



3LOMENIGIA
FUN SCIENCE

* **Crystallography**: is the science that deals with the study of crystals and crystalline materials, whether they are formed by nature (e.g. Quartz) or they are prepared in the laboratory (sugar crystal).

Crystalline substance متبلورة	Amorphous substance غير متبلورة
are characterized by arrangement of atom	are characterized by random arrangement of atom
Has periods of constant temperature	formed by rapid cooling

* **Crystal**: is a homogeneous solid material with a definite chemical composition bounded by naturally formed smooth planes surface which having symmetry relationship.

* **Crystal Parts**:

- 1) **Faces**: ~~external~~ external smooth planes reflect or show internal atomic arrangement.
- 2) **Edges**: it's the line resulting from meeting of 2 neighboring faces.
- 3) **Angles**

Solid
 result from meeting of more than 2 face / is the angle between 2 neighboring ^{interfacial} faces.

- * The angle can be measured by contact goniometer.
- * minerals can be distinguished from each other by their **(interfacial angle)** مقياس الزوايا
- * **interfacial angle** is constant regardless of its size because reflect the regular internal atomic arrangement.

- * **Crystal structure**: is a description of the ordered arrangement of atom or ions a crystalline material.
- * **unit cell**: is the building block of crystal and arranged in a geometrical 3 dimensional shape.

* Bravais lattice
atom are the same kind
Non Bravais lattice
atom aren't the same kind

* elements of symmetry and axes of symmetry
→ Plane of symmetry: divide the crystal into 2 equal identical.

(Notes): A crystal can be have one or more plane symmetry.
→ a axis of symmetry: is a imaginary axis passing through the centre of crystal, can be rotated and similar face comes to the same position in a complete rotation.

* Centre of symmetry: This an imaginary point

(Some Notes):

- | | | | |
|---------------------|-------------|--------------|--------|
| 1) axes of symmetry | محاور تماثل | → rotation | دوران |
| 2) plane | سطح تماثل | → Reflection | انعكاس |
| 3) centre | نقطة تماثل | → inversion | انقلاب |

* crystallographic angles: the intersections of the crystallographic axes.

- α , lies between b and c axes
- β , lies between a and c axes
- γ , lies between a and b axes

المحاور البلورية :-

crystallographic axes	محاور البلورية
axes of symmetry	محاور التماثل

* crystal form: it's a set of planar faces similar in both shape and size.

open form	closed form.
is one or more crystal face that can't close the crystal in all direction.	is a set crystal face that completely close crystal in all direction alone.

simple crystal	compound crystal
one face form it's similar	more than one form combined.

1) cubic system 3L4 4L3 6L2 9P 6

* crystallographic axes: (a, b, c)
(angles): α, β, γ (90)

* Elements of symmetry

Number of Planes: 9 P
Axes: 3L4, 4L3

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- * Centre of symmetry: is present in this class, Parallel face.
 - * Crystal forms: -
 - (1) Hexahedron, octahedron, Rhombic Dodecahedron, tetra hexahedron,
 - trisoctahedron, trapezohedron.

* Tetragonal system: $4L_2 \ 4L_2 \ 5P \ C$

* Crystallographic axes: $a_1 = a_2 \neq c$

angles: $\alpha = \beta = \gamma = 90^\circ$

1. Elements of symmetry

2. Number of planes $5P$

3. Axes $4L_2, 4L_2$

* Centre of symmetry: it's present.

* Crystal forms, Basal / Penacoid Ck's and open form 2 face parallel

1. tetragonal prism tetragonal bipyramid

1. Di Di

* Orthorhombic system $3L_2 \ 3P \ C$

* Crystallographic axes: $a \neq b \neq c$

* angle: $\alpha = \beta = \gamma = 90^\circ$

1. Elements of symmetry:

2. ne. of planes 3

3. ne. Axes $3L_2$

4. Centre of symmetry: it's present.

5. Crystal forms: Basal (b), (c), orthorhombic prism, orthorhombic bipyramid a or b or c Brach dome, b or macro dome.

* Hexagonal system. $6L_2 \ 6L_2 \ 7P \ C$

* Crystallographic axes: $a_1 = a_2 = a_3 \neq c$

* angle: $\alpha = \beta = \gamma$

1. Elements of symmetry:

ne. of planes: 7

ne. of Axes: $6L_2$

(4) *

* Centre of symmetry is present.
→ crystal form:

Basal (C) Pencil, Hexagonal Prism, Hexagonal bipyramid
Di- Di-

(important notes)

1) closed → bipyramid /

2) open: dome, prism, pincoid -

* Penciloid → is an open, 2 face 2 parallel face

* Dome → 2 non parallel face

3) Prism → consisting 3 or more parallel vertical face.

4) Bipyramid is closed form of 6, 8, 16 / 24 triangular

* Horizontal from:-

a → front to back

b → right to left

c → top to bottom.

☆ موضوع الدرس

II

Rock & mineral & crystal

موضوع الدرس

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mineral

* mineralogy: Branch of geology that study mineral.

- 1) Solid
- 2) naturally occurring
- 3) inorganic substance
- 4) have chemical composition
- 5) have internal arrangement of atom.

* minerals *

crystalline

- with internal atomic structure
- low rate of cooling

Amorphous

- without internal atomic structure
- High and speed rate of cooling

1) carbonates

(CO₃)²⁻ + ...

e.g CaCO₃, CaMg(CO₃)₂

2) silicates

(SiO₂) + ...

e.g KAlSi₃O₈, Mg(Fe)₂SiO₄

3) sulfides

(S)²⁻ + ...

e.g (PbS), (FeS), (ZnS)

4) oxides

(O₂)

e.g (Fe₂O₃), (Fe₃O₄)

5) halides

(Cl, F, I, Br) + ...

NaCl

CaF₂

6) Sulfates $(SO_4)^{-2}$

e.g. $CaSO_4 \cdot H_2O$

7) Phosphates $(PO_4)^{-3}$

e.g. $Ca_5(PO_4)_3OH$

8) Native elements C, Cu, Ag, Au

★ Physical Properties:

Optical Properties: dependent upon light

1) Colour: يعتمد على قدرة المعدن على منع موجات الضوء

1) Constant coloured mineral: e.g. malachite, sulfur

2) Variable: quartz,

3) Colourless

2) Luster: مقدار الضوء المنعكس من المعدن ويوجد منه نوعان

1) Metallic

2) Non metallic

→ Non metallic:

1) Vitreous → luster of glass ex: quartz

2) Resinous → Resin Sulfur

3) Pearly → Pearl talc

4) Silky → Silk

5) Adamantine → brilliant luster Diamond

6) Dull → unglazed pottery limonite

→ metallic: reflect the whole light.

3) Streak: لون مسحوق المعدن عند الفرك

4) Transparency: قدرة المعدن على مرور الضوء ويوجد منه أنواع

1) Transparent: Calcite, Gypsum

2) Translucent: talc, quartz

3) Opaque: magnetite, Galena.