Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY **5070/04**

Paper 4 Alternative to Practical

May/June 2006

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 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.
You may use a calculator.
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.

For Examiner's Use

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

SJF3715(CG) T07229/2

UNIVERSITY of CAMBRIDGE International Examinations

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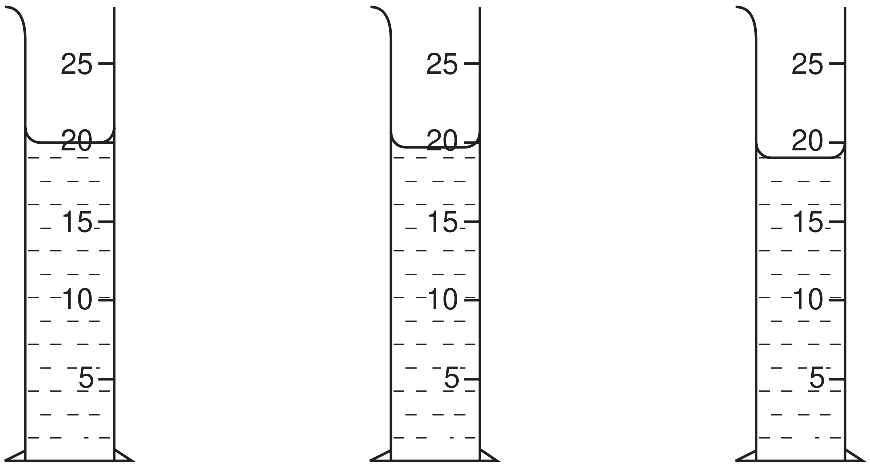
1 Which of the measuring cylinders shows exactly 20 cm^3 of liquid?



A **B** **C**

answer .... [1]

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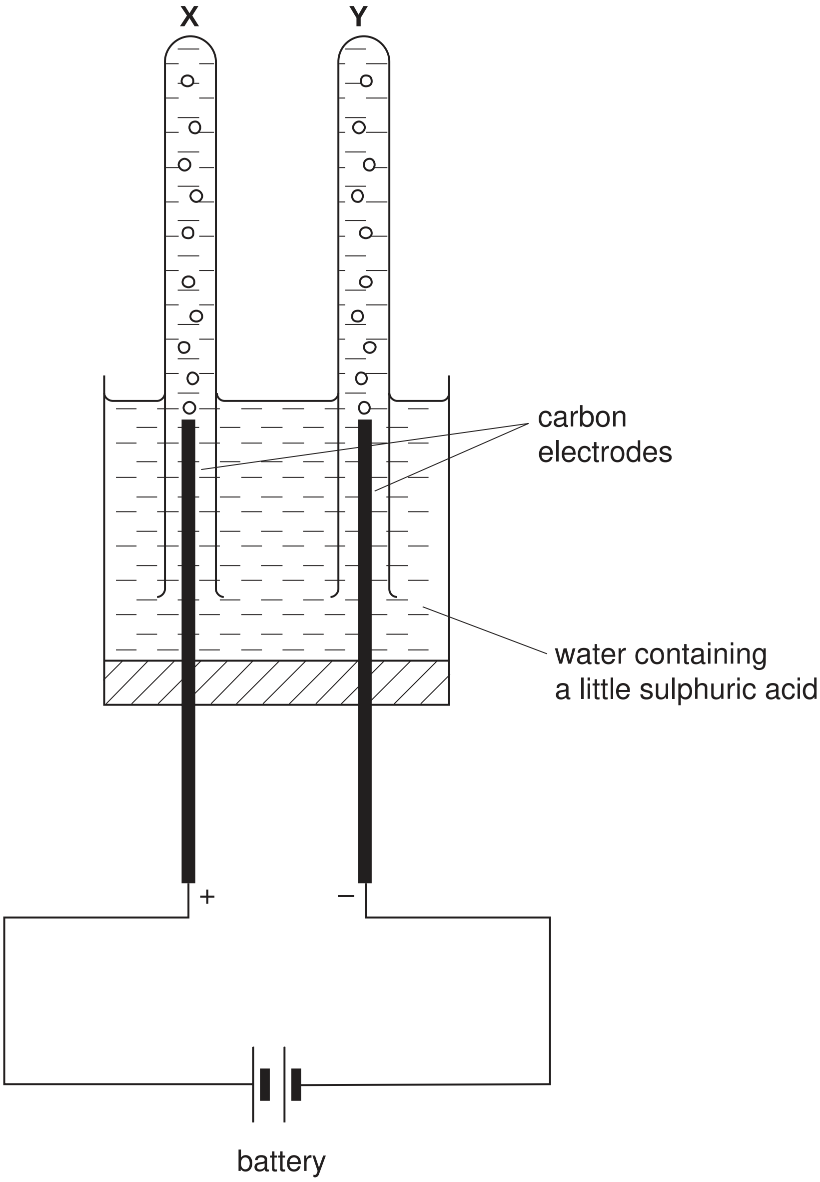
2 The apparatus below was used to electrolyse water.



(a) **(i)** Why was a small volume of sulphuric acid added to the water?

....

(ii) Name the gas collected in tube **X** and give a test for this gas.

gas ....

test ....

(iii) Name the gas collected in tube **Y** and give a test for this gas.

gas ....

test ....

[5]

(b) State how the volume of gas collected in tube **X** compares with the volume of gas collected in tube **Y**.

.... [1]

(c) Name a gas that may be used to sterilise water and give a test for this gas.

gas ....

test .... [2]

(d) A student added a small piece of sodium and a small piece of iron to separate samples of water. What observations were made?

sodium ....

....

iron ....

.... [3]

3 A student added 30 cm^3 of 1.5 mol/dm^3 aqueous silver nitrate to a beaker containing 50 cm^3 of 1.0 mol/dm^3 aqueous sodium bromide.

A precipitate of silver bromide was produced.

(a) **(i)** What colour was the precipitate?

....

(ii) Name the method by which this precipitate was separated from the mixture.

....
[2]

(b) **(i)** Calculate the number of moles of silver nitrate contained in 30 cm^3 of 1.5 mol/dm^3 aqueous silver nitrate.

.... moles

(ii) Calculate the number of moles of sodium bromide contained in 50 cm^3 of 1.0 mol/dm^3 aqueous sodium bromide.

.... moles
[2]

Sodium bromide reacts with silver nitrate according to the equation below.

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

(c) Using this equation and your answers to **(b)**, calculate the mass of silver bromide produced in this experiment.

[A_r: Ag, 108; Br, 80]

.... g [2]

(d) The student repeated the experiment using 40 cm^3 of 1.5 mol/dm^3 aqueous silver nitrate with 50 cm^3 of 1.0 mol/dm^3 sodium bromide.

Calculate the mass of silver bromide produced in this experiment.

.... g [2]

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

4 Hydrochloric acid has which of the following properties?

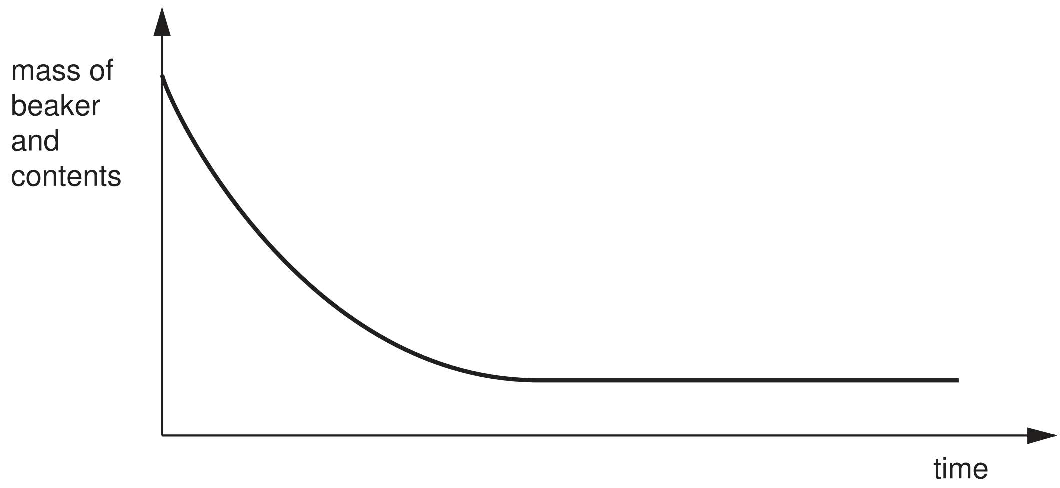
(a) It liberates ammonia from ammonium salts.

(b) It reacts with any base to give a salt.

(c) It reacts with any metal to give hydrogen.

(d) It turns litmus paper blue. [1]

5 Two solutions were mixed in a beaker and the mass of the beaker and contents was recorded at various times after mixing. The graph shows the results.



The two solutions could have been

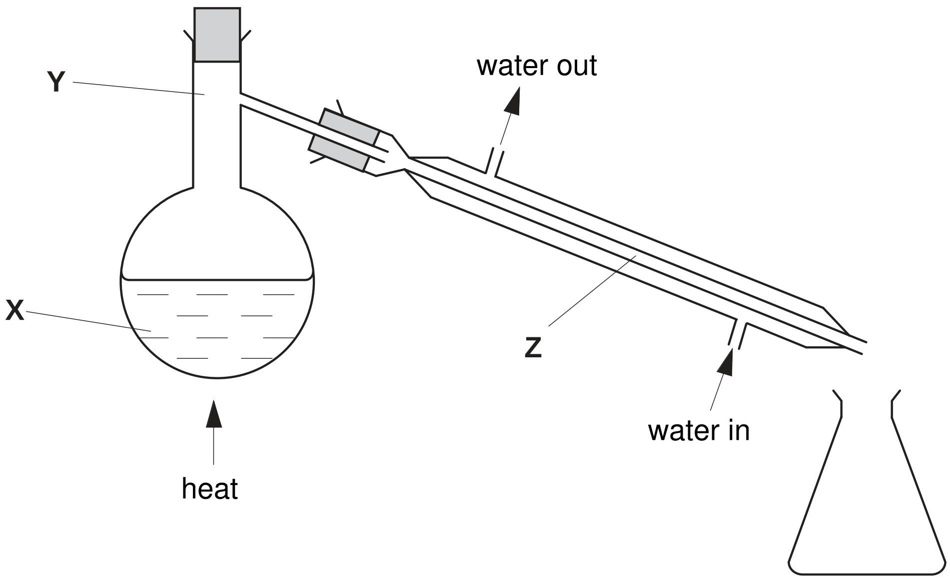
(a) aqueous copper(II) sulphate and aqueous ammonia.

(b) aqueous sodium carbonate and dilute nitric acid.

(c) aqueous sodium hydroxide and aqueous zinc sulphate.

(d) aqueous sodium sulphate and dilute hydrochloric acid. [1]

6 The diagram below shows apparatus used to distil sea-water.



At which point(s) is the temperature 100 °C?

(a) **X** only

(b) **Y** only

(c) **X** and **Y** only

(d) **Y** and **Z** only

(e) **X** and **Y** and **Z** [1]

7 A student added some zinc to a beaker containing aqueous copper(II) sulphate. After a while a pink deposit was seen and the solution became colourless.

Which of the following describes the reaction which took place?

(a) addition

(b) hydrolysis

(c) neutralisation

(d) redox [1]

8 A student did an experiment to decompose hydrogen peroxide.

Some manganese(IV) oxide, MnO_2, was added to increase the rate of reaction.

$$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$$

100 cm^3 of 0.050 mol/dm^3 hydrogen peroxide was allowed to decompose until no more oxygen was produced.

One mole of a gas at 25 °C occupies a volume of 24 dm^3.

The volume of oxygen produced was

(a) 12 cm^3. ☐

(b) 60 cm^3. ☐

(c) 120 cm^3. ☐

(d) 600 cm^3. ☐ [1]

9 **R** is a mixture of iron(II) sulphate and iron(III) sulphate.

A student determined the percentage of iron(II) sulphate in the mixture using 0.0200 mol/dm^3 aqueous potassium manganate(VII), solution **S**.

Potassium manganate(VII), which is purple, oxidises the iron(II) ions in the mixture.

(a) Suggest why potassium manganate(VII) does not react with iron(III) ions.

.... [1]

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

mass of container + **R** = 18.04 g
mass of container = 11.96 g

(b) Calculate the mass of **R** used in the experiment.

.... g [1]

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

25.0 cm^3 of **T** was transferred into a conical flask.

(c) What piece of apparatus should be used to transfer this volume of **T**?

.... [1]

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

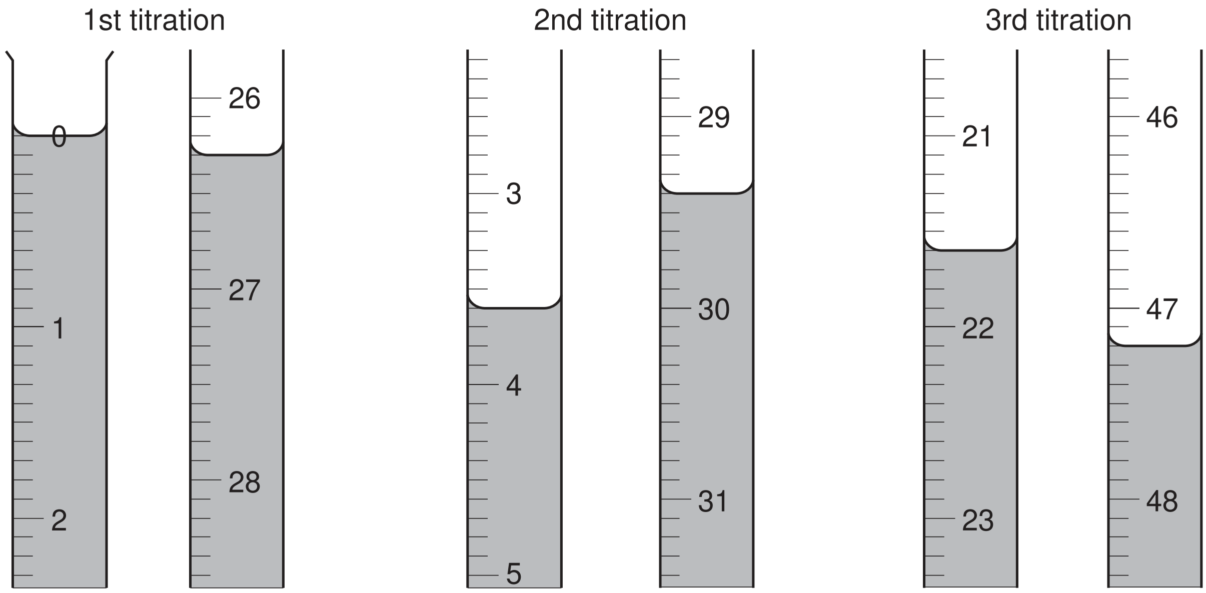
(d) What was the colour of the solution in the conical flask

(i) before **S** was added, ...

(ii) at the end-point? ....
[2]

[Turn over

Three titrations were done. The diagrams below show parts of the burette with the liquid levels at the beginning and end of each titration.



(e) 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 **S** used / cm^3			
best titration results (✓)			

Summary

Tick (✓) the best titration results.

Using these results the average volume of **S** used was .... cm^3. [4]

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

(f) Calculate the number of moles of potassium manganate(VII) present in the average volume of **S** in **(e)**.

………………………… moles [1]

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

(g) Calculate the number of moles of iron(II) sulphate in 25.0 cm^3 of **T**.

.... moles [1]

(h) Calculate the number of moles of iron(II) sulphate in 250 cm^3 of **T**.

.... moles [1]

(i) Using your answer to **(h)**, calculate the mass of iron(II) sulphate present in solution **T**.
[M_r: $FeSO_4$, 152]

.... g [1]

(j) Using your answers to **(b)** and **(i)**, calculate the percentage of iron(II) sulphate in the sample of **R**.

.... % [1]

10 The following table shows the tests a student did on substance **V** and the conclusions made from the observations. Complete the table by describing these observations and suggest the test and observation which led to the conclusion in test **(d)**.

test	observation	conclusion
(a) **V** was dissolved in water and the solution divided into three parts for tests **(b)**, **(c)** and **(d).**		**V** does not contain a transition metal.
(b) **(i)** To the first part, aqueous sodium hydroxide was added until a change was seen. **(ii)** An excess of aqueous sodium hydroxide was added to the mixture from **(i)**.		**V** may contain Zn^{2+} ions or Al^{3+} ions.
(c) **(i)** To the second part aqueous ammonia was added until a change was seen. **(ii)** An excess of aqueous ammonia was added to the mixture from **(i).**		The presence of Zn^{2+} ions is confirmed in **V**.
(d)		**V** contains I^- ions.

Conclusion: the formula of compound **V** is .... [9]

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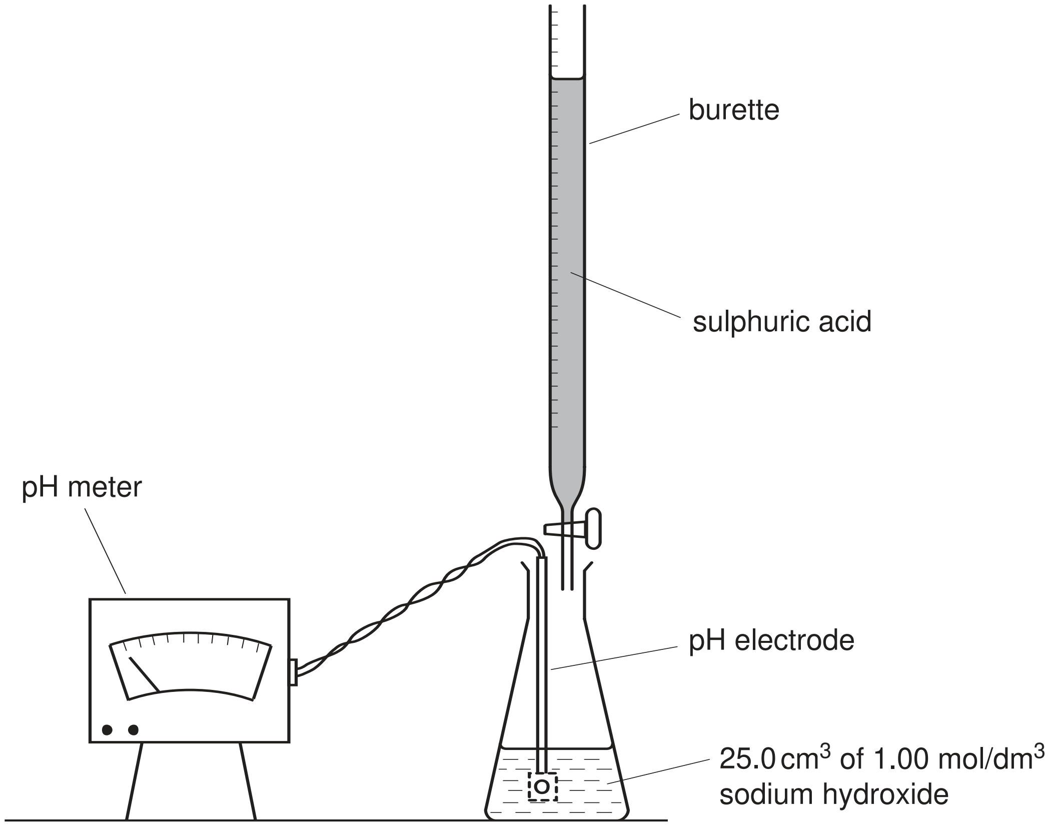
11 A student was asked to prepare a sample of the salt, sodium sulphate.

$25.0\,cm^3$ of $1.00\,mol/dm^3$ sodium hydroxide was transferred to the conical flask and sulphuric acid was added from a burette.

After each addition of sulphuric acid, the pH of the solution was recorded. The apparatus and table of results are shown below.



volume of acid added / cm^3	pH value
5.0	13.6
10.0	13.4
20.0	12.2
22.0	11.8
24.0	11.2
26.0	10.0
28.0	4.2
30.0	3.0
40.0	1.2

A graph of pH against the added volume of acid was drawn to find the volume of acid required to neutralise $25.0\,cm^3$ of $1.00\,mol/dm^3$ sodium hydroxide.

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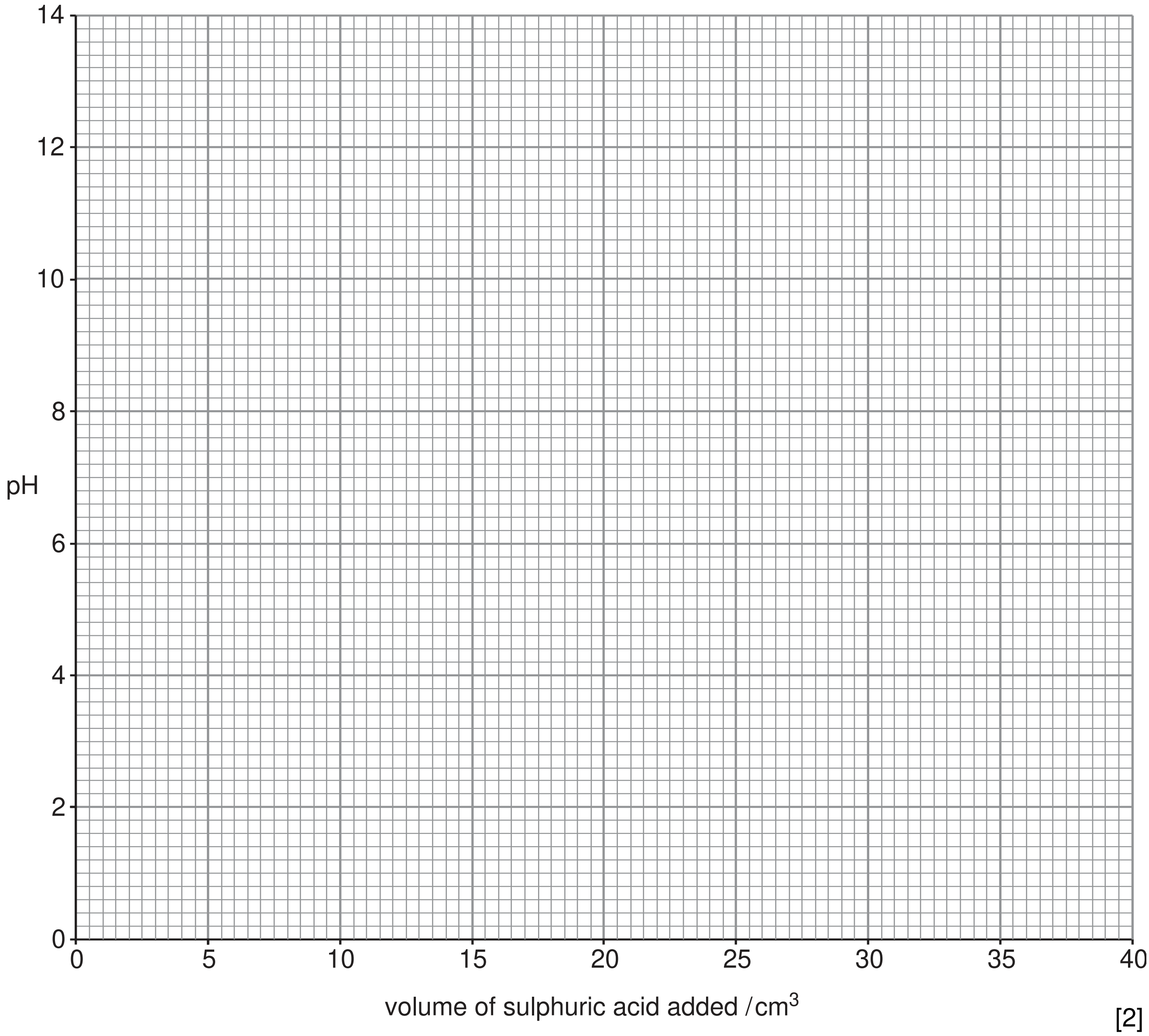
(a) Plot the results on the grid below and draw a smooth curve through the points.



[2]

Use the graph to answer the following questions.

(b) What is the pH of the solution when 35.0 cm^3 of acid is added?

pH .... [1]

(c) By extending the graph find the pH of 25.0 cm^3 of 1.00 mol/dm^3 sodium hydroxide. Show on the graph how you obtained your answer.

pH .... [2]

(d) **(i)** Suggest the pH of the solution at the end-point.

....

(ii) Using your answer to **(d)(i)**, what volume of acid is required to neutralise 25.0 cm^3 of 1.00 mol/dm^3 sodium hydroxide?

…………………………cm^3
[2]

In a separate experiment the volume of sulphuric acid from **(d)(ii)** was added to a further 25.0 cm^3 of 1.00 mol/dm^3 sodium hydroxide. The resulting solution was used to produce sodium sulphate crystals.

(e) **(i)** Describe briefly the steps the student should take in order to produce good quality crystals from this solution.

....

....

....

....

.... [3]

(ii) The equation for the reaction is

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

Calculate the maximum mass of sodium sulphate that can be produced from the neutralisation of 25.0 cm^3 of 1.00 mol/dm^3 sodium hydroxide.
[A_r: Na, 23; S, 32; O, 16]

.... g [2]