NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCE

2021_1 EXAMINATIONS

COURSE CODE: PHY307
COURSE TITLE: SOLID STATE PHYSICS I
CREDIT UNIT: 2
TIME ALLOWED: (2 HRS)

INSTRUCTION: *Answer question 1 and any other three questions*

QUESTION 1

Question1

(a) What is the definition of crystal (i) macroscopically and (ii) microscopically?(2Marks each)

(b) State the convention for drawing lattice arrangements using axial lengths a, b, c and axial angles α, β, γ.(3 Marks)

(c) What are the seven crystal stems?(3½ Marks)

(d) Outline the rules in finding direction indices.(3 Marks)

(e) In one sentence, define Miller indices (2 Marks)

(f) If x, y and z axes intercept 3, 4, and 2, calculate the Miller indices.(3½ Marks)

(g) State Bragg's law of diffraction and give two geometrical facts that are

 necessary for the derivation of the law.(3 Marks)

(h) What are the methods required in determining the experimental crystal structure?(3Marks)

QUESTION 2

(a) What are the rules for Miller Indices (6 Marks)

 (b) Calculate the Miller Indices if the *x, y* and *z* intercepts are1, 2, 3. (4Marks)

(c) What are the general principles of Miller Indices?(5 Marks)

QUESTION 3

(a) Define stress (2 Marks)

(b) Write down the strain components of (i) e_{xy} (ii) e_{zx}(2 Marks)

(c) What are the stress components? (9 Marks)

(d) What does X_x represent in a stress component?(2 Marks)

QUESTION 4

(a) Define simple lattice. (3 Marks)

(b) State the metallic crystal structures.(4Marks)

(c) What are the elementary properties of a lattice?(5 Marks)

(d) Mention the basis vectors for a simple cubic lattice.(3 Marks)

QUESTION 5

(a) State the elementary properties of the reciprocal lattice. (5Marks)

(b) What are the properties of the reciprocal lattice that makes it important in the diffraction theory?(3 Marks)

(c) Show that the reciprocal lattice vectors as defined in the equations $A = 2\pi \frac{b \times c}{a \cdot b \times c}$; $B = 2\pi \frac{c \times a}{a \cdot b \times c}$; $C = 2\pi \frac{a \times b}{a \cdot b \times c}$; below satisfy $A \cdot B \times C = \frac{8\pi^3}{a.b \times c}$(7 Marks)