Cambridge Assessment International Education

Cambridge IGCSE™

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.

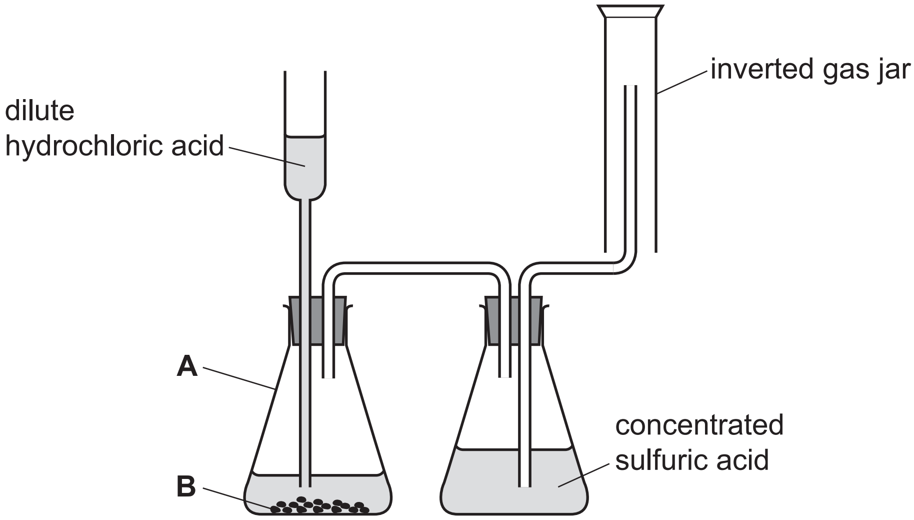
INFORMATION

- 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.

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**.

.... [1]

(c) Give the name of the substance labelled **B**.

.... [1]

(d) Suggest why this experiment should be carried out in a fume cupboard.

....

.... [1]

(e) Identify the **two** errors in the way the apparatus has been set up.

1 ....

....

2 ....

....
[2]

[Total: 6]

BLANK PAGE

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.

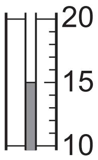
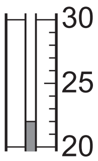
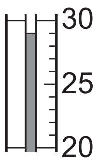
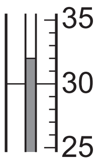
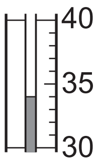
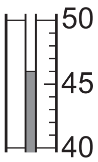
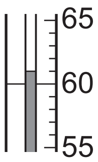
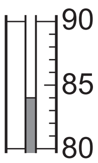
Experiment 5
- Experiment 4 was repeated but the mixture in the beaker was heated to a higher temperature than in Experiment 4.

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.

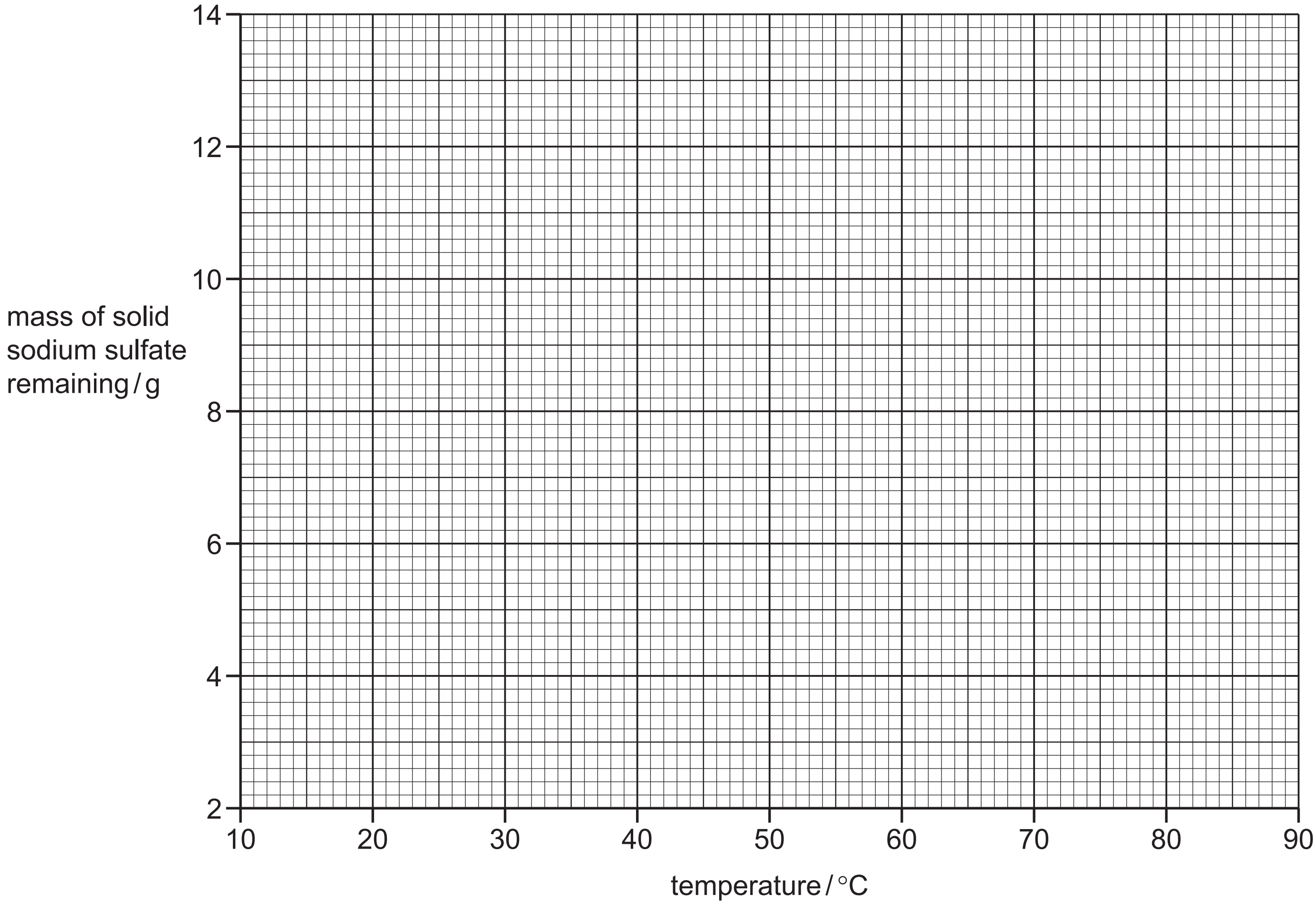
(a) Complete the table by using the thermometer diagrams and calculating the mass of solid sodium sulfate remaining in the evaporating basin at each temperature.

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	
2			56.3	62.2	
3			57.1	66.7	
4			58.0	69.7	
5			57.6	69.9	
6			56.4	68.1	
7			55.9	67.1	
8			57.6	68.4	

[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 = ... 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.
($1\,dm^3 = 1000\,cm^3$)

concentration = ... 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.

.... and .... [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.

.... [1]

(f) **(i)** Suggest why it is important that an **excess** of sodium sulfate is added to the water in the beaker.

.... [1]

(ii) Suggest why the mixture in the beaker was stirred as it was heated.

.... [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.

....

....

.... [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.

....

.... [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 ....

.... [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 .... [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 .... [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**.

.... [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 ....

observation ....
[2]

(e) Identify solid **X**.

....

.... [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.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

.... [6]

BLANK PAGE