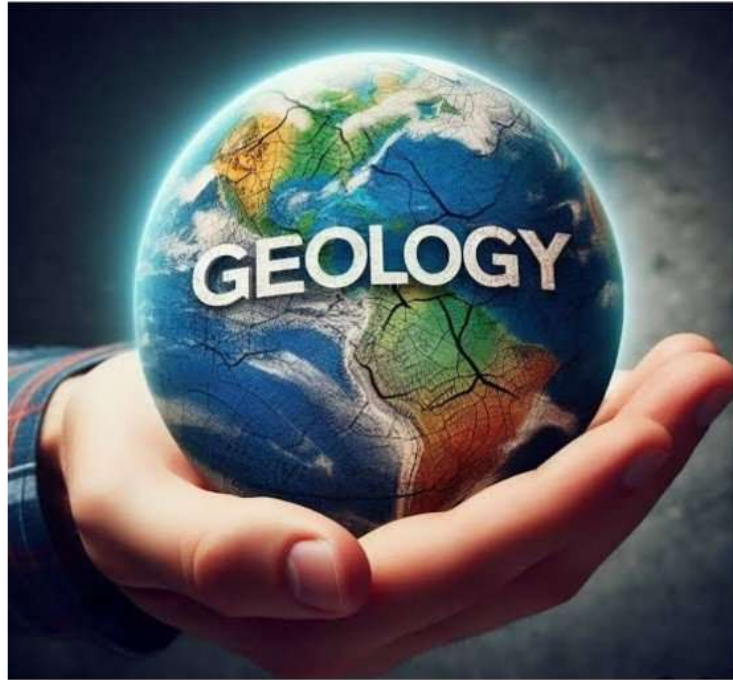


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

زتونة الجيولوجيا 🌟



By : Ahmed Salah

● قبل ما تدخل علي **Crystal Systems** لازم تكون عارف كذا حاجة مهمة يا دكترة

● **Crystal faces** : External smooth surfaces reflect the whole shape of the crystal.

● **Crystal edge**: The line that results from the meeting of two neighboring faces.

● **Crystal form** : is a set of Crystal faces that are related to each other by symmetry.

● **Open form**: is one or more Crystal faces that cannot close the Crystal.

● **Closed form** : is a set of Crystal faces that completely close the Crystal.

● **Simple Crystal**: This is a crystal containing one close form .

● **Compound Crystal** : This is a crystal containing more than one form .

● **Crystallographic axes**: These are imaginary lines passing through the center of the crystal.

a- axis : **front to the back** & b- axis : **left to right side**

c- axis: **top to bottom**

● **Crystallographic angles**: The intersection of the crystallographic axes at the center of the crystal.

(a) : **between b and c axes** & (p) : **between a and C**

(Y) : **between a and b**

● **Planes of symmetry**: imaginary planes which divided the crystal into two half .

● **Axes of symmetry**: is an imaginary line , where a face repeats itself or more times around this axis .

Diad (L^2) axis : **180°**

& **Triad** (L^3) : **120°**

Tetrad (L^4) : **90°**

& **Hexad** (L^6) : **60°**

- **Center of symmetry:** This is an imaginary point, which lies inside the crystal exactly in its center.

● خلي بالك جدا :

- Axes of symmetry - - - - > **Rotation** دوران
- Plane of symmetry - - - - > **Reflection** انعكاس
- Center of symmetry - - - - > **Inversion** انقلاب
- كذا يا دكترة ما دام وصلت لحد هنا ادخل بقا علي **Crystal Systems** وأنت قلبك جامد 🤪

● تعالي بقا ندخل علي **Crystal Systems**: عايزك يا دكترة في كل نظام هناخدته تعرف عنه
7 حاجات بس لا أكثر ولا أقل

1 **Cubic System :**

- [1] Crystallographic axes:** $a_1 = a_2 = a_3$
- [2] Crystallographic angles:** $\alpha = \beta = \gamma = 90^\circ$
- [3] Planes of symmetry:** There are nine of Symmetry
- [4] Axes of symmetry:** Has 13 axes of symmetry
- [5] Center of symmetry:** There is only one of symmetry
- [6] Complete system formula :** $3L^4 . 4L^3 . 6L^2 . 9P . C$

[7] Crystal forms : بص يا دكترة انت عندك 7 أشكال هتعرفها دلوقتي هديك العلامة المميزة لكل شكل علشان مش تتلخبط من الاخر هقولك هو بيسأل علي ايه في الامتحان

- (1) **Hexahedron:** it is composed of 6 square faces at 90° angles to each other.
- (2) **Octahedron:** it is composed of 8 equilateral triangles.
- (3) **Rhombic Dodecahedron:** it is composed of 12 rhomb- shaped faces .

- (4) **Tetrahexahedron:** it is composed of 24 isosceles triangular faces. This shape is dividing each face of a cube to 4 equal - sized triangular faces.
- (5) **Trapezohedron:** it is composed of 24 similar trapezium - shaped faces . This shape divides each face into 4 trapezium faces.
- (6) **Trisoctahedron:** it is composed of 24 - faced form , but the faces are isosceles triangles.
- (7) **Hexoctahedron: (General form) :** it is composed of 48 triangular faces, 6 faces appearing to be raised form each face of a simple Octahedron.

● كده نكون خلصنا يا دكترة أول نظام بلوري معانا ✨

2 **Tetragonal system:**

- [1] Crystallographic axes:** $a_1 = a_2 \neq c$
- [2] Crystallographic angles :** $\alpha = \beta = \gamma = 90^\circ$
- [3] Planes of symmetry:** There are five planes of symmetry
- [4] Axes of symmetry :** There are 5 axes of symmetry
- **one tetrad** axis perpendicular to one planes (1) ■
 - **four diad** axes perpendicular to four planes (6) ●
- [5] Center of symmetry:** Only one center of symmetry is observed in this normal class .
- [6] Complete symmetry formula:** $L^4 \cdot 4L^2 \cdot 5P \cdot C$

[7] Crystal forms: Tetragonal system includes seven forms:

- (1) **Basal (C) Pinacoid:** it is an open form composed of two faces parallel to each other and intersects only the c axis .
- (2) **Tetragonal prism 1st order :** it is an open form having 4 faces that are parallel to the c axis.
- (3) **Tetragonal prism 2nd order:** Here two faces intersect the a1 and are parallel to a2 , other two faces are parallel to a1 and intersect a1 .
- (4) **Ditetragonal prism :** This form consists of 8 faces parallel to the c-axis and intersect the horizontal axes but at different distances.
- (5) **Tetragonal bipyramid 1st order:** it is a closed form have 8 isosceles triangular faces intersecting all Crystallographic axes but not at the same distance.
- (6) **Tetragonal bipyramid 2nd order:** it has the basic shape as the form of the 1st order bipyramid, differing only in its orientation to horizontal axes (a1 , a2) .
- (7) **Ditetragonal bipyramid (General form) :** it is a closed form having 16 faces.

• كده نكون خالصنا يا دكترة تاني نظام بلوري معانا

3 Hexagonal system:

- [1] Crystallographic axes:** $a_1 = a_2 = a_3 \neq c$
- [2] Crystallographic angles:** $\alpha = \beta = 90^\circ \neq \gamma \approx 120^\circ$
- [3] Planes of symmetry:** There are seven planes of symmetry One of them is horizontal and the six planes are vertical.
- [4] Axes of symmetry:** Has 7 axes of symmetry.
 - **One hexad** axis perpendicular to one planes (1)
 - **six diad** axes perpendicular to four planes (6)

[5] Center of symmetry: Only one center of symmetry.

[6] Complete system formula: $L^6 \cdot 6L^2 \cdot 7P \cdot C$

[7] Crystal forms: Hexagonal system has 7 Systems:

(1) **Basal (C) Pinacoid:** it is an open form composed of two faces parallel to each other and intersects only the c - axis.

(2) **Hexagonal prism 1st order:** it is an open form having 6 faces that are parallel to the c axis.

(3) **Hexagonal prism 2nd order:** Here two faces intersect the a_1 and are parallel to a_2 While the other two faces are parallel to a_1 and intersect a_1 .

(4) **Dihexagonal prism :** This form consists of 12 faces parallel to the c axis and intersect the horizontal axes but at different distances.

(5) **Hexagonal bipyramid 1st order:** it is a closed form have 12 isosceles triangular faces intersecting all Crystallographic axes but not at the same distance.

(6) **Hexagonal bipyramid 2nd order:** Only in its orientation to horizontal axes (a_1 , a_2 , a_3) .

(7) **Dihexagonal bipyramid (General form) :** it is a closed form having 24 faces.

● كده نكون خلصنا يا دكترة ثالث نظام بلوري معانا 🙏

4 Orthorhombic system:

[1] Crystallographic axes: $a \neq b \neq c$

[2] Crystallographic angles: $\alpha = \beta = \gamma = 90^\circ$

[3] Planes of symmetry: There are 3 planes of symmetry
One of them is horizontal and the other two planes are vertical

[4] Axes of symmetry: Has 3 diagonal axes.

[5] Center of symmetry: Only one center of symmetry.

[6] Complete symmetry formula: $3L^2 \cdot 3P \cdot C$

[7] Crystal forms: The Orthorhombic system has 7 forms.

(1) **Basal (C) Pinacoid:** it is an open form composed of two parallel faces that intercept the c axis .

(2) **Front (a) Pinacoid:** it is an open form composed of two parallel faces that intercept a - axis.

(3) **Side (b) Pinacoid:** it is an open form composed of two parallel faces that intercept the b axis.

(4) **Orthorhombic prism:** it is an open form, consists of 4 faces which are parallel to C - axis.

(5) **Orthorhombic bipyramid (General form) :** it is a closed form, consists of 8 triangular faces, each of them intersects all 3 Crystallographic axes.

(6) **(a) or Brachy dome:** it is an open form, consists of 4 faces Parallel to a- axis.

(7) **(b) or Macro dome :** it is an open form, consists of 4 faces parallel to b - axis.

● وكده نكون خلصنا يا دكترة شابتة البلورات كامل 🤪

عافر حلمك يستاهل ❤️

【1】 **Colour** : the least useful Physical Property as more than one mineral can have the same colour.

【2】 **Constant - colored minerals** : Malachite and olivine are always green , pyrite is always brass - yellow.

【3】 **Varied - colored minerals** : color is not at all a diagnostic property. Most minerals occur in more than one color
ex: quartz , fluorite depends on the **impurities within the mineral**.

【4】 **Luster**: it is the intensity of light reflected from a mineral surface.

【5】 **Metallic Luster**: have a brilliant appearance and shine
ex: Galena , Pyrite , Magnetite

【6】 **Nonmetallic minerals**: Do not shine like polished metal.

ex: Vitreous -----> quartz .

Resinous -----> Sphalerite and sulfur.

Pearly -----> talc and mica .

Greasy -----> graphite .

Silky -----> gypsum and serpentine.

Adamantine -----> Diamond

Dull -----> Limonite.

【7】 **Streak** : it is the colour of mineral in its powdered form .
The streak of mineral is determined by **rubbing it on a streak plate**.

Colour	Streak
ex: Pyrite -----> brass yellow -----> greenish black	

Colour	streak
ex: Orthoclase -----> buff - colored -----> White	

Colour	streak
ex: Hematite -----> can have various colors -----> red - brown	

【8】 **Transparency (Diaphaneity)** :
It is the ability of minerals to pass light through it .

☆ **Transparent :** شفاف Light can pass through the mineral and images can be seen clearly.

ex : Calcite , pure quartz

☆ **Translucent:** شبه شفاف Light can pass through the mineral but it is diffused so images.

ex : Talc, fluorite

☆ **Opaque :** معتم No Light pass through the minerals .

ex : Galena

☆ **Play of Colors :** تلاعب الألوان The mineral appears in many colours when turned.

ex : Opal

☆ **Opalescence:** البريق Milky or pearly Reflections from the interior of the specimen.

ex : Opal

☆ **Chatoyancy:** عين الهر Silky appearance on reflected light result from closely packed parallel fibrous.

ex : Quartz

☆ **Pleochroism:** تعدد الألوان the specimen appears variously colored when viewed in different directions.

ex : Tourmaline

☆ **Tarnish :** التشويه chemical reactions between the mineral and air often produce thin coatings of the reaction products.

ex: Copper , bornite

☆ **Luminescence:** التلألؤ it is emission of light from non incandescent minerals.

ex : Fluorescent

☆ Thermoluminescence: التلألؤ الحراري

Minerals becomes luminous when heated .

ex : Apatite and Calcite.

☆ Triboluminescence: التلألؤ بالحك أو الخدش

Minerals become Luminous when scratched, rubbed, or crushed.

ex : Fluorite and Sphalerite.

☆ Iridescence: التقرح اللوني

It is a play colours due to the thin coating on the mineral surface.

ex : Goethite

☆ Silicates : contain the silica tetrahedral (SiO_4)

• Are the most common mineral class in igneous rocks .

■ عندي خمس أشكال مهمين جدا :

- (1) Isolated silicates - - - - - > Garnet
- (2) Single chain silicates - - - - - > Pyroxene
- (3) Double chain silicates - - - - - > Hornblende
- (4) Sheet silicates - - - - - > Muscovite
- (5) Framework silicates - - - - - > Quartz

☆ Native elements - - - - - > Gold , silver, Diamond

☆ Oxides - - - - - > Quartz , Magnetite , Pyrolusite

☆ Sulfides - - - - - > Pyrite , Sphalerite, Galena

☆ Halides - - - - - > Halite , Fluorite

☆ Carbonates - - - - - > Calcite , Magnesite , Siderite

☆ Sulfates - - - - - > Gypsum , Barite

☆ Phosphates - - - - - > Apatite

☆ وكده يا دكاترة خلصنا المحاضرة الأولى من شابتير المعادن