

Advanced Subsidiary GCE

F323 (1)

CHEMISTRY A

Unit F323: Practical Skills in Chemistry 1:
Qualitative Task

Specimen Task

For use from September 2008 to June 2009.

Candidates answer on the task sheet.

All items required by teachers and candidates for this task are included in this pack.

INFORMATION FOR CANDIDATES

- Qualitative Task: Preparation of Ammonium Sulfate.

INFORMATION FOR TEACHERS

- Mark scheme.
- Instructions for Teachers and Technicians.

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INSTRUCTIONS TO CANDIDATES

- Answer **all** parts of the task.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each part of the task.
- The total number of marks for this task is **10**.

ADVICE TO CANDIDATES

- Read each part carefully and make sure you know what you have to do before starting your answer..

FOR TEACHER'S USE		
Part	Max.	Mark
A1	5	
B1	5	
TOTAL	10	

Part	Max.	Mark
A1	5	
B1	5	
TOTAL	10	

This task consists of **6** printed pages.

Preparation of Ammonium Sulfate

Background

Ammonium sulfate occurs in nature as the mineral mascagnite. It is soluble in water and is prepared commercially by passing ammonia into sulfuric acid. Ammonium sulfate is used as a nitrogen source in fertilisers, in water treatment and in flame proofing materials.

Introduction

For this Practical Task you are given full instructions for the practical procedure, which must be followed carefully.

It is your responsibility to work safely and to organise your time efficiently.

You have two exercises to carry out:

- You will prepare a sample of ammonium sulfate.
- You will then carry out some chemical tests on some unknown solutions.

You will be assessed on the accuracy of your results.

A1 [1]

Depending on the time available, at Stage 5, you may be asked to leave your crystals of ammonium sulfate to dry until your next lesson. You will then be able to complete the practical.

Part 1 – Titration

Three chemicals are supplied.

- | | | |
|--|----------|---|
| • 1 mol dm ⁻³ sulfuric acid, H ₂ SO ₄ . | Irritant |  |
| • 2 mol dm ⁻³ aqueous ammonia, NH ₃ (aq). | Irritant |  |
| • Methyl orange. | | |

It is your responsibility throughout to ensure the cleanliness of the equipment.

1 Using the pipette and filler, transfer 25.0 cm³ of the ammonia solution into a conical flask.
Add about five drops of methyl orange indicator.

2 Fill the burette with fresh 1.0 mol dm⁻³ sulfuric acid.

Record all burette readings to 0.05 cm³ in a table on page 3.

Carry out a titration to find out how much acid is needed to neutralise the ammonia solution.

The colour change at the end point is from yellow to orange.

3 Repeat the process until two readings are within 0.20 cm³ of each other, recording all your results on page 3.

4 Finally repeat the titration, but **without** the indicator.

Add the volume of acid previously determined from your trial experiments.

A1 [1]

- 5 Pour the neutralised solution from the conical flask into an evaporating basin.

Place the evaporating basin on a tripod and gauze.

Heat the solution until the total volume has been reduced to about one-third of the original volume.

Do **not** heat to dryness.

Allow the evaporating basin to cool. Ammonium sulfate will start to crystallise from the solution. A1 [1]

- 6 Once the crystals have formed, carefully pour off any liquid and dry the crystals between filter papers.

When the crystals are completely dry, weigh the product and record the mass in the space below.

Place the crystalline product in sample tube and label this with your name.

A1 [1]

Readings

Titration results

You do not necessarily need to complete three titrations.

	trial 1	trial 2	trial 3
final volume/cm ³			
initial volume/cm ³			
titre/cm ³			

volume of H₂SO₄ required to neutralise the ammonia = cm³

Mass measurements

mass of ammonium sulfate crystals obtained = g

Safety

State two precautions that you took whilst carrying out this experiment.

precautions taken

.....

..... A1 [1]

[Turn over

Part 2 – Chemical tests

You are provided with the following solutions. For the purposes of these tests, you should assume that any of solutions **A–D** may be toxic.

• Solution A	Toxic	
• Solution B	Toxic	
• Solution C	Toxic	
• Solution D	Toxic	
• Silver nitrate solution, $\text{AgNO}_3(\text{aq})$	Irritant	
• Dilute hydrochloric acid, $\text{HCl}(\text{aq})$	Irritant	
• 2 mol dm^{-3} aqueous ammonia, $\text{NH}_3(\text{aq})$	Irritant	

Use separate portions of the solutions to carry out the tests detailed below.

Solutions **A**, **B**, **C** and **D** are all sodium salts.

One of the solutions is a **chloride** and one is a **carbonate**.

You will carry out **Test 1** and **Test 2** on each solution. Your observations will allow you to identify which solution is a chloride and which solution is a carbonate.

Test 1

Using a dropping pipette, add about ten drops of solutions **A**, **B**, **C** and **D** into each of four test-tubes.

Using a dropping pipette, add an equal volume of silver nitrate solution dropwise to each of the four solutions.

Record your observations in a suitable format below.

Test 2

Using a dropping pipette, add about ten drops of solutions **A**, **B**, **C** and **D** into each of four test-tubes.

Using a dropping pipette, add an equal volume of hydrochloric acid dropwise into each test-tube.

Record your observations in a suitable format below.

B1 [1]

Identifying the solutions

Use your observations from **Test 1** and **Test 2** to identify which solution is sodium chloride and which is sodium carbonate.

Explain how each observation has aided your identification.

Sodium chloride is solution

Explanation.....

.....

.....

.....

..... B1 [1]

Sodium carbonate is solution

Explanation.....

.....

.....

..... B1 [1]

[Total: 10]

END OF TASK

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The maximum mark for this task is **10**.

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Quality A1	Max Mark
carries out the titration adequately for determination of the volume of HCl(aq) required	[1]
heats solution safely without boiling over or spillage during evaporation	[1]
obtains a mass of product within 20% of centre value	[1]
obtains a white crystalline solid	[1]
states two relevant safety comments	[1]
Quality B1	
Test 1: Solution A : red/brown precipitate Solution B : white precipitate Solution C : black precipitate Solution D : no change Four observations: 2 marks Three observations: 1 mark	[2]
Test 2: Solution A : orange solution Solution B : no change Solution C : bubbles Solution D : no change Four observations: 1 mark	[1]
Sodium chloride is solution B .	[1]
Explanation: white precipitate in Test 1 .	[1]
Sodium carbonate is solution C .	[1]
Explanation: bubbles in Test 2 .	
Total:	[10]

Instructions for Teachers and Technicians

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This is a Qualitative Task. There is no time limit but it is expected that it can be completed within one hour.

Candidates may attempt more than one qualitative task with the best mark from this type of task being used to make up the overall mark for Unit F323.

Preparing for the assessment

It is expected that before candidates attempt Practical Skills in Chemistry 1 (Unit F323) they will have had some general preparation in their lessons. They will be assessed on a number of qualities such as demonstration of skilful and safe practical techniques using suitable qualitative methods, the ability to make and record valid observations, and the ability to organise results suitably. It is therefore essential that they should have some advance practice in these areas so that they can maximise their attainment.

Preparing candidates

At the start of the task the candidates should be given the task sheet.

Candidates must work on the task individually under controlled conditions with the completed task being submitted to the teacher at the end of the lesson. Completed tasks should be kept under secure conditions until results are issued by OCR.

Candidates should not be given the opportunity to redraft their work, as this is likely to require an input of specific advice. If a teacher feels that a candidate has under-performed, the candidate may be given an **alternative** task. In such cases it is essential that the candidate be given detailed feedback on the completed assessment before undertaking another Qualitative Task. Candidates are permitted to take each task **once** only.

Assessing the candidate's work

The mark scheme supplied with this pack should be used to determine a candidate's mark out of a total of 10 marks. The cover sheet for the task contains a grid for ease of recording marks. To aid moderators it is preferable that teachers mark work using red ink, including any appropriate annotations to support the award of marks.

Notes to assist teachers with this task

Teachers must trial the task before candidates are given it, to ensure that the apparatus, materials, chemicals etc provided by the centre are appropriate. The teacher carrying out the trial must complete a candidate's task sheet showing the results attained, and retain this, clearly labelled, so that it can be provided to the moderator when requested.

Health and Safety

Attention is drawn to Appendix G of the specification.

Apparatus list

Students must not be told any information about these materials apart from what is given on the assessment sheets.

Materials

Each student will require the following materials, labelled by the indicated name only and the hazard-warning symbol.

name		hazard	
H ₂ SO ₄	Aqueous (dilute) sulfuric acid of concentration 1 mol dm ⁻³ . Each student will require about 100 cm ³ in a suitable bottle.	Irritant	
NH ₃ (aq)	Aqueous ammonia of concentration 2 mol dm ⁻³ . Each student will require about 100 cm ³ in a suitable bottle.	Irritant	

Apparatus

Each student will require:

- Safety spectacles
- Burette and white tile
- Pipette (25.0 cm³) and filler
- Clamp stand, with boss and clamp (for supporting the burette)
- Filter funnel
- Measuring cylinder (25 cm³)
- Glass rod
- Spatula
- Wash bottle containing distilled or deionised water (about 300 cm³ will be required)
- Two conical flasks or conical beakers (250 cm³)
- Glass beaker (250 cm³)
- Bunsen burner
- Clamp stand, with boss and clamp (for supporting the quickfit apparatus)
- Gauze
- Evaporating basin
- Filter paper (four sheets)
- Two dropping pipettes
- Five test-tubes in a test-tube rack

Each student will also need access to the following:

- a dropping bottle containing methyl orange
- a top pan balance weighing to 0.01 g

Aqueous silver nitrate, $\text{AgNO}_3(\text{aq})$, of concentration 0.05 mol dm^{-3}



Dilute hydrochloric acid, $\text{HCl}(\text{aq})$, of concentration 1.0 mol dm^{-3}



NOTE: It is recognised that only solution A is toxic. However, as candidates are required to identify solutions, candidates will need to assume that any of solutions **A–D** may be toxic. Consequently, all solutions should be labelled as **TOXIC**.

- **solution A**
 $\text{Na}_2\text{CrO}_4(\text{aq})$ of concentration 0.1 mol dm^{-3}
(Each candidate will require about 30 cm^3)
- **solution B**
 $\text{NaCl}(\text{aq})$ of concentration 0.1 mol dm^{-3} (at least one for every four students).
- **solution C**
 $\text{Na}_2\text{CO}_3(\text{aq})$ of concentration 0.1 mol dm^{-3}
- **solution D**
 $\text{NaNO}_3(\text{aq})$ of concentration 0.1 mol dm^{-3}



Note: The quantities of chemicals required are approximate and due allowance should be made for wastage.