Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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 ▶

P 7 9 2 2 0 A 0 1 1 6

Pearson

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

Flame colour of lithium sulfate

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

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Name or formula of one gas produced

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Observation to identify sodium iodide

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Name or formula of one gas produced

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

(1)

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(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)

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

(2)

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

(1)

(Total for Question 1 = 15 marks)

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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, $NaHCO_3(aq)$, is added to 2 cm^3 of **X**.

Observation
no visible reaction

Name the functional group identified by these tests.

(1)

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(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)

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(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)

(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)

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3 An experiment was carried out by a group of students to determine the value of n in the formula of hydrated sodium carbonate, $Na_2CO_3 \cdot nH_2O$.

Procedure

Step **1** Make up 250.0 cm^3 of a standard solution using a known mass of $Na_2CO_3 \cdot nH_2O$.

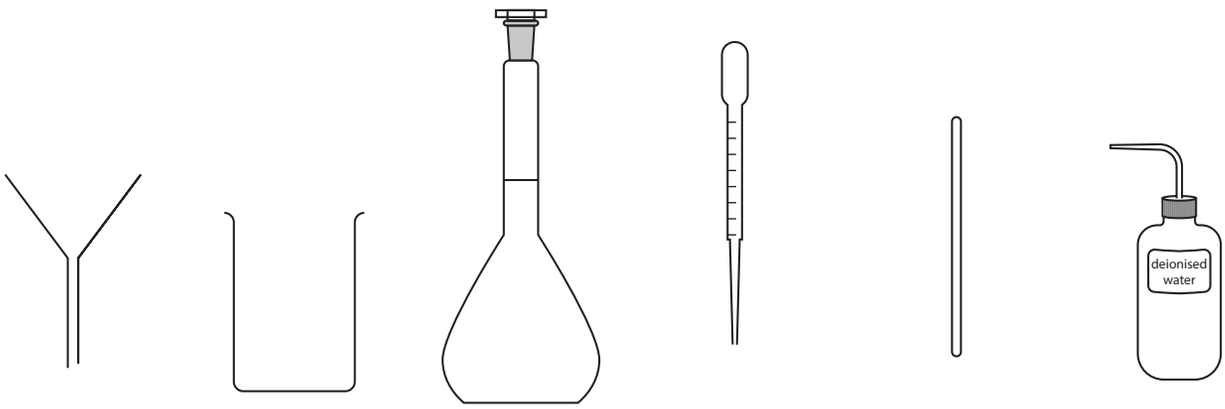
Step **2** Pipette 25.00 cm^3 of this solution into a conical flask.
Add a few drops of methyl orange indicator.

Step **3** Fill a burette with hydrochloric acid, of concentration 0.100 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, $Na_2CO_3 \cdot nH_2O$, in a weighing boat and the apparatus shown (not to scale).

(4)



filter funnel | glass beaker | 250.0 cm^3 volumetric flask | dropping pipette | stirring rod | deionised water

(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.

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

Calculate the number of moles of sodium carbonate present in 25.00 cm^3 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 cm^3 of the solution.

(1)

(v) Calculate the molar mass of the hydrated sodium carbonate, $Na_2CO_3 \cdot nH_2O$, **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 $Na_2CO_3 \cdot nH_2O$. 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)

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(Total for Question 3 = 14 marks)

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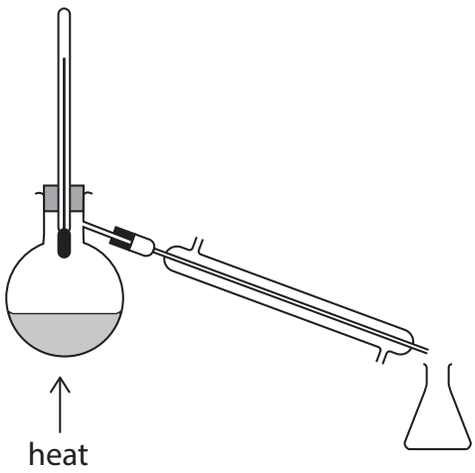
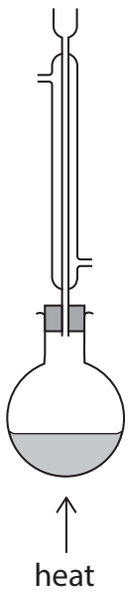
4 This question is about practical techniques used in organic reactions.

(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)

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(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.

$$CH_3CH_2CH_2OH + NaBr + H_2SO_4 \rightarrow CH_3CH_2CH_2Br + NaHSO_4 + H_2O$$

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) (18)
							1.0 H hydrogen 1										4.0 He helium 2
(1)	(2)		Key									(13)	(14)	(15)	(16)	(17)	
6.9 Li lithium 3	9.0 Be beryllium 4		relative atomic mass atomic symbol name atomic (proton) number									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	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(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	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	95.9 Mo molybdenum 42	[98] Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	138.9 La* lanthanum 57	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	[209] 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							

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

* Lanthanide series	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
* Actinide series	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