

**PHYSICS 425: Spring 2013: HomeWork #2**

**Due: Monday 06th February 2013**

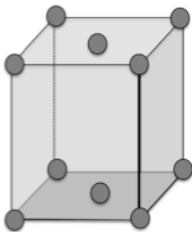
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- **Q-1** 15 points

Kittel Problem 3: Show that the  $c/a$  ratio for an ideal hexagonal close packed structure equals to 1.6333. If  $c/a$  is significantly larger than this value, the crystal structure may be thought of as composed of planes of closely packed atoms, the planes being loosely packed.

- **Q-2** 10 points

What is the Bravais Lattice of the crystal explained by the following non-primitive cell?



- **Q-3** 15 points

Gallium Arsenide crystallizes with a Zinc Blende structure. (Zinc Blende structure is similar to Diamond structure, with two different atoms in the basis) The Ga-As bond length is 2.45 Å. (a) what is the length of a cube edge? (b) What is the shortest Ga-Ga separation? (c) What is the density of GaAs? The atomic weights of Ga and As are 69.7 and 75.0 respectively.

- **Q-4** 15 points

Draw the Wigner seitz Unit cell for (a) two-dimensional square lattice (b) two dimensional rectangular lattice (c) two-dimensional hexagonal lattice (d) two-dimensional honey comb lattice.

- **Q-4** 15 points

Within a cubic unit cell, sketch the following directions:

- (a)  $[\bar{1}10]$  (b)  $[0\bar{1}2]$  (c)  $[\bar{1}\bar{1}1]$  (d)  $[1\bar{2}3]$   
(e)  $[\bar{1}21]$  (f)  $[1\bar{3}3]$  (g)  $[\bar{1}22]$  (h)  $[\bar{1}03]$

- **Q-4** 15 points

Sketch within a cubic unit cell the following planes:

(a)  $(0\bar{1}\bar{1})$  (b)  $(10\bar{2})$  (c)  $(\bar{1}\bar{1}\bar{1})$  (d)  $(\bar{1}2\bar{3})$

(e)  $(11\bar{2})$  (f)  $(1\bar{3}1)$  (g)  $(1\bar{2}\bar{2})$  (h)  $(0\bar{1}\bar{3})$