UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER
SPECIAL/SUP EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 117

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY

DATE:4/8/2023 **TIME:** 2:00-4:00PM

INSTRUCTIONS TO CANDIDATES:

TIME: 2 HOURS

ANSWER **QUESTION ONE** AND **ANY TWO** OF THE REMAINING

QUESTION ONE (30MARKS)

1. (a) In cold cathode tubes, the electric discharge in gas has three regions, with distinct current-voltage characteristics: Name the three regions **(3 MARKS)**

(b) Briefly explain how cathode rays are formed **(3 MARKS)**

(c) Who discovered the electrons and what was the original name given to the electrons? **(2 MARKS)**

(d) i) Define the term isotope **(1 MARK)**

ii) State any three uses of isotopes **(3 MARKS)**

(e) According to valence bond theory, two or more atomic orbitals on a central atom in a molecule "mix" to form an equal number of hybrid orbitals. What is the orbital hybridization of central atom in the following compounds **(2 marks)**

a) CH_4
b) BeF_2

(f) What experiment proved a small dense positively charged nucleus, and who did it? **(2 MARKS)**

(g) State any two postulates of Bohr's atomic model **(2 MARKS)**

(h) (I) explain the following as used in this course

i. Hund's rule
ii. Aufbau's principle
iii. Pauli's exclusion principle **(3 MARKS)**

(II) Write the electronic configuration of the following atoms using the orbitals (s,p,d,f) **(4 MARKS)**

i. Sulphur (16)
ii. Potassium (19)
iii. Copper (29)
iv. Nitrogen (7)

(i) Distinguish between ionic bonding and covalent bonding **(2 MARKS)**

(j) Valence bond theory and molecular orbital theory share many assumptions, but also differ in many ways. State the three similarities between them **(3 MARKS)**

QUESTION TWO (20 MARKS)

(2) (I) (a) Briefly describe the Rutherford Atomic model experiment **(5 MARKS)**

(b) Based on the observations made during the experiment, state the three conclusions he made **(3 MARKS)**

(c) State the four postulates of the Rutherford atomic model based on observations and conclusions **(4 MARKS)**

(II) (a) State the modern periodic Law **(1 MARK)**

(b) What is the basic difference in approach between the Mendeleev's and the Modern Periodic Law? **(2 MARKS)**

(c) Using alkali metals as an example explain the cause of periodicity in the modern periodic table **(3 MARKS)**

(d) Name all the blocks contained in the modern periodic table **(2 MARKS)**

QUESTION THREE (20 MARKS)

(I) State Hess's law **(2 marks)**

(II) Calculate the enthalpy for this reaction **(3 marks)**

$2C_{(s)} + H_{2(g)} \rightarrow C_2H_2 \ \Delta H° = ??? \ kJ$

Given the following thermochemical equations

$C_2H_{2(g)} + \frac{5}{2}O_{2(g)} \rightarrow 2CO_{2(g)} + H_2O_{(\ell)} \ \Delta H° = -1299.5 \ kJ$

$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)} \ \Delta H° = -393.5 \ kJ$

$H_{2(g)} + ½O_{2(g)} \rightarrow H_2O_{(\ell)} \ \Delta H° = -285.8 \ kJ$

(III) (a) State Lechatelier's principle **(1 mark)**

(b) Using the equation below

$N_{2\,(g)} + 3H_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)}$ ΔH-ve

Explain the effect of the following on the position of the equilibrium

i. Increase in pressure **(2 marks)**
ii. Decrease in temperature **(2 marks)**

(IV) Using Hund's diagram explain whether the following elements are paramagnetic or diamagnetic **(3 marks)**

i. Chromium(24)
ii. Zinc(30)
iii. Iron(26)

(V) Using Aufbau building principle, explain why 4S orbital is filled with electrons before the 3d orbital **(2 marks)**

(VI) The solubility product of silver chromate (Ag_2CrO_4) is 9×10^{-12}. Calculate the solubility of silver chromate **(2 marks)**

(VII) State any three factors that affect the rate of reaction **(3 marks)**

QUESTION FOUR (20 MARKS)

(a) (i)Solids are classified into two categories: Name the two categories **(2 MARKS)**

(ii) Explain the characteristics of the two categories named in (i) above giving examples **(4 MARKS)**

(b) (i) State the kinetic theory of matter **(1 MARK)**

(ii) (a) what is a redox reaction **(1 MARK)**

(c) Distinguish between molality and molarity **(2Marks)**

(d) A careful examination of several thousand crystals of various substances reveals that there are only seven possible crystal symmetries exhibited by solids. State the seven systems and explains what they entail **(7 MARKS)**

(e) State the four basic tenets of valence bond (VB) theory **(3 MARKS)**

QUESTION FIVE (20 MARKS)

(a) (i) The equilibrium constant (K_c) for the reaction $H_2+I_2 \leftrightarrow 2HI$ is 60 at 450 °C. Calculate the number of moles of HI in equilibrium with 2 moles of hydrogen and 0.3 moles of I at 450 °C. **(5 MARKS)**

(ii) Assume gases are ideal deduce the relationship between K_P and K_C **(5 MARKS)**

(b) (i) State Lechatelier's principle **(2 MARK)**

(ii) State and explain the four factors that affect the position of the equilibrium **(8 MARKS)**