



FreeExams.co.ke

2022/2023 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: 20/04/2023

TIME: 9:00-11:00AM

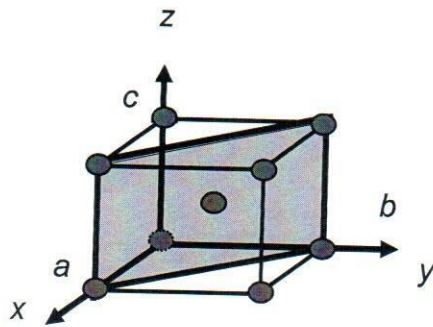
INSTRUCTIONS TO CANDIDATES

Answer question ONE and any other two questions

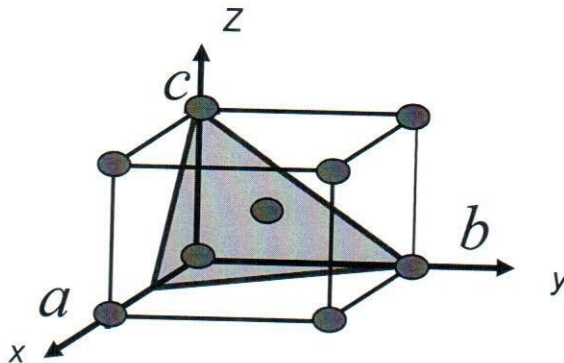
This paper consists of 4 printed pages. Please Turn over

QUESTION ONE

- a. Define the following terms as used in materials study:
- Materials (1mk)
 - Material science. (2mks)
 - Materials engineering (2mks)
 - Matter (1mk)
- b. What do you understand by following types of materials as used in material science
- Crystalline solids (2mks)
 - Amorphous solids (2mks)
 - Composite materials (2mks)
- c. Name four different types of Bonds responsible for holding atoms together in material formation. (4mks)
- d. Briefly explain ANY four characteristics of metal metals that make them suitable for material engineering applications. (4mks)
- e. State ANY Four applications of ceramic materials in materials engineering (4mks)
- f. If $a=b=c=1$, Give the planar coordinate for the cubic structure in the diagram below (3mks)



- g. If $a=1/2$, $b=c=1$. Calculate the Miller indices for the cubic structure shown below (3mks)



QUESTION TWO

- a. Define Semi-conductor materials? (2mks)
- b. Differentiate between intrinsic and extrinsic semi-conductors (4mks)
- c. Using Energy band diagram, explain the working principle of intrinsic semi-conductors at 0 temperature, low temperature and high temperature. (9mks)
- d. Differentiate between Sodium Chloride, Hydrogen Molecule and Magnesium metal in terms of:
 - i. Solubility in different solvents.(3mks)
 - ii. Thermal and electrical conductivity.(3mks)

QUESTION THREE

- a. Define the following terms as used in classification of polymers:
 - i. Thermoplastics (2mks)
 - ii. Thermosetables (2mks)
 - iii. Elastomers (2mks)
- b. State the **THREE** most important factors to be considered in selection of materials for gas cylinders. (3mks)
- e. With an aid of elaborate diagrams, explain how structural bonding occurs in the following compounds: (6 mks)
 - i. Sodium Chloride(NaCl)
 - ii. Hydrogen Molecule (H_2)
 - iii. Ammonium ion (NH_4^+)
- c. 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)
- e. State the **THREE** main types of defects that can occur in solid structures (6mks)
- f. Describe how conduction occurs in semi-conductor materials (6mks)