OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced Subsidiary GCE

CHEMISTRY 2813/03/TEST

Practical Examination 1 (Part B – Practical Test)

Wednesday **18 JANUARY 2006** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Data Sheet for Chemistry
Candidate's Plan (Part A of the Practical Examination)
Scientific calculator

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read instructions and questions carefully.

INFORMATION FOR CANDIDATES

- In this part of the Practical Test, you will be assessed on the Experimental and Investigative Skills:
  Skill I Implementing
  Skill A Analysing evidence and drawing conclusions
  Skill E Evaluating evidence and procedures
- You may use a scientific calculator.
- You are advised to show all the steps in any calculations.
- You will be awarded marks for the quality of written communication where this is indicated.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
Planning	**16**	
Implementing & Analysing	**30**	
Evaluating	**14**	
TOTAL	**60**	

This question paper consists of 8 printed pages.

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Answer **all** the parts.

Introduction

The aim of the experiment is to determine the relative atomic mass of magnesium by a titration method.
You will begin by adding excess hydrochloric acid to magnesium.
The acid left over after this reaction will be titrated with aqueous sodium hydroxide.

Four chemicals are provided.

- Solution **K** is aqueous **sodium hydroxide** of concentration 3.60 g dm^{-3} of NaOH. **Irritant** 
- Solution **L** is aqueous **hydrochloric acid** of concentration 2.00 mol dm^{-3}. **Irritant** 
- **M** is **magnesium metal ribbon.** **Flammable** 
- **Phenolphthalein** solution is the indicator. **Flammable** 

Part 1 Titration
Skill I (Implementing) **[16 marks]**

Record all your readings in the spaces on page 3.

Use a pipette and filler to measure out 25.0 cm^3 of solution **L**, (aqueous hydrochloric acid), into a 250 cm^3 beaker.

Take care: the reaction that follows will be vigorous.
Stand the beaker on a heat-proof mat.
Be careful not to breathe in any of the fine spray that may be produced.
Weigh the weighing bottle plus the magnesium ribbon, **M**.
Record the mass on page 3.
Add all the magnesium into the beaker containing solution **L**.

Weigh the empty weighing bottle.
Calculate the mass of magnesium you used and show your answer on page 3.

Stir the mixture frequently.
Use the glass rod to keep all of the magnesium below the surface of the acid.
Wait for the magnesium to react completely with the acid in the beaker.
This may take two or three minutes.

When the reaction stops, transfer the solution left in the beaker into the volumetric flask.
Rinse the beaker with distilled (or deionised) water and add this to the volumetric flask.
Make the solution up to 250 cm^3 with distilled (or de-ionised) water.
Mix this solution thoroughly before using it for your titrations.

Wash the pipette out thoroughly with distilled (or de-ionised) water.
Rinse the pipette with the solution you made up in the volumetric flask.
Using the pipette and filler, transfer 25.0 cm^3 of the solution into a conical flask.
Add about 5 drops of phenolphthalein indicator.

Fill the burette with solution **K**, aqueous sodium hydroxide.
Carry out a rough/trial titration using solution **K**.
Read the burette to the nearest 0.05 cm^3.
The end-point is when the indicator changes from colourless to pale pink.

Now carry out the titration accurately and obtain **two** consistent values for the titre.

Results

Use the spaces below to record **all** your readings.

Weighings

mass of magnesium used = ... g

Titration data (tabulated)

Summary

25.0 cm^3 of the diluted solution of acid required ..... cm^3 of the solution **K**, aqueous sodium hydroxide.

Show the readings you used to obtain this value of the volume of solution **K** by putting a tick (✔) under those readings.

Safety

The solution of phenolphthalein is labelled flammable, but solutions **K** and **L** are not. Suggest why the solution containing phenolphthalein is flammable but the others are not.

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Part 2 Calculating the relative atomic mass of magnesium
Skill A (Analysing) **[14 marks]**

Use the *Data Sheet* supplied.
In all parts, your working must be shown clearly.
Quote your answers to three significant figures.

In your procedure, some of the HC*l* in solution **L** reacted with the magnesium ribbon, **M**. The HC*l* left over after this reaction was diluted and titrated with solution **K**, aqueous sodium hydroxide.

(a) Solution **K** contains 3.60 g dm^{-3} of NaOH.
Show that the concentration of NaOH in solution **K** is 0.0900 mol dm^{-3}.

(b) Calculate the number of moles of NaOH used in your mean titre.

number of moles = ...

(c) Complete the balanced equation for the reaction taking place in the titration.

$$NaOH + HCl \longrightarrow \quad +$$

(d) Use your answers in **(b)** and **(c)** to deduce how many moles of HC*l* reacted with NaOH in the titration.

number of moles = ...

(e) Calculate the number of moles of HC*l* in 250 cm^3 of solution in the volumetric flask. (This is the number of moles of HC*l* that did **not** react with the magnesium).

number of moles = ...

(f) At the beginning of the experiment, 25.0 cm^3 of solution **L**, aqueous hydrochloric acid, were pipetted into the beaker.
The concentration of solution **L** was 2.00 mol dm^{-3}.
Calculate the number of moles of HC*l* pipetted at the beginning of the experiment.

number of moles = ...

(g) Use your answers to **(e)** and **(f)** to calculate the number of moles of HC*l* in solution **L** that **did** react with the magnesium.

(Note – if you were unable to work out the answer to **(e)**, assume that there were 0.0205 mol of HC*l* in 250 cm^3, so that you can continue with the calculation).

number of moles = ...

(h) Complete and balance the equation for the reaction of magnesium with hydrochloric acid, including state symbols.

Mg + HC*l* $\longrightarrow$ +

(i) Use your answers to **(g)** and **(h)** to calculate the number of moles of magnesium used in the experiment.

number of moles = ...

(j) From the mass of magnesium ribbon, **M**, you weighed out, calculate the relative atomic mass of magnesium.

relative atomic mass = ...

Part 3 Skill E (Evaluating) **[14 marks]**

About half of the marks for **Part 3** are awarded for **(a).**

(a) Discuss the accuracy of the experiment you have carried out with reference to:

- the weighing of the magnesium;
- the dilution of the acid;
- the indicator used.

(b) Discuss the **reliability** of your experiment.

(c) A student carried out the same experiment as you did, except that he used an 'old' sample of magnesium ribbon that had been left out in the laboratory for several weeks.
Suggest how his results would compare with yours.
Justify your suggestion.

(d) Another student determined the relative atomic mass of magnesium by adding the metal to an acid and collecting the gas evolved, using a procedure similar to the one in your Plan.

- Which determination is likely to be the more accurate, the method involving gas collection or the method you carried out involving titration?
- Explain your answer, but do **not** repeat any points you made in **(a)** or **(b).**

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