



Rewarding Learning

ADVANCED
General Certificate of Education
2013

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Centre Number
71

Candidate Number

Chemistry

Assessment Unit A2 3
Internal Assessment
Practical Examination 1

[AC231]



WEDNESDAY 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 **Questions 3(d) and (e)**.

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	Marks	Moderation Mark
1		
2		
3		
Total Marks		

Tea	Mar	Remark

1 Titration exercise

Hardness in water may be caused by the presence of dissolved calcium ions.

You are provided with:

- A solution of edta of concentration 0.01 mol dm^{-3}
- A sample of hard water
- Four portions of pH10 buffer solution
- Eriochrome Black T indicator solution (**use four drops**)
- A sample solution showing the colour at the end point

Assuming that all apparatus is clean and dry, you are required to carry out a titration and use your results to determine the concentration of calcium ions in the hard water sample.

(a) Give details of the procedure you intend to use. The edta solution should go into the burette.

[6]

(b) Carry out your procedure. Present your results in a suitable table and calculate the average titre.

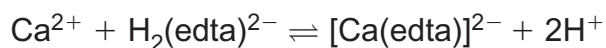
Tea Mar.	Remark

[8]

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

From _____ to _____ [2]

(d) With reference to the following equation explain the reason for adding the pH10 buffer to the reaction mixture.



[2]

(e) Calculate the concentration of the calcium ions in the hard water in mg dm^{-3} .

[5]

(f) Name another test that would be used to confirm the presence of calcium ions in the hard water, stating the expected result.

[2]

Te. Mar.	Remark

2 Observation/deduction

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

- (a) You are provided with a salt, labelled X. Carry out the following tests. Record your observations and deductions in the spaces below.

Test	Observations	Deductions
1 Describe the appearance of X.	[1]	[1]
2 Add a spatula measure of X to 50 cm ³ of deionised water and stir until there is no further change.	[1]	[1]
3 Add 5 drops of silver nitrate solution to a test tube containing 2 cm ³ of the solution of X. Allow the mixture to stand.	[3]	[1]
4 Put 2 cm ³ of the solution of X into a test tube. (a) Add 5 drops of sodium hydroxide solution. (b) Add a further 5 cm ³ of sodium hydroxide solution.	[3]	[3]
5 Place a spatula measure of solid X in a dry boiling tube and heat gently.	[2]	[1]

Give the name of compound X

_____ [2]

(b) You are provided with an organic liquid containing one functional group, labelled Y. Carry out the following tests and record your observations and deductions in the spaces below. The mass spectrum of Y is also provided.

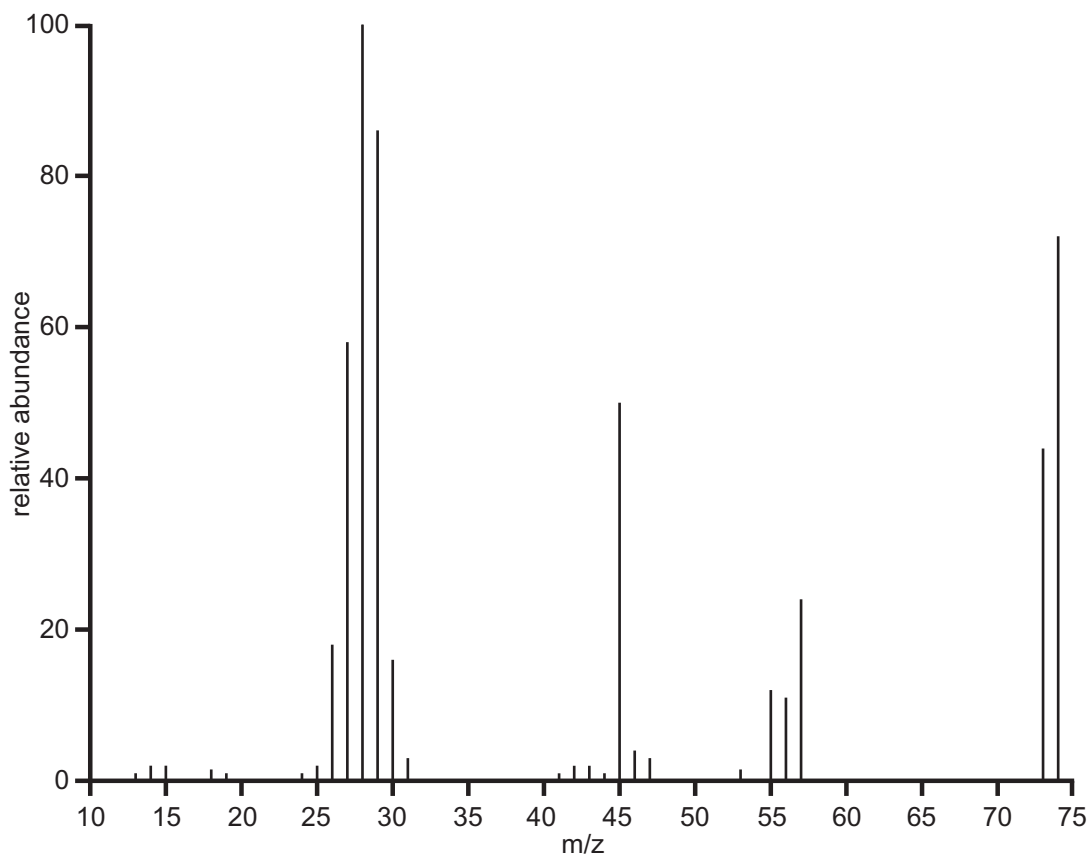
Test	Observations	Deductions
<p>1 Place 2 cm³ of Y into a boiling tube. Place in a test tube rack.</p> <p>(a) Under supervision, cautiously add a very small measure of phosphorus(V) chloride in a fume cupboard.</p> <p>(b) In a fume cupboard, hold the stopper of a bottle of concentrated ammonia solution over the boiling tube used in test 1(a).</p>	<p>[2]</p> <p>[1]</p>	<p>[1]</p> <p>[1]</p>
<p>2 Place 2 cm³ of Y into a test tube. Add 1 cm³ of sodium carbonate solution.</p>	<p>[1]</p>	<p>[1]</p>

(i) What homologous series does Y belong to?

_____ [1]

Test	Mark	Remark

Use the following mass spectrum to deduce the structure of Y.

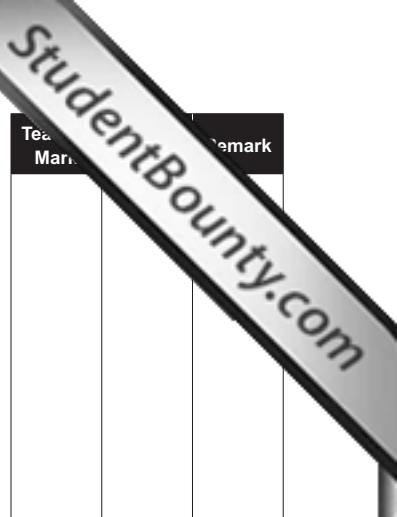


(ii) Draw the structure of Y below.

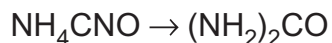
[1]

Maximum [25] marks

Tea	Mark	Remark



(c) The ammonium cyanate rearranges to form urea as shown in the equation below.



(i) The crude product is purified by dissolving in the minimum volume of hot ethanol, filtering to remove insoluble impurities, and cooling. What name is given to this purification process?

_____ [1]

(ii) What practical considerations determine the choice of solvent used?

_____ [2]

(iii) Why is the minimum amount of hot ethanol used?

_____ [1]

(iv) How is the pure dry product obtained from the filtrate?

_____ [2]

Quality of written communication will be assessed in parts (d) and (e).

(d) Giving practical details, describe how you would determine whether or not the crystals of urea produced are pure.

_____ [3]

Tea	Mark	Remark

- (e) How could you use the following infrared spectroscopic data to follow the progress of the rearrangement of ammonium cyanate to urea?

Bond	Wave number/cm ⁻¹
C = O	1650
C ≡ N	2100
N-H (in amines)	3200–3500

[3]

Quality of written communication

[2]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

ADVANCED
General Certificate of Education
2013

Chemistry

Assessment Unit A2 3

Internal Assessment

Practical Examinations 1 and 2

[AC231] [AC232]

WEDNESDAY 15 MAY AND THURSDAY 16 MAY



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.**

Apparatus and Materials List

Practical Examination 1

Each candidate must be supplied with safety goggles or glasses.

Question 1

Each candidate must be supplied with:

- one 50 cm³ burette of at least class B quality
- a funnel for filling the burette
- a retort stand and clamp
- two small beakers
- one 25 cm³ pipette of at least class B quality
- a safety pipette filler
- three conical flasks 250 cm³ capacity
- a white tile or white paper
- a wash bottle containing deionised/distilled water
- Eriochrome Black T indicator solution labelled **Eriochrome Black T, corrosive, use 4 drops**, made by adding 0.2 g of solid Eriochrome Black T to 30 cm³ of concentrated ammonia solution and 10 cm³ of ethanol. This should be made up the day before the examination and should stay in the fume cupboard with droppers available.
- 150 cm³ of 0.01 mol dm⁻³ edta solution labelled **edta solution 0.01 mol dm⁻³**, made by diluting an existing 0.1 M solution or by dissolving 18.6 g of the solid hydrated disodium salt of EDTA to 5 dm³ with deionised water. The formula of this salt is [CH₂N(CH₂COOH).CH₂COONa]₂.2H₂O and it has M_R = 372.
- 150 cm³ of approximately 0.01 mol dm⁻³ solution of Ca²⁺ labelled **hard water**, made by dissolving 10.0 g of CaCl₂.6H₂O in 5 dm³ of deionised water.
- pH 10 buffer solution 4 × 10 cm³ portions labelled **pH 10 buffer solution**.
- A conical flask containing 30 cm³ 0.01M edta, 30 cm³ deionised water, 4 drops of Eriochrome Black T indicator, labelled **end point colour reference** (made up on the morning of the practical examination).

Appropriate amounts should be prepared for the total number of candidates taking the examination.

Question 2

Each candidate must be supplied with:

- a small beaker
- four test tubes
- two boiling tubes
- a test tube holder
- a test tube rack
- a spatula
- a stirring rod
- a heat-proof mat
- a Bunsen burner
- several plastic droppers
- about 3.0 g of hydrated chromium(III) chloride ($\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$), labelled **X**.
- about 10 cm^3 of sodium hydroxide solution in a reagent bottle/beaker labelled **sodium hydroxide solution**. This solution should be approximately 2 mol dm^{-3} .
- about 10 cm^3 of silver nitrate solution in a reagent bottle/beaker labelled **silver nitrate solution**. This solution should be approximately 0.1 mol dm^{-3} (17.0 g dm^{-3}).
- about 10 cm^3 of ethanoic acid solution in a stoppered container labelled **Y**. This solution should be approximately 1 mol dm^{-3} .
- about 10 cm^3 of sodium carbonate solution labelled **sodium carbonate solution**. This solution should be approximately 1M.
- a reagent bottle containing concentrated ammonia solution labelled **concentrated ammonia solution** and **irritant** (placed in fume cupboard).
- access to phosphorus(V) chloride*, labelled **phosphorus(V) chloride** and **harmful**, and placed in fume cupboard with gloves provided.

***Safety note:** test 2(b) part 1(a) involving PCl_5 – the amount of PCl_5 used must be **very** small, it must remain in the fume cupboard away from water, and be in a vessel that is easy to open and is closed after use. Students should carry out test 2(b) part 1(a) under close supervision.

Appropriate amounts should be prepared for the total number of candidates taking the examination.

Practical Examination 2

Each candidate must be supplied with safety goggles or glasses.

Question 1

Each candidate must be supplied with:

- one 50 cm³ burette of at least class B quality
- a funnel for filling the burette
- a retort stand and clamp
- two small beakers
- one 25 cm³ pipette of at least class B quality
- a safety pipette filler
- three conical flasks of 250 cm³ capacity
- a white tile or white paper
- a wash bottle containing deionised/distilled water
- Eriochrome Black T indicator solution labelled **Eriochrome Black T, corrosive, use 4 drops**, made by adding 0.2 g of solid Eriochrome Black T to 30 cm³ of concentrated ammonia solution and 10 cm³ of ethanol. This should be made up the day before the examination and should stay in the fume cupboard with droppers available.
- 150 cm³ of 0.01 mol dm⁻³ edta solution labelled **edta solution 0.02 mol dm⁻³**, made by diluting an existing 0.1 M solution or by dissolving 18.6 g of the solid hydrated disodium salt of EDTA to 5 dm³ with deionised water. The formula of this salt is [CH₂N(CH₂COOH).CH₂COONa]₂.2H₂O and it has M_R = 372.
- 150 cm³ of approximately 0.01 mol dm⁻³ solution of Ca²⁺ labelled **hard water**, made by dissolving 10.0 g of CaCl₂.6H₂O in 5 dm³ of deionised water.
- pH 10 buffer solution 4 × 10 cm³ portions labelled **pH 10 buffer solution**.
- A conical flask containing 30 cm³ 0.01M edta, 30 cm³ deionised water, 4 drops of Eriochrome Black T indicator, labelled **end point colour reference** (made up on the morning of the practical examination).

Appropriate amounts should be prepared for the total number of candidates taking the examination.

Question 2

Each candidate must be supplied with:

- a small beaker
- four test tubes
- two boiling tubes
- a test tube holder
- a test tube rack
- a spatula
- a stirring rod
- a heat-proof mat
- a Bunsen burner
- several plastic droppers
- about 3.0 g of hydrated manganese chloride ($\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$), labelled **R**. (This should be freshly opened as it oxidises).
- about 10 cm^3 of sodium hydroxide solution in a reagent bottle/beaker labelled **sodium hydroxide solution**. This solution should be approximately 2 mol dm^{-3} .
- about 10 cm^3 of silver nitrate solution in a reagent bottle/beaker labelled **silver nitrate solution**. This solution should be approximately 0.1 mol dm^{-3} (17.0 g dm^{-3}).
- about 10 cm^3 of ethanoic acid solution in a stoppered container labelled **S**. This solution should be approximately 1 mol dm^{-3} .
- about 10 cm^3 of sodium carbonate solution labelled **sodium carbonate solution**. This solution should be approximately 1M.
- a reagent bottle containing concentrated ammonia solution labelled **concentrated ammonia solution** and **irritant** (placed in fume cupboard).
- access to phosphorus(V) chloride*, labelled **phosphorus(V) chloride** and **harmful**, and placed in fume cupboard with gloves provided.

***Safety note:** test 2(b) part 1(a) involving PCl_5 – the amount of PCl_5 used must be **very** small, it must remain in the fume cupboard away from water, and be in a vessel that is easy to open and is closed after use. Students should carry out test 2(b) part 1(a) under close supervision.

Appropriate amounts should be prepared for the total number of candidates taking the examination.



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Chemistry

Assessment Unit A2 3

Internal Assessment

Practical Examinations 1 and 2

[AC231] [AC232]

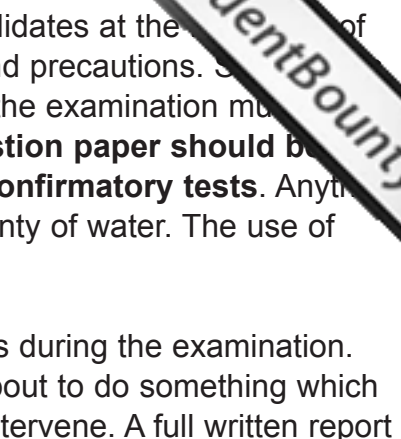
WEDNESDAY 15 AND THURSDAY 16 MAY

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 Friday 10 May 2013.** 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 10 May 2013.**
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 must be treated with caution. **Only those tests specified in the question paper should be attempted. Candidates must not attempt any additional confirmatory tests.** Anytime 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 1

Wednesday 15 May 2013

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

Northern Ireland Council for the Curriculum, Examinations and Assessment

General Certificate of Education

Advanced

Chemistry

Practical Examination 2

Thursday 16 May 2013

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

