

Print copy of braille text (UEB)

**[braille page 1]**

WJEC GCSE

3410U10-1

CHEMISTRY – Unit 1:

Chemical Substances, Reactions and Essential Resources

FOUNDATION TIER

FRIDAY, 13 JUNE 2025 – MORNING

1 hour 45 minutes (plus your additional time allowance)

**ADDITIONAL MATERIALS:**

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

**ITEMS INCLUDED WITH QUESTION PAPER**

A separate Diagram Booklet.

A separate Periodic Table.

Bumpers for Question 5 (a) (iii) and Question 6 (b).

**[braille page 2]**

**INSTRUCTIONS TO CANDIDATES**

Write your name, centre number and candidate number on your paper.

Answer ALL questions.

Write your answers on your paper.

**INFORMATION FOR CANDIDATES**

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

Question 7 (a) is a quality of extended response (QER) question where your writing skills will be assessed.

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**[braille page 3]**

Answer ALL questions.

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1. Look at the diagram for Question 1 in the separate Diagram Booklet.

The diagram shows part of the Periodic Table.

(a) **What is** the number of the GROUP in the Periodic Table that contains the element chlorine, Cl?

Choose the correct answer from the following list:

5   6   7

Ans: \_\_\_\_ [1 mark]

(b) **What is** the number of the PERIOD in the Periodic Table that contains the element chlorine, Cl?

Choose the correct answer from the following list:

1   2   3

Ans: \_\_\_\_ [1 mark]

**[braille page 4]**

(c) **What is** the colour of chlorine gas?

Choose the correct answer from the following list:

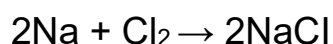
A = green

B = orange

C = blue

Ans: \_\_\_\_ [1 mark]

(d) Sodium metal reacts with chlorine gas to form sodium chloride, **as shown in the equation below.**



(i) **Which** word describes sodium chloride?

Choose the correct answer from the following list:

A = element

B = compound

C = mixture

Ans: \_\_\_\_ [1 mark]

**[braille page 5]**

(ii) Sodium ions in sodium chloride can be identified using a FLAME TEST.

What is the colour of the flame produced by sodium ions in a flame test?

Choose the correct answer from the following list:

A = red

B = yellow

C = green

Ans: \_\_\_\_ [1 mark]

**[braille page 6]**

(e) Sodium reacts with bromine to form sodium bromide.

Choose the correct formula of sodium bromide from the following list:

A = NaBr

B = SBr

C = nabr

D = NaB

Ans: \_\_\_\_ [1 mark]

(Total for Question 1 = 6 marks)

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**[braille page 7]**

2. (a) Look at the diagram for Question 2 (a) in the separate Diagram Booklet.

The diagram shows two tests that identify different gases.

Choose the name of the gas that is being identified by the test in each diagram from the following list:

A = carbon dioxide

B = oxygen

C = hydrogen

Ans: Test (i) gas = \_\_\_\_

Ans: Test (ii) gas = \_\_\_\_

[2 marks]

**[braille page 8]**

(b) The gases in the early atmosphere came from volcanic eruptions.

The table below shows the percentages of some gases in the early atmosphere and today's atmosphere.

| Name of gas    | Percentage of gas (%) |                    |
|----------------|-----------------------|--------------------|
|                | Early atmosphere      | Today's atmosphere |
| oxygen         | 0                     | 21                 |
| water vapour   | 20                    | 0-3                |
| carbon dioxide | 35                    | 0.04               |

**[braille page 9]**

(i) USE ONLY THE INFORMATION IN THE TABLE to complete the following sentence.

Over geological time, the amount of I. \_\_\_\_ in the atmosphere has increased and the amounts of II. \_\_\_\_ and III. \_\_\_\_ have decreased.

Ans: I. \_\_\_\_ II. \_\_\_\_ III. \_\_\_\_ [2 marks]

(ii) Choose the names of TWO processes from the following list, which USE oxygen from the atmosphere.

photosynthesis

sedimentation

respiration

combustion

Ans: \_\_\_\_ and \_\_\_\_ [2 marks]

**[braille page 10]**

(c) Look at the diagram for Question 2 (c) in the separate Diagram Booklet.

The diagram shows a symbol key representing atoms of hydrogen, carbon and oxygen.

The diagram also shows how the symbols could represent a molecule of water, H<sub>2</sub>O.

(i) Look at the diagram for Question 2 (c) (i) in the separate Diagram Booklet. The diagram shows 4 possible ways the symbols could represent a molecule of carbon dioxide,  $\text{CO}_2$

Choose the correct molecule for carbon dioxide.

Ans: molecule \_\_\_\_ [1 mark]

**[braille page 11]**

(ii) Look at the diagram for Question 2 (c) (ii) in the separate Diagram Booklet. The diagram shows another molecule.

Use the key in the diagram for Question 2 (c) to write the formula of this molecule.

Ans: \_\_\_\_ [1 mark]

(Total for Question 2 = 8 marks)

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**[braille page 12]**

3. Lithium, sodium, potassium and rubidium are all Group 1 elements.

(a) What is the name given to the Group 1 elements?

Choose the correct answer from the following list:

A = halogens

B = noble gases

C = alkali metals

Ans: \_\_\_\_ [1 mark]

(b) Look at the diagram for Question 3 (b) in the separate Diagram Booklet. The diagram shows two charts.

The charts show the densities and some of the melting points of the Group 1 elements.

USE ONLY THE INFORMATION IN THE CHARTS to answer the following questions.

**[braille page 13]**

(i) Name the element with the highest density.

Ans: \_\_\_\_ [1 mark]

(ii) Give the state (solid, liquid or gas) of sodium at  $100^\circ\text{C}$ .

Ans: \_\_\_\_ [1 mark]

(iii) **What is** the most likely melting point of potassium?

Choose the correct answer from the following list:

A = 25°C

B = 64°C

C = 106°C

Ans: \_\_\_\_ [1 mark]

**[braille page 14]**

(c) (i) Potassium reacts with oxygen to produce potassium oxide.

Potassium oxide contains the ions  $K^+$  and  $O^{2-}$

**What is** the correct formula of potassium oxide?

Choose the correct answer from the following list:

A = KO

B =  $KO_2$

C =  $K_2O$

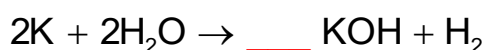
D =  $K_2O_2$

Ans: \_\_\_\_ [1 mark]

**[braille page 15]**

(ii) Potassium reacts with water to produce potassium hydroxide solution and hydrogen gas.

I. Put a number **before KOH below** to balance the equation for this reaction.



Ans: \_\_\_\_ KOH [1 mark]

II. **Which** observation shows that a gas is formed during this reaction?

Choose the correct answer from the following list:

A = potassium floats

B = potassium melts

C = fizzing

D = potassium disappears

Ans: \_\_\_\_ [1 mark]

(Total for Question 3 = 7 marks)

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**[braille page 16]**

4. (a) Look at the diagram for Question 4 (a) in the separate Diagram Booklet. Calcium carbonate reacts with hydrochloric acid to produce a gas which can be collected and measured using the apparatus shown in the diagram.

(i) What is the name of the apparatus labelled A.

Choose the correct answer from the following list:

P = test tube

Q = measuring cylinder

R = beaker

S = evaporating dish

Ans: \_\_\_\_ [1 mark]

(ii) Use the diagram to give the volume of gas collected.

Ans: \_\_\_\_ cm<sup>3</sup> [1 mark]

**[braille page 17]**

(iii) If the experiment is repeated using a higher concentration of acid, the rate of the reaction increases.

Choose words from the list below to complete the following sentence to explain why the rate increases.

energy

particles

collisions

gases

solutions

When the concentration of the acid increases there are more

I. \_\_\_\_ in the same volume and a higher chance of successful II. \_\_\_\_

Ans: I. \_\_\_\_ II. \_\_\_\_ [2 marks]

**[braille page 18]**

(iv) Apart from increasing the concentration of the acid, give another change that will increase the rate of this reaction.

Ans: \_\_\_\_ (1 print line) [1 mark]

(b) In a similar experiment, 48 cm<sup>3</sup> of gas was collected in 2 minutes.

The mean rate of the reaction can be calculated using the following equation.

$$\text{mean rate} = \frac{\text{volume of gas}}{\text{time}}$$

Use the equation to calculate the mean rate of the reaction in cm<sup>3</sup>/s.

**Ans:** Mean rate = \_\_\_\_ cm<sup>3</sup>/s [2 marks]

**[braille page 19]**

(c) Calculate the relative formula mass,  $M_r$ , of calcium carbonate, CaCO<sub>3</sub>

$$A_r(\text{Ca}) = 40$$

$$A_r(\text{C}) = 12$$

$$A_r(\text{O}) = 16$$

**Ans:**  $M_r$  = \_\_\_\_ [2 marks]

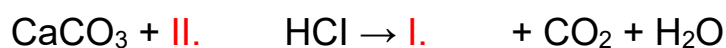
**[braille page 20]**

(d) The word equation for the reaction is as follows:

calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water

Complete the symbol equation for the reaction by

- giving the formula of calcium chloride
- putting a number in front of HCl to balance the equation



**Ans:** I. \_\_\_\_ II. \_\_\_\_ [2 marks]

**[braille page 21]**

(e) Limestone is mainly composed of calcium carbonate. Limestone is quarried on Halkyn mountain in Flintshire.

There are benefits and drawbacks associated with limestone quarrying.

Benefits include the production of an important building material and employment for the local community.

Give ONE drawback of limestone quarrying.

**Ans:** \_\_\_\_ (1 print line) [1 mark]

(f) Look at the diagram for Question 4 (f) in the separate Diagram Booklet.  
The diagram shows the limestone cycle.

(i) Give the chemical name of quicklime,  $\text{CaO}$ .

Ans: \_\_\_\_ [1 mark]

**[braille page 22]**

(ii) Give the name of the substance added to quicklime,  $\text{CaO}$ , to convert it to slaked lime,  $\text{Ca(OH)}_2$

Ans: \_\_\_\_ [1 mark]

(Total for Question 4 = 14 marks)

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**[braille page 23]**

5. The hardness of water can be measured by adding soap solution.

A class investigated the hardness of water from different locations in Wales.

They measured the volume of soap solution needed to create a permanent lather when it was shaken in a flask with samples of water from each location.  
The results are shown in the table below.

| Location    | Volume of soap solution needed to create a permanent lather ( $\text{cm}^3$ ) |        |      |
|-------------|-------------------------------------------------------------------------------|--------|------|
|             | Test 1                                                                        | Test 2 | Mean |
| Abergavenny | 23                                                                            | 27     | 25   |
| Brecon      | 15                                                                            | 14     | 15   |
| Carmarthen  | 53                                                                            | 57     | 55   |
| Holyhead    | 37                                                                            | —      | 35   |
| Wrexham     | 61                                                                            | 58     | 60   |

**[braille page 24]**

(a) (i) Give the MISSING RESULT for Test 2 used to calculate the mean volume for the sample from Holyhead.

Ans: Missing result = \_\_\_\_ cm<sup>3</sup> [1 mark]

(ii) State TWO factors that must be controlled in this investigation.

Ans: Factor 1 \_\_\_\_

Ans: Factor 2 \_\_\_\_

[2 marks]

**[braille page 25]**

(iii) Look at the diagram for Question 5 (a) (iii) in the separate Diagram Booklet. The diagram is an incomplete bar chart.

Complete the bar chart to show the mean volume of soap solution needed to create a permanent lather for the water from each location.

The first bar has been drawn for you.

A spare tactile diagram, bumpons and drawing film are available for this question.

[2 marks]

(iv) Give the location with the hardest water. Explain your answer.

Ans: Location \_\_\_\_

Reason \_\_\_\_ (2 print lines) [2 marks]

(b) Give the name of an ion which causes hard water.

Ans: \_\_\_\_ [1 mark]

**[braille page 26]**

(c) What are the TWO benefits of hard water?

Choose the TWO correct answers from the following list:

A = makes boilers more efficient

B = reduces the risk of heart disease

C = strengthens bones

D = less detergent is needed to wash dishes

E = prevents limescale forming

Ans: \_\_\_\_ and \_\_\_\_ [2 marks]

(Total for Question 5 = 10 marks)

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**[braille page 27]**

6. (a) Look at the diagram for Question 6 (a) in the separate Diagram Booklet. The diagram represents an atom of the element boron.

(i) Complete the sentence below:

The nucleus of the boron atom contains five I. \_\_\_\_ and six II. \_\_\_\_.

Ans: I. \_\_\_\_ II. \_\_\_\_ [1 mark]

(ii) Give the mass number of the boron atom.

Ans: \_\_\_\_ [1 mark]

(iii) Explain why an atom of boron has no overall charge.

Ans: \_\_\_\_ (3 print lines) [2 marks]

**[braille page 28]**

(b) Look at the diagram for Question 6 (b) in the separate Diagram Booklet. The diagram represents an atom of aluminium. The diagram is incomplete. An atom of aluminium has 13 electrons.

Complete the diagram to show the electronic structure of an aluminium atom. A spare tactile diagram and bumpons are provided for this question. [1 mark]

(Total for Question 6 = 5 marks)

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**[braille page 29]**

7. (a) Look at Diagram 1 for Question 7 (a) in the separate Diagram Booklet. Diagram 1 represents the chromatogram produced when the dyes in a purple ink were separated using water as the solvent.

Look at Diagram 2 for Question 7 (a) in the separate Diagram Booklet. Diagram 2 shows two possible ways of setting up the apparatus to produce the chromatogram shown in Diagram 1

Explain why

- chromatography can separate dyes in this way
- set up A rather than set up B would produce the chromatogram shown in Diagram 1

Ans: \_\_\_\_ (12 print lines) [6 QER marks]

**[braille page 30]**

(b) Look at the diagram for Question 7 (b) in the separate Diagram Booklet.

The diagram shows a simplified chromatogram produced in another experiment.

The  $R_f$  value of a dye can be calculated using the equation

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

Measure the distance travelled by dye X and use the equation to calculate its  $R_f$  value.

Ans:  $R_f = \underline{\hspace{1cm}}$  [2 marks]

**[braille page 31]**

(c) Look at the diagram for Question 7 (c) in the separate Diagram Booklet. The diagram shows the apparatus used to separate a mixture of ethanol and water.

Explain why a mixture of ethanol and water is separated when it is heated in this apparatus.

Ans:            (4 print lines) [2 marks]

(Total for Question 7 = 10 marks)

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**[braille page 32]**

8. Look at the diagram for Question 8 in the separate Diagram Booklet.

The diagram represents part of the Periodic Table.

The letters shown are NOT the symbols of the elements.

(a) USE LETTERS FROM THE DIAGRAM to answer parts (i) and (ii).

(i) Give the letters of two elements that have atoms with three electrons in their outer shell.

Ans:        and        [1 mark]

(ii) Give the letter of the element that has atoms with four electron shells.

Ans:        [1 mark]

**[braille page 33]**

(b) Name the element represented by the letter F. Give ONE use of this element.

Ans: Name \_\_\_\_

Ans: Use \_\_\_\_ (1 print line)

[1 mark]

(c) State TWO properties that you would expect element B to have.

Ans: Property 1 \_\_\_\_

Ans: Property 2 \_\_\_\_

[2 marks]

(Total for Question 8 = 5 marks)

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**[braille page 34]**

9. (a) Look at the diagram for Question 9 (a) in the separate Diagram Booklet.

The diagram shows some of the Earth's tectonic plates and the directions in which they are moving.

(i) Give the numbers of two plates which share a CONSTRUCTIVE boundary.

Ans: \_\_\_\_ and \_\_\_\_ [1 mark]

(ii) Describe what happens at a DESTRUCTIVE plate boundary.

Ans: \_\_\_\_ (4 print lines) [2 marks]

**[braille page 35]**

(b) Look at the diagram for Question 9 (b) in the separate Diagram Booklet.

Alfred Wegener proposed that the Earth's continents had once all been joined together in a land mass he called Pangaea and that they had moved apart over time.

He called this the 'theory of continental drift'.

The diagram represents Wegener's theory.

(i) Give TWO pieces of evidence that Alfred Wegener used to support his theory of continental drift.

Ans: Evidence 1 \_\_\_\_ (1 print line)

Ans: Evidence 2 \_\_\_\_ (1 print line)

[2 marks]

(ii) State why Wegener's theory was not initially accepted.

Ans: \_\_\_\_ (2 print lines) [1 mark]

(Total for Question 9 = 6 marks)

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**[braille page 36]**

10. Groundwater is the water found underground in the cracks and spaces in soil, sand and rock.

It is stored in and moves slowly through layers of soil, sand and rocks called aquifers.

Groundwater provides 550 megalitres of the total water needed on average per day in Wales, approximately 5% of the total volume used. Some of the negative ions dissolved in groundwater include carbonate, chloride and sulfate ions.

Groundwater can also contain pollutants which can cause harm to humans if consumed.

Many of these pollutants are natural, such as bacteria and viruses. However, there are now a number of man-made pollutants present in our water supplies, including fertilisers, pesticides and chemicals from industrial and household landfill waste.

**[braille page 37]**

(a) (i) **What is** the approximate total volume of water used daily in Wales.

Choose the correct answer from the following list:

A = 110 megalitres

B = 550 megalitres

C = 11,000 megalitres

Ans: \_\_\_\_ [1 mark]

(ii) Suggest why recycling more industrial chemicals could improve the quality of groundwater.

Ans: \_\_\_\_ (2 print lines) [1 mark]

(iii) Which is the solution that could be used to identify one of the negative ions present in groundwater supplies.

Choose the correct answer from the following list:

A = sodium hydroxide, NaOH

B = silver nitrate, AgNO<sub>3</sub>

C = potassium nitrate, KNO<sub>3</sub>

Ans: \_\_\_\_ [1 mark]

**[braille page 38]**

(b) Look at the diagram for Question 10 (b) in the separate Diagram Booklet.

The diagram shows the stages of treatment of the public water supply when it leaves reservoirs before being distributed to our homes.

The first stage of treatment of the public water supply is sedimentation.

The purpose of sedimentation is to remove large insoluble particles from the water.

Give the purpose of the filtration and chlorination stages of water treatment.

Ans: Filtration \_\_\_\_ (2 print lines)

Ans: Chlorination \_\_\_\_ (2 print lines)

[2 marks]

**[braille page 39]**

(c) (i) In some areas, fluoride is added to water supplies.

Give the reason why fluoride is added to water supplies.

Ans: \_\_\_\_ (1 print line) [1 mark]

(ii) Give ONE reason why some people disagree with the addition of fluoride to water supplies.

Ans: \_\_\_\_ (2 print lines) [1 mark]

**[braille page 40]**

(iii) Fluoride is added to water in compounds such as sodium fluorosilicate,  $\text{Na}_2\text{SiF}_6$

The relative formula mass ( $M_r$ ) of  $\text{Na}_2\text{SiF}_6$  is 188

Calculate the percentage by mass of sodium in  $\text{Na}_2\text{SiF}_6$

$$A_r(\text{Na}) = 23$$

Ans: Percentage = \_\_\_\_% [2 marks]

(Total for Question 10 = 9 marks)

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**TOTAL FOR PAPER = 80 MARKS**

**END OF PAPER**

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