

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International GCSE (9–1)

Monday 19 May 2025

Morning (Time: 1 hour 40 minutes) **Paper reference 4WCH1/1C**

Chemistry (Modular)
UNIT 1: 4WCH1
PAPER: 1C

You must have:
 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.*
- Show all the steps in the calculations and state the units where required.

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
 – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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The Periodic Table of the Elements

1	2	Key										3	4	5	6	7	0
1 H hydrogen 1		relative atomic mass atomic symbol name atomic (proton) number															
7 Li lithium 3	9 Be beryllium 4																
23 Na sodium 11	24 Mg magnesium 12																
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 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						

* The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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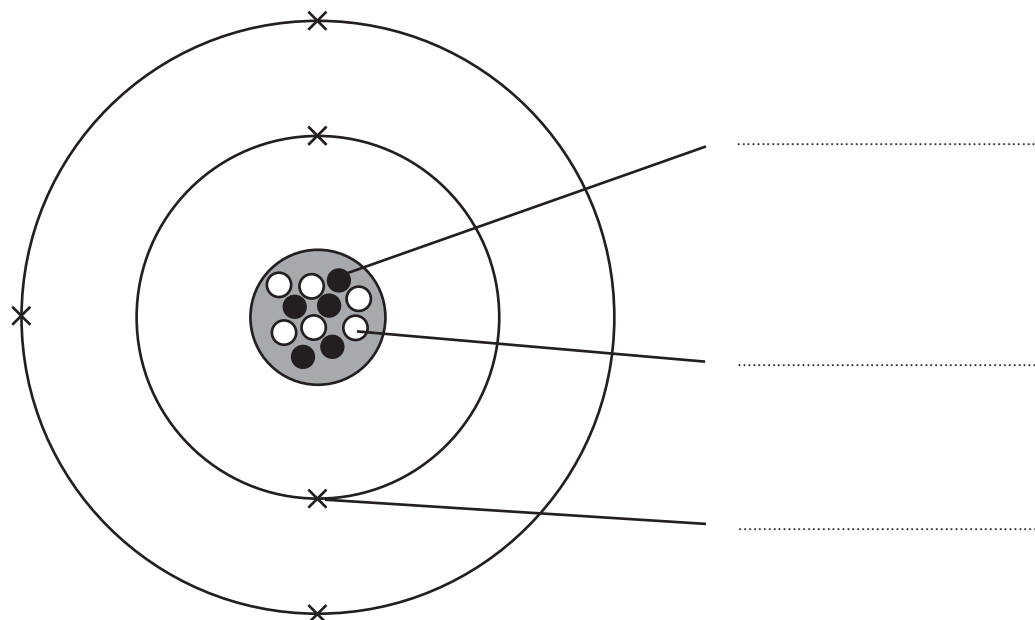
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Answer ALL questions.

Some questions must be answered with a cross ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

- 1 The diagram represents an atom of an element.



- (a) Label the three sub-atomic particles on the diagram.

(3)

- (b) Use information from the diagram to complete the table for this element.

(4)

mass number	
group number	
period number	
electronic configuration	

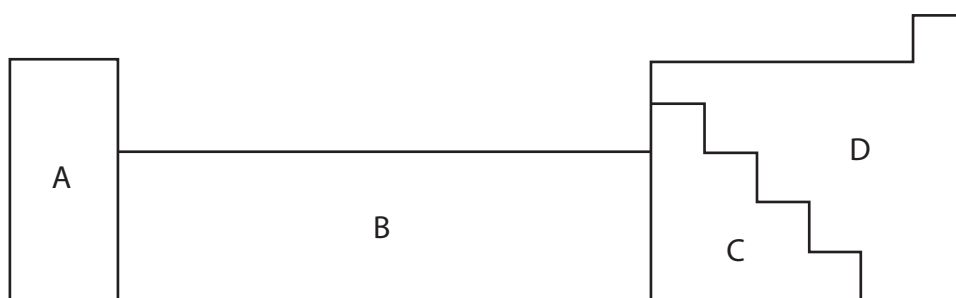
- (c) Give the name of this element.

(1)

(Total for Question 1 = 8 marks)

2 This question is about metals and non-metals.

(a) The diagram shows four sections, A, B, C and D of the Periodic Table.



Use the diagram to answer these questions.

(i) Element X has a melting point of -220°C and does not conduct electricity.

Which section of this Periodic Table contains element X?

(1)

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(ii) Element Y has three electron shells and the outer shell contains one electron.

Which section of this Periodic Table contains element Y?

(1)

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(iii) Element Z conducts electricity and reacts violently with water.

Which section of this Periodic Table contains element Z?

(1)

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(b) Neon is a noble gas.

State why neon does not readily react.

(1)

(c) Lithium and potassium have similar chemical properties.

(i) Give another element that will have similar chemical properties to these elements.

(1)

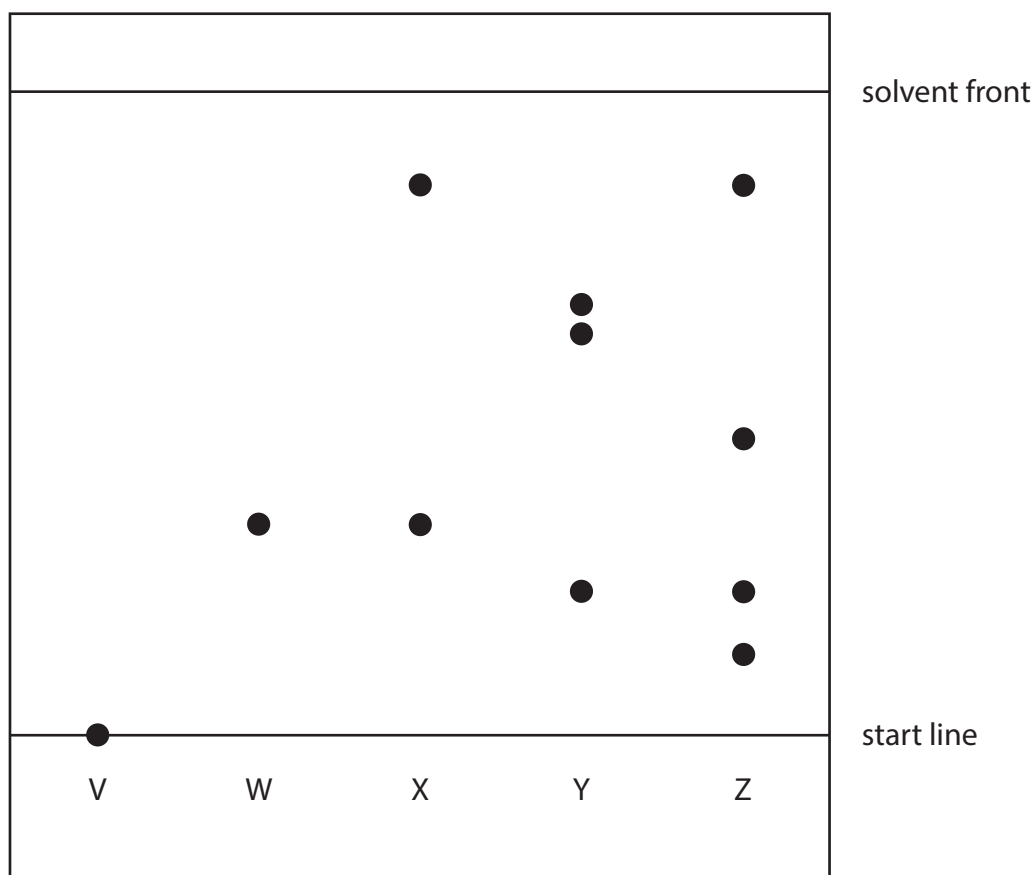
(ii) Explain why these elements have similar chemical properties.

(3)

(Total for Question 2 = 8 marks)

- 3 A student uses paper chromatography to investigate the dyes in five different inks, V, W, X, Y and Z.

The chromatogram shows the results of the investigation.



- (a) Explain why the start line on the paper is drawn in pencil rather than in ink.

(2)

.....

.....

.....

.....

- (b) Explain which two inks contain the dye that is most soluble in the solvent.

(2)

.....

.....

.....

.....

(c) Explain how the chromatogram shows that

- W contains only one dye
- V may contain more than one dye

(3)

(d) Calculate the R_f value for the dye in W.

Give your answer to two significant figures.

(4)

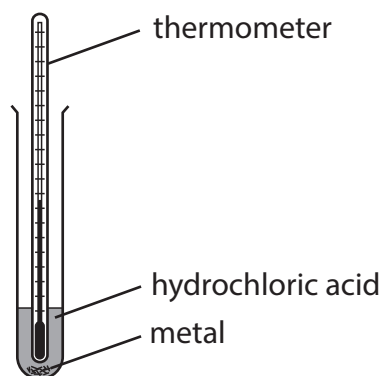
R_f value =

(Total for Question 3 = 11 marks)



- 4 (a) A student does an experiment to identify three metals, iron, magnesium and zinc.

The diagram shows some of the equipment provided.



Describe an experiment that the student could do to identify the three metals, by comparing their reactions with hydrochloric acid.

(6)



(b) Give the chemical equation for the reaction between magnesium and hydrochloric acid.

(2)

(c) Which of these metals is in Group 2?

(1)

- ☐ **A** copper
- ☐ **B** iron
- ☐ **C** magnesium
- ☐ **D** zinc

(Total for Question 4 = 9 marks)

5 (a) Butane (C_4H_{10}) is an alkane.

Explain why butane is a saturated hydrocarbon.

(3)

(b) (i) When butane burns completely in oxygen, carbon dioxide and water are produced.

Give a chemical equation for this combustion reaction.

(2)

(ii) Incomplete combustion can occur when the oxygen supply is limited.

One product of the incomplete combustion of butane is carbon monoxide.

Give the name of another product of this incomplete combustion.

(1)

(iii) State why carbon monoxide is poisonous to humans.

(1)



(c) C_4H_{10} exists as two isomers.

(i) State what is meant by the term **isomers**.

(2)

(ii) Draw the displayed formula of each isomer.

(2)

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(Total for Question 5 = 11 marks)

- 6 (a) Calculate the amount, in mol, of N_2 in 70 g of nitrogen gas.

(3)

amount of N_2 = mol

- (b) Ammonia is a compound containing nitrogen and hydrogen.

Calculate the relative molecular mass of ammonia, NH_3

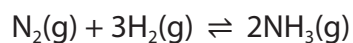
(2)

relative molecular mass =



- (c) Nitrogen reacts with hydrogen to form ammonia, NH_3

This is the equation for the reaction.



- (i) Calculate the mass, in kg, of hydrogen needed to produce 5.10 tonnes of ammonia.

Give your answer in standard form.

[1 tonne = 1000 kg]

(5)

mass of hydrogen = kg

(ii) The reaction produces 3.65 tonnes of ammonia instead of 5.10 tonnes.

Calculate the percentage yield of ammonia.

Give your answer to one decimal place.

(3)

percentage yield = %

(Total for Question 6 = 13 marks)



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- 7 A teacher investigates the effect of temperature on the solubility in water of barium nitrate, $\text{Ba}(\text{NO}_3)_2$

The teacher records the maximum mass, in g, of barium nitrate that dissolves in 100 cm^3 of water at different temperatures.

The table shows the teacher's results.

Temperature in $^{\circ}\text{C}$	Mass of barium nitrate in g
0	5.0
20	9.1
40	14.5
60	20.0
80	30.0
100	34.0

- (a) (i) Plot the results on the grid. (1)
- (ii) One of the results is anomalous.
Draw a ring around the anomalous result. (1)
- (iii) Draw a curve of best fit. (1)

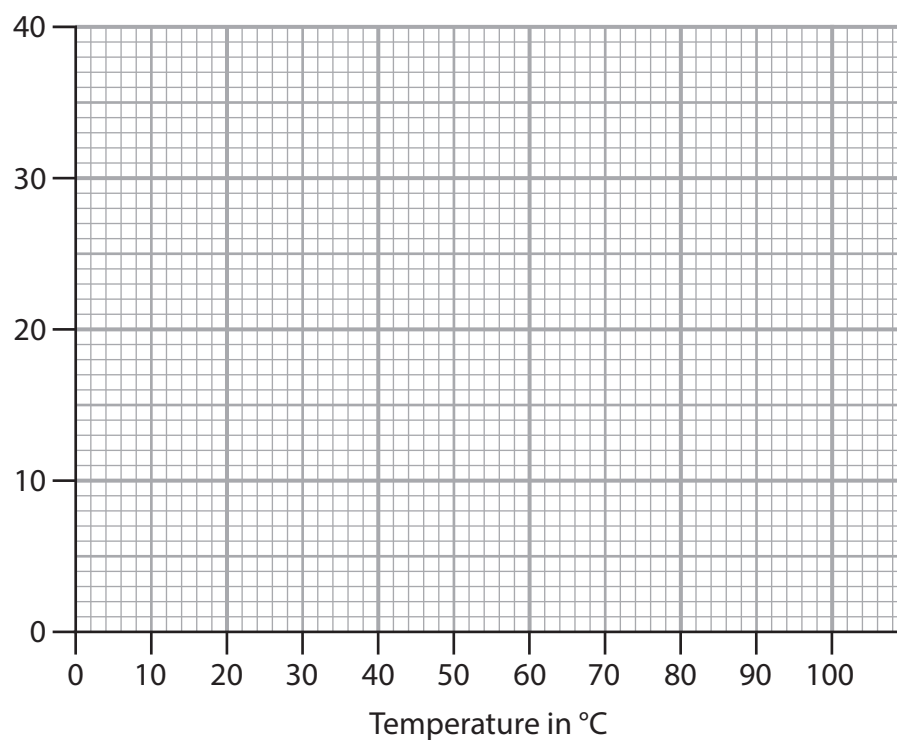


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Mass of barium
nitrate in g



(iv) Use the graph to determine the mass of barium nitrate that dissolves at 50 °C.

(1)

mass = g



P 8 1 5 7 8 A 0 1 7 2 8

(b) Barium nitrate dissolves in water to form a solution.

Describe the changes in arrangement, movement and energy of the water molecules when the solution is heated to boiling point.

(4)

(c) (i) The element barium has many isotopes.

State what is meant by the term **isotopes**.

(2)



(ii) A sample of barium contains these three isotopes.

- 12.0% of ^{136}Ba
- 16.0% of ^{137}Ba
- 72.0% of ^{138}Ba

Calculate the relative atomic mass of the sample.

(2)

relative atomic mass =

(Total for Question 7 = 12 marks)

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8 Pylons are used to support overhead power cables.

The photograph shows an example of a pylon.



(Source: © Paul Maguire / Shutterstock)

(a) Suggest why steel is used to make pylons.

(1)

(b) Overhead power cables are used to transmit electricity and are supported by pylons.

The table shows some information about power cables made from copper and power cables made from aluminium.

Metal	Ability to conduct electricity	Mass of 100 m of cable in kg	Cost of cable per kg in US dollars
copper	good	160	7.40
aluminium	good	48	1.25

Using information from the table, comment on the use of copper and aluminium in overhead power cables.

[illegible]

- (c) Copper and aluminium are used to make many useful objects other than overhead power cables.

For each metal, give one other use and the property important for this use.

(4)

copper use

property

aluminium use

property

(Total for Question 8 = 9 marks)



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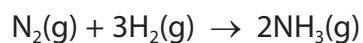
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9 This question is about ammonia.

(a) Nitrogen reacts with hydrogen to form ammonia, NH_3



The table gives some bond energies.

Bond	Bond energy in kJ/mol
$\text{N} \equiv \text{N}$	944
$\text{H} - \text{H}$	436
$\text{N} - \text{H}$	388

Using the equation and the data in the table, calculate the enthalpy change (ΔH), in kJ/mol, for the reaction.

Include a sign in your answer.

(3)

$\Delta H = \dots\dots\dots$ kJ/mol

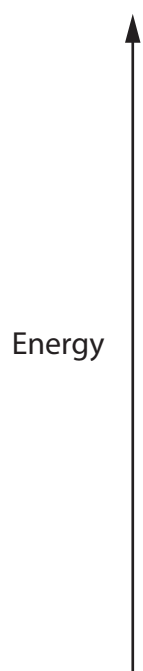


- (b) Explain, in terms of bonds broken and bonds made, why this reaction is exothermic.

(2)

- (c) Complete the energy level diagram for this exothermic reaction by showing the reactants and products.

(2)



(d) A cylinder contains 4.6 mol of NH_3 gas.

Calculate the volume, in dm^3 , of the gas at rtp.

[at rtp, molar volume = $24\,000\text{ cm}^3$]

(2)

volume = dm^3

(Total for Question 9 = 9 marks)

TOTAL FOR PAPER = 90 MARKS



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