



Crystallography

Definition & Concept

Lab. 1

AIMS:

- ❖ **Definition**
- ❖ **Crystal build**
- ❖ **Crystallization**
- ❖ **Crystal Morphology**
- ❖ **Crystallographic elements**



Crystallography: is the experimental science of determining the arrangement of atoms in the crystalline solids

The crystallographic study includes:

- 1- Growth
- 2- External shape
- 3- Internal structure

Crystal: is a regular geometric solid bounded by smooth plane surfaces.



Types of crystals:

Euhedral crystal: A crystal with well-formed faces.



Subhedral crystal: crystal has imperfectly developed faces.

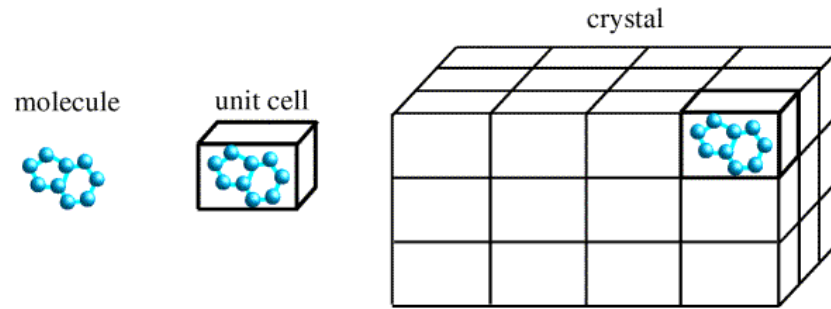


Anhedral crystal: A crystal which none of the faces is developed.



Crystal build

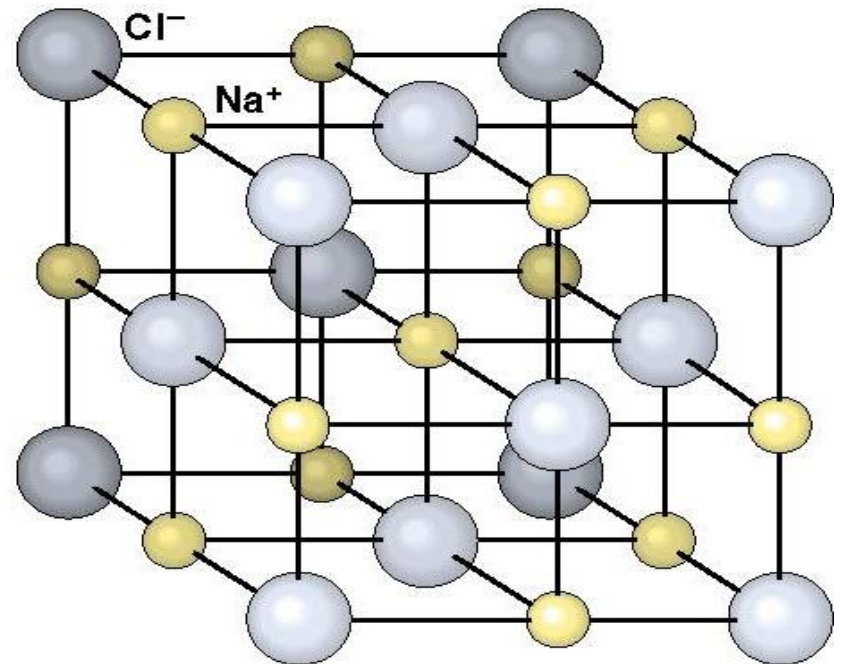
- In all crystal, a small group of atoms, like a single brick in a wall, repeats itself over and over. This small group of atoms is called a unit cell



- Unit cell is the smallest three-dimensional portion of a complete space lattice, which when repeated over and over again in different directions produces the complete space lattice (Crystal).

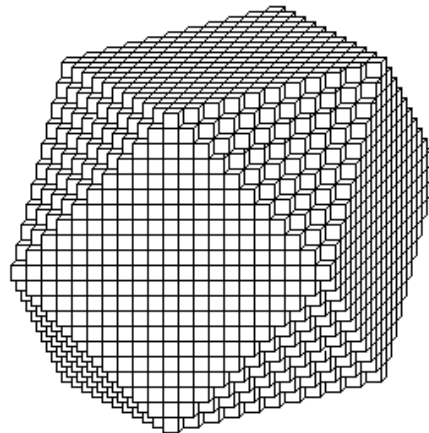
➤ Space Lattice

A regular 3-dimensional geometric arrangement of the atoms or molecules or ions composing a crystal



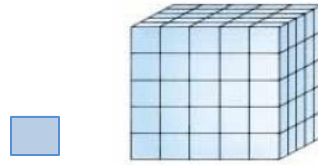
Crystallization: The generation of crystal is known as crystallization.

- Crystals are formed from solutions, melts, and vapors.
- The atoms in disordered states have a random distribution but with changing temperature (T), pressure (P), and concentration they may join in an ordered arrangement characteristic of the crystalline state.
- Crystal is composed of millions of repeated unit cells.



- Shape of crystal depends on shape of unit cell and their arrangements.

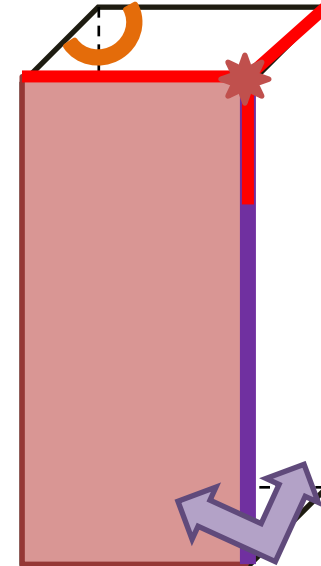
eg. Halite



Crystal Morphology

Crystal morphology consists of:

1. Crystal Faces
2. Crystal edge
3. Solid angle
4. Interfacial angle

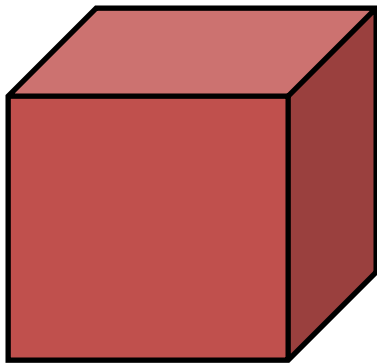


1. Crystal Faces

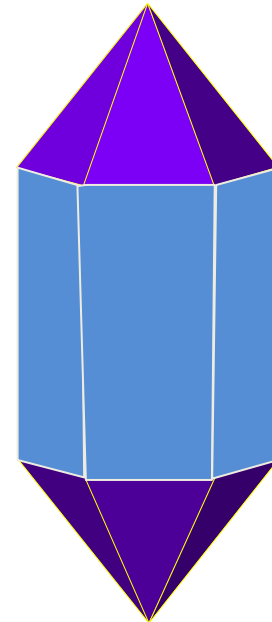
- ❖ Flat or curved similar or non- similar
- ❖ A crystal is usually bounded by a number of flat surfaces (Faces)

Type of faces:

- ❖ Like faces (similar): all faces have same shape
- ❖ Un-like faces (non-similar): crystal consists of more than one shape.



6 faces

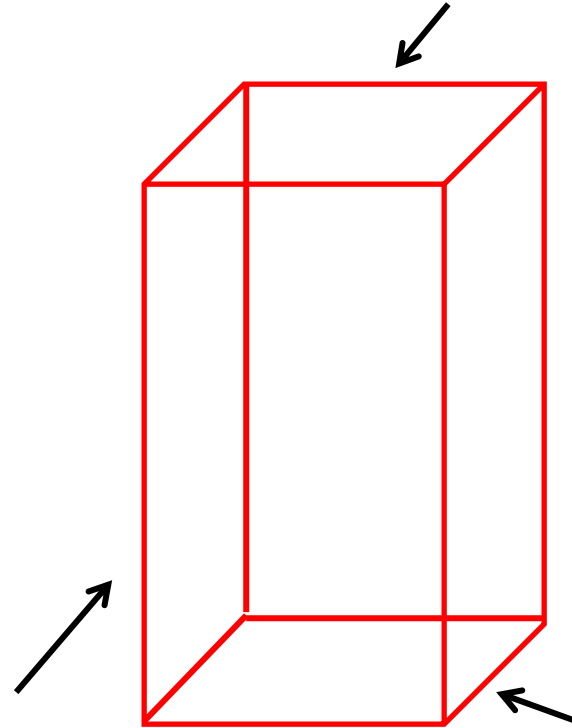


18 faces

2. Crystal edges

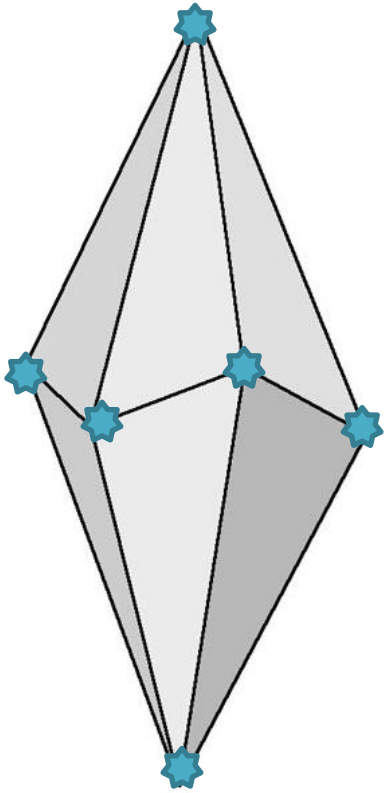
An edge is formed by the intersection of any two adjacent faces.

$$4+4+4= 12 \text{ edges}$$

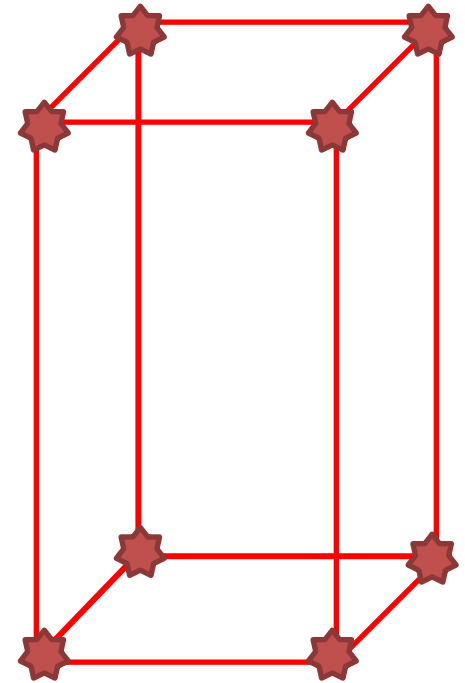


3. Solid angle

A solid angle is formed by the intersection of three or more faces.



$$1+8+1=10$$



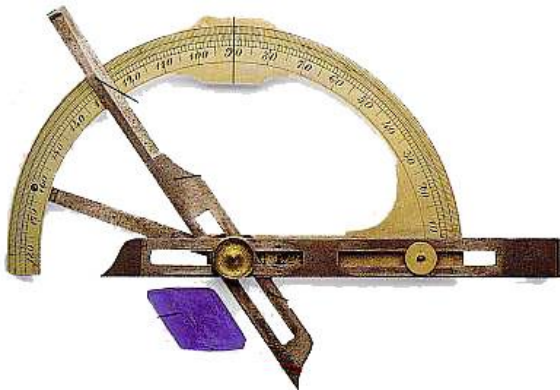
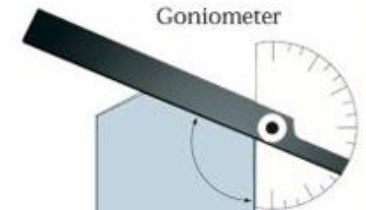
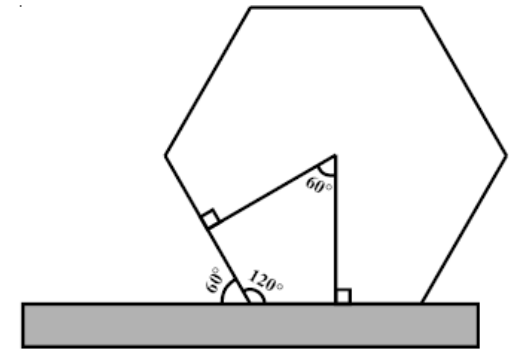
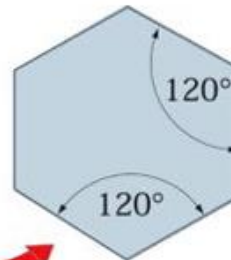
$$4+4=8$$

4. Interfacial angle

- The angle between any two faces of a crystal is termed the interfacial angle.
- Interfacial angle measured by goniometer.



Basal cross section

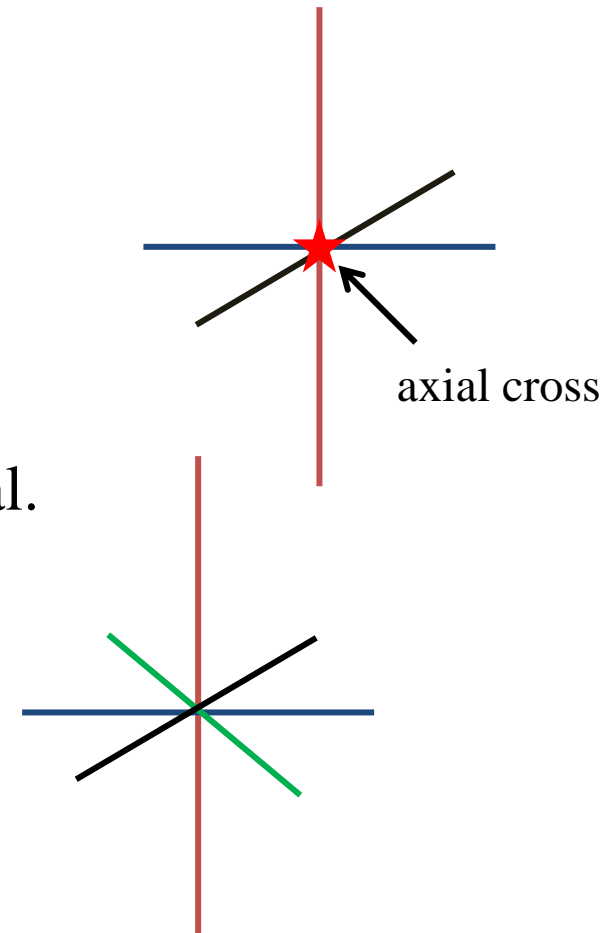


Crystallographic elements

Crystallographic axes: Are imaginary straight lines, intersect at the center of the crystal and extending to the mid of the crystal faces, edges or solid angle.

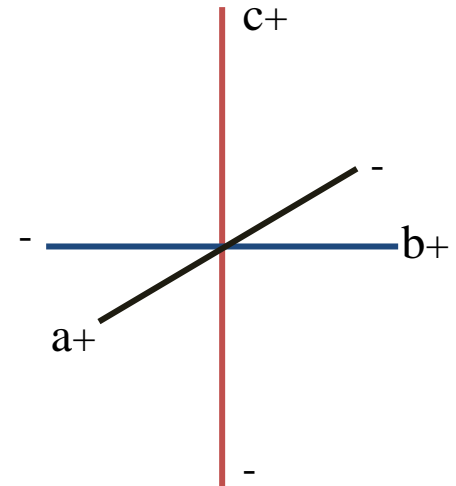
Some characteristic of Crystal axes:

- 1- They are straight lines.
- 2- Intersect at a point called axial cross.
- 3- They are 3 or 4 lines.
- 4- One of them is vertical others are horizontal.
- 5- May be equal in length or different.



Crystallographic axes name:

- 1- **a** axis- horizontal and is oriented front to back.
- 2- **b** axis- horizontal and is run right to left.
- 3- The two ends of each of these axes are given the + or – notation by convention.
- 4- **c** axis is vertical extending from upper to lower in the crystal.
- 5- The top of **c-axis** is **c+** and the bottom is **c-**; the front portion of the **a-axis** is **a+**, and the back portion is **a-**; the right side of the **b-axis** is **b+** and the left side is **b-**.



NEXT LAB

CRYSTAL SYSTEMS