ENGR 240 Science of Materials
Homework 3
16 points

1. [2 points] Sketch a cubic unit cell. Within the unit cell, sketch and label the following:

   a. [0 1 0]
   b. [2 2 1].

2. [2 points] Sketch a tetragonal unit cell with lattice parameters a = 3 nm and c = 5 nm. Within the unit cell, sketch and label the following:

   a. [1 $\bar{2}$ 0]
   b. [$\bar{1}$ 0 1].

3. [2 point] Sketch a cubic unit cell. Within the unit cell, sketch and label the following:

   a. (0 0 1)
   b. (2 0 $\bar{1}$).

4. [4 points] Callister Problem 3.29 – crystallographic directions.

5. [2 point] Callister Problem 3.34 – crystallographic planes.

6. [2 points] Bicycle components such as handle bars, wheel rims, and brake calipers are often manufactured using heat-treated aluminum alloys. An aluminum rim on a mountain bike typically weighs about 400 grams. Assuming the aluminum rim is made entirely of aluminum (Al has the fcc structure), calculate:
   a. The volume of aluminum used for the rim.
   b. The approximate number of aluminum unit cells in the rim.

7. [2 points] Calculate the volume of the bcc unit cell in terms of the atomic radius R.