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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER
SUPPLEMENTARY EXAMINATIONS
FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 117

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY

DURATION: 2 HOURS

DATE: 3/02/2021

TIME: 8-10 A.m

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 5 printed pages. Please Turn Over



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Question one (30 marks)

- a. Identify the three main fundamental particles which constitute an atom and state the charge on each particle. **(3 marks)**.
- b. Distinguish between an atomic number and mass number. **(2 marks)**
- c. The isotopic composition of an element X is as shown below.

Mass number	Percentage abundance%
35	75.8
37	24.2

Calculate the relative atomic mass of element X. **(3 marks)**

- d. (i) Distinguish between ground state and excited state of an atom. **(2marks)**

(ii) Determine the energy in joule of a photon whose frequency is 3.55×10^{17} Hz. (planks constant = 6.626×10^{-34} m² kg / s **(2marks)**

- e. (i) Explain : (i) Aufabau's principle

(ii) Pauli's exclusion principle **(2marks)**

(ii) Using s, p, d, f notation, write the electron arrangement of the following;

- S (16)
- C (6)
- K (19) **(3marks)**

- f. (i) Distinguish between molecular formula and empirical formula **(1mark)**

(ii) Analysis of 10.15g sample of a compound known to contain phosphorous and oxygen, indicates phosphorous content of 4.433g. What is the empirical formula of this compound? (P =31, O = 16) **(4 marks)**

g. (i) What is molarity? (1mark)

(ii) To produce 40g of AgCrO_4 , 23.4g of K_2CrO_4 is needed as a reactant. 5 liters of 6.0M K_2CrO_4 solution is available. Calculate the volume of the solution needed to give 23.4g of K_2CrO_4 needed for the reaction. (K=39, Cr=52, O=16) (3marks)

h. If 0.5g of impure Copper (II) Oxide reacted with 50cm^3 of 0.1M Nitric Acid. Calculate the percentage of Copper (II) Oxide in the impure sample, assuming that the impurities did not react with the acid. (Cu = 63.5, O = 16.0, N = 14.0, H = 1.0) (4 marks)

Question two (20 marks)

a. Explain what is meant by the following the following terms;

(i) Atomic radius

(ii) Electronegativity

(iii) Electron affinity (3 marks)

b. State and explain two factors that affect atomic size (4 marks)

c. Explain why Mg (12) has a higher Ionization energy than Al (13) (3 marks)

d. (i) What is redox reaction? (1 mark)

e. Determine the oxidation number of each atom indicated in the following (3 marks)

i) KMnO_4 (Mn)

ii) ClO_4^- (Cl)

iii) $\text{Cr}_2\text{O}_7^{2-}$ (Cr)

f) Balance the following redox ionic equations. (4 marks)



g) State two advantages of the oxidation number concept in Chemistry. (2 marks)

Question three (20 marks)

a. Define the following terms;

(i) Standard enthalpy of formation (1 mark)

(ii) Standard enthalpy of combustion (1 mark)

b. Ethanol cannot be prepared directly from its constituent elements so the standard enthalpy change of combustion of ethanol must be obtained indirectly. Use the information given below to answer the questions that follow.

$$\Delta H_c^\circ \text{C (graphite)} = -393 \text{ kJmol}^{-1}$$

$$\Delta H_c^\circ \text{H}_2 \text{ (g)} = -286 \text{ kJmol}^{-1}$$

$$\Delta H_c^\circ \text{(C}_2\text{H}_5\text{OH)} = -1368 \text{ kJmol}^{-1}$$

(i) Draw an energy cycle diagram (2 marks)

(ii) Determine the enthalpy change of formation of ethanol (3 marks)

c. State Le Chatelier's principle (1 mark)

(i) List three factors affecting equilibrium (3marks)

(ii) When one mole of hydrogen iodide is allowed to dissociate in 1.0dm³ vessel at 440^o C, only 0.78 moles of hydrogen iodide are present at equilibrium. Determine the equilibrium constant at this temperature of the reaction? (3marks)

d. State and explain three factors that affect the rate of reaction. (6marks)

Question four (20 marks)

a) Explain what is meant by the following terms. (6 marks)

i) Ionisation energy

ii) Atomisation energy

iii) Lattice energy

b.) draw a complete fully labelled born Haber cycle for formation of potassium bromide

(5marks)

c.) using the information in the table below calculate the lattice enthalpy of potassium bromide. **(3 marks)**

Reaction	$\Delta H/\text{kJ mol}^{-1}$
$\text{K(s)} + \frac{1}{2}\text{Br(l)} \rightarrow \text{K}^+\text{Br}^{\text{(s)}}$	- 392
$\text{K(s)} \rightarrow \text{K(g)}$	+90
$\text{K(g)} \rightarrow \text{K}^{\text{(g)}} + \bar{\text{e}}$	+420
$\frac{1}{2}\text{Br}_2 \rightarrow \text{Br(g)}$	+112
$\text{Br}_2 + \bar{\text{e}} \rightarrow \text{Br}^{\text{(g)}}$	-342

d.) the values of lattice enthalpies of other potassium halide are shown in the table below;

Compound	KF	KCl	KI
Lattice enthalpy/ kJmol^{-1}	-813	-710	-643

Give an explanation for the trend in these values.

(4 marks)