Cambridge Assessment International Education

# Cambridge IGCSE™

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*0436997365*

**CHEMISTRY** **0620/52**

Paper 5 Practical Test **October/November 2020**

**1 hour 15 minutes**

You must answer on the question paper.

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

**INSTRUCTIONS**

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

**INFORMATION**

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

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| Total | |

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


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**1** You are going to investigate the rate of the reaction between sodium metabisulfite and potassium iodate.

**Read all of the instructions carefully before starting the experiments.**

**Instructions**
You are going to do five experiments. In each experiment the total volume of liquid is 45 $cm^3$.

*Experiment 1*
- Use a 10 $cm^3$ measuring cylinder to pour 5 $cm^3$ of aqueous sodium metabisulfite into the beaker.
- Use another 10 $cm^3$ measuring cylinder to pour 5 $cm^3$ of starch solution into the beaker.
- Use a 25 $cm^3$ measuring cylinder to pour 15 $cm^3$ of distilled water into the beaker.
- Use another 25 $cm^3$ measuring cylinder to pour 20 $cm^3$ of aqueous potassium iodate into the beaker. At the same time start the stop-clock.
- Stir the mixture in the beaker and continue to stir until a sudden colour change is seen.
- Stop the stop-clock and record the time in seconds to the nearest whole number in the table.
- Rinse the beaker with water.

*Experiment 2*
- Repeat Experiment 1 using 17 $cm^3$ of distilled water and 18 $cm^3$ of aqueous potassium iodate.

*Experiment 3*
- Repeat Experiment 1 using 21 $cm^3$ of distilled water and 14 $cm^3$ of aqueous potassium iodate.

*Experiment 4*
- Repeat Experiment 1 using 23 $cm^3$ of distilled water and 12 $cm^3$ of aqueous potassium iodate.

*Experiment 5*
- Repeat Experiment 1 using 25 $cm^3$ of distilled water and 10 $cm^3$ of aqueous potassium iodate.

**(a)** Complete the table.

| experiment | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| volume of aqueous sodium metabisulfite / $cm^3$ | | | | | |
| volume of distilled water / $cm^3$ | | | | | |
| volume of aqueous potassium iodate / $cm^3$ | 20 | 18 | 14 | 12 | 10 |
| time taken to change colour / s | | | | | |

[4]

**(b)** State the sudden colour change seen.

start colour .....

end colour .....

[1]

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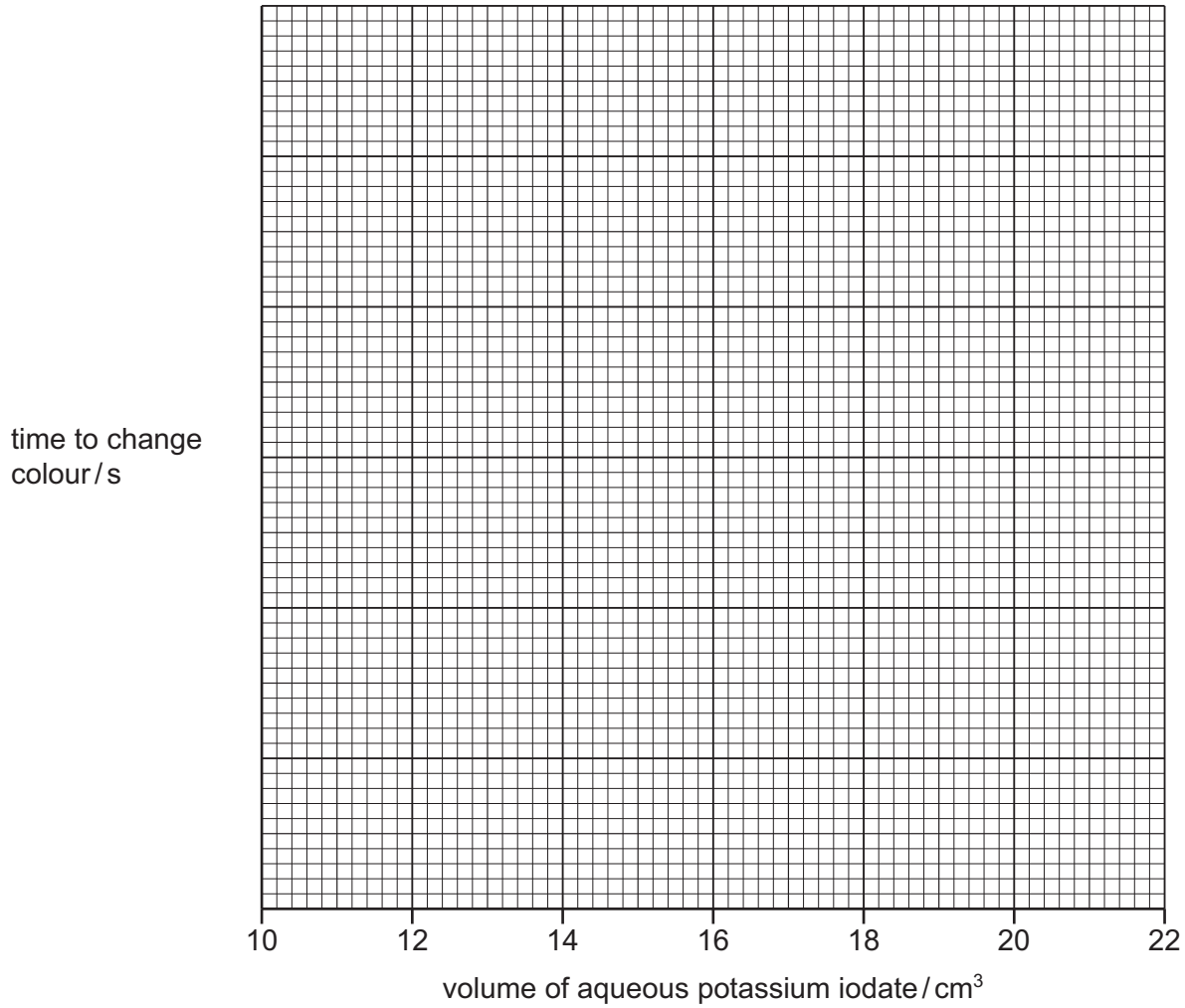
**(c)** Add a suitable scale for the *y*-axis and plot your results from Experiments 1 to 5 on the grid. Draw a smooth curve of best fit.




[4]

**(d) (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.

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

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

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**[Turn over**

**(f)** 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.

concentration = ..... $mol/dm^3$ [1]

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

..... [1]

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

.....

..... [1]

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

change to apparatus .....

.....

explanation .....

.....
[2]

**(i)** Describe how the reliability of the results of this investigation could be checked.

.....

..... [1]

[Total: 19]

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**2** You are provided with two solids, solid **Q** and solid **R**.
Do the following tests on solid **Q** and solid **R**, recording all of your observations at each stage.

**tests on solid Q**

**(a)** Using a spatula, place approximately three quarters of solid **Q** in a boiling tube.
Add about 10 $cm^3$ of dilute sulfuric acid to the boiling tube. Test any gas produced.
Record your observations.

**Keep the contents of the boiling tube for (c).**

.....

.....

..... [3]

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

..... [1]

**(c)** Filter the reaction mixture from **(a)**.
The filtrate is solution **S**. Pour 1 cm depth of solution **S** into a boiling tube.

**(i)** To solution **S** in the boiling tube add aqueous sodium hydroxide dropwise and then in excess.
Record your observations.

.....

.....

..... [2]

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

.....

..... [1]

**(iii)** Suggest an additional test that can be done on solution **S** that would allow you to identify the cation contained in solution **S**.

**Do not carry out this test.**

.....

..... [1]

**(d)** Place the remaining solid **Q** in a hard-glass test-tube. Heat the solid strongly until no further change is seen. Stop heating and leave the solid to cool.
Record your observations.

.....

.....

..... [2]

**tests on solid R**

**(e)** Carry out a flame test on solid **R**.
Record your observations.

..... [1]

**(f)** Place solid **R** in a boiling tube. Add about 10 $cm^3$ of distilled water to the boiling tube. Place a stopper in the boiling tube and shake the tube to dissolve solid **R** and form solution **R**.

Divide solution **R** into two approximately equal portions in two test-tubes.

**(i)** Add the first portion of solution **R** to the aqueous bromine provided in a test-tube.
Record your observations.

..... [1]

**(ii)** To the second portion of solution **R** add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.
Record your observations.

.....

..... [1]

**(g)** Identify solid **R**.

.....

..... [2]

[Total: 15]

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**3** 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.

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..... [6]

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**Notes for use in qualitative analysis**
**Tests for anions**

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

**Tests for aqueous cations**

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

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**Tests for gases**

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

**Flame tests for metal ions**

| metal ion | flame colour |
|---|---|
| lithium ($Li^+$) | red |
| sodium ($Na^+$) | yellow |
| potassium ($K^+$) | lilac |
| copper(II) ($Cu^{2+}$) | blue-green |

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