

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	
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Pearson Edexcel International Advanced Level

Thursday 21 May 2026

Morning (Time: 1 hour 20 minutes)

Paper reference **WCH13/01**

Chemistry

International Advanced Subsidiary/Advanced Level

UNIT 3: Practical Skills in Chemistry I

You must have:
Scientific calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- A Periodic Table is printed on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Show all your working in calculations and include units where appropriate.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL the questions. Write your answers in the spaces provided.

1 This question is about different tests used to identify compounds.

- (a) A flame test was used to distinguish between solid samples of lithium sulfate and potassium sulfate.

Explain how the flame test is carried out.
Include the flame colour for each compound.

(5)

Flame test

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Flame colour of lithium sulfate

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Flame colour of potassium sulfate

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- (b) Concentrated sulfuric acid was used to distinguish between solid samples of sodium bromide and sodium iodide.

In the test, a few drops of concentrated sulfuric acid were added to samples of solid sodium bromide and sodium iodide in separate test tubes.

- (i) Give an observation that distinguishes each compound.
Include the identity of one of the gases produced in each case.

(4)

Observation to identify sodium bromide

Name or formula of one gas produced

Observation to identify sodium iodide

Name or formula of one gas produced

- (ii) State why the tests in (b) are carried out in a fume cupboard.

(1)



(c) Two tests were used to identify the ions present in an aqueous solution of ammonium sulfate.

(i) State the reagents, conditions and positive result for the ammonium ion test.

(2)

(ii) State the reagents and positive result for the sulfate ion test.

(2)

(iii) Give the **ionic** equation for the sulfate ion test in (c)(ii).

(1)

(Total for Question 1 = 15 marks)



- 2 A liquid organic compound **X** contains two functional groups.
Tests are carried out to identify **X**.

(a) Test 1 A small amount of phosphorus(V) chloride, PCl_5 , is added to 2 cm^3 of **X**.

Observation
misty fumes given off

Test 2 Aqueous sodium hydrogencarbonate, $\text{NaHCO}_3(\text{aq})$, is added to 2 cm^3 of **X**.

Observation
no visible reaction

Name the functional group identified by these tests.

(1)

- (b) Test 3 A few drops of **X** are added to 2 cm^3 of Benedict's solution.
The mixture is placed in a warm water bath.
The test gives a positive result.

(i) Complete the table by giving the expected observations for the positive result produced by compound **X**.

(2)

Observations	
Initial appearance	Final appearance

(ii) Identify, by name or formula, the functional group identified by this test.

(1)

(c) The mass spectrum of compound **X** has a molecular ion peak, $m/z = 74$.

(i) Draw the **two** possible structural isomers of **X**.

Use the information about **X** and your answers to (a) and (b).

(2)

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(ii) Suggest how the mass spectrum fragmentation patterns of **X** could be used to identify which isomer is present.

In your answer refer to the structure and m/z values of any relevant fragments.

(2)

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(Total for Question 2 = 8 marks)



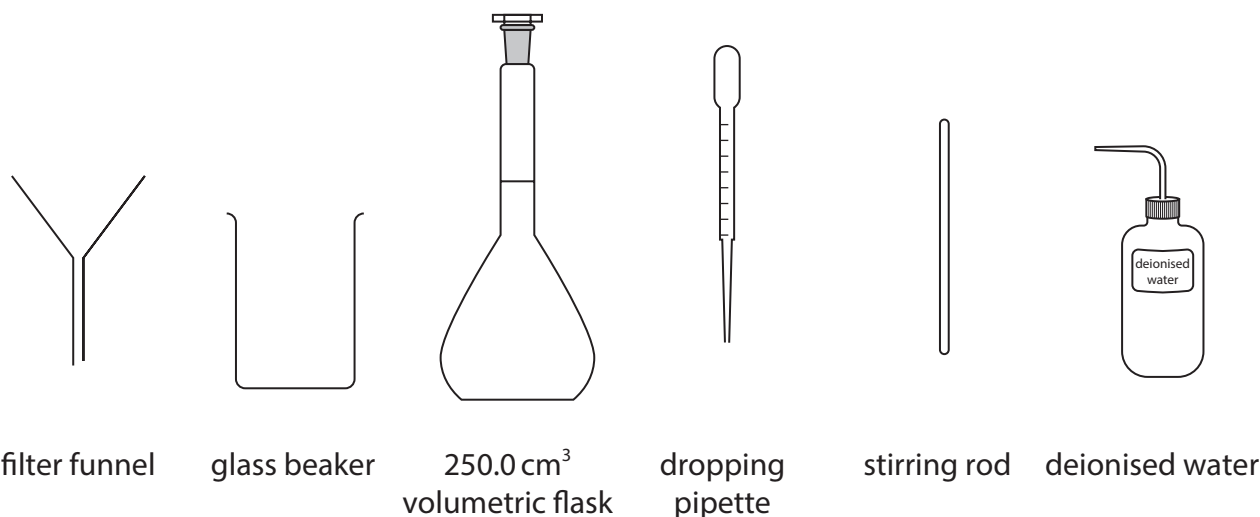
- 3 An experiment was carried out by a group of students to determine the value of n in the formula of hydrated sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O}$.

Procedure

- Step 1 Make up 250.0 cm^3 of a standard solution using a known mass of $\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O}$.
- Step 2 Pipette 25.00 cm^3 of this solution into a conical flask. Add a few drops of methyl orange indicator.
- Step 3 Fill a burette with hydrochloric acid, of concentration $0.100 \text{ mol dm}^{-3}$. Titrate the hydrochloric acid against the sodium carbonate solution.
- Step 4 Repeat Steps 2 and 3 until concordant results are recorded.

- (a) Describe how you would make up the standard solution in Step 1.
You are supplied with a mass of 3.15 g of hydrated sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O}$, in a weighing boat and the apparatus shown (not to scale).

(4)



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(b) (i) One student's results are shown.

Titration number	1	2	3
Final burette reading / cm ³	22.45	44.40	22.05
Initial burette reading / cm ³	0.00	22.45	0.00
Titre / cm ³			

Complete the table **and**, using appropriate values, calculate the mean titre.

(1)

(ii) Calculate the number of moles of hydrochloric acid in this mean titre.

(1)

(iii) The reaction taking place in this titration is shown.



Calculate the number of moles of sodium carbonate present in 25.00 cm³ of the solution.

Use the equation shown and your answer to (b)(ii).

(1)

(iv) Calculate the number of moles of sodium carbonate present in 250.0 cm³ of the solution.

(1)



- (v) Calculate the molar mass of the hydrated sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O}$,
and therefore the value of n .

(3)

Value of n =

- (c) Devise an alternative experiment involving heating crystals of hydrated sodium carbonate that could be used to calculate the value of n in $\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O}$. List the essential steps in the procedure, including the measurements you would take.

You are **not** required to explain how the data is used to calculate n .

(3)

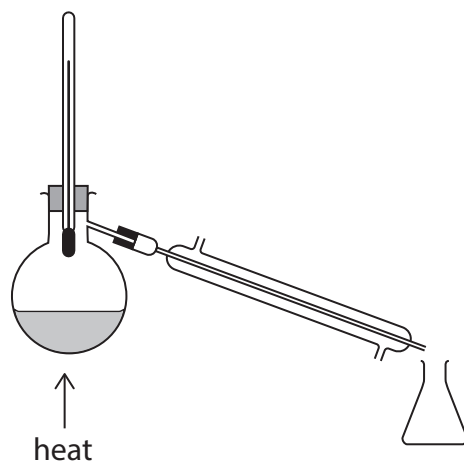
(Total for Question 3 = 14 marks)



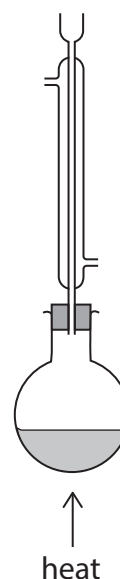
4 This question is about practical techniques used in organic reactions.

- (a) Give the names of the practical techniques represented by Apparatus **A** and Apparatus **B**.

(1)



Apparatus **A**



Apparatus **B**

Apparatus **A**

Apparatus **B**

- (b) Butanal can be prepared by reacting butan-1-ol with a suitable oxidising mixture and heating with anti-bumping granules in Apparatus **A**.

- (i) Name a suitable oxidising mixture for this reaction and include the colour change observed.

(2)

Oxidising mixture

Colour change

(ii) Explain why Apparatus **B** is **not** suitable for this oxidation reaction.

(2)

- (c) 1-bromopropane can be prepared by reacting propan-1-ol with a mixture of sodium bromide and 50% concentrated sulfuric acid and heating the mixture in Apparatus **B** for 45 minutes.



Describe what happens in Apparatus **B** when the mixture is heated.

(2)

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- (d) After heating for 45 minutes, the mixture is allowed to cool and then some deionised water is added. The contents of the round-bottomed flask are then transferred to Apparatus **A** and heated.
The resulting mixture collects in the conical flask and consists of two layers. One is an aqueous layer and the other contains the impure 1-bromopropane.

Draw a fully labelled diagram of the apparatus that would be used to separate the impure 1-bromopropane from the aqueous layer.

The density of 1-bromopropane is 1.35 g cm^{-3} and the density of the aqueous solution is approximately 1.0 g cm^{-3} .

(3)

- (e) In an experiment, 10.0 cm^3 of propan-1-ol was used and, after purifying the liquid, 7.98 g of 1-bromopropane was collected.

[Data: M_r values propan-1-ol = 60.0, 1-bromopropane = 122.9
Density of propan-1-ol = 0.80 g cm^{-3}]

Calculate the percentage yield of 1-bromopropane in this experiment.

(3)

(Total for Question 4 = 13 marks)

TOTAL FOR PAPER = 50 MARKS



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The Periodic Table of Elements

1	2	3	4	5	6	7	0 (8)
6.9 Li lithium 3	9.0 Be beryllium 4	10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	65.4 Zn zinc 30	63.5 Cu copper 29	58.7 Ni nickel 28	58.9 Co cobalt 27	58.7 Fe iron 26	55.8 Mn manganese 25
85.5 Rb rubidium 37	87.6 Sr strontium 38	112.4 Cd cadmium 48	107.9 Ag silver 47	106.4 Pd palladium 46	102.9 Rh rhodium 45	101.1 Ru ruthenium 44	101.1 Tc technetium 43
132.9 Cs caesium 55	137.3 Ba barium 56	200.6 Hg mercury 80	197.0 Au gold 79	195.1 Pt platinum 78	192.2 Ir iridium 77	190.2 Os osmium 76	186.2 Re rhenium 75
[223] Fr francium 87	[226] Ra radium 88	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	209.0 Po polonium 84	210 At astatine 85	[222] Rn radon 86

Elements with atomic numbers 112-116 have been reported but not fully authenticated

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	163 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

* Lanthanide series

* Actinide series

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

1.0
H
hydrogen
1

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