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

1. (5 pts) A unit cell have in general shape of a) cube b) tetrahedron c) parallelepiped

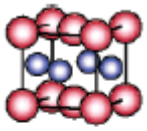
2. (35 pts) Assume that CaO reacts with CeO_2 and forms $CaCeO_3$. What could be the structure type of this compound? _____

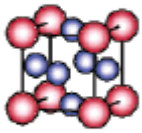
Write balanced chemical equations for the reactions taking place at the interfaces I and II (assume counter diffusion of both cations) and calculate the Kirkendall ratio for this process.

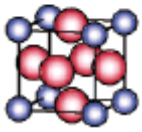
	I	II	
	CaO	**$CaCeO_3$**	**CeO_2**

3. (10 pts) Derive Miller indices for planes that intersects the cell axes at a/2, 2b/3, 2c.

4. (15 pts) Give stoichiometric formulas for the structures. Large atoms = A, small atoms = B







5. (15 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.

6. (20 pts) Maghemite γ-Fe_2O_3 crystallizes in a defect inverse spinel structure (as Fe_3O_4), but some positions of Fe^{3+} in octahedral holes must be vacant, in order to maintain stoichiometry. What part of these holes must be empty in comparison with Fe_3O_4.
□ = vacancy, empty hole, (X) = tetrahedral position, [Y] = octahedral position
Fill stoichiometric coefficients at the horizontal lines:

(Fe)___ [Fe___, □____] O_4