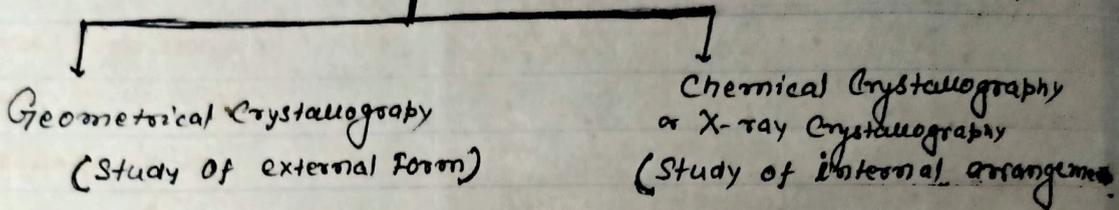**Goniometer:** – For rough work Contact goniometer a type of Pivoted Protractor. For accurate work, reflection goniometer is used.

FORM: – A Crystal have several faces, some of them are similar, the set of similar faces are called form. (FORM).

CRYSTALLOGRAPHY: –

Geometrical Crystallography
(Study of external form)

Chemical Crystallography or X-ray Crystallography
(Study of internal arrangement)

Geometrical Crystallography: –
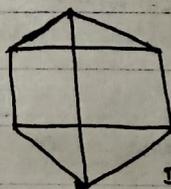
The studies of Geometrical Crystallography is done by the help of three laws: –

① Steno's Law of Constancy of interfacial angles.
② Law of Constancy of Symmetry.
③ Hauy's Law of rational intercepts.
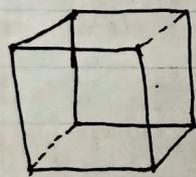
I
Neural
Formation of Nacl in Neutral Medium
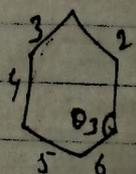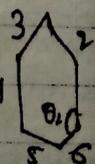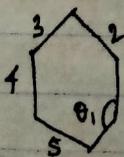
II
± UREA
Formation of Nacl with Urea and Shape is
II

III
fresh shop
Gumarabic.
Formation of Nacl with Gumarabic.

(1) N-Steno (1669) formulated that external shape or habit of a Crystal of given Substance may vary Kitdly with Conditions of formation. But the angle between the Corresponding faces (interfacial angle) of all the Crystal are Constant.

Angle between face 1&6 in each Cases.
i.e. $\theta_1 = \theta_2 = \theta_3$

(2) Law Of Constancy Of Symmetry: → (Geometrical Operation,)

Reflection across a plane — Plane of Symmetry

Rotation along a line: — Axis of Symmetry
(axis)

Rotation along a line (Point): — Centre of Symmetry

(a) **Plane of Symmetry:** —

A crystal is said to posses a plane of Symmetry, When an imaginary Plane Passing through the Centre of Crystal can divide it into two Parts. Such that One is exact mirror image of the other.
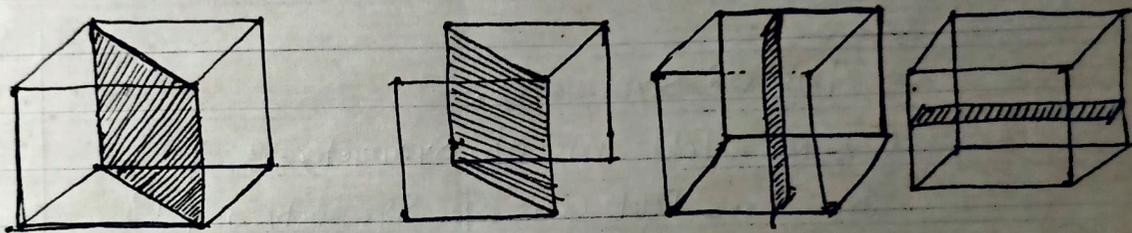

(b) **Axis of Symmetry:** —

It is a line about which the Crystal may be rotated so that it represents the same appearance more than one during a Complete revolution (Rotating through the angle of 360°).
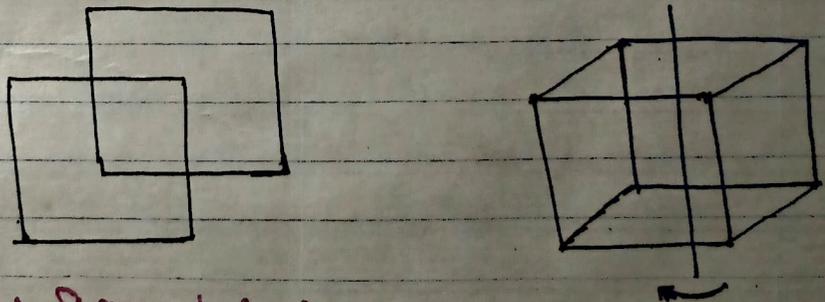
(c) **Centre of Symmetry:** →

It is a imaginary Point in the body of the Crystal Such that a line drawn through it intersects the Opposite identical faces at equal distance. In both directions.

Collectively the Plane, axis and Centre of Symmetry are known as element of Symmetry.
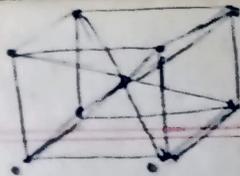
Laws : — The law of Constancial Symmetry is Stated
as fellows : —

"All Crystals of one and of the same Substance
have the same symmetry."

i.e. Total Number of element of Symmetry
of a Cubic Crystal (Say -NaCl) = 23.

1. Plane of Symmetry

   (a) Rectangular Plane of Symmetry = 3 ⎫
   (b) diagonal Plane of Symmetry = 6 ⎬ 9

                                      9+13+1 = 23

2. Axis of Symmetry :—

   (a) Four Fold axis of Symmetry = 3 ⎫
   (b) Three Fold axis of Symmetry = 4 ⎬ 13
   (c) Two Fold axis of Symmetry = 6 ⎭