GradeMax

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 ▶

P78830A

©2025 Pearson Education Ltd.
M:1/1/1/

P 7 8 8 3 0 A 0 1 1 6

Pearson

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 ($CH_3CH_2COCH_2CH_3$), propanal (CH_3CH_2CHO), propan-1-ol ($CH_3CH_2CH_2OH$), propanoic acid (CH_3CH_2COOH), 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

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(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)

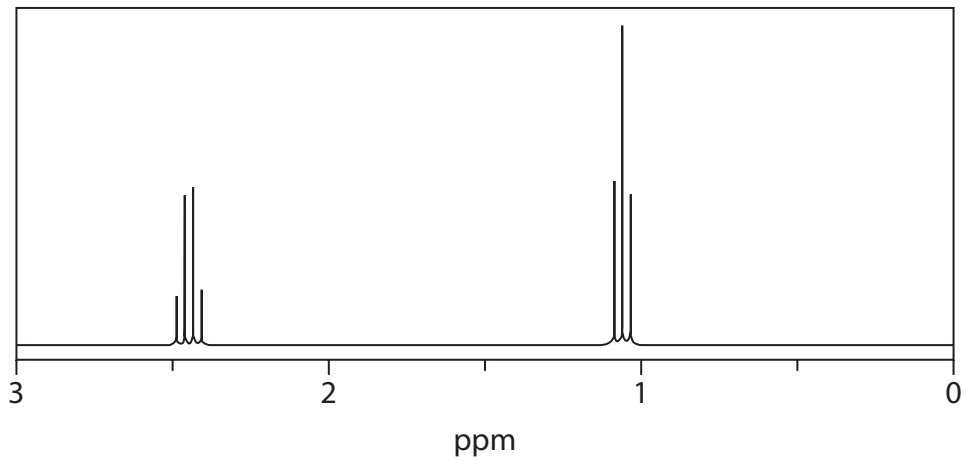
.....

.....

.....

.....

(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)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

BLANK PAGE

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)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

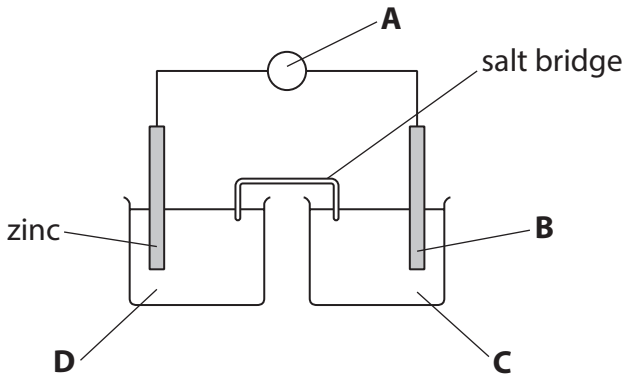
(c) An electrochemical cell was set up.

The half-equations for this cell are shown.

$$Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s) \quad E^{\ominus} = +0.34\,V$$

$$Zn^{2+}(aq) + 2e^- \rightleftharpoons Zn(s) \quad E^{\ominus} = -0.76\,V$$

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)

.....

.....

.....

.....

(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.

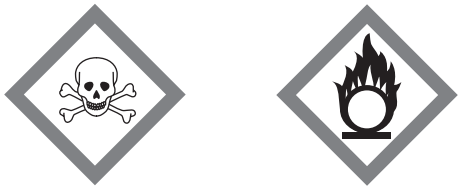
Step **2** The solution and washings are transferred to a 250 cm^3 volumetric flask and distilled water added up to the mark.
The flask is then stoppered and shaken.

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)

.....

.....

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

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

$$2Cu^{2+}(aq) + 4I^{-}(aq) \rightarrow 2CuI(s) + I_2(aq)$$

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

$$2S_2O_3^{2-}(aq) + I_2(aq) \rightarrow S_4O_6^{2-}(aq) + 2I^{-}(aq)$$

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 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.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

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)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(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)

(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)

(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.

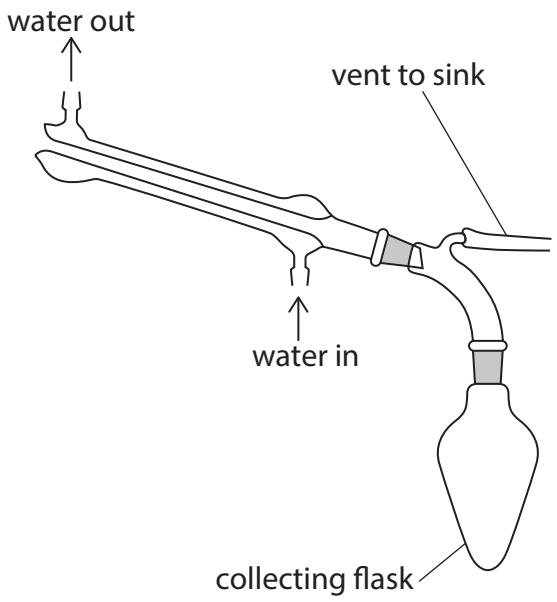
(1)

.....

.....

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

(3)



DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

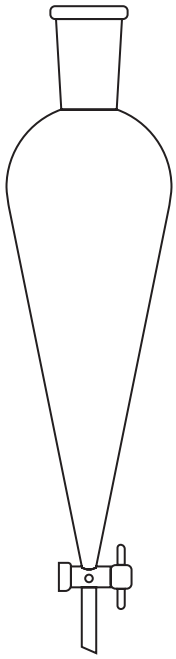
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(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)

.....

.....

.....

.....

(Total for Question 4 = 8 marks)

TOTAL FOR PAPER = 50 MARKS

BLANK PAGE

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

BLANK PAGE

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 damstadtium 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

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

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

GradeMax