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**KIBABII UNIVERSITY  
(KIBU)**

**UNIVERSITY EXAMINATIONS  
2020/2021 ACADEMIC YEAR**

**FOURTH YEAR SECOND SEMESTER <sup>SPE/SUPP</sup> ~~MAIN~~ EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE IN PHYSICS**

**COURSE CODE: SPH 426E**

**COURSE TITLE: MATERIAL SCIENCE AND POLYMER  
PHYSICS**

**DATE:** 11/01/2022

**TIME:** 8-10 AM

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**INSTRUCTIONS TO CANDIDATES**

TIME: 2 Hours

Answer question ONE and any TWO of the remaining.

Symbols used bear the usual meaning.

KIBU observes ZERO tolerance to examination cheating

**Question One (30 marks)**

- a) Discuss the processes of Crushing and Pulverization as used in metallurgy (4 marks)
- b) Describe polymers in terms of their molecular arrangement (2 marks)
- c) Differentiate between cement and concrete (2 marks)
- d) Show that the minimum cation-to-anion ratio for the coordination number 3 is 0.155 for a given molecule (4 marks)
- e) What is the role of (i) lime stone in iron extraction and (ii) cryolite in aluminium extraction.? (2 marks)
- f) Describe the crystal structure of ceramic materials (4 marks)
- g) Give the principle of froth floatation process. How can we separate ZnS and PbS present in an ore using froth floatation process? (3 marks)
- h) Discuss the macroscopic deformation in polymers. (4 marks)
- i) Describe the two common structural composites the Laminar and sandwich (2 marks)
- j) How do you refine nickel by Mond's process? (3 marks)

**Question Two (20 marks)**

- a) Discuss the structure of Portland cement (5 marks)
- b) Discuss the chemistry of cement (15 marks)

**Question Three (20 marks)**

- a) Explain the concentration of bauxite ore. (6 marks)
- b) How do you extract Aluminium from bauxite ore? Explain with a well labeled diagram (10 marks)
- c) Give the chemical reactions involved in Copper extraction (4 marks)

**Question Four (20 marks)**

- a) Discuss the chemistry of polymer molecules. (14marks)
- b) Discuss the process of vulcanization in elastomers. (6 marks)

**Question Five (20 marks)**

- a) A reinforced concrete column 200mm in diameter is designed to carry an axial compressive load of 300KN. Determine the required area of the reinforcing steel if the allowable stresses are 6MPa and 120MPa for concrete and steel respectively. Use  $E_{concrete} = 14GPa$  and  $E_{steel} = 200GPa$  (14 marks)
- b) Discuss how thermal conductivity is improved in concrete structures a case study of Bridge structures (6 marks)