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**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**

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**INSTRUCTIONS TO CANDIDATES:**

**TIME: 2 HOURS**

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

### QUESTION ONE (30 MARKS)

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)  $\text{CH}_4$   
b)  $\text{BeF}_2$
- (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)**

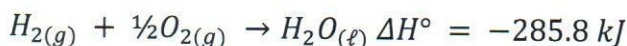
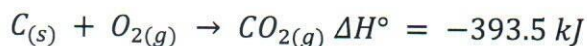
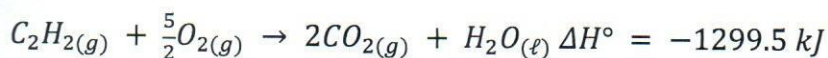
### QUESTION THREE (20 MARKS)

- (I) State Hess's law **(2 marks)**
- (II) Calculate the enthalpy for this reaction **(3 marks)**





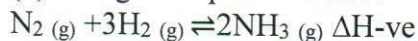
Given the following thermochemical equations



(III) (a) State Lechatelier's principle

(1 mark)

(b) Using the equation below



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  $9 \times 10^{-12}$ . 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

(2 Marks)

(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 explain 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)