

Pearson Edexcel International Advanced Level

Monday 20 October 2025

Afternoon (Time: 1 hour 20 minutes)

Paper

reference

WCH13/01A

Chemistry

International Advanced Subsidiary / Advanced Level

UNIT 3: Practical Skills in Chemistry I

Question Paper

You must have:

Scientific calculator, ruler, Answer Booklet (sent separately).

Do not return the question paper with the answer book.

Turn over ►

P87420A

©2025 Pearson Education Ltd.
M:1/1/1/1/1/




Pearson

Answer ALL the questions. Write your answers in the spaces provided.

- 1** Experiments were carried out on a sample of hydrated barium nitrate crystals, $\text{Ba}(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$.

- (a) Describe how to carry out a flame test to show which cation is present in the sample.

Include the expected result on the hydrated salt.

(4)

- (b) The barium nitrate crystals were heated gently in a test tube. Fumes which looked like steam were given off.

Identify a substance that could be used to test for the presence of steam in the fumes. Include the expected colour change for this test.

(2)

- (c) On further heating of the sample, a mixture of two gases was evolved. One of the gases was coloured, the other was colourless.

- (i) Identify the coloured gas by name **and** colour.

(1)

- (ii) Identify the colourless gas, stating how the gas would be tested, **with** the positive result.

(1)

- (d) A white solid remained after complete decomposition.

Complete the equation for this decomposition of the hydrated crystals.

State symbols are not required.

(1)

- (e) The white solid which remained in the test tube was allowed to cool to room temperature. Dilute hydrochloric acid was added to the solid and a solution formed.

This solution is used in a common laboratory test for an anion.

Give the **formula** of this anion **and** the positive result of the test.

(2)

(Total for Question 1 = 11 marks)

- 2 A student carried out experiments to determine the enthalpy change for the hydration of anhydrous magnesium sulfate, MgSO_4 , to form hydrated magnesium sulfate crystals, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.

To find the enthalpy change of solution of anhydrous magnesium sulfate, 100.0 cm^3 of deionised water was placed in a polystyrene cup and the temperature measured at one minute intervals.

After 2.5 minutes, 3.01 g of anhydrous magnesium sulfate was added and the mixture stirred continuously.

The results are shown.

Time / minutes	0	1	2	2.5	3	4	5	6	7	8
Temperature / $^{\circ}\text{C}$	21.0	21.0	21.0	X	25.6	27.2	27.0	26.2	25.2	24.3

- (a) Plot a graph of temperature against time on the grid.

(3)

- (b) Determine the maximum temperature change, ΔT , using your graph.

You **must** show your working on the graph.

(2)

$\Delta T =$

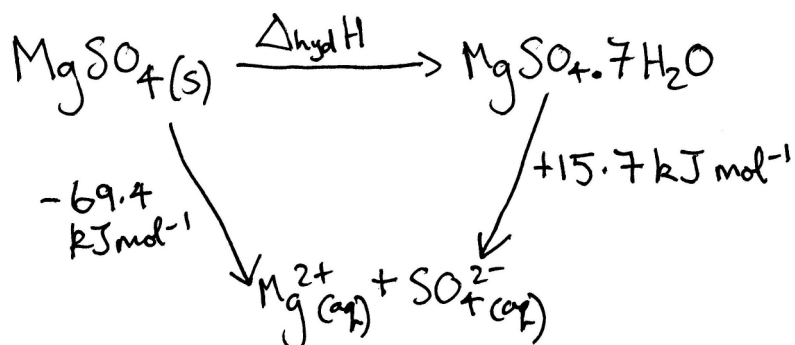
- (c) The value of the enthalpy change from this experiment was -69.4 kJ mol^{-1} .

Give **one** possible reason why this value is different from a data book value of $-103.0\text{ kJ mol}^{-1}$.

(1)

- (d) After another experiment to find the enthalpy change of solution of hydrated magnesium sulfate crystals, the student constructed the Hess cycle shown.
- (i) Calculate the enthalpy change of hydration for the conversion of anhydrous magnesium sulfate to hydrated magnesium sulfate crystals.

(1)



- (ii) Give **one** possible reason why the enthalpy change of hydration in (d)(i) could not be found directly by experiment.

(1)

(Total for Question 2 = 8 marks)

3 Borax is hydrated sodium tetraborate, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$. It is a primary standard and may be used to determine the concentration of a solution of hydrochloric acid.

- (a) Sodium hydroxide is not suitable to be used as a primary standard because the solid absorbs moisture from the air.

The mass of pure sodium hydroxide required to make a solution of known concentration is calculated. The mass is weighed out and dissolved to make a solution.

State how the absorption of moisture from the air affects the concentration of this solution. Justify your answer.

(1)

- (b) The mass of an empty weighing bottle was measured and then it was reweighed containing a sample of borax. The mass of the borax was 9.53 g.

The sample was dissolved in deionised water and transferred, with washings, to a 500 cm^3 volumetric flask.

The mixture was made up to the mark with deionised water and mixed thoroughly.

- (i) A two-decimal point balance with a measurement uncertainty of $\pm 0.01\text{ g}$ was used for each measurement.

Give the possible numerical range for a mass of 9.53 g using this balance.

(1)

- (ii) 25.0 cm^3 of the borax solution was pipetted into each of three conical flasks.

Calculate the number of moles of borax in each conical flask.

(3)

(c) A few drops of methyl orange indicator were added to each conical flask.

A hydrochloric acid solution of unknown concentration was placed in a burette and titrated against the borax solution.

The titration results obtained are shown.

Titration	1	2	3
Final burette reading / cm ³	17.00	33.25	16.35
Initial burette reading / cm ³	0.00	17.00	0.00
Titre / cm ³	17.00	16.25	16.35

(i) State the colour change at the end-point.

(1)

(ii) 1 mol of borax reacts with water to produce 2 mol of sodium hydroxide, which then neutralises the hydrochloric acid.

Calculate the concentration of hydrochloric acid in g dm⁻³, giving your answer to an appropriate number of significant figures.

You will need to use

- your answer to (b)(ii)
- the mean titre calculated from the results table.

(3)

(Total for Question 3 = 9 marks)

4 This question is about three organic liquids, **Q**, **R** and **S**.

(a) Tests were carried out on **Q** and **R**.

Each liquid contained **one** functional group.

(i) Test 1

A spatula measure of phosphorus(V) chloride, PCl_5 , was added to 1 cm^3 of each liquid in separate test tubes.

Any gas evolved was tested with damp blue litmus paper.

Q	R
Misty fumes were given off	Misty fumes were given off
Damp blue litmus paper turned red	Damp blue litmus paper turned red

Give the **formula** of the steamy fumes produced in Test 1.

(1)

(ii) Test 2

About 1 cm^3 of sodium hydrogencarbonate solution was added to 1 cm^3 of each liquid in separate test tubes.

Q	R
No reaction	A colourless gas was given off that turned limewater cloudy

Identify, by name or formula, the gas produced in Test 2.

(1)

(iii) **Name** the functional groups present in **Q** and **R**.

Use the results from Tests 1 and 2 and the information at the start of the question.

(2)

- (iv) **Q** and **R** both have a molar mass of 60 g mol^{-1} .

Draw a possible structure of **Q** and the structure of **R** using **displayed** formulae.

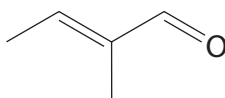
(2)

- (v) State whether or not it is possible to distinguish between **Q** and **R** using infrared spectra. Justify your answer.

Wavenumber values are not required.

(1)

- (b) The organic liquid **S** is a pheromone which has been shown to stimulate weight gain in pigs.



State the initial and final appearance of each mixture when the tests described were carried out on liquid **S**.

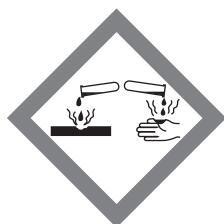
(4)

(Total for Question 4 = 11 marks)

- 5 The halogenoalkane 2-chloro-2-methylpropane may be prepared from 2-methylpropan-2-ol.

Procedure

- Step 1** Add 35 cm³ of concentrated hydrochloric acid to 8.00 g of 2-methylpropan-2-ol in a conical flask.
Swirl the mixture gently for 20 minutes.
- Step 2** Two distinct layers form. The upper (organic) layer contains the required product. The lower aqueous layer is removed using a separating funnel.
- Step 3** Add a solution of sodium hydrogencarbonate to the organic layer.
Swirl gently. Stopper the separating funnel and shake it.
Invert the separating funnel and open the tap.
- Step 4** Return the separating funnel to the upright position, remove the stopper and discard the aqueous layer.
Transfer the organic layer into a clean conical flask.
- Step 5** Add some anhydrous calcium chloride.
Leave the flask to stand and decant off the liquid.
- Step 6** Distil the liquid, collecting the product between 50 °C and 52 °C.
- (a) (i) The concentrated hydrochloric acid used in Step 1 was labelled with the two diagrams shown.



Suggest **two** safety precautions, other than wearing safety spectacles and a laboratory coat, to minimise the risk when using this reagent in Step 1.

(2)

- (ii) State why the tap of the separating funnel must be opened in Step 3.

(1)

- (iii) Describe the change in appearance of the organic layer when anhydrous calcium chloride is added in Step 5.

(1)

- (iv) Draw the apparatus required to distil the product and collect the distillate between 50 °C and 52 °C in Step 6.

(4)

- (b) The chloroalkane produced is used in an experiment to compare its rate of hydrolysis with two other halogenoalkanes.

A student dissolves separate 1.0 cm^3 samples of each halogenoalkane in ethanol and adds 2 cm^3 of silver nitrate solution.

The time taken for a precipitate to form is recorded. The results are shown.

Halogenoalkane	Time / s
2-chloro-2-methylpropane	5
1-chloro-2-methylpropane	320
1-bromo-2-methylpropane	140

The student concludes that both the structure of the halogenoalkane and the identity of the halogen affect the rate of hydrolysis.

Explain how the results support this conclusion.

(3)

(Total for Question 5 = 11 marks)

TOTAL FOR PAPER = 50 MARKS

BLANK PAGE



The Periodic Table of Elements

1

2

3

4

5

6

7

0 (8)

(18)

1.0
Hhydrogen
1

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

(1)(2)

6.9Li
lithium
3

9.0Be
beryllium
4

23.0Na
sodium
11

24.3Mg
magnesium
12

(3)(4)(5)(6)(7)(8)(9)(10)(11)(12)

45.0Sc
scandium
21

47.9Ti
titanium
22

50.9V
vanadium
23

52.0Cr
chromium
24

54.9Mn
manganese
25

55.8Fe
iron
26

58.9Co
cobalt
27

58.7Ni
nickel
28

63.5Cu
copper
29

65.4Zn
zinc
30

88.9Y
yttrium
39

91.2Zr
zirconium
40

92.9Nb
niobium
41

95.9Mo
molybdenum
42

[98]Tc
technetium
43

101.1Ru
ruthenium
44

102.9Rh
rhodium
45

106.4Pd
palladium
46

107.9Ag
silver
47

112.4Cd
cadmium
48

138.9La*
lanthanum
57

137.3Ba
barium
56

132.9Cs
caesium
55

180.9Ta
tantalum
73

178.5Hf
hafnium
72

186.2Re
rhenium
75

190.2Os
osmium
76

192.2Ir
iridium
77

195.1Pt
platinum
78

197.0Au
gold
79

200.6Hg
mercury
80

204.4Tl
thallium
81

207.2Pb
lead
82

209.0Bi
bismuth
83

209Po
polonium
84

210At
astatine
85

[222]Rn
radon
86

(13)(14)(15)(16)(17)

10.8B
boron
5

12.0C
carbon
6

14.0N
nitrogen
7

16.0O
oxygen
8

19.0F
fluorine
9

27.0Al
aluminium
13

28.1Si
silicon
14

31.0P
phosphorus
15

32.1S
sulfur
16

35.5Cl
chlorine
17

39.9Ar
argon
18

39.8Kr
krypton
36

131.3Xe
xenon
54

[222]

* Lanthanide series

* Actinide series

140Ce
cerium
58

141Pr
praseodymium
59

144Nd
neodymium
60

147Pm
promethium
61

150Sm
samarium
62

152Eu
europium
63

157Gd
gadolinium
64

159Tb
terbium
65

163Dy
dysprosium
66

165Ho
holmium
67

167Er
erbium
68

173Yb
ytterbium
70

175Lu
lutetium
71

232Th
thorium
90

[231]Pa
protactinium
91

238U
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



Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

--	--	--	--	--

--	--	--	--	--

Pearson Edexcel International Advanced Level**Monday 20 October 2025**

Afternoon (Time: 1 hour 20 minutes)

Paper
reference**WCH13/01A****Chemistry****International Advanced Subsidiary /Advanced Level****UNIT 3: Practical Skills in Chemistry I****Answer Book****You must have:**

Question paper (sent separately), Scientific calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **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 ►

P87478A©2025 Pearson Education Ltd.
M:1/1/1/1/

Answer ALL the questions. Write your answers in the spaces provided.

1

(a)

(4)

.....

.....

.....

.....

.....

.....

.....

Expected result.....

(b)

(2)

Identity of substance.....

Colour change.....

(c)

(i)

(1)

Identity of gas.....

Colour of gas.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(ii)

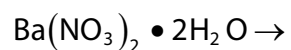
(1)

Identity of gas.....

Test and positive result.....

(d)

(1)



(e)

(2)

Formula.....

Positive test result.....

(Total for Question 1 = 11 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

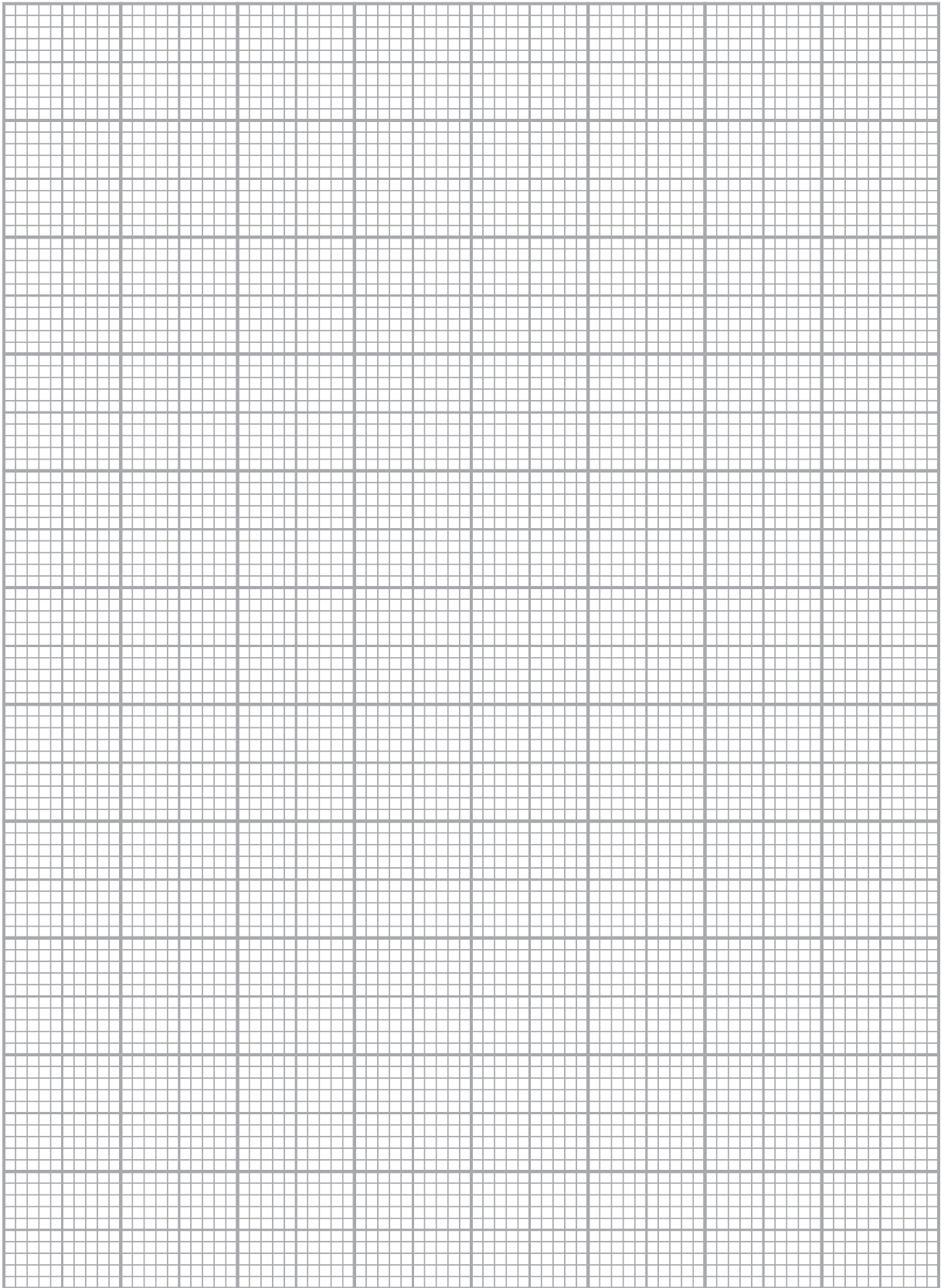
DO NOT WRITE IN THIS AREA



2

(a)

(3)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4



(2)

$$\Delta T = \dots\dots\dots$$

(1)

(i)

(1)

(ii)

(1)

(Total for Question 2 = 8 marks)



3

(a)

(1)

(b)

(i)

(1)

(ii)

(3)

(c)

(i)

(1)

From to

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(ii)

(3)

(Total for Question 3 = 9 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



4

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(a)

(i) (1)

(ii) (1)

(iii) (2)

Functional group in Q	Functional group in R

(iv) (2)

Q	R

(v) (1)



(b)

(4)

Tests	Observations
A few drops of S were shaken with bromine water	
In a test tube, a few drops of S were added to 1cm ³ of Benedict's or Fehling's solution. The mixture was warmed in a water bath	

(Total for Question 4 = 11 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



5

(a)

(i)

(2)

(ii)

(1)

(iii)

(1)

(iv)

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b)

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 5 = 11 marks)

TOTAL FOR PAPER = 50 MARKS



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

