

**CATHOLIC SCHOOLS NORTHERN ZONE
FORM FOUR JOINT EXAMINATION**

032/1

CHEMISTRY 1

Time: 3:00 Hours

Year: 2025

Instructions

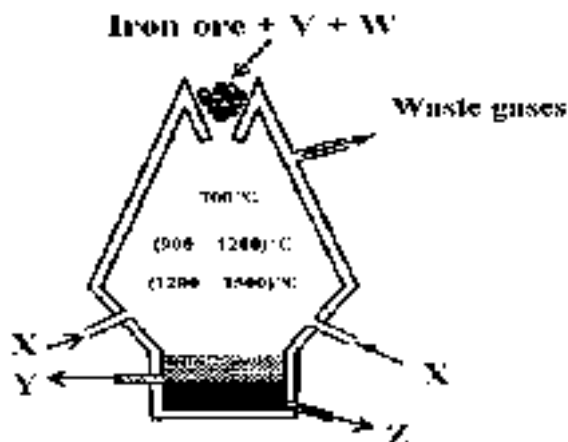
1. This paper consists of sections **A**, **B** and **C** with a total of **eleven (11)** questions.
2. Answer all questions in section **A** and **B** and **two (2)** questions from section **C**.
3. The following constants may be used;
 - GMV at STP = $22400 \text{ cm}^3 = 22.4 \text{ dm}^3$
 - 1 Faraday = 96,500 C
 - 1 Litre = $1 \text{ dm}^3 = 1000 \text{ cm}^3$
 - Atomic masses: H = 1, C = 12, N = 14, O = 16, Na = 23, Al = 27, S = 32, Cl = 35.5, K = 39, Ca = 40, Mn = 55, Fe = 56, Cu = 63.5, Zn = 65, Br = 80

SECTION A (16 Marks)

Answer all questions in this section.

1. For each of the items (i) - (x), choose the most correct answer from the given alternatives and write its letter beside the item number in the answer sheets provided.
 - (i) Ionic compounds do not conduct electricity in solid state. This is due to;
A. Absence of oppositely charged ions in solid state
B. Absence of mobile ions in solid state.
C. Absence of force of attraction between ions in solid state.
D. Absence of free electrons in solid state.
 - (ii) Which property is common among Na^+ , F^- and Mg^{2+} ions?
A. Size B. Ionization energy C. Electronic configuration D. Nuclear charge
 - (iii) Which among the following has minimum molarity?
A. 20 g of NaOH in 100 cm^3 of solution C. 14 g of HCl in 100 cm^3 of solution
B. 30 g of H_2SO_4 in 500 cm^3 of solution D. 37 g of $\text{Ca}(\text{OH})_2$ in 2 dm^3 of solution
 - (iv) In the Down's cell, the substance considered as a by-product is;
A. Oxygen B. Chlorine C. Sodium D. hydrogen
 - (v) Relation between electrochemical equivalent (e) and equivalent weight (E) is given by:
A. $E = \frac{e}{96500}$ B. $E = \frac{96500}{e}$ C. $e = \frac{E}{96500}$ D. $e = \frac{\text{valency}}{96500}$
 - (vi) One mole of ethyne on complete combustion gives:
A. Two moles of carbon monoxide and one mole of water.
B. Four moles of carbon dioxide and one mole of water.
C. Two moles of carbon dioxide and two mole of water.
D. Two moles of carbon dioxide and one mole of water.

- (vii) In the extraction of sulphur by Frasch process, water remain liquid at 170 °C while the boiling point of water is 100 °C. This is due to;
 A. High temperature B. High pressure. C. Low volume D. Low pressure.
- (viii) The diagram below illustrates the extraction of iron in the blast furnace.



The reaction at 700 °C and the mass of iron produced by 100 kg of the major ore are respectively;

- A. $\text{CO}_2(g) + \text{C}(s) \longrightarrow 2\text{CO}(g)$ and 70 kg
 B. $\text{Fe}_2\text{O}_3(s) + 3\text{CO}(g) \longrightarrow 2\text{Fe}(l) + 3\text{CO}_2(g)$ and 100 kg
 C. $\text{Fe}_2\text{O}_3(s) + 3\text{CO}(g) \longrightarrow 2\text{Fe}(l) + 3\text{CO}_2(g)$ and 70 kg
 D. $\text{C}(s) + \text{O}_2(g) \longrightarrow \text{CO}_2(g)$ and 100 kg
- (ix) Consider the reaction: $\text{Zn}(s) + 2\text{HCl}(aq) \longrightarrow \text{ZnCl}_2(aq) + \text{H}_2(g)$
 Which of the following increases the rate of production of zinc chloride?
 A. Decreasing the amount of HCl C. Increasing the volume of hydrogen
 B. Increasing the concentration of zinc D. Increasing the surface area of zinc
- (x) Increase in temperature cause increase in solubility of many salts. The solubility of 5 g potassium nitrate in 40 cm³ of water at 8 °C is;
 A. 200 g/100 grams of water C. 8 g/100 grams of water
 B. 45 g/100 grams of water D. 12.5 g/100 grams of water

2. Match the type of fertilizers and manures in **List A** with their corresponding composition in **List B** by writing the letter of the correct response beside the item number.

List A	List B
(i) Straight fertilizer.	A. Excreta of worms and other microorganisms.
(ii) Farmyard manure.	B. Green plant materials.
(iii) Complete fertilizer.	C. Decayed organic matter such as animal waste and plant residues
(iv) Vermi-compost manure.	D. (37:0:0), example sulphate of ammonia (SA)
(v) Compound fertilizer.	E. (12-11-18), example YaraMila
(vi) Compost manure.	F. Waste of farm animals.
	G. (42:18:0), example Diammonium phosphate

SECTION B (54 Marks)
Answer all questions in this section.

3. (a) (i) Give two ways of handling wood apparatuses during experiment.
(ii) Why luminous flame is more visible than non-luminous flame? Explain
(iii) State the role of each factor that affects the problem during scientific study.
- (b) (i) "All pure substances are homogeneous. But, all homogeneous substances are not pure". Justify
(ii) Give three (3) differences between evaporation and boiling.
4. (a) (i) What is the basic difference between Mendeleev's periodic table and modern periodic table?
(ii) Why it is not possible to displace fluorine from metallic fluorides by any other halogen. Explain
(iii) Why distilled water is not suitable for drinking? Give two reasons
- (b) (i) How is oxygen gas prepared from air? Explain briefly
(ii) Give two limitations of solar energy.
5. (a) Give reason for each of the following:
(i) Boiling is useless in eliminating permanent hardness of water.
(ii) Hard water boils at a temperature above 100 °C.
(iii) Boiling lowers electrical conductivity of temporary hard water.
(iv) Soap does not form lather with hard water at first but eventually forms the lather.
(v) Hardness of water is not a problem to plants.
- (b) (i) Give limitations of distillation and addition of lime water (calcium hydroxide) as methods for treating hard water.
(ii) Formation of temporary hardness in water and its removal by boiling are reverse processes. Use chemical equations to explain the validity of this statement.
6. (a) Give reason for each of the following:
(i) Electrolysis of dilute sodium chloride solution is simply the electrolysis of water.
(ii) The blue colour of the solution fades with time during electrolysis of copper(II) sulphate solution using carbon electrodes.
(iii) The ratio of the volume of oxygen to that of hydrogen collected during electrolysis of dilute sulphuric acid is not exactly 1:2.
- (b) (i) A current of 2A was passed through a solution of divalent metal **B** for three minutes. If 0.1184 g of the metal **B** was deposited at cathode, identify the metal.
(ii) A chemistry student performed an experiment to produce a gas that relights a glowing splint by decomposing a compound using electricity. She allowed a steady current of 6.0 A to flow through the solution for three hours. Calculate the volume of the gas produced at STP and the current that could be used to produce 12.36 dm³ of the gas.

7. (a) (i) The thermochemical reaction was studied and found that the total energy for bond breaking was less than the total energy for bond formation. State with reason whether the reaction was exothermic or endothermic.
- (ii) Draw the energy level diagram for the following reaction.
- $$2\text{C}(g) + \text{H}_2(g) \longrightarrow \text{C}_2\text{H}_2(g) \quad \Delta H = +53 \text{ kJ/mol}$$

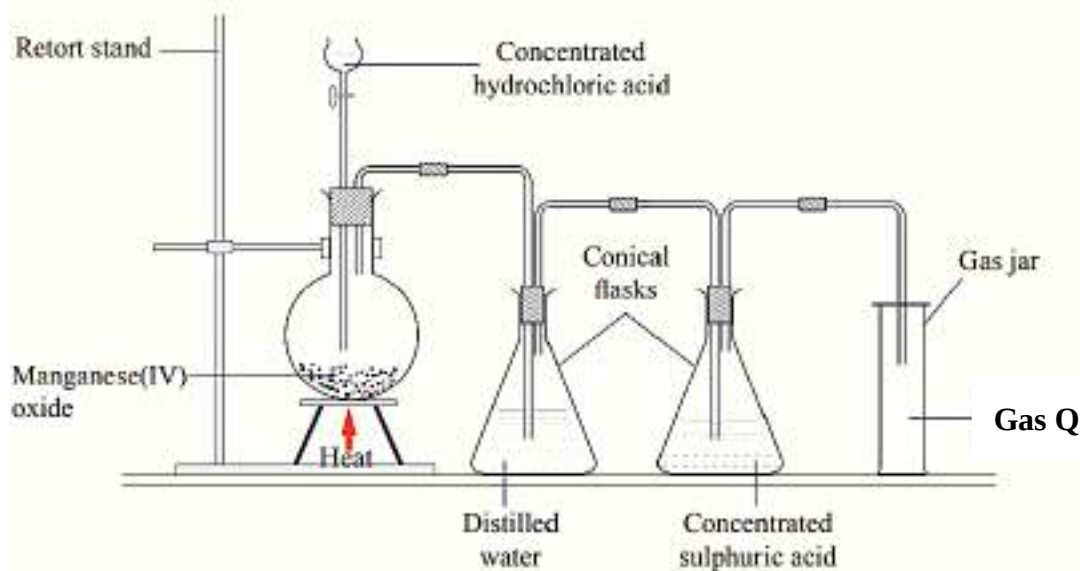
- (b) The following equilibrium is set up in solution by dissolving cobalt(II) chloride crystals in water to form the pink species, $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and then adding concentrated hydrochloric acid until the solution becomes blue.



- (i) Does the reaction cease when the solution becomes blue? Explain
- (ii) The forward reaction is endothermic. State and explain the colour change observed on cooling the reaction mixture.
- (iii) Mention two ways of reversing the change caused by cooling the reaction.

8. (a) Distinguish between rhombic sulphur and monoclinic sulphur basing on the following:
- (i) Shape (ii) Melting point (iii) Density

- (b) The set-up below represents the preparation of gas **Q** in the laboratory. Study it carefully and use it to answer the subsequent questions



- (i) Write an equation for the production of gas **Q**.
- (ii) Which method is suitable for collecting gas **Q**? Explain
- (iii) State the roles of distilled water and concentrated sulphuric acid in the set-up.
- (iv) Can gas **Q** be collected over water? Explain
- (v) Determine the volume of gas **Q** at STP that can be collected using 8.7 g of MnO_2 .

SECTION C (30 Marks)
Answer two questions from this section.

9. (a) A form four student planned to prepare a 0.45 M HNO_3 solution by mixing 100 cm^3 of 0.30 M HNO_3 solution and $V \text{ cm}^3$ of 0.50 M HNO_3 solution. Determine the value of V .
- (b) A dry cleaning solvent with molecular mass 147 containing C, H, and Cl was suspected to be a cancer-causing agent. When 0.250 g of the sample was studied by combustion analysis, 0.451 g of CO_2 and 0.0617 g of H_2O produced. Find its molecular formula.
- (c) 10.8 g of aluminium reacts with 35.5 g of chlorine gas to produce aluminium chloride.
- Which reactant is the limiting reagent and which reactant is present in excess?
 - How much grams of the product is produced?
10. (a) 0.2 g of impure iron sample reacted with 27 cm^3 of 0.3 M HCl solution to form iron(III) chloride and hydrogen gas. Calculate the percentage purity of iron.
- (b) Exactly 15.80 cm^3 of 0.3M HCl solution was enough to neutralize 25 cm^3 of sodium carbonate solution prepared by dissolving 6.78 g of hydrated salt $\text{Na}_2\text{CO}_3 \cdot X\text{H}_2\text{O}$ in a 250 cm^3 of solution. Find the value of X in the hydrated salt.
- (c) 3.552 g of divalent metal hydroxide $\text{A}(\text{OH})_2$ was made up to 1000 cm^3 . 25 cm^3 of this solution required 30 cm^3 of 0.04 M sulphuric acid for complete neutralization. Find atomic mass of element **A** and provide its IUPAC name.
11. (a) Give reason for each of the following:
- Ethanoic acid has high boiling point than ethanol.
 - Increase in size of alkyl group lowers the solubility of carboxylic acids in water.
 - Ethane has no action with lime water but affects it when it is burning.
 - The first three members of alkane have no isomers.
- (b) The molar ratio of carbon dioxide and water produced by combustion of one mole of a hydrocarbon **T** (C_xH_y) is 5:4.
- Write the structures of two linear isomers of **T** and provide their IUPAC names.
 - Explain using chemical equation, whether the hydrocarbon **T** will show positive or negative test for unsaturation.
- (c) A compound **P** on hydrolysis produces a gas **Y** which on hydrogenation produces a gas **Z** which can decolorize bromine water forming a compound with molecular weight 188.
- Identify **P**, **Y** and **Z** and write their structures.
 - Write a balanced chemical equation for the formation of gas **Y**.
- (d) A farmer was advised to supply 160 kilogram of nitrogen on her maize farm. How many bags of urea fertilizer, $\text{CO}(\text{NH}_2)_2$ each containing 25 kilogram she must buy in order to meet the farm demand?
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