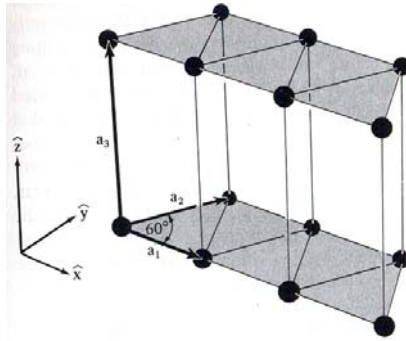


**ECE6453 (Spring 2008)****Homework 1**

Due Date: January 22, 2007

Note: No late homework will be accepted

- Calculate the location of the intrinsic Fermi level in silicon at liquid nitrogen temperature (77K), at room temperature (300K), and at 100C. Assume that  $m_p^* = 0.5 m_0$  and  $m_n^* = 0.3 m_0$ , where  $m_0$  is the free electron mass.
  - Draw a simple energy band diagram for silicon doped with  $10^{16} /\text{cm}^3$  arsenic at 77K, 300K, and 600K, respectively. Show the Fermi level and use the intrinsic Fermi level as reference.
- Find the reciprocal lattice of a simple hexagonal Bravais lattice (shown below) is given by the following primitive vectors:  $\bar{a}_1 = a\hat{x}, \bar{a}_2 = \frac{a}{2}\hat{x} + \frac{\sqrt{3}}{2}a\hat{y}, \bar{a}_3 = c\hat{z}$ , where  $a$  and  $c$  are constants.



- Use the information given in the lecture note..
  - Find possible compositions of the  $\text{Ga}_x\text{In}_{1-x}\text{As}$  that is lattice matched to InP
  - Find possible compositions of the  $\text{Ga}_x\text{In}_{1-x}\text{As}_y\text{P}_{1-y}$  that is lattice matched to InP
  - Find an expression of the bandgap energy for  $\text{Ga}_x\text{In}_{1-x}\text{As}_y\text{P}_{1-y}$  that is lattice matched to InP