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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

THIRD YEAR SUPP/SPECIAL EXAMINATION

COURSE CODE: SPH 311

COURSE TITLE: SOLID STATE PHYSICS

DURATION: 2 HOURS

DATE: 16/02/2021 **FROM:TO:** 11:00- 1:00 Pm

INSTRUCTIONS TO CANDIDATES

Answer question ONE and any TWO of the remaining.

Symbols used bear the usual meaning.

This paper consists of 3 printed pages. Please Turn Over

KIBU observes ZERO tolerance to examination cheating

Use the following Numerical constants where necessary.

Avogadro's Number	$N = 6.02 \times 10^{24}$ kg/mole
Mass of an electron	$Me = 9.1 \times 10^{-31}$ kg
Electron charge	$e = 1.6 \times 10^{-19}C$
Planks Constant	$h = 6.626 \times 10^{-34}JS$
Permittivity of free space	$£_o = 8.85 \times 10^{-12}\ C^2/N.M^2$
Speed of light	$C = 3.0 \times 10^8$ M/S

QUESTION ONE (30 MARKS)

a) Explain three most common types of space Lattice (5mks)
b) The density of iron is 7.8×10^3 Kg/m^3. Atomic weight of iron is 55.0g. If iron crystalizes in BCC space lattice; Find the lattice constant (4mks)
c) Explain three elements of symmetry (3mks)
d) Explain five importance of miller Indices (5mks)
e) The Debye temperature of Carbon is 1850K. Calculate the specific heat Per Kilo Mole for Carbon at 20K. (4mks)
f) Draw the following planes and direction in the case of FCC structure (122) (001) and (101) (5mks)
g) What are the values of total energy of an electron in hydrogen atoms revolving in Borr first order. (4mks)

QUESTION TWO (20 MARKS)

a) Determine the inter atomic spacing when the glancing angle of 30° is observed during first order reflection in a crystal plane. Miller Indices as (111) given that the wavelength of X-ray is 2.0×10^{-10} m (6mks)
b) In a single cubic Crystal. Find the ration of the intercept on the three axes by (1,2,3) plane (5mks)
c) Explain three methods of determining crystal structure (9mks)

QUESTION THREE (20 MARKS)

a) Explain five properties of metallic crystals (10mks)
b) Discuss three types of primary bonds found in different materials (6mks)
c) Distinguish between Bond energy and Atomic Radius (4mks)

QUESTION FOUR (20MARKS)

a) Determine interatomic spacing when the glancing angle of 30° is observed forming first order reflection in a crystal lens Miller index as (111) given that the crystal length is 2.0×10^{-10} m (5mks)
b) Discuss five properties of solid materials (10mks)
c) Discuss five importance of miller indices (5mks)

QUESTION FIVE (20MKS)

a) Explain three methods of determining a crystal structure (9mks)
b) Magnesium has HCP structure, the radius of Magnesium atom is 0.1605nm. Calculate the volume change of unit cell of magnesium (6mks)
c) Discuss the structure of Sodium Chloride (5mks)