

**ADVANCED SUBSIDIARY GCE
CHEMISTRY**

2813/03/TEST

Practical Examination 1 (Part B – Practical Test)

TUESDAY 15 MAY 2007

Afternoon

Time: 1 hour 30 minutes

Additional materials: *Data Sheet for Chemistry* (Inserted)
Candidate's Plan (Part A of the
Practical Examination)
Scientific calculator



Candidate
Name

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- 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.
- A copy of the *Data Sheet for Chemistry* is provided as an insert with this question paper.

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

This document consists of **8** printed pages and a *Data Sheet for Chemistry*.

Answer **all** the parts.

Introduction

Ethanoic acid, CH_3COOH , was one of the liquids you identified in your Plan. This liquid slowly becomes impure when left in contact with the atmosphere.

In this experiment, you will determine the % purity of ethanoic acid by titrating a solution of the acid with aqueous sodium hydroxide.

Three chemicals are provided.

- Solution **D** is aqueous sodium hydroxide, containing 4.20 g dm^{-3} of NaOH.
- Liquid **E** is ethanoic acid.
- A solution of bromothymol blue is the indicator.

Irritant



Corrosive



Part 1 Titration of ethanoic acid with sodium hydroxide Skill I (Implementing)

[16 marks]

Record all of your readings on page 3.

Weigh the stoppered bottle containing **E**.
Pour all the liquid carefully into a 250 cm^3 volumetric flask, using a funnel.
Weigh the empty stoppered bottle.
Calculate the mass of **E** used.

Use distilled or deionised water to rinse any remaining liquid from the funnel into the volumetric flask.

Make up a solution of **E** to exactly 250 cm^3 with distilled or deionised 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 this solution into a conical flask.
Add 10 drops of bromothymol blue indicator.

Fill the burette with solution **D**.
Record all accurate burette readings to 0.05 cm^3 .

At the end point, the colour of the indicator changes to **blue**.
Carry out a trial titration.
Use the trial titration to familiarise yourself with the colour change.

Repeat the titration until you obtain **two** consistent results.
In each case use 25.0 cm^3 of your solution of **E**.

Calculate your mean titre.

Results

Use the spaces below to record all your readings.

Weighings

mass of **E** used = g

Titration data (tabulated)

Summary

25.0 cm³ of the solution of **E** required a mean titre of cm³ of solution **D**.

Show which readings you used to obtain this value of the volume of **D** by placing a tick (✓) under the readings used.

Safety

The solution of **E** that you prepared for use in the titration does **not** require a hazard symbol whereas liquid **E** does. Suggest a reason.

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Part 2 Calculation of the % purity of ethanoic acid
Skill A (Analysing evidence and drawing conclusions)

[14 marks]

In this section all your working must be shown clearly.
 Use the *Data Sheet* for relative atomic mass values.
 All answers should be quoted to **three** significant figures.

- (a) Solution **D** contains 4.20 g dm^{-3} of NaOH.

Calculate the concentration of NaOH, in mol dm^{-3} , in solution **D**.

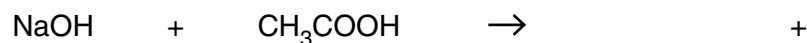
answer = mol dm^{-3}

- (b) Calculate how many moles of NaOH were used in your mean titre.

answer = mol

- (c) Complete and balance the equation below for the reaction taking place during the titration.

Include state symbols.



- (d) Deduce the number of moles of CH_3COOH in 25.0 cm^3 of the solution of **E** used in the titration.

answer = mol

(e) Calculate the number of moles of CH_3COOH in 250 cm^3 of the solution of **E** you made up.

answer = mol

(f) Calculate the mass of CH_3COOH dissolved in 250 cm^3 of this solution of **E**.

answer = g

(g) Calculate the % purity by mass of CH_3COOH in the impure ethanoic acid, **E**.

answer = %

(h) Ethanoic acid becomes impure when left in contact with the atmosphere.

(i) State what assumption was made about the nature of the substance causing the impurity in the above calculations. Explain your answer.

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(ii) Suggest an identity for the main impurity in **E**.

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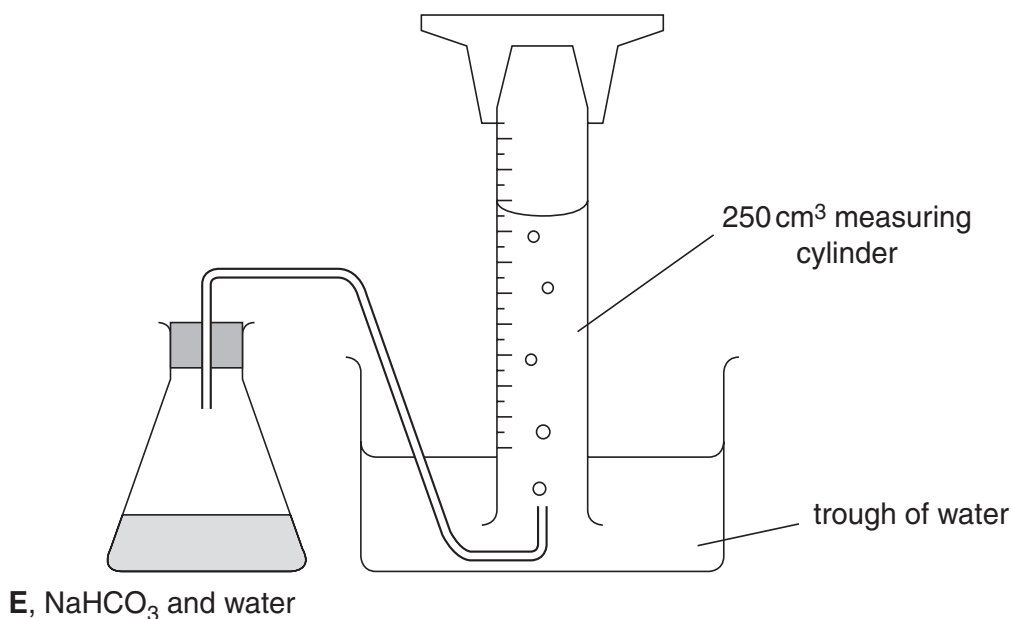
Information

A student determined the % purity by mass of CH_3COOH in **E** by a different method.

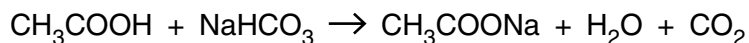
A sample of **E** was weighed out and added to about 10cm^3 of water.

This solution was allowed to react with a known mass of sodium hydrogencarbonate, NaHCO_3 , as shown in the diagram below.

After about one minute, the volume of gas collected was recorded.



The equation for the reaction is:



The following readings were obtained.

Mass of E used	= 0.30 g
Mass of NaHCO_3 used	= 0.32 g
Volume of gas collected at r.t.p.	= 40cm^3

The volume occupied by 1 mole of gas molecules at room temperature and pressure (r.t.p.) = $24\,000\text{cm}^3$.

Questions

- (a) Explain why the titration procedure you carried out in **Part 1** is more **reliable** than the student's experiment above.

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[2]

(b) Was the mass of NaHCO_3 used by the student sufficient to be in excess? Carry out a calculation to justify your answer.

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..... [3]

(c) Identify **three** sources of inaccuracy in the student's experiment involving collection of gas.

In **each** case:

- explain the reason for the inaccuracy;
- suggest how the inaccuracy could be reduced or eliminated by modifying the apparatus or the procedure.

Do not repeat any ideas used in your answers to (a) or (b).

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