

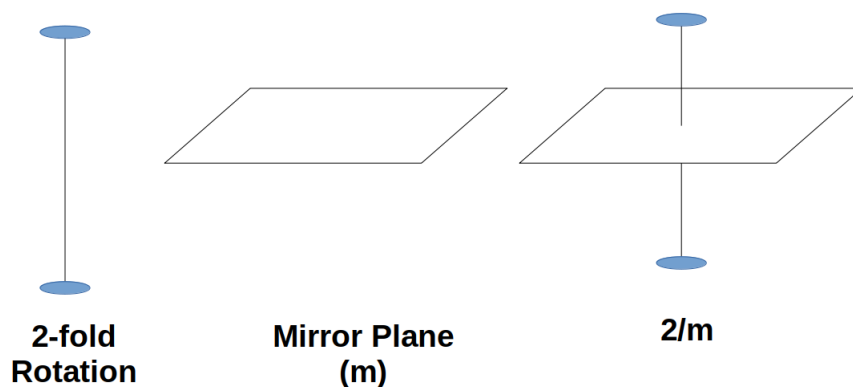
Assignment 1: Crystal Structure

January 28, 2021

1. Show the location of the 6 rotation axis on the hexagonal unit cell.
2. Why is there no base-centred (C-centred) cubic lattice? Describe your answer using appropriate geometrical drawings.
3. Similarly, show that attempting to center two perpendicular faces of a cubic crystal class, does not result in a new Bravais lattice.
4. The monoclinic unit cell is compatible with the point group 2 , m and $2/m$. They are described by the symmetry elements.

2	a lone two rotation axis
m	a single mirror plane
$2/m$	a two fold axis with a perpendicular mirror plane

Diagrammatically, let's represent this as following,



Draw similar diagram for the group 222 , mm , and mmm compatible with the orthorhombic system.

5. The point group D_{4h} or $4/mmm$ is developed from the point group C_{4h} or $4/m$ by introducing a 2 rotation axis perpendicular to the principal 2 axis of the $2/m$ point group. This construction can be written as:

$$D_{4h} = C_{4h} \times \{1, 2'\}.$$

Draw the stereograms of $C_4 \equiv 4$, $C_{4h} \equiv 4/m$, $D_{4h} \equiv 4/mmm$ evolving them in a step-by-step fashion.