OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

CHEMISTRY 2816/03/TEST

Practical Examination (Part B): Practical Test

Wednesday **22 JANUARY 2003** Morning 1 hour 30 minutes

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

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 on the question paper.

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.
- Use of a *Data Sheet for Chemistry* is allowed.
- You may refer to your plan produced for Part A.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
Planning	16	
1	14	
2	16	
3	14	
TOTAL	60	

This question paper consists of 8 printed pages.

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Answer **all** the questions.

Introduction

We can find out how much nickel is in a nickel(II) compound by a procedure called back-titration. This titration uses **edta**. Edta is a ligand which forms complex ions.

- Excess edta is added to a solution of a nickel(II) compound.
- One mole of nickel(II) ions reacts with one mole of edta.
- The amount of edta left over is measured by titration with magnesium sulphate.
- One mole of magnesium ions reacts with one mole of edta.

In this Test, you will determine the amount of nickel(II) ion in a sample of hydrated nickel(II) sulphate, $NiSO_4.xH_2O$. You will then calculate the number, **x**, in this formula.

Five labelled materials are provided.

E is hydrated nickel(II) sulphate, **harmful**  .

F is aqueous **edta** of concentration 0.110 mol dm^{-3}.

G is aqueous magnesium sulphate of concentration 0.0800 mol dm^{-3}.

H is a buffer solution, **irritant**  .

A solid indicator called solochrome black.

1 Skill I Implementing [14 marks]

All readings should be recorded on page 3 of this booklet.

Weigh the bottle containing **E**, the hydrated nickel(II) sulphate.
Tip the entire contents of the bottle into a beaker and weigh the empty bottle.

Dissolve solid **E** in about 150 cm^3 of distilled (or de-ionised) water.
Transfer all this solution into a 250 cm^3 volumetric flask.

Add distilled water to make up the solution to exactly 250 cm^3.
Mix the solution thoroughly before use.

Using a pipette and filler, transfer 25.0 cm^3 of this solution of **E** into a conical flask.
Then add:

- 25.0 cm^3 of solution **F** (edta), using **another** pipette;
- about 25 cm^3 of **H**, the buffer solution, using a measuring cylinder;
- a **few specks** of solochrome black indicator.

Now fill the burette with solution **G**, aqueous magnesium sulphate.
Record all burette readings to 0.05 cm^3.
Carry out a trial titration.
The colour change at the end-point is from **blue** to **purple**.

Repeat the titration procedure to obtain two accurate titres.
In each case, remember to add all three chemicals listed above to the 25.0 cm^3 portion of **E**.

Use the space below to record all your readings.

(a) Calculate the mean titre. Show which readings you used to calculate the mean titre by placing a tick under the readings used.

(b) State and explain **one** safety precaution you took while doing the experiment.

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2 Skill A Analysing evidence and drawing conclusions [16 marks]

In this section all your working must be shown clearly.

One mole of edta reacts with one mole of Mg^{2+} ions.
One mole of edta reacts with one mole of Ni^{2+} ions.

(a) Calculate the amount, in moles, of $MgSO_4$ used in the mean titre.
The concentration of $MgSO_4$ is 0.0800 mol dm^{-3}.

(b) Write down the amount, in moles, of edta that reacted with this amount of $MgSO_4$.

(c) Calculate the **total** amount, in moles, of edta used in each titration.
The concentration of edta is 0.110 mol dm^{-3}.

(d) Calculate the amount, in moles, of edta which reacted with 25.0 cm^3 of your solution of **E**.

(e) Calculate the amount, in moles, of Ni^{2+} in 250 cm^3 of your solution.

(f) Calculate the mass of one mole of $NiSO_4.xH_2O$.
Then deduce the value of **x**.

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3 Skill E Evaluating evidence and procedures [14 marks]

*About **half** of the marks for skill E will be awarded for part* **3(b)**.

(a) A student determined the value of **x** in $NiSO_4.xH_2O$ by another method. This method involved heating the hydrated compound in order to drive off the water of crystallisation and obtain anhydrous nickel(II) sulphate.
The following readings were obtained.

Mass of empty crucible	= 20.00 g
Mass of crucible and hydrated nickel(II) sulphate	= 21.31 g
Mass of crucible and residue, after heating for five minutes	= 20.77 g

(i) Assume that the residue is anhydrous nickel(II) sulphate.

Calculate the amount, in moles, of anhydrous nickel(II) sulphate obtained.

(ii) Calculate **x** in the formula $NiSO_4.xH_2O$.

(b) State and explain **three** precautions that the student should take to ensure that the experiment was as accurate as possible.

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(c) Which result for the value of **x** is probably more reliable, your own from the titration or the result from the student's experiment? Justify your answer.