

Centre Number	Candidate Number	Name
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CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

**CHEMISTRY**

**5070/04**

Paper 4 Alternative to Practical

May/June 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.

**For Examiner's Use**

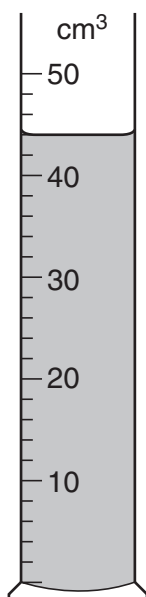
If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **13** printed pages and **3** blank pages.



- 1 What is the volume of liquid, to the nearest  $\text{cm}^3$ , in the measuring cylinder?



.....  $\text{cm}^3$  [1]

- 2 A student investigated the properties of dilute aqueous ammonia.

- (a) A few drops of litmus solution were added to  $5 \text{ cm}^3$  of aqueous ammonia.

What was the colour of the mixture?

.....[1]

- (b) Aqueous sodium hydroxide was added to the aqueous ammonia and the solution was warmed. A gas was evolved.

Name this gas and give a test and result to confirm its presence.

gas .....

test .....

result .....[3]

The fertiliser ammonium phosphate, which is made from ammonia, has the formula  $(\text{NH}_4)_3\text{PO}_4$ . It contains phosphorus, one of three essential elements for the growth of plants.

- (c) (i) Which other essential element is found in ammonium phosphate?

.....

- (ii) Calculate the mass of phosphorus contained in 1 kg of ammonium phosphate.  
( $A_r$ : N, 14; H, 1; P, 31; O, 16)

.....[3]

- 3** A student used magnesium oxide to prepare magnesium nitrate. The magnesium nitrate was then heated to re-form magnesium oxide. The object of the experiment was to determine whether the mass of magnesium oxide produced was the same as the amount used initially.

Some magnesium oxide was put into a weighed evaporating dish. The dish was reweighed.

Mass of dish + magnesium oxide = 14.70 g  
Mass of dish = 8.90 g

- (a)** Calculate the mass of magnesium oxide used.

The mass of magnesium oxide = ..... g [1]

- (b)** An acid was slowly added until all the magnesium oxide had dissolved. Magnesium nitrate was produced.

Name the acid.

.....[1]

- (c)** The solution was evaporated to dryness and the resulting solid was heated in a fume cupboard. The following reaction took place.



After cooling, the dish was weighed. It was then heated again, cooled and reweighed. The final mass of the dish and contents was 14.40 g.

- (i)** Why was the heating done in a fume cupboard?

.....[1]

- (ii)** Why was the dish reweighed?

.....[1]

- (iii)** Calculate the mass of magnesium oxide obtained.

..... g [1]

- (d)** Using your answers to **(a)** and **(c)(iii)** calculate the percentage yield of magnesium oxide.

.....% [1]

- (e)** Suggest one reason why the experiment did not produce the same amount of magnesium oxide as was used at the beginning of the experiment.

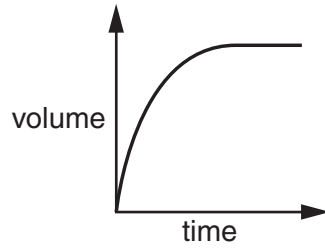
.....[1]

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

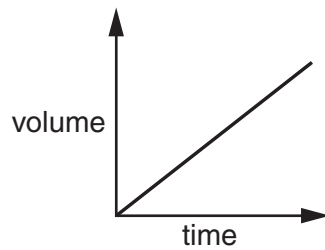
- 4 When dilute hydrochloric acid was added to powdered calcium carbonate, carbon dioxide was produced. The volume of gas was measured at time intervals and a graph was drawn.

Which of the following best represents the shape of the graph?

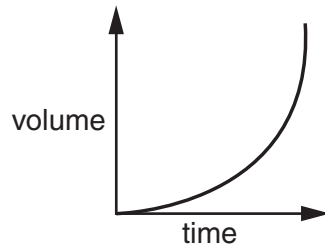
(a)



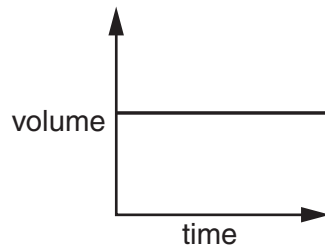
(b)



(c)



(d)



[1]

- 5 **Q** is an oxidising agent. It is added to each of the four reagents shown below. Which of the following colour changes is correct?

reagent	effects of adding <b>Q</b>	
(a) aqueous bromine	orange to colourless	<input type="checkbox"/>
(b) acidified potassium dichromate(VI)	orange to green	<input type="checkbox"/>
(c) acidified potassium manganate(VII)	purple to colourless	<input type="checkbox"/>
(d) aqueous potassium iodide	colourless to brown	<input type="checkbox"/>

[1]

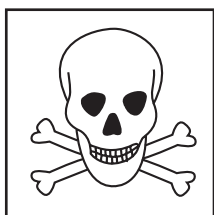
- 6 Concentrated hydrochloric acid was electrolysed using inert electrodes. What was produced at each electrode?

cathode	anode	
(a) chlorine	oxygen	<input type="checkbox"/>
(b) hydrogen	chlorine	<input type="checkbox"/>
(c) hydrogen	oxygen	<input type="checkbox"/>
(d) oxygen	chlorine	<input type="checkbox"/>

[1]

7 Which of the following hazard warning signs should appear on a bottle of ethanol?

(a)



toxic

(b)



corrosive

(c)



oxidising agent

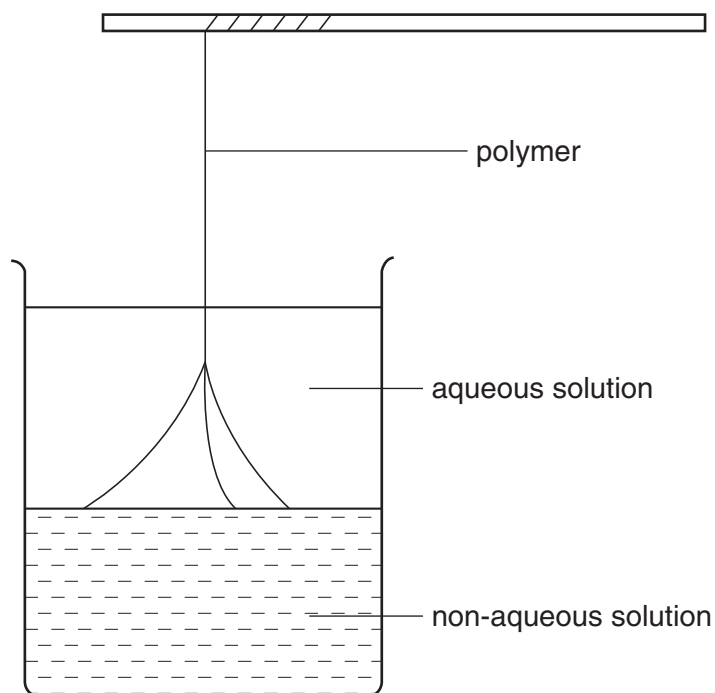
(d)



flammable

[1]

- 8 A student made a polyamide using the apparatus below. The polyamide was formed at the junction of the two liquids.



The polyamide was:

- (a) nylon
- (b) poly(ethene)
- (c) starch
- (d) *Terylene*

[1]

- 9 The formula of an acid is written as  $H_xA$ .

A student tried to find the value of  $x$  in the formula of the acid by titrating its aqueous solution with aqueous sodium hydroxide.

**S** is a  $0.0450 \text{ mol/dm}^3$  aqueous solution of acid  $H_xA$ .

**T** is  $0.120 \text{ mol/dm}^3$  sodium hydroxide.

A burette was filled with **S**.

A  $25.0 \text{ cm}^3$  portion of **T** was measured into a conical flask.

- (a) Which piece of apparatus was used for this measurement?

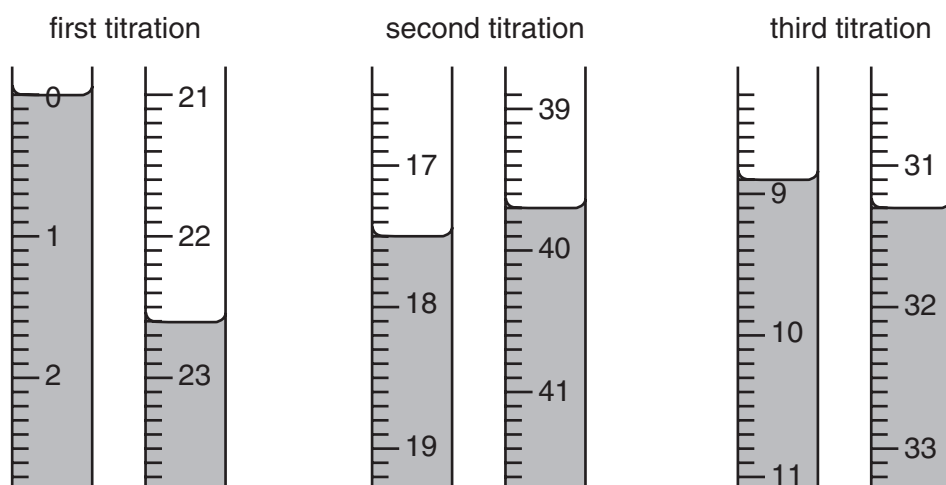
.....[1]

A few drops of methyl orange indicator were added.

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

The indicator changed from ..... to ..... [1]

- (c) The diagrams below show parts of the burette with the liquid levels before and after each titration. Use them to complete the results table and summary.



Results

titration number	1	2	3
final burette reading/ $\text{cm}^3$			
first burette reading/ $\text{cm}^3$			
volume of <b>S</b> required/ $\text{cm}^3$			

Summary.

Tick the best titration results. Using these results, the average volume of solution **S** was .....  $\text{cm}^3$ .



- (d) **T** is  $0.120 \text{ mol/dm}^3$  sodium hydroxide.  
Calculate how many moles of sodium hydroxide are present in  $25.0 \text{ cm}^3$  of solution **T**.

..... moles [1]

- (e) **S** is  $0.0450 \text{ mol/dm}^3$   $\text{H}_x\text{A}$ .  
Calculate how many moles of acid  $\text{H}_x\text{A}$  are present in your average volume of **S**.

..... moles [1]

- (f) Using your answers to (d) and (e) deduce how many moles of sodium hydroxide react with one mole of  $\text{H}_x\text{A}$ .

..... moles [1]

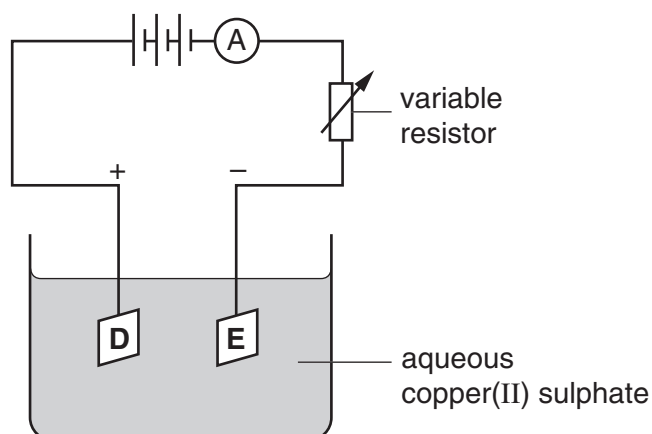
- (g) Using your answer to (f) deduce the value of  $x$  in the formula  $\text{H}_x\text{A}$ .

..... [1]

- (h) Using your answers to (f) and (g) write an equation for the reaction between sodium hydroxide and  $\text{H}_x\text{A}$ .

.....[2]

- 10 A constant current was passed through aqueous copper(II) sulphate using inert electrodes as shown in the diagram below. Copper was deposited at one of the electrodes.



- (a) Name a suitable material for the inert electrodes.

.....

[1]

- (b) At which electrode was copper deposited, **D** or **E**?

.....

[1]

- (c) What was seen at the other electrode?

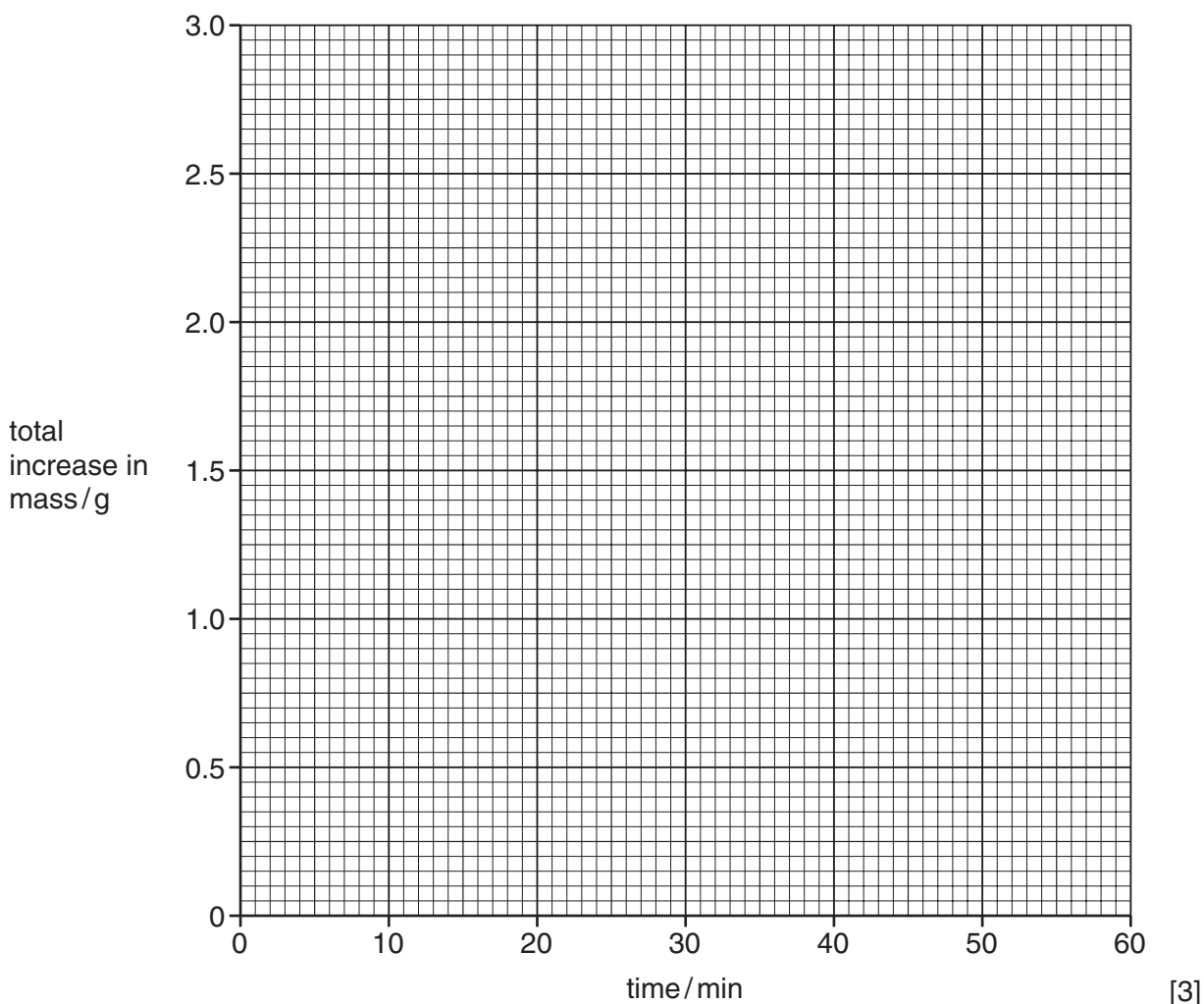
.....[1]

The electrode at which copper was deposited was removed at intervals, washed, dried and weighed. The results are shown in the table below.

time / mins	mass of cathode / g	total increase in mass / g
0	7.55	0.00
10	8.00	0.45
20	8.45	0.90
30	8.90	
40	9.35	
50	9.80	
60	9.80	

- (d) (i) Complete the table by calculating the total increase in mass after each 10 minute interval. [2]

(ii) Plot a graph of the data given in the table.



(iii) How long did it take for 1.60 g of copper to be deposited?

..... minutes [1]

(iv) Suggest why the last two readings were the same.

.....[1]

(e) What was the colour of the electrolyte

(i) at the start of the experiment,

.....

(ii) at the end of the experiment?

.....

[2]

The experiment was repeated with aqueous copper sulphate of the same concentration as before, but this time using copper electrodes. The same current was passed for the same length of time.

(f) Draw a line on your graph, labelled **M**, to show the result you would expect for this second experiment. [1]

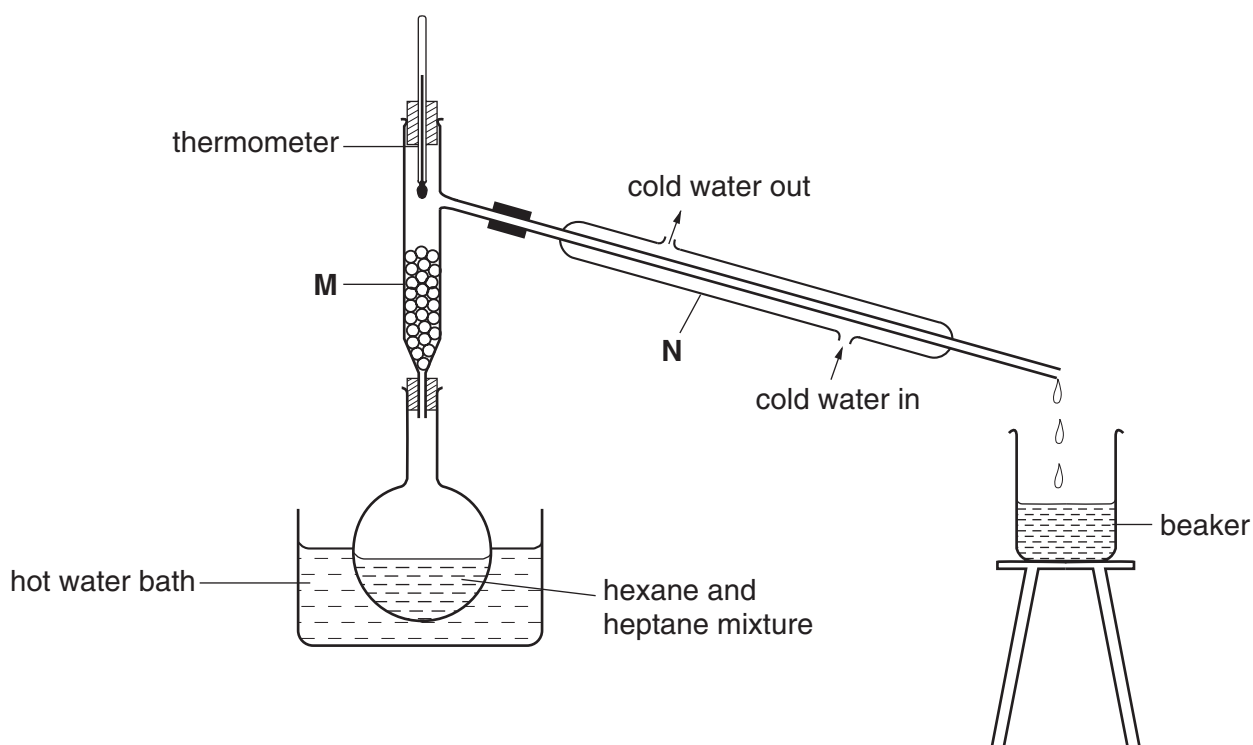
(g) What was the colour of the electrolyte at the end of the experiment?

.....[1]

11 A student was given three aqueous solutions **P**, **Q**, and **R**. Complete the test and observations which lead to the conclusions.

test	observation	conclusion
(a) To a few cm <sup>3</sup> of <b>P</b> , dilute nitric acid and aqueous barium nitrate were added.		<b>P</b> contains SO <sub>4</sub> <sup>2-</sup> ions.  [2]
(b) To a few cm <sup>3</sup> of <b>Q</b> dilute hydrochloric acid was added. The gas given off was tested.		<b>Q</b> contains CO <sub>3</sub> <sup>2-</sup> ions.  [2]
(c)	yellow precipitate	<b>R</b> contains I <sup>-</sup> ions.  [3]

- 12 A student separated two alkanes, hexane (bp  $69^{\circ}\text{C}$ ) and heptane (bp  $98^{\circ}\text{C}$ ), using the apparatus shown below.



- (a) (i) Name the piece of apparatus labelled **M**.

.....

- (ii) What is it used for?

.....

- (iii) Name the piece of apparatus labelled **N**.

.....

- (iv) What is it used for?

.....

[4]

- (b) Why was a hot water bath used rather than a flame for heating the mixture?

.....[1]

- (c) What was the reading on the thermometer when the first few drops of distillate appeared in the beaker?

.....[1]

- (d) How did the student know when all the first alkane had distilled over?

.....[1]





