THIS IS A LEGACY SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

CHEMISTRY

2813/03/TEST

Practical Examination 1 (Part B – Practical Test)

CUP/T68092

Candidates answer on the question paper

OCR Supplied Materials:
- *Data Sheet for Chemistry* (inserted)

Other Materials Required:
- Candidate's Plan (Part A of the Practical Examination)
- Scientific Calculator

Friday 16 January 2009
Morning

Duration: 1 hour 30 minutes

2813303

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- 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 may refer to your Plan produced for Part A.
- You will be awarded marks for the quality of written communication where this is indicated.
- A copy of the *Data Sheet for Chemistry* is provided as an insert with this question paper.
- This document consists of **8** pages. Any blank pages are indicated.

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

Answer **all** the parts.

Introduction

Lime water is a saturated solution of calcium hydroxide, $Ca(OH)_2$, in water.

You will determine the concentration of $Ca(OH)_2$ in lime water by titration with an unknown acid **HX**.

You will also identify **HX**.

Three chemicals are provided.

- Solution **W** contains a strong aqueous acid, **HX**, of concentration $1.00\,mol\,dm^{-3}$.

Irritant

- Solution **Y** is lime water, aqueous $Ca(OH)_2$.
- Phenolphthalein solution is the indicator.

Flammable

Part 1 Titration of lime water with a diluted solution of W
Skill I (Implementing) **[14 marks]**

Record all your readings in the space on page 3.

Using a pipette and filler, transfer $10.0\,cm^3$ of **W** into a $250\,cm^3$ volumetric flask.
Make the solution up to $250\,cm^3$ using distilled (or de-ionised) water.
Invert the volumetric flask several times before use, to mix the solution thoroughly.

Using a pipette and filler, transfer $25.0\,cm^3$ of **Y** into a conical flask.
Add five drops of phenolphthalein indicator.

Fill the burette with the **diluted** solution of **W** that you prepared in the volumetric flask.
Carry out a trial titration.
Record all burette readings to $0.05\,cm^3$.
The titration is complete when the indicator changes from pale pink to colourless.

Repeat the titration until you obtain **two** consistent accurate results.
In each case, use $25.0\,cm^3$ of **Y**.

Calculate your mean titre.

Keep your **diluted** solution of **W** for use in **Part 3**.

Readings and calculations

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

Titration data (tabulated)

Summary

25.0 cm^3 of **Y** was exactly neutralised by a mean titre of ..... cm^3 of the diluted solution of **W**.

Show the readings you used to obtain this value of the volume of the diluted solution of **W** by putting a tick (✓) under these readings.

Safety

Suggest what hazard symbol, if any, you would put on a bottle containing your **diluted** solution of **W**.

Justify your answer.

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Part 2 Calculating the concentration of $Ca(OH)_2$ in lime water
Skill A (Analysing) **[10 marks]**

Use the *Data Sheet* for any data you require.
Show your working clearly.
Give your answers to **three** significant figures.

(a) Show that the concentration, in $mol\,dm^{-3}$, of acid **HX** in the **diluted** solution of **W** is $0.0400\,mol\,dm^{-3}$.

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

answer = ...mol

(c) Complete **and** balance the equation for the reaction of solution **Y** (aqueous calcium hydroxide) with the diluted solution of acid **HX**.
Include state symbols.

$Ca(OH)_2$( ) + **HX**( ) $\rightarrow$ Ca**X**$_2$ ( ) + ...( )

(d) Deduce the number of moles of $Ca(OH)_2$ dissolved in $25.0\,cm^3$ of solution **Y**.

answer = ...mol

(e) Calculate the concentration, in $mol\,dm^{-3}$, of $Ca(OH)_2$ in solution **Y**.

concentration = ...$mol\,dm^{-3}$

(f) Calculate the mass of $Ca(OH)_2$ dissolved in $1.00\,dm^3$ of solution **Y**.

mass =.....g

Part 3 Identification of HX
Skills I + A (Implementing and Analysing) **[6 marks]**

Solution **W** contains a strong aqueous acid, **HX**.
HX is one of the following acids: hydrochloric acid, hydrobromic acid or hydroiodic acid.
In this Part you will identify **HX**.

Two chemicals are provided.

- Aqueous silver nitrate, $AgNO_3$. **Irritant** 
- Dilute aqueous ammonia, NH_3. **Irritant** 

(a) Pour about a 2 cm depth of your **diluted** solution of **W** into a test-tube.
Add five drops of aqueous silver nitrate.
Keep the contents of the test-tube for **(b)**.

Record your observation.

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(b) Using a measuring cylinder, add 5 cm^3 of dilute aqueous ammonia to the mixture in the test-tube.
Place a stopper on the test-tube and shake it thoroughly for a few seconds.

Record your observation.

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(c) Identify acid **HX**.
Justify your answer.

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(d) Give a balanced equation for the reaction between **HX** and silver nitrate in **(a)**.
Include state symbols.

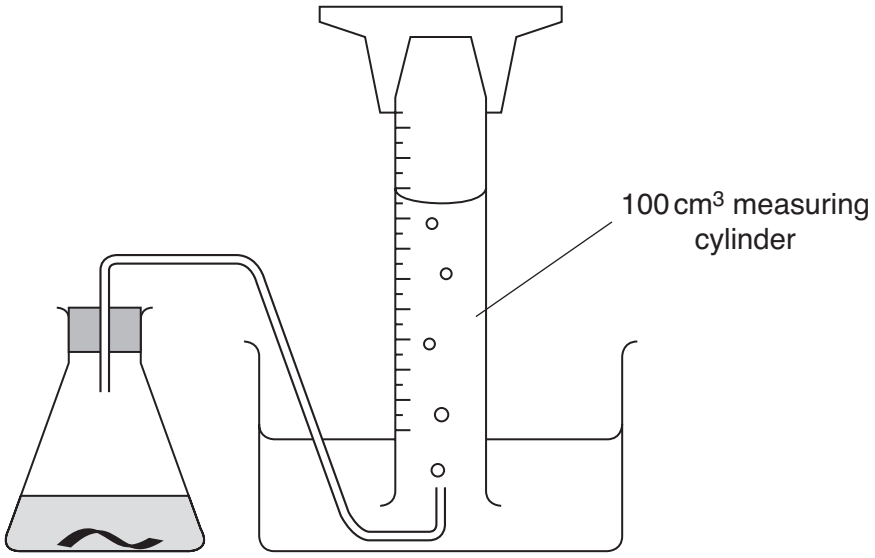
Part 4 Skill E (Evaluating evidence and procedures) **[14 marks]**

Information

A data book gives the concentration of $Ca(OH)_2$ in lime water as $1.60\,g\,dm^{-3}$.
A student who carried out the same titration as in **Part 1** obtained a value of $2.00\,g\,dm^{-3}$ for the concentration of $Ca(OH)_2$ in lime water.

The student thought that the solution of acid **HX** had **not** been made up correctly.
He carried out an experiment to find out whether the concentration of **HX** in solution **W** was $1.00\,mol\,dm^{-3}$.

He used the apparatus shown below.
Using a pipette, he measured out $10.0\,cm^3$ of solution **W** into a conical flask.
Then he added 0.15 g of magnesium ribbon and, as quickly as possible, he put the bung into the conical flask, so that the gas produced would be collected in the inverted measuring cylinder.



After one minute, he measured the volume of gas collected.

The equation for the reaction of magnesium with acid **HX** is

$$Mg(s) + 2\mathbf{HX}(aq) \rightarrow MgX_2(aq) + H_2(g)$$

(a) (i) State why it is important that an **excess** of magnesium is used during the reaction with **HX**.

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..... **[1]**

(ii) Carry out a calculation to prove that the student used **excess** magnesium in his experiment.
Assume that the concentration of **HX** in the solution is 1.00 mol dm^{-3} for this calculation.

[3]

(iii) State an observation that would confirm that the magnesium had been used in excess.

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..... **[1]**

(b) Bearing in mind the capacity of the measuring cylinder, do you think that 10.0 cm^3 of the solution of acid **HX** was a sensible quantity to use?

Carry out a calculation to justify your answer.
Assume that the concentration of **HX** in the solution is 1.00 mol dm^{-3} for this calculation.
One mole of gas occupies 24.0 dm^3 at room temperature and pressure, r.t.p.

[3]

(c) (i) State **and** explain **two** ways in which the student's experiment involving gas collection could be modified to make it more accurate.
Do **not** repeat any ideas you have written about in your answers to **(b)**.

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..... **[4]**

(ii) Which experiment is more **reliable**, the student's experiment involving gas collection or your method involving titration?

Justify your answer.

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..... **[2]**

END OF QUESTION PAPER