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ADVANCED  
General Certificate of Education  
2014

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Centre Number  
71  
Candidate Number

## Chemistry

Assessment Unit A2 3  
Internal Assessment  
Practical Examination 1

[AC231]

THURSDAY 15 MAY, MORNING



### TIME

2 hours 30 minutes.

### INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Answer **all three** questions.

Write your answers in the spaces provided.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Questions 1 and 2 are practical exercises each worth 25 marks.

Question 3 is a planning exercise worth 20 marks.

Quality of written communication will be assessed in **Question 3(b)**.

**You may not have access to notes, textbooks and other material to assist you.**

A Periodic Table of the Elements, containing some data, is included in this question paper.

For Examiner's use only		
Question Number	Examiner Mark	Remark
1		
2		
3		
<b>Total Marks</b>		

## 1 Titration exercise

You are required to dissolve a weighed sample of ammonium iron(II) sulfate in dilute sulfuric acid and make the solution up to  $250\text{ cm}^3$  in a volumetric flask. You will then titrate  $25.0\text{ cm}^3$  portions of this solution with acidified potassium manganate(VII). You will then use your results to calculate the concentration of the acidified potassium manganate(VII) solution.

You are provided with:

- Hydrated ammonium iron(II) sulfate,  $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$
- Dilute sulfuric acid
- Deionised water
- A  $250\text{ cm}^3$  volumetric flask
- An acidified solution of potassium manganate(VII).

- (a) (i) Weigh out between 7.80 g and 7.90 g of ammonium iron(II) sulfate. Record the mass to **two** decimal places.

Mass of  $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$  \_\_\_\_\_ [2]

- (ii) Dissolve the weighed sample in approximately  $100\text{ cm}^3$  of dilute sulfuric acid and make the solution up to  $250\text{ cm}^3$  in the volumetric flask using deionised water. Calculate the concentration of the solution in  $\text{mol dm}^{-3}$ .

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

(b) Titrate 25.0 cm<sup>3</sup> portions of your solution with acidified potassium manganate(VII). Record your results in a suitable table in the space below. Calculate the average titre.

[8]

(c) (i) Describe how you ensured the end point of your titration was accurate.

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[2]

(ii) State the colour change at the end point of your titration.

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[1]

(d) (i) Write the half-equation for the reduction of acidified manganate(VII) ions to form manganese(II) ions.

\_\_\_\_\_ [2]

(ii) Write the half-equation for the oxidation of iron(II) ions to iron(III) ions.

\_\_\_\_\_ [1]

(iii) Write the ionic equation for the reaction.

\_\_\_\_\_ [2]

(iv) Calculate the concentration of the acidified potassium manganate(VII) solution in  $\text{g dm}^{-3}$ .

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [4]

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**(Questions continue overleaf)**

## 2 Observation/deduction

Safety glasses must be worn at all times and care should be exercised during this practical examination.

- (a) (i) You are provided with a solid, labelled A. Carry out the following tests. Record your observations in the spaces below.

Test	Observations
1 Describe the appearance of A.	[1]
2 Dissolve two spatula measures of A in approximately 50 cm <sup>3</sup> of water. Keep this solution for use in further tests.	[1]
3 Place 4 cm <sup>3</sup> of the solution from test 2 in a test tube. Add an equal volume of concentrated hydrochloric acid.	[1]
4 Place 4 cm <sup>3</sup> of the solution from test 2 in a test tube. Add an equal volume of 1,2-diaminoethane solution.	[1]
5 (a) Place 4 cm <sup>3</sup> of the solution from test 2 in a test tube. Slowly add an equal volume of sodium hydroxide solution.  (b) Add a further 5 cm <sup>3</sup> of sodium hydroxide solution.	[2]
6 Place 4 cm <sup>3</sup> of the solution from test 2 in a test tube. In a fume cupboard, add an equal volume of concentrated ammonia solution.	[1]
7 Place 4 cm <sup>3</sup> of the solution from test 2 in a test tube. Add 1 cm <sup>3</sup> of barium chloride solution dropwise.	[1]

- (ii) Identify A.

\_\_\_\_\_ [2]

(iii) Suggest the formulae of the complex ions formed in tests 2, 3, 4 and 6.

Test 2 \_\_\_\_\_ [1]

Test 3 \_\_\_\_\_ [1]

Test 4 \_\_\_\_\_ [1]

Test 6 \_\_\_\_\_ [1]

(iv) Give the formulae of the precipitates formed in tests 5 and 7.

Test 5 \_\_\_\_\_ [1]

Test 7 \_\_\_\_\_ [1]

- (b) (i) You are provided with an aqueous solution of an organic compound B. Carry out the following tests. Record your observations in the spaces below.

Test	Observations
1 Describe the solution. Include a description of its smell.	[1]
2 Place 4 cm <sup>3</sup> of the solution in a test tube. Add an equal volume of potassium dichromate solution and acidify with 1 cm <sup>3</sup> of dilute sulfuric acid. Heat in a water bath for five minutes.	[1]
3 Place 4 cm <sup>3</sup> of the solution in a test tube. Add half a spatula measure of sodium hydrogencarbonate.	[2]

- (ii) Identify the functional group present in B.

\_\_\_\_\_ [1]

- (iii) Suggest how the infrared spectrum of B could confirm the presence of this functional group.

\_\_\_\_\_  
\_\_\_\_\_ [2]

- (iv) Suggest how the mass spectrum of B could confirm its identity.

\_\_\_\_\_  
\_\_\_\_\_ [2]



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**(Questions continue overleaf)**

### 3 Planning exercise

Ethyl methanoate,  $\text{HCOOCH}_2\text{CH}_3$ , exists as a liquid at room temperature and pressure. Its boiling point is  $55^\circ\text{C}$  and its density is  $0.9\text{ g cm}^{-3}$ .

- (a) (i) Write the equation for the formation of ethyl methanoate from methanoic acid and ethanol.

\_\_\_\_\_ [1]

- (ii) Assuming a 60% yield, calculate the minimum mass of each reactant required to produce 4.44 g of ethyl methanoate.

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 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [3]

- (b) Describe the laboratory preparation of ethyl methanoate up to and including the removal of the crude product from the reaction mixture.

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 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [5]

Quality of written communication [2]

(c) The crude product can be purified using an aqueous solution of sodium carbonate followed by anhydrous calcium chloride.

(i) Why and how is the sodium carbonate solution used?

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[4]

(ii) Why and how is the anhydrous calcium chloride used?

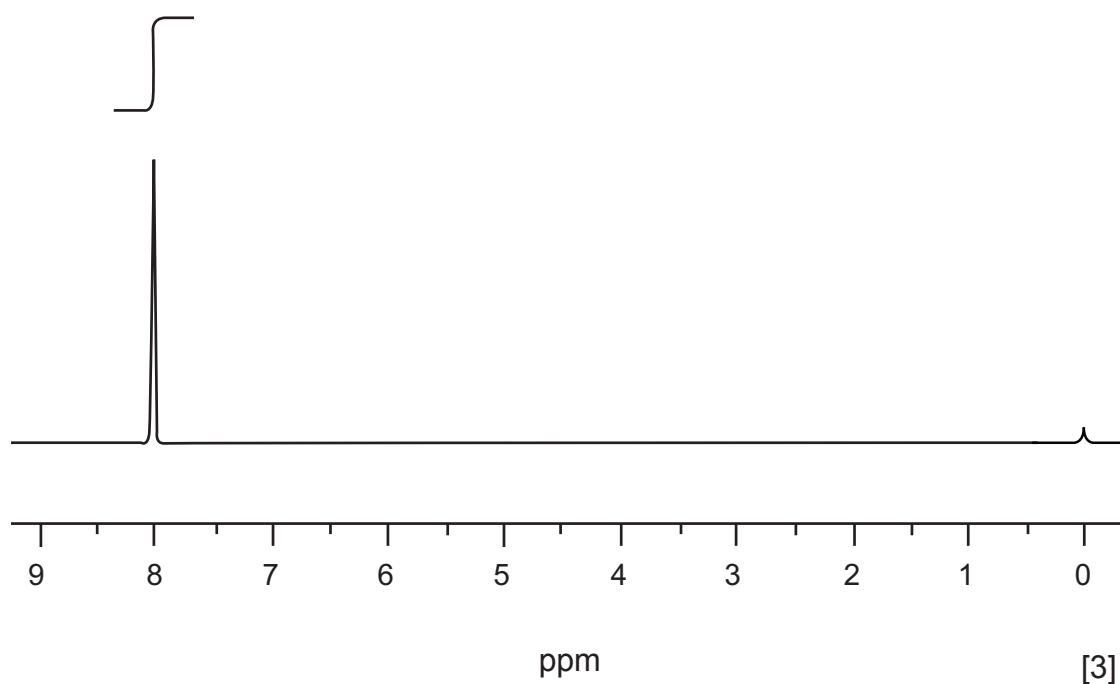
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[2]

- (d) Part of the nmr spectrum of ethyl methanoate is shown below.  
Complete the nmr spectrum in terms of integration and splitting pattern.



[3]

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**THIS IS THE END OF THE QUESTION PAPER**

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## **Chemistry**

**Assessment Unit A2 3**  
**Internal Assessment**  
**Practical Examinations 1 and 2**

**[AC231] [AC232]**

**THURSDAY 15 MAY AND FRIDAY 16 MAY**

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AC231 AC232

# **APPARATUS AND MATERIALS LIST**

### Advice for centres

- All chemicals used should be at least laboratory reagent specification and labelled with appropriate safety symbols, e.g. irritant.
- For centres running multiple sessions – candidates for the later session should be supplied with clean, dry glassware. If it is not feasible then glassware from the first session should be thoroughly washed, rinsed with deionised water and allowed to drain.
- **Ensure all chemicals are in date otherwise expected observations may not be seen.**

## Practical Examination 1

Each candidate must be supplied with safety goggles or glasses.

### Question 1

Each candidate must be supplied with:

- one 50 cm<sup>3</sup> burette of at least class B quality
- one 25 cm<sup>3</sup> pipette of at least class B quality
- one 250 cm<sup>3</sup> volumetric flask
- a safety pipette filler
- three conical flask of 250 cm<sup>3</sup> capacity
- a funnel for filling the burette (optional)
- a white tile or white paper
- 250 cm<sup>3</sup> beaker
- a wash bottle containing deionised water
- a retort stand and clamp
- weighing bottle (or equivalent)
- approximately 9.0g of ammonium iron(II) sulfate
- access to an accurate balance (reading to 2 decimal places)
- glass rod
- spatula
- 250 cm<sup>3</sup> of dilute sulfuric acid (approximately 1.0 mol dm<sup>-3</sup>) labelled **dilute sulfuric acid** and **caution**
- 150 cm<sup>3</sup> of 0.02 mol dm<sup>-3</sup> acidified potassium manganate(VII) labelled **potassium manganate(VII) solution**.

## Practical Examination 1

### Question 2

Each candidate must be supplied with:

- a small beaker
- five test tubes
- a boiling tube
- a test tube holder
- a test tube rack
- a spatula
- a stirring rod
- a heat-proof mat
- a Bunsen burner
- several plastic droppers
- deionised water
- kettle to supply hot water (optional)
- hydrated copper(II) sulfate (approximately 3.0 g) labelled **A**
- about 10 cm<sup>3</sup> of concentrated hydrochloric acid in a stoppered reagent bottle labelled **concentrated hydrochloric acid** and **corrosive**
- about 10 cm<sup>3</sup> of an aqueous solution of 1,2-diaminoethane (approximately 0.2M) labelled **1,2-diaminoethane**
- about 10 cm<sup>3</sup> of an aqueous solution of sodium hydroxide (approximately 2.0M) labelled **sodium hydroxide** and **corrosive**
- a reagent bottle containing concentrated ammonia labelled **concentrated ammonia** and **irritant** (available in the fume cupboard(s)). Each candidate will only need about 10 cm<sup>3</sup>
- about 10 cm<sup>3</sup> of aqueous solution of barium chloride (approximately 0.1M) labelled **barium chloride solution**
- about 10 cm<sup>3</sup> of aqueous ethanoic acid (approximately 25% glacial 75% water) labelled **B**
- about 10 cm<sup>3</sup> of aqueous potassium dichromate (approximately 0.1M) labelled **potassium dichromate** and **irritant**
- 2M sulfuric acid labelled **dilute sulfuric acid** and **caution**
- 2–3 g of sodium hydrogencarbonate

## Practical Examination 2

Each candidate must be supplied with safety goggles or glasses.

### Question 1

Each candidate must be supplied with:

- one 50 cm<sup>3</sup> burette of at least class B quality
- one 25 cm<sup>3</sup> pipette of at least class B quality
- one 250 cm<sup>3</sup> volumetric flask
- a safety pipette filler
- three conical flask of 250 cm<sup>3</sup> capacity
- a funnel for filling the burette (optional)
- a white tile or white paper
- one beaker of 250 cm<sup>3</sup> capacity
- a wash bottle containing deionised/distilled water
- a retort stand and clamp
- weighing bottle (or equivalent)
- approximately 9.0g of ammonium iron(II) sulfate
- access to an accurate balance (reading to 2 decimal places)
- glass rod
- spatula
- 250 cm<sup>3</sup> of dilute sulfuric acid (approximately 1.0 mol dm<sup>-3</sup>) labelled **dilute sulfuric acid** and **caution**
- 150 cm<sup>3</sup> of 0.02 mol dm<sup>-3</sup> acidified potassium manganate(VII) labelled **potassium manganate(VII) solution**.

## Practical Examination 2

### Question 2

Each candidate must be supplied with:

- a small beaker
- five test tubes
- a boiling tube
- a test tube holder
- a test tube rack
- a spatula
- a stirring rod
- a heat-proof mat
- a Bunsen burner
- several plastic droppers
- deionised water
- kettle to supply hot water (optional)
- hydrated nickel(II) sulfate (approximately 3.0 g) labelled **X**
- about 10 cm<sup>3</sup> of an aqueous solution of edta (approx 0.1M) labelled **edta**
- about 10 cm<sup>3</sup> of an aqueous solution of 1,2-diaminoethane (approximately 0.2M) labelled **1,2-diaminoethane**
- about 10 cm<sup>3</sup> of an aqueous solution of sodium hydroxide (approximately 2.0M) labelled **sodium hydroxide**
- a reagent bottle containing concentrated ammonia labelled **concentrated ammonia** and **irritant** (available in the fume cupboard(s)). Each candidate will only need about 10 cm<sup>3</sup>
- about 10 cm<sup>3</sup> of aqueous solution of barium chloride (approximately 0.1M) labelled **barium chloride solution**
- about 10 cm<sup>3</sup> of aqueous ethanoic acid (approximately 25% glacial 75% water) labelled **Y**
- about 10 cm<sup>3</sup> of potassium dichromate (approximately 0.1M) labelled **potassium dichromate** and **irritant**
- 2M sulfuric acid labelled **dilute sulfuric acid** and **caution**
- 2–3 g of sodium hydrogencarbonate









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## **Chemistry**

**Assessment Unit A2 3**

*Internal Assessment*

**Practical Examinations 1 and 2**

**[AC231] [AC232]**

**THURSDAY 15 AND FRIDAY 16 MAY**

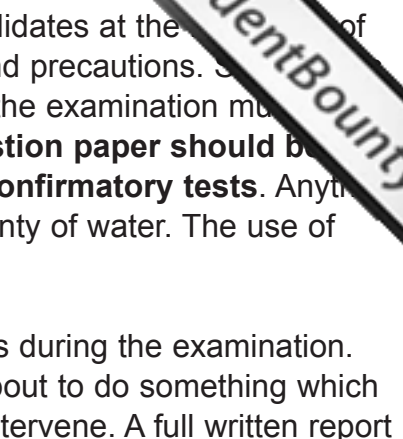
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# **Confidential Instructions to the Supervisor of the Practical Examination**

# INSTRUCTIONS TO THE SUPERVISOR OF THE PRACTICAL EXAMINATION

## General

1. The instructions contained in this document are for the use of the Supervisor **and are strictly confidential**. Under no circumstances may information concerning apparatus or materials be given before the examination to a candidate or other unauthorised person.
2. In a centre with a large number of candidates it may be necessary for two or more examination sessions to be organised. **It is the responsibility of the schools to ensure that there should be no contact between candidates taking each session.**
3. A suitable laboratory must be reserved for the examination and kept locked throughout the period of preparation. Unauthorised persons not involved in the preparation for the examination must not be allowed to enter. Candidates must not be admitted until the specified time for commencement of the examination.
4. The Supervisor must ensure that the solutions provided for the candidates are of the nature and concentrations specified in the Apparatus and Materials List.
5. **The Supervisor is to be granted access to the Teacher's Copy of the Question Paper, showing parts of questions 1 and 2 only, on Monday 12 May 2014.** The Supervisor is asked to check, at the earliest opportunity, that the experiments and tests in the question paper may be completed satisfactorily using the apparatus, materials and solutions that have been assembled. **This question paper must then be returned to safe custody** at the earliest possible moment after the Supervisor has ensured that all is in order. **No access to the question paper should be allowed before 12 May 2014.**
6. In the case of centres who have candidates entered for both practical examinations, the Supervisor must **return all unused scripts of Practical Examination 1** to the Examinations Officer immediately on completion of the examination. **The contents of this examination must be kept confidential until the completion of Practical Examination 2.**
7. Pipettes and burettes should be checked before the examination, and there should be an adequate supply of spare apparatus in case of breakages. The Apparatus and Materials List should be regarded as a minimum and there should be no objection to candidates being supplied with more than the minimum amount of apparatus and materials.
8. **Candidates may not use text books and laboratory notes for reference during the examination, and must be informed of this beforehand.**

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9. Clear instructions must be given by the Supervisor to all candidates at the beginning of the examination concerning appropriate safety procedures and precautions. Supervisors are also advised to remind candidates that all substances in the examination materials should be treated with caution. **Only those tests specified in the question paper should be attempted. Candidates must not attempt any additional confirmatory tests.** Any material spilled on the skin should be washed off immediately with plenty of water. The use of appropriate eye protection is essential.
  10. Supervisors are reminded that they may not assist candidates during the examination. However, if in the opinion of the Supervisor, a candidate is about to do something which may endanger him/herself or others, the Supervisor should intervene. A full written report must be sent to CCEA at once.
  11. Upon request, a candidate may be given additional quantities of materials (answer paper, reagents and unknowns) without penalty. No notification need be sent to CCEA.
  12. The examination room must be cleared of candidates immediately after the examination.
  13. No materials will be supplied by CCEA.



Northern Ireland Council for the Curriculum, Examinations and Assessment

General Certificate of Education

Advanced

Chemistry

Practical Examination 2

Friday 16 May 2014

Centre Number

71

Candidate Number


This report must be completed by the Supervisor during the examination. The complete report should include all candidates taking this Practical Examination. This Supervisor's Report should be copied and attached to **Each Advice Note** bundle and returned to CCEA in the normal way.

Comments:

Supervisor's Signature . . . . . Date . . . . .





