

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Friday 31 October 2025

Afternoon (Time: 1 hour 20 minutes)

Paper reference **WCH16/01**

Chemistry

International Advanced Level

UNIT 6: Practical Skills in Chemistry II

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** All the labels have come off five bottles of organic liquids.

The five liquids are pentan-3-one ($\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$), propanal ($\text{CH}_3\text{CH}_2\text{CHO}$), propan-1-ol ($\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$), propanoic acid ($\text{CH}_3\text{CH}_2\text{COOH}$), and propanone (CH_3COCH_3).

A series of **chemical** tests is used to identify the liquids.

- (a) (i) A few drops of each liquid are added, separately, to 2 cm^3 of a solution of 2,4-dinitrophenylhydrazine (Brady's reagent).

Three of the five liquids will give a positive result for this test.

Complete the table, identifying the three liquids and the observation for this positive test.

(3)

Three liquids giving a positive test	Observation in the positive test



- (ii) Two of the three liquids giving a positive test in (a)(i) can be identified using two different chemical tests.

Complete the tables giving details of the two tests, observations and the liquids identified.

(4)

Test 1	Observation and identity of one of the liquids giving a positive test in (a)(i)

Test 2	Observation and identity of one of the liquids giving a positive test in (a)(i)

- (b) Explain how a different chemical test would distinguish between the remaining two liquids **not** identified in (a).

(2)

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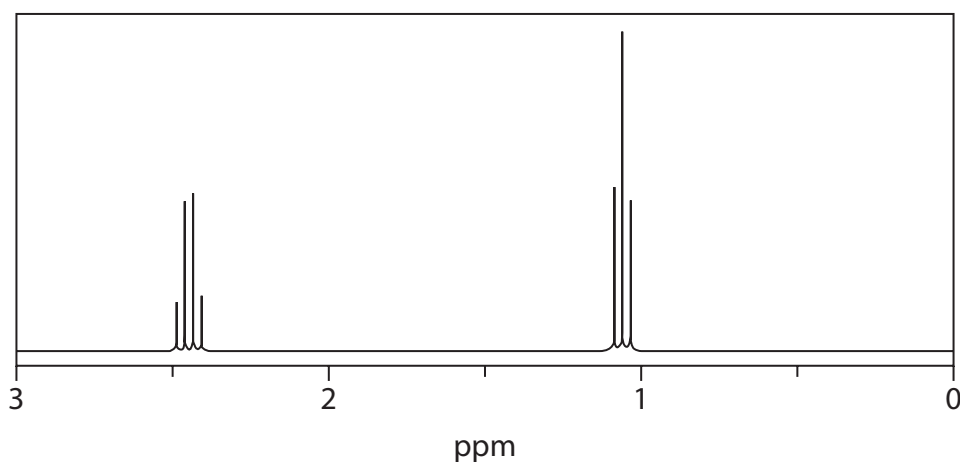
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- (c) A high resolution proton NMR spectrum of one of the liquids is shown. These are the only peaks in the spectrum.



Identify the liquid by name or formula.

Justify your answer by referring to the number of peaks and their splitting patterns in the spectrum.

(3)

(Total for Question 1 = 12 marks)

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2 This question is about zinc and some of its compounds.

(a) Some tests were carried out on an aqueous solution of zinc sulfate, ZnSO_4 .

To a solution of zinc sulfate in a test tube, aqueous sodium hydroxide solution was added until it was in excess.

(i) State the piece of apparatus used for this addition **and** how you would use it.

(2)

(ii) Describe the changes that would be observed in this test.

(2)

(b) To confirm the presence of sulfate ions in the zinc sulfate solution, a student suggested carrying out the following procedure.

- acidify an aqueous solution of zinc sulfate with sulfuric acid
- add a few drops of aqueous barium chloride solution

(i) State the observation that would be made in this test.

(1)

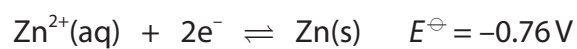
(ii) Give the reason why the student's procedure would **not** give a valid result.

(1)

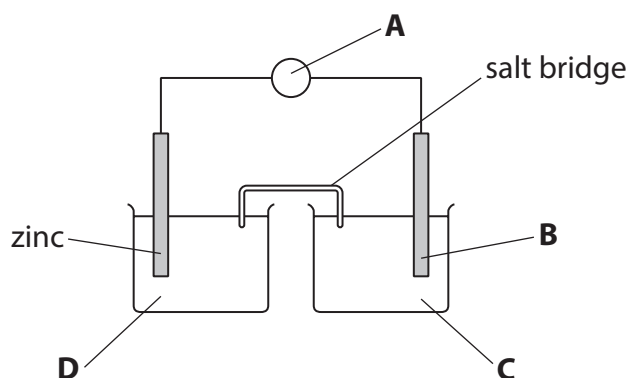


(c) An electrochemical cell was set up.

The half-equations for this cell are shown.



The diagram shows an experiment to measure the emf of this cell.



(i) Complete the table, identifying parts **A–D**.

(2)

A	
B	
C	
D	

(ii) Describe how a salt bridge could be made for this experiment.

(2)

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(iii) Write the balanced equation for the overall reaction.
Include state symbols.

(1)



- (d) The composition of a sample of brass containing only copper and zinc can be found by experiment.

Procedure

- Step 1** A brass screw is weighed, placed in a beaker and reacted with concentrated nitric acid until all the brass dissolves.
- Step 2** The solution and washings are transferred to a 250 cm^3 volumetric flask and distilled water added up to the mark.
The flask is then stoppered and shaken.
- Step 3** 25.0 cm^3 portions of the solution are pipetted into a conical flask, the solution neutralised, and an excess of potassium iodide solution added.
- Step 4** The iodine produced in Step 3 is titrated with sodium thiosulfate solution.
- In Step 1, both zinc and copper react with concentrated nitric acid to produce soluble metal nitrates, nitrogen dioxide gas and water.

Two of the hazard warning signs for nitrogen dioxide are



- (i) Identify the two hazards indicated by these labels.

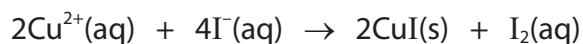
(1)

- (ii) Give one precaution to reduce the risk from nitrogen dioxide when carrying out Step 1.

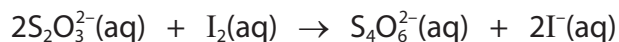
Assume that safety spectacles and a laboratory coat are worn.

(1)

(iii) In Step 3, only the Cu^{2+} ions react with the iodide ions.



In Step 4, the liberated iodine reacts with the sodium thiosulfate solution.



Name the indicator used for the titration in Step 4 **and** state the colour change at the end-point.

(2)

(iv) Calculate the percentage of copper by mass in the brass screw.
You **must** show your working.

[Data: Mass of brass screw = 0.880 g

Mean titre of $0.0380 \text{ mol dm}^{-3}$ sodium thiosulfate = 23.70 cm^3]

(5)

(Total for Question 2 = 20 marks)



- 3 A group of students carried out a series of experiments to calculate the activation energy for the reaction between calcium carbonate and dilute hydrochloric acid.

The equation for the reaction is shown.



Procedure

Step 1 Measure 50 cm^3 of 1.00 mol dm^{-3} hydrochloric acid into a conical flask.
Record the temperature of the hydrochloric acid.

Step 2 Add one lump of calcium carbonate to the conical flask. Start the timer.

Step 3 Time how long it takes for the reaction to finish.

Step 4 Repeat the process at different temperatures by warming the conical flask containing the acid.

Assume the calcium carbonate lumps are all the same size and have a mass of 0.20 g .

- (a) (i) Calculate how many moles of hydrochloric acid are in excess in this reaction.

(2)

- (ii) Name the most suitable piece of apparatus to measure the 50 cm^3 of hydrochloric acid.

(1)

- (iii) State how you would know when the reaction has finished.

(1)



(b) The students' results are shown.

time (t) / s	1/t / s ⁻¹	ln (1/t)	Temperature (T) / K	1/T / K ⁻¹
120	0.00833	-4.787	290	3.448×10^{-3}
69	0.01449	-4.234	298	3.356×10^{-3}
36	0.02778	-3.583	308	3.247×10^{-3}
14	0.07143	-2.639	323	3.096×10^{-3}

Explain why 1/t is a reasonable measure of the rate of the reaction between calcium carbonate and excess hydrochloric acid.

(2)

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(c) Explain how a graph can be used to find the activation energy for this reaction. You are **not** required to perform any calculation or draw the graph that you refer to in your answer.

[Data: Arrhenius equation can be shown as $\ln k = \frac{-E_a}{R} \times \frac{1}{T} + \text{constant}$]

(4)

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(Total for Question 3 = 10 marks)



4 This question is about the extraction of lavender oil by steam distillation.

Procedure

Step 1 Lavender flowers and stalks are crushed and then mixed with water.

Step 2 The mixture is steam distilled.

Step 3 The distillate from Step 2 is poured into a separating funnel and the aqueous layer is removed.

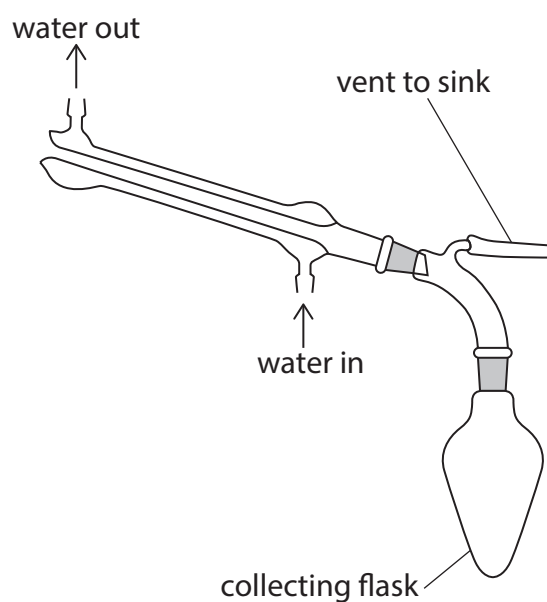
Step 4 The lavender oil is placed in a small conical flask.

(a) Name the apparatus used in Step 1 to crush the lavender flowers and stalks.

(1)

(b) Complete the diagram of the apparatus used in Step 2 for steam distillation.

(3)

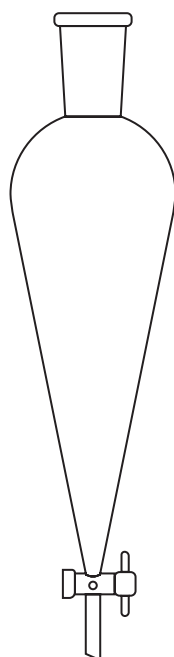


- (c) (i) The distillate contains an immiscible mixture of water and lavender oil and is poured into a separating funnel in Step 3.

Complete and label the diagram of the separating funnel showing the two layers.

[Data: Density of lavender oil = 0.885 g cm^{-3}]

(2)



- (ii) After removing the aqueous layer, the lavender oil is cloudy.

Suggest why the lavender oil is cloudy and how it could be treated to make it clear.

(2)

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(Total for Question 4 = 8 marks)

TOTAL FOR PAPER = 50 MARKS

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The Periodic Table of Elements

[illegible]

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	moscovium	101
	254	No	nobelium	102
	257	Lr	lawrencium	103

* Lanthanide series

* Actinide series

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