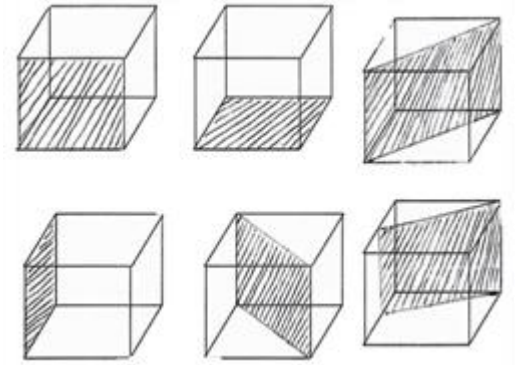


## TUTORAL N°2

### Activity 1:

In a three-dimensional crystal lattice with lattice parameters  $a$ ,  $b$ , and  $c$ :

1. Draw the rows (direction  $[100]$ ,  $[210]$ ,  $[111]$ ,  $[112]$ ).
2. Calculate the angle between the rows  $[100]$  and  $[111]$ .
3. Draw the crystallographic planes  $(111)$ ,  $(210)$ ,  $(001)$ ,  $(100)$ ,  $(2^{-1}02^{-1}0)$ , and  $(222)$ .
4. Provide Miller indices for the following planes.



### Activity 2 :

If we consider that the constituent atoms of the crystals are solid spheres with a radius  $r$ , what is the packing efficiency or compactness in the following cases:

- Simple Cubic (cP)
- Body-Centered Cubic (cI)
- Face-Centered Cubic (cF)
- Hexagonal Close-Packed (hCP)
- Diamond

### Activity 3:

The X-ray diffraction (XRD) analysis revealed that the structure of fluorite ( $\text{CaF}_2$ ) is as follows:

Fluoride ions ( $\text{F}^-$ ) occupy the vertices, face centers, edge midpoints, and cube centers, while  $\text{Ca}^{2+}$  cations occupy the centers of the small face-centered cubes with an edge length of  $a/2$ .

calculate the mentioned parameters:

- Coordination Number
- Multiplicity
- Packing Ratio
- Density (Volumetric Mass).

