HW 1	Inorganic Materials Chemistry	Name:	
Points:	**C7780**	**Date:**	
Max. 100 points	**Fall 2013**	**A**	

1. (8 pts) A unit cell has in general shape of a) cube b) tetrahedron c) parallelepiped

2. (12 pts) In the crystalline Cu_2O, oxygen atoms possess coordination number 4. What is the coordination number of Cu? Show how you arrive to the answer.

3. (30 pts) A solid state reaction between Ni and $NiBi_3$ discs leads to the product shown below. Consider three cases:
a) only Ni diffuses through the interfaces
b) only Bi diffuses through the interfaces
c) both Ni and Bi diffuse through the interfaces at the same rate
Calculate for each case the Kirkendall ratio, compare your results with Figure 5, and suggest which mechanism is the most plausible.

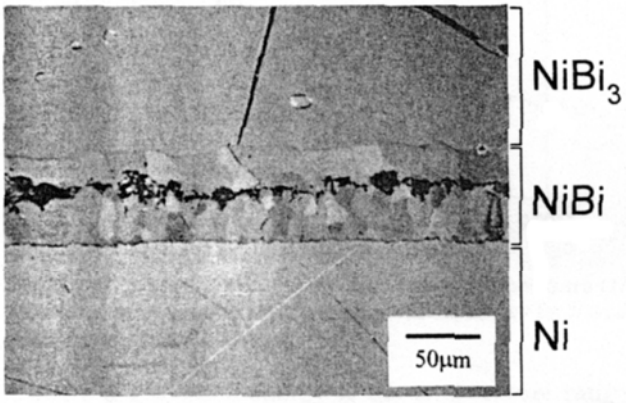


Figure 5. A cross sectional picture (polarized) showing the reaction product NiBi for the reaction between $NiBi_3$ and Ni at 370 °C for 600 h. From top to bottom, the three layers are $NiBi_3$, NiBi, and Ni, respectively. The crack within NiBi delineates the original interface between Ni and $NiBi_3$ before the reaction.

4. (15 pts) A (111) diffraction in the powder X-ray diffractogram appears at 41 degree 2θ when Cu Kα radiation was used (λ = 1.54059Å).
a) What is the value of the interplanar distance d_{hkl} ?

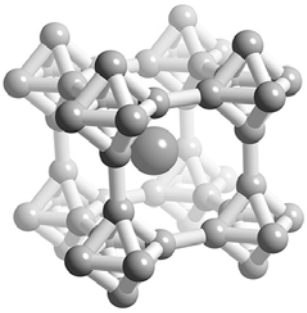
b) What would be the value of the diffraction angle when Mo Kα radiation is used instead (λ = 0.70932 Å).

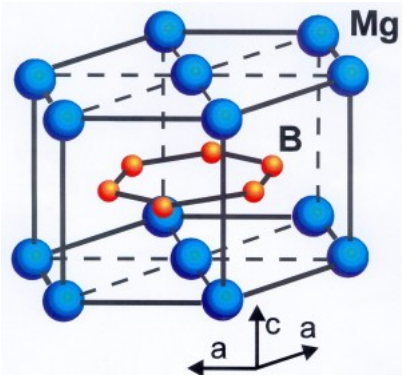
c) The relationship between d_{hkl} and cubic lattice parameter a is:

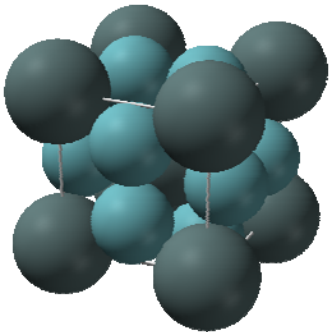
$$\frac{1}{d^2_{hkl}} = \frac{h^2 + k^2 + l^2}{a^2}$$

Calculate the cubic cell size.

5. (15 pts) Give stoichiometric formulas for these structures. Large atoms = A, small atoms = B







6. (20 pts) Specific surface area of α-Fe_2O_3 was measured by nitrogen adsorption at 77 K and its value is 120 $m^2\ g^{-1}$. Density of this oxide is 5.277 g cm^{-3}. Calculate the particle size assuming a spherical particle shape.