UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6256816399

CHEMISTRY **5070/41**

Paper 4 Alternative to Practical **October/November 2012**

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.
The number of marks is given in brackets [ ] at the end of each question or part question.
At the end of the examination, fasten all your work securely together.

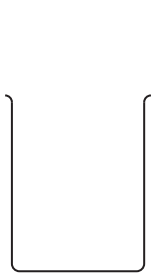
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This document consists of **14** printed pages and **2** blank pages.

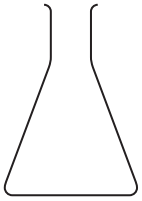
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1 The following apparatus is found in a laboratory.

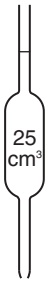
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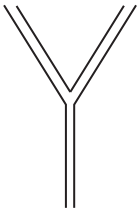
A



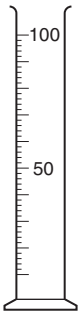
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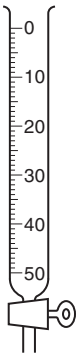
C



D



E



F

Write the letter of the apparatus most suitable for the purpose in the table below.

purpose	apparatus
(a) removing 25.0 cm^3 of a liquid from a container	
(b) measuring about 60 cm^3 of a liquid	
(c) as a titrating flask	
(d) to separate a precipitate from a solution	

[Total: 4]

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2 A student is given two test-tubes, one of which contains magnesium metal, the other magnesium oxide.

(a) Describe the appearance of

(i) magnesium,

.....

..... [1]

(ii) magnesium oxide.

.....

..... [1]

(b) When dilute hydrochloric acid is added to the test-tube containing magnesium, a gas is produced.

(i) Name the gas.

gas ..... [1]

(ii) Give a test to identify the gas.

test .....

observation ..... [1]

(iii) Construct the equation for the reaction between hydrochloric acid and magnesium.

..... [1]

(c) **(i)** How can magnesium be converted into magnesium oxide?

.....

..... [1]

(ii) Construct the equation for the reaction.

..... [1]

[Total: 7]

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[Turn over

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3 **(a)** A student is given a test-tube containing an unknown colourless liquid.

Suggest a **chemical** test to confirm the presence of water in the liquid.

.....

.....

..... [3]

(b) Suggest how the student can find out whether or not the liquid is pure water.

.....

.....

..... [2]

[Total: 5]

4 A student makes zinc sulfate by adding powdered zinc carbonate to a beaker half-filled with dilute sulfuric acid.
The equation for the reaction is

$$ZnCO_3 + H_2SO_4 \rightarrow ZnSO_4 + CO_2 + H_2O$$

(a) Give a test for carbon dioxide.

test .....

observation ..... [1]

(b) **(i)** If the acid is in excess how will the student know when the reaction has stopped?

.....

..... [1]

(ii) If the zinc carbonate is in excess what additional observation will the student make when the reaction has stopped?

.....

..... [1]

(c) To ensure that all the acid is neutralised, the student adds excess zinc carbonate. The mixture is well stirred.

How is the unreacted zinc carbonate removed from the mixture?

.....

..... [1]

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(d) The student repeats the experiment, this time adding excess zinc carbonate to 100 cm^3 of 0.5 mol/dm^3 sulfuric acid.

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Calculate the number of moles of sulfuric acid used in the experiment.

..... moles [1]

(e) Using your answer to **(d)** and the equation, calculate

(i) the mass of zinc sulfate which is produced,
[A_r: O, 16; S, 32; Zn, 65]

..... g [2]

(ii) the volume of carbon dioxide evolved.
[One mole of a gas occupies 24 dm^3 at room temperature and pressure.]

..... cm^3 [1]

[Total: 8]

In questions **5** to **8** place a tick (✓) in the box against the correct answer.

5 A student adds some zinc to a beaker containing aqueous copper(II) sulfate. After a while a pink deposit is seen and the solution becomes colourless.

Which of the following reactions takes place?

(a) addition ☐

(b) hydrolysis ☐

(c) neutralisation ☐

(d) redox ☐

[1]

[Total: 1]

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6 In doing a titration, five students each add hydrochloric acid from a burette to 25.0 cm^3 of aqueous sodium hydroxide.
The volumes of hydrochloric acid are shown in the table below.

student	1	2	3	4	5
volume / cm^3	25.2	25.3	25.3	26.1	25.2

Which of the following could be a reason for the result obtained by student 4?

(a) The burette had been washed with hydrochloric acid. ☐

(b) The flask had been washed with aqueous sodium hydroxide. ☐

(c) The student had used too much indicator. ☐

(d) The pipette had been washed with aqueous sodium hydroxide. ☐

[1]

[Total: 1]

7 A student does a series of experiments in which a halogen is displaced from its salt by the addition of another halogen.

Which result is **not** correct?

	halogen	salt	halogen produced
(a)	Br_2	KC*l*	Cl_2 ☐
(b)	Br_2	KI	I_2 ☐
(c)	Cl_2	KBr	Br_2 ☐
(d)	Cl_2	KI	I_2 ☐

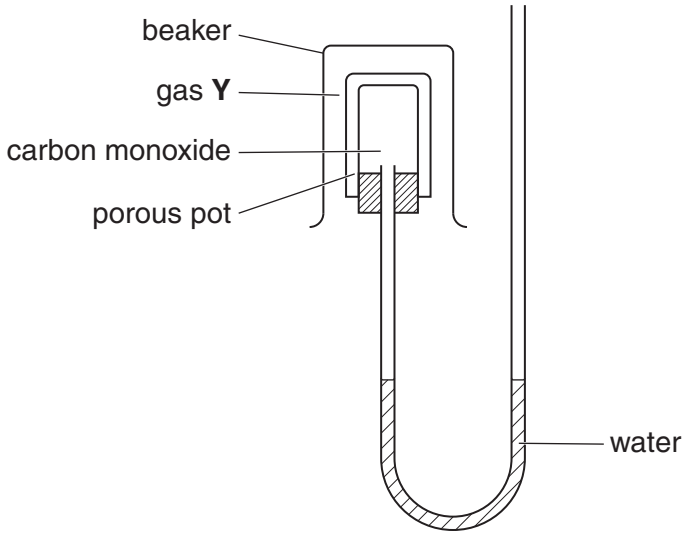
[1]

[Total: 1]

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8 A beaker of an unknown gas **Y** is inverted over a porous pot containing carbon monoxide.

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The apparatus is left for a while but the water level does not change.

The gas **Y** could be

(a) ammonia, ☐

(b) carbon dioxide, ☐

(c) chlorine, ☐

(d) nitrogen. ☐

[1]

[A_r; H, 1; C, 12; N, 14; O, 16; C*l*, 35.5]

[Total: 1]

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9 A student is given a sample of an organic acid and asked to

- determine its relative molecular mass
- suggest its formula.

The student titrates **R**, an aqueous solution containing 7.00 g/dm^3 of the organic acid, with **S**, an aqueous solution containing 0.100 mol/dm^3 of sodium hydroxide.

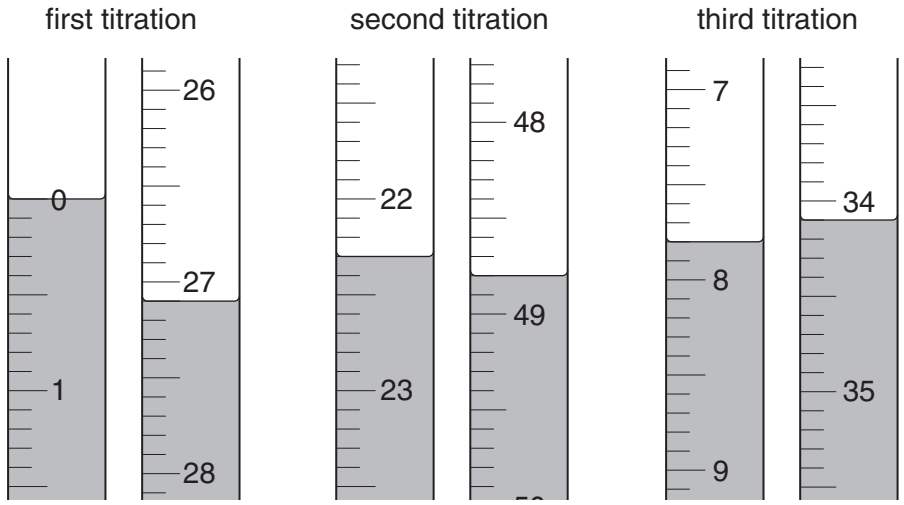
(a) 25.0 cm^3 of **S** is transferred into a conical flask.
A few drops of phenolphthalein indicator are added to the conical flask.
R is put into a burette and added to the solution in the conical flask until an end-point is reached.
Phenolphthalein is colourless in acid solution and pink in alkali solution.

What is the colour of the solution in the conical flask

(i) before **R** is added .....

(ii) at the end-point? ..... [1]

(b) The student does three titrations. The diagrams below show parts of the burette with the liquid levels at the beginning and end of each titration.



Use these diagrams to complete the following table.

titration number	1	2	3
final burette reading/cm^3			
initial burette reading/cm^3			
volume of **R** used/cm^3			
best titration results (✓)			

Summary

Tick (✓) the best titration results.

Using these results, the average volume of **R** is

..... cm^3 [4]

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(c) Calculate the number of moles of sodium hydroxide in 25.0 cm^3 of **S**.

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..... moles [1]

(d) Given that 1 mol of acid neutralises 1 mol of sodium hydroxide, use your answer in **(c)** to deduce the number of moles of the organic acid in the average volume of **R**.

..... moles [1]

(e) Calculate the number of moles of the acid in 1.00 dm^3 of **R**.

..... moles [1]

(f) Using your answer to **(e)** and the information that **R** contains 7.00 g/dm^3 of the acid, calculate the relative molecular mass of the acid.

..... [1]

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[Turn over

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(g) The organic acid has the formula

$$C_nH_{2n+1}CO_2H$$

Where **n** is a whole number.
Using your answer to **(f)**, deduce the value of **n** and hence the formula for the organic acid.
[A_r : H,1; C,12; O,16]

n = ... [2]

Formula for the organic acid is ..... [1]

(h) The organic acid can be produced by oxidising an alcohol.

(i) Give the name and formula of the alcohol.

name .....

formula ..... [1]

(ii) Suggest an oxidising agent which may be used.

..... [1]

[Total: 14]

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10 **T** is a compound which contains two ions.
Complete the table by adding the conclusion for **(a)**, the observations for **(b)(i)** and **(ii)** and **(c)(i)** and **(ii)**, and both the test and observation for **(d)**.

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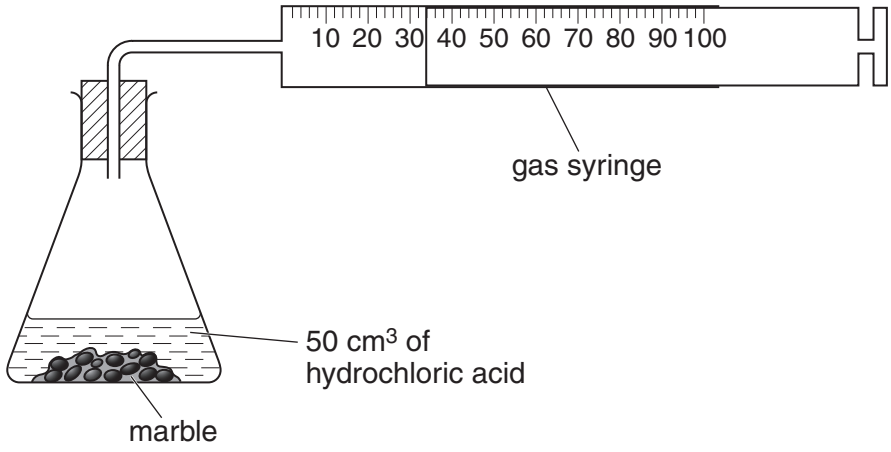
test	observation	conclusion
(a) **T** is dissolved in water and the solution divided into three parts for use in **(b)**, **(c)** and **(d)**.	A colourless solution is formed.	
(b) **(i)** To the first part, aqueous sodium hydroxide is added until a change is seen. **(ii)** An excess of aqueous sodium hydroxide is added to the mixture from **(i)**.		**T** may contain Al^{3+} or Zn^{2+} ions.
(c) **(i)** To the second part, aqueous ammonia is added until a change is seen. **(ii)** An excess of aqueous ammonia is added to the mixture from **(i)**.		**T** contains Zn^{2+} ions.
(d)		**T** contains I^- ions.

Conclusion: the formula of compound **T** is .....

[Total: 7]

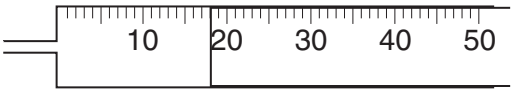
11 A student does two experiments to investigate the speed of reaction between hydrochloric acid and an excess of marble.
$50\,cm^3$ of hydrochloric acid is used in each experiment.
Carbon dioxide is produced.

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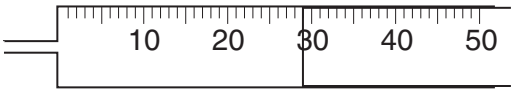


(a) Experiment **1**.
$50\,cm^3$ of $0.10\,mol/dm^3$ hydrochloric acid are added to the marble pieces.

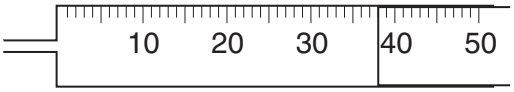
The diagrams below show parts of the syringe indicating the total volume of gas collected at the times stated.



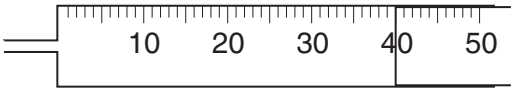
1 min



2 min



4 min



6 min

Use these diagrams to complete the following table.

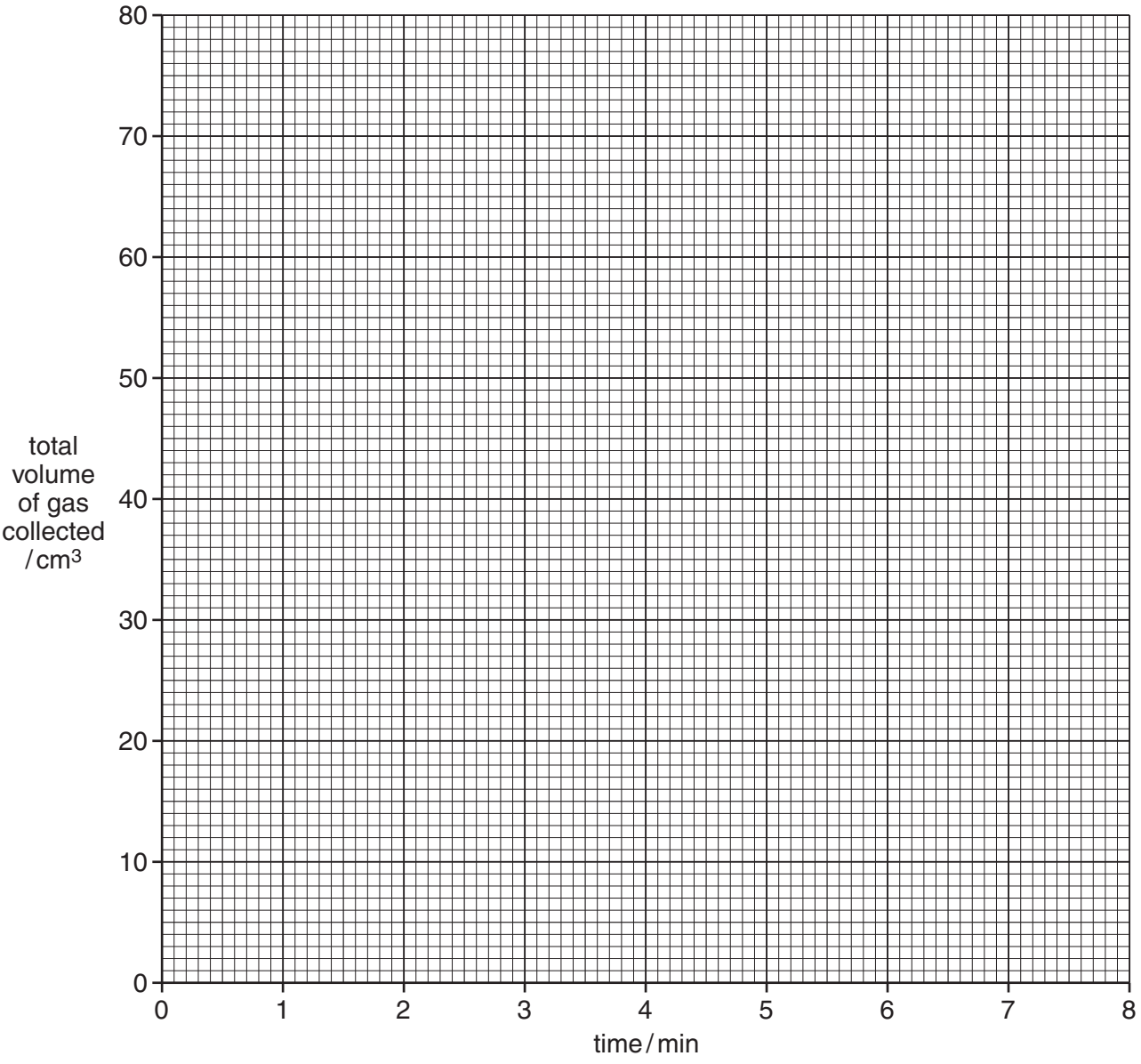
experiment	1 min	2 min	4 min	6 min	8 min
1					40
2	28	42	56	60	60

[1]

Experiment **2**.
$50\,cm^3$ of hydrochloric acid of a different concentration are added to the marble pieces.
The results are shown in the table.

(b) Plot the results for both experiments on the grid and join each set of points with a smooth curve.

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[3]

Use your graphs to answer the following questions.

(c) **(i)** What volume of gas is collected in experiment **1** during the first 3 minutes?

experiment **1** ..... cm^3 [1]

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(ii) The speed of a reaction may be calculated using the formula:

$$\text{speed of reaction} = \frac{\text{volume of gas produced / cm}^3}{\text{time taken / min}}$$

Calculate the speed of reaction in experiment **2** over the first 3 minutes.

.....cm^3/min [2]

(iii) Deduce the concentration of hydrochloric acid in experiment **2**. Explain your answer.

..... [2]

(d) A third experiment is done in which 50 cm^3 of 0.10 mol/dm^3 hydrochloric acid is added to an excess of **powdered** marble.
On your grid sketch the curve you would expect to see for the results of this experiment. [2]

[Total: 11]

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