ESO225, Introduction to Materials Science and Engineering

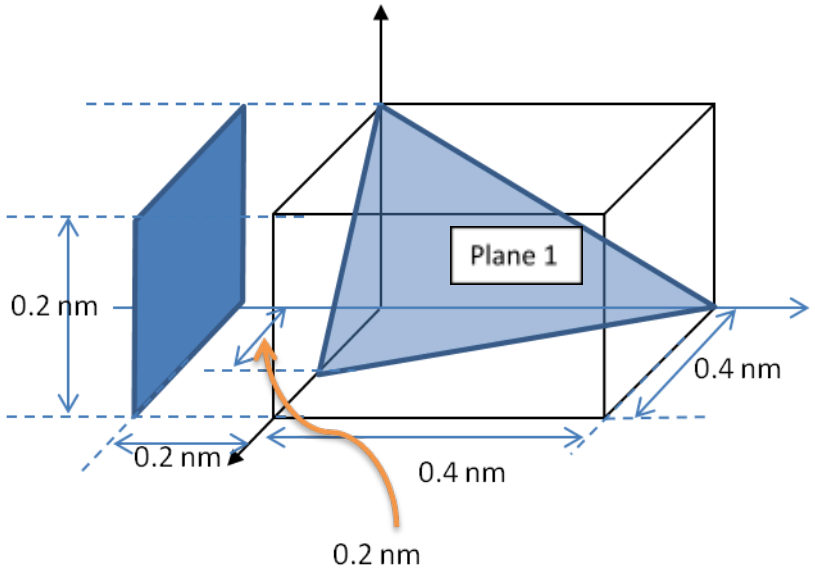
Due: 21-8-2024

Assignment 2

Total: 60 Points

Answer all the questions!

1. Determine the Miller indices for the two planes shown in the following schematic. [5 Points]



2. In an arbitrary unit cell, draw directions, $[\bar{1}10],[\bar{1}30],[\bar{1}\bar{1}0],[\bar{1}03]$; specify the axes. Make sure to show all these directions in one unit cell. [10 Points]

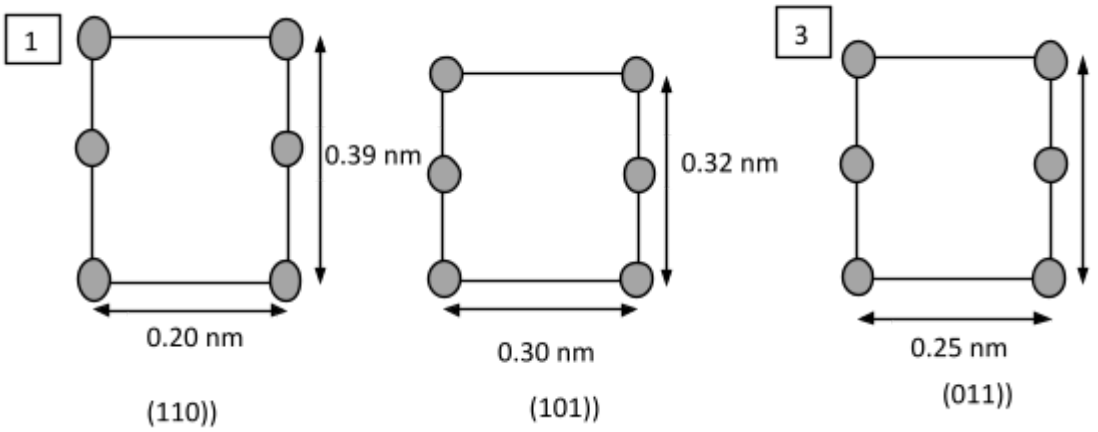
3. Draw the following specific planes and directions for a simple cubic unit cell (specify the axes):

$$\left[\bar{1}\,\bar{2}\,\bar{1}\right] \quad \left(1\bar{1}\,1\right) \quad \left[1\,0\,1\right] \quad \left(\bar{2}02\right) \quad \left[20\,\bar{1}\right] \quad \left(1\,\bar{2}\,1\right)$$

[15 Points]

4. Prove (mathematically) that the possible crystallographic rotational symmetries are: 1, 2, 3, 4 and 6-fold. [10 Points]

5. Following are three crystallographic planes for a unit cell of a hypothetical metal. The circles represent atoms.



a. To what crystal system and the Bravais Lattice does this unit cell belong? [5 Points]
b. If the density of this metal is 18.91 g/cm^3, determine its atomic weight. [5 Points]

6. Write out all of the ,<100>, <110>, and <111> type directions that lie within (011) plane for a cubic crystal structure. [10 Points]