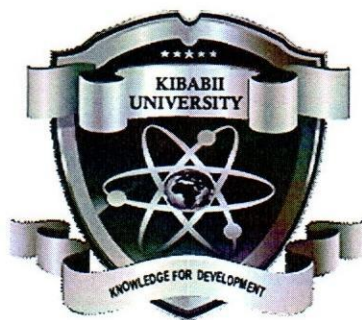


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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS**

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: SCH 326

COURSE TITLE: SOFT MATTER CHEMISTRY

DURATION: 2 HOURS

DATE: 19/1/2022

TIME: 8-10PM

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



KIBU observes ZERO tolerance to examination cheating

Question 1

- a) State three types of Unit Cells. [3mks]
- b) Draw a three-dimensional lattice array and indicate the plane with the Miller index of (101). [2mks]
- c) Explain what is meant by adsorption. [1mk]
- d) State the difference between adsorption and absorption. [3mks]
- e) What do you understand by activation of adsorbent? How is it achieved? [3mks]
- f) calculate the mean life time of adsorbate molecule for an adsorbent surface at 300k if the desorption activation energy for the system is;
- i. 20kJmol^{-1} [2mks]
- ii. 200kJmol^{-1} (Assume $\gamma_0 = 10^{-10}$, $R = 8.314\text{Jmol}^{-1}\text{k}^{-1}$) [2mks]
- g) State four Application of surface tension [4mks]
- h) Describe the Mechanism of Micelle formation. [3mks]
- i) Write the mechanism of free radical polymerization of ethene. [4mks]
- j) Explain three factors considered when measuring zeta potential [3mks]

Question 2

- a) Distinguish between hydrophilic sols and hydrophobic sols [4mks]
- b) On one gram of charcoal and a gas pressure of 1 atm, volume of N_2 adsorbed at 88k is 155cm^3 and at 273k is 15cm^3 . Calculate heat of adsorption of N_2 on charcoal. ($R = 8.314\text{Jmol}^{-1}\text{k}^{-1}$). [3mks]
- c) Derive Gibbs adsorption equation, for a two component system consisting of n_1 moles of a solvent and n_2 moles of a solute with their chemical potentials as μ_1 and μ_2 respectively. [10mks]
- d) State three limitations of Langmuir Adsorption Equation [3mks]

Question 3

- a) State three Methods of determining molar masses of polymers [3mks]
- b) Describe the difference between atactic and isotactic polymers. [4mks]
- c)
- i. Using the formula, explain what is meant by the terms *mass average* and *number average molecular weights* of a colloidal system. [4mks]
- ii. How do the two terms in (i) define the polydispersity of the colloidal system? [1 mk]
- iii. A certain polymer has 15% of its molecules having a mass of 10 kg/mol, 20% of its molecules having a mass of 20 kg/mol, 50% of its molecules with a mass of 25 kg/mol, and 15% of its molecules having a mass of 35 kg/mol. Is the system mono disperse? Explain. [8mks]

Question 4

- a) State three factors affecting the rheological behaviour of colloidal dispersions. [3mks]
- b) Explain briefly why the tendency of a polymer to crystallize decreases with increasing molecular weight. [2mks]
- c) The density and associated percent crystallinity for two polytetrafluoroethylene materials are as follows:

ρ (g/cm ³)	Crystallinity (%)
2.144	51.3
2.215	74.2

- i. Compute the densities of totally crystalline and totally amorphous polytetrafluoroethylene. [3mks]
- ii. Determine the percent crystallinity of a specimen having a density of 2.26 g/cm³. [3mks]
- d) State three properties of Semi-crystalline polymer [3mks]
- e) Using Mark Houwink's relation, determine the molecular weight of a polystyrene sample which has an a value of 0.060, K value of 1.6×10^{-4} dL/g, and a limiting viscosity number or intrinsic viscosity of 0.04 dL/g. [3mks]
- f) State three advantages of using Gel permeation Chromatography in determination of molecular mass of polymers. [3mks]

Question Five

- a) Using illustrations, describe electrophoresis process. [4mks]
- b) State three assumptions of Gouy-Chapman theory. [3mks]
- c) Calculate the thickness of the diffuse double layer for a negatively charged solid in contact with aqueous solutions of the following concentrations at 25°C. [4mks]
- i. 0.010 M KCl;
- ii. 0.0010 M K₂SO₄;
- d) Discuss the working principle of a Fuel Cell. [5mks]
- e) Explain the differences between supercapacitor and Battery. [4mks]