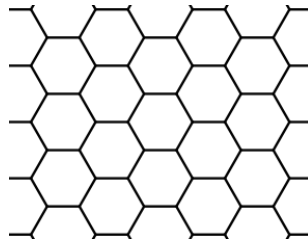


PHY 491 - 2013

Atomic, Molecular, and Condensed Matter Physics

Problem Set 8

1. Consider a two-dimensional (2D) Bravais lattice with primitive vectors \mathbf{a}_1 and \mathbf{a}_2 . Find (primitive) reciprocal lattice vectors. (3 pt) Find the area of the primitive cell of the reciprocal lattice and the possible types of the shape of the first Brillouin zone (3 pt).
2. Consider “packing fraction” for a 2D lattice. It may be defined as a ratio of two areas. One is the area within the primitive cell covered by identical circles centered at the lattice points, with radii such that the circles on the nearest points touch each other. The other is the area of the primitive cell itself. Find this fraction as a function of the ratio of the lengths of the primitive vectors \mathbf{a}_1 and \mathbf{a}_2 and the angle between them (6 pt)
3. Prove the equivalence of the two definitions of the Miller indices used in class; please go beyond the textbook (3 pt)
4. For the honeycomb lattice with the interatomic distance a , find the basis, the unit cell, the lattice vectors, and the reciprocal lattice vectors. (10 pt)



You are supposed to get 25 points. The solution is due on November 6.