Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1120109685

CHEMISTRY **5070/41**

Paper 4 Alternative to Practical **May/June 2017**

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.

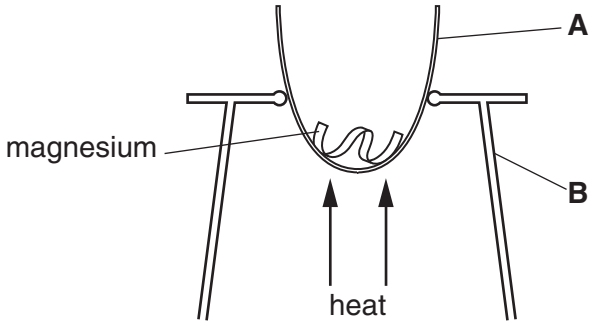
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **12** printed pages.

CAMBRIDGE International Examinations

1 A student does an experiment to convert magnesium into magnesium oxide, MgO.

A 0.36 g sample of magnesium is heated strongly for several minutes using the apparatus shown.



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

A .....

B ..... [2]

Magnesium is converted into a white powder, MgO. The expected mass of MgO is 0.60 g.

The student found that 0.55 g of MgO is produced in the experiment.

(b) Suggest one reason why the mass of MgO is lower than expected and suggest how the expected result may be achieved.

.....

.....

.....[2]

(c) The student does a similar experiment using 0.36 g of zinc instead of 0.36 g of magnesium.

Explain why he is wrong to expect that the mass of zinc oxide will also be 0.60 g.
[A_r: Mg, 24; Zn, 65]

.....

.....

.....[2]

(d) Suggest a safety item that the student should use when doing this experiment.

.....[1]

[Total: 7]

2 Sand is insoluble in water; sodium chloride is soluble in water.

You are provided with a beaker containing 10.0 g of a mixture of sand and sodium chloride.

Suggest an experiment to determine the percentage, by mass, of sodium chloride in the mixture.

You should state

- the apparatus required,
- any measurements you need to make,
- how you would use your results to determine the percentage, by mass, of sodium chloride in the mixture.

.....

.....

.....

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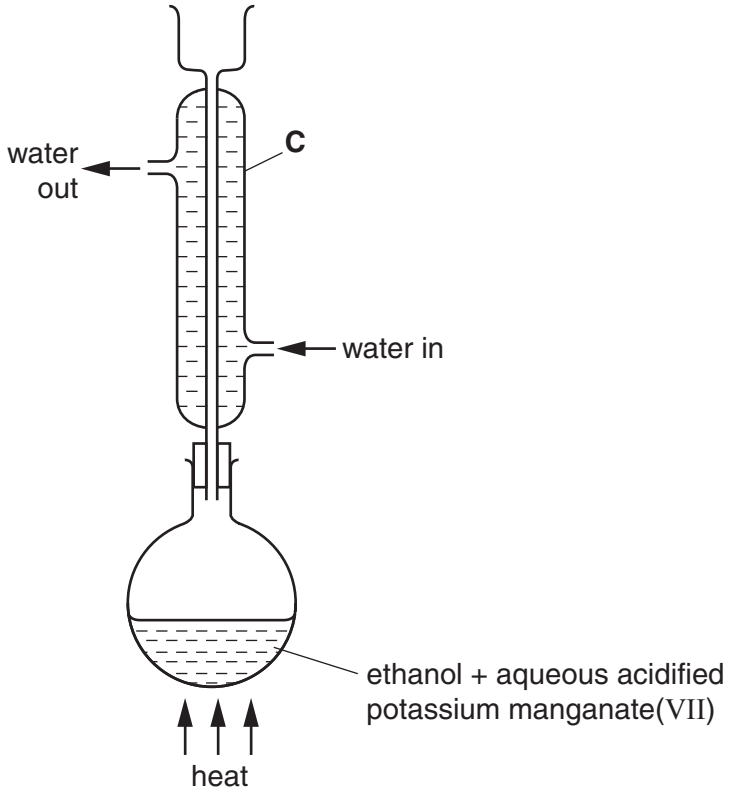
.....

[Total: 5]

[Turn over

3 A sample of ethanoic acid, CH_3COOH, can be prepared in the apparatus shown.



(a) (i) Name apparatus **C**.

.....[1]

(ii) What is the purpose of apparatus **C**?

.....[1]

(b) After heating the mixture in the flask for some time, all the ethanol will be oxidised to ethanoic acid.

Draw a diagram to show how the apparatus may be adapted to allow the ethanoic acid to be distilled from the resulting mixture in the flask.

You should add any further apparatus to your diagram to enable the distillation to take place.

[4]

(c) The boiling point of ethanoic acid is 118 °C.

Suggest which compound in the final reaction mixture will be the first to distil over, and the temperature at which it distils.

compound .....

temperature ..... [2]

(d) What does the student observe when a small volume of ethanoic acid is added to a test-tube containing aqueous sodium carbonate?

.....[1]

[Total: 9]

[Turn over

4 A student is given a bottle containing small pieces of scrap iron. She is asked to find the purity of this sample of iron.

A small quantity of the iron is placed in a previously weighed container which is then reweighed.

mass of container + scrap iron = 7.16 g
mass of container = 5.72 g

(a) Calculate the mass of the scrap iron.

..... g [1]

(b) The iron is placed in a conical flask and excess dilute sulfuric acid is added. The flask is warmed and the iron reacts with the sulfuric acid to produce Fe^{2+} ions.

Suggest why the flask is warmed.

.....[1]

(c) A gas is produced during the reaction.

(i) Name the gas.

..... [1]

(ii) Give a test and observation to identify this gas.

.....[1]

(d) When all the iron has reacted, the resulting solution is cooled and made up to 250 cm^3 with distilled water. This is solution **S**.

(i) In which apparatus should **S** be prepared?

..... [1]

(ii) 25.0 cm^3 of **S** is transferred into a conical flask.

Which apparatus should be used to transfer 25.0 cm^3 of **S** into a conical flask?

..... [1]

(e) Solution **T** is 0.0200 mol / dm^3 potassium manganate(VII). Aqueous potassium manganate(VII) is purple.

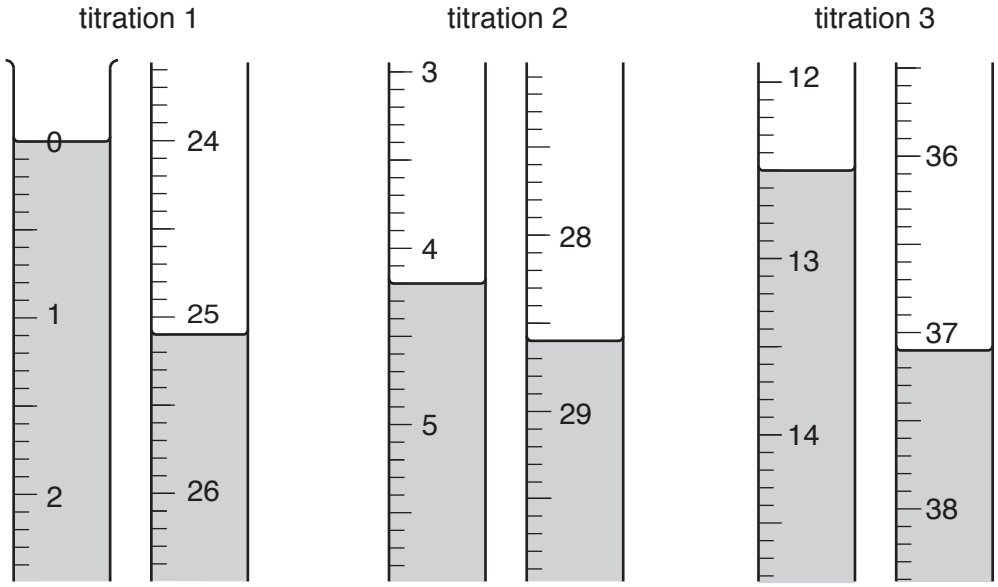
A burette is filled with **T**. **T** is run into the conical flask containing **S** until an end-point is reached.

What colour is the solution in the flask at the end-point? Explain your answer.

.....

.....[2]

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



Use the diagrams to complete the results table.

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

Summary

Tick (✓) the best titration results.

Using these results, the average volume of **T** required is

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

(g) Calculate the number of moles of potassium manganate(VII) in the average volume of **T** required.

T is 0.0200 mol / dm^3 potassium manganate(VII).

..... moles [1]

(h) Five moles of Fe^{2+} react with one mole of potassium manganate(VII).

Calculate the number of moles of Fe^{2+} in 25.0 cm^3 of **S**.

..... moles [1]

(i) Calculate the number of moles of Fe^{2+} in 250 cm^3 of **S**.

..... moles [1]

(j) Calculate the mass of Fe^{2+} in 250 cm^3 of **S**.
[A_r: Fe, 56]

..... g [1]

(k) Using your answers to **(a)** and **(j)**, calculate the percentage purity of the sample of scrap iron.

.....% [1]

[Total: 17]

5 A student is given compound **M** which contains a cation and an anion. He does the following tests to identify the two ions.

(a) A sample of **M** is dissolved in water. The solution is colourless.

Suggest what conclusion can be made.

.....[1]

(b) To a test-tube containing 1 cm^3 of aqueous **M**, a small volume of aqueous sodium hydroxide is added.

A white precipitate is produced. The precipitate is soluble in excess aqueous sodium hydroxide.

Suggest **two** cations which could be present in aqueous **M.**

..... and ..... [2]

(c) What further test should the student do with aqueous **M** to identify which of the two cations suggested in **(b)** is present in **M**?

test .....

observations .....

.....
[2]

(d) **M** is known to contain either chloride or iodide ions.

Suggest a test to identify which of the two anions is present in **M**.

test .....

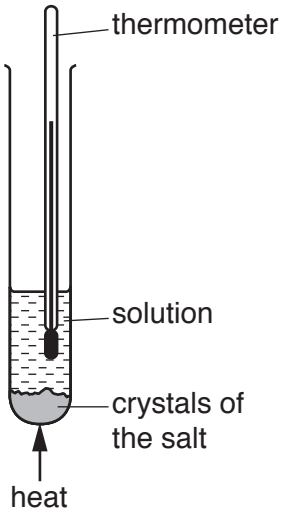
observations .....

.....
[3]

[Total: 8]

[Turn over

6 A student investigates the solubility of two salts, potassium chlorate(V) and sodium chloride, using the apparatus shown.



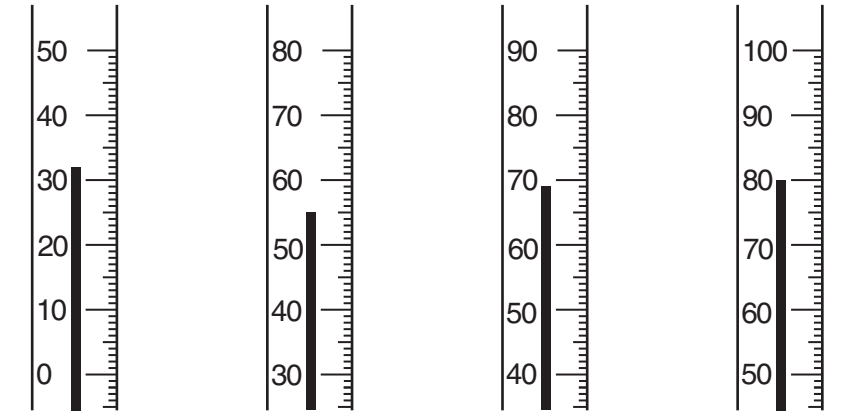
10 g of water is transferred into a boiling tube. 0.5 g of potassium chlorate(V) is added.

The tube and contents are heated until all the solid dissolves. The tube is allowed to cool.

At the first sign of solid reappearing the temperature is noted.

The experiment is repeated using 1.0, 2.0, 3.0 and 4.0 g of potassium chlorate(V).

The diagrams show parts of the thermometer stems giving the temperature at which the solid appears.



(a) Use the thermometer readings to complete the table.

mass of potassium chlorate(V) in 10 g of water / g	0.5	1.0	2.0	3.0	4.0
temperature at which potassium chlorate(V) reappears / °C	10				

[2]

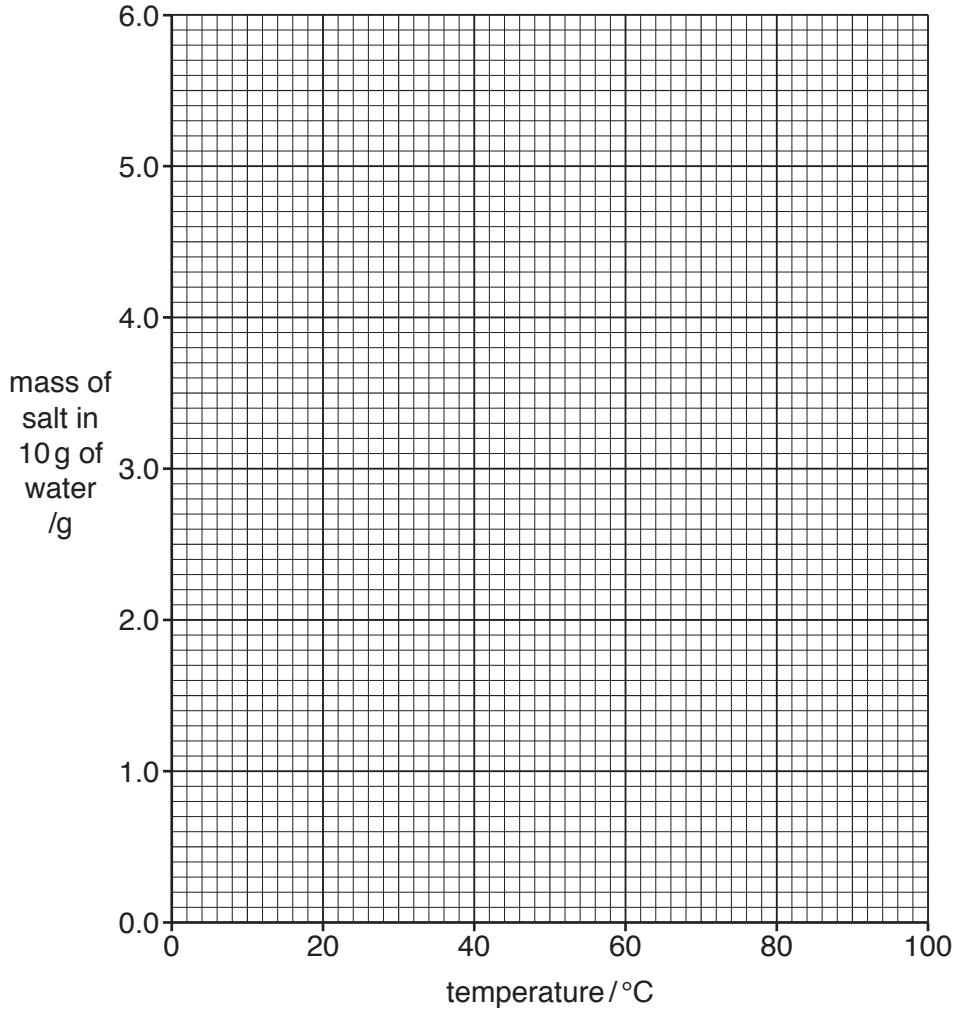
The experiment is repeated using different masses of sodium chloride. The results are shown in the table.

mass of sodium chloride in 10 g of water / g	2.7	3.0	3.2	3.4
temperature at which sodium chloride reappears / °C	10	34	50	66

(b) Plot the points for both potassium chlorate(V) and sodium chloride on the grid.

Draw a smooth curve through the points for potassium chlorate(V) and a straight line through the points for sodium chloride.

Extend each line in both directions so that at the lower ends, each line crosses the *y*-axis and at the upper ends the lines cross.



[4]

(c) Use your graphs to answer the following questions.

What mass of each compound is dissolved in 10 g of water at 0 °C?

(i) potassium chlorate(V) ..... g [1]

(ii) sodium chloride ..... g [1]

(d) The solubility of a salt is defined as the maximum mass of salt that will dissolve in 100 g of water at a given temperature.

(i) Use your graphs to determine the temperature at which the solubility of each salt is the same.

..... °C [1]

(ii) Calculate the solubility of both potassium chlorate(V) and sodium chloride at the temperature you have given in **(i)**.

..... g [1]

(e) The student is given two boiling tubes, one containing 2.0 g of potassium chlorate(V) in 10 g of water, the other containing 2.0 g of sodium chloride in 10.0 g of water. Both boiling tubes are at a temperature of 40 °C.

The mixtures are stirred.

Use your graphs to describe the contents of each tube.

potassium chlorate(V) .....

.....

sodium chloride .....

.....[2]

(f) By referring to your graphs, compare the effect of increasing the temperature on the solubility of each salt.

.....

.....[2]

[Total: 14]