

CLASS 4:

1.

The inversion operator is a symmetry operator about a point if for any lattice vector \mathbf{r} about this point, there is another lattice vector $-\mathbf{r}$.

- (a) Show that any Bravais lattice is invariant under inversion about a lattice point.
- (b) Show that diamond is symmetric to inversion about a point that is located at the middle between two nearest atoms.

2.

Show that Bravais lattice can only be symmetric to rotation (around a point) by φ where $2 \cos(\varphi) = \text{Integer}$. Can you find a Bravais lattice with rotation symmetry of $2\pi/3$, but without symmetry for rotation of $2\pi/6$?

RECIPROCAL LATTICE

3.

Find the reciprocal lattice of $\vec{a}_1 = \hat{x}$, $\vec{a}_2 = \hat{x} + \alpha\hat{y}$.

4.

For an N dimensional space we have a_1, \dots, a_n . Write the relation $b_j \cdot a_i = 2\pi\delta_{ij}$ as matrix multiplication and find an expression for b_j in terms of a_i .

5.

Hexagonal lattice:

- (a) Find the reciprocal lattice vectors
- (b) Draw the the first brillouin zone, what its volume.
- (c) Draw the planes defined by the Miller indices (1, 0, 0), (0, 1, 0), (0, 0, 1).