Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/42**

Paper 4 Alternative to Practical **October/November 2015**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.
Electronic calculators may be used.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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

DC (LK/CGW) 89576/6

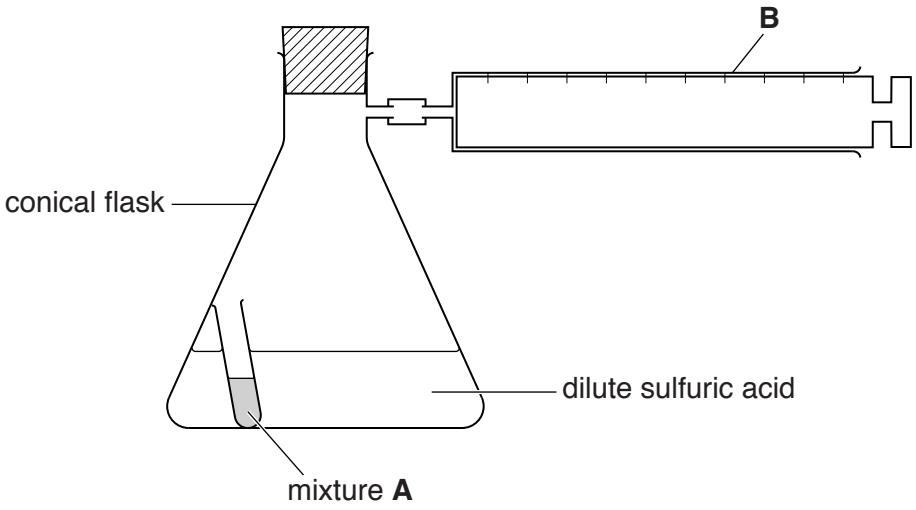
CAMBRIDGE
International Examinations

[Turn over

1 A student determines the mass of copper in mixture **A** which is composed of only copper and zinc.

Zinc reacts with dilute sulfuric acid. Copper does not.

Dilute sulfuric acid is mixed with **A** in the apparatus below. A gas is given off which is collected in **B**.



(a) Name apparatus **B**.

..... [1]

(b) **(i)** Name the gas collected in **B**. Give a test and observation to identify the gas.

name of gas .....

test and observation .....
[2]

(ii) Construct an equation for the reaction between zinc and dilute sulfuric acid.

..... [1]

(c) When all the zinc has reacted, the volume of gas collected in **B** is 96.0 cm^3 when measured at room temperature and pressure.
[1 mole of any gas occupies 24 000 cm^3 at room temperature and pressure.]

(i) Calculate the number of moles of gas in 96.0 cm^3.

..... moles [1]

(ii) Using your answers to **(b)(ii)** and **(c)(i)** calculate the mass of zinc in **A**.
[A_r: Zn, 65]

..... g [1]

(iii) The mass of mixture **A** is 1.20 g. Calculate the mass of copper in mixture **A**.

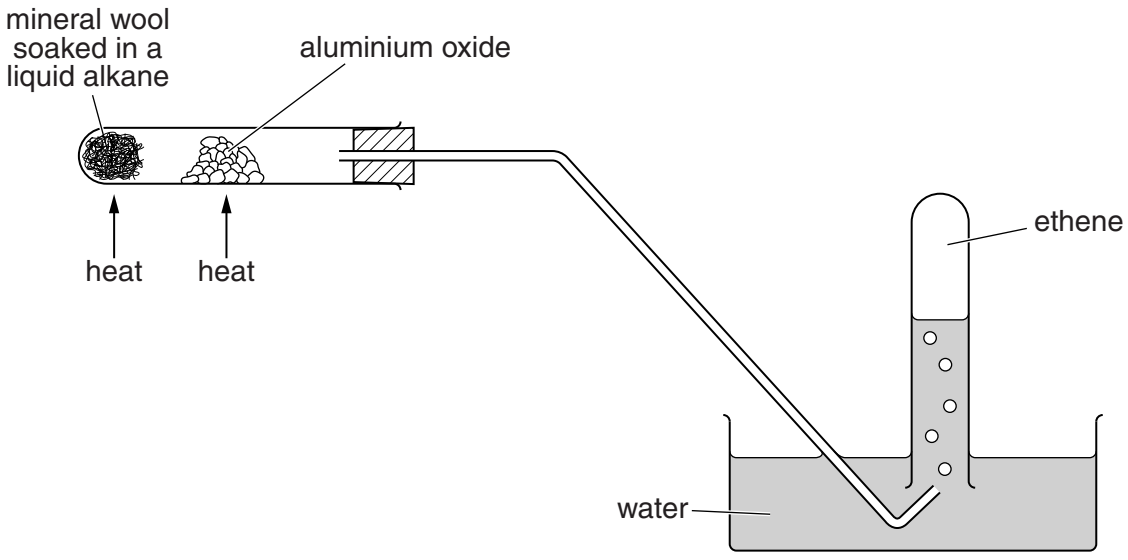
..... g [1]

(d) When the reaction has finished, the student separates the copper from the solution remaining in the conical flask by filtration, using a previously weighed filter paper. As soon as the filtration finishes the student weighs the filter paper containing the copper residue and finds that its mass is greater than he expected. Explain why.

.....[1]

[Total: 8]

2 A student prepares ethene, C_2H_4, using the apparatus below.



(a) **(i)** What is this type of reaction called?

.....[1]

(ii) Suggest why aluminium oxide is used in this reaction.

.....[1]

(iii) The liquid alkane has eight carbon atoms in each molecule. Give the molecular formula of the alkane.

.....[1]

(iv) The reaction produces ethene and one other product. Construct a possible equation for the reaction.

.....[1]

(b) Two drops of aqueous bromine are added to ethene.

(i) What observation is made?

.....[1]

(ii) What type of reaction occurs?

.....[1]

(iii) Construct an equation for the reaction between bromine and ethene.

.....[1]

(c) When ethene undergoes complete combustion in air, the products are water and a colourless gas.

Name the colourless gas. Give a test and observation to identify this gas.

name of gas .....

test and observation .....

[2]

[Total: 9]

In questions **3** to **6** inclusive, place a tick (✓) in the box against the correct answer.

3 A compound, **T**, contains 41.0% potassium, 33.7% sulfur and 25.3% oxygen by mass.

What is the empirical formula of **T**?
[A_r: K, 39; S, 32; O, 16]

(a) $K_4S_3O_3$ ☐

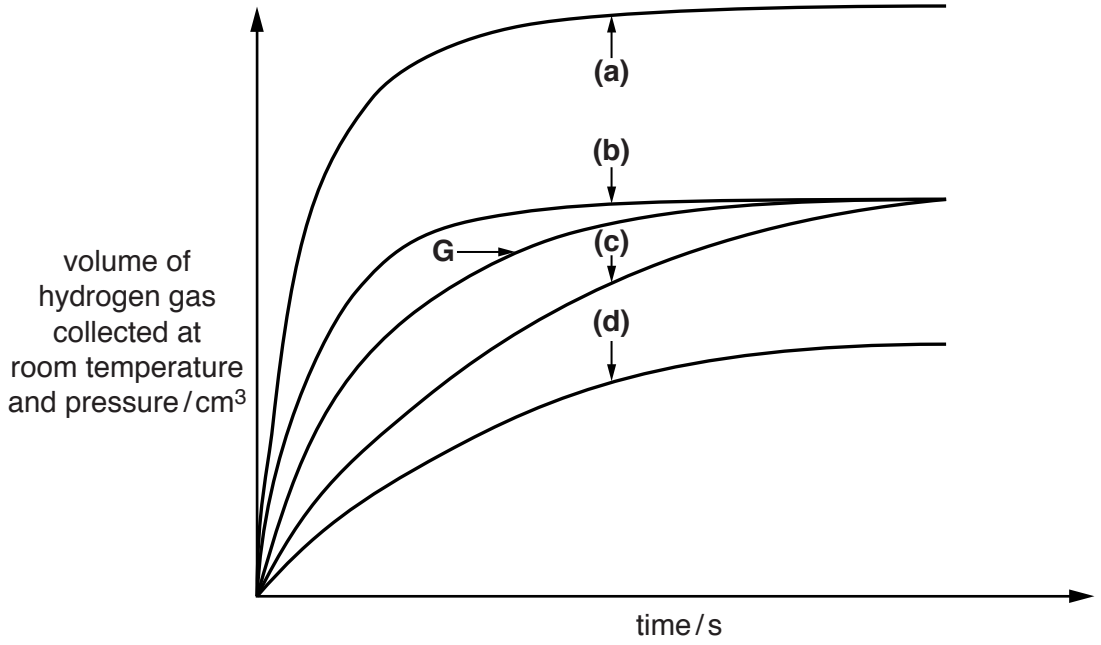
(b) K_2SO_3 ☐

(c) K_2SO_4 ☐

(d) $K_2S_2O_3$ ☐

[Total: 1]

4 A student adds excess zinc to 50 cm^3 of 1.00 mol/dm^3 hydrochloric acid at 20 °C.
A graph, labelled **G**, is drawn, showing how the volume of hydrogen gas evolved varies with time.



The experiment is repeated using identical conditions but with the hydrochloric acid at a temperature of 40 °C.

Which of the graphs correctly shows how the volume of hydrogen gas evolved varies with time when using hydrochloric acid at 40 °C?

(a) ☐

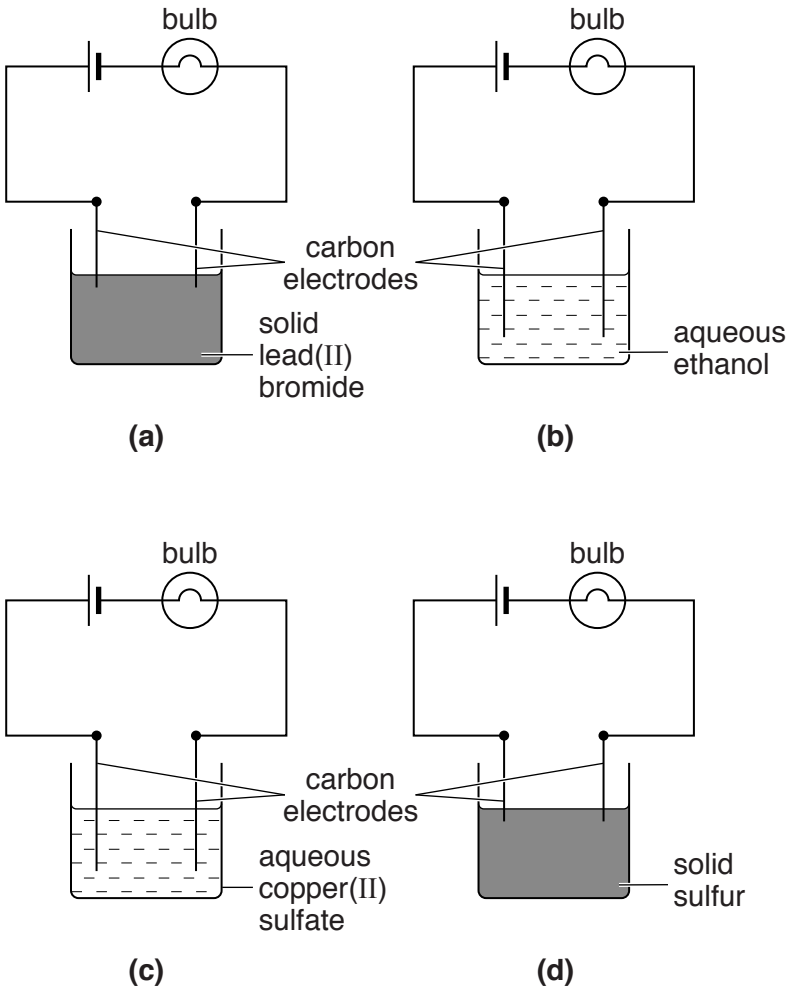
(b) ☐

(c) ☐

(d) ☐

[Total: 1]

5 In which of the following circuits would the bulb light?



(a) ☐

(b) ☐

(c) ☐

(d) ☐

[Total: 1]

6 Which of the following would **not** react together to form a precipitate?

(a) aqueous sodium hydroxide and aqueous ammonium chloride ☐

(b) aqueous silver nitrate and aqueous sodium chloride ☐

(c) aqueous sodium hydroxide and aqueous iron(II) sulfate ☐

(d) aqueous barium nitrate and aqueous magnesium sulfate ☐

[Total:1]

7 A student determines the percentage composition by mass of a mixture of two solids, sodium chloride, NaC*l*, and sodium carbonate, Na_2CO_3. This is mixture **M**.

(a) A sample of **M** is placed in a previously weighed container, which is then reweighed.

mass of container + **M**	=	9.05 g
mass of container	=	7.23 g

Calculate the mass of **M** used in the experiment.

..... g [1]

(b) The sample of **M** is dissolved in distilled water and the solution made up to 250 cm^3. This is solution **Q**.

Name the apparatus in which solution **Q** should be made up to 250 cm^3.

.....[1]

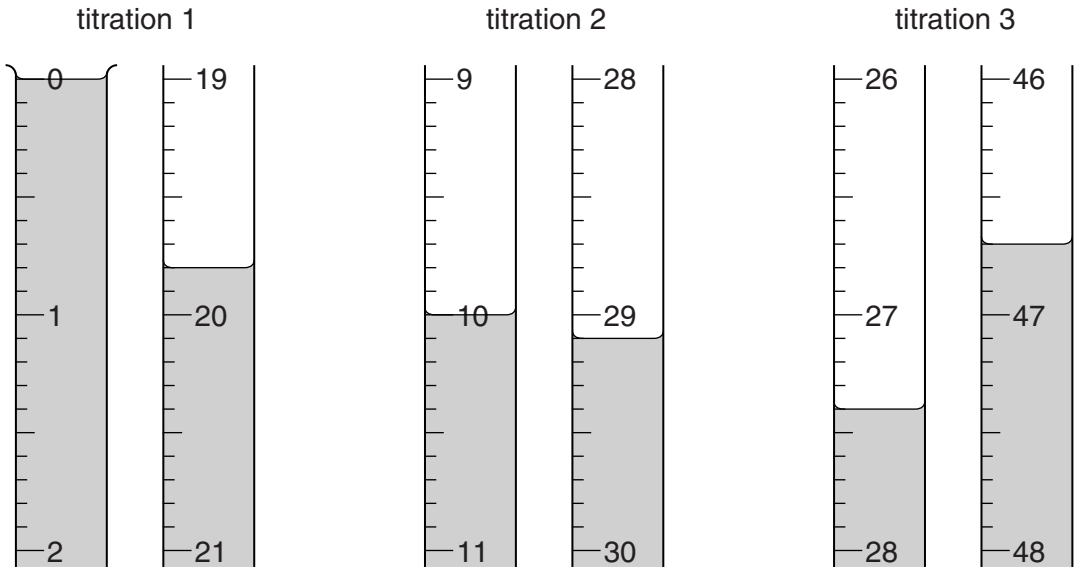
(c) A 25.0 cm^3 sample of **Q** is transferred into a conical flask and a few drops of methyl orange indicator are added. A burette is filled with 0.100 mol/dm^3 hydrochloric acid.

The hydrochloric acid is added to **Q** until the end-point is reached.

What is the colour of the solution in the conical flask

- before the hydrochloric acid is added, ...
- at the end-point? ..... [1]

(d) 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 the diagrams to complete the following table.

titration number	1	2	3
final burette reading/cm^3			
initial burette reading/cm^3			
volume of hydrochloric acid/cm^3			
best titration results (✓)			

Summary

Tick (✓) the best titration results.

Using these results, the average volume of hydrochloric acid required is

..... cm^3. [4]

(e) Calculate the number of moles of hydrochloric acid in the average volume of 0.100 mol/dm³ hydrochloric acid in **(d)**.

..... moles [1]

(f) Sodium carbonate reacts with hydrochloric acid but sodium chloride does not.

Construct the equation for the reaction between sodium carbonate, Na_2CO_3, and hydrochloric acid.

One mole of sodium carbonate reacts with two moles of hydrochloric acid.

.....[1]

(g) Using the information in **(f)** and your answer to **(e)**, deduce the number of moles of sodium carbonate in 25.0 cm^3 of **Q**.

..... moles [1]

(h) Calculate the number of moles of sodium carbonate in 250 cm^3 of **Q**.

..... moles [1]

(i) Use your answer to **(h)** to calculate the mass of sodium carbonate, Na_2CO_3, in the sample of **M**.
[A_r: Na, 23; C, 12; O, 16]

..... g [1]

(j) Using your answers to **(i)** and **(a)**, calculate the mass of sodium chloride in the sample of **M**.

..... g [1]

(k) Calculate the percentage by mass of sodium chloride in **M**.

..... % [1]

[Total: 14]

[Turn over

8 Compound **L** is a solid. The following table shows the tests a student does on compound **L**.

Complete the table by adding the conclusion for test **(a)**, the observations for tests **(b)** and **(c)** and both the test and observation which lead to the conclusion for test **(d)**.

test	observation	conclusion
(a) **L** is dissolved in water and the solution divided into three parts for tests **(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.		**L** may contain Al^{3+}, Ca^{2+} or Zn^{2+} ions.
(ii) An excess of aqueous sodium hydroxide is added to the mixture from **(i)**.		**L** may contain Al^{3+} or Zn^{2+} ions.
(c) **(i)** To the second part, aqueous ammonia is added until a change is seen.		**L** may contain Al^{3+} or Zn^{2+} ions.
(ii) An excess of aqueous ammonia is added to the mixture from **(i)**.		**L** contains Al^{3+} ions.
(d)		**L** contains SO_4^{2-} ions.

[8]

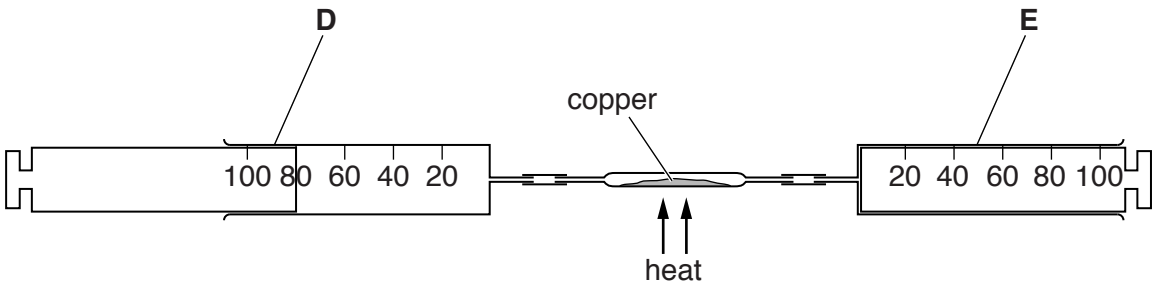
(e) Conclusion: the formula of compound **L** is ..... . [1]

[Total: 9]

Question 9 begins on page 12.

[Turn over

9 A student uses the apparatus below to oxidise copper.



At the start of the experiment, **D** contains 80 cm^3 of air. The air is forced over heated copper into **E**. The air is then forced back into **D**. The process is repeated several times until the volume of gas forced back into **D** is constant. The gas is allowed to cool to room temperature before recording the final volume.

(a) The copper reacts with oxygen in the air to produce copper(II) oxide. Construct an equation for this reaction.

.....[1]

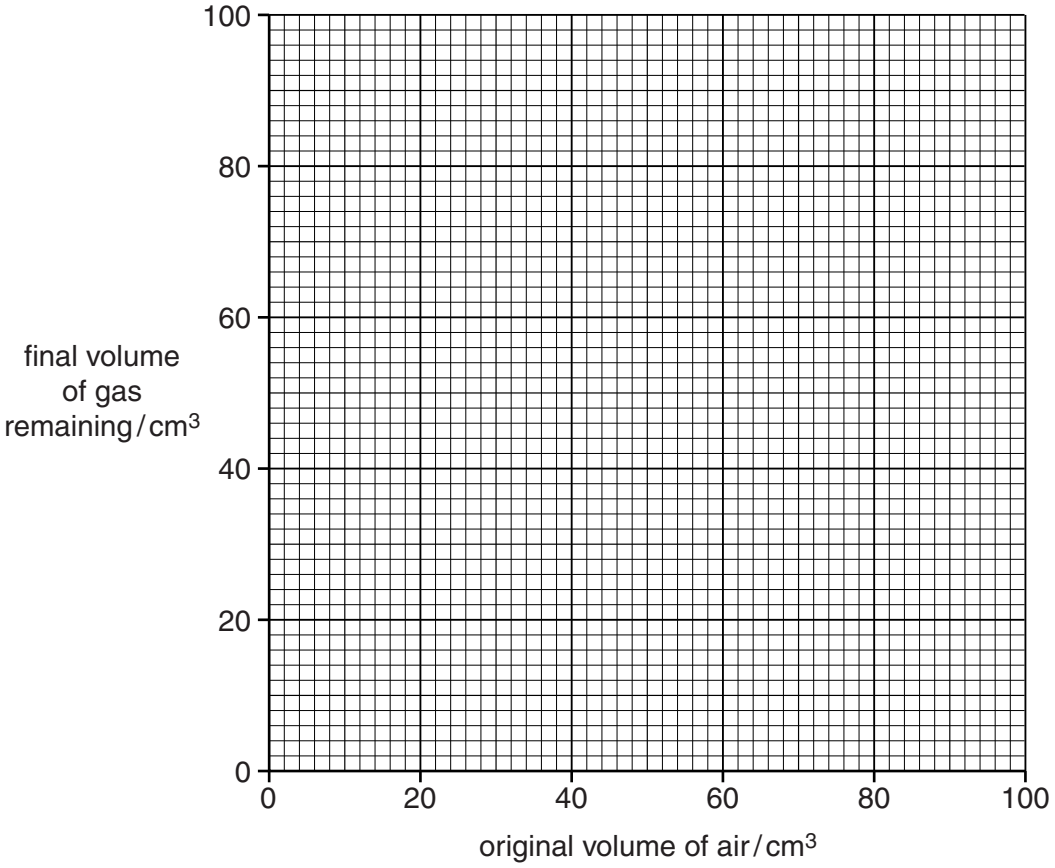
(b) Name the major component of the gas remaining in **D** at the end of the experiment.

.....[1]

(c) The student repeats the experiment several times using different volumes of air in **D**. The results are recorded in the table.

original volume of air / cm^3	final volume of gas remaining / cm^3
80	64
70	56
65	52
50	45
35	28
20	16

(i) Plot the results on the grid opposite and draw a straight line of best fit through your points.



[3]

(ii) There is one anomalous reading of the final volume of gas. Circle the anomalous point. [1]

(iii) Use your graph to deduce the correct final volume of gas corresponding to the point circled in **(c)(ii)**.

..... cm^3 [1]

(iv) The anomalous result is not due to an error in reading the final volume of gas. Suggest a reason why the anomalous result occurred.

.....

.....[1]

(d) Use your graph to answer the following questions.

(i) What is the final volume of gas if the student uses 25.0 cm^3 as the original volume of air?

..... cm^3 [1]

(ii) If the final volume of gas is 35.0 cm^3, what is the original volume of air that the student uses?

..... cm^3 [1]

[Total: 10]

[Turn over

10 A student converts copper(II) oxide into copper(II) sulfate.

(a) Name the substance that reacts with copper(II) oxide to produce aqueous copper(II) sulfate.

.....[1]

(b) Construct an equation for the reaction between copper(II) oxide and the substance in **(a)**.

.....[1]

(c) What colour is the solution when the reaction is complete?

.....[1]

(d) Describe how the student can make pure dry crystals of copper(II) sulfate from the solution formed by the reaction in **(b)**.

.....

.....

.....

.....

.....[3]

[Total: 6]

BLANK PAGE

BLANK PAGE