



9. Homework Unit cell, Wigner-Seitz unit cell

1. How does the Wigner-Seitz unit cell depend on the choice of basis vectors?
Please draw the Wigner-Seitz unit cell of the lattice, which have the following lattice constants:

- a) $a=1, b=2, \alpha = 70^\circ$
- b) $a=1, b=1, \alpha = 60^\circ$
- c) $a=1, b=2, \alpha = 90^\circ$

2. The 2D crystal structure has a 3-fold axis. Define type of Bravais lattice for this crystal. The atomic positions in a unit cell are given by following coordinates $A=[x,y]$:

- a) $[x,y]=[0.2,0.1]$
- b) $[x,y]=[1/3,2/3]$
- c) $[x,y]=[0.3,0.7]$

Find the positions of all symmetry-equivalent atoms in the crystallographic unit cell.

3. The structure of a 2D crystal can be describes by a centered rectangular crystal lattice. This structure has a mirror plane m , which is parallel to the crystallographic b -axis ($[-x,y]$ transformation). The atomic positions are given by following coordinates $A=[x,y]$:

- a) $[x,y]=[0.2,0.1]$;
- b) $[x,y]=[0,0]$;
- c) $[x,y]=[0.25,0.25]$;

Find the positions of all symmetry-equivalent atoms in the crystallographic unit cell (the unit cell is not primitive).