



CANDIDATE
NAME

--

--	--	--	--	--

--	--	--	--

0620/62

February/March 2020

1 hour

No additional materials are needed.

- 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.

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

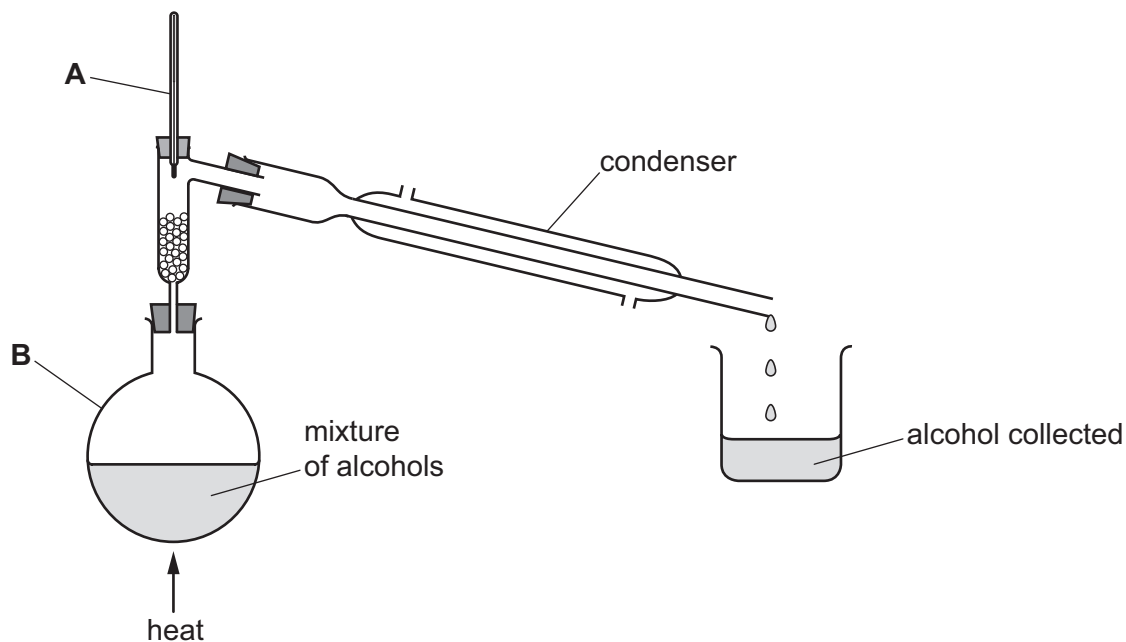
IB20 03_0620_62/2RP
© UCLES 2020

[Turn over

1 The table gives the boiling points of four alcohols.

alcohol	boiling point/°C
methanol	65
ethanol	79
propan-1-ol	97
butan-1-ol	117

The apparatus shown can be used to separate a mixture of the four alcohols shown in the table.



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

A

B

[2]

(b) Add to the diagram **one** arrow to show where water enters the condenser.

[1]

(c) (i) Why is it **not** safe to heat the mixture of alcohols with a Bunsen burner?

..... [1]

(ii) Suggest how the mixture of alcohols can be heated safely?

..... [1]

(d) Describe how the condenser allows the alcohol to be collected as a liquid.

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

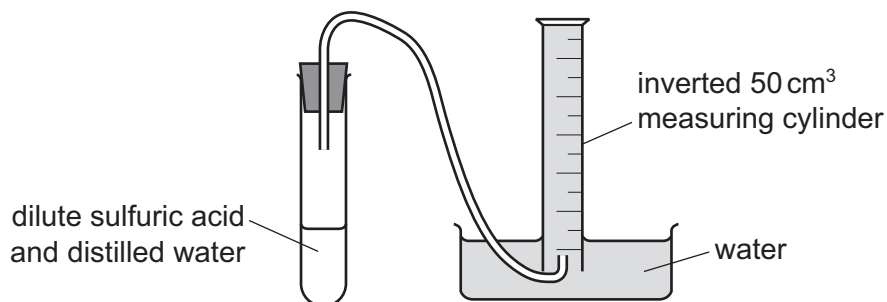
(e) Which alcohol would be collected first?
Explain your answer.

alcohol collected first
explanation
..... [2]

[Total: 8]

- 2 A student investigated the time taken to collect 40 cm^3 of hydrogen gas when magnesium reacts with dilute sulfuric acid.

Five experiments were done using the apparatus shown.



Experiment 1

- Using a measuring cylinder, 8 cm^3 of dilute sulfuric acid was poured into the boiling tube.
- Using a second measuring cylinder, 12 cm^3 of distilled water was added to the acid in the boiling tube.
- The apparatus was set up as shown in the diagram, ensuring the inverted measuring cylinder was full of water.
- The bung was removed from the boiling tube.
- A coiled length of magnesium ribbon was added to the boiling tube, the bung was immediately replaced and a timer started.
- The time taken for 40 cm^3 of gas to be collected was measured.
- The student felt the outside of the boiling tube.

- (a) (i) The student noticed that the boiling tube was warm.

What does this tell you about the type of reaction?

..... [1]

- (ii) Describe **one** change that could be made to the apparatus to help keep the temperature of the contents of the boiling tube constant during the reaction.

..... [1]

Experiment 2

- The boiling tube was rinsed out with distilled water.
- Experiment 1 was repeated using 10 cm^3 of dilute sulfuric acid and 10 cm^3 of distilled water.

Experiment 3

- Experiment 2 was repeated using 12 cm^3 of dilute sulfuric acid and 8 cm^3 of distilled water.

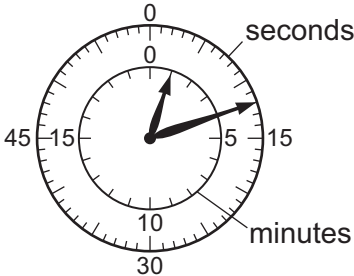
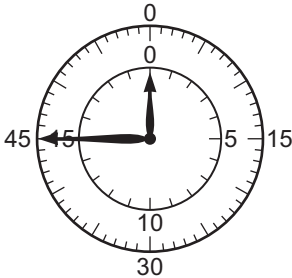
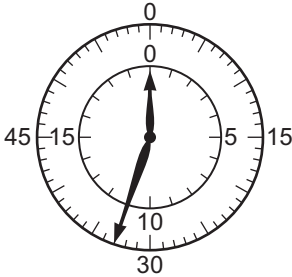
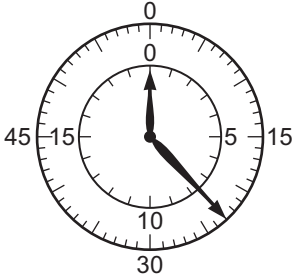
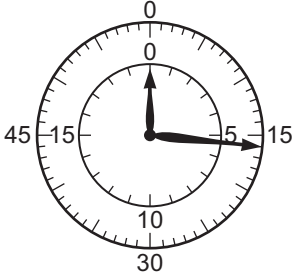
Experiment 4

- Experiment 2 was repeated using 16 cm^3 of dilute sulfuric acid and 4 cm^3 of distilled water.

Experiment 5

- Experiment 2 was repeated using 20 cm^3 of dilute sulfuric acid and no distilled water.

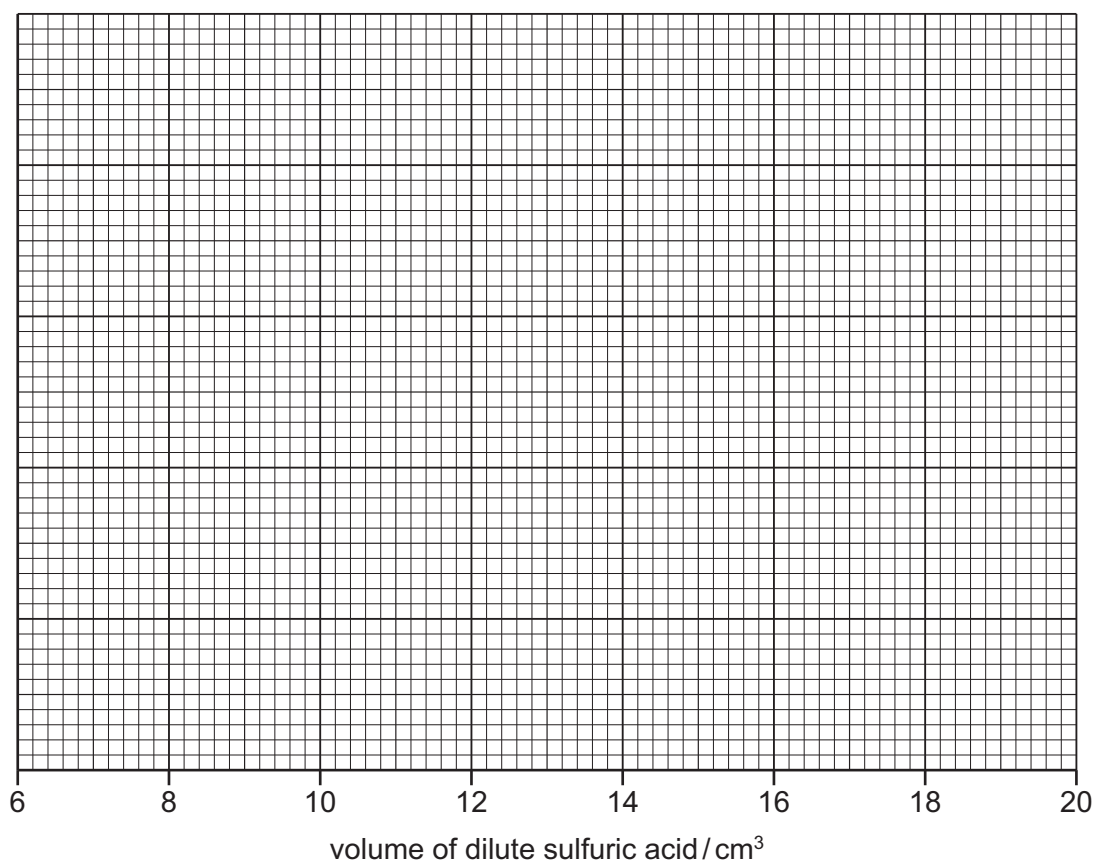
(b) Use the information in the description of the experiments and the timer diagrams to complete the table. Record the time in **seconds**.

experiment	volume of dilute sulfuric acid / cm ³	volume of distilled water / cm ³	timer diagram	time to collect 40 cm ³ of gas/s
1	8			
2	10			
3	12			
4	16			
5	20			

[4]

- (c) Add a suitable scale to the y-axis and plot the results from Experiments 1 to 5 on the grid. Draw a smooth line graph.

time to collect
40 cm³ of gas / s



[4]

- (d) (i) **From your graph**, deduce the time taken to collect 40 cm³ of gas if the experiment was repeated using 9 cm³ of dilute sulfuric acid.

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

..... s
[2]

- (ii) What volume of distilled water would be needed if the experiment was repeated using 9 cm³ of dilute sulfuric acid?

..... cm³ [1]

- (e) 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 1. Give the units for the rate of reaction you have calculated.

rate of reaction = units = [2]

- (ii) In which Experiment, 1, 2, 3, 4 or 5, was the rate of reaction greatest?

..... [1]

- (f) Why would measuring the volume of dilute sulfuric acid with a burette rather than a measuring cylinder be an improvement?

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

- (g) The magnesium starts to react with the dilute sulfuric acid as soon as it is added.

- (i) Why does this decrease the accuracy of the investigation?

..... [1]

- (ii) Describe **one** improvement that you could make to overcome this problem.

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

[Total: 19]

- 3 Solution **J** and solid **K** were analysed.

tests on solution J

tests	observations
<p>Solution J was colourless. Solution J was divided into three portions in three test-tubes.</p> <p>test 1</p> <p>Universal indicator paper was dipped into the first portion of solution J.</p>	<p>the universal indicator paper turned red</p>
<p>test 2</p> <p>A spatula measure of sodium carbonate was added to the second portion of solution J. The gas given off was tested.</p>	<p>effervescence was seen, the gas produced turned limewater milky</p>
<p>test 3</p> <p>1 cm³ of dilute nitric acid and a few drops of aqueous silver nitrate were added to the third portion of solution J.</p>	<p>a white precipitate formed</p>

- (a) Use the observation from **test 1** to suggest the pH of solution **J**.

pH = [1]

- (b) Name the gas given off in **test 2**.

..... [1]

- (c) Identify solution **J**.

.....

..... [2]

tests on solid K

Solid **K** was ammonium nitrate.

Complete the expected observations.

Solid **K** was dissolved in water to produce solution **K**. Solution **K** was divided into two equal portions.

- (d) About 1 cm³ of dilute nitric acid and a few drops of aqueous barium nitrate were added to the first portion of solution **K**.

observations [1]

- (e) 2 cm³ of aqueous sodium hydroxide was added to the second portion of solution **K**. The mixture was warmed and the gas given off was tested.

observations

.....

..... [2]

[Total: 7]

- 4** A black dye can be obtained from some plant roots.

Plan an investigation to determine how many different coloured substances are contained in a black dye obtained from plant roots.

You must include how the results you obtain will tell you how many different coloured substances are contained in the black dye.

You have access to plant roots and all normal laboratory apparatus.

[6]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.