



KIBABII UNIVERSITY

2019/2020 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATIONS

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE ENERGY AND
BIOFUELS TECHNOLOGY**

COURSE CODE: REN 222

COURSE TITLE: MATERIAL SCIENCE 1

DATE: 5/2/2021

TIME: 8:00-10:00am

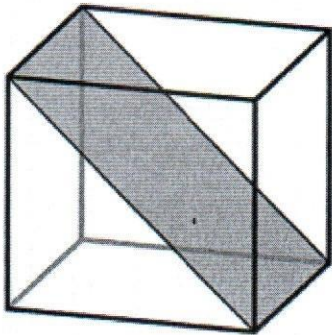
INSTRUCTIONS TO CANDIDATES

Answer question ONE and any other two questions

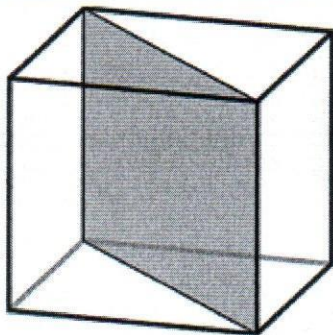
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QUESTION ONE

- a. Define the following terms as used in materials study:
 - I. Material science. (2mks)
 - II. Materials engineering (2mks)
 - III. Matter (2mks)
- b. Differentiate the following types of materials as used in material science
 - I. Crystalline solids (2mks)
 - II. Amorphous solids (2mks)
 - III. Composite materials (2mks)
- c. Name four different types of Bonds responsible for holding atoms together in material formation. (4mks)
- d. Using well labelled diagrams, differentiate between the following materials:
 - I. Conductors (3mks).
 - II. Semi-conductors (3mks)
 - III. Insulators (3mks)
- e. Give the planar coordinate for the cubic structure in the diagram below (2mks)



- f. Calculate the Miller indices for the cubic structure shown below (3mks)



QUESTION TWO

- a. With an aid of elaborate diagrams, explain how structural bonding occurs in the following compounds: (12mks)
 - I. Sodium Chloride(NaCl)
 - II. Hydrogen Molecule (H₂)
 - III. Magnesium Metal (Mg)
 - IV. Ammonium ion (NH₄⁺)
- b. Differentiate between Sodium Chloride, Hydrogen Molecule and Magnesium metal in terms of:
 - I. Solubility in different solvents.(3mks)
 - II. Thermal and electrical conductivity.(3mks)
- c. Lattice energy depends on the size of an ion and the valence number. Explain how lattice energy changes with: (2mks)
 - I. Increase in ion size.
 - II. Increase in valence number

QUESTION THREE

- a. Materials can be classified basing on their functions. Give 6 functional classifications of materials (6mks).
- b. Define the following terms as used in classification of polymers:
 - I. Thermoplastics (2mks)
 - II. Thermostables (2mks)
 - III. Elastomers (2mks)
- c. State the **THREE** most important factors to be considered in selection of materials for gas cylinders. (3mks)
- d. With an aid of well labelled diagrams, describe the following structures.
 - I. Body Centered Cubic (BCC) (2mks)
 - II. Face centered Cubic (FCC) (3mks)

QUESTION FOUR

- a. Define Alloying as used in material science (2mks)
- b. Why is alloying important in material science and engineering? (2mks)
- c. Differentiate between Ferrous and Non-Ferrous alloys giving examples (4mks)
- d. With aid of well labelled diagrams, describe:
 - I. Tensile loading (3mks)
 - II. Compression loading (3mks)
 - III. Shear (3mks)
 - IV. Torsion (3mks)

QUESTION FIVE

- a. Using well labelled diagrams, clearly describe:
 - I. Plastic deformation (4mks).
 - II. Elastic deformation (4mks)
- b. State the THREE main types of defects that can occur in solid structures (6mks)
- c. Describe how conduction occurs in semi-conductor materials (6mks)