Write your name here

Surname	Other names

Scholarship Paper 2025

Subject: Chemistry

Time: 1 Hour

You must have:
Pen, Pencil, Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name.
- Answer the questions in the answer sheets provided**.**
  - *there may be more space than you need.*

Information

- The total mark for this paper is **60**
- 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.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Q1.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about mixtures and compounds.

(a) The table shows some methods used in the separation of mixtures.

Place one tick (✓) in each row to show the best method for each separation.

(2)

	Method			
Separation	**Crystallisation**	**Filtration**	**Fractional distillation**	**Simple distillation**
kerosene from crude oil				
water from potassium nitrate solution				

(b) Rock salt is a mixture of sand and salt.

Salt is soluble in water.
Describe a method to separate the sand and the salt from a sample of rock salt.

(3)

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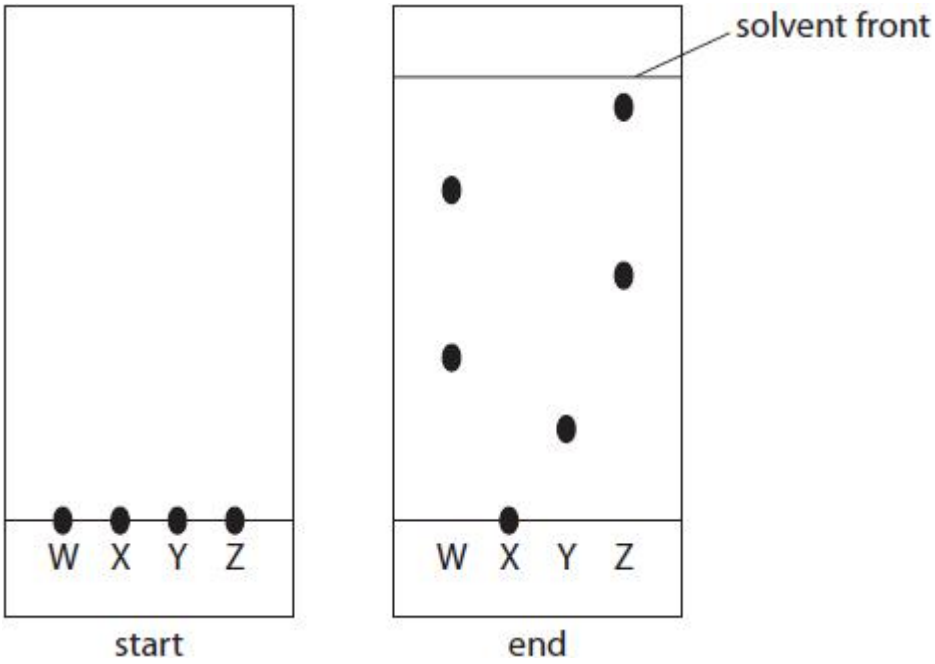
(c) A student uses paper chromatography to separate the dyes contained in food colourings.

The student places spots of four known food colourings, W, X, Y and Z, on the chromatography paper.
The diagram shows the chromatography paper at the start and at the end of the experiment.



(i) Describe how the student should complete the experiment after placing the four spots on the paper.

(3)

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(ii) Describe how the student could determine the R_f value for food dye Y.
Do not include any calculations.

(2)

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(iii) Give a reason why food colouring X does not move during the experiment.

(1)

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(d) A compound has the formula $Al_2(SO_4)_3$

(i) How many different elements are in $Al_2(SO_4)_3$?

(1)

- ☒ **A** 3
- ☒ **B** 4
- ☒ **C** 5
- ☒ **D** 9

(ii) How many atoms are in the formula $Al_2(SO_4)_3$?

(1)

- ☒ **A** 3
- ☒ **B** 10
- ☒ **C** 17
- ☒ **D** 21

(Total for question = 13 marks)

Q2.

This question is about gases.

(a) The table gives information about five gases.

Name of gas	argon	carbon dioxide	hydrogen	oxygen	nitrogen
Formula of gas	Ar	CO_2	H_2	O_2	N_2
***M*, of gas**	40		2	32	28

Use information from the table to answer these questions. Each gas may be used once, more than once or not at all.

(i) Give the name of the gas that is about 79 % of the atmosphere by volume.

(1)

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(ii) Give the name of the gas that is a compound.

(1)

.....

(iii) Give the name of the least reactive gas.

(1)

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(iv) Give the name of the gas that is not normally found in the atmosphere.

(1)

.....

(v) Give the name of the gas that affects global warming.

(1)

.....

(vi) Calculate the M_r for carbon dioxide.

(1)

M_r = ...

(vii) Give a reason why it is not possible to give information for air in the table.

(1)

.....

.....

(b) When copper(II) carbonate is heated, the products are copper(II) oxide and carbon dioxide.

(i) Give the name for this type of reaction.

(1)

.....

(ii) Give the colour change that occurs during this reaction.

(2)

..... to .....

(iii) Give a chemical equation for this reaction.

(1)

.....

(Total for question = 11 marks)

Q3.

This question is about gases.

(a) (i) Name the gas that is about 1% of dry air by volume.

(1)

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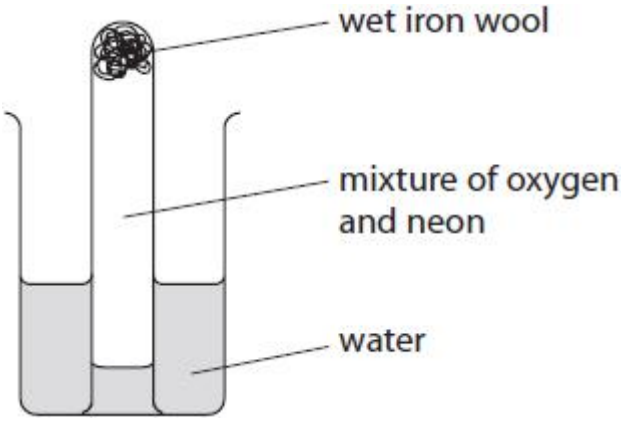
(ii) Which is the most abundant gas in dry air by volume?

(1)

- ☒ **A** carbon dioxide
- ☒ **B** methane
- ☒ **C** nitrogen
- ☒ **D** oxygen

(b) A student uses this apparatus to find the percentage by volume of oxygen in a mixture of oxygen and neon.



This is the student's method.

- measure the initial length of the column of gas in the inverted test tube
- leave the test tube in the beaker for a week
- measure the final length of the column of gas in the test tube

(i) Some of the iron wool rusts.
Give the chemical name for rust.

(1)

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(ii) Give a reason why neon does not react with the iron wool.

(1)

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(iii) The table shows the student's results.

initial length of column of gas	75 mm
final length of column of gas	30 mm

Use the results to calculate the percentage of oxygen in the mixture of oxygen and neon.

(2)

percentage of oxygen = ... %

(Total for question = 6 marks)

Q4.

This question is about Group 1 metals.

(a) (i) Complete the equation for the reaction between sodium and water by adding the state symbols.

(2)

2Na(.....) + $2H_2O$(.....) → 2NaOH(.....) + H_2(.....)

(ii) Give two observations that would be made when a small piece of sodium is added to a large trough containing water.

(2)

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(iii) At the end of the reaction, a few drops of red litmus indicator are added to the trough.

Explain the final colour of the indicator.

(2)

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(b) A small piece of a different Group 1 metal is added to water. The reaction is faster than the reaction of sodium with water, and a lilac flame is seen.

Identify this Group 1 metal.

(1)

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(Total for question = 7 marks)

Q5.

(a) The table shows the number of electrons, neutrons and protons in particles P, Q, R, S, T and V.

particle	number of		
	electrons	neutrons	protons
P	1	0	1
Q	3	4	3
R	8	8	8
S	13	14	13
T	18	16	16
V	18	20	20

(i) Which particle is a negatively charged ion?
Put a cross in the box next to your answer.

(1)

- ☒ **A** P
- ☒ **B** S
- ☒ **C** T
- ☒ **D** V

(ii) Which particles are atoms of metals?
Put a cross in the box next to your answer.

(1)

- ☒ **A** P and R
- ☒ **B** Q and R
- ☒ **C** Q and S
- ☒ **D** Q, S and V

(b) Each element has an atomic number.

(i) State what is meant by **atomic number.**

(1)

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(ii) The atomic number of boron is 5.
Boron exists as two isotopes boron-10 and boron-11.
Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

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(c) (i) Explain what is meant by the term relative atomic mass.

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(2)

(ii) A sample of boron contains
19.7% of boron-10.
80.3% of boron-11.
Use this information to calculate the relative atomic mass of boron.

(3)

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(Total for Question = 10 marks)

Q6.

A student investigates the effect of temperature on the rate of reaction between two solutions, A and B. When the reaction occurs, the mixture turns from colourless to blue.

This is the student's method.

- pour 25 cm^3 of solution A into a conical flask
- add solution B and measure the temperature of the mixture
- record the time taken for the mixture to turn blue

The student repeats this method at different temperatures.

(a) Give two variables that the student needs to keep constant in this investigation.

(2)

1 .....

2 .....

(b) The table shows the student's results.

Temperature in °C	15	20	25	35	45	65
Time taken in seconds	178	156	132	130	122	113

(i) Plot the student's results on the grid.

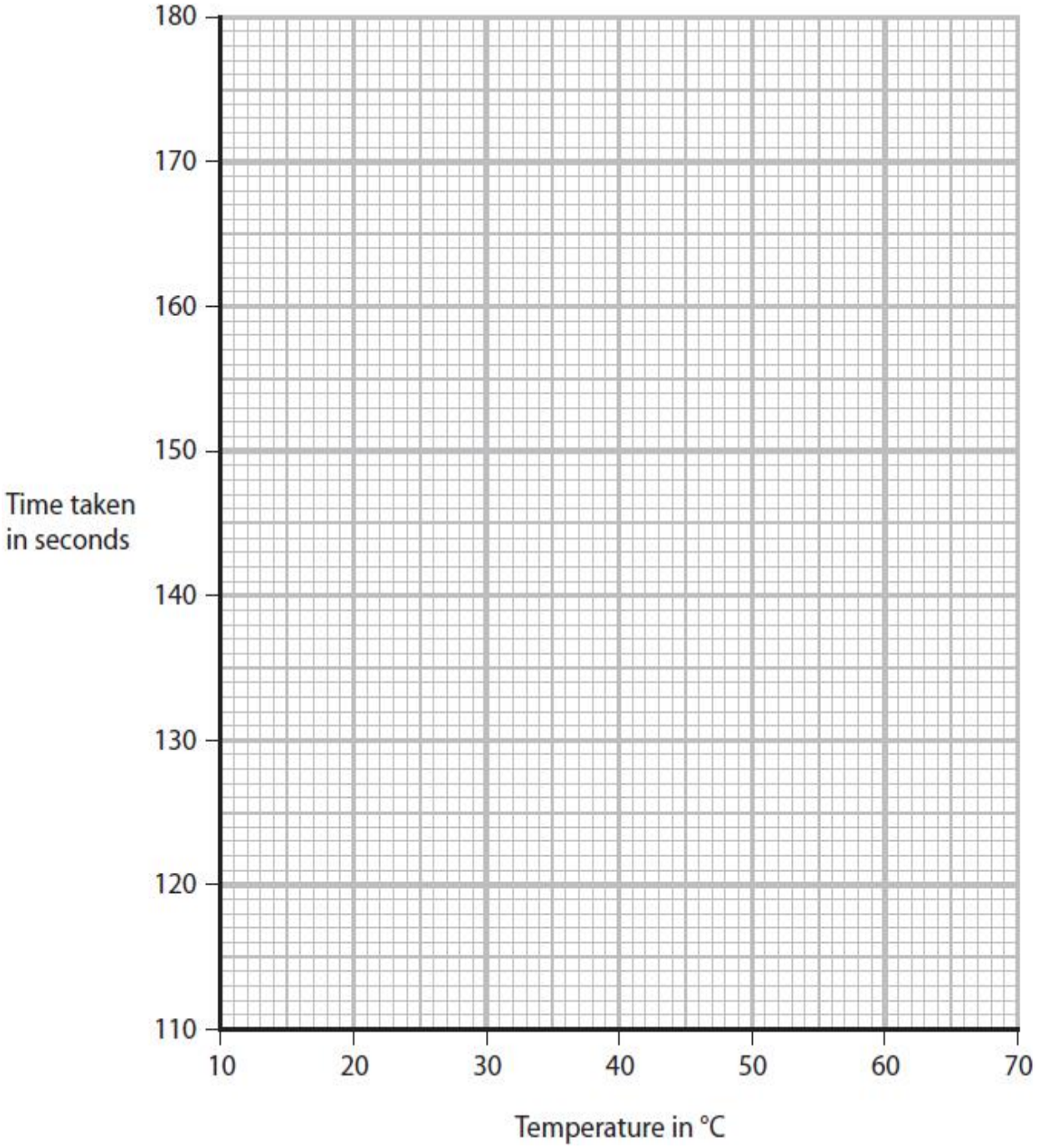
(1)

(ii) Draw a circle around the anomalous result.

(1)

(iii) Draw a curve of best fit.

(1)



(iv) Give a reason for the anomalous result.

(1)

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(v) Use your graph to determine the time taken for the mixture to turn blue at 55 °C. Show your working on the graph.

(2)

time taken = ... s

(c) Use information from the table to calculate the mean rate of reaction at 20 °C.

Use the expression

$$\text{mean rate} = \frac{1}{\text{time in seconds}}$$

Give your answer in standard form.

(2)

mean rate = ... s^{-1}

(d) Explain how increasing the temperature affects the rate of a reaction.

Refer to particle collision theory in your answer.

(3)

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(Total for question = 13 marks)