

EASTERN UNIVERSITY, SRI LANKA



THIRD EXAMINATION IN SCIENCE - 2003/2004

SECOND SEMESTER

(June/July 2005)

PH 304 CONDENSED STATE PHYSICS

Time: 01 hour.

Answer ALL Questions

1. (a) Illustrate face centered cubic (*fcc*) crystal structure. Determine the following for this crystal structure of lattice constant $2.4A^0$.
- Nearest neighbor distance.
 - The volume of the primitive cell of this lattice.
 - If atomic weight of the crystal is $24g$ the density of the crystal (assume Avagadro's number 6×10^{23} per mole).
- (b) Explain what is meant by *packing fraction* of the structures made of identical hard spheres. The cube edge of the Diamond crystal structure is $3.56A^0$. Calculate
- atomic radius.
 - packing fraction of the crystal.
2. Show that for a cubic lattice with lattice constant a the distance between the (hkl) planes is

$$d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

Write down the Bragg's Law for crystal diffraction on (hkl) plane.

Aluminium has face centered cubic structure and the spacing of its (100) plane is $4.05A^0$. The X-Ray line radiation of wavelength $1.537A^0$ is incident on an Aluminium crystal and produces a diffracted beam of the (111) plane at a Bragg angle of 19.2^0 . Determine the following.

- the cube edge of the Aluminium
- the order of diffraction
- the Avagadro's number

You may assume the following.

the atomic weight of Aluminium = $27g$

the density of Aluminium = $2.7 \times 10^3 kgm^{-3}$