**Department of Physics and Astronomy**

**King Saud University, Riyadh**

**Home Assignment # 1**

**Physics 574**

1. In FCC lattice ,
	1. Write down the position of atoms.
	2. How large in volume is the FCC cell as compared to the primitive cubic cell?
2. Draw the following planes and directions in a tetragonal unit cell: (001), (01l), (113), [110], [201], [ ī01].
3. Show [111] is perpendicular to (111) in the cubic system, but not, in general, in the tetragonal system.
4. Show the direction [2$¯$11] in cubic and [111¯] in orthorhombic lattice
5. Define direct lattice translation vector **T** in terms of primitive translation vector of direct lattice.
6. Determine the miller indices of a plane that makes an intercept of 2Å, 3Å and 4Å on the co-ordinate axes of an orthorhombic crystal with a:b:c = 4:3:2
7. Find the Miller indices of a plane that makes intercepts on a, b and c axes equal to 3 Å, 4 Å and 3 Å in a tetragonal crystal with the c/a ratio of 1.5.
8. Calculate the atomic density (number of atoms per unit area) in (111), (110) and (100) plane of copper (FCC) with the lattice parameter of 3.61 Å. Can we pack atoms more closely than in (111) plane?
9. Calculate the number of atoms per unit area of (111), (110) and (100) planes of BCC crystal. The answer may be derived as a function of the lattice parameter *a*.
10. Define the primitive translation vector of reciprocal lattice. Write down the reciprocal lattice vector **G**.
11. Consider a plane *hkl* in a crystal lattice. (a) Prove that the reciprocal lattice vector **G**=*h*b1+*k*b2+*l*b3 is perpendicular to the plane. (b) Prove that the distance between two adjacent parallel plane of the lattice is *d(hkl)=2π/│****G****│.* (c) Show for simple cubic lattice is *d2=a2/(h2+k2+l2).*