PHYS 321 Test #2 Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Bragg’s law for X-ray diffraction:



Additional Conditions: BCC: *h+k+l*=even FCC: h,k,l either odd or even

1. The 2ϴ values in degrees for diffraction peaks are given below for a metal with cubic structure, using X-rays of wavelength 0.1542 nm: 37.21, 43.23, 62.86, 75.31, 79.32.

(a) Complete the table below.

(b) Determine the crystal structure.

(c)Determine the lattice constant.

(d) Determine the ionic radius.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2θ (deg.) | θ (rad) | Sin2θ | Normalize | Clear  Fractions | h2+k2+l2 | (hkl) |  |
| 37.21 |  |  |  |  |  |  |  |
| 43.23 |  |  |  |  |  |  |  |
| 62.86 |  |  |  |  |  |  |  |
| 75.31 |  |  |  |  |  |  |  |
| 79.32 |  |  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
|  |  | Figure 3 |

2. Silver and palladium both have the FCC crystal structure, and Pd forms a substitutional solid solution for all concentrations at room temperature. Compute the unit cell edge length for a 65 wt% Ag–35 wt% Pd alloy. The room-temperature density of Pd is 12.02 g/cm3, and its atomic weight is 106.4 g/mol. The room-temperature density of Ag is 10.49 g/cm3, and its atomic weight is 107.9 g/mol.

 the resistivity of aluminum is 2.7 × 10-8 -m **V = IR J = I/A E = V/L**

3. (a) Compute the resistance of an aluminum wire 5 mm (0.20 in.) in diameter and 5 m (200 in.) in length.

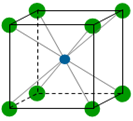
(b) What would be the current flow if the potential drop across the ends of the wire is 0.04 V?

(c) What is the current density?

(d) What is the magnitude of the electric field across the ends of the wire?

4a. Compute the theoretical density of CsCl. (Atomic masses: Cs=132.91 g/mol and Cl= 35.45 g/mol) (Ionic radii: Cs+ = 0.170nm, Cl- = 0.181 nm)

4b**.** Compute the atomic packing factor for cesium chloride.



5. The following electrical characteristics have been determined for both intrinsic and p-type extrinsic gallium antimonide (GaSb) at room temperature:



|  |  |  |  |
| --- | --- | --- | --- |
|  | **σ (Ω.m)**–1 | **n (m**–3**)** | **p (m**–3**)** |
| Intrinsic | 8.9 × 104 | 8.7 × 1023 | 8.7 × 1023 |
| Extrinsic (p-type) | 2.3 × 105 | 7.6 × 1022 | 1.0 × 1025 |

Calculate electron and hole mobilities.