Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Tuesday 20 January 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 A student investigated a sample of a mixture containing a Group 2 metal chloride and a different halide of the same Group 2 metal.

(a) The Group 2 metal cation was identified using a flame test.

(i) Describe how a flame test is carried out.

(3)

(ii) In this test, a yellow-red flame colour was seen.

Identify the Group 2 **cation** present in the mixture.

(1)

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(b) The student identified the unknown halide using tests on an aqueous solution of the mixture of the Group 2 metal halides.
A 5 cm^3 portion of this solution was added to a test tube.
The tests on the solution and the student's observations are shown.

(i) Complete the table with the expected inferences that the student made.

(2)

Test	Observation	Inference
5 cm^3 of aqueous chlorine was added to the test tube	The colour of the **solution** in the test tube changed from colourless to yellow	....
3 cm^3 of hexane was added to the yellow **solution** in the test tube The solution was shaken and left to stand for 1 minute	The upper layer of the two layers formed was purple	....

(ii) Deduce the **formula** of the unknown Group 2 metal halide in the mixture.

(1)

.....

(c) The student carried out an experiment to determine the percentage by mass of the Group 2 chloride in the mixture.

Procedure

Step **1** Dissolve 10.5 g of the mixture in distilled water to form a solution.

Step **2** To this solution, add two reagents in excess to give silver halide precipitates.

Step **3** Add excess dilute aqueous ammonia to the precipitates.

Step **4** Filter, wash, dry and weigh the remaining precipitate.

The mass of the dried precipitate was 1.78 g.

(i) Identify, by name or formula, the **two** reagents added in Step **2**.

(2)

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(ii) Explain the change in the appearance of the precipitates when excess dilute aqueous ammonia is added in Step **3**.

(2)

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(iii) Calculate the percentage by mass of the Group 2 chloride in the mixture.
Use information from the procedure and your answer in (b)(ii).

(4)

(Total for Question 1 = 15 marks)

2 Two students carried out different experiments to determine the concentration of an aqueous solution of sodium hydroxide.

(a) Student **1** used a thermochemical procedure.

Procedure 1

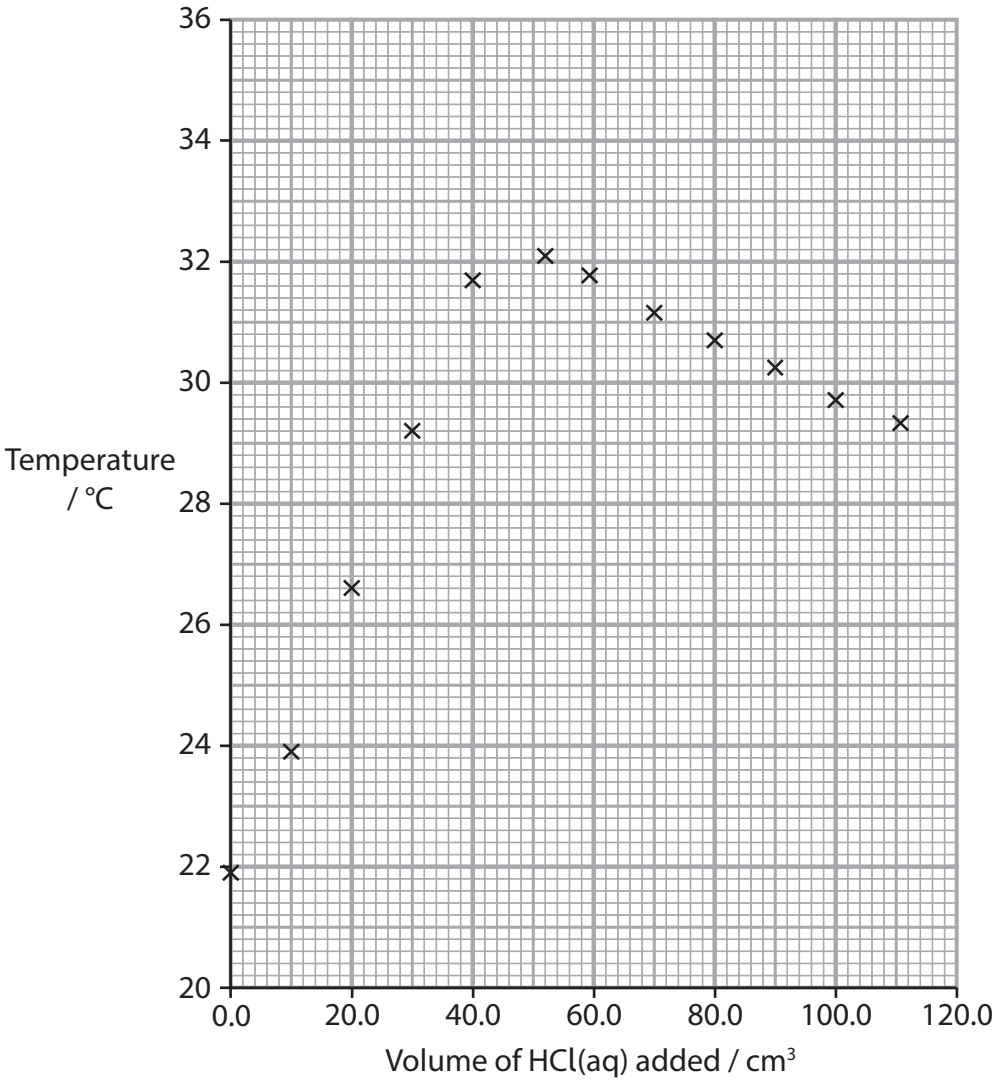
Step **1** Use a measuring cylinder to transfer 50 cm^3 of the sodium hydroxide solution into a polystyrene cup.
Record the temperature of the solution.

Step **2** Add 10.0 cm^3 portions of 2.50 $mol\,dm^{-3}$ hydrochloric acid to the polystyrene cup at regular intervals.
After each addition, stir and record the temperature of the mixture.

Student **1** plotted the points as shown.

(i) Draw **two** best-fit lines and extrapolate them to determine the volume of hydrochloric acid added at the maximum temperature.

(2)



Volume of hydrochloric acid added at the maximum temperature ..... cm^3

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(ii) Calculate the concentration, in **mol dm^{-3}**, of the sodium hydroxide solution using Student **1**'s results.

(2)

(b) Student **2** used a titration procedure. The sodium hydroxide solution was diluted, then titrated with dilute hydrochloric acid to determine the concentration of the sodium hydroxide solution.

Procedure 2

Step **1** Pipette a 25.0 cm^3 portion of the sodium hydroxide solution to a 250.0 cm^3 volumetric flask to make a diluted solution.
Make up to the mark with distilled water, stopper the flask and invert to mix.

Step **2** Use a volumetric pipette to transfer a 25.0 cm^3 portion of the **diluted** sodium hydroxide solution into a conical flask.

Step **3** Titrate this portion with a hydrochloric acid solution of concentration 0.223 $mol\,dm^{-3}$.

Step **4** Repeat Steps **2** and **3** until concordant titres are obtained.

The burette mean titre was 27.15 cm^3.

(i) State the effect on the titre value obtained of rinsing with distilled water the pieces of apparatus used in Steps **2** and **3**.
Justify your answer in each case.

(3)

Volumetric pipette

Conical flask

Burette

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(ii) Calculate the concentration, in **mol dm^{-3}**, of the **original** sodium hydroxide solution using Student **2**'s results.

(3)

(c) The uncertainties of some apparatus used by Student **2** are shown.

Apparatus	Uncertainty
Volumetric flask	± 0.15 cm^3
Volumetric pipette	± 0.04 cm^3

Deduce by calculation which of these pieces of apparatus is the more accurate.

(2)

(Total for Question 2 = 12 marks)

3 This question is about the oxidation of alcohols.

(a) Propan-1-ol can be oxidised to propanoic acid in the laboratory.

(i) Write the equation for the oxidation of propan-1-ol to propanoic acid.
Use the symbol [O] to represent oxygen atom(s) from the oxidising agent.
State symbols are not required.

(1)

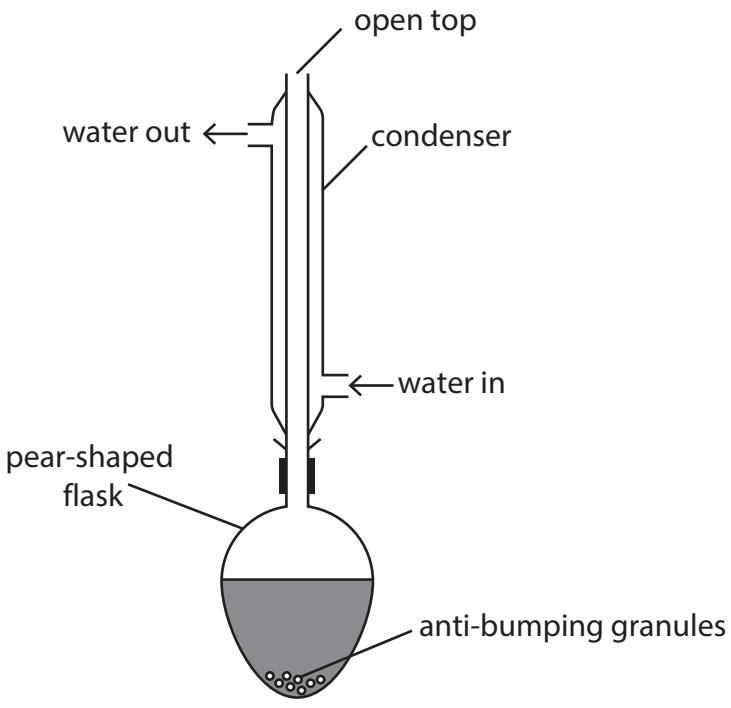
(ii) State, using name or formula, the **two** reagents in the oxidising agent.

(2)

.....

.....

(b) The reflux apparatus for this oxidation is shown.



The oxidising agent is placed in the pear-shaped flask in an ice-water bath.

1 cm^3 of propan-1-ol is added, a few drops at a time, down the condenser, allowing a short time between each addition.

(i) Give the reason why the reaction mixture is cooled.

(1)

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.....

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(ii) State the reason for the direction of the water flow in the condenser.

(1)

.....

.....

(c) When the addition of the alcohol is complete, the ice-water bath is removed.
The apparatus is allowed to warm to room temperature.
Anti-bumping granules are added to the pear-shaped flask.
A water bath is placed around the flask and is heated to 100°C for 20 minutes.

(i) Give the reason for adding anti-bumping granules to the pear-shaped flask.

(1)

.....

.....

(ii) State why a water bath, rather than a Bunsen burner, is used for heating the pear-shaped flask.

(1)

.....

.....

(iii) Describe how the reflux apparatus makes sure that any propanal produced is oxidised to propanoic acid.

(2)

.....

.....

.....

.....

(d) After 20 minutes the apparatus is allowed to cool. The apparatus is rearranged to allow for the distillation and collection of propanoic acid.

Give the reasons for the changes described in the table.

[Data: Boiling temperature of propanoic acid = 141°C]

(3)

Change to apparatus	Reason for change
A thermometer and still head are added at the top of the pear-shaped flask	
The position of the condenser is changed from vertical to sloping and then joined to the still head	
The water bath is replaced by an oil bath	

(e) Give a test and the positive result that could be used to show that the distillate contained an acid.
Do not suggest a pH indicator.

(2)

Test

.....

.....

Positive result

.....

.....

(Total for Question 3 = 14 marks)

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4 Hydrocarbon gases are used in portable heaters and cookers.

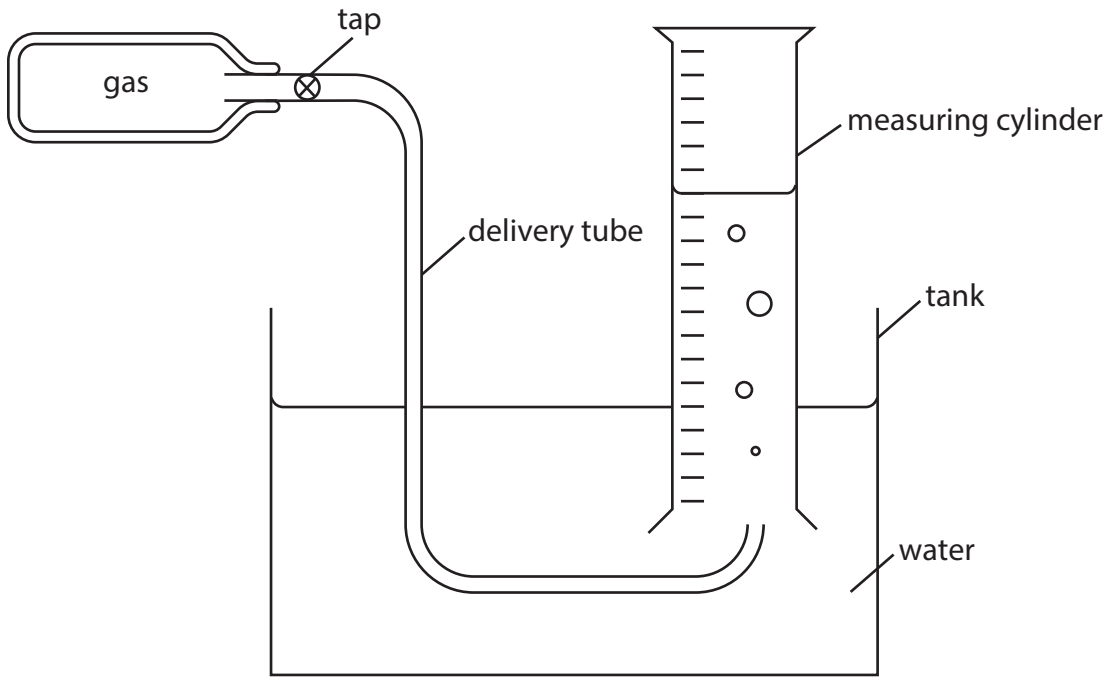
(a) A cylinder of gas is labelled with two hazard symbols.

Complete the table to show what is meant by each symbol.

(2)

(b) The apparatus shown is used in an experiment to determine the relative molecular mass, M_r, of a sample of a hydrocarbon gas.



Procedure

Step **1** Weigh the gas canister and connect it to the delivery tube.
Allow 750 cm^3 of gas into the measuring cylinder, making sure that the water levels inside and outside the cylinder are the same.

Step **2** Disconnect the delivery tube from the gas canister, dry the outside of the canister and reweigh.

The decrease in mass of the canister was 1.81g.

(i) Calculate the M_r of the hydrocarbon gas.

[Data: Molar volume of a gas at room temperature and pressure = 24 dm^3]

(2)

(ii) Suggest the **skeletal formula** of the hydrocarbon gas.

(1)

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(iii) Suggest why it is important that the water levels inside and outside the measuring cylinder should be the same when the 750 cm^3 of gas has been added in Step **1**.

(1)

.....

.....

(c) Water may condense on the outside of the gas canister during the experiment.

Explain the effect on the calculated value of M_r if the canister is not dried in Step **2**.

(2)

.....

.....

.....

.....

(d) Give the **most important** reason why this experiment would **not** be suitable for determining the M_r of carbon dioxide gas.

(1)

.....

.....

(Total for Question 4 = 9 marks)

TOTAL FOR PAPER = 50 MARKS

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

* Actinide 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
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

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