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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BSC (PHYSICS)

COURSE CODE: SPH 426E

COURSE TITLE: MATERIAL SCIENCE AND POLYMER PHYSICS

DURATION: 2 HOURS

DATE: 04/10/2018

TIME: 8:00-10:00AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Question one has a total of **30 marks** whereas questions two to five is each **20 Marks**
- 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 2 printed pages. Please Turn Over



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QUESTION ONE (30 MARKS)

- a) Differentiate between cement and concrete (2 marks)
- b) Describe the two common structural composites the Laminar and sandwich (2 marks)
- c) Low tensile strength of cement paste is a result of low fracture toughness, describe four ways in which the flaws can be reduced (4 marks)
- d) Discuss the structure of Portland cement (4 marks)
- e) Describe polymers in terms of their molecular arrangement (2 marks)
- f) Show that the minimum cation-to-anion ratio for the coordination number 3 is 0.155 for a given molecule (5 marks)
- g) Describe the process of extraction of pure Copper from its ore (3 marks)
- h) Describe the crystal structure of ceramic materials (4 marks)
- i) Discuss the processes of Crushing and Pulverization as used in metallurgy (4 marks)

QUESTION TWO (20 MARKS)

- a) Discuss three steps involved in extraction of metals from their ores (8 marks)
- b) A continuous and aligned glass fibre-reinforced composite consists of 40 vol% of glass fibres having a modulus of elasticity of 69GPa and 60vol% of a polyester resin that, when hardened displays a modulus of 3.4GPa
 - i) Compute the modulus of elasticity of this composite in the longitudinal direction
 - ii) If the cross-sectional area is 250mm² and a stress of 50MPa is applied in this longitudinal direction compute the magnitude of the load carried by each of the fiber and matrix phases
 - iii) Determine the strain that is sustained by each phase when the stress in part (ii) is applied (12 marks)

QUESTION THREE (20 MARKS)

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

QUESTION FOUR (20 MARKS)

- a) Discuss the chemistry of polymer molecules which include polyethylene, PVC, PTFE, Polypropylene, polystyrene and PMMA (12 marks)
- b) Discuss the molecular structure of polymers (8 marks)

QUESTION FIVE (20 MARKS)

Discuss the process of extraction of the following metals

- (a) Iron (14 marks)
- (b) Zinc (6 marks)