Past-Questions That I have or am working on

Phy-322

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA. SCHOOL OF PHYSICAL SCIENCES.

DEPARTMENT OF PHYSICS.

SECOND SEMESTER EXAMS. 2017/2018 SESSION.

COURSE: PHY 322 (SOLID STATE PHYSICS I). UNIT: 3. INSTRUCTION: ATTEMPT ANY FOUR (4) QUESTIONS. TIME ALLOWED: 3 HRS

1. a (i) Distinguish between lattice and a crystal structure

   (ii) State the fourteen possible Bravais lattice types

   b. Define the Wigner Seitz Primitive cell, what are the steps needed to construct such a cell?

   c. The primitive translation vectors of a hexagonal space lattice are

$$\bar{a}_1 = \frac{\sqrt{3}}{2}a\hat{x} + \frac{a}{2}\hat{y}, \bar{a}_2 = -\frac{\sqrt{3}}{2}a\hat{x} + \frac{a}{2}\hat{y} \text{ and } \bar{a}_3 = c\hat{z}$$

   Determine the primitive translation vectors of the corresponding reciprocal lattice

2. a. Define the following: (i) Symmetry operation (ii) Identity operation (iii) n-fold axis of symmetry

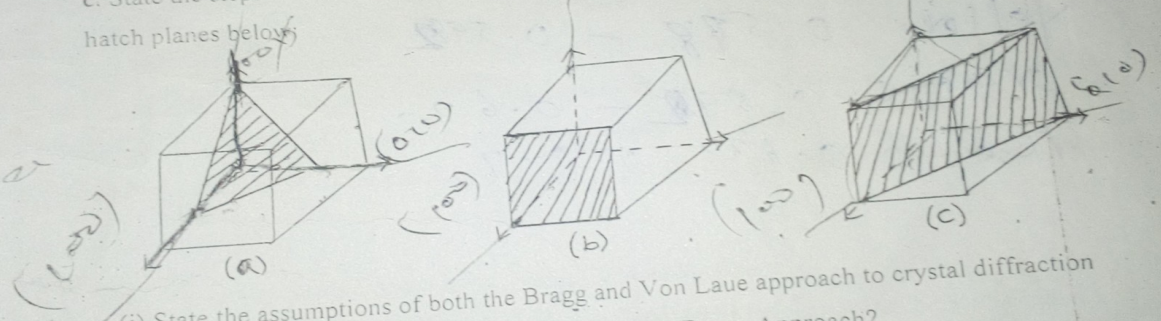
   b. List all the Crystallographic Symmetries of a cube

   c. With aid of diagrams only, sketch the nine planes of symmetry of a cube

3. a. State the factors that affect the structure of ionic solids. Define the term 'Filling Factor'

   b. Determine the filling factor of an FCC lattice

   c. State the steps involved in determining Miller Indices. Determine the Miller indices of the cross hatch planes below:



4. a. (i) State the assumptions of both the Bragg and Von Laue approach to crystal diffraction

   (ii) How does the Von Laue approach differ from the Bragg Approach?

   b. (i) When can the Geometric structure factor be used with certainty to predict the absolute intensity of the Bragg peak?

   (ii) Show that for a BCC crystal structure:

$$F(hkl) = 2f_j(\mu),$$

   if the integers (hkl) are all even. All the terms have their usual meanings.

   c. Determine the neutron energy in eV required for a diffraction to occur for a de Brog wavelength of 1 Å.