result of **test 3**?

no halides

.... [1]

(e) What conclusions can be made about solid **H** from the results of **test 1**, **test 2** and **test 4**?

hydrated sodium sulfate

....

.... [3]

[Total: 11]

4 Cobalt, manganese and nickel are metals. They react with dilute hydrochloric acid to form hydrogen gas.

Plan an investigation to find the order of reactivity of these three metals.

You are provided with:
- samples of each metal
- dilute hydrochloric acid
- common laboratory apparatus.

Your plan must make it clear how your investigation will be a fair test and how you will use your results to place the metals in order of reactivity.

measure a fixed volume of HCl of a specific concentration
measure a specific mass of cobalt powder
mix the metal with the acid at a constant temperature
time how long it takes until the reaction stops (no more bubble)
repeat with the other 2 metals
the metal that requires the least time to complete the reaction is the most reactive

[6]

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CHEMISTRY **0620/61**

Paper 6 Alternative to Practical **May/June 2021**

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.
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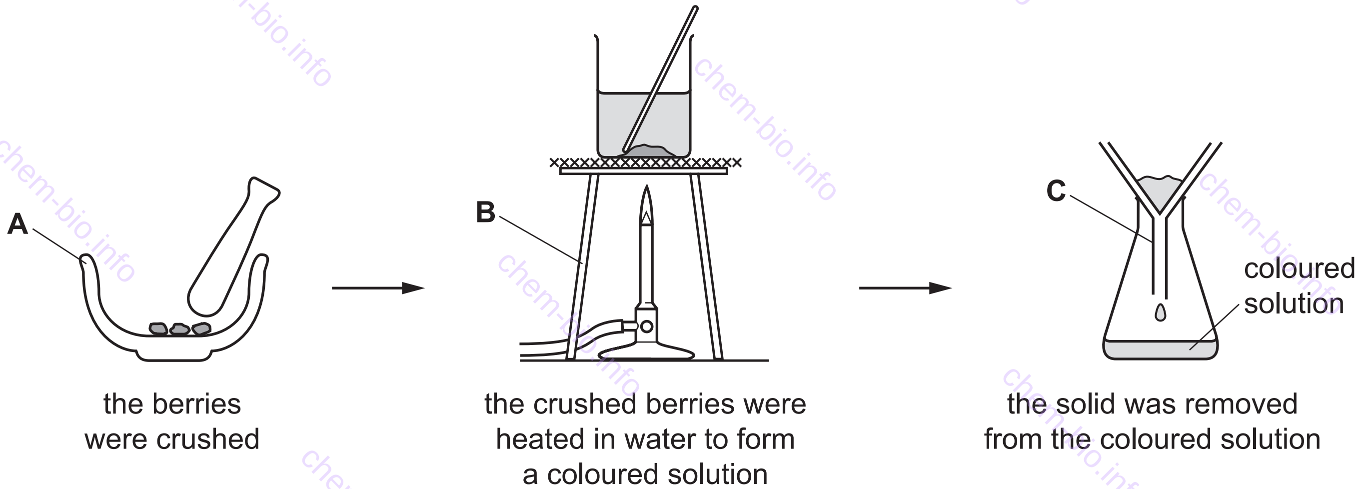
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

1 Many indicators are coloured substances obtained from plants.

A student extracted the coloured substances from some berries using the method shown.



(a) Name the items of apparatus labelled **A**, **B** and **C**.

A mortar

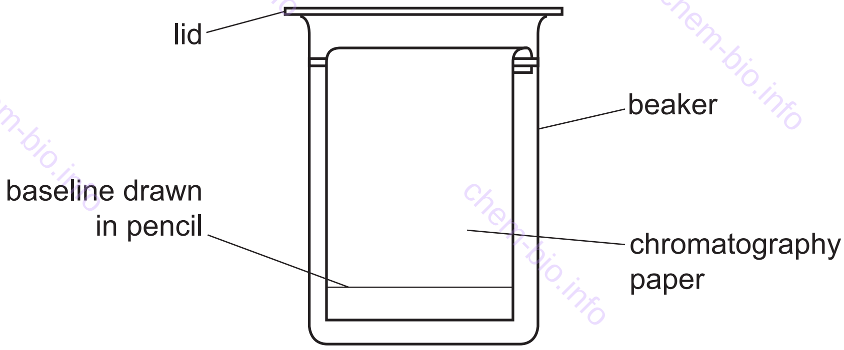
B tripod

C funnel

[3]

(b) The student analysed the coloured solution using chromatography.

(i) Complete the diagram to show:
- where the spot of coloured solution should be placed on the paper
- the level of the solvent in the beaker.



[2]

(ii) Explain why pencil is used to draw the baseline on the chromatography paper.

graphite does not dissolve in the solvent

[1]

(c) The student made two chromatograms. After chromatography, one chromatogram was dipped in dilute hydrochloric acid and one was dipped in aqueous sodium hydroxide.

The results are shown.

chromatogram dipped in dilute hydrochloric acid

chromatogram dipped in aqueous sodium hydroxide

(i) Determine the number of coloured substances in the solution obtained from the berries.

..........2.. [1]

(ii) The table gives the colours of some indicators in acid and alkali.

name of indicator	colour in acid	colour in alkali
anthocyanin	red	blue
bromothymol blue	yellow	blue
congo red	blue	red
methyl purple	purple	green

Use the data in the table and the results to give a possible identity for **one** indicator in the berries.

..........anthocyanin.. [1]

[Total: 8]

2 A student investigated the temperature decrease when sodium hydrogencarbonate reacts with dilute hydrochloric acid.

The student did six experiments.

Experiment 1

- Using a measuring cylinder, $25\,cm^3$ of dilute hydrochloric acid was poured into a conical flask.
- The initial temperature of the acid was measured using a thermometer.
- 1 g of sodium hydrogencarbonate was added to the conical flask. At the same time a stop-clock was started.
- The acid and sodium hydrogencarbonate mixture in the conical flask was stirred continuously using the thermometer.
- The temperature of the mixture after 1 minute was measured.
- The conical flask was rinsed with distilled water.

Experiment 2

- Experiment 1 was repeated using 2 g of sodium hydrogencarbonate instead of 1 g.

Experiment 3

- Experiment 1 was repeated using 3 g of sodium hydrogencarbonate instead of 1 g.

Experiment 4

- Experiment 1 was repeated using 5 g of sodium hydrogencarbonate instead of 1 g.

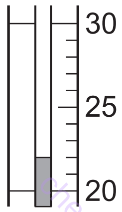
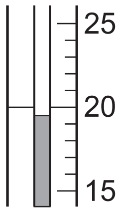
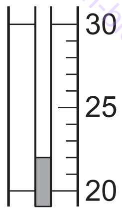
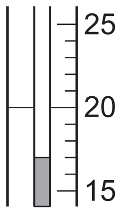
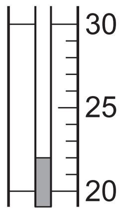
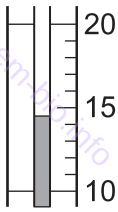
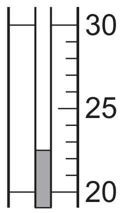
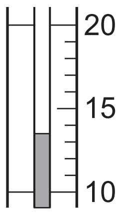
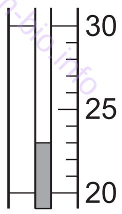
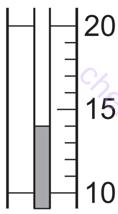
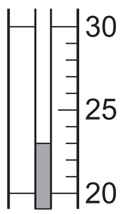
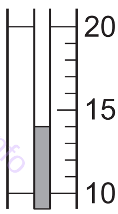
Experiment 5

- Experiment 1 was repeated using 6 g of sodium hydrogencarbonate instead of 1 g.

Experiment 6

- Experiment 1 was repeated using 7 g of sodium hydrogencarbonate instead of 1 g.

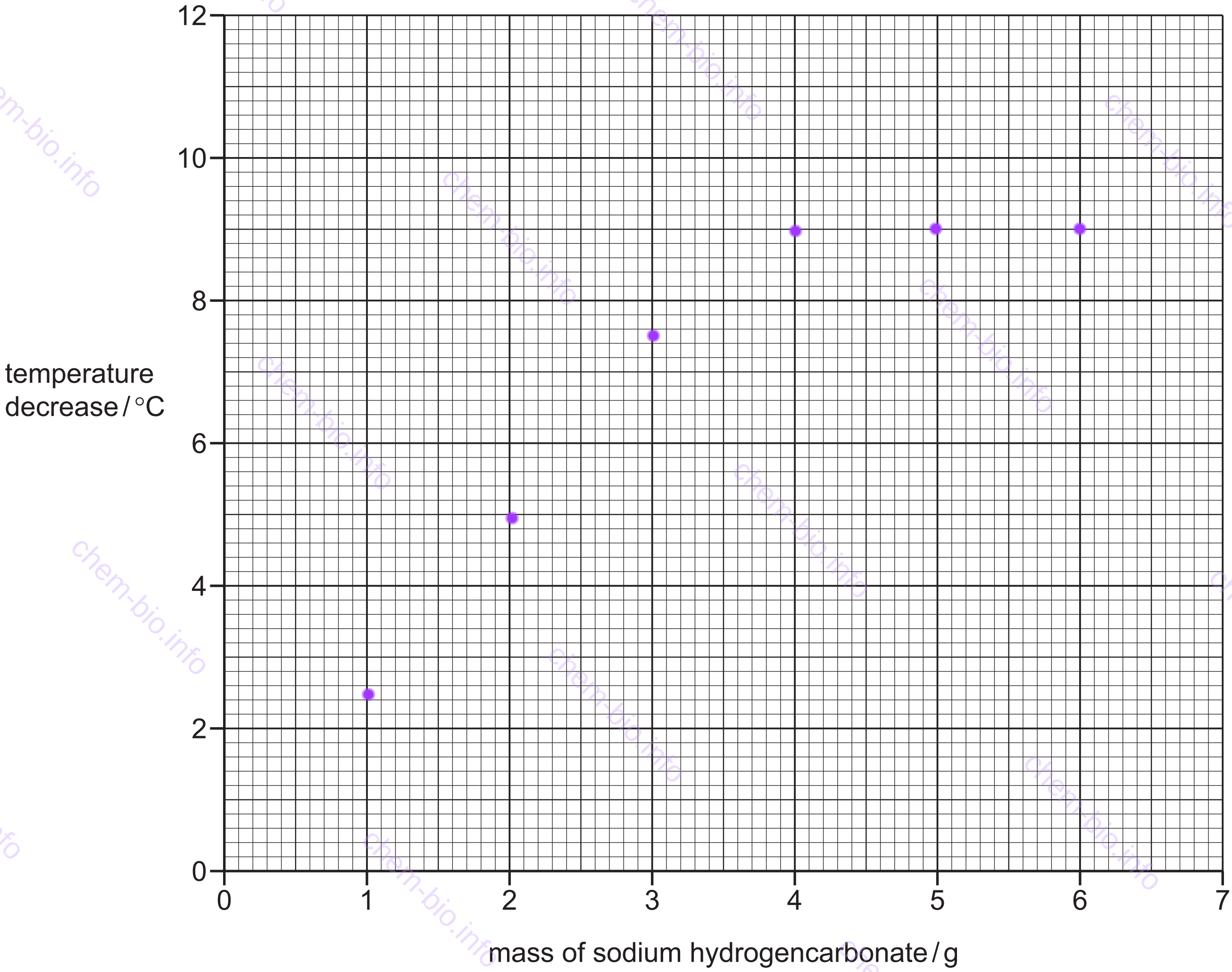
(a) Use the thermometer diagrams to complete the table and calculate the temperature decreases.

experiment	mass of sodium hydrogencarbonate / g	thermometer diagram	initial temperature of acid / °C	thermometer diagram	temperature after 1 minute / °C	temperature decrease / °C
1	1		22		19.5	2.5
2	2		22		17	5
3	3		22		14.5	7.5
4	5		22.5		13.5	9
5	6		23		14	9
6	7		23		14	9

[4]

(b) Plot the results from Experiments 1 to 6 on the grid.

Draw **two** best-fit straight lines through your points. The first straight line should be for the first three points and must pass through (0,0). The second straight line should be for the last three points and must be horizontal. Extend your straight lines so that they meet each other.



[4]

(c) **(i)** **From your graph**, determine the temperature decrease and mass of sodium hydrogencarbonate where your two straight lines meet. Include appropriate units in your answer.

Show clearly **on the grid** how you worked out your answer.

temperature decrease = 9 oC

mass of sodium hydrogencarbonate = 3.6 g

[3]

(ii) Explain why the temperature decrease becomes constant for high masses of sodium hydrogencarbonate.

all acid has been used up/

sodium hydrogen carbonate is in excess [1]

(d) The investigation was repeated with dilute hydrochloric acid of half the concentration, but the same volume.

Sketch **on the grid** the graph you would expect to obtain.

Label your line **D**. [2]

(e) Suggest **two** changes that could be made to the apparatus that would improve the accuracy of the results. For each change explain why it would improve the accuracy of the results.

change 1 ....use a pipette........

explanation 1 ...because it is more accurate than measuring cylinder

....

change 2 ....polystyrene cup instead of confocal flask........

explanation 2 for insulation..........

....

[4]

[Total: 18]

3 Solid **E** and solution **F** were analysed.
Tests were done on each substance.

tests on solid E

tests	observations
test 1 About half of solid **E** was placed in a test-tube and heated gently.	steam was given off; condensation appeared near the mouth of the test-tube
The remaining solid **E** was dissolved in distilled water to produce solution **E**. The solution was divided into four equal portions in three test-tubes and a boiling tube. **test 2** About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the first portion of solution **E**.	no visible change
test 3 About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate were added to the second portion of solution **E**.	white precipitate
test 4 Excess aqueous ammonia was added to the third portion of solution **E**.	white precipitate
test 5 Aqueous sodium hydroxide was added dropwise and then in excess to the fourth portion of solution **E** in the boiling tube.	white precipitate which dissolved in excess to form a colourless solution
test 6 The product from **test 5** was warmed gently and any gas given off was tested with damp red litmus paper.	the red litmus paper turned blue

(a) State the conclusion that can be made from the observations in **test 1**.

hydrated / contains water of crystallisation

.... [1]

(b) State the conclusion that can be made from the observation in **test 2**.

No halide

.... [1]

[Turn over

(c) Identify the **three** ions in solid **E**.

sulfate + aluminium + ammonium

.... [3]

tests on solution F

Solution **F** was aqueous sodium hydroxide.

Complete the expected observations.

(d) A flame test was carried out on solution **F**.

observations yellow flame [1]

(e) The remaining solution **F** was divided into two approximately equal portions in two test-tubes.

(i) To the first portion of solution **F** a few drops of universal indicator solution were added.

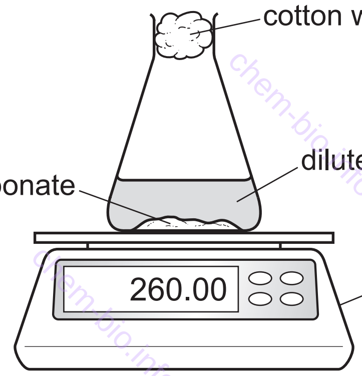
observations blue / purple [1]

(ii) To the second portion of solution **F** approximately 2 cm^3 of aqueous copper(II) sulfate was added.

observations blue precipitate [1]

[Total: 8]

4 Dilute hydrochloric acid reacts with calcium carbonate to make carbon dioxide gas. The apparatus shown in the diagram can be used to follow the progress of the reaction. The carbon dioxide gas leaves the flask causing the mass shown on the balance to decrease.



Plan an investigation, using the apparatus shown in the diagram, to find out how the temperature of the dilute hydrochloric acid affects the rate of the reaction. Your plan should include how your results will show how the temperature of the dilute hydrochloric acid affects the rate of the reaction.

You are provided with dilute hydrochloric acid, calcium carbonate and common laboratory apparatus.

measure a fixed mass of calcium carbonate using a balance

measure a fixed volume of acid using a pipette & pour in the flask

measure the temperature of the acid

Mix the acids and carbonate and record the initial mass

Record the time it takes until the there's no change in mass

/ record the mass loss in set time

Repeat the measurement 5x and find the average time

calculate the rate = change in mass ÷ time

Repeat at higher temperatures of the acid

At higher temperature there will be more mass loss per unit time

[6]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 2 7 7 0 3 5 3 3 4 3 *

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2021**

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

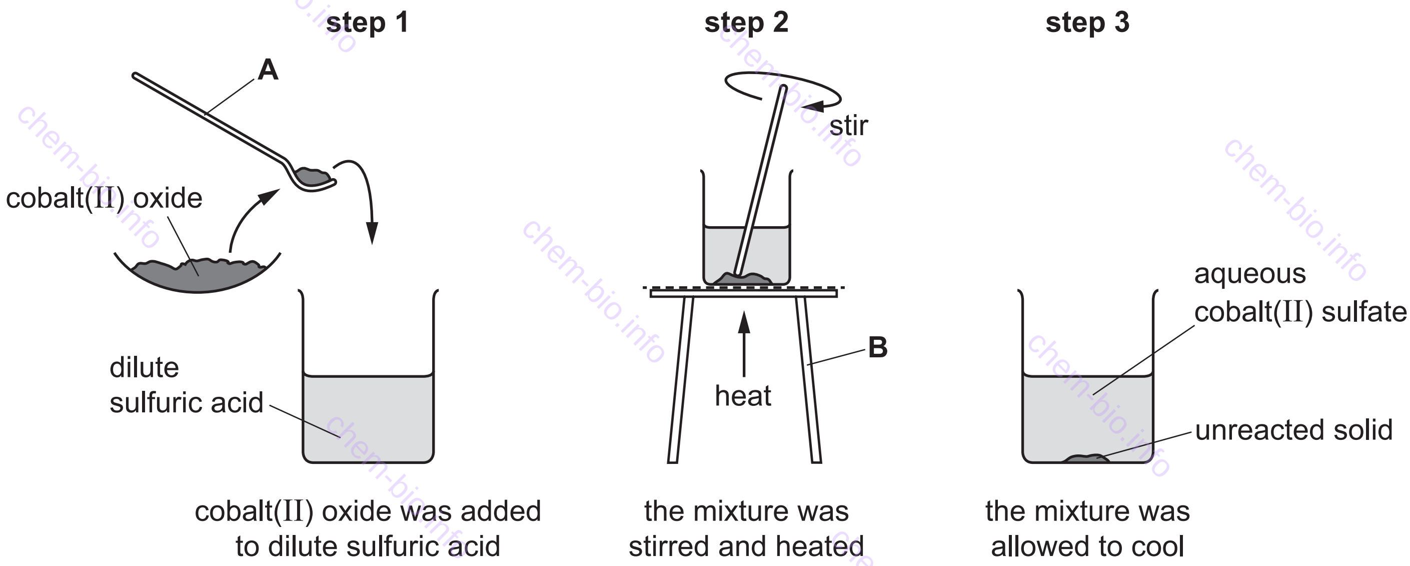
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

IB21 06_0620_63/3RP

1 Cobalt(II) sulfate is a soluble salt. It can be made by reacting insoluble cobalt(II) oxide with dilute sulfuric acid.

A student made a sample of hydrated cobalt(II) sulfate using the following steps.



(a) Name the items of apparatus labelled **A** and **B**.

A spatula

B tripod

[2]

(b) (i) Suggest why the mixture was heated in **step 2**.

to increase the rate of reaction

[1]

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

Bunsen burner [1]

(c) Name the reactant which was in excess.
Explain your answer.

copper(II) oxide because solid was left at the end

[1]

(d) Additional steps are required to obtain pure cobalt(II) sulfate.

(i) The unreacted solid is removed from the aqueous cobalt(II) sulfate.

Name the process used to remove the unreacted solid.

filtration [1]

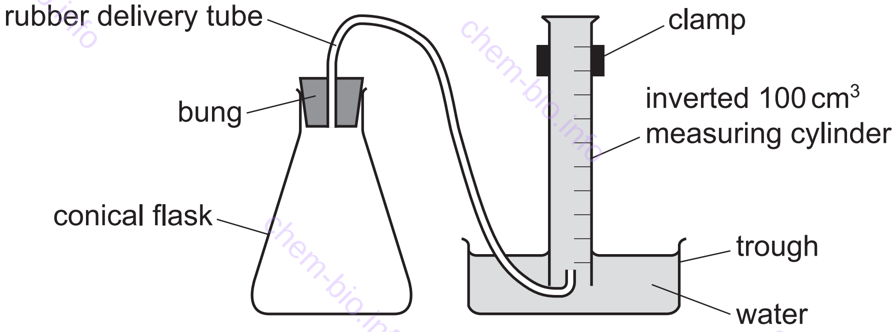
(ii) Describe how crystals of hydrated cobalt(II) sulfate could be made from the solution obtained in **(i)**.

heat to evaporate the water
until crystallisation point
and let the solution cool
[2]

[Total: 8]

2 A student investigated the rate at which hydrogen gas was made when magnesium reacted with dilute sulfuric acid.

Five experiments were carried out using the apparatus shown.



Experiment 1
- Using a measuring cylinder, 25 cm^3 of dilute sulfuric acid was poured into a conical flask.
- Using a different measuring cylinder, 30 cm^3 of distilled water was poured into the conical flask.
- The apparatus was set up as shown in the diagram.
- The bung was removed from the conical flask.
- A coiled length of magnesium ribbon was added to the conical flask, the bung was replaced immediately and a timer started.
- The volume of gas collected in the inverted measuring cylinder after 30 seconds was measured.

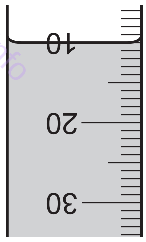
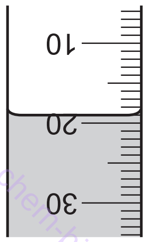
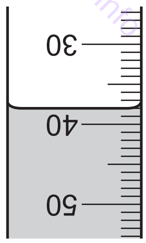
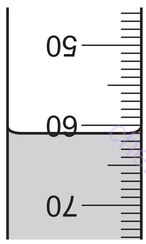
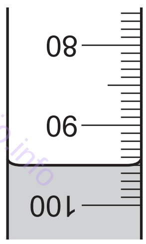
Experiment 2
- Experiment 1 was repeated using 20 cm^3 of distilled water instead of 30 cm^3.

Experiment 3
- Experiment 1 was repeated using 10 cm^3 of distilled water instead of 30 cm^3.

Experiment 4
- Experiment 1 was repeated using 5 cm^3 of distilled water instead of 30 cm^3.

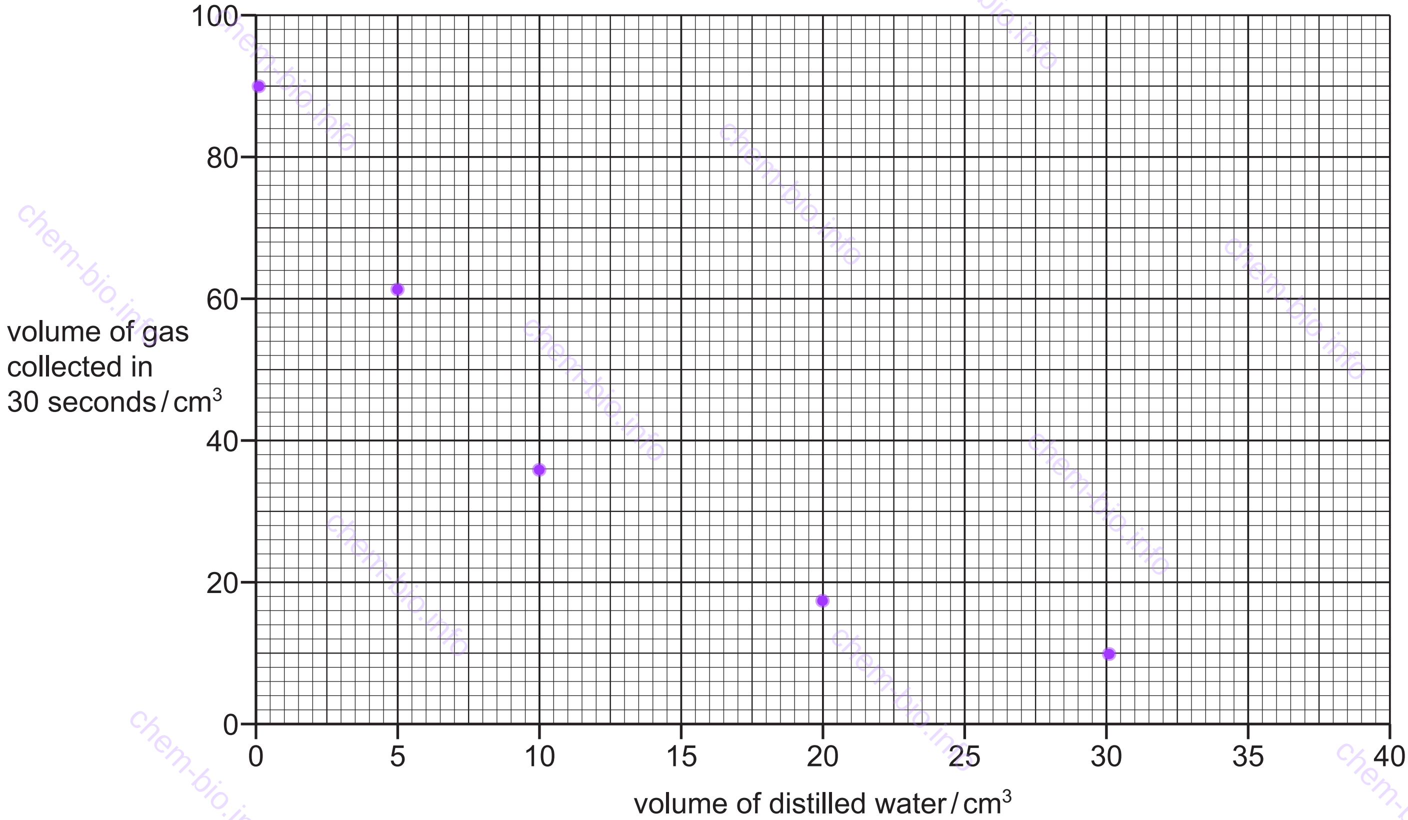
Experiment 5
- Experiment 1 was repeated without adding any distilled water to the dilute sulfuric acid.

(a) Use the information in the description of the experiments and the inverted measuring cylinder diagrams to complete the table.

experiment	volume of dilute sulfuric acid / cm^3	volume of distilled water / cm^3	inverted measuring cylinder diagram	volume of gas collected in 30 seconds / cm^3
1	25	30		10
2	25	20		19
3	25	10		38
4	25	5		61
5	25	0		95

[4]

(b) Plot the results from Experiments 1 to 5 on the grid. Draw a smooth curve of best fit.



[3]

(c) Extrapolate (extend) the line on your graph and deduce the volume of gas that would be collected in 30 seconds if 35 cm^3 of distilled water was added to the dilute sulfuric acid.

.... cm^3 [2]

(d) The rate of reaction can be calculated using the equation shown.

$$\text{rate of reaction} = \frac{\text{volume of gas collected}}{\text{time taken to collect the gas}}$$

(i) Use this equation to calculate the rate of reaction in Experiment 3. Give the units for the rate you have calculated.

38 ÷ 30

rate = 1.27

units = cm3 / s

[2]

(ii) State which Experiment, 1, 2, 3, 4 or 5, had the highest rate of reaction.

5 [1]

(e) The volume of the dilute sulfuric acid was measured using a measuring cylinder. A 25 cm^3 pipette could have been used instead of a measuring cylinder.

(i) State **one** advantage of using a 25 cm^3 pipette instead of a measuring cylinder.

more accurate [1]

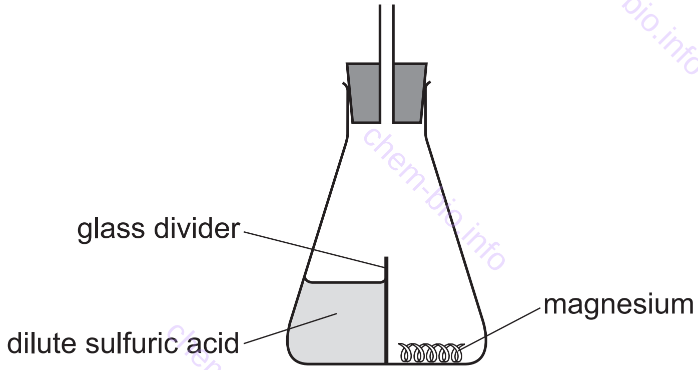
(ii) State **one** disadvantage of using a 25 cm^3 pipette instead of a measuring cylinder.

slower [1]

(f) Name another item of apparatus, which can be used instead of an inverted measuring cylinder, to collect and measure the volume of gas made in the reaction.

gas syringe [1]

(g) The diagram shows a modified conical flask that could be used in this investigation.



Explain the advantage of using this type of conical flask instead of the type used in the investigation.

The reaction can be started by tipping the flask

we do not have to remove the bung

So no gas escapes while the bung is being removed [2]

[Total: 17]

  [Turn over

3 Solid **I** and solid **J** were analysed. Solid **I** was chromium(III) chloride.

tests on solid I

Complete the expected observations.

Solid **I** was placed in a boiling tube and about 10 cm^3 of distilled water was added to the boiling tube. The mixture was shaken to dissolve solid **I** and form solution **I**. Solution **I** was divided into four portions in four test-tubes.

(a) Aqueous sodium hydroxide was added dropwise and then in excess to the first portion of solution **I**.

observations green precipitate which is soluble in excess

.... [2]

(b) Aqueous ammonia was added dropwise and then in excess to the second portion of solution **I**.

observations grey green precipitate which is insoluble in excess

.... [2]

(c) About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the third portion of solution **I**.

observations white precipitate [1]

(d) About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate were added to the fourth portion of solution **I**.

observations no precipitate [1]

tests on solid J

tests	observations
test 1 A flame test was carried out on solid **J**.	lilac flame
The remaining solid **J** was placed in a boiling tube and about 10 cm^3 of distilled water was added to the boiling tube. The mixture was shaken to dissolve solid **J** and form solution **J**. **test 2** About 5 cm^3 of dilute nitric acid was added to solution **J**. Any gas produced was tested.	 effervescence the gas turned limewater milky
test 3 A few drops of aqueous silver nitrate were added to the mixture formed in **test 2**.	no visible change

(e) Identify the gas formed in **test 2**.

carbon dioxide .... [1]

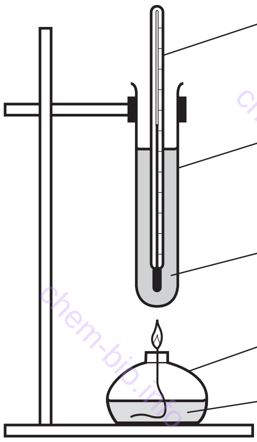
(f) Identify solid **J**.

potassium carbonate ....

.... [2]

[Total: 9]

4 The energy given out when different liquid alcohols are burned can be compared using the apparatus shown.



Describe how the apparatus shown can be used to compare the amount of energy given out by three different liquid alcohols, ethanol, propanol and butanol. Your answer should include how the results can be used to determine which fuel gives out the most energy.

measure the mass of ethanol + burner
measure a fixed volume of water
record the initial temperature of water
burn the fuel until the temperature of water rises by 10 oC
reweigh the burner and ethanol
determine the mass of ethanol used
initial mass - final mass
repeat 5x find the average mass
repeat for propanol and butanol
the fuel that requires the least mass to heat the water is
the one that gives out the largest amount of heat
[6]

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CHEMISTRY **0620/61**

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 **16** pages. Any blank pages are indicated.

IB24 06_0620_61/2RP

1 A student carries out a titration to find the concentration of a sample of dilute hydrochloric acid.

The student:

- adds 25.0 cm^3 of aqueous potassium hydroxide to the apparatus labelled **A** in Fig. 1.1

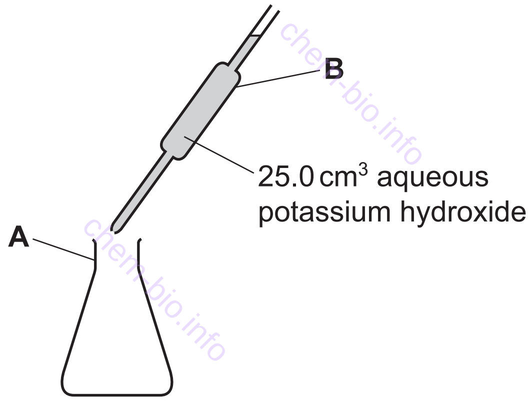


Fig. 1.1

- adds a few drops of a suitable indicator to the apparatus labelled **A**
- uses a burette to add dilute hydrochloric acid to the aqueous potassium hydroxide and indicator mixture in the apparatus labelled **A**.

(a) Name the items of apparatus labelled **A** and **B** in Fig. 1.1.

A conical flask

B volumetric pipette

[2]

(b) The student adds the indicator after the volume of the 25.0 cm^3 of aqueous potassium hydroxide has been measured.

(i) Explain why the student adds an indicator to the aqueous potassium hydroxide.

to observe the change in colour at the end point [1]

(ii) Name a suitable indicator.

methyl orange / thymolphthalein [1]

(c) Describe how the student can determine the volume of dilute hydrochloric acid used in this titration.

read the initial and final volume in the burette

volume of acid = final reading - initial reading [2]

(d) The student observes the colour changes that occur as they add dilute hydrochloric acid from the burette.

State one **other** thing the student should do as they add the dilute hydrochloric acid to the aqueous potassium hydroxide.

the student should swirl the flask

.... [1]

[Total: 7]

2 A student investigates the temperature change when magnesium reacts with dilute sulfuric acid.

The student does five experiments.

Experiment 1

- Use a 25 cm^3 measuring cylinder to pour 20 cm^3 of dilute sulfuric acid into a boiling tube.
- Use a thermometer to measure the initial temperature of the acid in the boiling tube. Record the initial temperature.
- Add a coiled 5 cm length of magnesium ribbon to the acid in the boiling tube. At the same time start a timer.
- Continually stir the contents of the boiling tube using the thermometer.
- After 45 seconds, measure the temperature of the mixture in the boiling tube. Record this temperature.
- Rinse the boiling tube with distilled water.

Experiment 2

- Use the 25 cm^3 measuring cylinder to pour 20 cm^3 of dilute sulfuric acid into the boiling tube.
- Use a 10 cm^3 measuring cylinder to add 2.0 cm^3 of distilled water to the acid in the boiling tube.
- Place a bung in the boiling tube and invert the tube to mix the acid and water.
- Use the thermometer to measure the initial temperature of the contents of the boiling tube. Record the initial temperature.
- Add a coiled 5 cm length of magnesium ribbon to the contents of the boiling tube. At the same time start a timer.
- Continually stir the contents of the boiling tube using the thermometer.
- After 45 seconds, measure the temperature of the mixture. Record this temperature.
- Rinse the boiling tube with distilled water.

Experiment 3

- Repeat Experiment 2, adding 4.0 cm^3 of distilled water instead of 2.0 cm^3.

Experiment 4

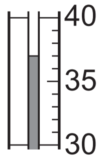
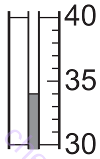
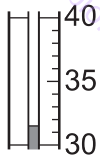
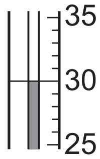
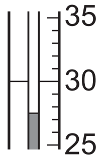
- Repeat Experiment 2, adding 6.0 cm^3 of distilled water instead of 2.0 cm^3.

Experiment 5

- Repeat Experiment 2, adding 10.0 cm^3 of distilled water instead of 2.0 cm^3.

(a) Use the information in the description of the experiments and the thermometer diagrams to complete Table 2.1.

Table 2.1

experiment	volume of dilute sulfuric acid / cm^3	volume of distilled water / cm^3	initial temperature / °C	thermometer diagram after 45 s / °C	temperature after 45 s / °C	temperature increase / °C
1	20	0	25.0		37	12
2	20	2	25.5		34	8.5
3	20	4	25.5		31.5	6
4	20	6	26.0		30	4
5	20	10	26.0		27.5	1.5

[5]

(b) **(i)** State which Experiment, 1, 2, 3, 4 or 5, had the smallest temperature change.

5 .... [1]

(ii) Explain why the temperature change was smallest in the experiment you have given in **(b)(i)**.

largest volume of liquid to be heated ....

.... [1]

(c) Complete a suitable scale on the *y*-axis and plot your results from Experiments 1 to 5 on Fig. 2.1. Draw a line of best fit.

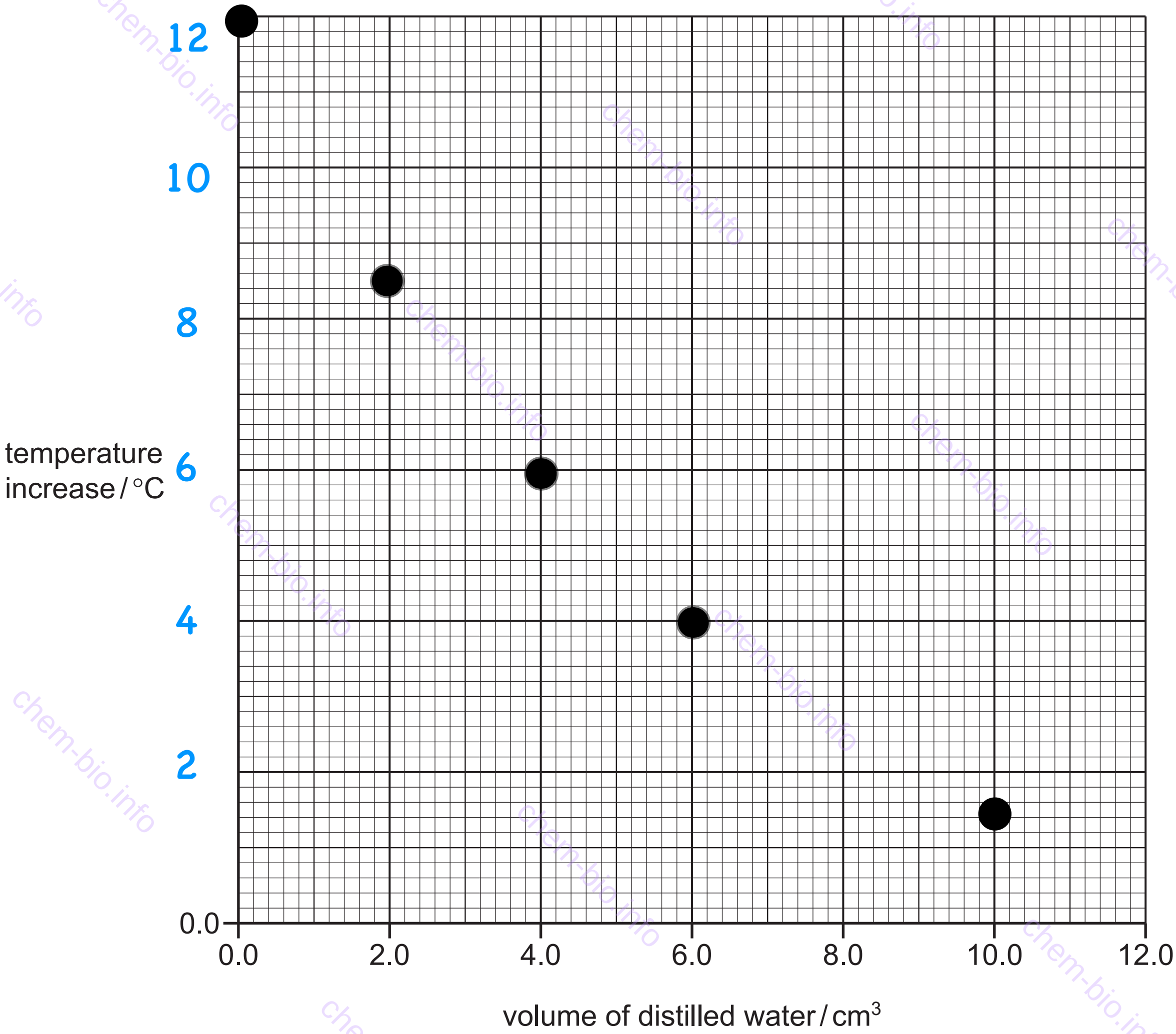


Fig. 2.1

[4]

(d) Use your graph in Fig. 2.1 to deduce the temperature increase when Experiment 2 is repeated with 7.5 cm^3 of distilled water instead of 2.0 cm^3.

Show clearly **on Fig. 2.1** how you worked out your answer.

.... °C [2]

(e) The average rate of temperature increase in each experiment is calculated using the equation shown.

$$\text{average rate of temperature increase} = \frac{\text{temperature increase}}{\text{45 seconds}}$$

Calculate the average rate of temperature increase in Experiment 1. Give units for the rate you have calculated.

12 ÷ 45

average rate of temperature increase = 0.27

units = °C / s

[2]

(f) **(i)** Explain why the results of the experiment are more accurate if the boiling tube is wrapped in cotton wool.

cotton is an insulator that reduces heat loss

it'll prevent temperature decrease

so more accurate temperature reading

[2]

(ii) Explain why a 25.0 cm^3 volumetric pipette **cannot** be used to accurately measure the volume of the distilled water added.

volumetric pipette can only measure fixed 25cm³

[1]

(iii) State one **other** way in which the **apparatus** can be changed to give more accurate results.

ues a burette instead of measuring cylinder

[1]

(g) Sketch **on Fig. 2.1** the graph you would expect if all of the experiments were repeated using a 2 cm length of magnesium ribbon instead of the 5 cm length.

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

[Total: 20]

3 A student tests two substances: solution **E** and solid **F**.

Tests on solution E

Solution **E** is aqueous chromium(III) bromide.

Solution **E** is divided into two portions.

Record the expected observations.

(a) To the first portion of solution **E**, the student adds aqueous sodium hydroxide dropwise and then in excess.

observations adding dropwise green precipitate

observation in excess precipitate dissolves

[2]

(b) To the second portion of solution **E**, the student adds about 1 cm^3 of dilute nitric acid and a few drops of aqueous silver nitrate.

observations cream precipitate

[1]

Tests on solid F

Table 3.1 shows the tests and the student's observations for solid **F**.

Table 3.1

tests	observations
test 1 Heat about half of solid **F** in a boiling tube until there is no further change.	the white solid forms a colourless liquid, steam comes out from the boiling tube and condensation is seen at the top of the boiling tube, after a while the colourless liquid becomes a white solid
test 2 The remaining solid **F** is dissolved in water to form solution **F**. Solution **F** is divided into three portions. To the first portion of solution **F** in a boiling tube, add aqueous sodium hydroxide dropwise and then in excess. Warm the product and hold damp red litmus paper at the mouth of the boiling tube.	no change the damp red litmus paper remains red
test 3 To the second portion of solution **F**, add 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate.	white precipitate
test 4 To the third portion of solution **F**, add a few drops of acidified aqueous potassium manganate(VII).	the solution becomes light purple

(c) The observations in **test 1** show that solid **F** is hydrated.

Describe a chemical test to show that the condensation at the top of the boiling tube contains water.

test anhydrous cobalt(II) chloride papers

result turns pink

[2]

(d) From the tests and observations in Table 3.1 it is **not** possible to identify the cation in solid **F**.

Give another test that can be carried out to help identify the cation in solid **F**.

flame test

.... [1]

(e) Identify the anion in solid **F**.

sulfate .... [1]

[Total: 7]

4 A **mixture** contains three compounds:

- liquid ethanol
- solid sodium chloride
- solid zinc carbonate.

Table 4.1 gives some information about these three compounds.

Table 4.1

name of compound	solubility in water	solubility in ethanol
ethanol	soluble	
sodium chloride	soluble	insoluble
zinc carbonate	insoluble	insoluble

Describe how to obtain a pure sample of each of the three compounds, ethanol, sodium chloride and zinc carbonate, from the mixture.

You are provided with common laboratory apparatus.

filter the mixture to obtain the ethanol as the filtrate

add water to the residue

stir the mixture

filter again to obtain zinc carbonate as the residue

rinse the residue to remove any sodium chloride

heat the filtrate to evaporate water and obtain sodium chloride

[6]

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CHEMISTRY **0620/61**

Paper 6 Alternative to Practical **October/November 2020**

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 [ ].

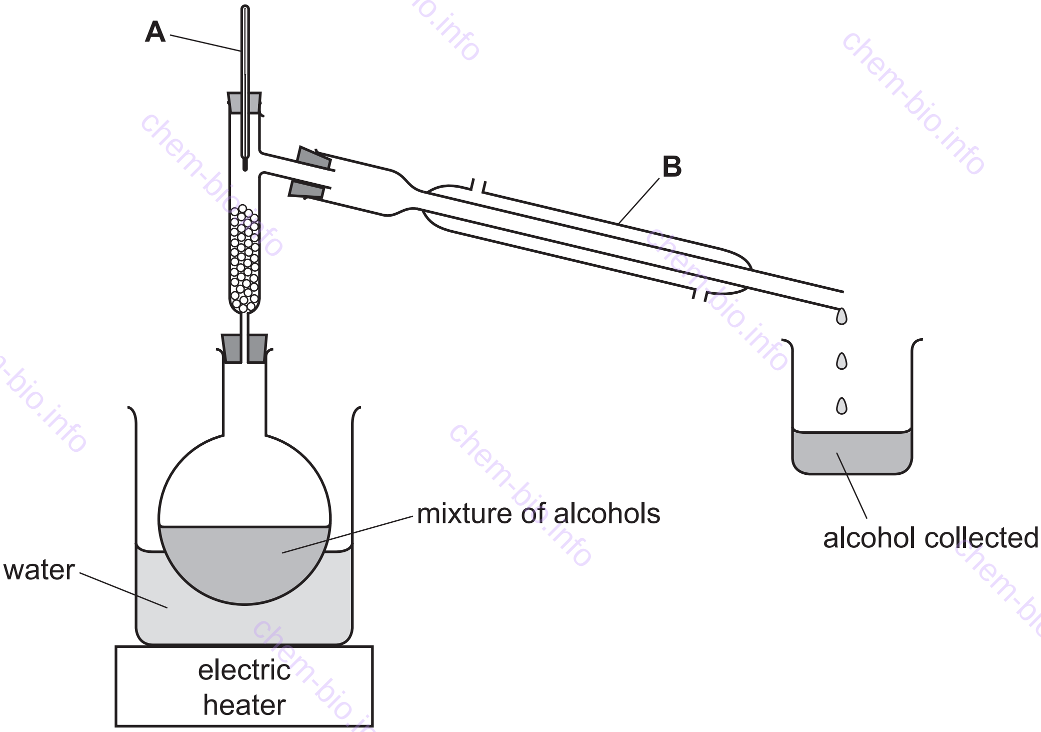
This document has **12** pages. Blank pages are indicated.

IB20 11_0620_61/3RP

1 The table gives the boiling points of four alcohols.

alcohol	boiling point / °C
butanol	117
ethanol	79
pentanol	138
propanol	97

The apparatus shown can be used to obtain propanol from a mixture containing butanol, ethanol, pentanol and propanol.



(a) Name the items of apparatus labelled **A** and **B**.

A Thermometer ....

B Condenser ....

[2]

(b) Name this method of separation.

Fractional distillation .... [2]

(c) Explain why it is safer to heat the mixture of alcohols in the way shown rather than with a Bunsen burner.

Alcohols are flammable .... [1]

(d) Describe how propanol can be obtained from the mixture. Use data from the table.

Heat to remove ethanol first

And then collect propanol at 97 oC

.... [2]

(e) Explain why the apparatus in the diagram **cannot** be used to obtain butanol from the mixture.

Butanol has a higher boiling point than water (100 oC)

.... [1]

[Total: 8]

2 A student investigated the mass of lead(II) iodide precipitate formed when aqueous potassium iodide reacts with aqueous lead(II) nitrate.

The equation for the reaction is shown.

$$2KI(aq) + Pb(NO_3)_2(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$$

The student did seven experiments.

Experiment 1

- Using a 50 cm^3 measuring cylinder, 25 cm^3 of aqueous potassium iodide was poured into a beaker.
- Using a clean 50 cm^3 measuring cylinder, 10 cm^3 of aqueous lead(II) nitrate was added to the aqueous potassium iodide in the beaker. The solutions were mixed together.
- The mass of the precipitate of lead(II) iodide formed was found.

Experiment 2

- Experiment 1 was repeated using a larger volume of aqueous lead(II) nitrate than in Experiment 1.

Experiment 3

- Experiment 1 was repeated using a larger volume of aqueous lead(II) nitrate than in Experiment 2.

Experiment 4

- Experiment 1 was repeated using a larger volume of aqueous lead(II) nitrate than in Experiment 3.

Experiment 5

- Experiment 1 was repeated using a larger volume of aqueous lead(II) nitrate than in Experiment 4.

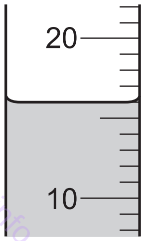
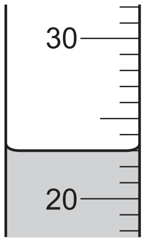
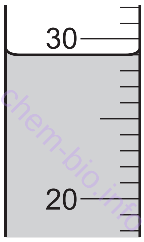
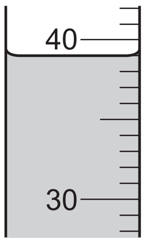
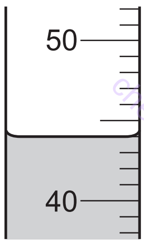
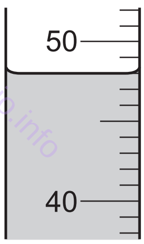
Experiment 6

- Experiment 1 was repeated using a larger volume of aqueous lead(II) nitrate than in Experiment 5.

Experiment 7

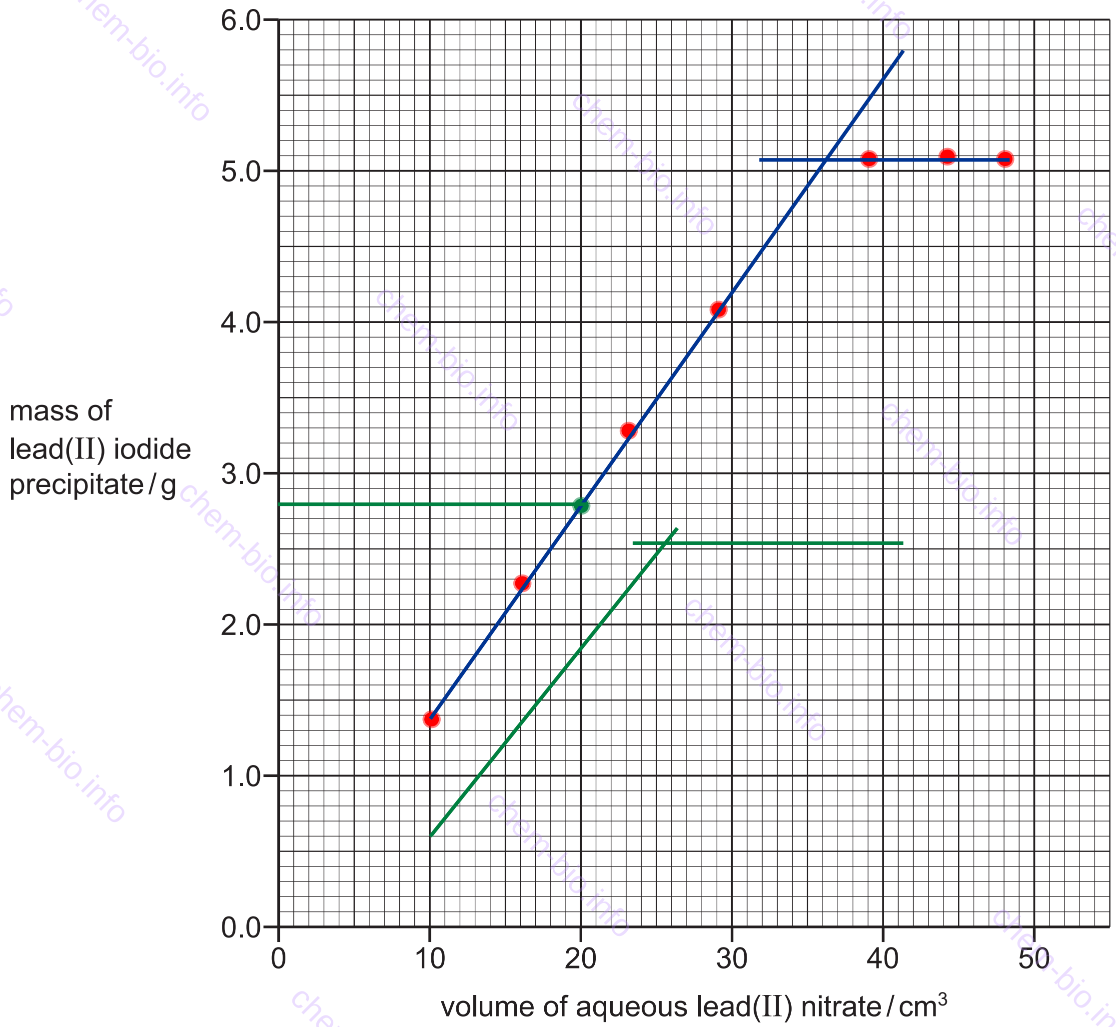
- Experiment 1 was repeated using a larger volume of aqueous lead(II) nitrate than in Experiment 6.

(a) Use the measuring cylinder diagrams to complete the table.

experiment	volume of aqueous potassium iodide / cm^3	measuring cylinder diagram for aqueous lead(II) nitrate	volume of aqueous lead(II) nitrate / cm^3	mass of lead(II) iodide precipitate / g
1	25		10	1.4
2	25		16	2.3
3	25		23	3.3
4	25		29	4.1
5	25		39	5.1
6	25		44	5.1
7	25		48	5.1

[2]

(b) Plot the results from Experiments 1 to 7 on the grid. Draw two straight lines through the points. Extend your straight lines so that they meet.



[5]

(c) **From your graph**, deduce the mass of lead(II) iodide precipitate that would be formed if Experiment 1 was repeated using 20 cm^3 of aqueous lead(II) nitrate.

Show clearly **on the grid** how you worked out your answer.

mass = ...2.8.......... g [2]

(d) Explain why the same mass of precipitate is formed in Experiment 5, Experiment 6 and Experiment 7.

All potassium iodide has been used up

.... [1]

(e) Sketch **on the grid** the graph you would expect if all of the experiments were repeated using aqueous potassium iodide with half the concentration. [2]

(f) **(i)** State why using a 25.0 cm^3 pipette to measure the volume of aqueous potassium iodide would be an improvement.

It is more accurate than a measuring cylinder

.... [1]

(ii) State why a 25.0 cm^3 pipette could **not** be used to measure the volume of aqueous lead(II) nitrate in each experiment.

The pipette can only be used to measure 25 cm3

.... [1]

(g) Describe how the solid lead(II) iodide can be separated from the reaction mixture and its mass found.

Filter

Wash with distilled water

Dry and then weigh

.... [3]

[Total: 17]

3 Solid **Y** and solid **Z** were analysed.
Tests were done on each solid.

tests on solid **Y**	observations
Solid **Y** was dissolved in distilled water to form solution **Y**. Solution **Y** was divided into four portions in four boiling tubes. **test 1** Aqueous ammonia was added dropwise and then in excess to the first portion of solution **Y**.	a white precipitate formed which was insoluble in excess
test 2 Aqueous sodium hydroxide was added dropwise and then in excess to the second portion of solution **Y**.	a white precipitate formed which dissolved in excess to form a colourless solution
test 3 A piece of aluminium foil was added to the solution formed in **test 2**. The mixture was warmed and any gas given off was tested.	the gas turned damp red litmus paper blue
test 4 About 1 cm^3 of dilute nitric acid and a few drops of aqueous silver nitrate were added to the third portion of solution **Y**.	the solution remained colourless, no precipitate formed

(a) Name the gas given off in **test 3**.

Ammonia

.... [1]

(b) Identify solid **Y**.

Aluminium nitrate

....

.... [2]

(c) A strip of universal indicator paper was dipped into the fourth portion of solution **Y**.
The universal indicator paper turned orange.

What additional information does this give about solution **Y**?

Weakly acidic

.... [1]

tests on solid Z

Solid **Z** was iron(II) sulfate.

Complete the expected observations.

Solid **Z** was dissolved in water to produce solution **Z**. Solution **Z** was split into three equal portions in three boiling tubes.

(d) Aqueous ammonia was added dropwise and then in excess to the first portion of solution **Z**.

observations Green precipitate

that is insoluble in excess

[2]

(e) About 2 cm^3 of dilute hydrochloric acid was added to the second portion of solution **Z**.

observations No change [1]

(f) The solution from **(e)** was warmed and a piece of filter paper soaked in acidified aqueous potassium manganate(VII) was held at the mouth of the boiling tube.

observations No change [1]

(g) About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate were added to the third portion of solution **Z**.

observations White precipitate [1]

[Total: 9]

4 A mixture contains three solid compounds:

- copper(II) sulfate
- cetyl alcohol
- silicon dioxide.

The table gives some information on the solubility of these three solids.

name of compound	solubility in water	solubility in propanone
copper(II) sulfate	soluble	insoluble
cetyl alcohol	insoluble	soluble
silicon dioxide	insoluble	insoluble

Plan a method to obtain a pure sample of each of the three solids, copper(II) sulfate, cetyl alcohol and silicon dioxide, from the mixture.

You have access to normal laboratory apparatus.

add water to dissolve copper sulfate and stir

Filter and wash the residue with water

Evaporate the filtrate to get copper sulfate

Add propanone to the residue to dissolve cetyl alcohol

Filter to remove silicon dioxide and then wash with propanone

evaporate the filtrate to get cetyl alcohol

[6]

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CANDIDATE NAME

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* 8 9 5 5 2 3 8 2 3 1 *

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **October/November 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

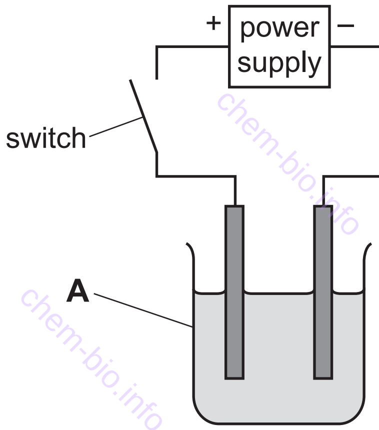
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction 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 [ ].

This document has **12** pages. Blank pages are indicated.

1 The diagram shows the apparatus used to pass an electric current through concentrated hydrochloric acid. Hydrogen and chlorine were formed at the electrodes.



(a) Name the item of apparatus labelled **A**.

beaker .... [1]

(b) The electrodes were made of platinum.

(i) Give **two** reasons why platinum is a suitable material for the electrodes.

1 inert / unreactive

2 conducts electricity

[2]

(ii) Suggest another material suitable to use as electrodes in this experiment.

graphite .... [1]

(c) The teacher doing this experiment wore safety glasses, gloves, had their hair tied back and stood up throughout the experiment.

State **one** other safety precaution that should be taken when doing this experiment. Explain your answer.

safety precaution fume cupboard

explanation chlorine is toxic

[2]

[Total: 6]

2 A student investigated the rate of a reaction between sodium metabisulfite and potassium iodate. In the reaction, starch was used as an indicator. At first the reacting mixture remained colourless but then suddenly changed to a blue-black colour.

Five experiments were done. In each experiment the total volume of liquid was 45 cm^3.

Experiment 1

- Using a 10 cm^3 measuring cylinder, 5 cm^3 of aqueous sodium metabisulfite was poured into a beaker.
- Using another 10 cm^3 measuring cylinder, 5 cm^3 of aqueous starch was poured into the beaker.
- Using a 25 cm^3 measuring cylinder, 15 cm^3 of distilled water was poured into the beaker.
- Using another 25 cm^3 measuring cylinder, 20 cm^3 of aqueous potassium iodate was poured into the beaker. At the same time a stop-clock was started.
- The mixture in the beaker was stirred until a sudden colour change was seen.
- The stop-clock was immediately stopped and the time recorded.
- The beaker was rinsed with water.

Experiment 2

- Experiment 1 was repeated using 17 cm^3 of distilled water and 18 cm^3 of aqueous potassium iodate.

Experiment 3

- Experiment 1 was repeated using 21 cm^3 of distilled water and 14 cm^3 of aqueous potassium iodate.

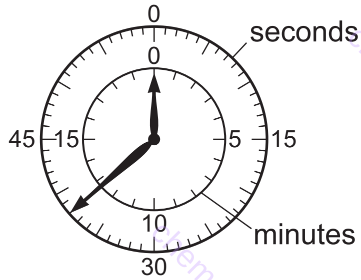
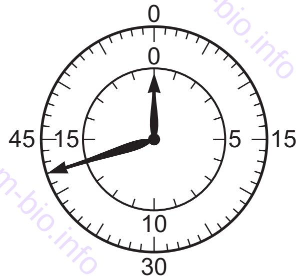
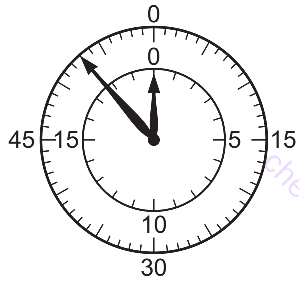
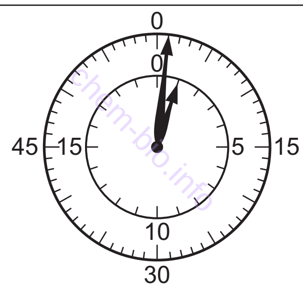
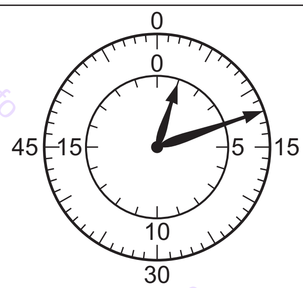
Experiment 4

- Experiment 1 was repeated using 23 cm^3 of distilled water and 12 cm^3 of aqueous potassium iodate.

Experiment 5

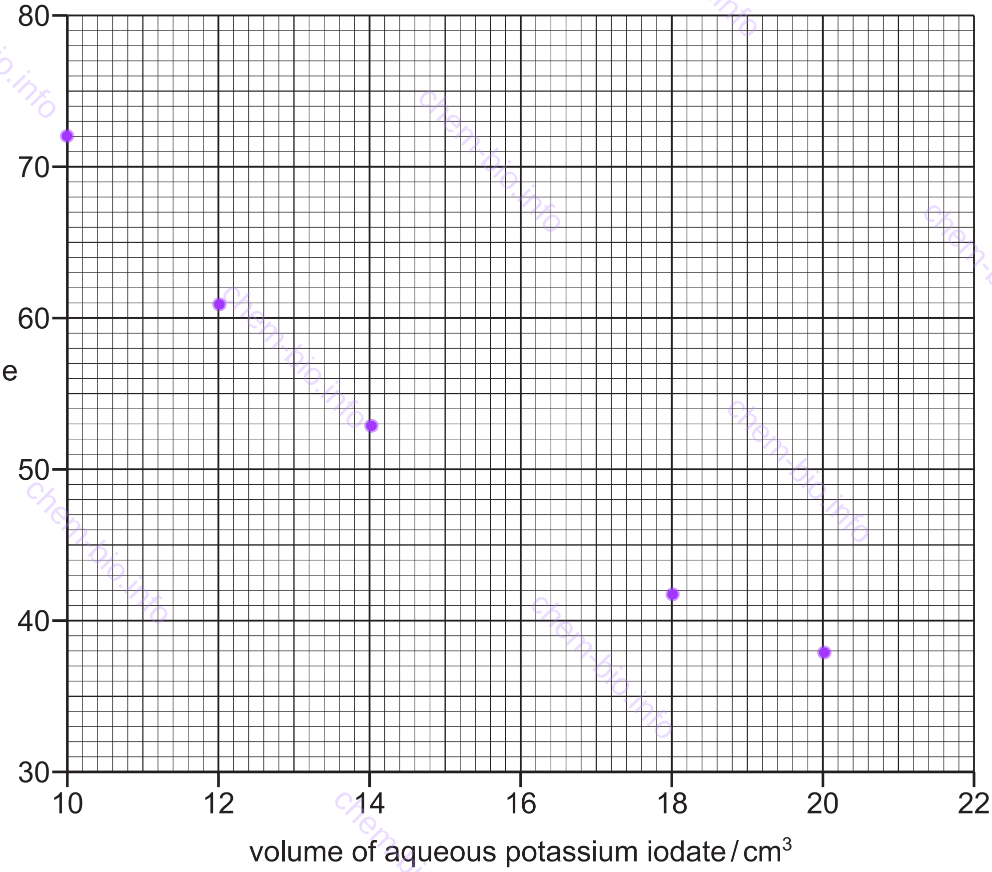
- Experiment 1 was repeated using 25 cm^3 of distilled water and 10 cm^3 of aqueous potassium iodate.

(a) Use the information in the description of the experiments and the stop-clock diagrams to complete the table. Record the times in **seconds**.

experiment	volume of aqueous sodium metabisulfite / cm^3	volume of distilled water / cm^3	volume of aqueous potassium iodate / cm^3	stop-clock diagram	time to change colour / s
1	5	15	20		38
2	5	17	18		42
3	5	21	14		53
4	5	23	12		61
5	5	25	10		72

[5]

(b) Plot the results from Experiments 1 to 5 on the grid.
Draw a smooth curve of best fit.



[3]

(c) **(i)** **From your graph**, predict the time to change colour if 16 cm^3 of aqueous potassium iodate was used.
Show clearly **on the grid** how you worked out your answer.

time to change colour = ... s [2]

(ii) Calculate the volume of distilled water required if 16 cm^3 of aqueous potassium iodate was used.

$35 - 16 = 19$

volume of distilled water = ... cm^3 [1]

(d) Sketch **on the grid** the graph you would expect if Experiments 1 to 5 were repeated at a higher temperature. [1]

(e) The concentration of potassium iodate in the reaction mixture in each experiment can be calculated using the equation shown.

$$\text{concentration} = \frac{0.05 \times \text{volume of aqueous potassium iodate}}{45}$$

(i) Calculate the concentration of potassium iodate in the reaction mixture in Experiment 2.

$0.05 \times 18 \div 45$

concentration = 0.02 mol / dm³ [1]

(ii) State which experiment, 1, 2, 3, 4 or 5, had the fastest rate of reaction.

experiment 1 [1]

(f) Suggest why the volume of distilled water added to each experiment was increased as the volume of aqueous potassium iodate was decreased.

to keep total volume constant so fair comparison

[1]

(g) Give **one** change you could make to the apparatus used which would improve the results. Explain your answer.

change to apparatus use a pipette instead of a

measuring cylinder

explanation it is more accurate

[2]

(h) How could the reliability of the results of this investigation be checked?

repeat the experiment, compare the results

to find anomalies and find the mean [1]

[Total: 18]

3 Solid **Q** and solid **R** were analysed. Solid **Q** was zinc carbonate.
Tests were done on each solid.

tests on solid Q

Complete the expected observations.

(a) Solid **Q** was placed in a boiling tube. About 10 cm^3 of dilute sulfuric acid was added to the boiling tube. Any gas produced was tested.
The contents of the boiling tube were kept for **(c)**.

observations ....bubbles........

........solid dissolves........

........lime water turns milky........ [3]

(b) Identify the gas given off in **(a)**.

........carbon dioxide........ [1]

(c) The reaction mixture from **(a)** was filtered.
The filtrate was solution **S**. 1 cm depth of solution **S** was poured into a boiling tube.

(i) Aqueous sodium hydroxide was added dropwise and then in excess to solution **S** in the boiling tube.

observations ....white precipitate which is soluble in excess........

....

.... [2]

(ii) Explain why it is **not** possible to identify the cation contained in solution **S** from your observations in **(c)(i)**.

........it could be Zn or Aluminium........

........as aluminium ions produce same result........ [1]

(iii) Suggest an additional test that can be done on solution **S** to confirm the cation was Zn^{2+}.

........add excess aqueous ammonia precipitate........

........dissolves with zinc ions but not aluminium........ [1]

tests on solid R

Tests were done and the following observations were made.

tests on solid **R**	observations
test 1 A flame test was done on solid **R**.	yellow flame
Solid **R** was dissolved in distilled water to produce solution **R**. The solution was divided into two equal portions in two test-tubes. **test 2** About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the first portion of solution **R**.	yellow precipitate formed
test 3 The second portion of solution **R** was added to 1 cm^3 of aqueous bromine in a test-tube.	the solution changed colour from orange to brown

(d) Identify solid **R**.

Sodium iodide

[2]

[Total: 10]

4 Brass is a mixture of two metals, copper and zinc.

Copper does not react with dilute sulfuric acid. Zinc reacts with hot dilute sulfuric acid to form the soluble salt zinc sulfate.

Plan an investigation to find the percentage by mass of zinc in a sample of brass.
In your answer you should include how to calculate the percentage by mass of zinc.

You have access to normal laboratory apparatus.

measure the mass of the brass using a balance

add excess sulfuric acid

filter and dry the copper residue

measure the mass of copper

% Zinc = (mass of brass - mass of copper)

÷ mass of brass x 100

[6]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3930589971

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **October/November 2020**

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

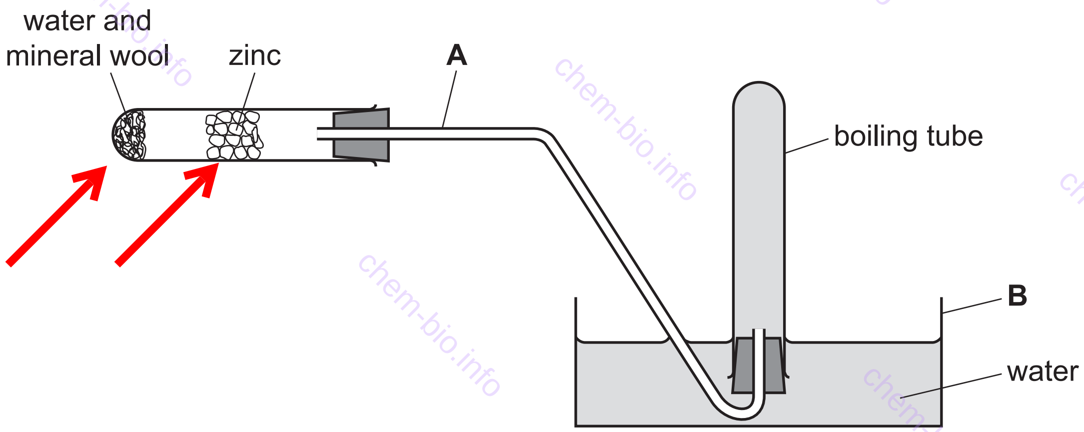
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

IB20 11_0620_63/2RP

1 Hot zinc reacts with steam to make zinc oxide and hydrogen gas.

A student wanted to use the apparatus shown to react zinc with steam and to collect the hydrogen.



(a) Name the items of apparatus labelled **A** and **B**.

A Delivery tube

B Trough

[2]

(b) State the purpose of the mineral wool.

To absorb and hold the water

[1]

(c) The apparatus shown is dangerous to use because of an error in the way it has been set up.

Identify this error.

Explain why this error makes it dangerous to use the apparatus.

error The entire heating apparatus is sealed

explanation Pressure builds up and the apparatus would explode

[2]

(d) Add **two** arrows to the diagram to show the two places where the apparatus should be heated once the error in **(c)** has been corrected. [1]

(e) Describe the test for hydrogen gas.

test Lighted splint ....

result pops ....

[2]

[Total: 8]

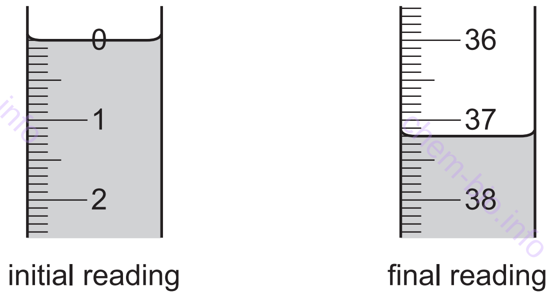
2 A student investigated the reaction between dilute ethanoic acid and two different solutions of sodium hydroxide labelled solution **A** and solution **B**.

Two experiments were done.

(a) *Experiment 1*

- A burette was rinsed with solution **A**.
- The burette was filled with solution **A**. Some of solution **A** was run out of the burette so that the level of solution **A** was on the burette scale.
- Using a measuring cylinder, 25 cm^3 of dilute ethanoic acid was poured into a conical flask.
- Five drops of thymolphthalein indicator were added to the conical flask.
- Solution **A** was added slowly from the burette to the conical flask, while the flask was swirled, until the solution just changed colour.

Use the burette diagrams to complete the table for Experiment 1.

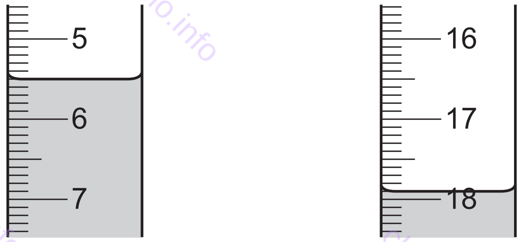


	Experiment 1
final burette reading / cm^3	37.2
initial burette reading / cm^3	0
volume of solution **A** added / cm^3	37.2

Experiment 2

- The conical flask was emptied and rinsed with distilled water.
- The burette was emptied and rinsed with distilled water.
- The burette was rinsed with solution **B**.
- The burette was filled with solution **B**. Some of solution **B** was run out of the burette so that the level of solution **B** was on the burette scale.
- Using a measuring cylinder, 25 cm^3 of dilute ethanoic acid was poured into a conical flask.
- Five drops of thymolphthalein indicator were added to the conical flask.
- Solution **B** was added slowly from the burette to the conical flask, while the flask was swirled, until the solution just changed colour.

Use the burette diagrams to complete the table for Experiment 2.



initial reading   final reading

	Experiment 2
final burette reading / cm^3	17.9
initial burette reading / cm^3	5.5
volume of solution **B** added / cm^3	12.4

[4]

(b) Explain why universal indicator is **not** a suitable indicator to use in this titration.

It is hard to determine the end point of titration with universal indicatory because it has many colours [1]

(c) **(i)** State which solution of sodium hydroxide, solution **A** or solution **B**, was the more concentrated.
Explain your answer.

B, because less volume of this solution was required to neutralise the acid [1]

(ii) State how many times more concentrated this solution of sodium hydroxide was than the other solution of sodium hydroxide.

37.2 ÷ 12.4 = 3x more concentrated

[1]

(d) Determine the volume of solution **B** that would be required if Experiment 2 was repeated with $10\,cm^3$ of dilute ethanoic acid.

10/25 x 12.4 = 4.96 cm3

[2]

(e) Describe how the reliability of the results could be checked.

Repeat and compare the results

[1]

(f) A $25\,cm^3$ pipette can be used to measure the volume of a solution.

(i) Describe an advantage of using a $25\,cm^3$ pipette to measure the volume of the dilute ethanoic acid.

It is more accurate

[1]

(ii) Explain why a $25\,cm^3$ pipette could **not** be used to measure the volume of solution **A**.

It has a fixed volume of 25 cm5

[1]

(g) **(i)** Explain why the burette was rinsed with distilled water in Experiment 2.

To remove the remaining solution A

[1]

(ii) Explain why the burette was then rinsed with solution **B**.

To remove distilled water from the previous step

[1]

(iii) State the effect that **not** rinsing the burette with solution **B** would have on the final burette reading.
Explain your answer.

effect The reading of solution B will be larger

explanation Because solution B will diluted by the water remaining in the burette

[2]

[Total: 16]

3 Two solids, solid **C** and solid **D**, were analysed.
Tests were done on each solid.

tests on solid C

Tests were done and the following observations were made.

tests on solid **C**	observations
test 1 Half of solid **C** was placed in a test-tube. The solid was heated gently and then strongly.	steam was given off and condensation appeared at the mouth of the test-tube, the remaining solid became black
The remaining solid **C** was dissolved in distilled water to produce solution **C**. The solution was divided into two equal portions in two test-tubes. **test 2** A few drops of universal indicator solution were added to the first portion of solution **C**.	the solution became orange
test 3 A spatula measure of solid sodium carbonate was added to the second portion of solution **C**. Any gas produced was tested.	effervescence was seen, the gas turned limewater milky

(a) Suggest the pH of solution **C**.

pH = 4 [1]

(b) Identify the gas produced in **test 3**.

CO2 [1]

(c) What conclusions can you make about solid **C**?

Hydrated & acidic

[2]

tests on solid D

Solid **D** was calcium chloride.

Complete the expected observations.

Solid **D** was dissolved in water to form solution **D**. Solution **D** was divided into four approximately equal portions in four test-tubes.

(d) **(i)** A few drops of aqueous sodium hydroxide were added to the first portion of solution **D**.

observations White precipitate [1]

(ii) An excess of aqueous sodium hydroxide was added to the mixture from **(d)(i)**.

observations Precipitate does not dissolve [1]

(e) Aqueous ammonia was added dropwise and then in excess to the second portion of solution **D**.

observations No change

[2]

(f) About 1 cm^3 of dilute nitric acid and a few drops of aqueous silver nitrate were added to the third portion of solution **D**.

observations White precipitate [1]

(g) About 1 cm^3 of dilute nitric acid and a few drops of aqueous barium nitrate were added to the fourth portion of solution **D**.

observations No change [1]

[Total: 10]

4 A toothpaste contains:

- sodium fluoride
- calcium carbonate
- silica
- mint flavouring.

Sodium fluoride and the mint flavouring are soluble in water.
Calcium carbonate and silica are insoluble in water.
Calcium carbonate reacts with dilute hydrochloric acid to form the soluble salt calcium chloride.

Plan an investigation to find the percentage by mass of silica in the toothpaste.

In your answer you should include how you will calculate the percentage by mass of silica in the toothpaste.

You have access to normal laboratory apparatus.

Weigh the toothpaste using a balance

Add excess HCl

Filter to remove silica

Wash the residue with distilled water

Dry the residue in an oven

Weigh the dry silica

% silica = mass silica ÷ mass of tooth paste x 100

[6]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0293365347

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **February/March 2022**

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.

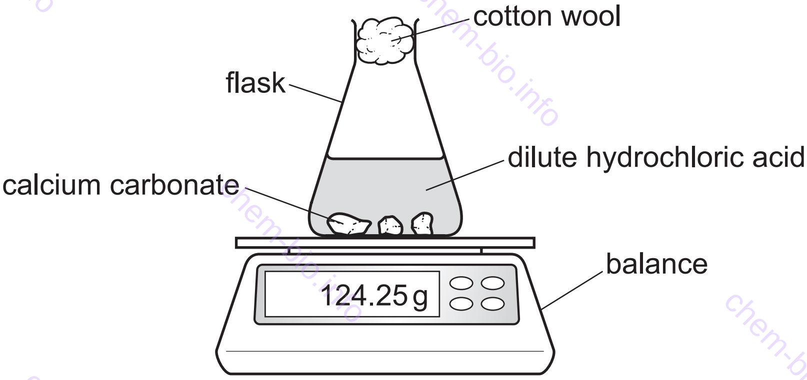
INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

1 Calcium carbonate reacts with dilute hydrochloric acid. The products of the reaction are aqueous calcium chloride, water and carbon dioxide gas.

A student investigated the rate of the reaction between calcium carbonate and dilute hydrochloric acid using the apparatus shown.



The mass of the flask and contents was recorded every 30 seconds.
When the reaction stopped there were still small pieces of calcium carbonate in the flask.

(a) State what happens to the reading on the balance as the reaction takes place.
Explain your answer.

reading on balance reading decreases

explanation carbon dioxide is released / gas is given off

.... [2]

(b) There is a piece of cotton wool in the neck of the flask.

(i) Suggest why a bung is **not** used in the neck of the flask.

to allow the gas to escape otherwise the mass won't change

.... [1]

(ii) Suggest why cotton wool is placed in the neck of the flask rather than leaving the flask open.

to prevent the liquids from splashing out

.... [1]

(c) State which reactant is in excess.

calcium carbonate [1]

(d) Describe how crystals of calcium chloride can be obtained from the mixture left in the flask after the reaction has stopped.

filter to remove excess calcium carbonate

evaporate the water until point of crystallisation

cool down the mixture

[3]

[Total: 8]

2 A student investigated the temperature change when anhydrous lithium chloride dissolves in water.

The student did six experiments.

(a) *Experiment 1*

- Using a measuring cylinder, $30\,cm^3$ of distilled water was poured into a $100\,cm^3$ beaker.
- The initial temperature of the water was measured using a thermometer.
- 1.0 g of anhydrous lithium chloride was added to the water in the beaker. At the same time a timer was started.
- The water and lithium chloride mixture was continually stirred using a thermometer.
- The temperature of the mixture was measured after 30 seconds.
- The beaker was rinsed with distilled water.

Experiment 2

- Experiment 1 was repeated using 1.5 g of anhydrous lithium chloride instead of the 1.0 g of anhydrous lithium chloride.

Experiment 3

- Experiment 1 was repeated using 2.0 g of anhydrous lithium chloride instead of the 1.0 g of anhydrous lithium chloride.

Experiment 4

- Experiment 1 was repeated using 2.5 g of anhydrous lithium chloride instead of the 1.0 g of anhydrous lithium chloride.

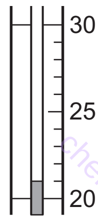
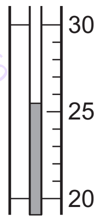
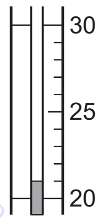
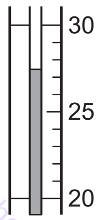
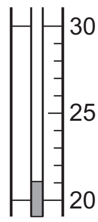
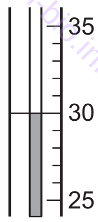
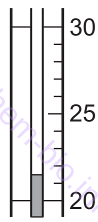
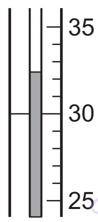
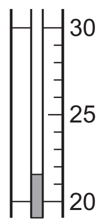
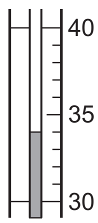
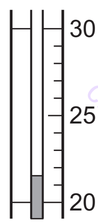
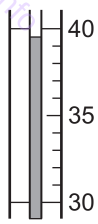
Experiment 5

- Experiment 1 was repeated using 3.0 g of anhydrous lithium chloride instead of the 1.0 g of anhydrous lithium chloride.

Experiment 6

- Experiment 1 was repeated using 4.0 g of anhydrous lithium chloride instead of the 1.0 g of anhydrous lithium chloride.

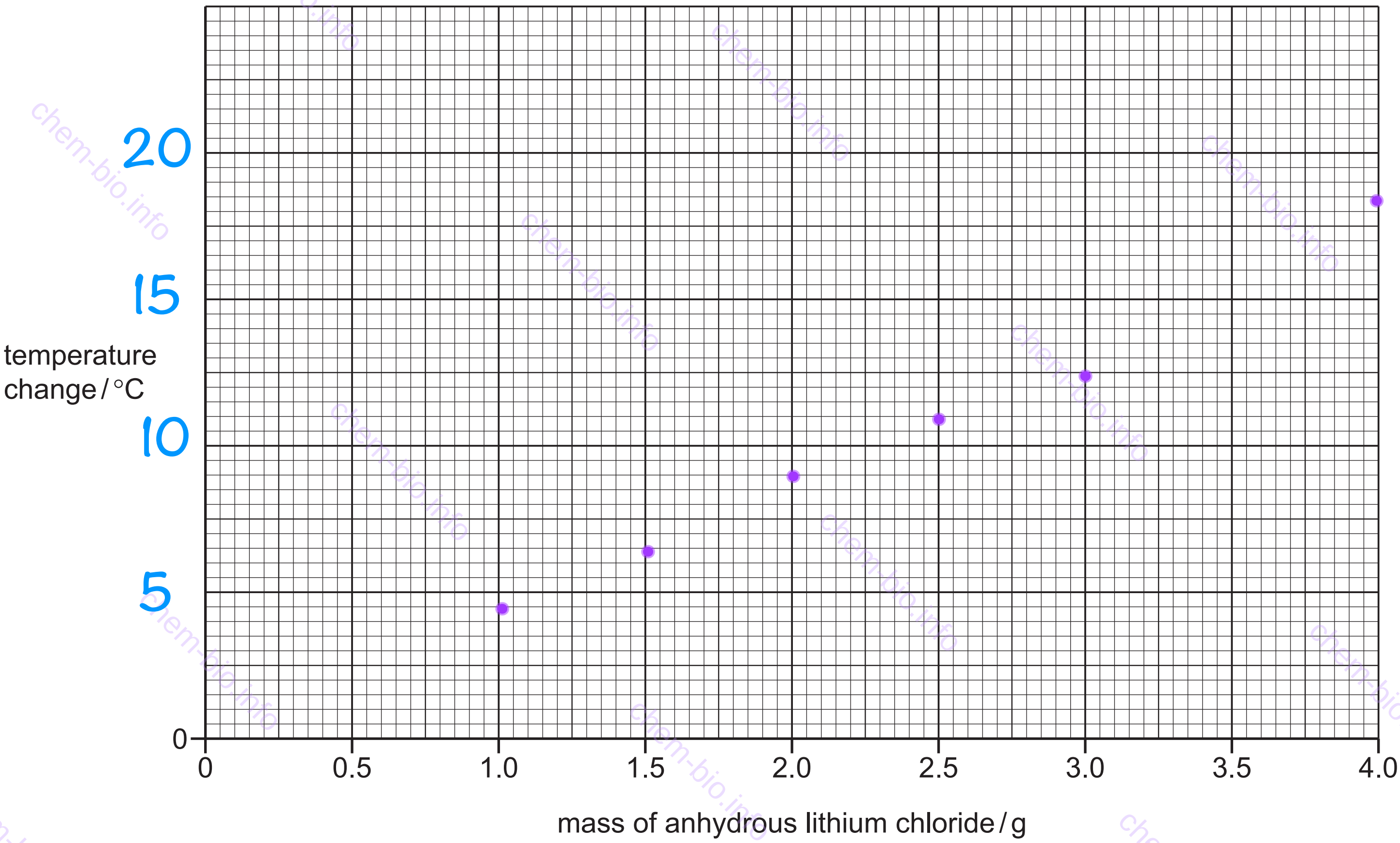
Use the thermometer diagrams to complete the table and calculate the temperature changes.

experiment	mass of anhydrous lithium chloride / g	initial		after 30 seconds		temperature change / °C
		thermometer diagram	temperature / °C	thermometer diagram	temperature / °C	
1	1.0		21		25.5	4.5
2	1.5		21		27.5	6.5
3	2.0		21		30	9
4	2.5		21.5		32.5	11
5	3.0		21.5		34	12.5
6	4.0		21.5		39.5	18

[5]

(b) Complete a suitable scale on the *y*-axis and plot the results from Experiments 1 to 6 on the grid.

Draw a straight line of best fit through your points. The straight line must pass through (0,0).



[5]

(c) **From your graph**, deduce the temperature change when 3.2 g of anhydrous lithium chloride is dissolved in 30 cm^3 of distilled water.

Show clearly **on the grid** how you worked out your answer.

temperature change = ... °C [2]

(d) Estimate the temperature change if Experiment 6 is repeated using 60 cm^3 of water instead of 30 cm^3 of water. Give a reason for your answer.

9 oC

heat is spread over double the volume of water

.... [2]

(e) Suggest **two** changes that could be made to the apparatus to improve the accuracy of the results. For each change explain why it improves the accuracy of the results.

change 1 ...... use a burette to measure 30 cm3 of water / pipette

explanation 1 more accurate than a measuring cylinder ......

....

change 2 ...... use a polystyrene cup instead of a beaker ......

explanation 2 .. to reduce heat loss / for insulation ......

....

[4]

[Total: 18]

3 Solution **A** and solid **B** were analysed. Solution **A** was aqueous copper(II) bromide.
Tests were done on each substance.

Complete the expected observations.

tests on solution A

Solution **A** was divided into three approximately equal portions in three test-tubes.

(a) The end of a piece of wire was dipped into the first portion of solution **A**. The end of the wire was then placed at the edge of a roaring Bunsen burner flame.

observations ......blue- green / green...... [1]

(b) To the second portion of solution **A** aqueous ammonia was added dropwise until in excess.

observations ......blue precipitate that dissolves in excess......

......ammonia and turns into a dark blue solution......

.... [3]

(c) To the third portion of solution **A** about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added.

observations ......cream precipitate......

.... [1]

tests on solid B

tests	observations
Solid **B** was added to 15 cm^3 of water in a boiling tube. A bung was placed in the boiling tube and it was shaken to dissolve solid **B** and form solution **B**. Solution **B** was divided into three approximately equal portions in three test-tubes. **test 1** The first portion of solution **B** was tested using universal indicator paper.	the universal indicator paper turned blue
test 2 To the second portion of solution **B** aqueous sodium hydroxide was added dropwise and then in excess.	a white precipitate formed which remained when excess aqueous sodium hydroxide was added
test 3 To the third portion of solution **B** aqueous ammonia was added dropwise and then in excess.	the solution remained colourless

(d) Deduce the pH of solution **B**.

pH = 8 - 14 [1]

(e) Identify solid **B**.

calcium hydroxide

.... [2]

[Total: 8]

4 Fizzy drinks contain carbon dioxide gas dissolved in a liquid. The carbon dioxide gas can be removed from the fizzy drink by heating.

Plan an investigation to find the volume of carbon dioxide gas in 1 dm^3 of a fizzy drink.
Include in your answer how you will calculate the volume of carbon dioxide gas dissolved in 1 dm^3 of a fizzy drink.

You are provided with a small sample (less than 1 dm^3) of the fizzy drink and common laboratory apparatus.
(1 dm^3 = 1000 cm^3)

measure a fixed volume of the drink
warm up gently in a test-tube using Bunsen burner
until the there's no more fizz
collect the gas released in a gas syringe
record the volume of the gas
volume per 1 dm3 =
(gas volume collected x 1000) ÷ volume of drink

[6]

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CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **February/March 2021**

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.

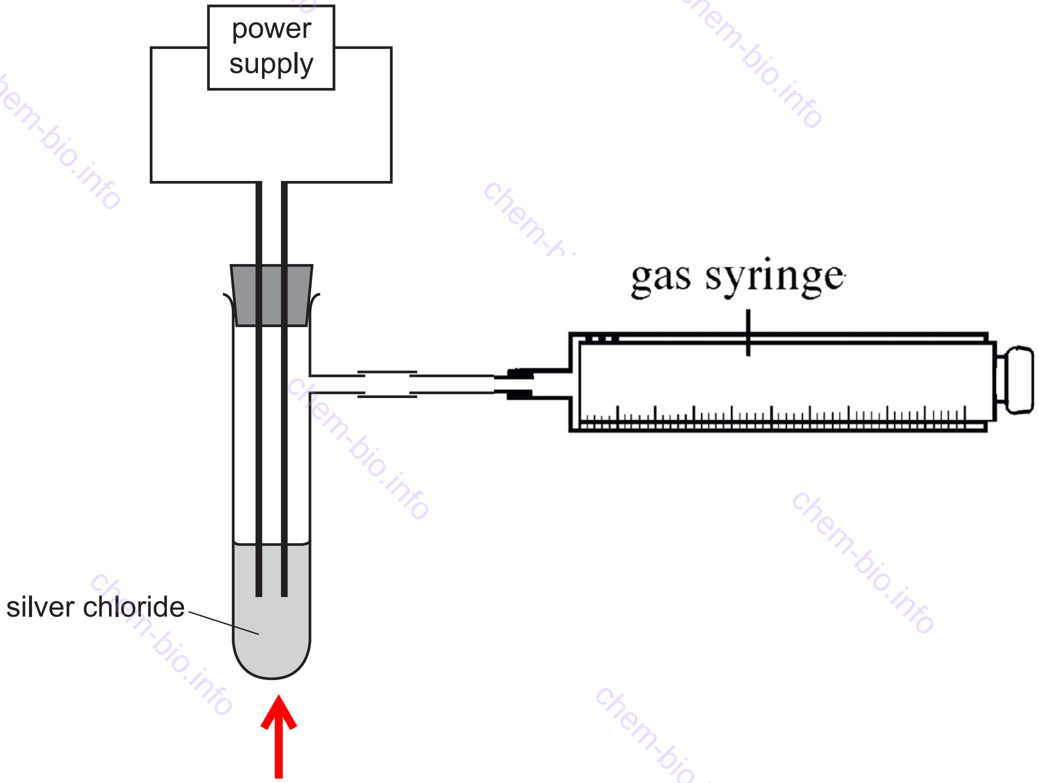
INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

IB21 03_0620_62/2RP

1 Silver chloride is an ionic compound and is insoluble in water. Molten silver chloride breaks down during electrolysis. The products are chlorine and silver.
Chlorine gas is soluble in water and toxic.

A student suggests using the apparatus shown to break down silver chloride.



(a) Draw an arrow on the diagram to show where heat must be applied so that the silver chloride can break down. [1]

(b) Complete the diagram to show how chlorine gas can be collected and the volume of the chlorine measured. Label any apparatus you have drawn. [2]

(c) Give **two** observations that are made as the silver chloride breaks down.

1 pale green gas at the anode

2 Bubbles at the anode

[2]

Silvery metal at the cathode

(d) The person doing the experiment followed all normal laboratory safety rules.

State **one** additional safety precaution that should be taken when doing this experiment. Give a reason for your answer.

safety precaution ....Use fume a cupboard....

reason ....Chlorine is a toxic gas....

[2]

(e) Suggest **one** reason why zinc is **not** a suitable material to use as the electrodes.

....Zinc is reactive, it'll react with chlorine....

.... [1]

(f) The chlorine gas was bubbled into an aqueous solution of a sodium salt. The colour of the solution changed from colourless to orange.

Identify the sodium salt and explain what has happened to cause the colour change.

sodium salt ....Sodium bromide....

explanation ....Chlorine is more reactive than bromine....

....

[2]

[Total: 10]

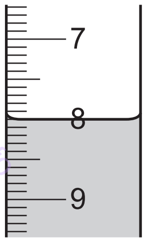
2 A student investigated the reaction between aqueous potassium hydroxide and two different aqueous solutions of hydrochloric acid labelled solution **A** and solution **B**.

Two experiments were done.

(a) *Experiment 1*

- A burette was filled with solution **A**. Some of solution **A** was run out of the burette so that the level of solution **A** was on the burette scale.
- A measuring cylinder was used to measure 25 cm^3 of the aqueous potassium hydroxide.
- The aqueous potassium hydroxide was poured into a conical flask.
- Five drops of methyl orange indicator were added to the conical flask.
- Solution **A** was added slowly from the burette to the conical flask, while the flask was swirled, until the solution just changed colour.

Use the burette diagrams to complete the table for Experiment 1.



initial reading

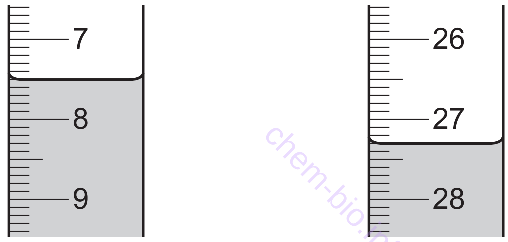
final reading

	Experiment 1
final burette reading / cm^3	17.9
initial burette reading / cm^3	8
volume of solution **A** added / cm^3	9.9

Experiment 2

- The conical flask was emptied and rinsed with distilled water.
- The burette was emptied and rinsed with distilled water.
- The burette was rinsed with solution **B**.
- The burette was filled with solution **B**. Some of solution **B** was run out of the burette so that the level of solution **B** was on the burette scale.
- A measuring cylinder was used to measure 25 cm^3 of the aqueous potassium hydroxide.
- The aqueous potassium hydroxide was poured into the conical flask.
- Five drops of methyl orange indicator were added to the conical flask.
- Solution **B** was added slowly from the burette to the conical flask, while the flask was swirled, until the solution just changed colour.

Use the burette diagrams to complete the table for Experiment 2.



initial reading   final reading

	Experiment 2
final burette reading / cm^3	27.3
initial burette reading / cm^3	7.5
volume of solution **B** added / cm^3	19.8

[4]

(b) State the colour change observed in the conical flask at the end-point in Experiment 2.

from Yellow to Organge [1]

(c) Before starting the titration in Experiment 2 the conical flask was rinsed with water.

(i) Explain why the conical flask was rinsed with water.

To remove remaining solution A [1]

(ii) The conical flask was **not** then rinsed with aqueous potassium hydroxide.

State how rinsing the conical flask with aqueous potassium hydroxide would change the volume of solution **B** needed. Explain your answer.

Some potassium hydroxide will remain in the flask, so more of solution B will be needed to neutralise [2]

(d) (i) Deduce which aqueous solution of hydrochloric acid, **A** or **B**, was more concentrated. Explain your answer.

A, less volume of A was required to neutralise potassium hydroxide [1]

(ii) Deduce how many times more concentrated this solution of hydrochloric acid was than the other solution of hydrochloric acid.

$19.8 \div 9.9 = 2x$ [1]

(e) Explain why Experiment 1 and Experiment 2 should be repeated.

A repeat is needed to find the average and to spot any anomalous result [1]

(f) Deduce the volume of solution **B** required if Experiment 2 is carried out with 50 cm^3 of aqueous potassium hydroxide.

19.8 x 2 = 39.6 cm3

[2]

(g) Describe **one** change that could be made to the apparatus to improve the accuracy of the results.

Replace the measuring cylinder with a pipette

[1]

(h) Describe what effect using a larger conical flask would have on the results obtained.

No effect as the volume of solution in the flask is still the same [1]

[Total: 15]

3 Two solids, solid **C** and solid **D**, were analysed.
Tests were done on each solid.

tests on solid C

Tests were carried out and the following observations were made.

tests	observations
test 1 A flame test was carried out on solid **C**.	a red flame was seen
Solid **C** was dissolved in distilled water to produce solution **C**. **test 2** About 5 cm^3 of aqueous sodium hydroxide was added to solution **C**.	no change
test 3 A piece of aluminium foil was added to the mixture formed in **test 2**.The mixture was warmed gently and any gas produced was tested.	effervescence was seen; damp red litmus paper turned blue

(a) Name the gas that turned the damp red litmus paper blue in **test 3**.

Ammonia .... [1]

(b) Identify solid **C**.

Lithium nitrate ....

.... [2]

tests on solid D

Solid **D** was aluminium sulfate.

Complete the expected observations.

Solid **D** was dissolved in water to form solution **D**. Solution **D** was divided into four approximately equal portions in four test-tubes.

(c) Aqueous sodium hydroxide was added dropwise and then in excess to the first portion of solution **D**.

observations ...White precipitate that is soluble in excess...

.... [2]

(d) Aqueous ammonia was added dropwise and then in excess to the second portion of solution **D**.

observations ...White precipitate that is insoluble in excess...

.... [2]

(e) About 1 cm^3 of dilute nitric acid and a few drops of aqueous silver nitrate were added to the third portion of solution **D**.

observations ...No observations... [1]

(f) About 1 cm^3 of dilute nitric acid and a few drops of aqueous barium nitrate were added to the fourth portion of solution **D**.

observations ...White precipitate... [1]

[Total: 9]

4 Old concrete contains calcium carbonate. Calcium carbonate reacts with dilute hydrochloric acid.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Plan an investigation to find which of two lumps of concrete contains the larger percentage of calcium carbonate. Your plan should include how you will use your results to determine which one of the two lumps has the larger percentage of calcium carbonate.

You have access to all common laboratory materials and a supply of dilute hydrochloric acid.

Take 10 g of the first concrete

Crush using a pestle and mortar

Add excess HCl in a conical flask

Filter the concrete left in the flask

Dry and measure its mass

Repeat with the second concrete and compare final mass

The concrete the has a lower final mass is the one

that has more calcium carbonate

[6]

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CENTRE NUMBER						CANDIDATE NUMBER					

* 8 7 1 3 5 3 2 2 6 8 *

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **February/March 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 **16** pages. Any blank pages are indicated.

1 Calcium carbonate is an insoluble solid.
Calcium carbonate can be made by adding excess aqueous calcium chloride to aqueous sodium carbonate.

$$CaCl_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2NaCl(aq)$$

A student makes a sample of calcium carbonate.
The first two steps of the method are shown in Fig. 1.1.

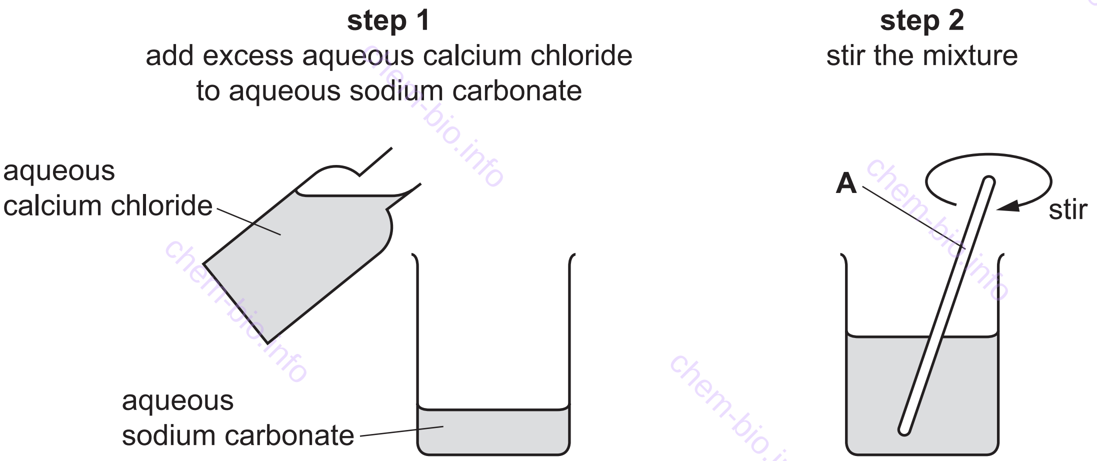

Fig. 1.1

(a) Name the item of apparatus labelled **A** in Fig. 1.1.

glass rod / stirring rod .... [1]

(b) Suggest why the mixture is stirred in **step 2**.

to allow the reactant to collide and speed up

the rate of reaction .... [1]

(c) After **step 2** the student filters the mixture to remove the solid calcium carbonate formed and collect the filtrate.

Draw a labelled diagram to show the apparatus used for this filtration.

[2]

(d) The solid calcium carbonate obtained by filtration is not pure.

(i) Identify **one** substance, **other** than water, which is mixed with the calcium carbonate and makes it impure.

Calcium chloride / sodium chloride [1]

(ii) Describe how the substance you have identified in **(d)(i)** can be removed from the calcium carbonate.

Rinse the residue with distilled water

[1]

(e) Describe a test the student can do on the filtrate obtained in **(c)** to show that the calcium chloride used is in excess. Give the result the student obtains if the calcium chloride is in excess.

test add HCl Add aqueous NaOH

result Effervescence White precipitate insoluble in excess

[2]

[Total: 8]

2 A student investigates the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid, labelled **A** and **B**.

The student does three experiments.

Experiment 1

- Rinse a burette with distilled water and then with dilute hydrochloric acid **A**.
- Rinse a conical flask with distilled water.
- Fill the burette with dilute hydrochloric acid **A**. Run some of the dilute hydrochloric acid out of the burette so that the level of the dilute hydrochloric acid is on the burette scale.
- Record the initial burette reading.
- Use a measuring cylinder to pour $25\,cm^3$ of aqueous sodium carbonate into the conical flask.
- Add five drops of methyl orange indicator to the conical flask.
- Stand the conical flask on a white tile.
- Slowly add dilute hydrochloric acid **A** from the burette to the conical flask, while swirling the flask, until the solution becomes orange.
- Record the final burette reading.

Experiment 2

- Refill the burette with dilute hydrochloric acid **A**. Run some of the dilute hydrochloric acid out of the burette so that the level of the dilute hydrochloric acid is on the burette scale.
- Record the initial burette reading.
- Empty the conical flask and rinse it with distilled water.
- Use the measuring cylinder to pour $25\,cm^3$ of aqueous sodium carbonate into the conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Stand the conical flask on a white tile.
- Slowly add dilute hydrochloric acid **A** from the burette to the conical flask, while swirling the flask, until the solution becomes colourless.
- Record the final burette reading.

Experiment 3

- Repeat Experiment 1, using dilute hydrochloric acid **B** instead of dilute hydrochloric acid **A**.

(a) Use the burette diagrams in Fig. 2.1, Fig. 2.2 and Fig. 2.3 to record the readings for Experiments 1, 2 and 3 in Table 2.1 and complete Table 2.1.

Experiment 1

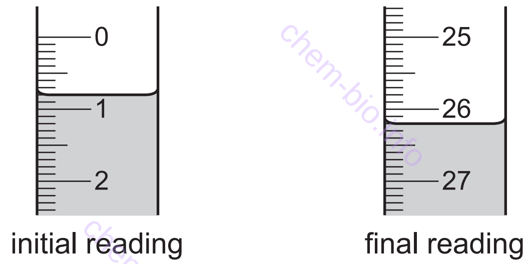

Fig. 2.1

Experiment 2

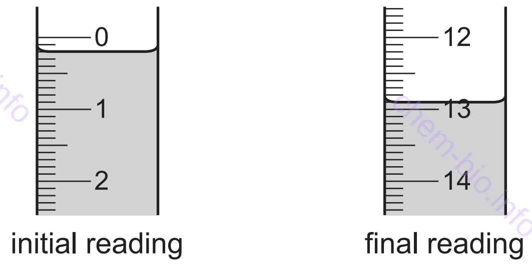

Fig. 2.2

Experiment 3

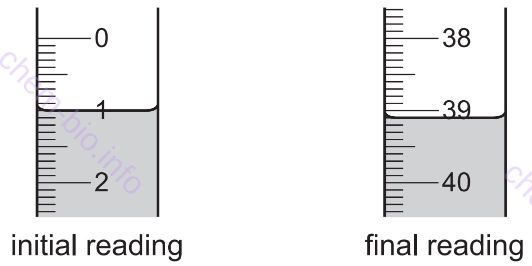

Fig. 2.3

Table 2.1

	Experiment 1	Experiment 2	Experiment 3
final burette reading / cm^3	26.2	12.9	39.1
initial burette reading / cm^3	0.8	0.2	1
volume of dilute hydrochloric acid added / cm^3	25.4	12.7	38.1

[4]

(b) (i) State which solution of dilute hydrochloric acid, **A** or **B**, is the more concentrated. Explain your answer.

more concentrated solution of dilute hydrochloric acid ....A........

explanation ....less volume of A than B was required to........

........neutralise the same alkali........ [1]

(ii) Deduce how many times more concentrated this solution of dilute hydrochloric acid is than the other solution of dilute hydrochloric acid.

........1.5x........

.... [1]

(c) (i) Compare the volume of dilute hydrochloric acid **A** used in Experiment 1 to the volume of dilute hydrochloric acid **A** used in Experiment 2.

........more volume was used in A........

........2x more volume in A than B........

.... [2]

(ii) Deduce the volume of dilute hydrochloric acid **B** required to reach the end-point if Experiment 3 is repeated using thymolphthalein indicator instead of methyl orange indicator. Use your answer to **(c)(i)** to help you.

volume of dilute hydrochloric acid **B** = ...19.05 cm3........ [2]

(d) At the start of Experiment 3 the burette is rinsed with distilled water and then with dilute hydrochloric acid **B**.

(i) Identify the substance removed from the burette when it is rinsed with distilled water at the start of Experiment 3.

Acid A .... [1]

(ii) Describe how the result of the titration would change if the burette was **not** rinsed with dilute hydrochloric acid **B** after it had been rinsed with water.

Some water remains, so acid B becomes less

concentrated and more volume of B is needed .... [1]

(iii) Explain why the conical flask is **not** rinsed with aqueous sodium carbonate after it is rinsed with water.

Some sodium carbonate remains which

increases its volume .... [1]

(e) Explain why a white tile is used during the titration.

to observe the change in colour more accurately

.... [1]

(f) Describe the effect on the result of warming the aqueous sodium carbonate used in Experiment 1 before carrying out the titration. Explain your answer.

effect .... no effect

explanation .... it doesn't affect the concentration

[2]

[Total: 16]

3 A student tests two substances: solid **C** and solid **D**.

Tests on solid C

Solid **C** is ammonium iodide.

The student dissolves solid **C** in water to form solution **C**. The student divides solution **C** into three approximately equal portions.

Complete the expected observations.

(a) To the first portion of solution **C**, the student adds about 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate.

observations no change

[1]

(b) To the second portion of solution **C**, the student adds about 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate.

observations yellow precipitate

[1]

(c) **(i)** To the third portion of solution **C**, the student adds an excess of aqueous sodium hydroxide.

observations no change

[1]

(ii) The student warms the product from **(c)(i)** and tests any gas given off.

observations damp red litmus paper turns blue

[1]

Tests on solid D

Table 3.1 shows the tests and the student's observations for solid **D**.

Table 3.1

tests	observations
test 1 Do a flame test on solid **D**.	yellow coloured flame
test 2 Gently heat about half of the remaining solid **D**. Hold a strip of anhydrous cobalt(II) chloride paper at the mouth of the boiling tube.	steam is given off and condensation forms at the top of the boiling tube the anhydrous cobalt(II) chloride paper changes colour
test 3 Dissolve the remaining solid **D** in water to form solution **D**. Divide solution **D** into three portions. To the first portion of solution **D**, add aqueous ammonia dropwise until in excess.	green precipitate which is insoluble in excess
test 4 To the second portion of solution **D**, add a piece of aluminium foil and about 5 cm^3 of aqueous sodium hydroxide. Heat the mixture formed and hold damp red litmus paper at the mouth of the boiling tube.	green precipitate the red litmus paper remains red
test 5 To the third portion of solution **D**, add about 5 cm^3 of dilute nitric acid. Bubble any gas formed through limewater.	effervescence the limewater becomes milky

(d) State the final colour of the cobalt(II) chloride paper in **test 2**.

pink .... [1]

(e) State what ion the observations in **test 4** show is **not** present.

nitrate .... [1]

(f) Identify the gas produced in **test 5**.

carbon dioxide [1]

(g) Identify the **three** ions in solid **D**.

iron(II)/ chromium(III) sodium, carbonate

[3]

[Total: 10]

4 When excess dilute sulfuric acid is added to solid zinc, hydrogen gas and aqueous zinc sulfate are made.

$$Zn(s) + H_2SO_4(aq) \rightarrow H_2(g) + ZnSO_4(aq)$$

Plan an experiment to show that copper is a catalyst for this reaction. Your plan should include how the results of the experiment will show that copper is a catalyst for this reaction.

You are provided with zinc powder, dilute sulfuric acid, copper powder and common laboratory apparatus.

.... [6]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 2 2 4 4 1 8 0 8 0 6 *

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **October/November 2022**

1 hour

You must answer on the question paper.

No additional materials are needed.

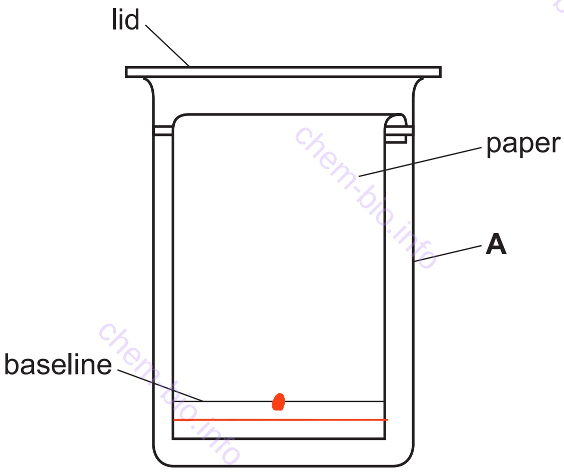
INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable 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 [ ].

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

[Turn over

1 A mixture of three coloured compounds was separated using the apparatus shown in the diagram.



(a) Give the name of the item of apparatus labelled **A**.

beaker [1]

(b) One drop of the mixture of coloured compounds was placed on the paper and some solvent was poured into **A**.

Draw **on the diagram**:

- a spot (●) to show where the drop of the mixture of coloured compounds should be placed on the paper at the start of the experiment
- a line to show the level of the solvent in **A** at the start of the experiment.

[2]

(c) Name an item of apparatus that should be used to place a drop of the mixture of coloured compounds onto the paper.

pipette/capillary tube/glass rod [1]

(d) State when the paper should be removed from the solvent in **A**.

when the solvent is near the top of the paper [1]

(e) Name this method of separation of coloured compounds.

chromatography [1]

[Total: 6]

2 A student investigated the temperature change when two different aqueous solutions of sodium hydroxide, solution **G** and solution **H**, reacted with dilute hydrochloric acid.

Two experiments were done.

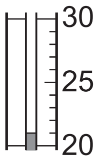
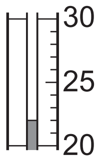
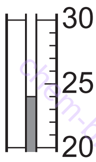
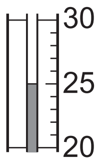
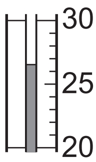
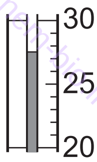
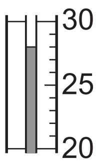
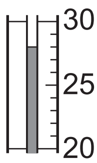
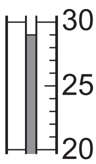
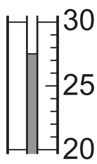
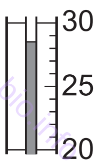
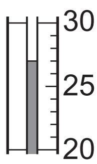
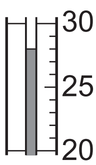
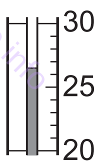
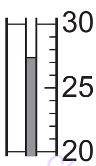
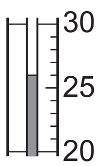
(a) *Experiment 1*

- A burette was rinsed with distilled water and then with dilute hydrochloric acid.
- The burette was filled with the dilute hydrochloric acid. The hydrochloric acid was then run out through the tap until the level was on the 0.00 cm^3 mark.
- A 50 cm^3 measuring cylinder was used to pour 20 cm^3 of solution **G** into a beaker.
- A thermometer was used to measure the initial temperature of solution **G**.
- 5 cm^3 of dilute hydrochloric acid was added from the burette into the beaker.
- The mixture in the beaker was stirred using the thermometer and the temperature of the mixture was measured.
- Another 5 cm^3 of dilute hydrochloric acid was added from the burette into the beaker.
- The mixture in the beaker was stirred using the thermometer and the temperature of the mixture was measured.
- 5 cm^3 portions of dilute hydrochloric acid continued to be added and the temperature measured until a total of 35 cm^3 of dilute hydrochloric acid had been added.

Experiment 2

- Experiment 1 was repeated using solution **H** instead of solution **G**.

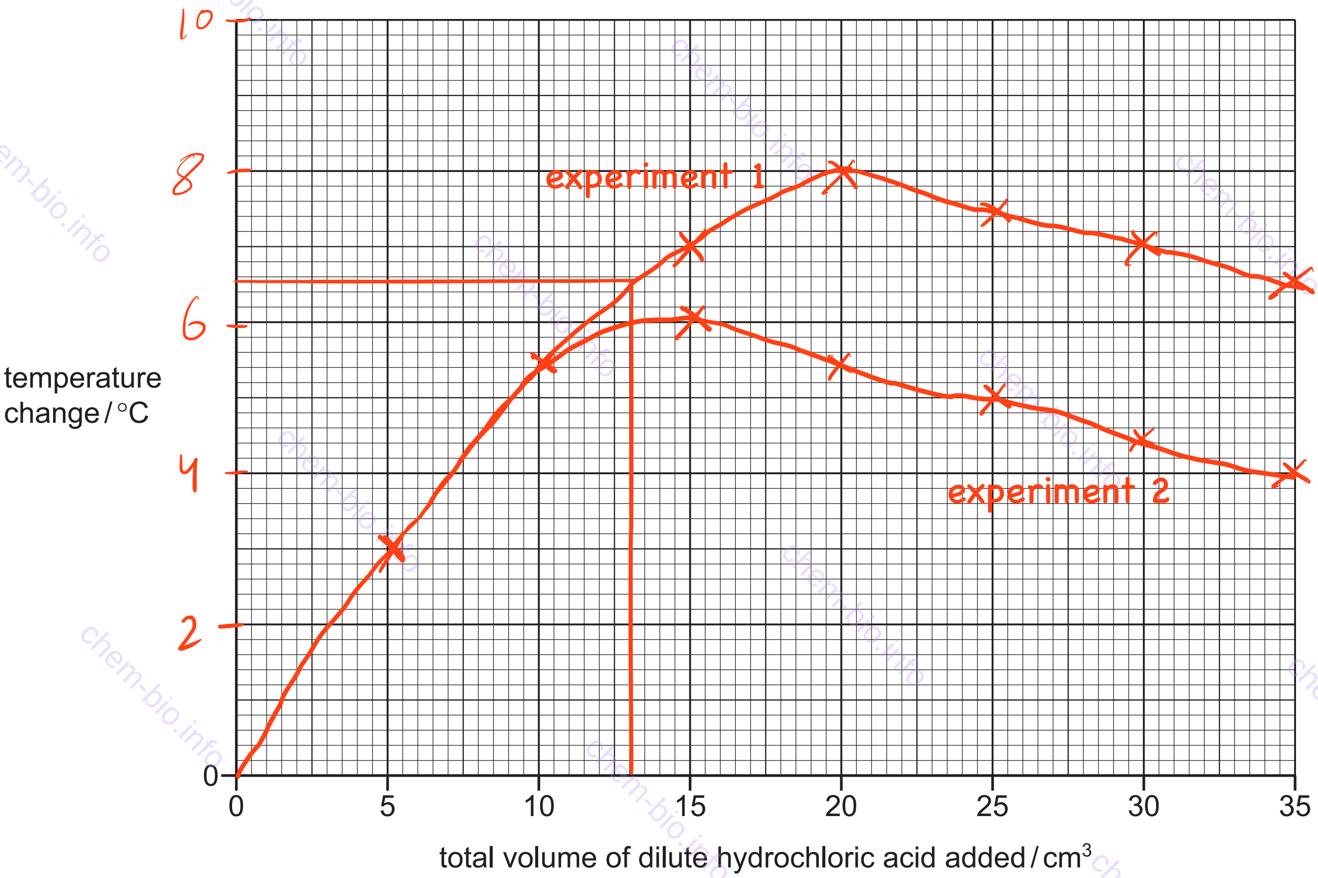
Use the thermometer diagrams to complete the table.

total volume of dilute hydrochloric acid added / cm^3	Experiment 1 using solution **G**: thermometer diagram	Experiment 1 using solution **G**: temperature / °C	Experiment 1 using solution **G**: temperature change since start / °C	Experiment 2 using solution **H**: thermometer diagram	Experiment 2 using solution **H**: temperature / °C	Experiment 2 using solution **H**: temperature change since start / °C
0		21.0			22.0	
5		24.0	3.0		25.0	3.0
10		26.5	5.5		27.5	5.5
15		28.0	7.0		28.0	6.0
20		29.0	8.0		27.5	5.5
25		28.5	7.5		27.0	5.0
30		28.0	7.0		26.5	4.5
35		27.5	6.5		26.0	4.0

[5]

(b) Complete a suitable scale on the *y*-axis and plot the results from Experiments 1 and 2 on the grid.

Draw two smooth line graphs. Both curves must start at (0,0). Clearly label your lines.



[5]

(c) **From your graph**, deduce the temperature change obtained when a total volume of 13 cm^3 of dilute hydrochloric acid is added in Experiment 1.

Show clearly **on the grid** how you worked out your answer.

temperature change = ...6.5.......... °C [2]

(d) Explain why the temperature change decreases towards the end of each experiment.

hydrochloric acid becomes in excess

reaction stopped, all of the NaOH was used up .... [1]

(e) Explain what conclusion about the concentrations of solution **G** and solution **H** can be made from the results of Experiments 1 and 2.

solution G is more concentrated than solution H

as maximum temperature change is higher in experiment 1

[2]

(f) Explain how the results obtained would be different if a polystyrene cup is used instead of the beaker.

temperature change will be higher as less heat is lost

[2]

(g) Give an advantage and a disadvantage of using a burette rather than a measuring cylinder to add the dilute hydrochloric acid to solution **G** and solution **H**.

advantage burette is more accurate

disadvantage it's slow/takes time

[2]

[Total: 19]

3 Solid **I** and solid **J** were analysed.
Tests were done on each substance.

tests on solid I

tests	observations
test 1 Dilute hydrochloric acid was added to a boiling tube containing solid **I**. Any gas produced was tested.	effervescence was seen, the solid dissolved to form a colourless solution the gas turned limewater milky
test 2 A flame test was carried out on the solution formed in **test 1**.	a red flame was seen

(a) Identify the gas made in **test 1**.

carbon dioxide/CO_2 [1]

(b) Identify solid **I**.

lithium carbonate

Li_2CO_3 [2]

tests on solid J

Solid **J** was aluminium chloride.

Solid **J** was dissolved in water to form solution **J**. Solution **J** was divided into four approximately equal portions in four test-tubes.

(c) Aqueous sodium hydroxide was added dropwise and then in excess to the first portion of solution **J**.

observations ....white precipitate........

........dissolves in excess........ [2]

(d) Aqueous ammonia was added dropwise and then in excess to the second portion of solution **J**.

observations ....white precipitate........

........remains/does not dissolve in excess........ [2]

(e) About 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate were added to the third portion of solution **J**.

observations ....no change/remains colourless........ [1]

(f) About 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the fourth portion of solution **J**.

observations ....white precipitate........ [1]

[Total: 9]

4 Hydrogels are powders that absorb water to form hydrated solids. Hydrogels and the hydrated solids formed are insoluble in water.

Plan an investigation to find which hydrogel, **hydrogel A** or **hydrogel B**, is able to absorb the greater mass of water.

You are provided with samples of **hydrogel A**, **hydrogel B**, water and common laboratory apparatus.

use a known mass of hydrogel, for example 5g
add excess water to hydrogel and stir to mix
filter to obtain solid hydrogel and excess water
weigh the mass of hydrogel
mass of water absorbed= final mass – initial mass
repeat the experiment with the other hydrogels

OR

use a known mass of hydrogel, like 5 g
add water gradually to hydrogel and stir to mix
add water until no more is being absorbed
find the mass of the hydrated hydrogel
mass of water absorbed= final mass-initial mass
repeat the experiment with the other hydrogels

[6]

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CANDIDATE NAME	

CENTRE NUMBER							CANDIDATE NUMBER					

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CHEMISTRY **0620/61**

Paper 6 Alternative to Practical **May/June 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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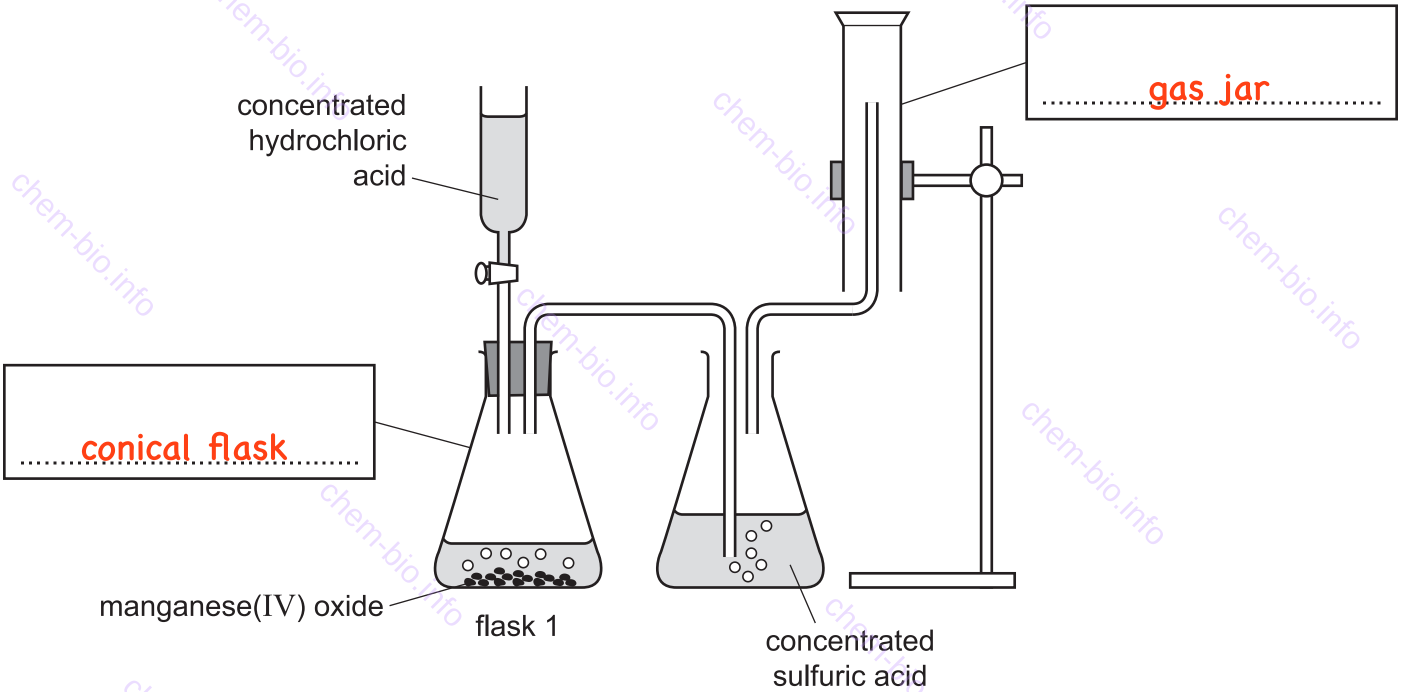
1 The diagram shows the apparatus a student used to prepare a dry sample of chlorine gas. Chlorine is more dense than air.



(a) Complete the boxes to name the apparatus. [2]

(b) Use the diagram to identify **two** mistakes the student made.

1 no bung in second flask

2 gas jar should not be inverted

[2]

(c) Suggest **one** reason why the gas produced in flask 1 is passed through concentrated sulfuric acid.

to dry the gas/remove water [1]

(d) Describe a test for chlorine.

test litmus

observations turns white/bleaches

[2]

(e) Suggest why this experiment is done in a fume cupboard.

chlorine gas is toxic [1]

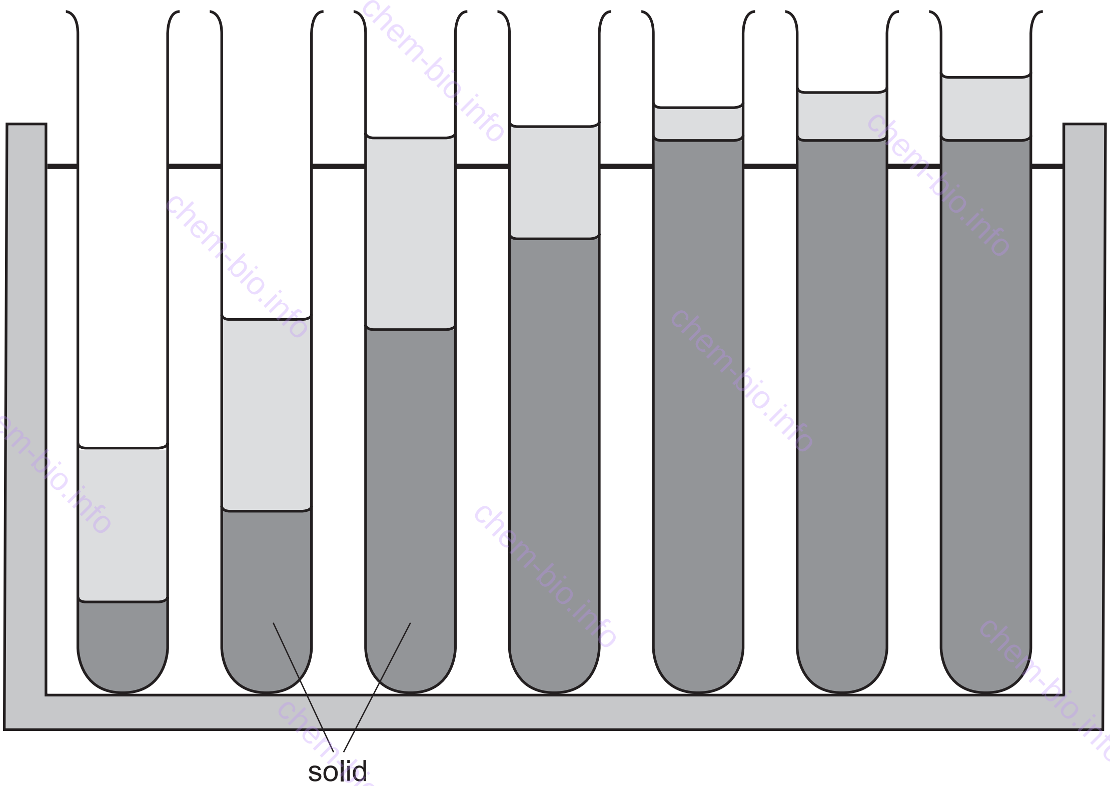
[Total: 8]

2 A student investigated the reaction between aqueous sodium carbonate and aqueous barium nitrate.

- A burette was filled with aqueous sodium carbonate.
- Seven test-tubes were labelled 1, 2, 3, 4, 5, 6 and 7.
- A measuring cylinder was used to pour 6 cm^3 of aqueous barium nitrate into each of the seven test-tubes in a test-tube rack.
- 1.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 1.
- 2.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 2.
- 4.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 3.
- 5.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 4.
- 6.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 5.
- 7.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 6.
- 8.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 7.

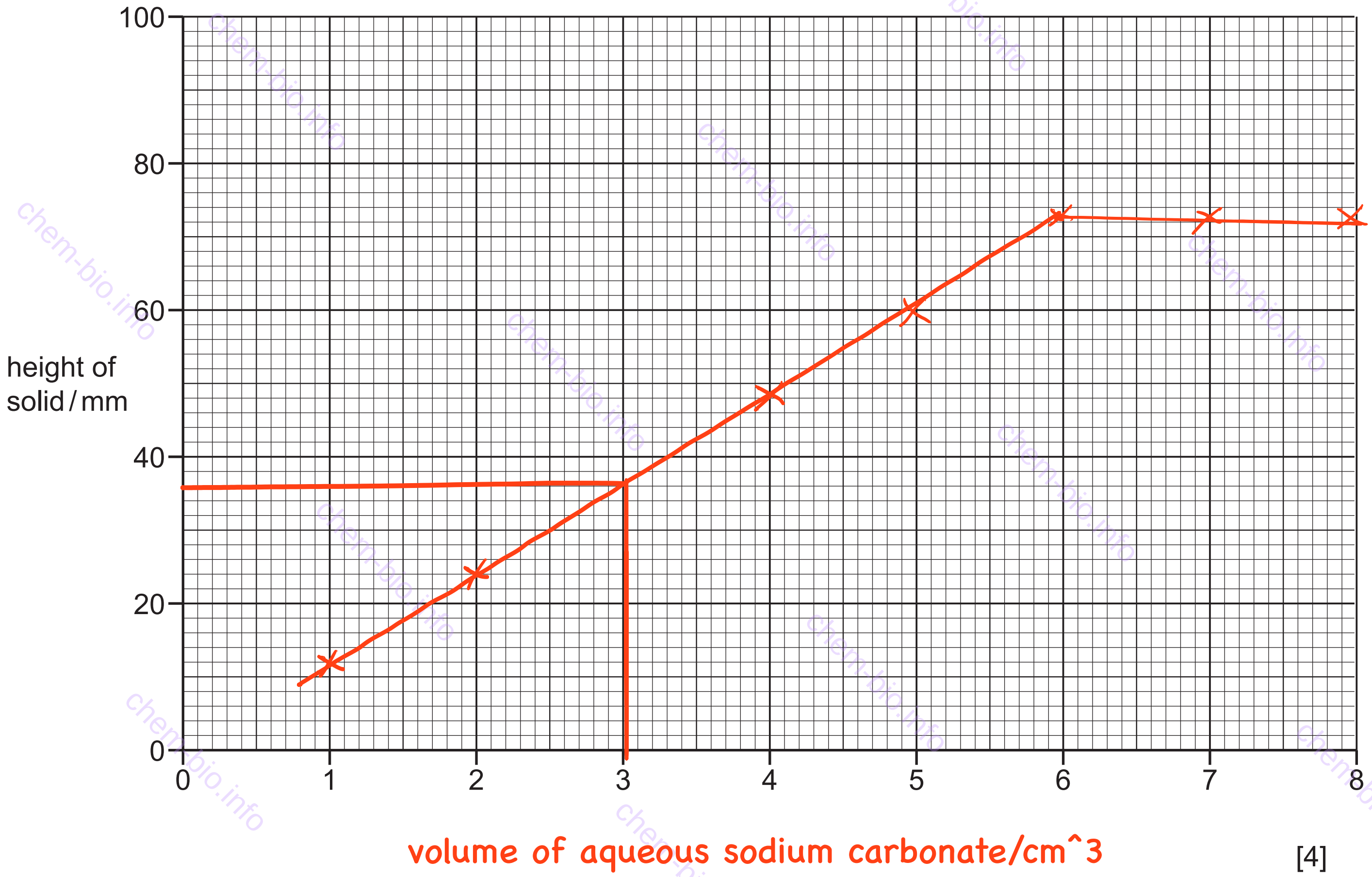
A glass rod was used to stir the contents of each of the test-tubes. The contents of the test-tubes were left to stand until the solid formed had settled. A ruler was used to measure the height of the solid formed in each test-tube.

(a) Use a ruler to measure the heights of the solid formed in each test-tube shown in the diagram. Record the heights of the solid formed in the table and complete the table.

test-tube number	1	2	3	4	5	6	7
volume of aqueous sodium carbonate / cm^3	1	2	4	5	6	7	8
							
height of solid / mm	12	24	48	60	73	73	73

[3]

(b) Plot the results on the grid. Draw **two** intersecting lines of best fit. Label the *x*-axis.



[4]

(c) **From your graph**, deduce the height of the solid formed when 3.0 cm^3 of aqueous sodium carbonate is added to 6 cm^3 of aqueous barium nitrate.

Show clearly **on the grid** how you worked out your answer.

.............36............ mm [2]

(d) Describe the trend in the heights of the solids formed in test-tubes 1–7.

....

.......height increases then levels off/becomes constant.......

.... [2]

(e) Predict what would happen if the experiment were continued using three further test-tubes each containing 6 cm^3 of aqueous barium nitrate and separately adding 9.0 cm^3, 10.0 cm^3 and 11.0 cm^3 of aqueous sodium carbonate to each one.
Explain your answer.

same heights at 73 mm

because all of the barium nitrate reacted

[2]

(f) Suggest **one** change to the **apparatus** used which could be made to obtain more accurate results.

use burette/pipette to measure the barium nitrate [1]

(g) Suggest a **different** method to measure the amount of solid formed during the experiment.

filter the solution

wash and dry the solid

weigh the solid

[3]

(h) Suggest how the reliability of the results could be checked.

repeat and compare

[1]

[Total: 18]

3 Two substances, solution **F** and solid **G**, were analysed. Solution **F** was dilute hydrochloric acid. Tests were done on solution **F** and solid **G**.

tests on solution F

Complete the expected observations.

Solution **F** was divided into four equal portions in four test-tubes.

(a) The pH of the first portion of solution **F** was tested.

pH = ...2................ [1]

(b) Magnesium ribbon was added to the second portion of solution **F**. The gas produced was tested.

observations ..bubbles/fizz/effervescence..

use a lighted splint, which will make a pop sound

.... [3]

(c) Dilute nitric acid and aqueous silver nitrate were added to the third portion of solution **F**.

observations ...white precipitate.. [1]

(d) Dilute nitric acid and aqueous barium nitrate were added to the fourth portion of solution **F**.

observations ...no reaction/change.. [1]

tests on solid G

Some of the tests and observations are shown.

tests on solid **G**	observations
The appearance of solid **G** was studied.	white solid
test 1 Dilute hydrochloric acid was added to solid **G**. The gas produced was tested. The solution formed was divided into two portions for **test 2**.	rapid effervescence limewater turned milky
test 2 An excess of aqueous sodium hydroxide was added to the first portion of the solution from **test 1**. An excess of aqueous ammonia was added to the second portion of the solution from **test 1**.	white precipitate formed which was insoluble in excess no precipitate formed

(e) Identify solid **G**.

.... calcium carbonate .... [2]

[Total: 8]

4 Steel nails rust in the presence of air and water. Plan an investigation to:

- show that coating steel nails with paint helps to protect the nails from rusting
- show that coating steel nails with zinc helps to protect the nails from rusting
- determine which coating is more effective at protecting steel nails from rusting.

You are provided with:

- uncoated steel nails
- steel nails coated with paint
- steel nails coated with zinc
- common laboratory apparatus.

weigh nails/use set number of nails

place nails in a suitable container

add water to nails

leave the nails in water for a suitable amount of time

observe the nails/reweigh the nails

repeat with nail with other coverings

nail with least rust/mass increase have the best coating

[6]

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CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

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CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **May/June 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
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Do not use staples, paper clips, glue or correction fluid.
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Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
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1 A student did the following steps to make zinc chloride crystals from solid zinc oxide.

step 1 Pour 40 cm^3 of dilute hydrochloric acid into a beaker. Add a small amount of zinc oxide. Warm the mixture and stir it.
step 2 Continue to add zinc oxide to the beaker until all of the dilute hydrochloric acid has reacted.
step 3 Remove the excess zinc oxide.
step 4 Obtain crystals of zinc chloride from the solution.

(a) Name the apparatus used in **step 1** to:

(i) add the zinc oxide

spatula [1]

(ii) warm the mixture.

Bunsen burner [1]

(b) How did the student know that all of the dilute hydrochloric acid had reacted in **step 2**?

solid remains/ZnO stops dissolving

[1]

(c) **(i)** What is meant by the term *excess* in **step 3**?

more than enough to react [1]

(ii) How is the excess zinc oxide removed in **step 3**?

filtration [1]

(d) Describe how the crystals are obtained in **step 4**.

heat/evaporate the solution
to crystallising point
leave the crystals to cool [3]

(e) Suggest how the method would differ if zinc carbonate were used instead of zinc oxide.

heating/warming not necessary [1]

[Total: 9]

2 A student investigated the rate of reaction between magnesium ribbon and solutions of dilute hydrochloric acid of different concentrations, solutions **H**, **I**, **J** and **K**. The dilute hydrochloric acid was in excess in all experiments.

Five experiments were done.

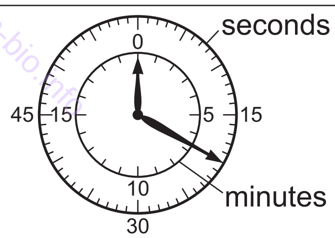
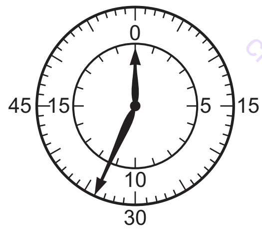
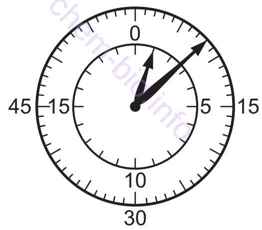
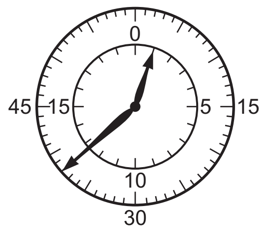
Experiment 1
- A measuring cylinder was used to pour 30 cm^3 of solution **H** into a beaker.
- A 5.0 cm length of magnesium ribbon was then added to the beaker.
- A timer was started immediately.
- The time taken for all of the magnesium ribbon to react and to disappear completely was measured.

Experiment 2
- Experiment 1 was repeated but using solution **I** instead of solution **H**.

Experiment 3
- Experiment 1 was repeated but using solution **J** instead of solution **H**.

Experiment 4
- Experiment 1 was repeated but using solution **K** instead of solution **H**.

(a) Use the stop-clock diagrams to record the time taken for each experiment in the table.

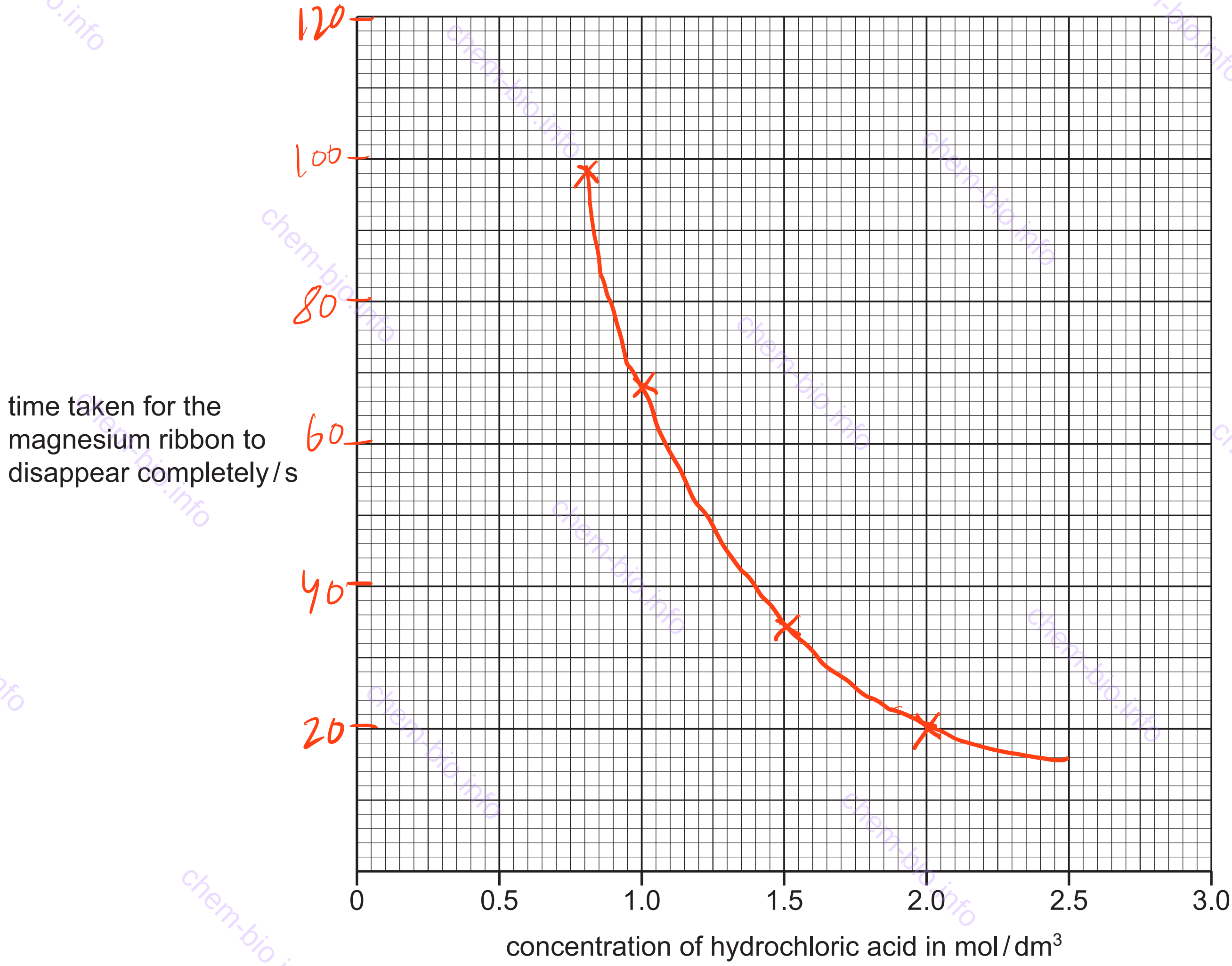
experiment	solution	concentration of hydrochloric acid in mol/dm^3	stop-clock diagram	time taken for the magnesium ribbon to disappear completely/s
1	**H**	2.0		20
2	**I**	1.5		34
3	**J**	1.0		68
4	**K**	0.8		98

[3]

Experiment 5
Solution **J** was added to some magnesium ribbon in a test-tube. The gas produced was tested. The observations were recorded in the table.

observations	rapid effervescence and the test-tube felt hot lighted splint 'popped'

(b) Plot the results for Experiments 1–4 on the grid. Draw a smooth line graph.



[3]

(c) **From your graph**, deduce the time taken for the magnesium ribbon to disappear completely if a solution of hydrochloric acid of concentration 2.5 mol / dm^3 were used.

Show clearly **on the grid** how you worked out your answer.

16 s .... [3]

(d) **(i)** Why was the same length of magnesium used in Experiments 1–4?

length is a control variable [1]

(ii) Suggest the effect on the results if Experiments 1–4 were repeated using 2.5 cm lengths of magnesium ribbon instead of 5.0 cm lengths of magnesium ribbon. Explain your answer.

results would be lower because less magnesium is used [1]

(e) Suggest a **different** method which a student could use to investigate the rate of reaction between magnesium ribbon and dilute hydrochloric acid. State the apparatus the student would use and the measurements the student would take.

apparatus gas syringe/measuring cylinder over water

measurements volume of gas

time

[3]

(f) Use the observations from Experiment 5 to answer these questions.

(i) What type of chemical reaction occurs when magnesium ribbon reacts with dilute hydrochloric acid?

exothermic/redox/displacement [1]

(ii) Identify the gas produced.

hydrogen/H2 [1]

[Total: 16]

3 Two substances, solid **L** and solid **M**, were analysed. Solid **L** was hydrated ammonium sulfate. Tests were done on solid **L** and solid **M**.

tests on solid L

Complete the expected observations.

(a) Describe the appearance of solid **L**.

....white solid....................................... [1]

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

(b) The first portion of solid **L** was heated in a hard-glass test-tube. Any gas produced was tested with cobalt(II) chloride paper.

observations ...condensation/drops on side of tube...

..........cobalt (II) chloride paper turns from blue to pink.......................... [3]

The second portion of solid **L** was added to distilled water. The mixture was shaken to dissolve solid **L** and form solution **L**. The solution of **L** was divided into two equal portions in two test-tubes.

(c) An excess of aqueous sodium hydroxide was added to the first portion of solution **L**. The mixture was heated and the gas produced was tested.

observations ...red litmus paper turns blue...

..........pungent smell.. [2]

(d) Dilute nitric acid and aqueous barium nitrate were added to the second portion of solution **L**.

observation ....white precipitate.. [1]

tests on solid M

Some of the tests and observations are shown.

tests on solid **M**	observations
Solid **M** was dissolved in water. The solution was divided into three portions. **test 1** An excess of aqueous sodium hydroxide was added to the first portion of the solution.	red-brown precipitate formed
test 2 An excess of aqueous ammonia was added to the second portion of the solution.	red-brown precipitate formed
test 3 Dilute nitric acid and aqueous silver nitrate were added to the third portion of the solution.	white precipitate formed

(e) Identify solid **M**.

iron (III) chloride/FeCl3 .... [2]

[Total: 9]

4 Azurite is an ore of copper which contains copper(II) carbonate. Azurite contains no other metal ions.

Plan an experiment to show how a sample of copper could be obtained from large lumps of azurite.

Your answer should include:

- descriptions of the reactions involved
- the expected observations.

You are provided with a large lump of azurite and common laboratory chemicals and apparatus.

crush azurite into powder using pestle and mortar
heat in crucible/test-tube with carbon/coke
or add hydrochloric acid with zinc/magnesium
reduction/displacement takes place
a brown solid forms
or electrolyse the solution, where a brown solid
forms at the negative electrode

[6]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8930451544

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **10** printed pages and **2** blank pages.

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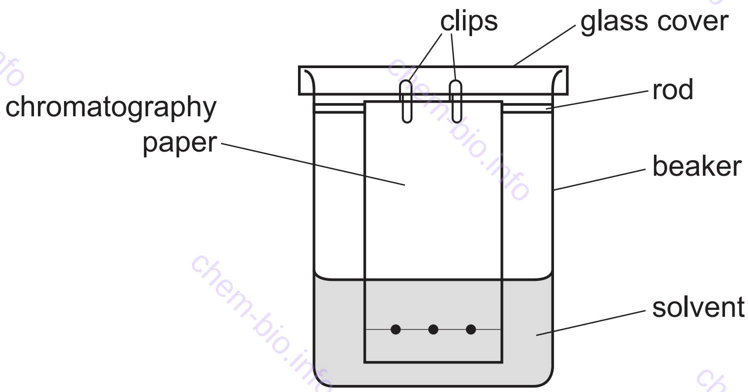
1 A student investigated the colours present in three hair dyes, **P**, **Q** and **R**, using chromatography. **P**, **Q** and **R** are insoluble in water. The student suggested setting up the apparatus for the experiment as shown.



(a) Why is a lid necessary on top of the beaker?

to prevent evaporation/loss of solvent [1]

(b) **(i)** Identify **one** mistake in the student's diagram.

solvent level above spots/hair dye samples [1]

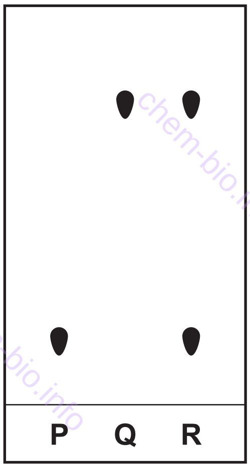
(ii) Suggest why this mistake would stop the experiment working.

dyes would mix/dissolve with the solvent/wash off paper [1]

(c) Name a suitable solvent that could be used in this experiment.

an organic solvent for example ethanol [1]

(d) A separate chromatography experiment was done using the hair dyes **P**, **Q** and **R**. The chromatogram obtained is shown.



State **three** conclusions about the hair dyes **P**, **Q** and **R** which can be deduced from the chromatogram.

1 R contains P/Q

2 R is a mixture/contains 2 colours

3 Q is a single colour/pure substance

P and Q are different colours

[3]

[Total: 7]

2 A student investigated the temperature changes when two different metals, zinc and magnesium, reacted with aqueous copper(II) sulfate.

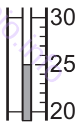
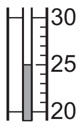
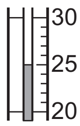
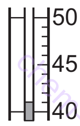
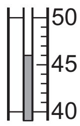
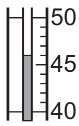
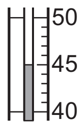
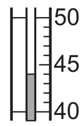
Three experiments were done.

Experiment 1

- A measuring cylinder was used to pour 25 cm^3 aqueous copper(II) sulfate into a polystyrene cup.
- The initial temperature of the solution was measured and the timer was started.
- The temperature of the solution was measured at 30 seconds and at 60 seconds.
- At 60 seconds, 5 g of zinc powder was added to the aqueous copper(II) sulfate. The mixture was stirred with a thermometer.
- The temperature of the mixture was measured every 30 seconds for 210 seconds. The mixture was stirred continuously.

  [Turn over

(a) Use the thermometer diagrams to record the temperatures in the table.

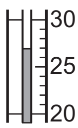
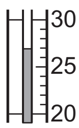
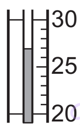
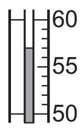
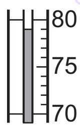
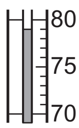
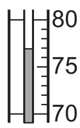
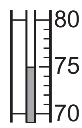
time / s	0	30	60	90	120	150	180	210
thermometer diagram								
temperature of mixture / °C	25	25	25	41	46	46	45	44

[2]

Experiment 2

- Experiment 1 was repeated using 5 g of magnesium powder instead of zinc powder.

(b) Use the thermometer diagrams to record the temperatures in the table.

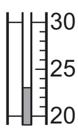
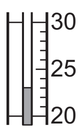
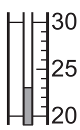
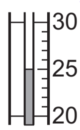
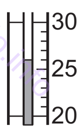
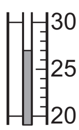
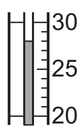
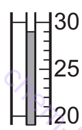
time / s	0	30	60	90	120	150	180	210
thermometer diagram								
temperature of mixture / °C	27	27	27	57	79	79	77	75

[1]

Experiment 3

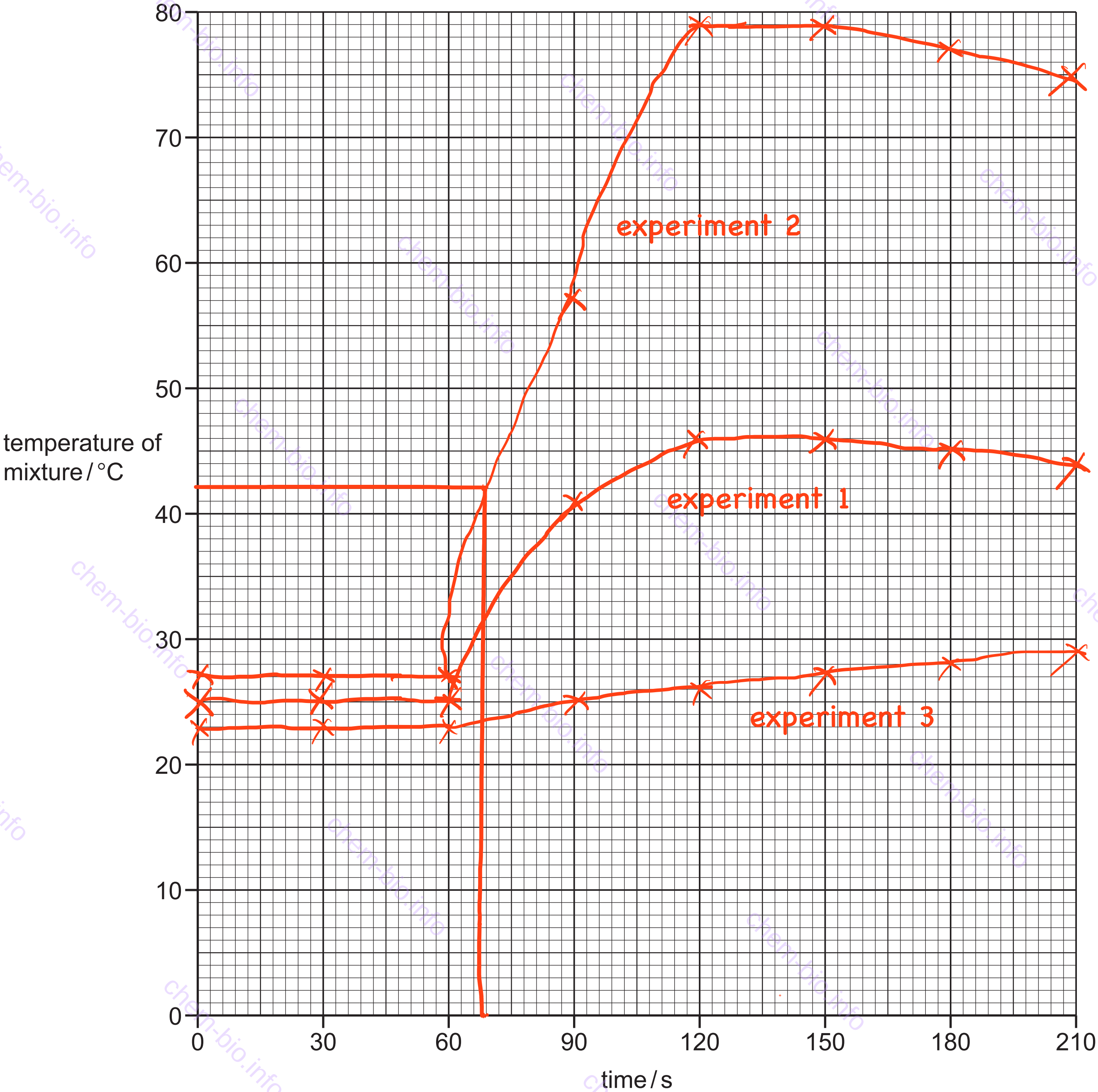
- Experiment 1 was repeated using 5 g of zinc granules instead of zinc powder.

(c) Use the thermometer diagrams to record the temperatures in the table.

time / s	0	30	60	90	120	150	180	210
thermometer diagram								
temperature of mixture / °C	23	23	23	25	26	27	28	29

[1]

(d) Plot the results for Experiments 1–3 on the grid and draw **three** smooth line graphs. Clearly label your lines.



[3]

(e) **From your graph**, deduce the temperature of the mixture in Experiment 2 after 75 seconds.

Show clearly **on the grid** how you worked out your answer.

..........42.......... °C [2]

(f) **(i)** From the results, which Experiment was the most exothermic? Explain your answer.

experiment 2

temperature change was the greatest [2]

(ii) Compare the rates of reaction in Experiments 1 and 3. Explain why the rates of reaction are different.

experiment 1 is faster than experiment 3

because surface area is greater so more frequent collisions

[2]

(g) Predict the temperature of the mixture in Experiment 2 after 2 hours. Explain your answer.

27 C since the reaction finished

[2]

(h) When doing the experiments, what would be the advantage of taking the temperature readings every 15 seconds?

more readings/points

so better/smoother graph [2]

(i) Explain why a copper can should **not** be used in place of the polystyrene cup in these experiments.

copper is a good conductor of heat

so high heat loss to the surroundings

[2]

[Total: 19]

3 Two substances, solid **N** and solid **O** were analysed. Solid **N** was hydrated aluminium sulfate. Tests were done on solid **N** and solid **O**.

tests on solid N

Complete the expected observations.

(a) Describe the appearance of solid **N**.

observation ...white solid... [1]

Solid **N** was divided into two portions.

(b) The first portion of solid **N** was heated in a hard-glass test-tube. Any gas produced was tested with cobalt(II) chloride paper.

observations ...condensation/drops on side of the tube...

...cobalt(II) chloride paper turns from blue to pink... [2]

The second portion of solid **N** was added to distilled water. The mixture was shaken to dissolve solid **N** and form solution **N**. Solution **N** was divided into two equal portions in two test-tubes.

(c) (i) Drops of aqueous sodium hydroxide were added to the first portion of solution **N** until a change was seen.

observations ...white precipitate... [1]

(ii) An excess of aqueous sodium hydroxide was then added to the mixture from **(c)(i)**.

observations ...precipitate dissolves... [1]

(d) Dilute nitric acid and aqueous barium nitrate were added to the second portion of solution **N**.

observations ...white potassium... [1]

tests on solid O

Some of the tests and observations are shown.

tests on solid **O**	observations
test 1 A flame test was done on solid **O**.	lilac flame
Solid **O** was dissolved in water. The solution was divided into two portions. **test 2** An excess of aqueous sodium hydroxide was added to the first portion of the solution.	no change
test 3 Dilute nitric acid and aqueous silver nitrate were added to the second portion of the solution.	white precipitate formed

(e) Identify solid **O**.

..........................potassium chloride.......................... [2]

[Total: 8]

4 Calcium carbonate, calcium hydroxide and calcium oxide can be used to neutralise the acid in soil.

Plan an investigation to find out which of these calcium compounds neutralises acid most effectively.

You are provided with the three calcium compounds, dilute hydrochloric acid and common laboratory apparatus and chemicals.

measure 25 cm^3 of dilute hydrochloric acid
add an indicator for example methyl orange
add 2g of a calcium compound and stir
continue adding the calcium compound until colour changes
repeat with other calcium compounds
the calcium compound that needs the smallest amount to
neutralise the acid is the most effective

OR

measure a known mass of calcium compound for example 5g
add methyl orange indicator
gradually add dilute hydrochloric acid and stir
continue adding the acid until colour changes
repeat with other calcium compounds
the calcium compound that neutralises the largest volume of acid
is the most effective

[6]

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Cambridge Assessment International Education

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 4 2 3 4 6 2 8 1 9 1 *

CHEMISTRY **0620/61**

Paper 6 Alternative to Practical **May/June 2022**

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

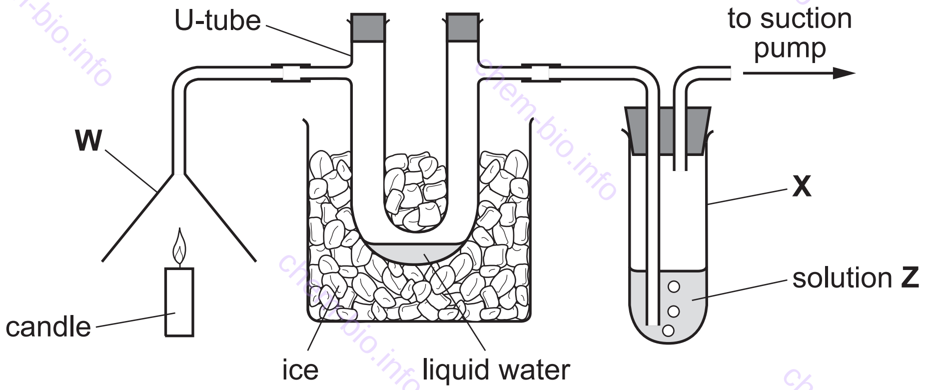
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

IB22 06_0620_61/3RP

[Turn over

1 The apparatus in the diagram was used to show that when a candle is burned both water and carbon dioxide are formed. The gases produced when the candle burns are passed through the apparatus using a suction pump.



(a) Name the items of apparatus labelled **W** and **X**.

W filter funnel

X test-tube

[2]

(b) Suggest why ice is placed around the U-tube.

to cool the steam to form water

[1]

(c) Describe how to test the liquid collected in the U-tube to show it is water.

measure the boiling point, it should be 100 C

measure the freezing point, it should be 0 C [1]

(d) Solution **Z** is used to show that carbon dioxide is produced.

Identify solution **Z**.

limewater/calcium hydroxide solution [1]

(e) Both water and carbon dioxide were made.

Identify **one** element that must be in the compound that makes up the candle.

contains carbon or hydrogen [1]

(f) Describe how the apparatus could be changed to see if sulfur dioxide is made. Give the observations if sulfur dioxide is made.

change use acidified potassium manganate(VII)

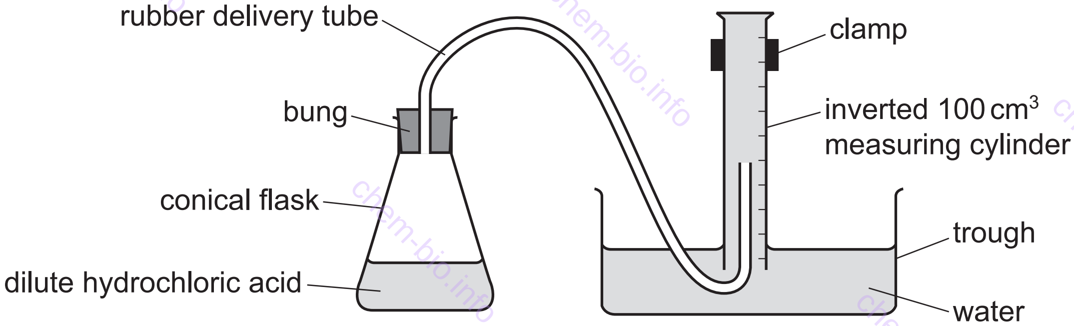
observation colour changes from purple to colourless

[2]

[Total: 8]

2 A student investigated the rate at which hydrogen gas is made when magnesium reacts with two different solutions of dilute hydrochloric acid, **C** and **D**, with different concentrations. The dilute hydrochloric acid was in excess in both experiments.

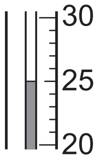
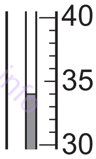
Two experiments were done using the apparatus shown.

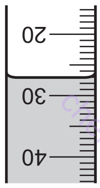
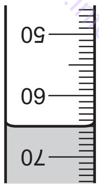
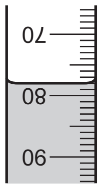
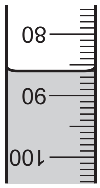
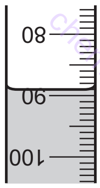
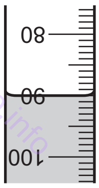
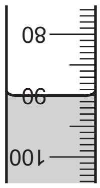


Experiment 1

- A measuring cylinder was used to pour 50 cm^3 of dilute hydrochloric acid **C** into a conical flask.
- The initial temperature of the dilute hydrochloric acid was measured using a thermometer.
- The apparatus was set up as shown in the diagram.
- The bung was removed from the conical flask and a coiled 5 cm length of magnesium ribbon was added to the flask. The bung was replaced immediately and a timer started.
- The volume of gas collected in the inverted measuring cylinder was recorded every 20 seconds for 160 seconds.
- The final temperature of the dilute hydrochloric acid in the flask was measured using a thermometer.

(a) Use the thermometer diagrams and the diagrams of inverted measuring cylinders to complete the tables.

initial		final	
thermometer diagram	temperature / °C	thermometer diagram	temperature / °C
	25.0		34.0

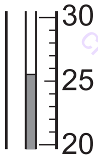
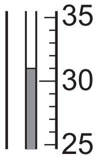
time / s	20	40	60	80	100	120	140	160
diagrams of inverted measuring cylinder								
volume of gas collected / cm^3	27	48	65	78	86	89	90	90

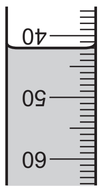
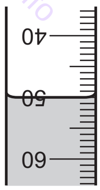
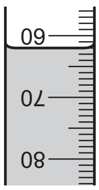
[2]

(b) *Experiment 2*

- Experiment 1 was repeated using 50 cm^3 of dilute hydrochloric acid **D** instead of dilute hydrochloric acid **C**.

Use the thermometer diagrams and the diagrams of inverted measuring cylinders to complete the tables.

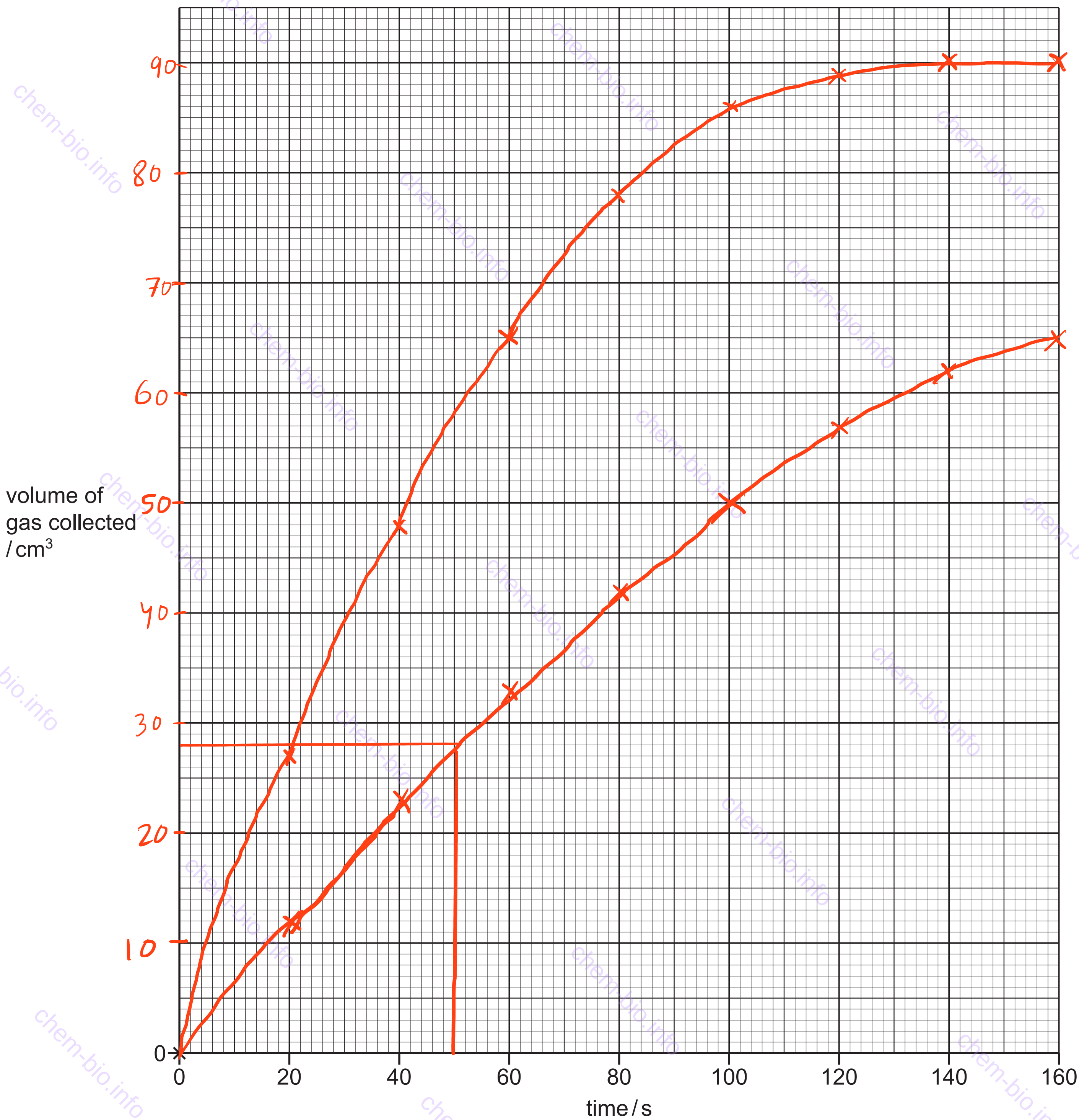
initial		final	
thermometer diagram	temperature / °C	thermometer diagram	temperature / °C
	25.5		31.0

time / s	20	40	60	80	100	120	140	160
diagrams of inverted measuring cylinder								
volume of gas collected / cm^3	12	23	33	42	50	57	62	65

[3]

(c) Complete a suitable scale on the *y*-axis and plot your results from Experiments 1 and 2 on the grid.

Draw **two** smooth line graphs. The lines must pass through (0,0). Clearly label your lines.



[5]

(d) **From your graph**, deduce the volume of gas that was collected after 50 seconds in Experiment 2.

Show clearly **on the grid** how you worked out your answer.

volume of gas = ...28 cm3.......... [3]

(e) Explain what can be deduced about the concentrations of dilute hydrochloric acid **C** and dilute hydrochloric acid **D**.

solution C is more concentrated than solution D

as reaction is faster

[2]

(f) **(i)** State what happens to the temperature of the dilute hydrochloric acid during Experiment 1.

increases [1]

(ii) State what effect this temperature change has on the total volume of gas made when the reaction has finished.

none/stays the same [1]

(iii) Describe a change that can be made to the apparatus or reagents to reduce the temperature change of the acid in Experiment 1.

use a water bath [1]

(g) Suggest why it is important to replace the bung in the conical flask immediately after adding the magnesium ribbon.

minimise gas loss

[1]

(h) State the advantage of measuring the volume of gas collected every 10 seconds rather than every 20 seconds.

more data so smoother graph/curve [1]

[Total: 20]

3 Solid **E** and solution **F** were analysed. Solid **E** was ammonium sulfate.
Tests were done on each substance.

tests on solid E

Complete the expected observations.

Solid **E** was dissolved in water to form solution **E**. Solution **E** was divided into three approximately equal portions in one boiling tube and two test-tubes.

(a) Aqueous sodium hydroxide was added to the first portion of solution **E** in a boiling tube. The mixture formed was warmed. Any gas produced was tested.

observations ....red litmus becomes blue....................

....

identity of gas ....ammonia/NH3.............................. [2]

(b) To the second portion of solution **E**, about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added.

observations ....no change/remains colourless.......... [1]

(c) To the third portion of solution **E**, about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate were added.

observations ....white precipitate.......... [1]

tests on solution F

tests	observations
Solution **F** was divided into two equal portions in two test-tubes. **test 1** A strip of universal indicator paper was placed in the first portion of solution **F**.	the universal indicator paper turned orange
test 2 The second portion of solution **F** was added to solid sodium carbonate in a boiling tube. Any gas made was tested.	effervescence and the solid disappeared limewater turned milky

(d) Deduce the pH of solution **F**.

(any in range 2-6) 3 .... [1]

(e) Identify the positive ion in solution **F**.

hydrogen/H+ .... [1]

[Total: 6]

4 A sample of muddy river water contains water, dissolved solids and insoluble solid mud.

Plan an investigation to find the concentration of dissolved solids, in g/dm^3, in the river water.

In your answer state how you will work out the concentration of the dissolved solids in g/dm^3.

You are provided with a small sample (less than $1\,dm^3$) of muddy river water and common laboratory apparatus.
($1\,dm^3 = 1000\,cm^3$)

filter the water to remove insoluble solid mud
measure the volume of the filtrate and place it in a suitable container, like beaker
heat the beaker to evaporate the filtrate
heat until all the water is gone/to constant mass/to dryness
measure the mass of the solid left
concentration: mass x 1000/volume used

[6]

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CENTRE NUMBER

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9457558127

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **May/June 2022**

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.

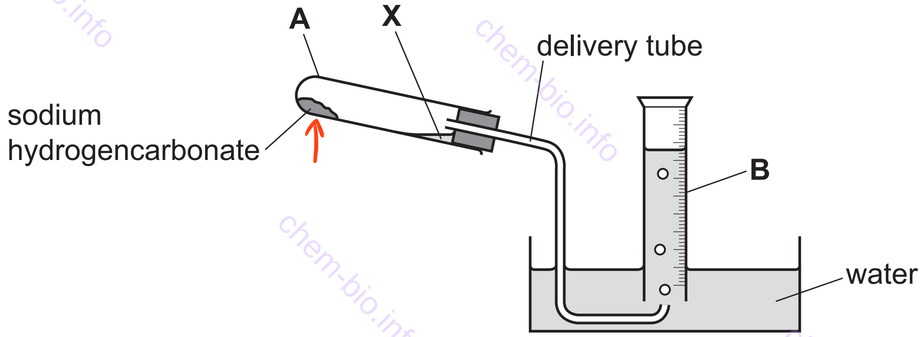
INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

1 Sodium hydrogencarbonate decomposes when heated. The products are solid sodium carbonate, water and carbon dioxide.

A student decomposed a sample of sodium hydrogencarbonate using the apparatus shown.



(a) Name the items of apparatus labelled **A** and **B**.

A test-tube

B measuring cylinder

[2]

(b) When the sodium hydrogencarbonate was heated, a colourless liquid collected at the point marked **X**.

Suggest the identity of the colourless liquid.

water/H2O [1]

(c) **On the diagram** draw one arrow to show where the apparatus should be heated during the experiment. [1]

(d) State an observation that would indicate the sodium hydrogencarbonate had stopped reacting.

no more bubbles

volume of gas stops changing [1]

(e) Explain why it is important to remove the delivery tube from the water as soon as heating is stopped.

test-tube breaks/cracks

suck back/water goes into tube

[2]

[Total: 7]

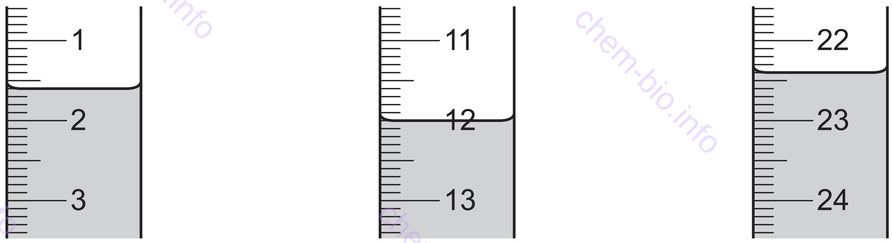
2 A student investigated the reaction between two different solutions of aqueous sodium carbonate, solution **K** and solution **L**, and dilute hydrochloric acid using two different indicators.

Two experiments were done.

Experiment 1

- A burette was rinsed with water and then with the dilute hydrochloric acid.
- The burette was filled with dilute hydrochloric acid. Some of the dilute hydrochloric acid was run out of the burette so that the level of the dilute hydrochloric acid was on the burette scale.
- Using a measuring cylinder, 25 cm^3 of solution **K** was poured into a conical flask.
- Five drops of methyl orange indicator **and** five drops of thymolphthalein indicator were added to the conical flask.
- The conical flask was placed on a white tile.
- Dilute hydrochloric acid was added slowly from the burette to the conical flask, while the flask was swirled, until the solution turned yellow. This is the first colour change.
- More dilute hydrochloric acid from the burette was added to the conical flask, while swirling the flask, until the solution changed colour again. This is the second colour change.

(a) Use the burette diagrams to complete the table for Experiment 1.



initial burette reading | burette reading at first colour change | burette reading at second colour change

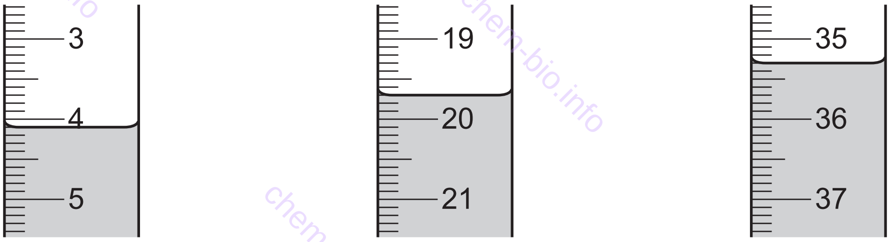
	Experiment 1
burette reading at first colour change / cm^3	12.0
final burette reading at second colour change / cm^3	22.4
initial burette reading / cm^3	1.6
volume of dilute hydrochloric acid added for first colour change / cm^3	10.4
total volume of dilute hydrochloric acid added for second colour change / cm^3	20.8

[3]

(b) *Experiment 2*

- The conical flask was emptied and rinsed with distilled water.
- Experiment 1 was repeated using solution **L** instead of solution **K**.

Use the burette diagrams to complete the table for Experiment 2.



initial burette reading

burette reading at first colour change

burette reading at second colour change

	Experiment 2
burette reading at first colour change / cm^3	19.7
final burette reading at second colour change / cm^3	35.3
initial burette reading / cm^3	4.1
volume of dilute hydrochloric acid added for first colour change / cm^3	15.6
total volume of dilute hydrochloric acid added for second colour change / cm^3	31.2

[3]

(c) State the colour change observed at the end-point when dilute hydrochloric acid is added to methyl orange in an alkaline solution.

from ....yellow........ to ....orange........ [1]

(d) For Experiment 1, compare the volume of dilute hydrochloric acid needed for the first colour change with the volume of dilute hydrochloric acid for the second colour change.

a greater volume is required to reach the second end point

the volume doubles [2]

(e) Compare the concentration of solution **K** used in Experiment 1 to the concentration of solution **L** used in Experiment 2.
Explain your answer.

smaller volume of acid is required for K/experiment 1
so L/experiment 2 is more concentrated than K

[3]

(f) **(i)** Deduce the volume of dilute hydrochloric acid needed for the second colour change when Experiment 2 is repeated using 50 cm^3 of solution **L**.

62.4 cm^3 [2]

(ii) State why using 50 cm^3 of solution **L** would cause a problem.

it's more than what can fit in the burette

[1]

(g) State the advantage of using a pipette instead of the measuring cylinder in these experiments.

more accurate [1]

(h) Explain why the conical flask was swirled as the dilute hydrochloric acid was added from the burette.

to mix the solutions

[1]

(i) At the start of Experiment 1, the burette was rinsed with water and then with dilute hydrochloric acid.
At the start of Experiment 2, the conical flask was rinsed with water but **not** with solution **L**.

(i) Explain why the conical flask was rinsed with water.

to clean/remove residues

[1]

(ii) Explain why the conical flask was **not** rinsed with solution **L** in Experiment 2.

it would add an unknown volume of solution L

[1]

[Total: 19]

3 Solid **M** and solid **N** were analysed. Solid **M** was iron(III) nitrate.
Tests were done on each substance.

tests on solid M

Complete the expected observations.

Solid **M** was dissolved in water to form solution **M**. Solution **M** was divided into two approximately equal portions in two test-tubes.

(a) To the first portion of solution **M**, aqueous sodium hydroxide was added gradually until in excess. The product was kept for **(b)**.

observations ....brown precipitate....
....it does not dissolve in excess.... [2]

(b) **(i)** The product from **(a)** was transferred to a boiling tube. A piece of aluminium foil was added and the mixture warmed gently. Any gas produced was tested.

observations ....red litmus turns blue....
.... [1]

(ii) Identify the gas made in **(i)**.

....ammonia/NH3.... [1]

(c) To the second portion of solution **M**, about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate were added.

observations ....no change/precipitate/reaction.... [1]

tests on solid N

tests	observations
test 1 A flame test was carried out on solid **N**.	the flame became red
Solid **N** was dissolved in water to form solution **N**. Solution **N** was divided equally into one test-tube and one boiling tube. **test 2** About 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the first portion of solution **N** in a test-tube.	no visible change
test 3 About 2 cm depth of dilute hydrochloric acid was added to the second portion of solution **N**. The mixture was warmed and any gas produced was tested.	acidified aqueous potassium manganate(VII) changed from purple to colourless

(d) Identify the gas produced in **test 3**.

sulfur dioxide/SO_2 [1]

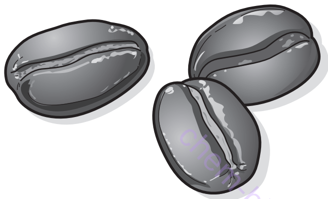
(e) Identify solid **N**.

lithium sulfite/Li_2SO_3

[2]

[Total: 8]

4 The diagram shows some coffee beans.



Caffeine occurs naturally in coffee beans. Caffeine is a white crystalline solid. It is very soluble in hot water but much less soluble in cold water.

Plan an investigation to obtain a pure crystalline sample of caffeine from coffee beans.

Assume that all other soluble substances in coffee beans are very soluble in both hot and cold water.

You are provided with coffee beans and common laboratory apparatus.

crush coffee beans to make powdered coffee using a pestle
and mortar
add water and stir to mix
heat to dissolve the powder
filter the mixture and leave the filtrate to cool/form crystals
wash and rinse the residue/crystals/caffeine

[6]

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CANDIDATE NAME

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* 3 6 1 6 3 7 9 9 2 6 *

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2022**

1 hour

You must answer on the question paper.

No additional materials are needed.

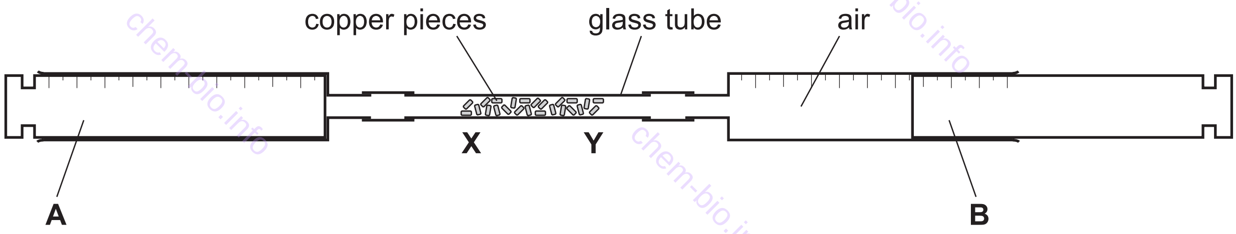
INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable 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 [ ].

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

IB22 06_0620_63/3RP

1 The apparatus shown was used to determine the percentage of oxygen in a sample of air.



The glass tube was heated strongly at **X** while the sample of air was passed backwards and forwards over the copper pieces in the tube. The source of heat was gradually moved along the tube from **X** to **Y**.
During the experiment the copper pieces in the glass tube reacted with oxygen in the sample of air.

(a) Name the item of apparatus labelled **B**.

gas syringe [1]

(b) Name the item of laboratory equipment that could be used to heat the glass tube strongly.

Bunsen burner [1]

(c) The copper pieces at **Y** did not change colour when they were heated.

Suggest why the copper pieces at **Y** did **not** change colour.

all oxygen is used up so copper does not reach

[1]

(d) (i) The table shows the volume of air in each part of the apparatus at the start of the experiment.

part of apparatus	volume of air at start / cm^3
A	0
glass tube	8
B	94

Calculate the total volume of air in the apparatus at the start of the experiment.

8+94

total volume of air at start = ...102.......... cm^3 [1]

(ii) The table shows the volume of gas in each part of the apparatus at the end of the experiment.

part of apparatus	volume of gas at end / cm^3
A	0
glass tube	8
B	75

Calculate the percentage of oxygen in the sample of air.

(19/102)x100

percentage of oxygen = ...18.6.......... [1]

[Total: 5]

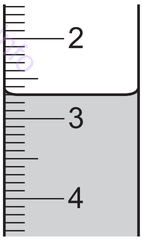
2 A student investigated the reaction between aqueous sodium hydroxide and two different solutions of dilute hydrochloric acid with different concentrations, labelled **Q** and **R**, using two different indicators.

Three experiments were done.

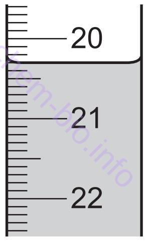
(a) *Experiment 1*

- A burette was filled with dilute hydrochloric acid **Q**. Some of the dilute hydrochloric acid was run out of the burette so that the level of the dilute hydrochloric acid was on the burette scale.
- Using a measuring cylinder, 25 cm^3 of aqueous sodium hydroxide was poured into a conical flask.
- Five drops of methyl orange indicator were added to the conical flask.
- The conical flask was placed on a white tile.
- Dilute hydrochloric acid was added slowly from the burette to the conical flask, while the flask was swirled, until the solution just changed colour.

Use the burette diagrams to complete the table for Experiment 1.



initial reading



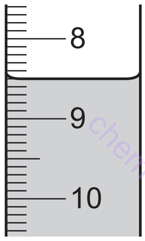
final reading

	Experiment 1
final burette reading / cm^3	20.3
initial burette reading / cm^3	2.7
volume of dilute hydrochloric acid **Q** added / cm^3	17.6

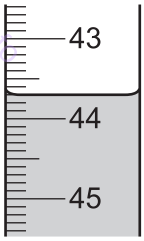
Experiment 2

- The conical flask was emptied and rinsed with distilled water.
- The burette was rinsed with distilled water and then with dilute hydrochloric acid **R**.
- Experiment 1 was repeated using dilute hydrochloric acid **R** instead of dilute hydrochloric acid **Q**.

Use the burette diagrams to complete the table for Experiment 2.



initial reading



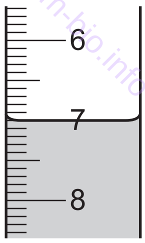
final reading

	Experiment 2
final burette reading / cm^3	43.7
initial burette reading / cm^3	8.5
volume of dilute hydrochloric acid **R** added / cm^3	35.2

Experiment 3

- The conical flask was emptied and rinsed with distilled water.
- Experiment 2 was repeated using thymolphthalein indicator instead of methyl orange indicator.

Use the burette diagrams to complete the table for Experiment 3.



initial reading

final reading

	Experiment 3
final burette reading / cm^3	42.2
initial burette reading / cm^3	7.0
volume of dilute hydrochloric acid **R** added / cm^3	35.2

[5]

(b) Determine the simplest whole number ratio of the volumes of dilute hydrochloric acid **R** used in Experiment 2 and Experiment 3.

1 : 1 [1]

(c) Deduce the volume of dilute hydrochloric acid **Q** needed when Experiment 1 is repeated using thymolphthalein indicator instead of methyl orange indicator.

volume of hydrochloric acid **Q** = 17.6 cm^3 [2]

(d) Compare the concentration of dilute hydrochloric acid **Q** used in Experiment 1 to the concentration of dilute hydrochloric acid **R** used in Experiment 2.
Explain your answer.

Q is more concentrated than R
as smaller volume of Q is required
Q is twice the concentration of R

[3]

(e) State how the results change, if at all, if the aqueous sodium hydroxide is warmed before adding the dilute hydrochloric acid.
Give a reason for your answer.

effect on results none

reason does not change amount of sodium hydroxide

[2]

(f) State the advantage of using a pipette instead of the measuring cylinder in these experiments.

more accurate volume of sodium hydroxide [1]

(g) Explain why a white tile is used in these experiments.

so colour change can be seen clearly [1]

(h) At the start of Experiment 2 the burette was rinsed with distilled water and then with dilute hydrochloric acid **R**.

(i) State what was removed from the burette when it was rinsed with distilled water.

acid Q [1]

(ii) State what was removed from the burette when it was rinsed with dilute hydrochloric acid **R**.

water

[1]

(iii) Explain why the burette does **not** need to be rinsed at the start of Experiment 3.

same acid was used [1]

(i) After the burette was filled with dilute hydrochloric acid at the start of Experiment 1, some of the acid was run out of the burette.

One reason for running the acid out of the burette is to make sure the level of the hydrochloric acid is on the scale.

Give one **other** reason why it is important to run some acid out of the burette after it has been filled for the first time in an experiment.

to fill the tap

[1]

[Total: 19]

3 Solid **S** and solution **Y** were analysed. Solid **S** was anhydrous copper(II) sulfate.
Tests were done on each substance.

tests on solid S

Complete the expected observations.

(a) A flame test was carried out on solid **S**.

observations ....blue green flame.. [1]

The remaining solid **S** was dissolved in about 10 cm^3 of distilled water to form solution **T**. Solution **T** was divided into two approximately equal portions in two test-tubes.

(b) State the colour change that occurred when water was added to solid **S** to form solution **T**.

from solid **S** ....white...................... to solution **T** ....blue.................... [1]

(c) To the first portion of solution **T**, about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate were added.

observations ....white precipitate.. [1]

(d) To the second portion of solution **T**, aqueous ammonia was added dropwise and then in excess.

observations ....blue precipitate..

dissolve in excess

to form deep blue solution .... [3]

tests on solution Y

tests	observations
test 1 A flame test was carried out on solution **Y**.	the flame became lilac
Solution **Y** was divided into three approximately equal portions in one boiling tube and two test-tubes. **test 2** Dilute hydrochloric acid was added to the portion of solution **Y** in a boiling tube. The mixture was warmed. A strip of filter paper soaked in acidified aqueous potassium manganate(VII) was held at the mouth of the boiling tube.	the acidified aqueous potassium manganate(VII) remained purple
test 3 About 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the second portion of solution **Y**.	yellow precipitate
test 4 Aqueous ammonia was added dropwise and then in excess to the third portion of solution **Y**.	a white precipitate formed which dissolved in excess to give a colourless solution

(e) Name the gas tested for in **test 2**.

sulfur dioxide [1]

(f) Identify the **three** ions in solution **Y**.

potassium/K+

Iodide/I-

zinc/Zn2+ [3]

[Total: 10]

4 When solution **A** and solution **B** are mixed they react slowly to form iodine.
Starch solution is added to the mixture to act as an indicator.
When a certain amount of iodine is made there is a sudden colour change to blue-black.

Plan an investigation to find the effect of temperature on the rate of the reaction between solution **A** and solution **B**.

You are provided with solution **A**, solution **B**, starch solution and common laboratory apparatus.

prepare known volumes of aqueous solution A and solution B, for example 25 cm^3 of each
use a measuring cylinder to measure the volumes
measure the temperature of each solution using a thermometer
warm the solutions before mixing
mix solutions together with starch solution
measure the time until the blue black colour is seen
repeat the experiment at different temperatures

[6]

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CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

* 2 9 0 9 6 8 4 6 2 5 *

CHEMISTRY **0620/61**

Paper 6 Alternative to Practical **October/November 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

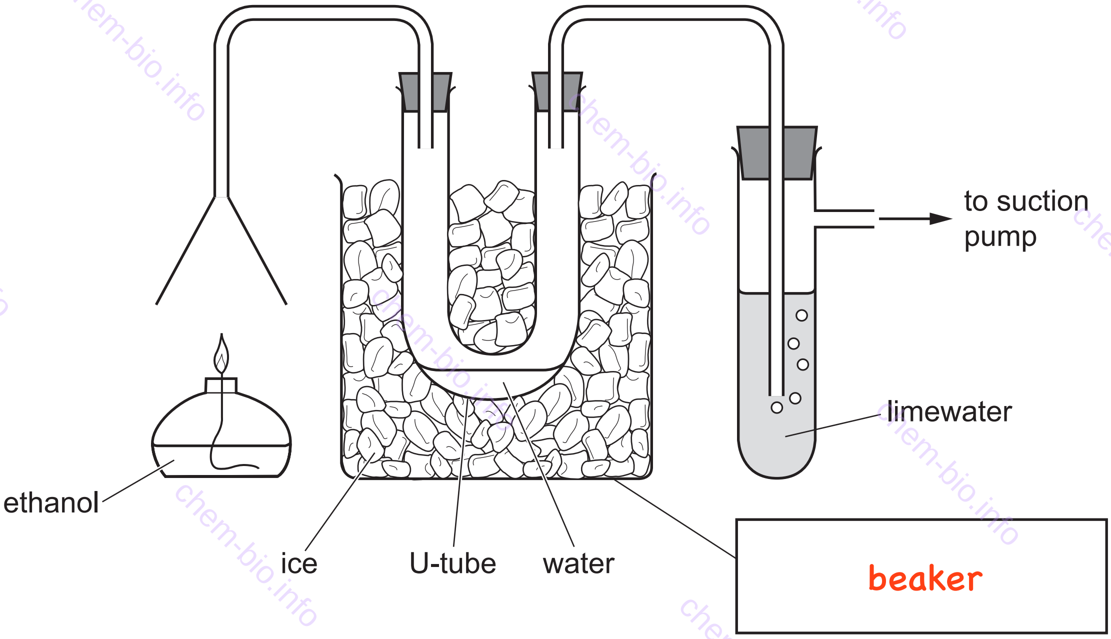
This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **8** printed pages.

IB19 11_0620_61/2RP

Cambridge Assessment International Education

1 The apparatus shown was used to investigate the products formed when ethanol, C_2H_5OH, burns in air.



(a) Complete the box to name the apparatus. [1]

(b) Explain why water collects in the U-tube.

steam/water vapour condenses/cools [2]

(c) State a chemical test for water.

test anhydrous copper (II) sulfate

observations turns blue

[2]

(d) What is the purpose of the suction pump?

to suck gases through apparatus [1]

(e) Predict the change seen in the test-tube containing the limewater. Explain your prediction.

turns milky

carbon dioxide formed

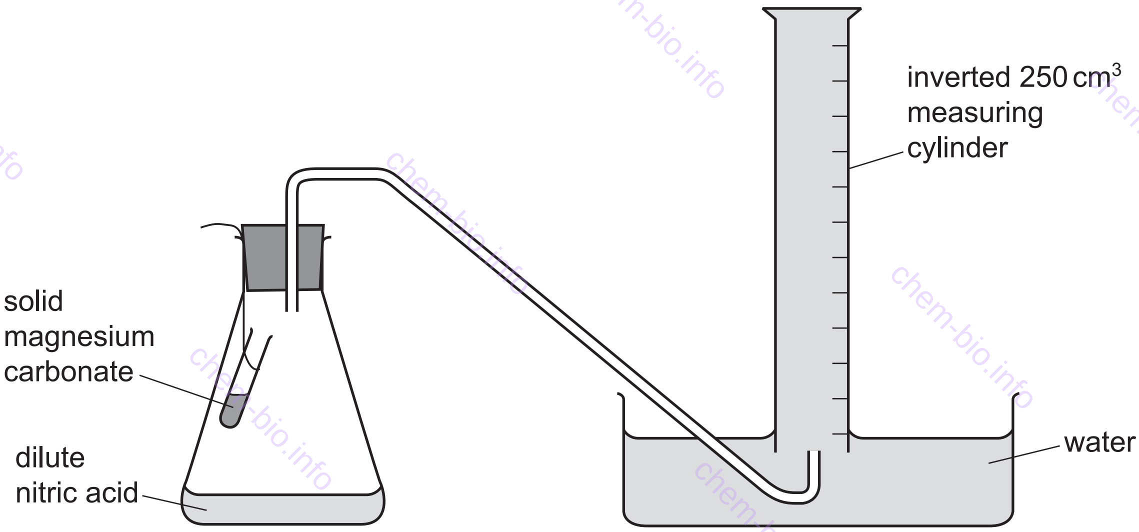
[2]

[Total: 8]

2 A student investigated the rate of reaction between dilute nitric acid and an excess of solid magnesium carbonate at room temperature.

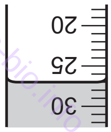
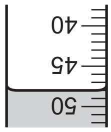
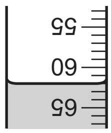
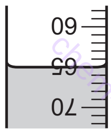
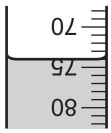
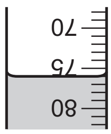
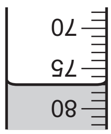
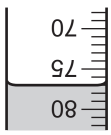
The apparatus was set up as shown in the diagram.

A small test-tube containing magnesium carbonate was suspended in the conical flask.



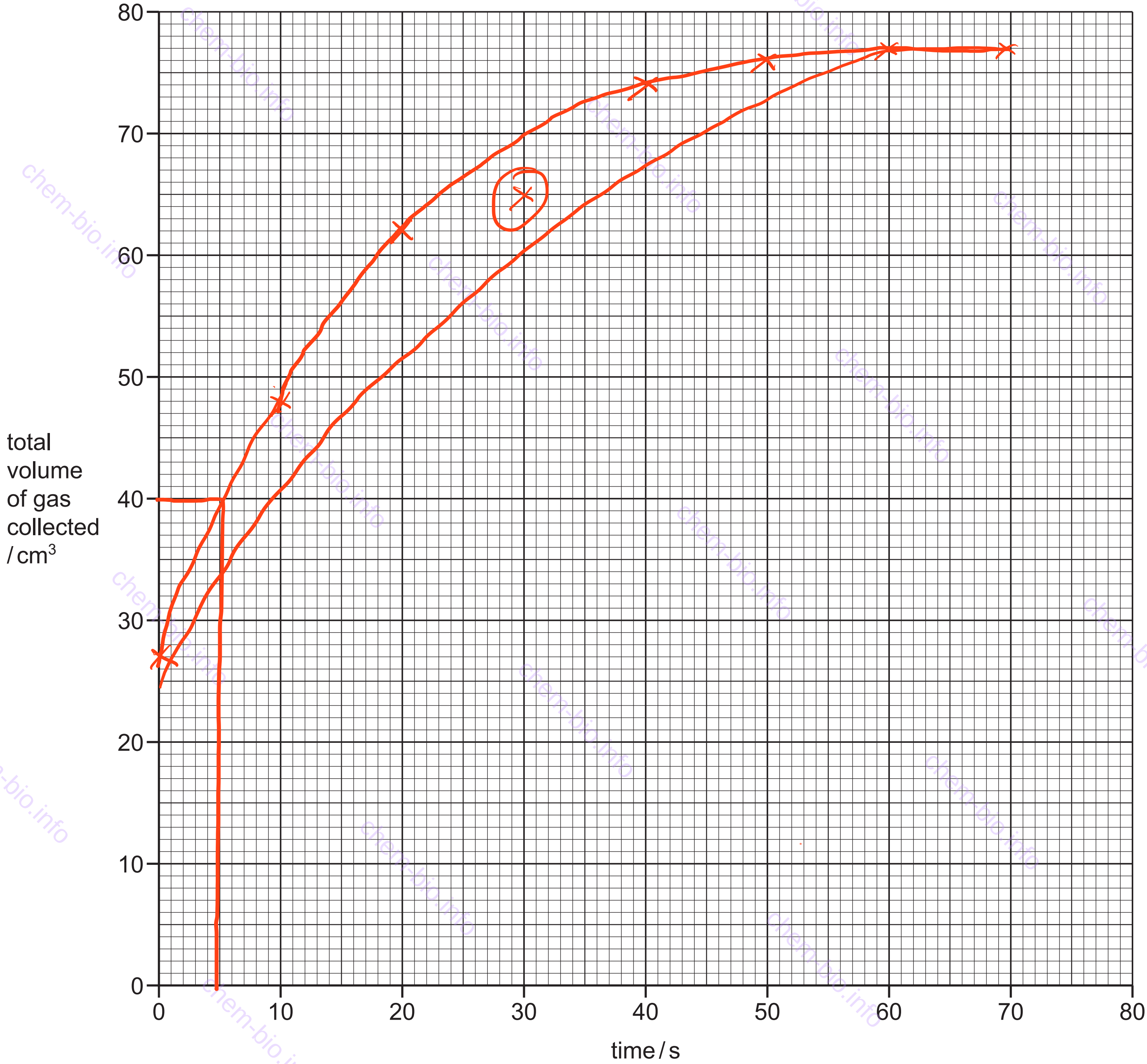
50 cm^3 of dilute nitric acid was added to the conical flask. The contents of the test-tube were released, allowing the solid magnesium carbonate to mix with the dilute nitric acid. A stop-clock was started and the volume of gas collected in the inverted measuring cylinder was measured every 10 seconds for 80 seconds.

(a) Use the inverted measuring cylinder diagrams to record the volume of gas collected in the table.

time / s	inverted measuring cylinder diagram	total volume of gas collected / cm^3
0		0
10		27
20		48
30		62
40		65
50		74
60		76
70		77
80		77

[2]

(b) Plot the results on the grid. Draw a smooth line graph.



[3]

(c) (i) One of the points is anomalous.

Circle this point on your graph. [1]

(ii) **From your graph**, deduce the time taken to collect 40 cm^3 of gas.
Show clearly **on the grid** how you worked out your answer.

..............5.............. s [2]

(d) State **one** possible source of error in this experiment. Suggest **one** improvement to reduce this source of error.

source of error ..use of 250 cm^3 measuring cylinder/inaccurate reading.....

improvement use a gas syringe .... [2]

(e) The average rate of the reaction can be calculated using the equation shown.

$$\text{average rate of reaction} = \frac{\text{volume of gas collected / cm}^3}{\text{time taken / s}}$$

(i) Calculate the volume of gas collected between 10 seconds and 30 seconds.

.... 35 cm^3 .... [1]

(ii) Calculate the average rate of reaction between 10 seconds and 30 seconds. Include the unit in your answer.

35/20

average rate of reaction = ...1.75......

unit = ...cm^3/s.......
[2]

(f) The student calculated that the total volume of gas collected in this reaction would be 85 cm^3.

Suggest and explain why the actual volume of gas collected was different from 85 cm^3.

volume of gas less/lower ....

carbon dioxide dissolved in water ....

.... [2]

(g) Sketch **on the grid** the graph you would expect if the experiment were repeated at a **lower** temperature. Label this graph as **L**. [2]

[Total: 17]

3 Two substances, solid **A** and solid **B**, were analysed. Solid **A** was zinc nitrate.
Tests were done on the substances.

tests on solid A

Complete the expected observations.

Solid **A** was added to distilled water and the mixture shaken to dissolve solid **A** and produce solution **A**. Solution **A** was divided into three equal portions in three test-tubes.

(a) **(i)** A few drops of aqueous sodium hydroxide were added to the first portion of solution **A**.

observations ....white precipitate.......... [2]

(ii) An excess of aqueous sodium hydroxide was then added to this mixture.

observations ....dissolves forming colourless solution.......... [1]

(b) **(i)** A few drops of aqueous ammonia were added to the second portion of solution **A**.

observations ....white precipitate.......... [1]

(ii) An excess of aqueous ammonia was then added to this mixture.

observations ....dissolves forming colourless solution.......... [1]

(c) Aluminium foil and aqueous sodium hydroxide were added to the third portion of solution **A**. The mixture was heated and the gas produced was tested with litmus paper.

observations ....bubbles/effervescence..........

..........litmus turns blue.......... [2]

tests on solid B

Some of the tests and observations are shown.

tests on solid **B**	observations
test 1 A flame test was done on solid **B**.	red flame
test 2 Solid **B** was dissolved in water. Dilute nitric acid and aqueous silver nitrate were added to the solution.	yellow precipitate formed

(d) Identify solid **B**.

..........lithium iodide.......... [2]

[Total: 9]

4 Iodine dissolves in two different solvents: ethanol and hexane.

Plan an experiment to find out in which solvent iodine is the most soluble at room temperature.

You are provided with iodine, the two solvents and common laboratory apparatus.

measure 25 cm^3 of ethanol
add 2g of iodine and stir/shake
filter the solution
dry and weigh the undissolved iodine
repeat the experiment with hexane
the less mass of undissolved iodine the better solvent is

[6]

Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 9 6 1 5 2 6 2 7 3 1 *

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **October/November 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

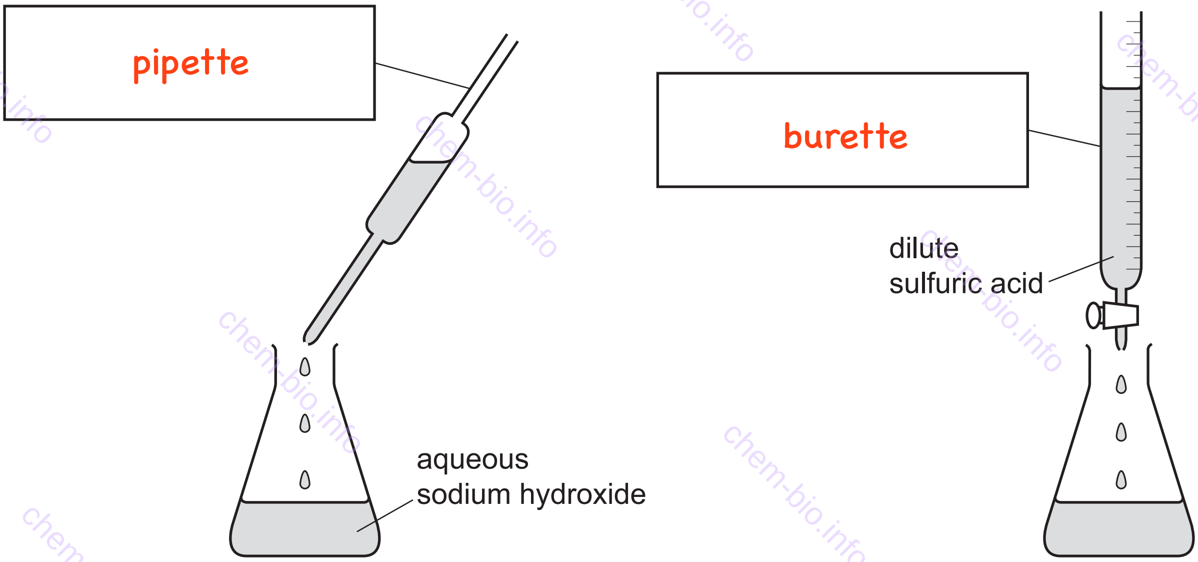
This document consists of **8** printed pages and **4** blank pages.

Cambridge Assessment International Education

1 A student did a single titration to find the concentration of a solution of dilute sulfuric acid.

The student added 25.0 cm^3 of aqueous sodium hydroxide to a conical flask, followed by a few drops of indicator. Dilute sulfuric acid was then added to the aqueous sodium hydroxide until the solution was neutral.

The apparatus used is shown in the diagram.



(a) Complete the boxes to name the apparatus. [2]

(b) Name a suitable indicator to use in the titration and give the colour change.

indicator ....methyl orange..........

colour change from ....yellow.......... to ....orange.......... [2]

(c) What readings should the student take when doing this single titration?

..........initial and final burette reading.......... [2]

(d) After the titration, the student discarded the contents of the conical flask and rinsed the conical flask with distilled water.

Suggest and explain what would be the effect, if any, on the titration values if the conical flask was not dried before repeating the titration.

values should be the same

moles/amount of sodium hydroxide added is still the same

.... [2]

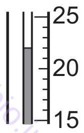
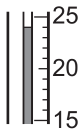
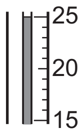
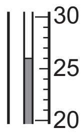
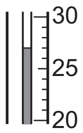
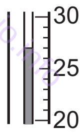
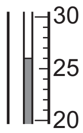
[Total: 8]

2 A student investigated the temperature changes when two different solids, **N** and **O**, dissolve in water.
Two experiments were done.

Experiment 1

- Using a measuring cylinder, 30 cm^3 of distilled water was poured into a polystyrene cup.
- The initial temperature of the distilled water was measured.
- Solid **N** was added to the distilled water, a timer started and the mixture was stirred with a stirring thermometer.
- The temperature of the mixture was measured every 30 seconds for three minutes (180 seconds).

(a) Use the thermometer diagrams to record the temperatures in the table.

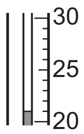
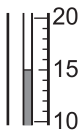
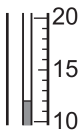
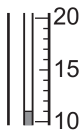
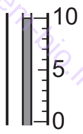
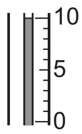
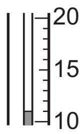
time / s	0	30	60	90	120	150	180
thermometer diagram							
temperature of mixture / °C	22	24	25	26	27	27	26

[2]

Experiment 2

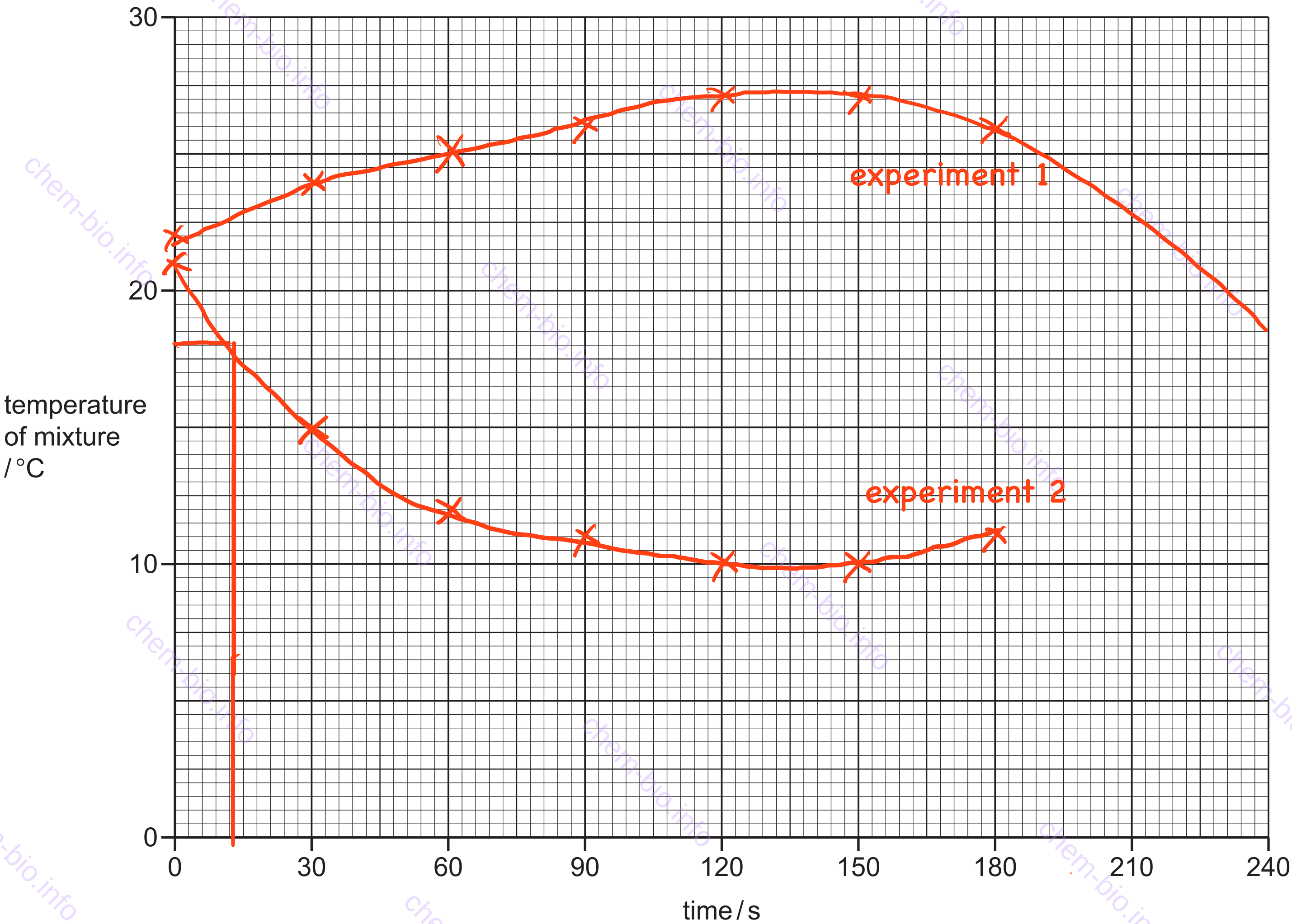
Experiment 1 was repeated using a new polystyrene cup and solid **O** instead of solid **N**.

(b) Use the thermometer diagrams to record the temperatures in the table.

time / s	0	30	60	90	120	150	180
thermometer diagram							
temperature of mixture / °C	21	15	12	11	10	10	11

[2]

(c) Plot the results for Experiments 1 and 2 on the grid. Draw **two** smooth line graphs. Clearly label your graphs.



[3]

(d) (i) **From your graph**, deduce the time taken for the initial temperature of the solution in Experiment 2 to change by 3 °C.

Show clearly **on the grid** how you worked out your answer.

..........12.......... s [3]

(ii) Extend your graph for Experiment 1 to give the expected temperature of the mixture after 240 seconds.

..........18.5.......... °C [2]

(e) Is the energy change in Experiment 2 exothermic or endothermic? Explain your answer.

endothermic, temperature decreases [1]

(f) State **two** possible sources of error in these experiments. Suggest **two** improvements to reduce each of these sources of error.

source of error 1 ....heat loss....

improvement 1 ....use a lid....

source of error 2 ....use of measuring cylinder....

improvement 2 ....use a pipette/burette....

[4]

[Total: 17]

3 Two substances, solid **P** and solid **Q**, were analysed. Solid **P** was copper(II) nitrate.
Tests were done on solid **P** and solid **Q**.

tests on solid P

Complete the expected observations.

(a) A flame test was done on solid **P**.

observations ....blue-green flame.. [1]

Solid **P** was added to distilled water and the mixture shaken to dissolve solid **P** and form solution **P**.
Solution **P** was divided into three equal portions in two test-tubes and one boiling tube.

(b) An excess of aqueous sodium hydroxide was added to the first portion of solution **P** in a test-tube.

observations ....blue precipitate.. [1]

(c) **(i)** A few drops of aqueous ammonia were added to the second portion of solution **P** in a test-tube.

observations ....blue precipitate.. [1]

(ii) An excess of aqueous ammonia was then added to this mixture.

observations ....deep/royal blue solution forms.. [2]

(d) Aluminium foil and aqueous sodium hydroxide were added to the third portion of solution **P** in a boiling tube. The mixture was heated and the gas produced tested.

observations ....litmus paper turns blue..

.... [2]

tests on solid Q

Some of the tests and observations are shown.

tests on solid **Q**	observations
test 1 A flame test was done on solid **Q**.	lilac colour
test 2 Solid **Q** was dissolved in water. Dilute nitric acid and aqueous silver nitrate were added to the solution.	cream precipitate formed

(e) Identify solid **Q**.

potassium bromide [2]

[Total: 9]

4 The table gives some information about the properties of three substances found in a hand cream.

substance	reaction with dilute nitric acid
polystyrene beads	no reaction
calcium carbonate	reacts and dissolves
sodium fluoride	dissolves

Use the information in the table to plan an experiment to obtain a pure, dry sample of polystyrene beads from this mixture of substances.

You are provided with a mixture of the three substances and common laboratory apparatus.

add dilute nitric acid to the mixture in a beaker
stir the solution until reaction stops, this is observed when the fizzing stops
filter the solution and wash the residue with water
dry the residue between pressed filter papers

[6]

Cambridge IGCSE

Cambridge Assessment International Education
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CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

* 1 8 6 8 8 2 7 1 4 8 *

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **October/November 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

IB19 11_0620_63/2RP

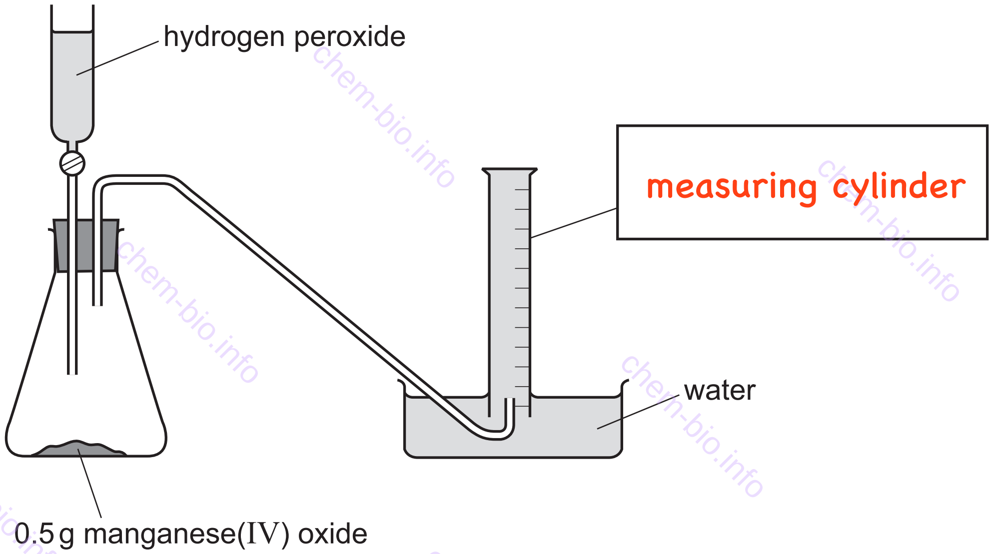
Cambridge Assessment International Education

1 Hydrogen peroxide, $H_2O_2(aq)$, decomposes slowly to form water and oxygen.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

The addition of 0.5 g of manganese(IV) oxide speeds up this decomposition. Manganese(IV) oxide is an insoluble solid.

The apparatus shown was used to follow the rate of decomposition of hydrogen peroxide. The hydrogen peroxide was added to the conical flask and a stop-watch was started.



(a) Complete the box to name the apparatus. [1]

(b) What measurements should be taken to follow the rate of the reaction?

volume of gas/oxygen

time [2]

(c) The rate of the reaction decreases over time. After 5 minutes the rate of reaction is zero.

(i) Why does the rate of reaction decrease?

concentration of hydrogen peroxide decreases [1]

(ii) Explain why the rate of reaction is zero after 5 minutes.

all of the hydrogen peroxide decomposed [1]

(d) (i) The manganese(IV) oxide acts as a catalyst.

How could a student separate the catalyst from the reaction mixture at the end of the reaction?

filtration .... [1]

(ii) Suggest how the student could show that the catalyst separated in **(d)(i)** is unchanged at the end of the reaction.

evaporate the water

re-weigh the manganese(IV) oxide

mass should be unchanged and remain 0.5 g

.... [3]

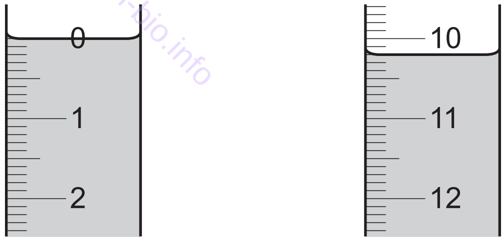
[Total: 9]

2 A student investigated the reaction between dilute hydrochloric acid and three different concentrations of aqueous sodium hydroxide, labelled **R**, **S** and **T**.

Three experiments were done.

Experiment 1

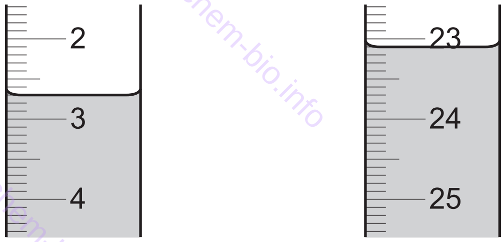
- A burette was filled with dilute hydrochloric acid. The initial burette reading was measured.
- Using a measuring cylinder, 20 cm^3 of solution **R** was poured into a conical flask.
- Six drops of methyl orange indicator were added to the conical flask.
- Dilute hydrochloric acid was added from the burette, until the solution just changed colour.
- The final burette reading was measured.



initial final

Experiment 2

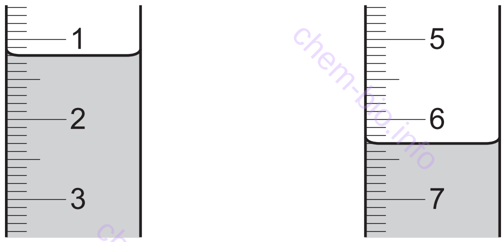
- Experiment 1 was repeated but using 20 cm^3 of solution **S** instead of solution **R**.



initial final

Experiment 3

- Experiment 1 was repeated but using 20 cm^3 of solution **T** instead of solution **R**.



initial final

(a) Use the burette diagrams to record all the burette readings in the table.

burette reading / cm^3	Experiment 1 using solution **R**	Experiment 2 using solution **S**	Experiment 3 using solution **T**
final burette reading	10.2	23.1	6.3
initial burette reading	0.0	2.7	1.2
volume used	10.2	20.4	5.1

[4]

(b) What colour change is observed in the conical flask at the end-point?

from ....yellow.......... to ....orange/pink/red..........
[2]

(c) Suggest why Universal Indicator is **not** a suitable indicator in these experiments.

....

no sharp colour change/no clear end point [1]

(d) **(i)** Complete the sentences below.

Experiment ....3.... needed the smallest volume of dilute hydrochloric acid to change the colour of the indicator.

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

(ii) Determine the simplest whole number ratio of volumes of dilute hydrochloric acid used in Experiments 1 and 2.

Experiment 1 ....1.... **:** ....2.... Experiment 2 [1]

(iii) Deduce the order of concentrations of the solutions of aqueous sodium hydroxide, **R**, **S** and **T**.

most concentrated ....S..........

..........R..........

least concentrated ....T..........
[1]

(e) What would be the effect on the results, if any, if the solutions of aqueous sodium hydroxide were warmed before adding the dilute hydrochloric acid? Give a reason for your answer.

effect on the results ....no effect....

reason ....concentration of reactants not affected....
[2]

(f) Suggest how the reliability of the results could be checked.

repeat the experiment until results are concordant

check for anomalous results

[2]

(g) Suggest a different method, **not** involving an indicator, of finding the order of concentrations of the solutions of aqueous sodium hydroxide, **R**, **S** and **T**.

measure temperature change

highest temperature change is the most concentrated

add hydrochloric acid

[3]

[Total: 17]

3 Two substances, solid **U** and liquid **V**, were analysed. Solid **U** was chromium(III) nitrate. Tests were done on solid **U** and liquid **V**.

tests on solid U

Complete the expected observations.

Solid **U** was added to distilled water and shaken to dissolve solid **U** and form solution **U**.

(a) Describe the colour of solution **U**.

blue/purple/green/violet [1]

Solution **U** was divided into three equal portions in three test-tubes.

(b) **(i)** A few drops of aqueous sodium hydroxide were added to the first portion of solution **U** until a change was seen.

observations green precipitate [2]

(ii) An excess of aqueous sodium hydroxide was then added to the mixture.

observations precipitate dissolves to form a green solution [1]

(c) An excess of aqueous ammonia was added to the second portion of solution **U**.

observations grey-green precipitate [1]

(d) Aluminium foil and aqueous sodium hydroxide were added to the third portion of solution **U**. The mixture was heated and the gas produced was tested.

observations effervescence

red litmus paper turns blue [2]

tests on liquid V

One of the tests done on liquid **V** and the observations made are shown.

tests on liquid **V**	observations
A lighted splint was used to touch about 1 cm^3 of liquid **V**.	liquid **V** set on fire and burned with a smoky blue flame

(e) Draw **one** conclusion about liquid **V**.

it's organic/a fuel [1]

[Total: 8]

4 Potassium nitrate and ammonium chloride are two salts. The energy change when they each dissolve in water is endothermic.

Plan an experiment to show which of these two salts produces the larger endothermic energy change per gram.

Your answer should include:
- any measurements you would take and record
- how the results could be used to draw a conclusion.

You are provided with potassium nitrate and ammonium chloride, distilled water and common laboratory apparatus.

measure the initial temperature of 25 cm^3 of water
add 2g of potassium nitrate or ammonium chloride and stir
measure the final temperatures of the solution
or measure the temperature every 30s
repeat the experiment with the same mass of the other solid
calculate energy change per gram
the greater temperature change the larger the energy change

[6]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 4 6 4 7 8 2 3 6 0 7 *

CHEMISTRY **0620/61**

Paper 6 Alternative to Practical **October/November 2022**

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.

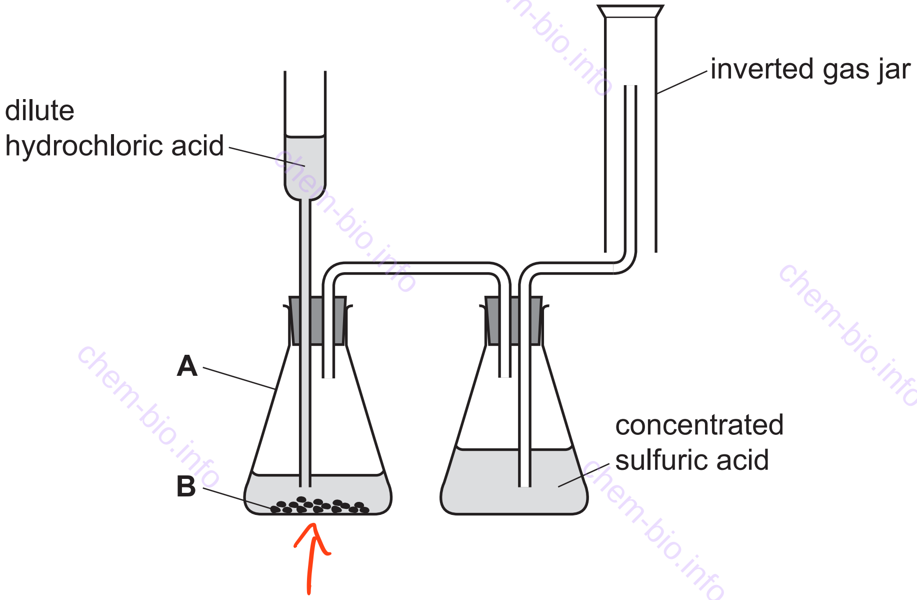
INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

IB22 11_0620_61/RP

1 Sulfur dioxide gas is toxic, denser than air and soluble in water. Sulfur dioxide gas can be made by adding dilute hydrochloric acid to solid sodium sulfite and heating the mixture. The gas made can be dried by passing it through concentrated sulfuric acid.

The diagram shows the apparatus a student used to try and collect some dry sulfur dioxide gas. There are **two** errors in the way the apparatus has been set up.



(a) Indicate with an arrow **on the diagram** where heat should be applied. [1]

(b) Give the name of the item of apparatus labelled **A**.

conical flask [1]

(c) Give the name of the substance labelled **B**.

sodium sulfite [1]

(d) Suggest why this experiment should be carried out in a fume cupboard.

sulfur dioxide gas is toxic

[1]

(e) Identify the **two** errors in the way the apparatus has been set up.

1 tube lining flasks should go into sulfuric acid

tube from flask to gas jar should not go into the acid

2 gas jar should not be inverted

[2]

[Total: 6]

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2 A student investigated how the solubility of sodium sulfate in water changes with temperature.

Eight experiments were done.

Experiment 1

- The mass of an empty evaporating basin was found.
- An excess of solid sodium sulfate was placed in a beaker.
- 100 cm^3 of cold water was added to the beaker.
- The mixture in the beaker was stirred and heated until it had reached a temperature of 15 °C. Some of the sodium sulfate had dissolved to form a saturated solution.
- A 25.0 cm^3 portion of the saturated solution was removed from the beaker and transferred to the evaporating basin.
- The evaporating basin was heated until no more steam could be seen and solid sodium sulfate remained in the evaporating basin.
- The mass of the evaporating basin and the solid sodium sulfate remaining was found.

Experiment 2

- Experiment 1 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 1.

Experiment 3

- Experiment 2 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 2.

Experiment 4

- Experiment 3 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 3.

Experiment 5

- Experiment 4 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 4.

Experiment 6

- Experiment 5 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 5.

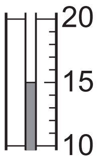
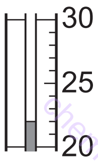
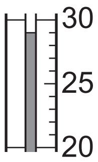
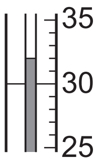
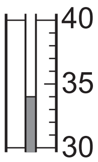
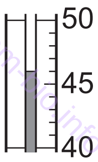
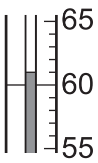
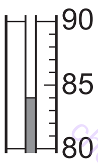
Experiment 7

- Experiment 6 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 6.

Experiment 8

- Experiment 7 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 7.

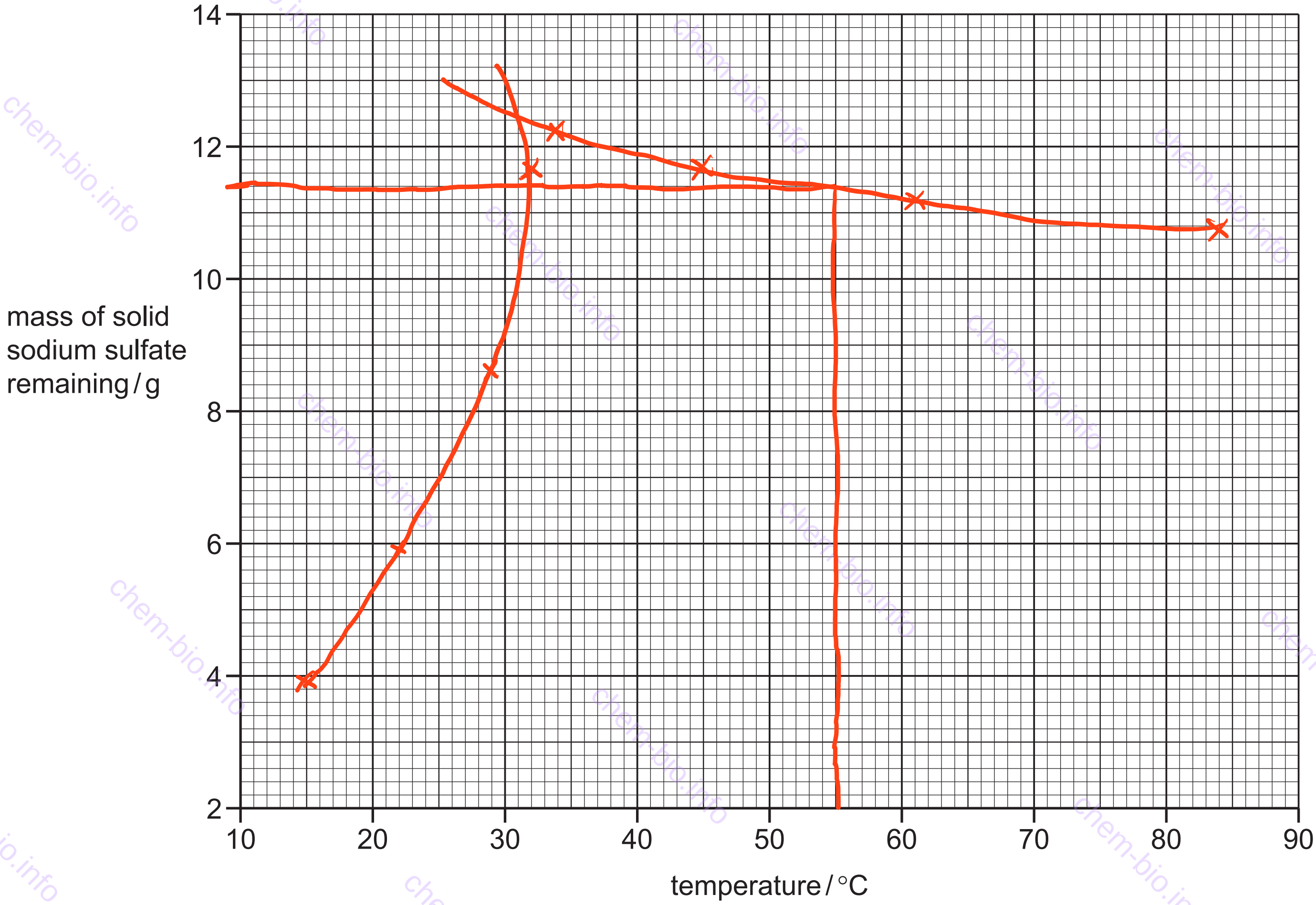
(a) Complete the table by using the thermometer diagrams and calculating the mass of solid sodium sulfate remaining in the evaporating basin at each temperature.

experiment	thermometer diagram	temperature / °C	mass of empty evaporating basin / g	mass of evaporating basin and solid sodium sulfate remaining / g	mass of solid sodium sulfate remaining / g
1		15	54.2	58.1	3.9
2		22	56.3	62.2	5.9
3		29	57.1	66.7	9.6
4		32	58.0	69.7	11.7
5		34	57.6	69.9	12.3
6		46	56.4	68.1	11.7
7		61	55.9	67.1	11.2
8		84	57.6	68.4	10.8

[4]

(b) Plot the results from Experiments 1 to 8 on the grid.

Draw two curves of best fit, one through the first four points and one through the second four points. Extend the two curves so that they cross.



[4]

(c) **(i)** **From your graph**, deduce the mass of solid sodium sulfate that remains in the evaporating basin when the mixture in the beaker is heated to 55 °C.

Show clearly **on the grid** how you worked out your answer.

mass of solid sodium sulfate remaining = ...11.4........ g [2]

(ii) The mass of solid sodium sulfate remaining in **(c)(i)** is the mass of sodium sulfate that will dissolve in 25.0 cm^3 of solution at 55 °C.

Use your answer to **(c)(i)** to calculate the concentration, in g / dm^3, of saturated aqueous sodium sulfate at 55 °C.
(1 dm^3 = 1000 cm^3)

11.4×40

concentration = ...456........ g / dm^3 [1]

(d) The student repeated the experiment and found 11.0 g of solid sodium sulfate remained in the evaporating basin.

Use your graph to deduce the **two** possible temperatures to which the mixture in the beaker may have been heated.

........31 C........ and ....67 C........ [2]

(e) Name an item of apparatus that can be used to remove the 25.0 cm^3 portion of saturated solution from the beaker.

........pipette........ [1]

(f) **(i)** Suggest why it is important that an **excess** of sodium sulfate is added to the water in the beaker.

to ensure a saturated solution is formed/so that it doesn't all dissolve [1]

(ii) Suggest why the mixture in the beaker was stirred as it was heated.

........to speed up dissolving........ [1]

(g) The saturated solution was heated until no more steam could be seen and solid sodium sulfate remained in the evaporating basin.

Suggest a better way of ensuring that **all** of the water has been evaporated.

....

........reheat and reweigh until mass stops changing........

.... [2]

(h) **Use your graph in (b)** to deduce what would be observed if a saturated solution of sodium sulfate at 80 °C is cooled to 50 °C.

........no change/remains colourless........

.... [1]

[Total: 19]

3 Two substances, solid **W** and solid **X**, were analysed. Solid **W** was zinc bromide.

tests on solid W

Complete the expected observations.

Solid **W** was dissolved in water to form solution **W**. Solution **W** was divided into three equal portions.

(a) To the first portion of solution **W**, aqueous ammonia was added dropwise and then in excess.

observations ....white precipitate....

....dissolves in excess.... [2]

(b) To the second portion of solution **W**, 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate were added.

observations ....no change/remains colourless.... [1]

(c) To the third portion of solution **W**, 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate were added.

observations ....cream precipitate.... [1]

tests on solid X

tests	observations
test 1 About 1 g of solid **X** was placed in a boiling tube and heated strongly. A strip of filter paper soaked in acidified aqueous potassium manganate(VII) solution was held at the mouth of the boiling tube.	the acidified aqueous potassium manganate(VII) turned from purple to colourless
The remaining solid **X** was dissolved in water to form solution **X**. Solution **X** was divided into three equal portions. **test 2** 1 cm^3 of dilute nitric acid and a few drops of aqueous silver nitrate were added to the first portion of solution **X**.	no change
test 3 1 cm^3 of dilute nitric acid and a few drops of aqueous barium nitrate were added to the second portion of solution **X**.	a white precipitate formed
test 4 Aqueous sodium hydroxide was added dropwise and then in excess to the third portion of solution **X**.	a green precipitate formed and remained in excess

(d) **(i)** Name the gas given off in **test 1**.

sulfur dioxide [1]

(ii) Water vapour is also given off in **test 1**.

Give a chemical test for water and the expected observation if water is present.

substance used anhydrous cobalt (II) chloride

observation changes from blue to pink

[2]

(e) Identify solid **X**.

iron(II) sulfate

FeSO4 [2]

[Total: 9]

4 The leaves of some trees contain coloured substances which can be used as pH indicators. These coloured substances are soluble in ethanol but insoluble in water.

You should assume that nothing else in the leaves is soluble in ethanol.

Plan an investigation to extract the coloured substances from some leaves and test them to see if they work as a pH indicator.

You are provided with leaves from a tree and common laboratory apparatus and chemicals.

crush/grind leaves using pestle and mortar
add ethanol to the leaves and stir
filter and split the sample into two
add hydrochloric acid to one portion
add sodium hydroxide to the other portion
samples colour will change/observe the colour change

[6]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 1 5 8 2 5 5 2 9 1 3 *

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **October/November 2022**

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
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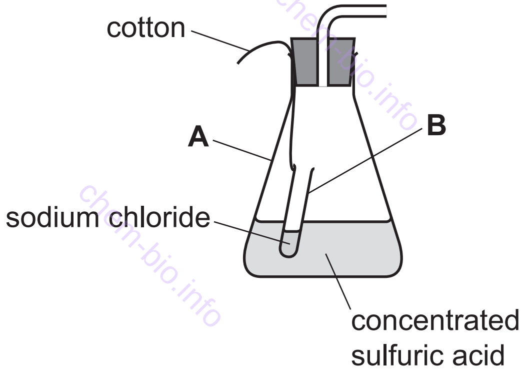
IB22 11_0620_63/RP

1 Hydrogen chloride is a colourless gas that is soluble in water and denser than air.
Hydrogen chloride can be made by reacting sodium chloride with concentrated sulfuric acid.

The diagram shows some of the apparatus a teacher used to make hydrogen chloride gas and to measure the volume of gas made.



(a) Name the items of apparatus labelled **A** and **B**.

A conical flask

B test-tube

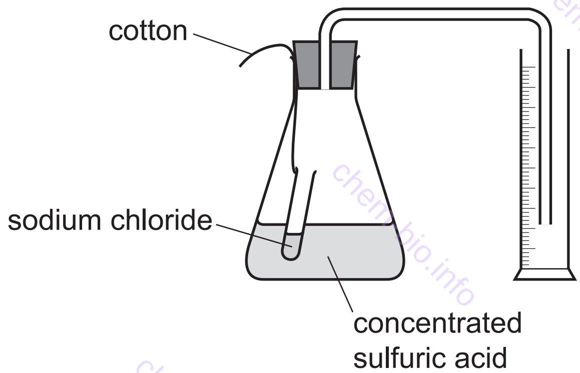
[2]

(b) Describe how the reaction is started after the apparatus has been set up.

tilt the container

lift the bung so tube falls over [1]

(c) A student suggests the gas can be collected and its volume measured using a measuring cylinder as shown in the diagram.

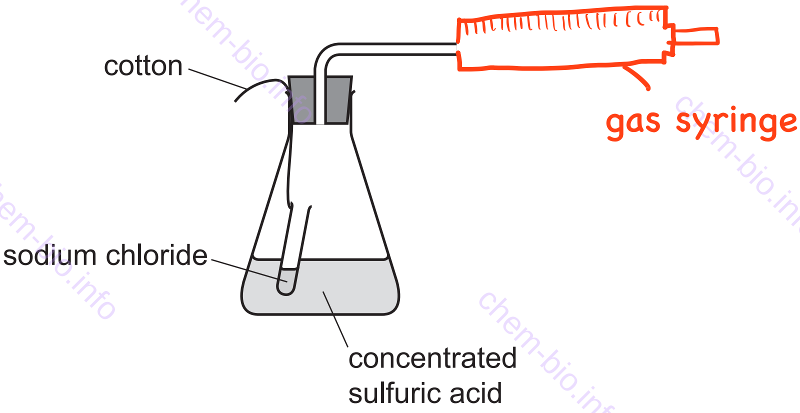


Explain why the volume of gas collected cannot be measured using this method.

the gas/hydrogen chloride is colourless and cannot be seen

[1]

(d) Complete the diagram to show how the hydrogen chloride gas could be collected and the volume of the gas measured.



[1]

(e) Hydrogen chloride is a toxic gas and concentrated sulfuric acid is corrosive.

(i) Give **one** safety precaution that should be taken when working with hydrogen chloride gas.

....................use a fume cupboard.................... [1]

(ii) Give **one** safety precaution that should be taken when working with concentrated sulfuric acid.

....................wear gloves.................... [1]

[Total: 7]

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2 A student investigated the rate of the reaction between sodium metabisulfite and potassium iodate at different temperatures.

Five experiments were done at different temperatures.

(a) *Experiment 1*

- 70 cm^3 of aqueous potassium iodate was measured using a 100 cm^3 measuring cylinder and poured into a 250 cm^3 beaker.
- 5 cm^3 of aqueous starch was measured using a 10 cm^3 measuring cylinder and poured into the beaker containing the aqueous potassium iodate.
- 5 cm^3 of aqueous sodium metabisulfite was measured using a clean 10 cm^3 measuring cylinder and poured into the beaker. At the same time a stop-clock was started.
- The mixture was stirred until a sudden colour change was seen.
- The stop-clock was stopped and the temperature of the mixture in the beaker was measured using a thermometer.
- The beaker was rinsed with distilled water.

Experiment 2

- 70 cm^3 of aqueous potassium iodate was measured using a 100 cm^3 measuring cylinder and poured into a 250 cm^3 beaker.
- 5 cm^3 of aqueous starch was measured using a 10 cm^3 measuring cylinder and poured into the beaker containing the aqueous potassium iodate.
- The aqueous potassium iodate and starch mixture was warmed over a Bunsen burner until the temperature of the solution was about 35 °C. The beaker was then removed from above the Bunsen burner.
- 5 cm^3 of aqueous sodium metabisulfite was measured using a clean 10 cm^3 measuring cylinder and poured into the beaker. At the same time a stop-clock was started.
- The mixture was stirred until a sudden colour change was seen.
- The stop-clock was stopped and the temperature of the mixture in the beaker was measured using a thermometer.
- The beaker was rinsed with distilled water.

Experiment 3

- Experiment 2 was repeated but the aqueous potassium iodate and starch mixture was warmed until the temperature of the solution was about 40 °C.

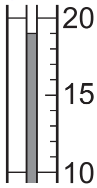
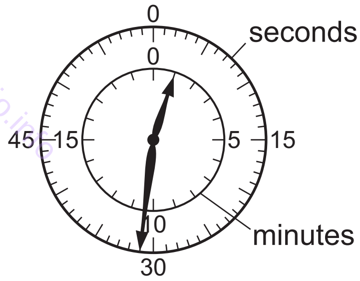
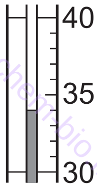
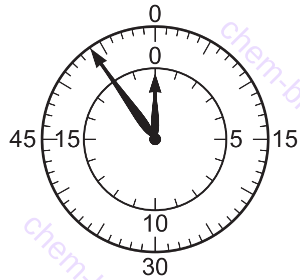
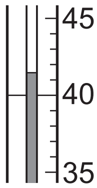
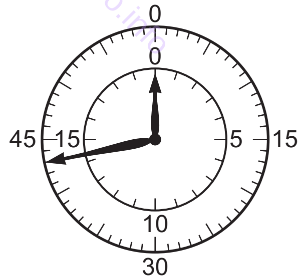
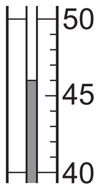
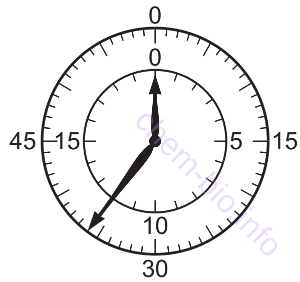
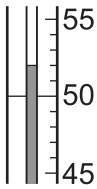
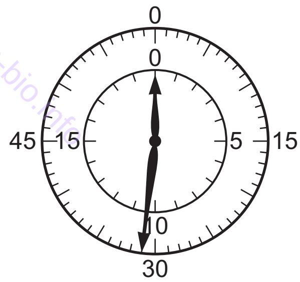
Experiment 4

- Experiment 2 was repeated but the aqueous potassium iodate and starch mixture was warmed until the temperature of the solution was about 45 °C.

Experiment 5

- Experiment 2 was repeated but the aqueous potassium iodate and starch mixture was warmed until the temperature of the solution was about 50 °C.

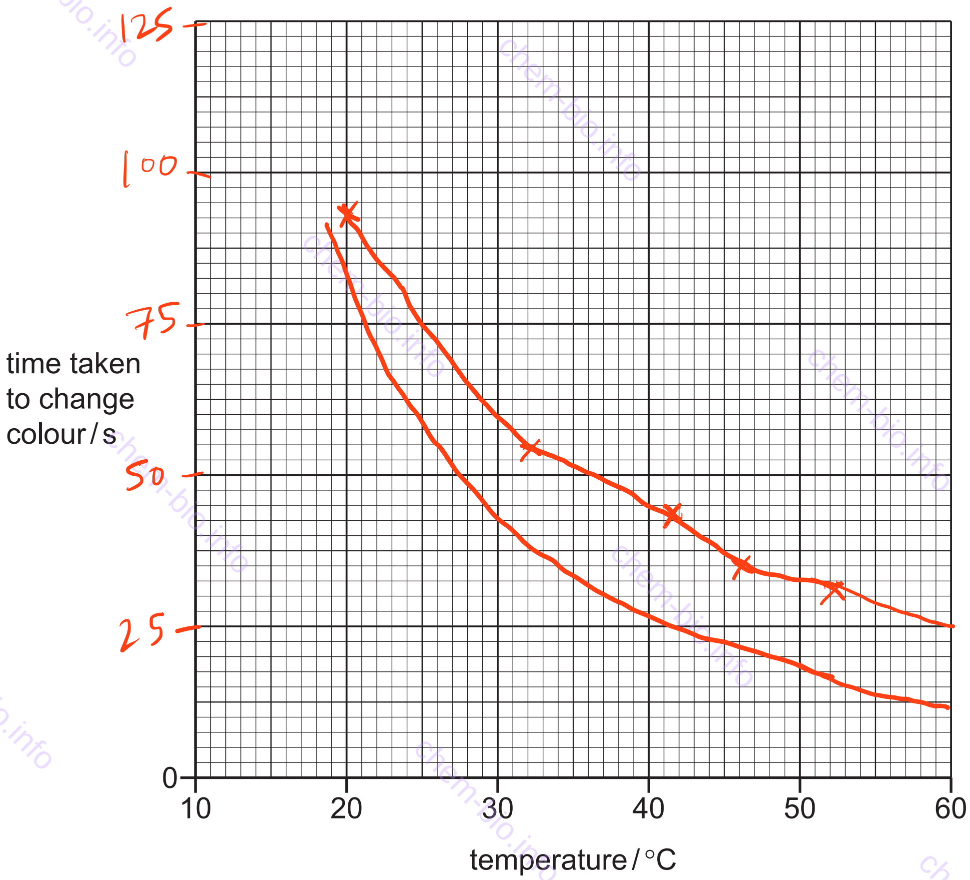
Use the thermometer diagrams and stop-clock diagrams to complete the table.

experiment	thermometer diagram	temperature / °C	stop-clock diagram	time / s
1		19.0		91
2		34.0		54
3		41.5		43
4		46.0		36
5		52.0		31

[4]

(b) Complete a suitable scale on the *y*-axis and plot the results from Experiments 1 to 5 on the grid.

Draw a curve of best fit through your points.



[4]

(c) Deduce which experiment had the fastest rate of reaction.

.................................experiment 5................................. [1]

(d) **From your graph**, deduce the time taken for the mixture to change colour at a temperature of 60.0 °C.

Show clearly **on the grid** how you worked out your answer.

time taken to change colour = ...25 s.......... [3]

(e) Experiments are often repeated and the results compared to check that they are reliable.

Suggest why this is difficult to do for these experiments.

..........difficult to get the temperature exactly the same..........

.... [1]

(f) Suggest why the aqueous potassium iodate is warmed **before** the aqueous sodium metabisulfite is added rather than after it has been added.

otherwise the temperature is still increasing/ changing while it reacts [1]

(g) A polystyrene cup can be used instead of the beaker in this experiment.

(i) Explain the advantage of transferring the warmed potassium iodate to a polystyrene cup rather than leaving it in the beaker.

insulator/reduces heat loss

temperature more constant/accurate

[2]

(ii) Suggest why it is **not** a good idea to put the aqueous potassium iodate in a polystyrene cup before it is warmed.

the polystyrene would melt

[1]

(h) Sketch **on the grid** the graph obtained when the experiments are repeated using aqueous potassium iodate of a higher concentration. [1]

[Total: 18]

3 Solid **N** and solution **O** were analysed. Solid **N** was zinc carbonate.

tests on solid N

(a) Dilute hydrochloric acid was added to a boiling tube containing solid **N**. Any gas produced was tested.

observations ..effervescence/bubbles/fizzing..

limewater turns milky

.... [2]

The mixture formed in the boiling tube in **(a)** was filtered. The filtrate collected was solution **P**. Solution **P** was divided into two approximately equal portions in two test-tubes.

(b) To the first portion of solution **P**, aqueous sodium hydroxide was added gradually until it was in excess.

observations ...white precipitate..

dissolves in excess

.... [2]

(c) To the second portion of solution **P**, aqueous ammonia was added gradually until it was in excess.

observations ...white precipitate..

dissolves in excess

.... [2]

tests on solution O

tests	observations
test 1 A flame test was carried out on solution **O**.	lilac flame
The remaining solution **O** was divided into three portions in three test-tubes. **test 2** Universal indicator paper was dipped into the first portion of solution **O**.	the universal indicator turned purple
test 3 1 cm^3 of dilute nitric acid and a few drops of aqueous silver nitrate were added to the second portion of solution **O**.	no change
test 4 Aqueous copper(II) sulfate was added dropwise and then in excess to the third portion of solution **O**.	blue precipitate which remained in excess

(d) Deduce the pH of solution **O**.

pH = ...12.......... [1]

(e) Identify solution **O**.

potassium hydroxide

KOH .... [2]

[Total: 9]

4 Many fizzy drinks contain phosphoric acid. Phosphoric acid reacts with sodium hydrogencarbonate to make carbon dioxide gas.

Value Coke and **Kola Koola** are two fizzy drinks which contain phosphoric acid as the only acid.

Plan an investigation to find which of these two fizzy drinks contains the highest concentration of phosphoric acid.

Include in your answer how your results will tell you which drink contains the highest concentration of phosphoric acid.

You are provided with samples of both fizzy drinks, solid sodium hydrogencarbonate and common laboratory apparatus.

prepare 25 cm^3 of each drink, then add excess sodium hydroxide
the drink should be in a conical flask, which is connected to a gas
syringe to collect gas
wait for the reaction to finish, this is observed when there is no
fizzing left
measure the volume of gas collected from each drink
the drink with the largest volume of gas has the highest
concentration of phosphoric acid

OR

prepare 25 cm^3 of each drink, then add excess sodium hydroxide
the drink should be in a conical flask, which is connected to a gas
syringe to collect gas
collect a fixed volume of gas or wait for a fixed time for example
one minute
measure the time taken to collect the gas
the drink with the shortest time/largest volume has the highest
concentration of phosphoric acid

[6]