OFFICE OF THE DEPUTY VICE CHANCELLOR

ACADEMICS, STUDENT AFFAIRS AND RESEARCH

# UNIVERSITY EXAMINATIONS

# 2023/2024 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR

EXAMINATION

## FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

**COURSE CODE:** CHE 110

**COURSE TITLE:** FUNDAMENTALS OF CHEMISTY

**DATE:** **TIME:**

INSTRUCTION TO CANDIDATES

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## REGULAR – MAIN EXAM

**CHE 110: FUNDAMENTALS OF CHEMISTRY**

**STREAM: BED (Science)** **DURATION: 3 Hours**

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**INSTRUCTIONS TO CANDIDATES**

i. *Answer **ALL** questions.*

ii. *Diagrams may be used whenever they serve to illustrate the answer.*

**Question One (17 Marks)**

a. Define the following terms

i. Wave function (1 Mark)

ii. Aufbau principle (1 Mark)

iii. Dipole moment (1 Mark)

iv. Polar covalent bond (1 Mark)

v. Mass number (1 Mark)

vi. Electron affinity (1 Mark)

vii. Bond length (1 Mark)

b. State any three postulates of Dalton's atomic theory (3 Marks)

c. Describe the Rutherford model of the atom (5 Marks)

d. Explain two limitations of the Bohr model of the atom (2 Marks)

**Question Two (13 Marks)**

a. Differentiate between constructive and destructive interference (2 Marks)

b. State Le Chatelier's principle (2 Marks)

c. What is hydrogen bond? (1 Mark)

d. An aqueous solution of an acid contains 3.14 g of XCOOH in 200 $cm^3$. 25 $cm^3$ of this acid solution was neutralized by 21.5 $cm^3$ of 0.207 M solution of sodium hydroxide solution. Calculate the

i. Formula mass of the acid (3 Marks)

ii. Relative mass of X in the acid (2 Marks)

(C = 12; H = 1)

e. Explain why ethanol exists as a liquid at room temperature with a boiling point of 78°C whereas diethyl ether has a boiling point of 34°C yet both have the same molecular formular (2 Marks)

Define the term resonance (1 Mark)

**Question Three (15 Marks)**

a. Draw the Lewis structures for each of the following molecules

i. Methane (1 Mark)

ii. Methanol (1 Mark)

iii. Ammonia (1 Mark)

iv. Phosphine (1 Mark)

v. Phosphorus pentachloride (1 Mark)

b. Explain the following trends in the periodic table

i. Fluorine is more electronegative than Sulphur (2 Marks)

ii. Rubidium is more reactive than lithium (2 Marks)

iii. Atomic radius decreases across the period (2 Marks)

iv. Atomic radius increases down the group (2 Marks)

v. Fluorine and chlorine are gases, bromine is a liquid whereas iodine is a solid (2 Marks)

**Question Four (14 Marks)**

a. A 30 $cm^3$ of 2 M hydrochloric acid completely reacted with 5.0 g of impure zinc carbonate. Calculate the percentage purity of zinc carbonate in the mixture. (3 Marks)

(Zn = 65; C = 12 O = 16)

b. How many cubic centimeters of hydrogen chloride gas at STP would be required to precipitate all the silver ions from 32 $cm^3$ of 0.08 M silver nitrate solution? (2 Marks)

c. State the following gas laws

i. Boyle's law (1 Mark)

ii. Gay Lussac's law (1 Mark)

iii. Avogadro's law (1 Mark)

d. Write the electronic configuration of each of the following chemical species

i. $Al^{3+}$ (1 Mark)

ii. $Na^{+}$ (1 Mark)

e. State the kinetic theory of matter and hence explain why ice has a definite shape whereas water doesn't have a definite shape but takes the shape of the container (3 Marks)

f. What are isotopes? (1 Mark)

**Question Five (11 Marks)**

a. State the shapes of the following molecules

i. Water (1 Mark)

ii. Beryllium dichloride (1 Mark)

iii. Ammonia (1 Mark)

b. On the basis of Le Chatelier's principle, explain the effect of each of the following on the position of a system at equilibrium

i. Temperature (2 Marks)

ii. Pressure (2 Marks)

iii. Presence of a catalyst (2 Marks)

iv. Concentration (2 Marks)

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