

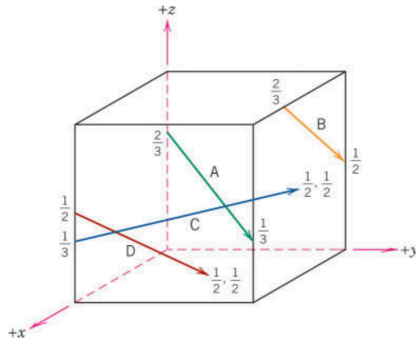
Material Science

Homework 1

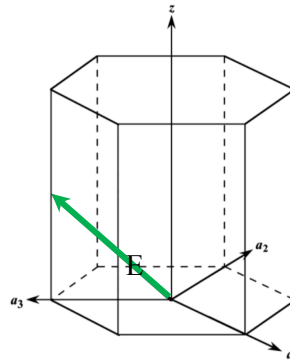
Due Tuesday Oct 16, 2018

1. Determine the indices for the direction B, D, and E shown in the following unit cell:

(a)

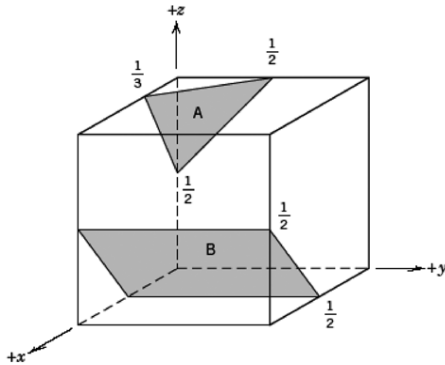


(b)

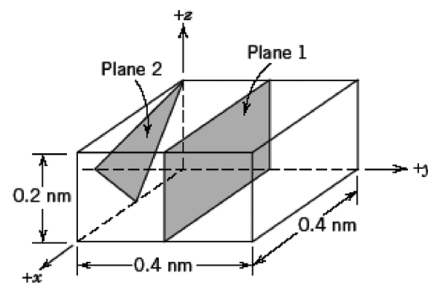


2. Determine the indices for four planes (plane A, B, 1, and 2) shown in the following unit cell:

(a)



(b)



3. Sketch the $(1\bar{1}01)$ and $(11\bar{2}0)$ planes in a hexagonal unit cell.
4. For the HCP crystal structure, show that:
- (a) the atomic packing factor is 0.74. (b) the ideal c/a ratio is 1.633.
5. The unit cell for tin has tetragonal symmetry, with a and b lattice parameters of 0.583 and 0.318 nm, respectively. If its density, atomic weight, and atomic radius are 7.30 g/cm^3 , 118.69 g/mol , and 0.151 nm , respectively, compute the atomic packing factor.
6. Zinc has an HCP crystal structure, a c/a ratio of 1.856, and a density of 7.13 g/cm^3 . Compute the atomic radius for Zn. (*Hint: Atomic weight of zinc is 65.41 g/mol .*)
7. (a) Derive linear density and planar density expressions for BCC $[111]$ and (110) in terms of the atomic radius R .
- (b) Compute linear and planar density values for these same direction and plane for tungsten.
- Hint : Atomic radius for tungsten is 0.137 nm .*
8. Zirconium has an HCP crystal structure and a density of 6.51 g/cm^3 . (a) What is the volume of its unit cell in cubic meters? (b) If the c/a ratio is 1.593, compute the values of c and a .
- Hint : Atomic weight of zirconium is 91.22 g/mol .*