



Rewarding Learning

ADVANCED
General Certificate of Education
2018

Centre Number

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Candidate Number

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Chemistry

Assessment Unit A2 3

assessing

Module 3: Practical Examination

Practical Booklet A



[AC233]

AC233

THURSDAY 10 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 **both** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 20.

Question 1 is a practical exercise worth 8 marks.

Question 2 is a practical exercise worth 12 marks.

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.





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1 Titration

You are required to carry out an iodine-thiosulfate titration.

You are provided with:

- a solution of potassium iodate(V)
- four 20 cm³ portions of dilute sulfuric acid
- four 1 g portions of potassium iodide
- 0.1 mol dm⁻³ sodium thiosulfate solution
- starch solution

Carry out the titration by:

- Pipetting 25.0 cm³ of the potassium iodate(V) solution into a conical flask.
- Adding 20 cm³ of dilute sulfuric acid to the conical flask.
- Adding 1 portion of potassium iodide to the conical flask and swirling the flask to ensure it dissolves.
- Titrating, using the 0.1 mol dm⁻³ sodium thiosulfate solution, until the solution is straw-coloured.
- Adding starch solution to the conical flask and titrating until the solution changes from blue-black to colourless.

Present your results in a table and calculate the average titre.

[8]

[Turn over

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2 Observation exercise

(a) You are provided with a solid, labelled **A**. Carry out the following tests on **A** and record your observations in the table below.

Test	Observations
<p>1 Describe the appearance of A.</p>	[1]
<p>2 Dissolve 2 spatula measures of A in 20 cm³ of deionised water in a beaker. Stir.</p> <p>Keep this solution for use in further tests.</p>	[1]
<p>3 Place 3 cm³ of the solution from test 2 in a test tube and add 3 cm³ of barium chloride solution.</p>	[1]
<p>4 Place 3 cm³ of the solution from test 2 in a test tube and add 5 drops of sodium hydroxide solution. Stopper and shake.</p> <p>Add a further 5 cm³ of sodium hydroxide solution to the test tube.</p>	[3]
<p>5 Place 3 cm³ of the solution from test 2 in a test tube and, in a fume cupboard, add 5 cm³ of concentrated hydrochloric acid.</p> <p>Place 3 cm³ of this solution in another test tube and add 5 cm³ of edta solution. Stopper and shake.</p>	[2]
<p>6 In a fume cupboard, place 2 cm³ of the solution from test 2 in a test tube and add 3 drops of concentrated ammonia solution.</p> <p>Add a further 5 cm³ of concentrated ammonia solution to the test tube.</p>	[2]

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(b) You are provided with a liquid, labelled **B**. Carry out the following test on **B** and record your observations in the table below.

Test	Observations
Mix 1 cm ³ of Fehling's No.1 solution with an equal volume of Fehling's No.2 solution in a test tube. Add 1 cm ³ of B and place the test tube in a hot water bath for at least five minutes.	[2]

THIS IS THE END OF THE QUESTION PAPER





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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:

- one 50 cm³ burette of at least class B quality;
- a funnel for filling the burette;
- a retort stand and burette clamp;
- two 250 cm³ beakers;
- one 25 cm³ pipette of at least class B quality;
- a safety pipette filler;
- three 250 cm³ conical flasks;
- a white tile or white paper;
- a wash bottle containing deionised water;
- 150 cm³ of 0.1 mol dm⁻³ sodium thiosulfate solution labelled **0.1 mol dm⁻³ sodium thiosulfate solution**;
- 150 cm³ of potassium iodate(V) solution of concentration 2.88 g/dm³ labelled **potassium iodate(V) solution** and **oxidising**;
- 4 × 20 cm³ portions of sulfuric acid solution labelled **dilute sulfuric acid** and **irritant**. This solution should be of approximate concentration 1 mol dm⁻³ ;
(Centres may choose to leave out a reagent bottle containing approximately 50 cm³ of 1 mol dm⁻³ sulfuric acid labelled dilute sulfuric acid and irritant and a 25 cm³ measuring cylinder and give candidates adequate instruction in this part.)
- 4 × 1 g portions (approximately) of solid potassium iodide labelled **potassium iodide**;
- A dropper bottle containing starch solution labelled **starch solution**.

Question No. 2

Each candidate must be supplied with:

- 6 test tubes (18 × 150 or 18 × 125 mm preferred)
- two stoppers to fit test tubes (Size 15 fits 18 × 150 or 125)
- a 100 cm³ beaker
- a suitable test tube rack
- a glass stirring rod
- a spatula
- a minimum of 8 disposable pipettes/droppers
- a wash bottle of deionised water
- 3 g of hydrated cobalt(II) sulfate, CoSO₄·7H₂O, in a stoppered sample bottle labelled **A**
- about 10 cm³ of barium chloride solution in a reagent bottle/beaker labelled **barium chloride solution**. This solution should be approximately 0.1 mol dm⁻³ (20.8 g dm⁻³ for BaCl₂ or 24.4 g dm⁻³ for BaCl₂·2H₂O).
- about 20 cm³ of sodium hydroxide solution in a stoppered reagent bottle labelled **sodium hydroxide solution** and **irritant**. This solution should be approximately 0.5 mol dm⁻³.
- about 20 cm³ of concentrated hydrochloric acid in a reagent bottle. This should be labelled **concentrated hydrochloric acid** and **corrosive**.
- about 10 cm³ of edta solution in a reagent bottle/beaker labelled **edta solution**. This solution should be approximately 0.1 mol dm⁻³ (38 g dm⁻³ for tetrasodium edta).
- about 20 cm³ of concentrated ammonia solution in a stoppered reagent bottle labelled **concentrated ammonia solution** and **corrosive**. This should be placed in a fume cupboard.
- about 5 cm³ of propanal in a stoppered container labelled **B** and **flammable**;
- access to Fehling's solutions No. 1 and No. 2; (approx. 1 cm³ of each per candidate)
- access to a kettle.

25 Risk Assessment Guidance

Cobalt and its compounds

Cobalt(II) nitrate(V)-6-water		Co(NO ₃) ₂ ·6H ₂ O (291.03)
Cobalt(II) chloride-6-water	<i>hydrated cobalt chloride</i>	CoCl ₂ ·6H ₂ O (237.93)
Cobalt(II) sulfate(VI)-7-water	<i>hydrated cobalt sulfate</i>	CoSO ₄ ·7H ₂ O (281.10)
Cobalt(II) carbonate		CoCO ₃ (118.94)
  nitrate	<p>Cobalt(II) nitrate(V)-6-water: May intensify fire; oxidiser [H272]</p> <p>Cobalt(II) chloride-6-water and cobalt(II) sulfate(VI)-7-water: Harmful if swallowed [H302].</p> <p>All: May cause an allergic skin reaction [H317]. May cause allergy or asthma symptoms or breathing difficulties if inhaled [H334]. Suspected of causing genetic defects [H341]. May cause cancer by inhalation [H350ij]. May damage fertility [H360F]. Very toxic to aquatic life with long lasting effects [H400/410].</p>	
 chloride, sulfate	<p>WEL (mg m⁻³): 0.1 (LTEL), 0.3 (STEL), Carc, Sen; as cobalt</p>	
DANGER		
Storage	Storage code: Ox (nitrate) Storage code: T (others)	[Pink-red solids]
Cobalt metal		Co (58.93)
 DANGER	<p>May cause an allergic skin reaction [H317]. May cause allergy or asthma symptoms or breathing difficulties if inhaled [H334]. May cause long lasting harmful effects to aquatic life [H413].</p> <p>WEL (mg m⁻³): 0.1 (LTEL), 0.3 (STEL), Sen; as cobalt</p> <p>Those who have a known sensitisation to metals should avoid skin contact (i.e. do not handle).</p>	
Storage	Storage code: GIn	[Grey solid]
Emergencies	Follow standard procedures (see <i>Emergency Hazcards and GL 120</i>).	

Read this *Hazardcard* in conjunction with *About Hazardcards (guide GL 120)*

Hazardcards 2016 Edition ©CLEAPSS (Updated: 09/16)

25 Risk Assessment Guidance

Cobalt and its compounds

Detailed guidance on specific activities and techniques involving these substances can be found at: www.cleapss.org.uk

General use of:	Hazard information	User	Suggested general control measures and guidance
Solids: Cobalt metal Cobalt (II) compounds	See reverse		Inhalation of cobalt(II) compounds is a remote possibility if significant amounts of dust become airborne. Use correct transfer techniques for solids and liquids. Do not allow small volumes of solution to dry out on glassware/lab surfaces; wipe up immediately with a damp cloth/paper towel.
Cobalt(II) solutions ≥ 0.2 M	 DANGER Sensitiser (skin), ≥ 0.2 M Sensitiser (respiratory), ≥ 0.2 M Serious health hazard (CMR)	TT (Y9)	<ul style="list-style-type: none"> Wear eye protection. Avoid raising dust. Take particular care to avoid skin contact. See activity-specific guidance and/or GL 120.
Cobalt(II) solutions < 0.2 M and ≥ 0.0015 M			Other notes; see also detailed activity-specific guidance: <ul style="list-style-type: none"> Weighing solids: Weigh on a balance placed in a fume cupboard that is not switched on. Have sash partially pulled down. Wipe down the work area with a damp paper towel. Preparing cobalt(II) solutions (TT): Recipe 30. Preparing cobalt(II) chloride papers: Recipe 30. Avoid skin contact. Use tweezers or forceps to handle prepared papers.
Cobalt(II) solutions < 0.0015 M	Currently not classified as hazardous.	Y7	
Disposal	Follow general guidance in About Hazcards (GL 120).		Disposal: W1, W2 (insoluble solids) W7 → 0.001 M (soluble salts)

Read this **Hazard** in conjunction with **About Hazcards (guide GL 120)**

Hazcards 2016 Edition ©CLEAPSS (Updated: 09/16)

Periodic Table of the Elements

For the use of candidates taking
Advanced Subsidiary and Advanced Level
Chemistry 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
(advanced)

I		II		THE PERIODIC TABLE OF ELEMENTS Group												III	IV	V	VI	VII	0
1 H Hydrogen 1	One mole of any gas at 20°C and a pressure of 1 atmosphere (10 ⁵ Pa) occupies a volume of 24 dm ³ . Planck Constant = 6.63 × 10 ⁻³⁴ Js Gas Constant = 8.31 J mol ⁻¹ K ⁻¹ Avogadro Constant = 6.02 × 10 ²³ mol ⁻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	99 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																			

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

$\begin{matrix} a \\ b \end{matrix} x$ a = relative atomic mass (approx.)
x = atomic symbol
b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 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