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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

- 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.

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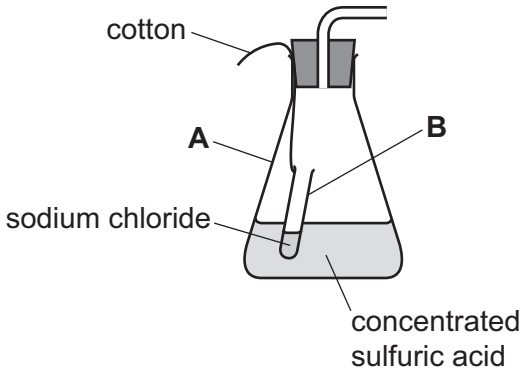
1 Hydrogen chloride is a colourless gas that is soluble in water and denser than air.
Hydrogen chloride can be made by reacting sodium chloride with concentrated sulfuric acid.

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 .....

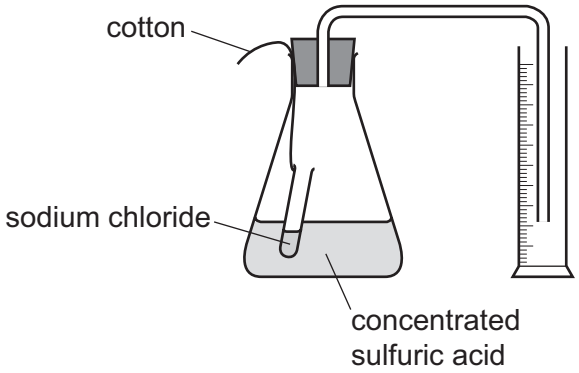
B .....
[2]

(b) Describe how the reaction is started after the apparatus has been set up.

.....

..... [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.

.....

..... [1]

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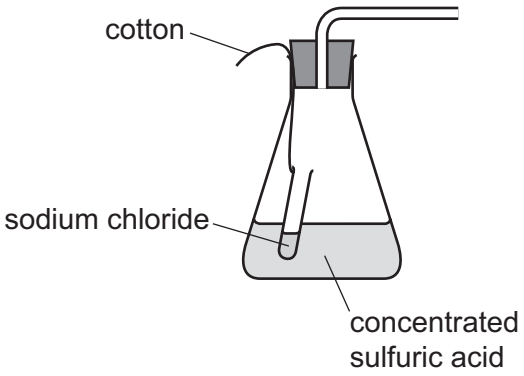
(d) Complete the diagram to show how the hydrogen chloride gas could be collected and the volume of the gas measured.



[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.

..... [1]

(ii) Give **one** safety precaution that should be taken when working with concentrated sulfuric acid.

..... [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.

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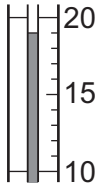
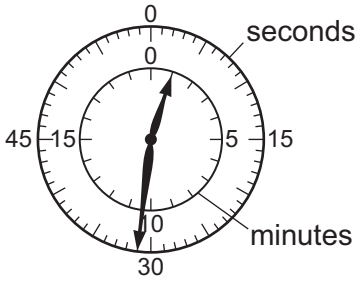
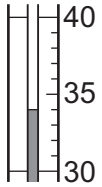
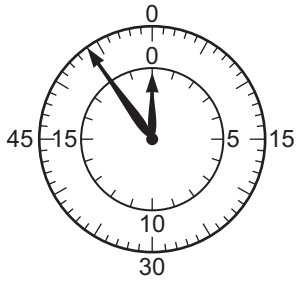
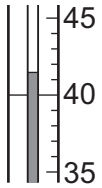
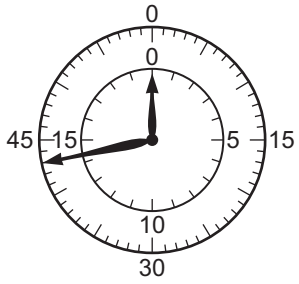
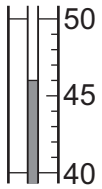
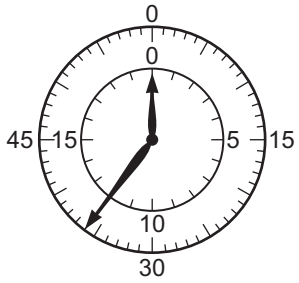
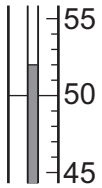
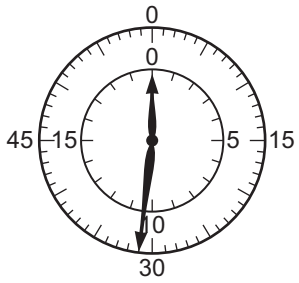
Use the thermometer diagrams and stop-clock diagrams to complete the table.

experiment	thermometer diagram	temperature / °C	stop-clock diagram	time / s
1				
2				
3				
4				
5				

[4]

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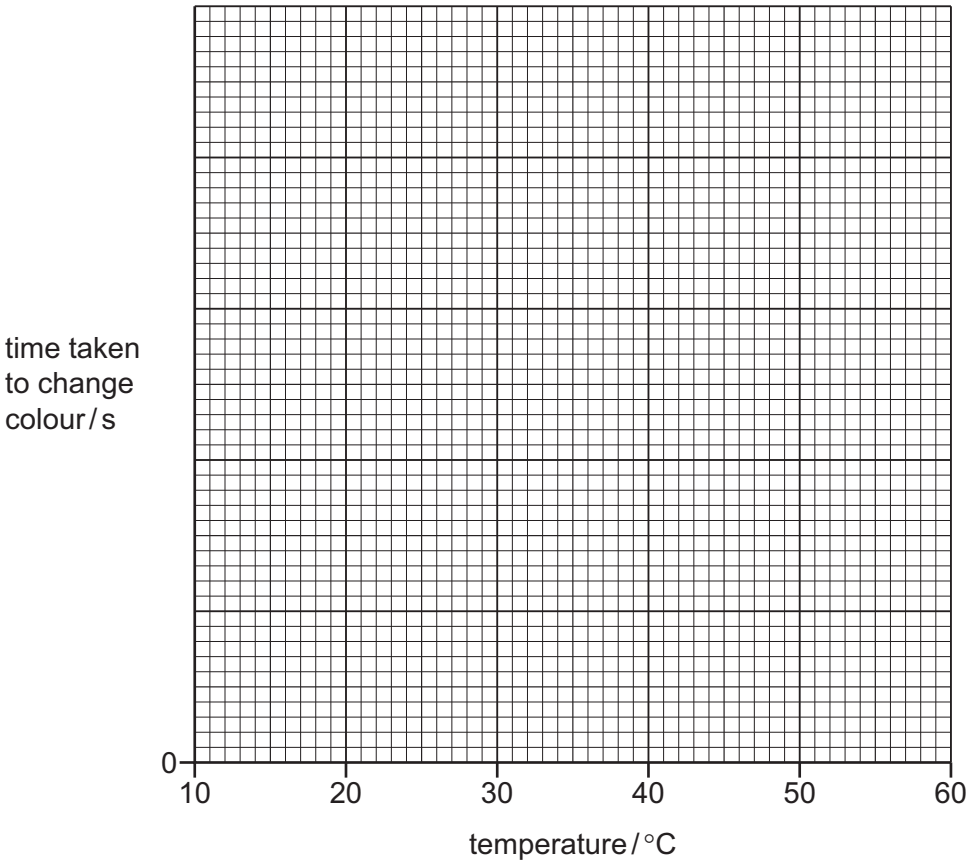
(b) Complete a suitable scale on the *y*-axis and plot the results from Experiments 1 to 5 on the grid.

Draw a curve of best fit through your points.



[4]

(c) Deduce which experiment had the fastest rate of reaction.

..... [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 = ... [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.

.....

..... [1]

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(f) Suggest why the aqueous potassium iodate is warmed **before** the aqueous sodium metabisulfite is added rather than after it has been added.

.....

..... [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.

.....

.....

..... [2]

(ii) Suggest why it is **not** a good idea to put the aqueous potassium iodate in a polystyrene cup before it is warmed.

.....

..... [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]

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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 .....

.....

..... [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 .....

..... [2]

(c) To the second portion of solution **P**, aqueous ammonia was added gradually until it was in excess.

observations .....

..... [2]

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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 = ... [1]

(e) Identify solution **O**.

.....

..... [2]

[Total: 9]

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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.

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