



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**FIRST YEAR FIRST SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS**

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 117

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY

DATE: 30/09/2021

TIME: 2:00-4:00PM

INSTRUCTIONS TO CANDIDATES:

TIME: 2 HOURS

ANSWER QUESTION ONE AND ANY TWO OF THE REMAINING

KIBU OBSERVES ZERO TOLERANCE TO examination cheating

QUESTION ONE (30MARKS)

1. (a) State the following principles and rule (3 marks)
- Aufbau's principle
 - Pauli's exclusion principle
 - Hund's rule
- (b) Write the electronic configuration of the following elements (4marks)
- Platinum(78)
 - Aluminium(13)
 - Chromium (24)
 - Titanium (22)
- (c) An element X with RAM of 21.845 has three isotopes X_1 , X_2 and X_3 of masses 20, 22 and W. Their relative abundances are 8.7, 89.4 and 1.9% respectively.
- Define the term isotopes (1 mark)
 - Determine the mass of isotope X_3 (3 marks)
- (d) At different times scientists have proposed various descriptions or models of the atom to match experimental evidence available. The model that Bohr's proposed was called the Bohr's model.
- Describe this model (2 marks)
 - What were the draw backs/failures of this model (3 marks)
- (e) Distinguish between Mendeleev's and modern periodic laws (2 marks)
- (f) Why was Mendeleev's periodic law rejected? (3 marks)
- (g) State the four basic tenets of valence bond (VB) theory (4marks)
- (h) Balance the following equation with the smallest whole number coefficients. What is the sum of the coefficients in the balanced equation (2 marks)
- $$\text{PtCl}_4 + \text{XeF}_2 \rightarrow \text{PtF}_6 + \text{ClF} + \text{Xe}$$
- (i) A 5.0 g sample of methanol, CH_3OH , was combusted in the presence of excess oxygen in a bomb calorimeter containing 4000 g of water. The temperature of the water increased from 24.0 °C to 29.765°C. The heat capacity of the calorimeter was 2657 J/°C. The specific heat of water is 4.184 J/g°C. Calculate E for the reaction in kJ/mol. (3marks)

QUESTION TWO (20 MARKS)

2. (I) (a) Briefly describe the Thomson's Atomic model experiment (Cathode ray experiment) (5 marks)
- (b) Based on the model, state the any three applications of plum pudding (3 marks)
- (c) State the two postulates of the Thomson's atomic model based on observations and conclusions (2 marks)
- (II) (a) Define quantum numbers (1 mark)
- (b) State the four quantum numbers (4 marks)
- (c) An electron is in one of the 3d orbitals. Give the possible values of n, l and ml for this electron (3 marks)
- (d) State any two differences between orbital and orbit (2 marks)

Question Three (20 marks)

3. (I) Distinguish between Mendeleev's and Moseley's periodic laws (2 marks)

(II) In terms of structure and bonding explain the differences between diamond and graphite
(5 marks)

(III) 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
(3 marks)

- CH₄
- BF₃
- BeF₂

(IV) (a) What are intermolecular forces?
(1 mark)

(b) Briefly describe the following intermolecular forces of attraction
(9 marks)

- Dipole-dipole attraction
- Dispersion force.
- Hydrogen bonding

QUESTION FOUR (20 MARKS)

4. (I) (a) Stepwise explain how you can one prepare 750 mL solution of 0.5 M H₂SO₄, from 2.5 M H₂SO₄ stock solution?
(3 marks)

(b) Using the equation $2\text{KBr (aq)} + \text{Pb (NO}_3)_2 \text{(aq)} \rightarrow 2\text{KNO}_3 \text{(aq)} + \text{PbBr}_2 \text{(s)}$ deduce;

(i) The ionic equation
(1 mark)

(ii) With a reason identify the reducing agent and the oxidizing agent
(2 marks)

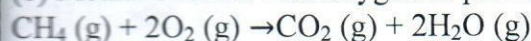
(II) If the volume of a sealed container is kept constant and the gas inside is heated to a higher temperature, the gas pressure increases. Explain
(3 marks)

(III) Briefly describe the two types of solids
(4 marks)

(a) Amorphous solids

(IV) (a) State Gay-Lussac's law
(1 mark)

(b) Methane reacts with oxygen as per following reaction



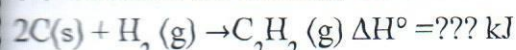
If 60 cm³ of methane was sparked with excess oxygen, determine the volume of residual gas at room temperature
(2 marks)

(V) Show that ideal gas equation is $P V = n R T$
(4marks)

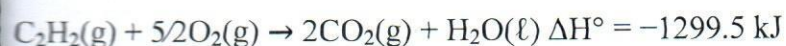
QUESTION FIVE (20 MARKS)

5. (I) State Hess's law
(2 marks)

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

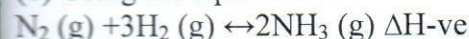


Given the following thermochemical equations



(III) (a) State Lechatelier's principle
(1 marks)

(b) Using the equation below



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

- Increase in pressure
(2 marks)

- (12)
- 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 Madelung rule, 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)**