7. [a past exam question similar to Lab 1 contents, 20 points] *B*elow are listed diffraction angles for the first three peaks (first-order or n = 1) of the x-ray diffraction pattern for some metal. Monochromatic x-radiation having a wavelength of 0.1254 nm was used.

| *Peak Number* | *Diffraction Angle* (2 ) |
|---|---|
| *1* | *31.2°* |
| *2* | *44.6°* |
| *3* | *55.4°* |

(a) If this is a BCC metal, determine the three planner indices for the peak number 1, 2, and 3.

(b) If this is a BCC metal, compute the value of the distance between (hkl) planes or $d_{hkl}$ of the three planes.

Use $d_{hkl} = \frac{n\lambda}{2\sin\theta}$. Note that the diffraction angle in the table is 2θ.

(c) If this is a BCC metal, compute the value of the unit cell length, a, using $a = d_{hkl}\sqrt{h^2+k^2+l^2}$ of the three planes.

(d) Are the three unit cell length values in (c) similar? If yes, the crystal structure of the metal is BCC. If no, it is not BCC.

(e) If this is a FCC metal, determine the three planner indices for the peak number 1, 2, and 3.

(f) If this is a FCC metal, compute the value of the unit cell length, a, using $a = d_{hkl}\sqrt{h^2+k^2+l^2}$ of the three planes.

(g) Are the three unit cell length values in (f) similar? If yes, the crystal structure of the metal is FCC. If no, it is not FCC.

(h) Based on the unit cell length and the crystal structure of the metal, can you identify the metal? Use textbook Table 3.1 showing atomic radii and crystal structures for 16 metals.