



KIBABII UNIVERSITY

2022/2023 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

SUPPLEMENTARY EXAMINATIONS

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

COURSE CODE: REN 222

COURSE TITLE: MATERIAL SCIENCE 1

DATE: 9/8/2023

TIME: 2:00-4:00PM

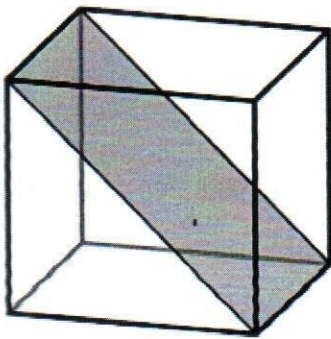
INSTRUCTIONS TO CANDIDATES

Answer question ONE and any other two questions

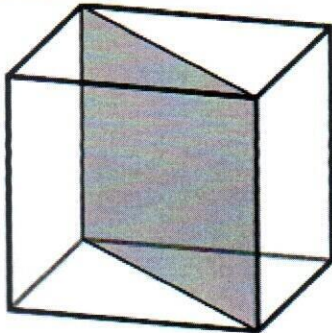
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QUESTION ONE

- a. Define the following terms as used in materials study:
- Material science. (2mks)
 - Materials engineering (2mks)
 - Matter (2mks)
- b. Name four different types of Bonds responsible for holding atoms together in material formation. (4mks)
- c. Differentiate between Sodium Chloride, Hydrogen Molecule and Magnesium metal in terms of:
- Solubility in different solvents.(3mks)
 - Thermal and electrical conductivity.(3mks)
- d. Using well labelled diagrams, differentiate between the following materials:
- Conductors (3mks).
 - Semi-conductors (3mks)
 - 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. 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 THREE

- a. Using well labelled diagrams, differentiate between:
 - 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)

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

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- a. With the aid of elaborate diagrams, explain how structural bonding occurs in the following compounds: (12mks)
- i. Sodium Chloride(NaCl)
 - ii. Hydrogen Molecule (H_2)
 - iii. Magnesium Metal (Mg)
 - iv. Ammonium ion (NH_4^+)
- 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. 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