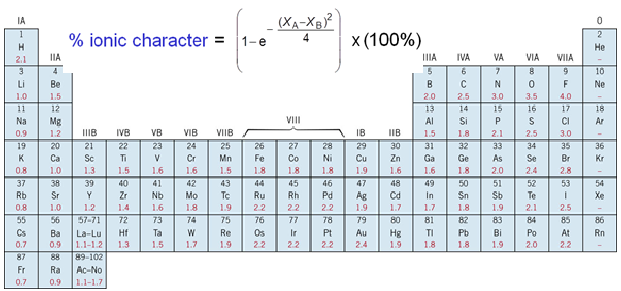
PHYS 321 S 2022 Test #1 Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

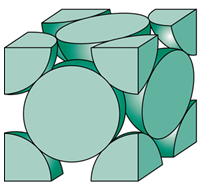
A. The net potential energy between two adjacent ions, EN, may be represented by:



Calculate the equilibrium inter-ionic spacing, r0 and the bonding energy E0 in terms of the parameters A, B, and n.

B. Compute the percent ionic character of the inter-atomic bonds for the following compounds: MgO and GaAs. The electronegativity values are given below.  


1. The unit cell for the face-centered cubic crystal structure is shown below.



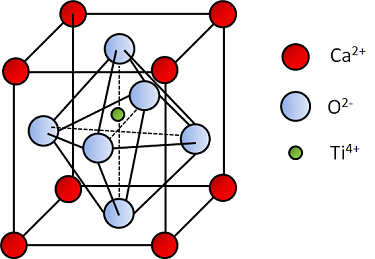
1. Show that the cube edge length, *a* and the atomic radius, R are   
related by:

2. Show that the atomic packing factor is 0.74 for FCC.

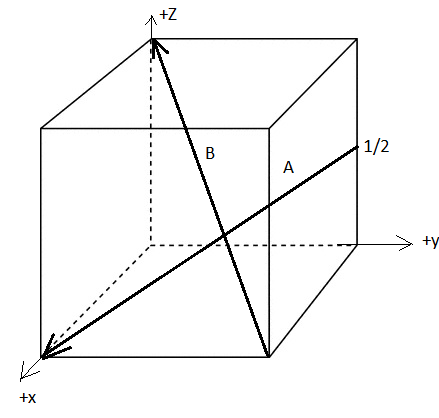
3a. Calculate the atomic radius of a lead atom, given that Pb has a FCC crystal structure, a density of 11.35 g/cm3, and an atomic weight of 207.2 g/mol.

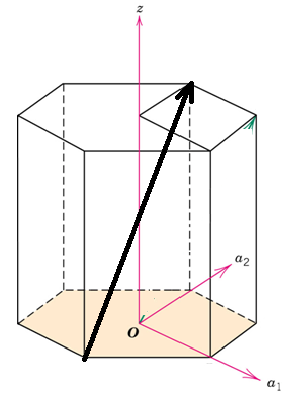
3b. Calculate the planar density for (110) planes in lead.

D. Determine the density of CaTiO2. Ionic radius: Ca = 0.100 nm, O = 0.140 nm, and Ti = 0.068 nm. Atomic masses: Ca = 40.08, O = 16, Ti = 47.87



E. 1. What are the indices for the directions shown, A and B within a cubic unit cell?  
 2. Draw the direction [



F. 1. Determine the 3-axis indices and then convert them to 4-axis indices for the directions shown.   


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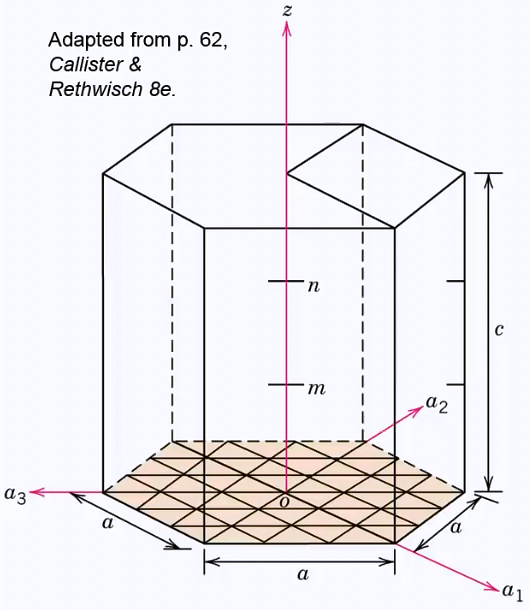
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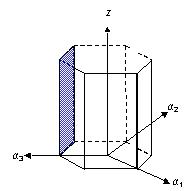
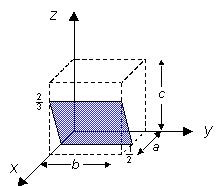
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2. Draw the direction [



G. What are the Miller indices for the planes shown below?   


H. Hexagonal Closed Pack Structure  
  
1. Show that the base area of the unit cell for HCP is given by, 6√3R2.

2. Show that the atomic packing factor for HCP is 0.74.

3. Magnesium (atomic weight = 24.31) has an HCP unit cell for which the ratio of the lattice parameters *c/a* is 1.624. If the density of Mg is 1.74 g/cm3, determine the radius of the Mg atom.

