

MATRL 100A: Structure and Properties I, Problem Set 2

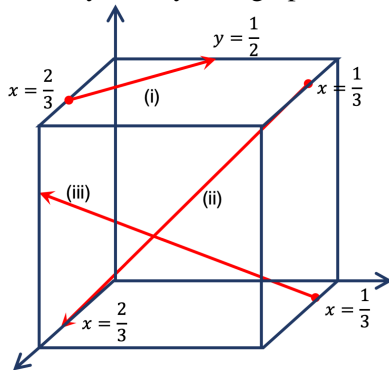
This problem set is due in lecture on **Wednesday, Oct 17th** in hard copy. Please write neatly, show your work clearly, and include units in all answers. While you are free to discuss this problem set with your classmates, the product that you turn in must be your own work. Do not copy or paraphrase each other's work.

Chapter 3

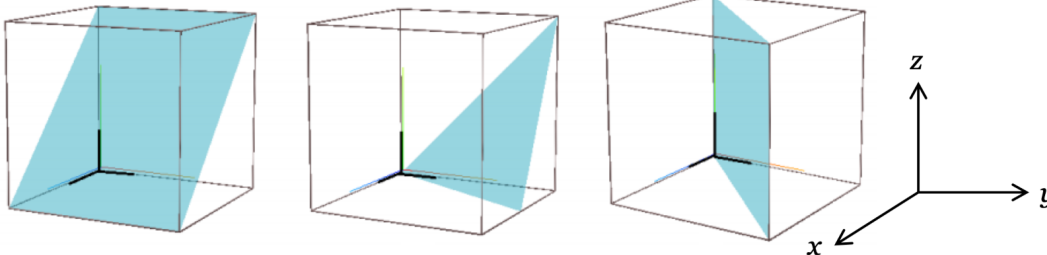
1. Prove that the atomic packing factor for the FCC structure is 0.74.
2. Using the table below, estimate the densities of Vanadium, Lead, and Polonium. Compare to measured densities.

Element	V	Pb	Po
Atomic weight	50.9	207.2	209
Radius (pm)	134	175	168
Crystal structure	BCC	FCC	SC

3. Rhodium has an atomic radius of 0.1345 nm and a density of 12.41 g/cm³. Determine whether it has an FCC or BCC crystal structure.
4. Draw the following crystallographic directions in a cubic unit cell.
 - (a) [021]
 - (b) [2 $\bar{1}$ 2]
5. Draw the following crystallographic planes in a cubic unit cell.
 - (a) (111)
 - (b) (201)
6. Identify the crystallographic directions shown in the unit cell below.



7. Identify the crystallographic planes shown in the unit cells below.
 - (i)
 - (ii)
 - (iii)



8. The planar density (PD) measures the density of a plane in reciprocal area (e.g. m^{-2} or radius^{-2}).

$$PD = \frac{\text{number of atoms centered on a plane}}{\text{area of plane}} \quad (1)$$

For the FCC unit cell, calculate PD for the (100), (110), or (111) plane in terms of the atom radius r .