NAME……ADM NO……
DATE……SIGN……

CHEMISTRY GRADE 10
OPENER EXAM TERM 2, 2026
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. ***Write your name, admission number, stream and date in the spaces provided above.***
2. ***This paper consists of TWO sections: Section I and Section II.***
3. ***Answer ALL questions in Section I (40 marks).***
4. ***Answer ALL questions in Section II (40 marks).***
5. ***All working must be shown clearly in the spaces provided.***
6. ***Candidates should check that all pages are printed and no questions are missing.***

SECTION I (40 MARKS)

Answer ALL questions in this section.

1. The Bohr diagrams below show the electron arrangements of three atoms. Study them and answer the questions that follow. **(8 marks)**

(a) State the period and group of each element in the Periodic Table:**(3 marks)**

Element	Proton Number	Period	Group
Sodium (Na)	11		
Chlorine (Cl)	17		
Calcium (Ca)	20		

(b) Write the electron configuration of a Chloride ion (Cl^-). State the noble gas it resembles. **(2 marks)**

(c) State the type of bond formed between sodium and chlorine. Explain how it forms. **(2 marks)**

(d) Which of the three elements has the largest atomic radius? Give a reason. **(1 mark)**

2. The diagram below represents part of the Periodic Table. The letters do not represent the actual symbols of the elements. **(6 marks)**

Gp I	Gp II	Gp III	Gp IV	Gp V	Gp VI	Gp VII	Gp 0
D						E	F
G	H				J	K	

(a) Identify the most reactive metal. Give a reason. **(2 marks)**

(b) Write the formula of the compound formed between element G and element K. **(1 mark)**

(c) Which element is least likely to form chemical bonds? Explain. **(2 marks)**

(d) State the number of electron shells in element H. **(1 mark)**

3. The alkali metals and halogens are two important chemical families in the Periodic Table. **(6 marks)**

(a) State TWO physical properties characteristic of the alkali metals. **(2 marks)**

(b) Complete the word equation for the reaction of sodium with water: **(2 marks)**

Sodium + Water → _____ + _____

State ONE observation made during this reaction.

(c) Explain why the reactivity of halogens **decreases** down Group VII. **(2 marks)**

4. A student set up the experiment below to investigate the percentage of oxygen in air. **(7 marks)**

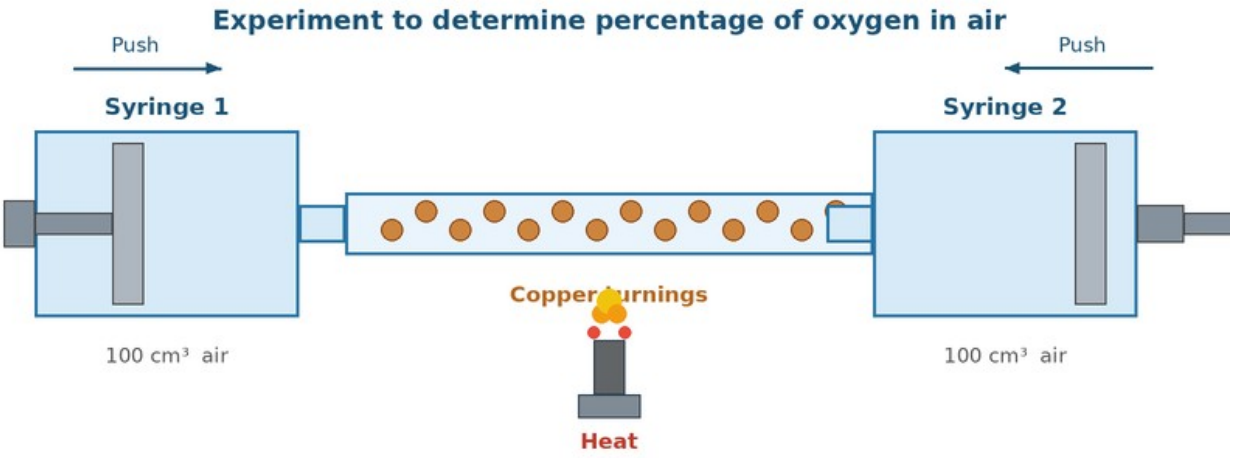


Fig. 4.1 — Experiment to determine percentage of oxygen in air

(a) Write a balanced chemical equation for the reaction that occurs in the tube. **(2 marks)**

(b) After the reaction is complete and the apparatus cooled, the total gas volume decreases from 100 cm³ to 79 cm³.

(i) Calculate the percentage of oxygen in air from this experiment. **(1 mark)**

(ii) Identify the gas that remains in the syringes. State its approximate percentage in air. **(1 mark)**

(c) State the difference between a **flammable** substance and a **combustible** substance. **(2 marks)**

(d) State ONE environmental consequence of incomplete combustion of fuels. **(1 mark)**

5. Study the water cycle diagram below and answer the questions that follow. **(7 marks)**

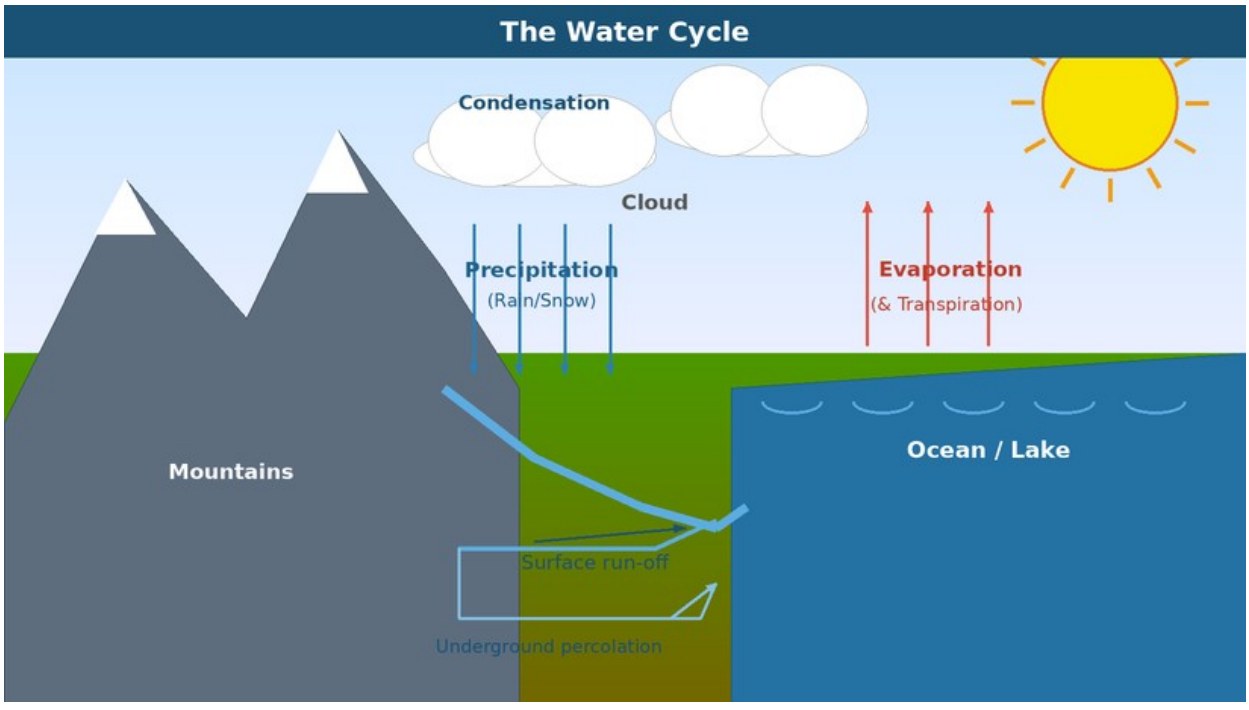


Fig. 5.1 — The Water Cycle

(a) Name TWO processes by which water enters the atmosphere, as shown in the diagram. **(2 marks)**

(b) Hard water contains dissolved calcium and magnesium salts. State the source of these ions in groundwater. **(1 mark)**

(c) Distinguish between **temporary hardness** and **permanent hardness** of water. **(2 marks)**

(d) Name TWO methods used to remove **permanent** hardness from water.**(2 marks)**

6. Study the diagram below showing the laboratory preparation of hydrogen gas and answer the questions that follow. **(6 marks)**

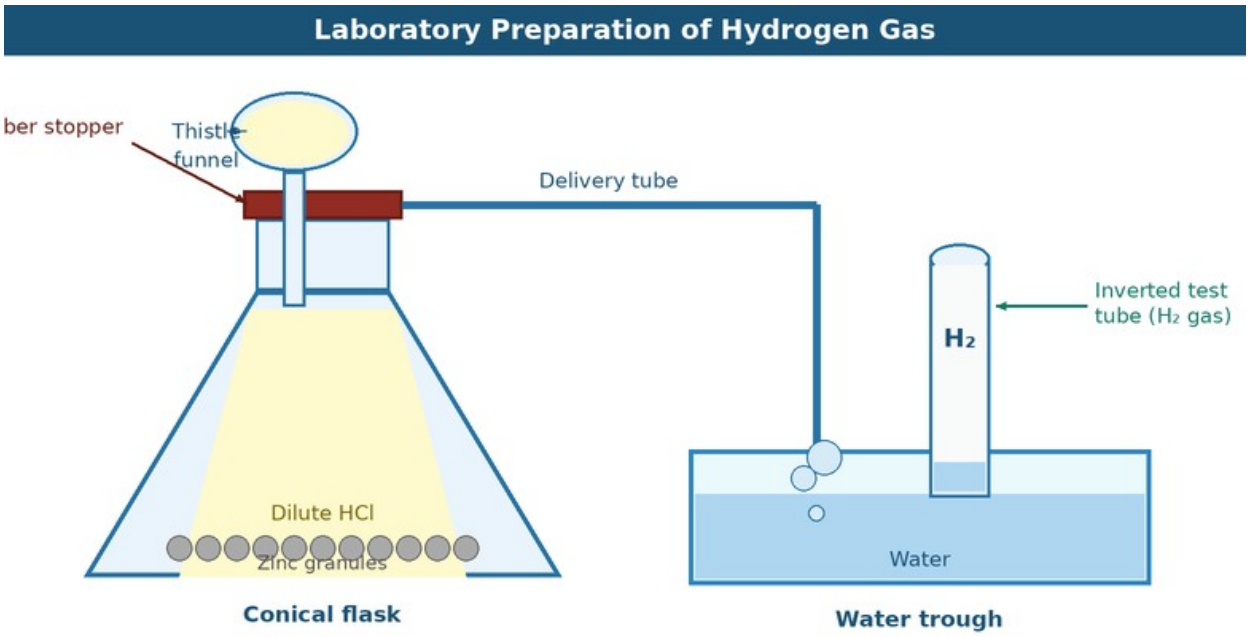


Fig. 6.1 — Laboratory preparation and collection of hydrogen gas

(a) Write a balanced chemical equation for the reaction occurring in the flask. **(2 marks)**

(b) Explain why hydrogen gas can be collected by downward displacement of water. **(2 marks)**

(c) Hydrogen is described as a clean fuel. Explain this statement. **(1 mark)**

(d) State ONE industrial use of hydrogen. **(1 mark)**

SECTION II (40 MARKS)

Answer ALL questions in this section.

7. This question is about atomic structure and isotopes. **(10 marks)**

(a) Define the term **isotopes.** Give one example using isotopic notation. **(3 marks)**

(b) An element X has the following isotopic data:

Isotope	Mass Number	Relative Abundance (%)	Contribution
X–35	35	75%	
X–37	37	25%	

(i) Calculate the relative atomic mass of element X. **(2 marks)**

(ii) Identify element X from the Periodic Table. Give a reason for your answer. **(1 mark)**

(c) Write the electron configurations for the following species and state the Period and Group each belongs to: **(4 marks)**

Species	Electron Configuration	Period	Group
$^{27}_{13}Al$			
$^{32}_{16}S$			

8. This question is about trends in the Periodic Table. **(10 marks)**

(a) State and explain the trend in **atomic radius** across Period 3 from left to right. **(3 marks)**

(b) State and explain the trend in **ionization energy** down Group I (alkali metals). **(3 marks)**

(c) The table below shows some properties of Period 3 elements:

Element	Na	Mg	Al	Si	P	S	Cl
Oxide type	Basic	Basic	Amphoteric	Acidic	Acidic	Acidic	Acidic
Chloride formula	NaCl	$MgCl_2$	$AlCl_3$	$SiCl_4$	PCl_3	SCl_2	Cl_2

(i) State the trend in the type of oxide formed across Period 3 from Na to Cl. **(1 mark)**

(ii) Aluminium oxide is amphoteric. What does this mean? **(1 mark)**

(iii) Write a balanced equation for the reaction of sodium oxide (Na_2O) with water. **(2 marks)**

9. This question is about hardness of water. **(10 marks)**

(a) A student collected two samples: rainwater and borehole water.

(i) Which sample is most likely to be soft water? Explain. **(2 marks)**

(ii) State ONE advantage and ONE disadvantage of hard water. **(2 marks)**

(b) Describe how **temporary hardness** is formed in groundwater. Include a relevant chemical equation. **(3 marks)**

(c) A student tested water samples with soap solution. Complete the table:

Sample	Soap lather before boiling	Soap lather after boiling	Type of hardness
P	Little / none	Good lather	
Q	Little / none	Little / none	
R	Good lather	Good lather	

(i) Identify the type of hardness in each sample P, Q and R. **(3 marks)**

10. This question is about air, combustion and oxides of carbon. **(10 marks)**

(a) Dry air is approximately 78% nitrogen, 21% oxygen and 1% other gases. State TWO ways in which nitrogen is important to living organisms. **(2 marks)**

(b) Complete the table below comparing the properties of the two oxides of carbon: **(3 marks)**

Property	Carbon Monoxide (CO)	Carbon Dioxide (CO_2)
Colour		
Solubility in water		
Effect on limewater		
Toxicity to humans		
Role in combustion		

(c) Carbon dioxide turns limewater milky. Write the ionic equation for this reaction. **(2 marks)**

(d) A student burns magnesium ribbon inside a gas jar of carbon dioxide. Describe what is observed and explain why this shows that carbon dioxide can act as an oxidising agent. **(3 marks)**

END