Rewarding Learning

ADVANCED
General Certificate of Education
2019

Centre Number

Candidate Number

Chemistry

Assessment Unit A2 3
assessing
Further Practical Chemistry
Practical Booklet A

ACH31

[ACH31]
THURSDAY 9 MAY, MORNING

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all three** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 30.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Periodic Table of Elements (including some data) is provided.
You may not have access to notes, textbooks and other material to assist you.
Safety glasses must be worn at all times and care should be taken during the practical examination.

12289.06**R**

1 You are required to titrate standard sodium thiosulfate solution against the iodine liberated by the reaction of potassium iodate(V) with excess potassium iodide in solution.

You are provided with:

- a solution of potassium iodate(V)
- three 20 cm^3 portions of dilute sulfuric acid
- three 1.0 g portions of potassium iodide
- 0.10 mol dm^{-3} sodium thiosulfate solution
- starch indicator

You should:

Step 1. Fill the burette with the 0.10 mol dm^{-3} sodium thiosulfate solution
Step 2. Use the pipette to transfer 25.0 cm^3 of the potassium iodate(V) solution to a conical flask
Step 3. Add a portion of dilute sulfuric acid to the conical flask
Step 4. Add a portion of potassium iodide to the conical flask and swirl the flask
Step 5. Carry out the titration

(a) (i) Record your results in a table.

[3]

(ii) Use your results to calculate the mean titre.

_____

_____ [2]

(b) (i) Describe what you observed in the conical flask when you carried out Step 4.

_____

_____ [1]

(ii) Describe the **three** changes observed in the conical flask when you carried out Step 5.

_____

_____

_____

_____ [3]

(iii) Calculate the percentage uncertainty in your mean titre. Assume the burette has an uncertainty of $\pm$ 0.10 cm^3.

_____

_____ [2]

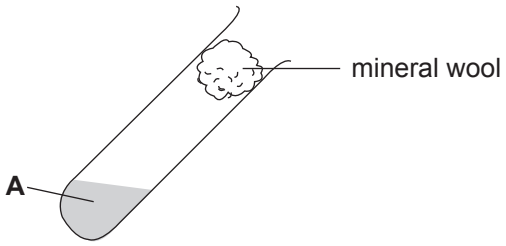
[Turn over

2 You are provided with a compound labelled **A**.

(a) Describe the appearance of **A**.

_____ [1]

(b) Weigh out approximately 10 g of **A** and record the mass to one decimal place. Transfer **A** to a boiling tube. Push a plug of mineral wool into the top of the boiling tube. Find the mass of the boiling tube and its contents and record it to one decimal place.



Mass of **A** _____

Mass of boiling tube and its contents _____ [1]

(c) **(i)** Heat **A** in the boiling tube until there is no further change in its appearance, stating **two** observations.

_____

_____ [2]

(ii) Allow the boiling tube to cool. Record the mass of the boiling tube and its contents to one decimal place and calculate the loss in mass.

_____

_____ [1]

(d) (i) Remove the plug of mineral wool from the boiling tube using tweezers. Add two spatula measures of its contents to 25 cm^3 of 2M sulfuric acid in a beaker. Heat the beaker and its contents on a tripod and gauze without boiling and stir gently until there is no further change. State **two** observations.

Keep the beaker and its contents for use in **(d) (ii)**.

_____

_____ [2]

(ii) Add two spatula measures of **A** to the contents of the beaker used in **(d) (i)**. State **two** observations.

_____

_____ [2]

(e) (i) Pour approximately 4 cm^3 of the solution, obtained in **(d) (ii)**, into a test tube. Add an equal volume of 2M sodium hydroxide solution. State **one** observation.

Keep the contents of the test tube for use in **(e) (ii)**.

_____

_____ [1]

(ii) Add 6 cm^3 of concentrated hydrochloric acid to the test tube. Stopper and shake the test tube. State **two** observations.

_____

_____ [2]

[Turn over

3 You are provided with cinnamic acid and propanone.

(a) Add approximately 12 cm^3 of ethanol to the sample of cinnamic acid in a boiling tube. Shake the boiling tube until the cinnamic acid dissolves. Pour half of the solution into a second boiling tube and keep it for use in **(a) (iii)**.

(i) Add one drop of the solution from the first boiling tube onto damp Universal Indicator paper and record the pH value.

_____ [1]

(ii) Into the first boiling tube, containing the solution of cinnamic acid in ethanol, add an equal volume of deionised water followed by approximately 6 cm^3 of bromine water. Stopper and shake the boiling tube. State **two** observations.

_____

_____ [2]

(iii) Into the second boiling tube, containing the solution of cinnamic acid in ethanol, add an equal volume of deionised water followed by a spatula measure of sodium hydrogencarbonate. State **two** observations.

_____

_____ [2]

(b) Place a watch glass on a heatproof mat and add several drops of propanone to the watch glass. Carefully touch the liquid with a lighted splint. Using a test tube holder, place the bottom half of an empty test tube in the flame. State **two** observations.

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
Total Marks	

Examiner Number

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General Certificate of Education
2019

Chemistry

Assessment Unit A2 3

assessing

Further Practical Chemistry
Practical Booklet A

[ACH31]

THURSDAY 9 MAY, MORNING

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.
- It is the responsibility of the centre to be cognisant of all health and safety issues and to carry out a thorough risk assessment. Up to date information can be obtained at www.cleapss.org.uk

Practical Examination

Each candidate must be supplied with safety goggles or glasses.

Question No. 1

Each candidate must be supplied with:

- a 50 cm^3 burette of at least B quality
- a funnel for filling the burette
- a retort stand and burette clamp
- access to beakers
- a 25 cm^3 pipette of at least class B quality
- a safety pipette filler
- 3 × 250 cm^3 conical flasks
- a white tile or white paper
- a wash bottle containing deionised water
- 150 cm^3 of 0.10 mol dm^{-3} sodium thiosulfate solution labelled **0.10 mol dm^{-3} sodium thiosulfate solution**.
- 150 cm^3 of potassium iodate(V) solution of concentration 3.36 g dm^{-3} labelled **potassium iodate(V) solution** and **oxidising**.
- 3 × 20 cm^3 portions of sulfuric acid solution labelled **Q1 dilute sulfuric acid** and **irritant**. This solution should be of approximate concentration 1 M.
  (Centres may choose to leave out a reagent bottle containing approximately 100 cm^3 of 1 M sulfuric acid labelled **dilute sulfuric acid** and **irritant** and a 25 cm^3 measuring cylinder and give candidates adequate instruction in this part.)
- 3 × 1 g portions of solid potassium iodide labelled **potassium iodide**.
- a dropper bottle containing starch solution labelled **starch indicator**.

Question No. 2

- Copper(II) carbonate (12 g) labelled **A** and **irritant**
- a plastic weighing boat or filter paper
- a small spatula, e.g. Nuffield Raised Centre Spatula (or similar size)
- 2 × boiling tubes
- 1 × test tube
- test tube/boiling tube rack
- 1 × stirring rod
- stopper to fit test tube
- dry mineral wool
- access to a balance reading to at least 1 d.p.
- test tube (boiling tube) holder
- tweezers
- bunsen burner
- tripod, gauze and heatproof mat
- 10 cm^3 measuring cylinder or access to plastic graduated dropping pipette
- 25 cm^3 measuring cylinder
- 100 cm^3 beaker
- 25–50 cm^3 of 2M sulfuric acid labelled **Q2 2M sulfuric acid** and **corrosive**
- 10 cm^3 of 2M sodium hydroxide labelled **Q2 2M sodium hydroxide** and **corrosive**
- 10 cm^3 of concentrated hydrochloric acid labelled as **Q2 concentrated hydrochloric acid** and **corrosive**. This should be stored and used in a fume cupboard with access to a 10 cm^3 measuring cylinder
- access to a lighter or matches

Question No. 3

- 0.6 g of cinnamic acid labelled **cinnamic acid** and **irritant**
- access to reagent bottle of ethanol labelled **ethanol** and **highly flammable**
- access to Universal Indicator paper (Johnston Test Papers pH 1 to pH 14)
- a small spatula, e.g. Nuffield Raised Centre Spatula (or similar size)
- 2 × boiling tubes
- test tube/boiling tube rack
- access to 0.2 M bromine water in a fume cupboard (yellow/orange in colour) labelled **bromine water**
- a 25 cm^3 measuring cylinder
- 2 × watch glasses
- access to plastic graduated dropping pipettes
- a wash bottle containing deionised water
- a wooden splint
- a test tube
- a test tube holder
- stopper to fit a boiling tube
- a heatproof mat
- 1 g of sodium hydrogencarbonate labelled **sodium hydrogencarbonate**
- approximately 5 cm^3 of propanone labelled **propanone** and **flammable**
- access to a lighter or matches

Rewarding Learning

ADVANCED
General Certificate of Education
2019

Chemistry

Assessment Unit A2 3

Practical Assessment

Practical Booklet A

[ACH31]

THURSDAY 9 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 Practical Booklet A on Friday 3 May 2019.** 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 Friday 3 May 2019.**

6. Centres may need to carry out multiple sessions to accommodate all their candidates sitting Practical Booklet A in a laboratory. Supervision must take place from 30 minutes after the scheduled starting time of the examination, as set out in the timetable, until the time when the candidate(s) begin(s) their examination(s). This is in order to ensure that there is no contact with other candidates. The centre must appoint a member of staff from the centre to supervise the candidate(s) at all times while he/she is on the premises.

7. All apparatus 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 is 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.**

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**. Anything 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.

14. All JCQ procedures for conducting examinations should be followed for this practical examination including displaying JCQ posters with examination information in the laboratory and removal of mobile phones. Posters should be available from your Examinations Officer.

Northern Ireland Council for the Curriculum, Examinations and Assessment

General Certificate of Education

Advanced

Chemistry

Practical Booklet A

[ACH31]

Thursday 9 May 2019

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 . . . . . .

General Information

1 tonne = 10^6 g
1 metre = 10^9 nm
One mole of any gas at 293 K and a pressure of 1 atmosphere (10^5 Pa) occupies a volume of 24 dm^3
Avogadro Constant = 6.02×10^{23} mol^{-1}
Planck Constant = 6.63×10^{-34} J s
Specific Heat Capacity of water = 4.2 J g^{-1} K^{-1}
Speed of Light = 3×10^8 m s^{-1}

Characteristic absorptions in IR spectroscopy

Wavenumber/cm^{-1}	Bond	Compound
550–850	C–X (X = Cl, Br, I)	Haloalkanes
750–1100	C–C	Alkanes, alkyl groups
1000–1300	C–O	Alcohols, esters, carboxylic acids
1450–1650	C=C	Arenes
1600–1700	C=C	Alkenes
1650–1800	C=O	Carboxylic acids, esters, aldehydes, ketones, amides, acyl chlorides
2200–2300	C≡N	Nitriles
2500–3200	O–H	Carboxylic acids
2750–2850	C–H	Aldehydes
2850–3000	C–H	Alkanes, alkyl groups, alkenes, arenes
3200–3600	O–H	Alcohols
3300–3500	N–H	Amines, amides

Proton Chemical Shifts in Nuclear Magnetic Resonance Spectroscopy (relative to TMS)

Chemical Shift	Structure	
0.5–2.0	–C**H**	Saturated alkanes
0.5–5.5	–O**H**	Alcohols
1.0–3.0	–N**H**	Amines
2.0–3.0	–CO–C**H**	Ketones
	–N–C**H**	Amines
	C_6H_5–C**H**	Arene (aliphatic on ring)
2.0–4.0	X–C**H**	X = Cl or Br (3.0–4.0)
		X = I (2.0–3.0)
4.5–6.0	–C=C**H**	Alkenes
5.5–8.5	RCON**H**	Amides
6.0–8.0	–C_6**H**$_5$	Arenes (on ring)
9.0–10.0	–C**H**O	Aldehydes
10.0–12.0	–COO**H**	Carboxylic acids

These chemical shifts are concentration and temperature dependent and may be outside the ranges indicated above.

COUNCIL FOR THE **CURRICULUM, EXAMINATIONS** AND **ASSESSMENT**
29 Clarendon Road, Clarendon Dock, Belfast BT1 3BG
Tel: +44 (0)28 9026 1200 Fax: +44 (0)28 9026 1234
Email: info@ccea.org.uk Web: www.ccea.org.uk

Rewarding Learning

New Specification

Rewarding Learning

Data Leaflet

Including the Periodic Table of the Elements

For the use of candidates taking
Advanced Subsidiary and
Advanced Level Examinations

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations

gce a/as examinations

chemistry

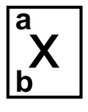
For first teaching from September 2016
For first award of AS Level in Summer 2017
For first award of A Level in Summer 2018
Subject Code: 1110

THE PERIODIC TABLE OF ELEMENTS

I	II											III	IV	V	VI	VII	0
Group																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H Hydrogen 1																	4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	98 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La* Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac† Actinium 89	261 Rf Rutherfordium 104	262 Db Dubnium 105	266 Sg Seaborgium 106	264 Bh Bohrium 107	277 Hs Hassium 108	268 Mt Meitnerium 109	271 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112						

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	145 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	242 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	245 Bk Berkelium 97	251 Cf Californium 98	254 Es Einsteinium 99	253 Fm Fermium 100	256 Md Mendelevium 101	254 No Nobelium 102	257 Lr Lawrencium 103

* 58 – 71 Lanthanum series
† 90 – 103 Actinium series



a = relative atomic mass (approx)
x = atomic symbol
b = atomic number