

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

3430UB0-1



S25-3430UB0-1

FRIDAY, 13 JUNE 2025 – MORNING

SCIENCE (Double Award)

Unit 2 – CHEMISTRY 1
HIGHER TIER

1 hour 15 minutes

ADDITIONAL MATERIALS

In addition to this examination paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **10(a)** is a quality of extended response (QER) question where your writing skills will be assessed.

The Periodic Table is printed on the back cover of this paper and the formulae for some common ions on the inside of the back cover.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	3	
3.	6	
4.	6	
5.	7	
6.	7	
7.	5	
8.	3	
9.	8	
10.	9	
Total	60	



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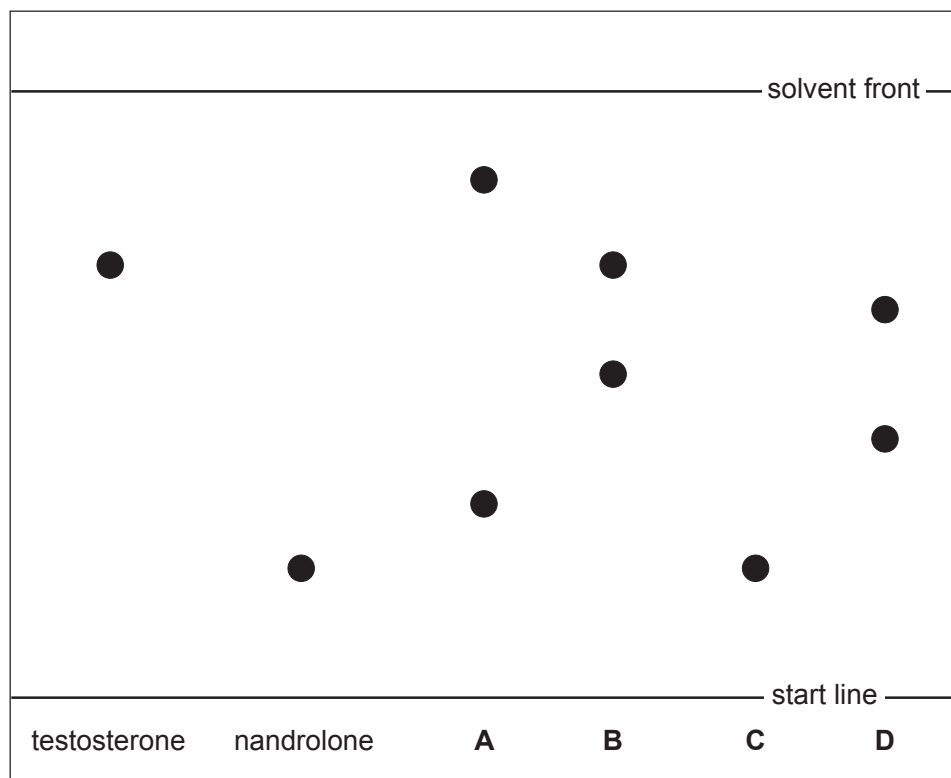
Answer **all** questions.

Examiner
only

1. (a) Testosterone and nandrolone are anabolic steroids, which have been used by some athletes to enhance performance. Chromatography can be used to test if athletes have taken these steroids.

Urine samples from four athletes, **A-D**, were tested to find out whether they have taken testosterone or nandrolone.

The chromatogram shows the results obtained.



- (i) Measure the required distances and find the R_f value of the spot given by testosterone.

[1]

$$R_f = \frac{\text{distance travelled by spot}}{\text{distance travelled by solvent front}}$$

$$R_f = \dots\dots\dots$$



(ii) State the conclusions that can be drawn about athletes **A-D**.

[3]

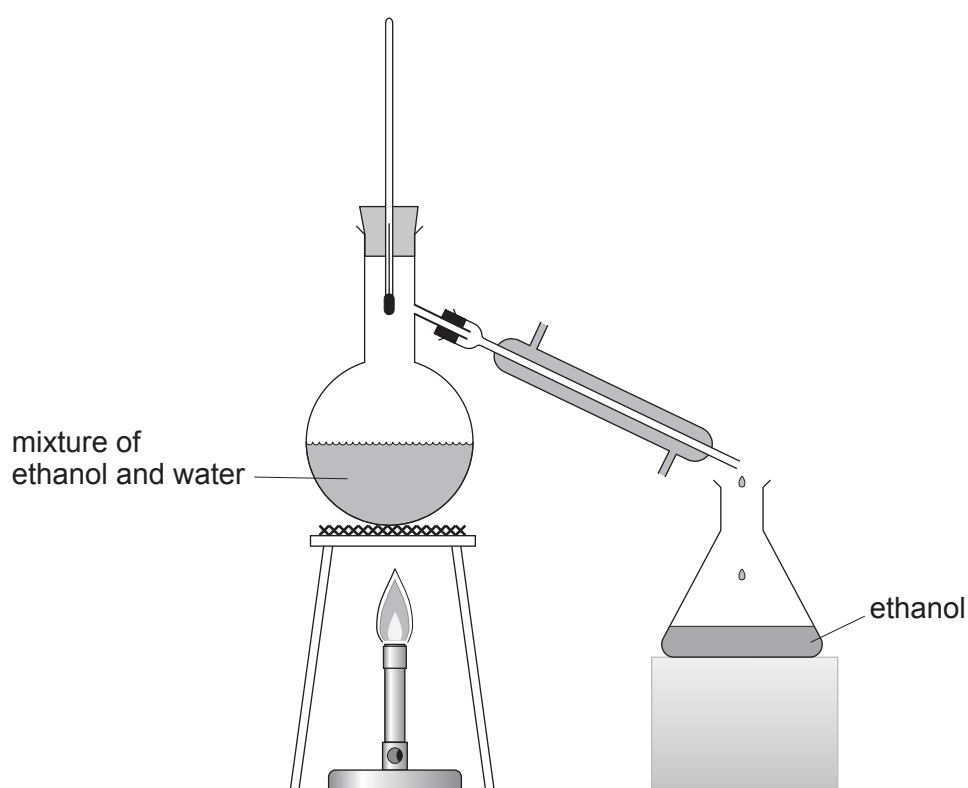
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(b) Ethanol can be separated from water by distillation using the apparatus shown.



Explain why ethanol can be separated from water by distillation.

[2]

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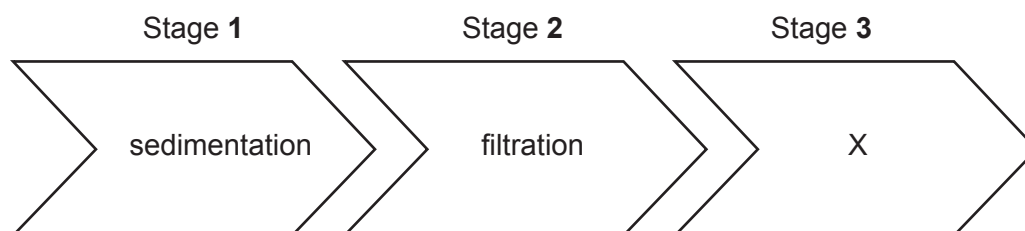
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2. Drinking water needs to be treated and purified before it is safe to drink.

The diagram shows the three main stages in the treatment of water before it enters the mains water system.



- (a) Describe what happens in stage 1.

[1]

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- (b) Stage 3 makes water safe to drink.

Name the substance that is added to water in stage 3 and state why this makes water safe to drink.

[2]

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3. (a) A Year 10 class carried out two tests to identify compounds **X** and **Y**.

Some of their results and conclusions are shown in the table.

Compound	Flame test		Add silver nitrate solution	
	Observation	Symbol of ion	Observation	Symbol of ion
X	yellow flame seen			Cl^-
Y		K^+	yellow precipitate formed	I^-

Both compounds contain only two ions.

- (i) Use the information given to **complete the table**. [3]

- (ii) Name compound **Y**. [1]

.....

- (b) Complete the symbol equation for the reaction between silver nitrate solution and lithium bromide solution by writing the formulae for the products. [2]

silver nitrate + lithium bromide $\longrightarrow$ silver bromide + lithium nitrate

AgNO_3 + LiBr $\longrightarrow$ +



4. (a) The nucleus of an atom contains protons and neutrons.

The nucleus of a helium atom is shown.



● proton
○ neutron

The diagram below shows the nuclei of four different atoms, **A-D**.



A



B



C



D

A-D are **not** the chemical symbols for the elements.

- (i) Give the letter, **A-D**, that represents an atom that has an atomic number of 5. [1]

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- (ii) Give the letter, **A-D**, that represents an atom that has a mass number of 9. [1]

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- (b) In the Periodic Table, fluorine is represented as ${}^{19}_{9}\text{F}$.

Complete the table to show the number of neutrons in a fluorine **atom** and the number of electrons in a fluoride **ion**. [2]

	Fluorine atom, F	Fluoride ion, F ⁻
protons	9	9
electrons	9	
neutrons		10



- (c) Fluorine reacts with iron to produce iron(III) fluoride.

Complete and balance the symbol equation for this reaction.

[2]



6



5. Bouncy balls can be made by reacting warm borax solution and PVA glue. Starch is added as a catalyst.

(a) State why catalysts are added to chemical reactions. Explain how they work. [2]

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- (b) A fixed volume of borax solution and PVA glue was mixed with different masses of starch at 20 °C.

The time taken for the bouncy ball to harden with each mass of starch was recorded and the results are shown in the table.

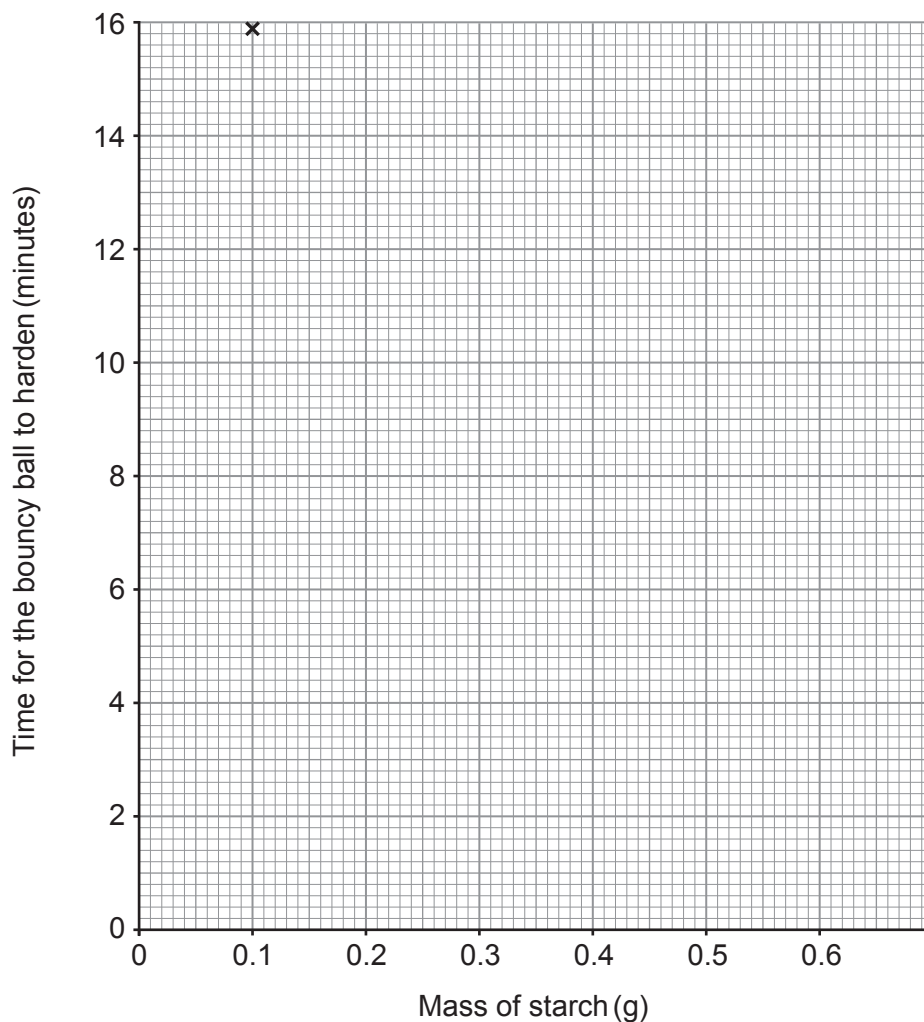
Mass of starch (g)	Time for the bouncy ball to harden (minutes)
0.1	15.9
0.2	9.4
0.3	5.6
0.4	4.0
0.5	3.4
0.6	3.4



- (i) Plot these results on the grid below and draw a suitable line.

The first point has been plotted for you.

[2]



- (ii) Describe the relationship between the mass of starch and the time for the bouncy ball to harden.

[2]

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- (c) Suggest what you would expect to happen if the experiment were repeated at a higher temperature.

[1]

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6. (a) The map shows the distribution of fossil remains of *Cynognathus* and *Glossopteris*.

Cynognathus was a **land** reptile up to 3 m long. *Glossopteris* was a type of fern growing in ancient **forests**.



- (i) Describe what the map shows and state what conclusion Alfred Wegener drew from this observation. [2]

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- (ii) Ammonites lived in the **oceans** around 150 million years ago.



Suggest why ammonite fossils would **not** have been useful for Wegener in proposing his theory.

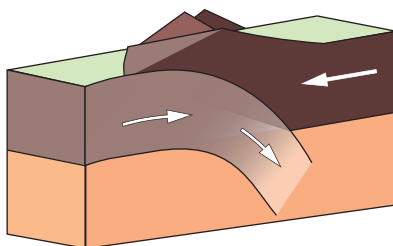
[1]

- (iii) Give **one** other piece of evidence that Wegener used to support his theory.

[1]

- (b) A destructive plate boundary is found along the western coast of South America.

The diagram shows a typical destructive plate boundary.



Describe what happens at a destructive plate boundary.

[3]



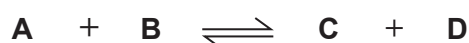
7. In most reactions, the reactants react to make products as shown.



These reactions are irreversible, which means that when the products are formed they can't be converted back to the reactants.

However, other reactions are **reversible**, which means that the products can be converted back to the reactants.

These reactions are represented using a different symbol ($\rightleftharpoons$).



In these reactions, the forward and backward reaction happen constantly.

If the forward and backward reactions are happening at the same rate, the amounts of reactants and products stay the same.

The total amount of reactants (**A** and **B**) and products (**C** and **D**) can be changed by changing the conditions as shown in the table.

Temperature (°C)	Pressure (atm)	Catalyst	Amount of A and B (%)	Amount of C and D (%)
100	50	no	60	40
100	50	yes	60	40
200	50	no	70	30
200	50	yes	70	30
200	80	no	60	40
200	80	yes	60	40



- (a) Use the information in the table. Tick (✓) the **three** statements that are true for this reversible reaction. [3]

adding a catalyst does not affect the amount of reactants or products

☐

adding a catalyst increases the amount of products

☐

adding a catalyst increases the amount of reactants

☐

increasing the pressure increases the amount of products

☐

increasing the pressure increases the amount of reactants

☐

increasing the temperature increases the amount of products

☐

increasing the temperature increases the amount of reactants

☐

- (b) Use the particle theory to explain why increasing the concentration of a reactant can increase the rate of a reaction. [2]

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5



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8. Use your knowledge of electronic structure to explain why the reactivity of the Group 1 elements increases on going down the group.

[3]

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3



9. (a) Temporary hardness can be removed from water by boiling.

Suggest why it becomes more expensive to use a kettle over time in a hard water area.

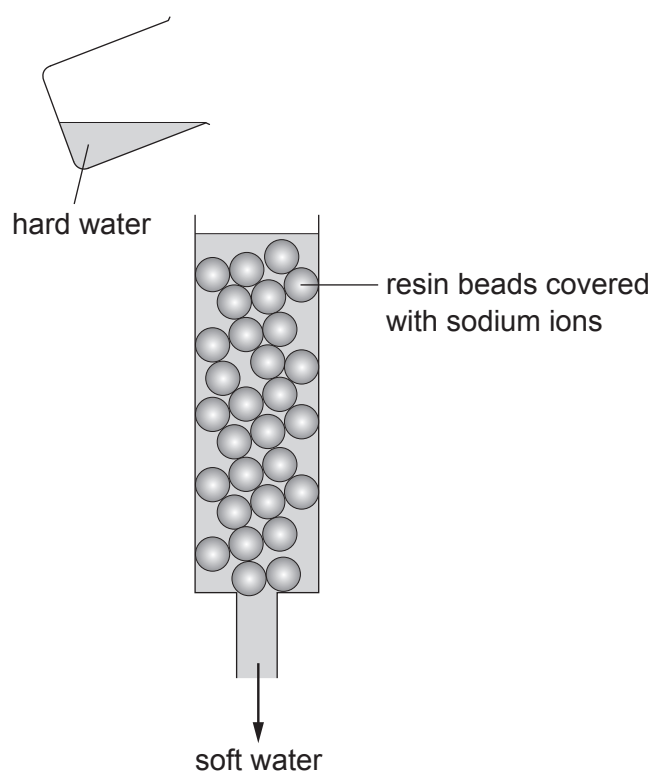
[2]

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- (b) Temporary and permanent hardness can be removed from water using the apparatus shown.



- (i) State how permanent hardness is removed by the resin in this apparatus.

[1]

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- (ii) Apart from cost, give **one** drawback of this method.

[1]

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- (c) A sample of permanent hard water contains 0.025 mol of magnesium sulfate.

Use the formula to calculate the mass of magnesium sulfate in the sample. [2]

$$M_r(\text{MgSO}_4) = 120$$

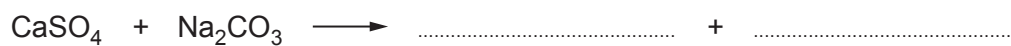
$$\text{number of moles} = \frac{\text{mass}}{M_r}$$

Mass = g

- (d) Permanent hardness in water can be caused by calcium sulfate.

This can be removed by reacting with sodium carbonate in the form of washing soda.

Complete the symbol equation for this reaction. [2]



10. (a) The reactivity of the Group 7 elements changes down the group. It is possible to determine their reactivity by reacting them with halide salts.

The table shows the results obtained when each Group 7 element was placed into solutions of the halides of other elements.

A tick (✓) indicates that a reaction took place and a cross (✗) indicates that no reaction took place.

		Halogen		
		iodine	chlorine	bromine
Halide	sodium iodide		✓	✓
	sodium chloride	✗		✗
	sodium bromide	✗	✓	

Use the results to give the order of reactivity of the Group 7 elements. Explain your answer in terms of the reactions taking place. Include an appropriate equation in your answer. [6 QER]

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- (b) Iron chloride is produced by heating iron strongly in chlorine gas.

A sample of iron chloride was found to contain 3.36 g of iron and 6.39 g of chlorine.

Calculate the simplest formula for this iron chloride. You **must** show your working. [3]

$$A_r(\text{Fe}) = 56$$

$$A_r(\text{Cl}) = 35.5$$

Simplest formula

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
aluminium	Al^{3+}	bromide	Br^-
ammonium	NH_4^+	carbonate	CO_3^{2-}
barium	Ba^{2+}	chloride	Cl^-
calcium	Ca^{2+}	fluoride	F^-
copper(II)	Cu^{2+}	hydroxide	OH^-
hydrogen	H^+	iodide	I^-
iron(II)	Fe^{2+}	nitrate	NO_3^-
iron(III)	Fe^{3+}	oxide	O^{2-}
lithium	Li^+	sulfate	SO_4^{2-}
magnesium	Mg^{2+}		
nickel	Ni^{2+}		
potassium	K^+		
silver	Ag^+		
sodium	Na^+		
zinc	Zn^{2+}		



Group

3 4 5 6 7 0

1 H Hydrogen 1																													
7	Li	9	Be							11	B	12	C	14	N	16	O	19	F	4	He								
	Lithium		Beryllium								Boron		Carbon		Nitrogen		Oxygen		Fluorine		Helium								
	3		4								5		6		7		8		9		2								
23	Na	24	Mg							27	Al	28	Si	31	P	32	S	35.5	Cl	40	Ar								
	Sodium		Magnesium								Aluminium		Silicon		Phosphorus		Sulfur		Chlorine		Argon								
	11		12								13		14		15		16		17		18								
39	K	40	Ca	45	Sc	48	Ti	51	V	52	Cr	55	Mn	56	Fe	59	Co	59	Ni	63.5	Zn	84	Kr						
	Potassium		Calcium		Scandium		Titanium		Vanadium		Chromium		Manganese		Iron		Cobalt		Nickel		Copper		Krypton						
	19		20		21		22		23		24		25		26		27		28		29		36						
86	Rb	88	Sr	89	Y	91	Zr	93	Nb	96	Mo	99	Tc	101	Ru	106	Rh	106	Pd	108	Ag	112	Cd	131	Xe				
	Rubidium		Strontium		Yttrium		Zirconium		Niobium		Molybdenum		Technetium		Ruthenium		Rhodium		Palladium		Silver		Cadmium		Xenon				
	37		38		39		40		41		42		43		44		45		46		47		48		54				
133	Cs	137	Ba	139	La	179	Hf	181	Ta	184	W	186	Re	190	Os	192	Ir	195	Pt	197	Au	201	Hg	222	Rn				
	Caesium		Barium		Lanthanum		Hafnium		Tantalum		Tungsten		Rhenium		Osmium		Iridium		Platinum		Gold		Mercury		Radon				
	55		56		57		72		73		74		75		76		77		78		79		80		86				
223	Fr	226	Ra	227	Ac											204	Tl	207	Pb	209	Bi	210	Po	210	At	222	Rn		
	Francium		Radium		Actinium												Thallium		Lead		Bismuth		Astatine		Polonium		Astatine		Radon
	87		88		89												81		82		83		85		84		85		86
Key																													

Key

relative atomic mass

A_r	Symbol	Name	Z
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