

NAIROBI SECONDARY SCHOOL

233/2 CHEMISTRY

Paper 2

Form 2 End Term Examination

Time: 2 ½ Hours

Name:

Adm No:

School:

Class:

Signature:

Date:

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and index number in the spaces provided at the top of this page.
- (b) Write your school name, sign and write the date of the examination in the spaces provided above.
- (c) This paper consists of **Two** sections: **Section I** and **Section II**.
- (d) Answer all questions as instructed in each section.
- (e) Marks may be given for correct working, relevant points, and clear presentation.
- (f) Non-programmable silent electronic calculators may be used where necessary.
- (h) This paper consists of **4 printed pages**.
- (i) Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.
- (j) Candidates should answer the questions in English.

For Examiner's Use Only

SECTION I

1	2	3	4	5	6	7	Total

SECTION II

8	9	10	11	12	13	14	15	Total	Grand Total

SECTION I (50 Marks)

Answer **all** questions in this section in the spaces provided.

1.

(12 mks)

(a) (i) Define atomic number. (1 mark) (ii) Define mass number. (1 mark) (iii) Define isotope. (1 mark)
Give one example of isotopes. (1 mark)

(b) Calculate the relative atomic mass of element X. (4 marks)

(c) Explain why isotopes have same chemical but different physical properties. (4 marks)

2. 2. Figure 1 shows a simplified part of the periodic table. Use it to answer the questions that follow.

(12 mks)

Group I	Group II	Group III
Period 2Li	Be	B
Period 3Na	Mg	Al
Period 4K	Ca	Sc

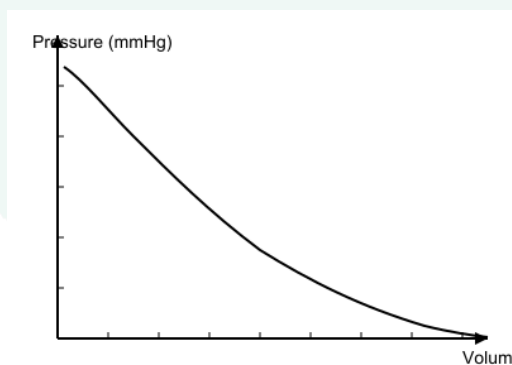
(a) Describe the trend in atomic radius across a period and down a group, with reasons. (3 marks)

(b) Predict which is more metallic: lithium or beryllium. Justify. (3 marks)

(c) Explain the trend in reactivity of metals down Group I using electron configurations. (3 marks)

(d) Identify the most reactive metal in Figure 1 and explain. (3 marks)

3. 3. Figure 2 shows the relationship between pressure and volume of a fixed mass of gas at constant temperature. (12 mks)



(a) State Boyle's law, give its mathematical expression, and explain using kinetic theory. (4 marks)

(b) Calculate the new volume when pressure changes from 760 mmHg to 950 mmHg. (4 marks)

(c) Calculate the volume at 127°C given volume 400 cm³ at 27°C. (4 marks)

4. (b) Write a balanced chemical equation for the reaction of sulphur dioxide with water. Identify the acid formed. Describe a simple test that can be used to confirm the presence of this acid. (4 marks) (c) Give two industrial uses of sulphur dioxide. For each use, explain the property that makes it suitable for that use. (4 marks) [Total: 12 marks] (12 mks)

(a) Describe four physical properties of sulphur dioxide. (4 marks)

(b) Write the equation for reaction with water, identify the acid, and describe a test. (4 marks)

(c) Give two industrial uses of sulphur dioxide and explain why it is used in each case. (4 marks)

5.

(12 mks)

(a) Word equation, balanced equation and products for reaction of chlorine with water. (4 marks)

(b) Explanation of bleaching action, condition needed, and equation. (4 marks)

(c) Laboratory preparation of chlorine: reagents, conditions and labelled diagram. (4 marks)

6.

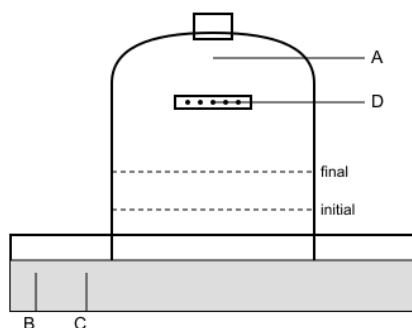
(10 mks)

(a) Dot-and-cross diagram for NaCl, electron transfer, and charges on ions. (4 marks)

(b) Dot-and-cross diagram for water, H₂O. (3 marks)

(c) Compare ionic and covalent compounds: melting point and electrical conductivity. (3 marks)

7. 7. Figure 3 shows an apparatus that can be used to determine the percentage of oxygen in air using iron filings. (10 mks)



(a) (i) Name parts A, B, C, D. (2 marks) (ii) Describe procedure. (1 mark) (iii) Explain observations. (1 mark)

(b) State conditions for rusting and write equation. (3 marks)

(c) Suggest two methods of preventing rusting with explanations and examples from Kenya. (3 marks)

233/2 CHEMISTRY MARKING SCHEME

Form 2 Paper 2

SECTION I (50 marks)

1.

(12 marks)

- (a)(i) B1: Atomic number is the number of protons in the nucleus of an atom. (1)
 - (a)(ii) B1: Mass number is the total number of protons and neutrons in the nucleus of an atom. (1)
 - (a)(iii) B1: Isotopes are atoms of the same element with the same atomic number but different mass numbers (different numbers of neutrons). (1)
 - (a)(iv) B1: Example: chlorine-35 and chlorine-37 OR carbon-12 and carbon-14. (1)
 - (b) M1: Relative atomic mass = $\Sigma(\text{isotopic mass} \times \text{relative abundance}) / 100$. (1)
 - (b) A1: Substitution: $(63 \times 70) + (65 \times 30)$ over 100. (1)
 - (b) A1: Numerator: $4410 + 1950 = 6360$. (1)
 - (b) A1: Final answer: 63.6 (accept 63.60). (1)
 - (c) B1: Chemical properties depend on the electron configuration; isotopes have the same number of electrons/protons. (1)
 - (c) B1: Same electronic arrangement gives the same chemical behaviour. (1)
 - (c) B1: Physical properties depend on atomic mass; isotopes have different masses/neutron numbers. (1)
 - (c) B1: Hence density, boiling/melting point, and rate of diffusion differ. (1)
- Alt:
- In (b), using fractional abundances: $0.70 \times 63 + 0.30 \times 65 = 63.6$.
 - In (c), 'same electronic configuration' is acceptable for same chemical properties; 'different relative atomic masses' for different physical properties.
 - Other isotope examples: oxygen-16 and oxygen-18, or hydrogen-1 and hydrogen-2.

2. 2. Figure 1 shows a simplified part of the periodic table. Use it to answer the questions that follow.

(12 marks)

- (a) B1: Across a period, atomic radius decreases. (1)
- (a) B1: Down a group, atomic radius increases. (1)
- (a) B1: Explanation: across a period, nuclear charge increases pulling electrons closer; down a group, extra electron shells are added. (1)
- (b) B1: Lithium is more metallic than beryllium. (1)
- (b) B1: Li is in Group I and has one outer electron. (1)

- (b) B1: The outer electron is more easily lost because it is less tightly held (lower nuclear charge / less ionisation energy). (1)
- (c) B1: Reactivity of Group I metals increases down the group. (1)
- (c) B1: Atomic radius increases and shielding increases. (1)
- (c) B1: The outer electron is farther from the nucleus and is lost more easily. (1)
- (d) B1: Potassium (K). (1)
- (d) B1: It is at the bottom of Group I in the figure. (1)
- (d) B1: It has the largest atomic radius / outermost electron is most easily lost. (1)

Alt:

- In (a), use specific elements: Li to Be radius decreases; Li to Na to K radius increases.
- In (b), accept 'metallic character decreases across a period' as justification.
- In (d), if the extract shows only Group I/II elements, potassium is still the correct answer.

3. 3. Figure 2 shows the relationship between pressure and volume of a fixed mass of gas at constant temperature. (12 marks)

- (a) B1: Boyle's law: For a fixed mass of gas at constant temperature, pressure is inversely proportional to volume. (1)
- (a) B1: Mathematical expression: $P_1V_1 = P_2V_2$ or $PV = \text{constant}$. (1)
- (a) B1: Kinetic theory: When volume is reduced, particles collide with the container walls more frequently. (1)
- (a) B1: More frequent collisions lead to an increase in pressure. (1)
- (b) M1: Use $V_2 = P_1V_1/P_2$. (1)
- (b) A1: Substitution: $V_2 = (760 \times 250) / 950$. (1)
- (b) A1: Calculation: $190000 / 950 = 200$. (1)
- (b) A1: Correct unit: 200 cm^3 . (1)
- (c) M1: Convert Celsius to Kelvin: $27^\circ\text{C} = 300 \text{ K}$, $127^\circ\text{C} = 400 \text{ K}$. (1)
- (c) B1: Charles's law: $V_1/T_1 = V_2/T_2$. (1)
- (c) M1: $V_2 = V_1 \times T_2/T_1 = 400 \times 400 / 300$. (1)
- (c) A1: $V_2 = 533.3 \text{ cm}^3$ (accept 533 cm^3). (1)

Alt:

- In (b), using $P_1V_1 = P_2V_2$: $760 \times 250 = 950 \times V_2$, $V_2 = 200 \text{ cm}^3$.
- In (c), using the combined gas law at constant pressure gives the same result.
- Accept 533 cm^3 if rounded to three significant figures.

4. (b) Write a balanced chemical equation for the reaction of sulphur dioxide with water. Identify the acid formed. Describe a simple test that can be used to confirm the presence of this acid. (4 marks) (c) Give two industrial uses of sulphur dioxide. For each use, explain the property that makes it suitable for that use. (4 marks) [Total: 12 marks]

- (a) B1: Colourless gas. (1)
- (a) B1: Pungent/choking smell. (1)
- (a) B1: Denser than air. (1)
- (a) B1: Very soluble in water. (1)
- (b) B1: Equation: $\text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{SO}_3(\text{aq})$. (1)
- (b) B1: Acid formed: sulphurous acid (H_2SO_3). (1)
- (b) B1: Test: blue litmus paper turns red. (1)
- (b) B1: Universal indicator shows pH below 7. (1)
- (c) B1: Use 1: manufacture of sulphuric acid (Contact process). (1)
- (c) B1: Reason: SO_2 is the raw material / oxidised to SO_3 . (1)
- (c) B1: Use 2: bleaching of straw/wood pulp/textiles. (1)
- (c) B1: Reason: SO_2 is a reducing agent / bleaches by reduction. (1)

Alt:

— In (b), any other correct acid test, e.g., addition of magnesium ribbon produces effervescence.

— In (c), alternatives: preservation of dried fruits (kills bacteria/fungi); refrigerant (easily liquefied).

— Physical properties may include 'poisonous' or 'can be liquefied under pressure'.

5. (12 marks)

- (a) B1: Word equation: chlorine + water $\rightarrow$ hydrochloric acid + hypochlorous acid. (1)
- (a) B1: Balanced equation: $\text{Cl}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCl}(\text{aq}) + \text{HOCl}(\text{aq})$. (1)
- (a) B1: Products: hydrochloric acid and hypochlorous acid. (1)
- (a) B1: Correct balancing and state symbols. (1)
- (b) B1: Chlorine bleaches only in the presence of moisture (damp conditions). (1)
- (b) B1: Chlorine reacts with water to form hypochlorous acid (HOCl). (1)
- (b) B1: HOCl decomposes to give nascent oxygen: $\text{HOCl}(\text{aq}) \rightarrow \text{HCl}(\text{aq}) + [\text{O}]$. (1)