



# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2019/2020 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER  
MAIN EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

**COURSE CODE:** SCH 117

**COURSE TITLE:** FUNDAMENTALS OF CHEMISTRY

**DURATION:** 2 HOURS

**DATE:** 17/12/2019 **TIME:** 3.00 PM

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### 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 4 printed pages. Please Turn Over



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**Question 1(30 marks)**

a) Define or state the following terms:

**(3marks)**

- i. Pauli's exclusive principle
- ii. Aufbau principle
- iii. Hunds rule

b) State two methods used to determine the ionization energy of an element. **(2marks)**

c) State three factors that affect atomic size. **(3 marks)**

d) A white powder is analyzed and found to contain 43.64% phosphorus and 56.36% oxygen by mass. The compound has a molar mass of 283.88 g. What are the compound's empirical and molecular formulas? (P = 31, O = 16) **(4 marks)**

e) i) What is molality **(1 mark)**

ii) What is the molality of acetone in a solvent composed of 255g of acetone  $(\text{CH}_3)_2\text{CO}$ , dissolved in 2g of water. (C=12, H=1, O = 16) **(3marks)**

f) State three postulates of Bohr's theory **(3marks)**

g) Calculate the energy of a photon associated with light of wavelength 6057.8 Å. (given that planks constant,  $P = 6.66 \times 10^{-37}$ ) **(2 marks)**

h) Using s, p, d and f notation write the electronic configuration of the following. **(4marks)**

C (6)

Mg (12)

O (8)

Cl (17)

i) h) State three factors affecting ionization energy **(3marks)**

**(3marks)**

**Question 2 (20 marks)**

- a. i) Give main observations recorded by Rutherford in his  $\alpha$ -particle scattering experiment. (8marks)
- ii) Give two failures of the Rutherford model of the atom. (2 marks)
- b) i) What is electronegativity? (1mark)
- ii) State and explain how electronegativity varies with:
1. across the period (2 marks)
  2. down the group (2 marks)
- c.) State five factors that influence a chemical bond. (5 marks)

**Question 3 (20 marks)**

- a) The initial rate of reaction  $E+F \rightarrow G$  was measured at three different initial concentration of the reactant as shown below

Trial	Initial rate (mol/dm <sup>3</sup> /S)	[E] Mol/dm <sup>3</sup>	[F] Mol/dm <sup>3</sup>
1	$2.73 \times 10^{-5}$	0.100	0.100
2	$5.47 \times 10^{-5}$	0.200	0.100
3	$2.71 \times 10^{-5}$	0.100	0.200

- i) Determine the rate law of the reaction (3 marks)
- ii) Determine the rate constant (2 marks)
- b) State the Le Chatelair's principle (1mark)
- c) (i) State and explain two factor affecting equilibrium. (4marks)
- (ii) When one mole of hydrogen iodide is allowed to dissociate in 1.0dm<sup>3</sup> vessel at 440<sup>o</sup> only 0.78moles of HI are present at equilibrium. Determine the equilibrium constant at this temperature. (2marks)

- d) Suppose 2 moles of hydrogen and one mole of iodine are mixed together in 1.0dm<sup>3</sup> vessel at 440°C. how many moles of HI, H<sub>2</sub> and I<sub>2</sub> will be present at equilibrium. (5marks)
- e) State three factors affecting reaction rate. (3marks)

**Question 4 (20 marks)**

- a.) Distinguish between empirical formula and molecular formula. (2marks)
- b.) Quantitative analysis shows that a compound contains 32.38% sodium, 22.65% sulphur and 44.97% oxygen. Find the empirical formula of this compound. (Na = 22.99, S = 32.07, O = 16) (3marks)
- c.) i) What is molality (1 mark)
- ii) A solution was prepared by dissolving 17.1g of sucrose (C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>) in 250g of water find the molality of the solution. (C=12, H=1, O = 16) (3marks)
- d.) i) State Gay-lussacs law (1mark)
- ii) 15cm<sup>3</sup> of a gaseous hydrocarbon were exploded with 105cm<sup>3</sup> of oxygen. After cooling the residual gas occupied 75cm<sup>3</sup>. On addition of caustic potash, there was fall in volume to 30cm<sup>3</sup>. What is the molecular formula of the hydrocarbon? (5marks)
- e) i) Study the information below and answer the questions that follows

$$\Delta H_c^\circ \text{ of graphite} = -393\text{kJ/mole}$$

$$\Delta H_f^\circ \text{ of Hydrogen} = -286\text{kJ/mole}$$

$$\Delta H_c^\circ \text{ of C}_4\text{H}_{10} = -2877\text{kJ/mole}$$

Using an energy cycle diagram, determine the enthalpy of formation of C<sub>4</sub>H<sub>10</sub>.

(5marks)