

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

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

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(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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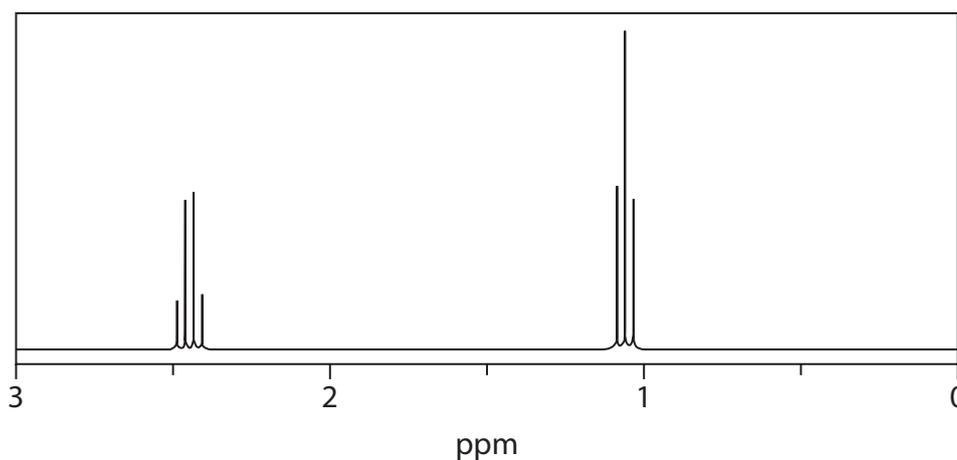
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P 7 8 8 3 0 A 0 3 1 6

(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)

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(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)

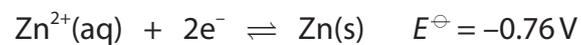
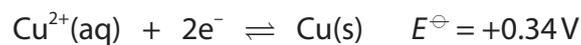
(ii) Give the reason why the student's procedure would **not** give a valid result.

(1)

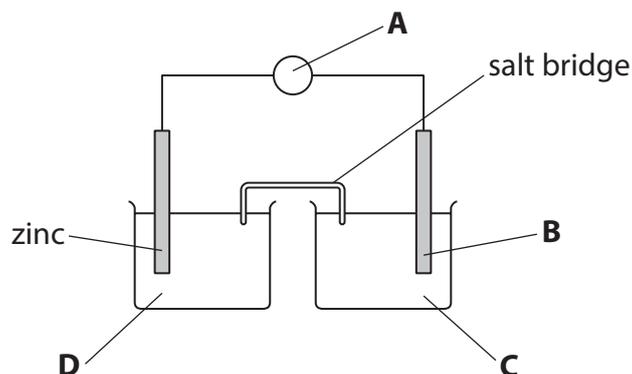


(c) An electrochemical cell was set up.

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 cm³ volumetric flask and distilled water added up to the mark.
The flask is then stoppered and shaken.

Step 3 25.0 cm³ 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)

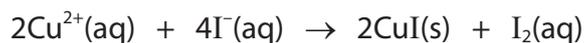
- (ii) Give one precaution to reduce the risk from nitrogen dioxide when carrying out Step 1.

Assume that safety spectacles and a laboratory coat are worn.

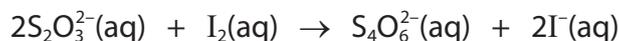
(1)



(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)



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.

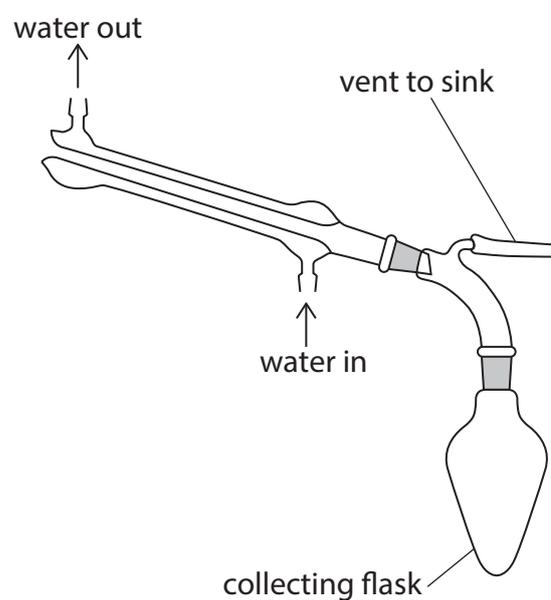
Step 2 The mixture is steam distilled.

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)



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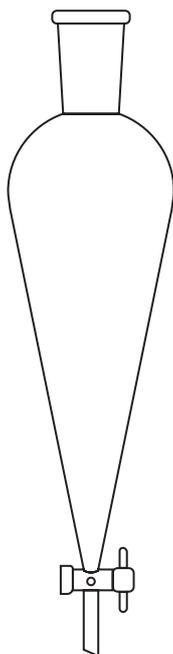
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- (c) (i) The distillate contains an immiscible mixture of water and lavender oil and is poured into a separating funnel in Step 3.

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

1 2 3 4 5 6 7 0 (8) (18)

1.0	H	hydrogen	1
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Key

relative atomic mass
atomic symbol
name
atomic (proton) number

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
6.9	9.0	45.0	47.9	50.9	52.0	54.9	55.8	58.9	58.7	63.5	65.4	10.8	12.0	14.0	16.0	19.0	4.0
Li	Be	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	B	C	N	O	F	He
lithium	beryllium	scandium	titanium	vanadium	chromium	manganese	iron	cobalt	nickel	copper	zinc	boron	carbon	nitrogen	oxygen	fluorine	helium
3	4	21	22	23	24	25	26	27	28	29	30	5	6	7	8	9	2
23.0	24.3	88.9	91.2	92.9	95.9	[98]	101.1	102.9	106.4	107.9	112.4	27.0	28.1	31.0	32.1	35.5	39.9
Na	Mg	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	Al	Si	P	S	Cl	Ar
sodium	magnesium	yttrium	zirconium	niobium	molybdenum	technetium	ruthenium	rhodium	palladium	silver	cadmium	aluminium	silicon	phosphorus	sulfur	chlorine	argon
11	12	39	40	41	42	43	44	45	46	47	48	13	14	15	16	17	18
39.1	40.1	88.9	91.2	92.9	95.9	[98]	101.1	102.9	106.4	107.9	112.4	69.7	72.6	74.9	79.0	79.9	83.8
K	Ca	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Ga	Ge	As	Se	Br	Kr
potassium	calcium	lanthanum	hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury	gallium	germanium	arsenic	selenium	bromine	krypton
19	20	57	72	73	74	75	76	77	78	79	80	31	32	33	34	35	36
85.5	87.6	138.9	178.5	180.9	183.8	186.2	190.2	192.2	195.1	197.0	200.6	69.7	72.6	74.9	79.0	79.9	83.8
Rb	Sr	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	In	Sn	Sb	Te	I	Xe
rubidium	strontium	lanthanum	hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury	indium	tin	antimony	tellurium	iodine	xenon
37	38	57	72	73	74	75	76	77	78	79	80	49	50	51	52	53	54
132.9	137.3	138.9	178.5	180.9	183.8	186.2	190.2	192.2	195.1	197.0	200.6	114.8	118.7	121.8	127.6	126.9	131.3
Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Pb	Bi	Po	At	Rn	Rn
caesium	barium	lanthanum	hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury	lead	bismuth	polonium	astatine	radon	radon
55	56	57	72	73	74	75	76	77	78	79	80	82	83	84	85	86	86
[223]	[226]	[227]	[261]	[262]	[266]	[264]	[277]	[268]	[271]	[272]	[272]	204.4	207.2	209.0	[210]	[222]	[222]
Fr	Ra	Ac*	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Rg	Tl	Pb	Bi	Po	At	Rn
francium	radium	actinium	rutherfordium	dubnium	seaborgium	bohrium	hassium	meitnerium	darmstadtium	roentgenium	roentgenium	thallium	lead	bismuth	polonium	astatine	radon
87	88	89	104	105	106	107	108	109	110	111	111	81	82	83	84	85	86

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

140	141	144	150	152	157	163	165	167	169	173	175
Ce	Pr	Nd	Sm	Eu	Gd	Dy	Ho	Er	Tm	Yb	Lu
cerium	praseodymium	neodymium	samarium	europium	gadolinium	dysprosium	holmium	erbium	thulium	ytterbium	lutetium
58	59	60	62	63	64	66	67	68	69	70	71
232	[231]	238	[242]	[243]	[247]	[251]	[254]	[253]	[256]	[254]	[257]
Th	Pa	U	Pu	Am	Cm	Cf	Es	Fm	Md	No	Lr
thorium	protactinium	uranium	plutonium	americium	curium	californium	einsteinium	fermium	mendeleevium	nobelium	lawrencium
90	91	92	94	95	96	98	99	100	101	102	103

* Lanthanide series

* Actinide series

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