Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY **5070/04**

Paper 4 Alternative to Practical

October/November 2003

1 hour

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, Centre number and candidate number in the spaces at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams, graphs, or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
You should use names, not symbols, when describing all reacting chemicals and products formed.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

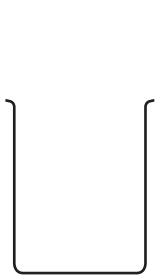
For Examiner's Use

This document consists of **15** printed pages and **1** blank page.

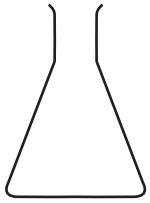
University of Cambridge
Local Examinations Syndicate

[Turn over

1 The following pieces of apparatus are found in a chemistry laboratory.



A



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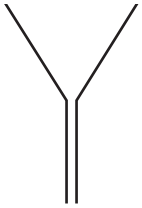

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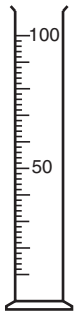

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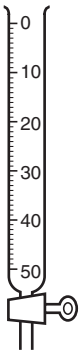


F

Answer each question by writing in the table below the letter of the piece of apparatus most suitable for the purpose.

	purpose	apparatus
(a)	helping to pour a liquid into a container with a narrow neck	
(b)	as a titrating flask	
(c)	transferring 80 cm^3 of a liquid into a container	

[3]

For Examiner's Use

2 A student was given a few grams (an excess) of powdered zinc and a beaker half filled with aqueous copper(II) sulphate.

(a) Describe the appearance of

(i) solid zinc,

.....

(ii) aqueous copper(II) sulphate.

.....[2]

The student added the zinc to the aqueous copper(II) sulphate. A reaction occurred.

(b) State three observations that were made.

(i) .....

(ii) .....

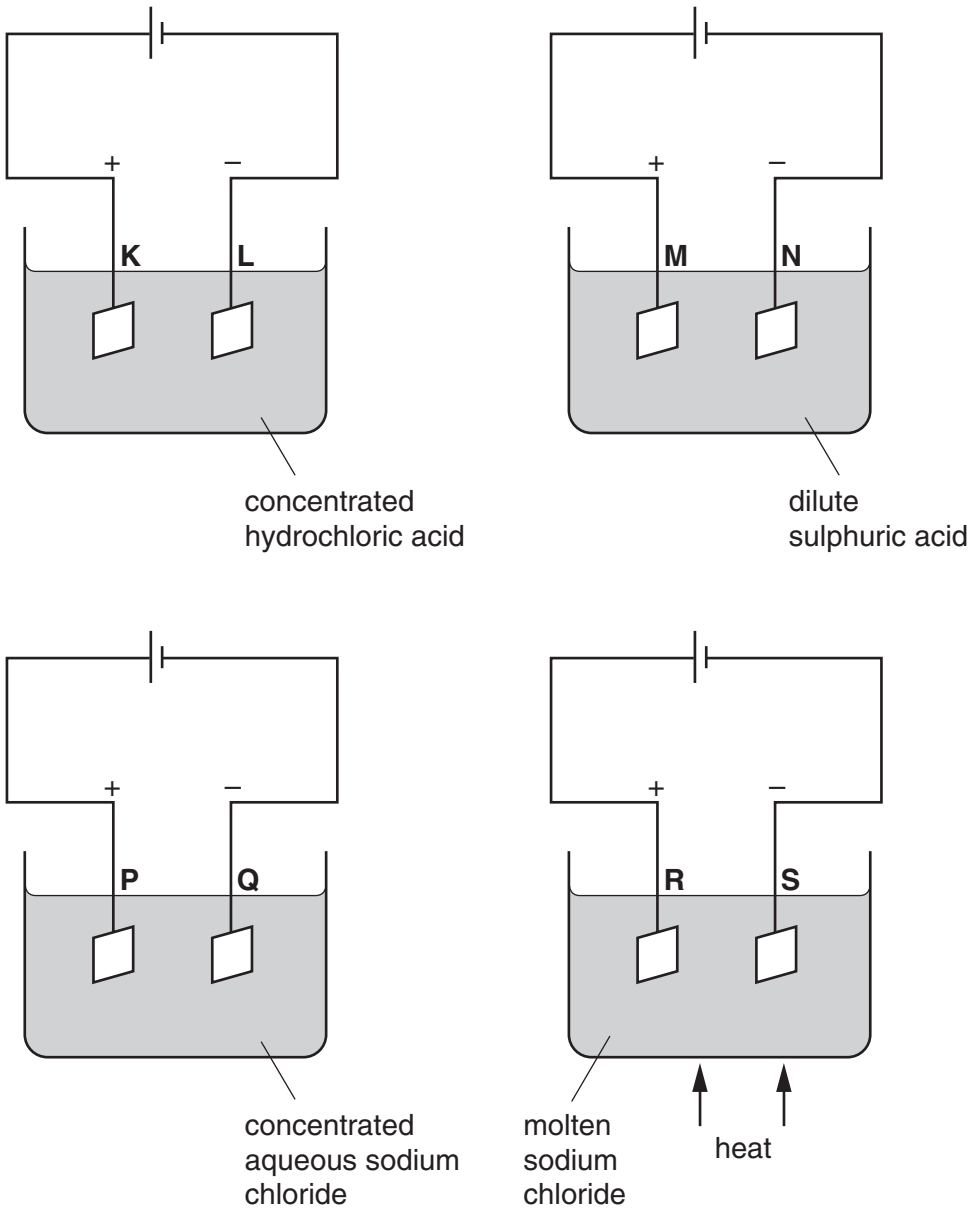
(iii) .....[3]

(c) Suggest what kind of chemical reaction occurs.

.....[1]

[Turn over

3 A student did four electrolysis experiments, each time using carbon electrodes.



Answer the following questions by writing the appropriate letter or letters.

(a) At which electrode(s) was hydrogen evolved?

.....

(b) At which electrode(s) was oxygen evolved?

.....

(c) At which electrode(s) was sodium produced?

.....

(d) At which electrode(s) was chlorine evolved?

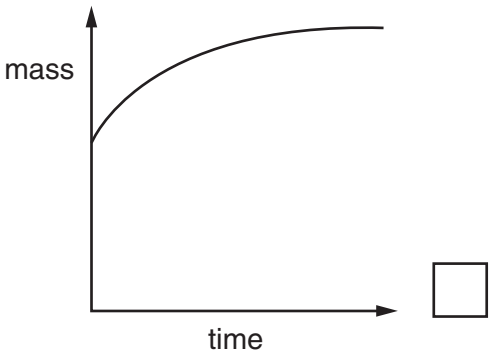
.....[6]

For Examiner's Use

In questions 4 to 8, place a tick in the box against the best answer.

4 A student added an excess of calcium carbonate to a flask half-filled with hydrochloric acid. Which of the graphs below best shows how the mass of the flask and contents changed as the reaction proceeded?

(a)



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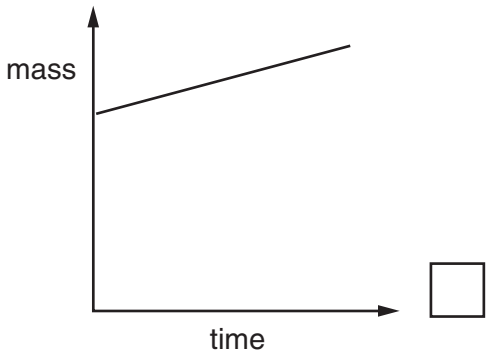
(b)



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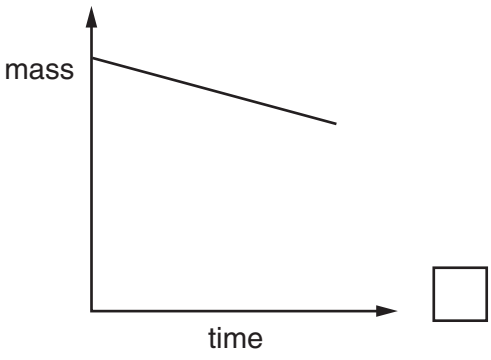
(c)



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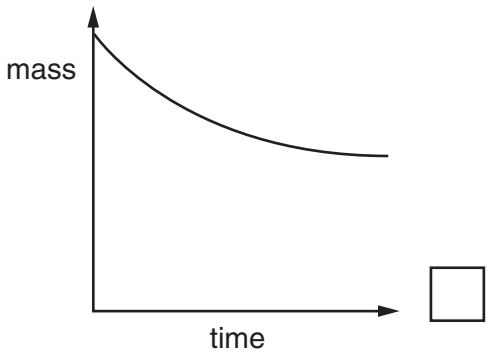
(d)

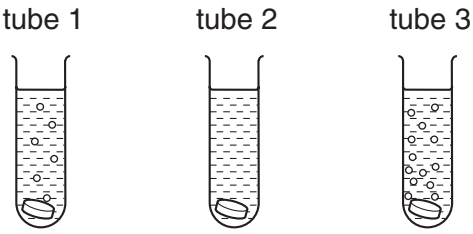


☐

[1]

[Turn over

5 A student did an experiment in which three different metals were placed in a tube containing hydrochloric acid.
The diagrams below show what the tubes looked like during the experiments.
Which metal was placed in each tube?



	tube 1	*tube 2*	*tube 3*	
(a)	iron	silver	magnesium	☐
(b)	iron	magnesium	silver	☐
(c)	magnesium	silver	iron	☐
(d)	magnesium	iron	silver	☐

[1]

6 A student was given some ethanol. They added half of it to some acidified sodium dichromate(VI) and warmed the mixture.
The organic product **X** was separated and then reacted under suitable conditions with the other half of the ethanol.
A product **Y** was formed.
What are **X** and **Y**?

	X	**Y**	
(a)	$CH_3CH_2CH_2OH$	$CH_3CH_2CO_2H$	☐
(b)	CH_3CO_2H	$C_2H_5CO_2CH_3$	☐
(c)	CH_3CO_2H	$CH_3CO_2C_2H_5$	☐
(d)	CH_3OH	CH_3CO_2H	☐

[1]

7 The salt zinc sulphate may be prepared by each of the following reactions.
Which reaction does **not** produce a gas as one of the other products?

(a) zinc and sulphuric acid ☐

(b) zinc oxide and sulphuric acid ☐

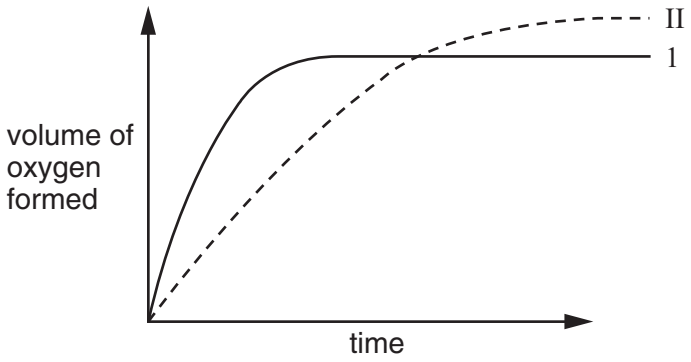
(c) zinc carbonate and sulphuric acid ☐

[1]

For Examiner's Use

8 100 cm^3 of 1.00 mol/dm^3 hydrogen peroxide was decomposed using manganese(IV) oxide as a catalyst. The volume of oxygen formed was plotted against time on the graph below. This was curve I.
The experiment was repeated using two different conditions, the results from which produced curve II.

Which change of conditions produced curve II?



(a) lowering the temperature and powdering the catalyst ☐

(b) increasing the volume and reducing the concentration of the hydrogen peroxide ☐

(c) increasing the temperature and using less catalyst ☐

(d) reducing the volume and increasing the concentration of the hydrogen peroxide ☐

[1]

[Turn over

9 A fertiliser **F** contains a mixture of ions, including iron(II). A student was asked to identify some of the ions in **F** and to determine the percentage of iron(II) in **F**.
The following table shows the tests on **F** and the conclusions made from the observations.
Complete the observations for tests **(a)** and **(b)** and the test and conclusion for test **(c)**.
Any gas produced was tested.

test	observations	conclusions
(a) **F** was dissolved in water and the resulting solution divided into two parts for tests **(b)** and **(c)**.		**F** contains a transition metal.
(b) **(i)** To the first part aqueous sodium hydroxide was added until a change was seen.		**F** contains Fe^{2+} ions.
(ii) An excess of aqueous sodium hydroxide was added to the mixture from **(i)**.		**F** contains Fe^{2+} ions.
(iii) This mixture was heated.		**F** contains NH_4^+ ions.
(c)		**F** contains SO_4^{2-} ions.

[1] [4] [3]

A student used 0.0200 mol/dm^3 potassium manganate(VII), solution **G**, to find the percentage of iron in **F**.

Potassium manganate(VII) is purple and oxidises iron(II) in the mixture to iron(III).

A sample of **F** was added to a previously weighed container, which was then reweighed.

mass of container + **F** = 15.57 g
mass of container = 8.62 g

(d) Calculate the mass of **F** used in the experiment.

..... g [1]

The sample of **F** was placed in a flask, dissolved in 100 cm^3 of dilute sulphuric acid and made up to 250 cm^3 with distilled water. This was solution **T**.

A 25.0 cm^3 sample of **T** was measured into the flask.

(e) Which piece of apparatus was used for this purpose?

.....[1]

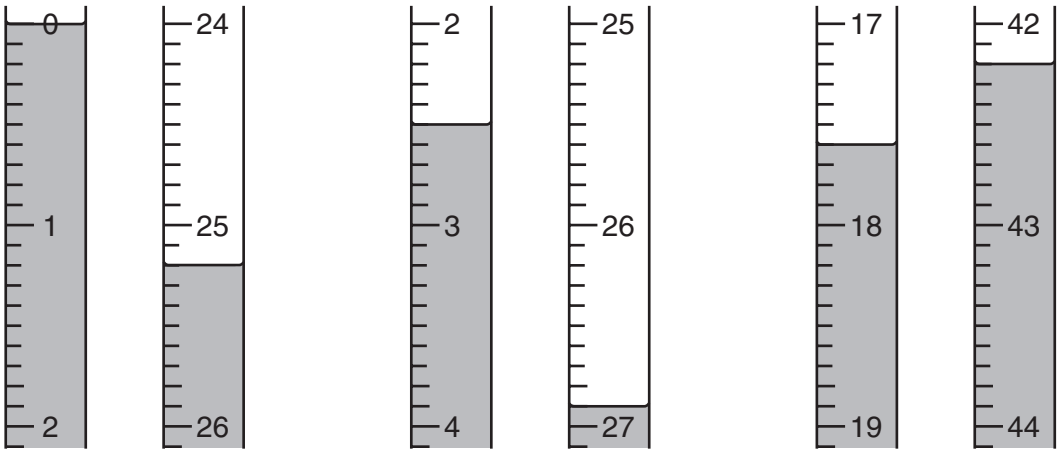
For Examiner's Use

Solution **G** was put into a burette and run into the flask containing **T**.

(f) What was the colour change at the end-point?

.....[2]

(g) Three titrations were done. Parts of the burette before and after each titration are shown below. Use these to complete the results table.



Results

titration number	1	2	3
final burette reading / cm^3			
first burette reading / cm^3			
volume of **G** required / cm^3			
best titration results (✔)			

Summary

Tick the best titration results. Using these results, the average volume of solution **G** was

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

(h) Calculate how many moles of potassium manganate(VII) were present in the average volume of **G**.

..... moles [1]

[Turn over

(i) One mole of potassium manganate(VII) reacts with five moles of iron(II).

Calculate how many moles of iron(II) were present in 25.0 cm^3 of **T**.

..... moles. [1]

(j) Calculate how many moles of iron(II) were present in 250 cm^3 of **T**.

..... moles. [1]

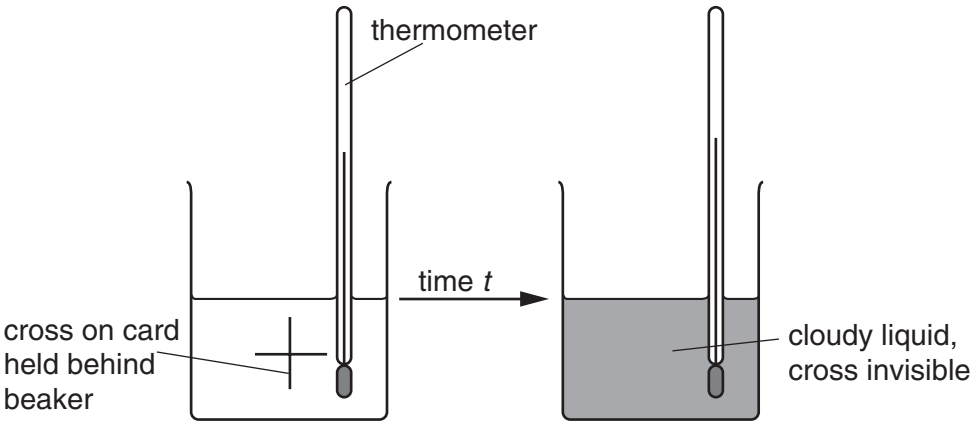
(k) Using your answer to **(k)** calculate the mass of iron(II) present in 250 cm^3 of **T**.
[A_r: Fe, 56].

..... g [1]

(l) Using your answers to **(d)** and **(l)**, calculate the percentage of iron(II) in the sample of **F**.

.....[1]

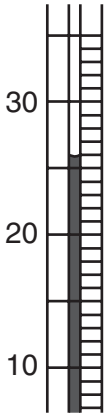
10 The reaction between sodium thiosulphate and hydrochloric acid produces sulphur which makes the solution cloudy. The rate of this reaction determines the time it takes for the solution to go cloudy.
A student did two experiments to investigate the effects of temperature and concentration on the rate of the reaction.



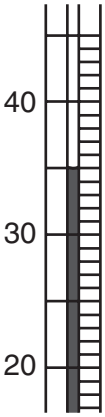
Experiment 1
50 cm^3 of aqueous sodium thiosulphate was put into a beaker and 5.0 cm^3 of 2.0 mol/dm^3 hydrochloric acid was added.
A stop watch was started and the temperature of the solution was noted. At the moment the cross became invisible, the watch was stopped and the time taken was recorded. The experiment was repeated at different temperatures.

(a) The diagrams below show parts of the thermometer stem for each of the temperature readings. Use these diagrams to complete the table below.

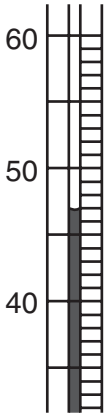
time 73s



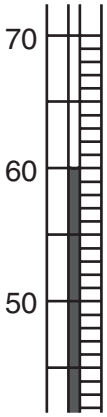
time 48s



time 30s



time 20s

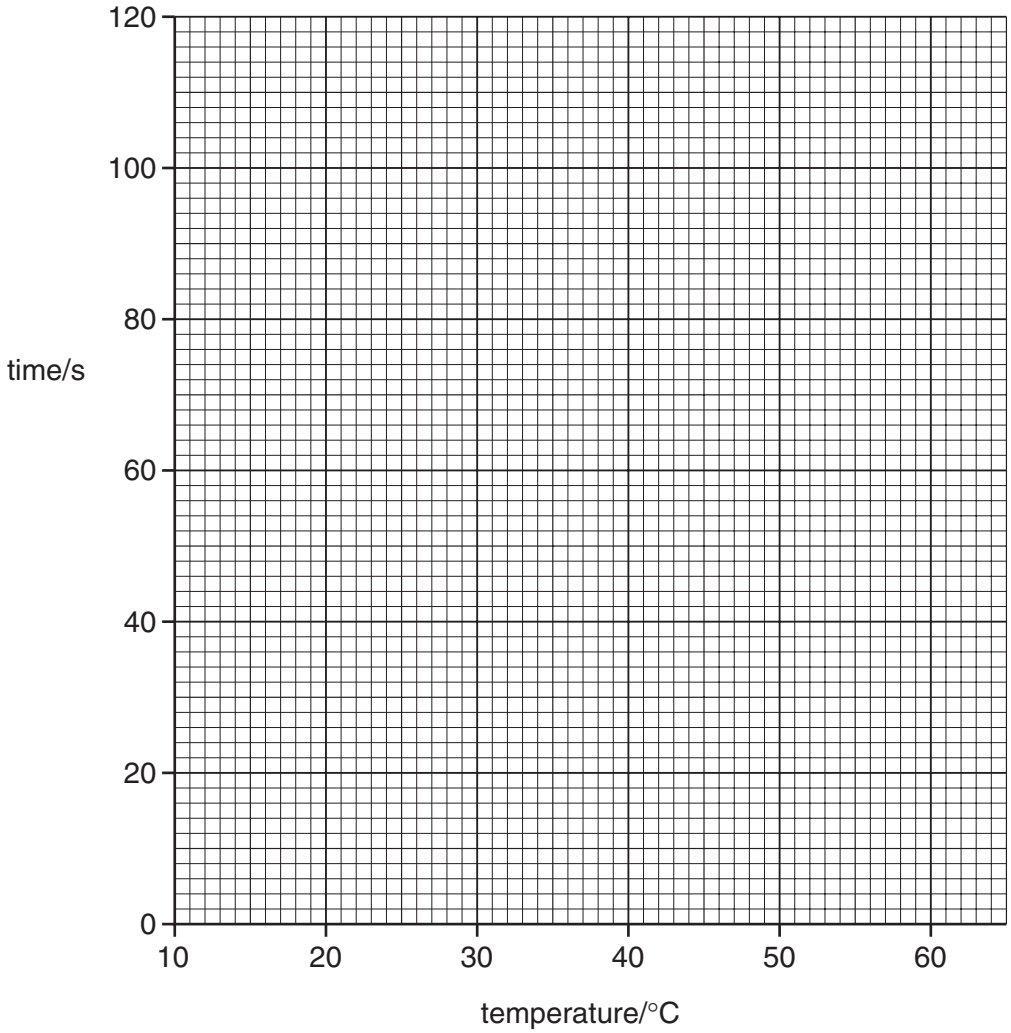


temperature / °C	time / s
20	110
	73
	48
	30
	20

[2]

[Turn over

(b) Plot the results on the grid below and draw a smooth curve through the points.



[1]

(c) How long would it take for the cross to become invisible at 40 °C?

..... s [1]

(d) At what temperature would the reaction be twice as fast as at 20 °C?

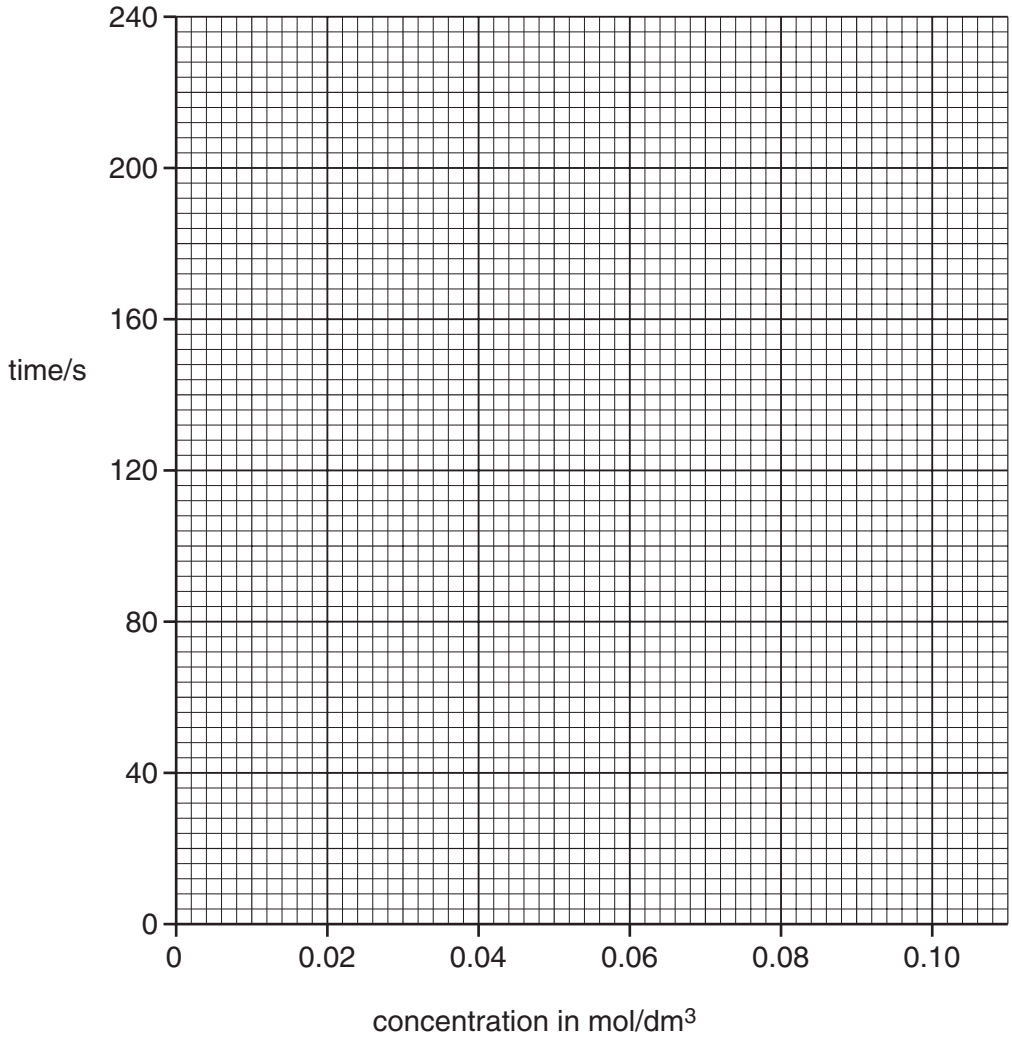
..... °C [1]

Experiment 2

50 cm^3 of 0.02 mol/dm^3 sodium thiosulphate was added to 5.0 cm^3 of 2.0 mol/dm^3 hydrochloric acid. The temperature was kept at 30 °C.
The time taken for the cross to become invisible was recorded.
The experiment was repeated for solutions of sodium thiosulphate of different concentrations, each at a temperature of 30 °C.

concentration, mol/dm^3	time, t / s	temperature / °C
0.02	210	30
0.04	86	30
0.06	43	30
0.08	28	30
0.10	20	30

(e) Plot the results on the grid below and draw a smooth curve through the points.



[2]

[Turn over

(f) How long would it take for the cross to become invisible for a sodium thiosulphate concentration of 0.07 mol / dm^3?

..... s [1]

(g) Using **both** graphs, suggest what the concentration of sodium thiosulphate was in the first experiment.

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

11 A student was given two beakers. One containing rain water, the other contained sea water.

The student placed a thermometer in each sample and heated it until it boiled.

(a) Did the rain water boil at a **lower**, **higher** or **the same** temperature as the sea water?

.....[1]

(b) Sea water contains salts. Which salt is present in the greatest percentage?

.....[1]

(c) Name a process by which sea water may be converted into drinkable water.

.....[1]

(d) The student bubbled a gas through the sea water to kill any bacteria that was present.

Name and give a test for this gas.

name .....

test .....[2]

(e) The student dropped a piece of sodium into a beaker half filled with rain water to which litmus solution had been added.
A gas was produced.

(i) Name and give a test and result for this gas.

gas .....

test .....

result .....

(ii) Suggest **two** other observations that they made.

.....

.....[4]

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