Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/42**

Paper 4 Alternative to Practical **May/June 2014**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

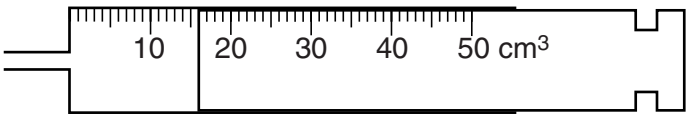
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

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

CAMBRIDGE International Examinations

1



(a) **(i)** Name the apparatus shown above.

..... [1]

(ii) What is the volume of gas in the apparatus?

..... cm^3
[1]

(b) Each of the following pairs of substances react together to produce a gas as one of the products.

In each case
- name the gas produced,
- describe a test for the gas,
- construct an equation for the reaction.

(i) calcium carbonate and dilute hydrochloric acid

gas .....

test .....

equation for the reaction .....
[3]

(ii) zinc and dilute sulfuric acid

gas .....

test .....

equation for the reaction .....
[3]

[Total: 8]

2 A student adds 50.0 cm^3 of 1.0 mol/dm^3 aqueous silver nitrate to a beaker containing 40.0 cm^3 of 1.5 mol/dm^3 aqueous sodium bromide.

(a) (i) A precipitate of silver bromide is produced.

Suggest the colour of the precipitate.

..... [1]

(ii) How is the precipitate separated from the reaction mixture?

..... [1]

(b) (i) Calculate the number of moles of silver nitrate in 50.0 cm^3 of 1.0 mol/dm^3 silver nitrate.

..... moles [1]

(ii) Calculate the number of moles of sodium bromide in 40.0 cm^3 of 1.5 mol/dm^3 sodium bromide.

..... moles [1]

(c) The equation for the reaction is

$$AgNO_3 + NaBr \longrightarrow NaNO_3 + AgBr$$

Using your answers to **(b)(i)**, **(b)(ii)** and the equation, calculate the mass of silver bromide produced in the experiment.
[A_r: Ag, 108; Br, 80]

.....g [2]

(d) The student repeats the experiment using 50.0 cm^3 of 1.0 mol/dm^3 silver nitrate with 60.0 cm^3 of 0.5 mol/dm^3 sodium bromide.

Calculate the mass of silver bromide produced in this experiment.

.....g [2]

[Total: 8]

3 **(a)** Using the general formula for the homologous series of alkanes, suggest the formula for both hexane and heptane, the sixth and seventh members of the alkane series respectively.

hexane

.....

heptane

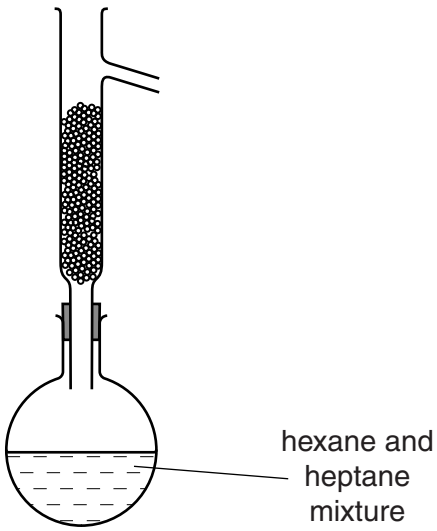
.....

[1]

(b) A mixture of hexane (b.p. 69 °C) and heptane (b.p. 89 °C) may be separated by fractional distillation.

The diagram below shows a fractionating column attached to a flask which contains a mixture of hexane and heptane.

Complete the diagram by adding further apparatus to enable each alkane to be collected.



[4]

[Total: 5]

In questions **4** to **8** inclusive place a tick (✓) in the box against the correct answer.

4 What mass of magnesium oxide is produced when 3.0 g of magnesium is burned in excess oxygen?
[A_r: Mg, 24; O, 16]

(a) 3.0 g ☐

(b) 4.0 g ☐

(c) 5.0 g ☐

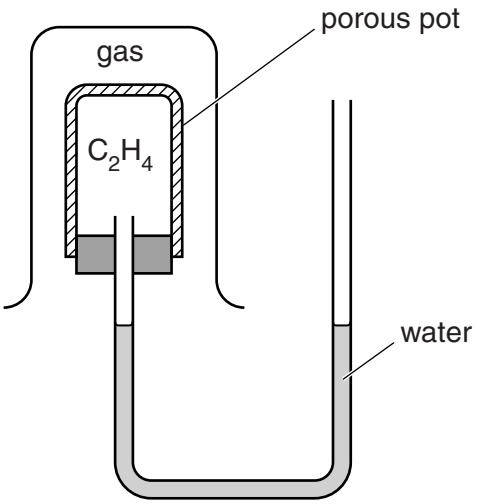
(d) 6.0 g ☐

[Total: 1]

5 The apparatus below is used in experiments with four gases: ammonia, NH_3; methane, CH_4; hydrogen, H_2; and nitrogen, N_2.

In each experiment another gas, ethene, C_2H_4, is in the inner container.

Each of the other gases is put into the outer container in turn.



Which gas does **not** cause a change in the water levels?
[A_r: H, 1; C, 12; N, 14]

(a) CH_4 ☐

(b) NH_3 ☐

(c) H_2 ☐

(d) N_2 ☐

[Total: 1]

6 When zinc is added to aqueous copper(II) sulfate, copper is produced.
The ionic equation for the reaction is

(a) $Cu + Zn^{2+} \rightarrow Cu^{2+} + Zn$ ☐

(b) $Cu^{+} + Zn \rightarrow Cu + Zn^{+}$ ☐

(c) $2Cu^{2+} + Zn \rightarrow 2Cu^{+} + Zn^{2+}$ ☐

(d) $Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$ ☐

[Total: 1]

7 Concentrated aqueous sodium chloride is electrolysed using carbon electrodes. What is produced at each electrode?

	cathode (negative electrode)	anode (positive electrode)	
(a)	sodium	chlorine	☐
(b)	hydrogen	chlorine	☐
(c)	hydrogen	oxygen	☐
(d)	sodium	oxygen	☐

[Total: 1]

8 The table below shows two indicators and their colours in acid and alkali respectively.

indicator	colour in acid	colour in alkali
bromothymol blue	red	yellow
thymol blue	yellow	blue

The two indicators are used in titrations involving hydrochloric acid and aqueous sodium hydroxide.

Which of the following shows the correct colour changes?

	solution in flask	solution in burette	colour change of bromothymol blue	colour change of thymol blue	
(a)	hydrochloric acid	sodium hydroxide	red → yellow	blue → yellow	☐
(b)	hydrochloric acid	sodium hydroxide	yellow → red	yellow → blue	☐
(c)	sodium hydroxide	hydrochloric acid	yellow → red	blue → yellow	☐
(d)	sodium hydroxide	hydrochloric acid	red → yellow	yellow → blue	☐

[Total: 1]

9 A student determines the percentage of zinc oxide in mixture **C**, containing both copper and zinc oxide.

(a) A sample of **C** is added to a previously weighed beaker which is then reweighed.

mass of beaker + **C** = 29.15 g
mass of beaker = 25.30 g

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

.....g [1]

(b) 50.0 cm^3 of 1.00 mol/dm^3 sulfuric acid (an excess) is added to the beaker containing the sample of **C**. This mixture is warmed gently while being stirred and then left to stand for a few minutes.

Zinc oxide reacts with sulfuric acid but copper does not.

The unreacted copper settles at the bottom of the beaker and is removed by filtration.

Construct the equation for the reaction between zinc oxide and sulfuric acid.

.....[1]

(c) When the reaction has finished the mixture is transferred to a volumetric flask and made up to 250 cm^3 with distilled water. This is solution **D**.

Using a pipette, 25.0 cm^3 of **D** is transferred into a conical flask and a few drops of methyl orange indicator are added.

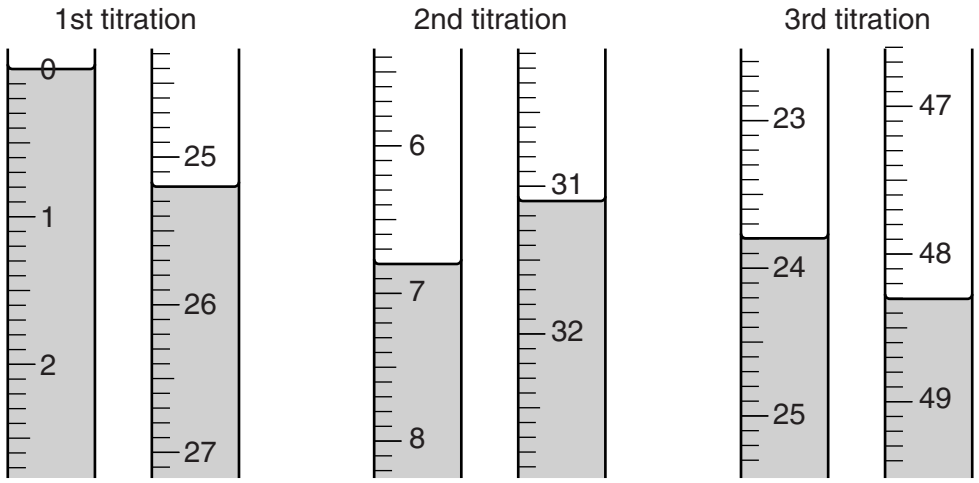
A burette is filled with 0.100 mol/dm^3 sodium hydroxide.

Aqueous sodium hydroxide is run into the conical flask containing **D** until the end-point is reached.

What is the colour change of the methyl orange during the reaction?

The colour changes from ..... to ..... [1]

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.



(d) Use the diagrams to complete the following results table.

titration number	1	2	3
final reading/cm^3			
initial reading/cm^3			
volume of 0.100 mol/dm^3 sodium hydroxide/cm^3			
best titration results (✓)			

Summary

Tick (✓) the best titration results.
Using these results, the average volume of 0.100 mol/dm^3 sodium hydroxide is

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

(e) Calculate the number of moles of sodium hydroxide in the average volume of 0.100 mol / dm^3 sodium hydroxide in **(d)**.

..... moles [1]

(f) Sodium hydroxide reacts with sulfuric acid according to the following equation.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Calculate the number of moles of sulfuric acid which reacts with the sodium hydroxide in **(e)**.

..... moles [1]

(g) Using your answer in **(f)**, calculate the number of moles of sulfuric acid in 250 cm^3 of **D**.

..... moles [1]

(h) Calculate the number of moles of sulfuric acid in 50.0 cm^3 of 1.00 mol / dm^3 sulfuric acid.

..... moles [1]

(i) Using your answers in **(g)** and **(h)**, calculate the number of moles of sulfuric acid which reacts with the zinc oxide in the sample of **C**.

..... moles [1]

(j) Using your equation in **(b)** and your answer in **(i)**, deduce the number of moles of zinc oxide in the sample of **C**.

..... moles [1]

(k) Calculate the mass of zinc oxide in the sample of **C**.
[A_r: Zn, 65; O,16]

.....g [1]

(l) Using your answers in **(a)** and **(k)** calculate the percentage by mass of zinc oxide in the sample of **C**.

.....% [1]

[Total: 15]

10 A student does some reactions using gas **X** and gas **Y**.

A colour change is seen in each case.

Complete the observations by stating the initial and final colours in each test.

test	observations	conclusions
(a) **X** is passed through aqueous potassium iodide.		**X** is an oxidising agent.
(b) **Y** is passed through acidified potassium dichromate(VI).		**Y** is a reducing agent.
(c) **Y** is passed through acidified potassium manganate(VII).		**Y** is a reducing agent.

[Total: 6]

Question 11 begins on page 12.

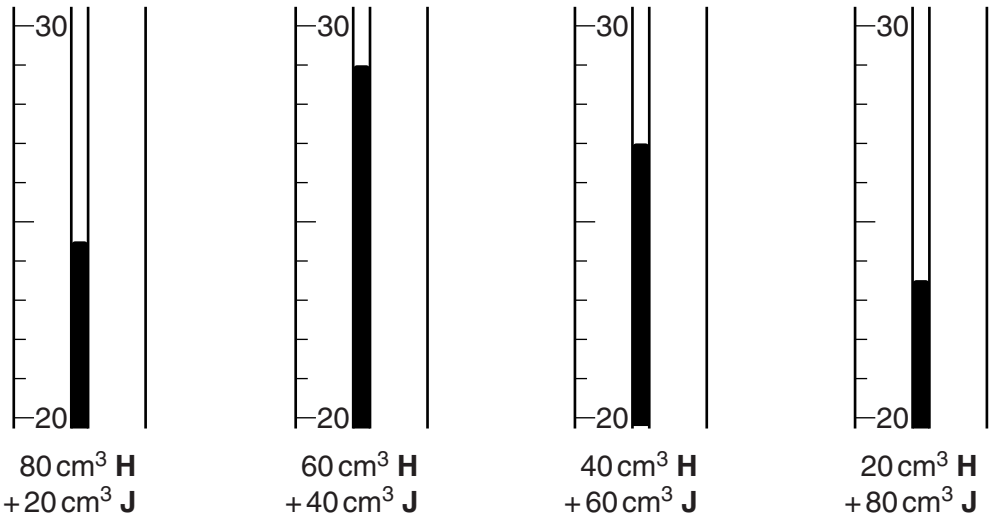
11 The addition of an acid solution to aqueous sodium hydroxide produces a rise in temperature.

A student is provided with **H**, aqueous sulfuric acid, and **J**, 1.00 mol / dm^3 sodium hydroxide.

He investigates the changes in temperature produced on mixing together different volumes of **H** and **J** while, in each experiment, keeping the total volume of solution constant at 100 cm^3.

The initial temperature of both **H** and **J** is 20 °C.

The diagrams below show parts of the thermometer stems indicating the maximum temperature recorded in each experiment.

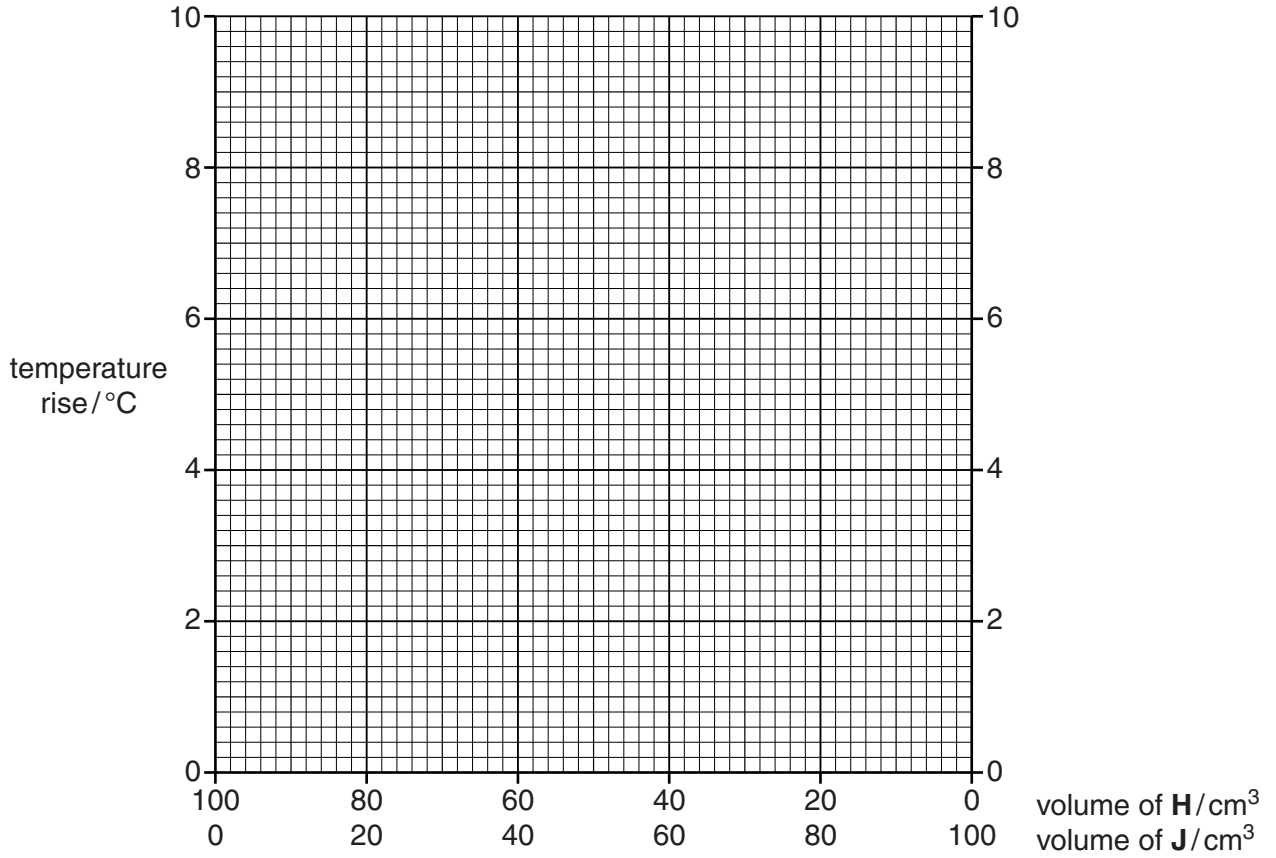


(a) Record these temperatures in the table below and then calculate the rise in temperature in each case.

volume of **H** / cm^3	volume of **J** / cm^3	maximum temperature / °C	temperature rise / °C
80	20		
60	40		
40	60		
20	80		

[2]

(b) Plot these results on the grid below.
Using the points, draw two intersecting straight lines.



[3]

(c) Use your graph to deduce

(i) the volumes of **H** and **J** in two mixtures, each of which produces a final temperature of 26 °C,

	volume of **H** / cm^3	volume of **J** / cm^3
mixture 1		
mixture 2		

[2]

(ii) the greatest temperature rise that can occur,

.....°C [1]

(iii) the volumes of **H** and **J** which produce this temperature rise.

H ..... cm^3

J ..... cm^3
[1]

(d) Solution **J** is 1.00 mol / dm^3 sodium hydroxide.
H is aqueous sulfuric acid.

Sodium hydroxide reacts with sulfuric acid according to the following equation.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Using this equation and your answers to **(c)(iii)**, calculate the concentration of **H**.

.....mol / dm^3 [2]

(e) The student repeats the experiment having first diluted the concentrations of both **H** and **J** to half those used in the original experiment.

Suggest

(i) the greatest temperature rise that would occur,

.....°C [1]

(ii) the volumes of both **H** and **J** that would produce this temperature rise.

H ..... cm^3

J ..... cm^3
[1]

[Total: 13]

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