

PROJECTION OF SOLIDS



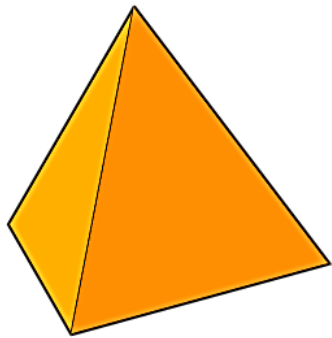
SOLIDS

- A 3-D object having length, breadth and thickness and bounded by surfaces which may be either plane or curved, or combination of the two is defined as a solid.
- It can also be defined as “The thickness measured along with three mutually perpendicular axes.”
- For complete representation of a solid on principal planes having only two dimensions length and breadth, atleast two orthographic views are necessary. Like, TV and FV.
- Sometimes, for acquiring additional information, additional views projected on auxiliary planes becomes necessary.

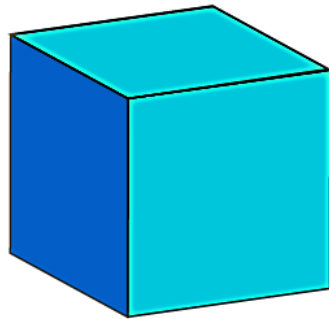
CLASSIFICATION/TYPES OF SOLIDS

- Classification of Solids:
- Solids are classified into two groups. They are,
 - A. **Polyhedron**: A solid, which is bounded by plane surfaces or faces, is called a polyhedron. Polyhedron are classified into two sub groups; these are
 - Regular Polyhedron and Other Polyhedron (Prisms and Pyramid)
 - 1. **Regular Polyhedron**: Polyhedron are regular if all their plane surfaces are regular polygons of the same shape and size. The regular plane surfaces are called "**Faces**" and the lines connecting adjacent faces are called "**edges**".
- Tetrahedron – four equal equilateral triangular faces
- Cube/hexahedron – six equal square faces
- Octahedron– eight equal equilateral triangular faces

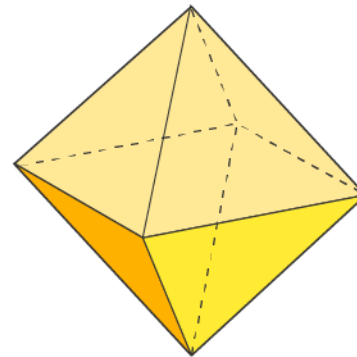
REGULAR POLYHEDRON



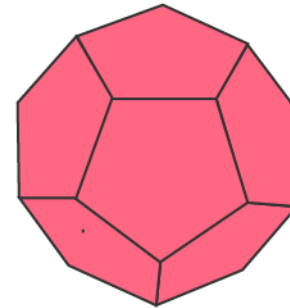
Tetrahedron



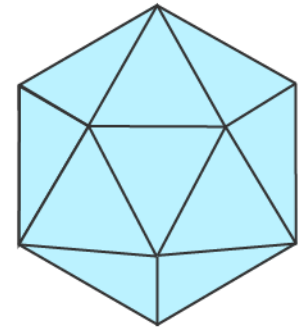
Cube



Octahedron



Dodecahedron



Icosahedron

CLASSIFICATION/TYPES OF SOLIDS

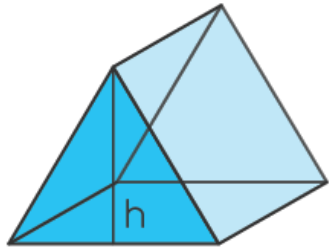
2. Other Polyhedron – Prisms and Pyramids

- a) **Prisms:** A prism is a polyhedron having two equal and parallel regular polygonal end faces joined by side faces which are rectangles. The different types of prisms are, triangular, square, pentagonal etc.

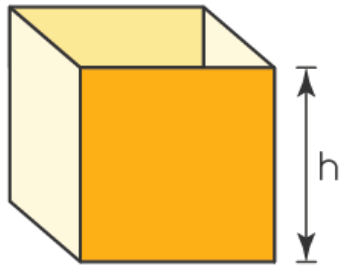
Terms used for Prisms

- I. **Base** – When the prisms are placed on one of its end faces, the end faces on which the prism rests is called the base of the prism.
- II. **Top face** – The end face of the prism on which it does not rest is called the top face of the prism.
- III. **Axis** – The imaginary straight line passing through the centres of base and top face is called the axis of the prism.
- IV. **Lateral faces** – The side face which are rectangular in shape are called lateral faces.
- V. **Edge** – The face on which the prism rests are called Edges.

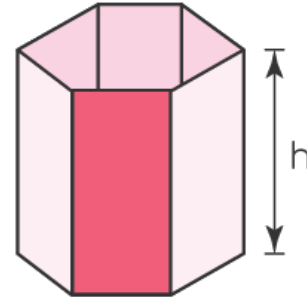
PRISMS



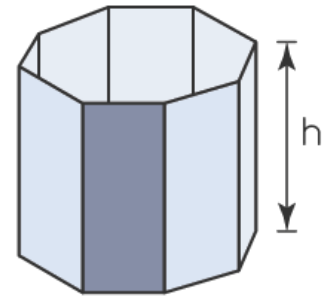
Triangular prism



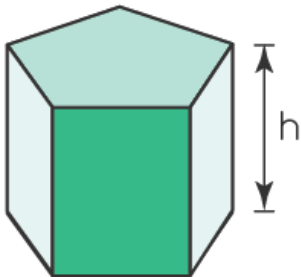
Square prism



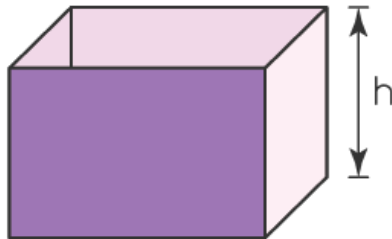
Hexagonal prism



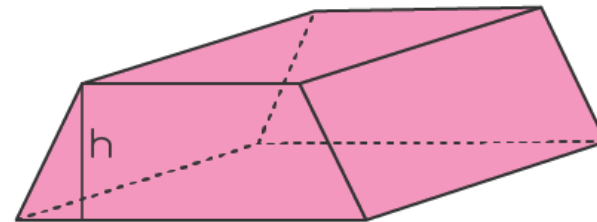
Octagonal prism



Pentagonal prism



Rectangular prism



Trapezoidal Prism

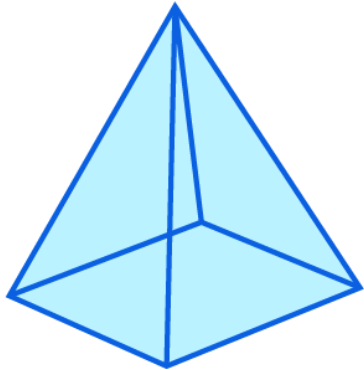
CLASSIFICATION/TYPES OF SOLIDS

- b) **Pyramids:** A polyhedron formed by a plane surface as its base and a number of triangles as its side faces, all meeting at a point, called vertex or apex is called the Pyramids. The different types of pyramids are triangular, square etc.

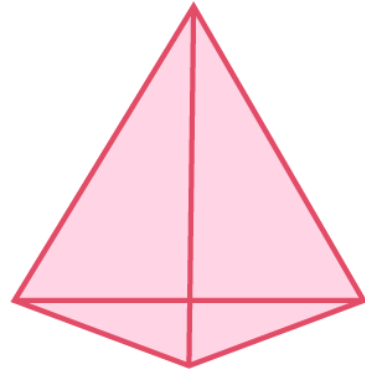
Terms used in Pyramids,

- I. **Axis** – the imaginary line connecting the apex and the center of the base.
- II. **Inclined/slant faces** – Inclined triangular side faces.
- III. **Inclined/slant/longer edges** – The edges which connect the apex and the base corners.

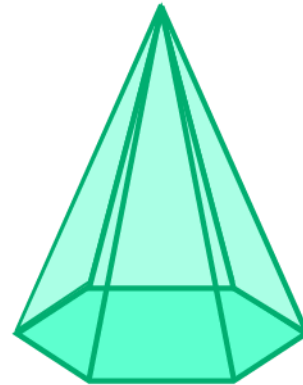
PYRAMIDS



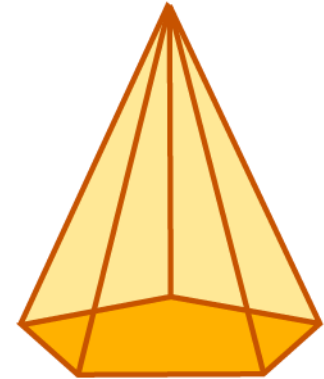
Square pyramid



Triangular pyramid



Hexagonal pyramid

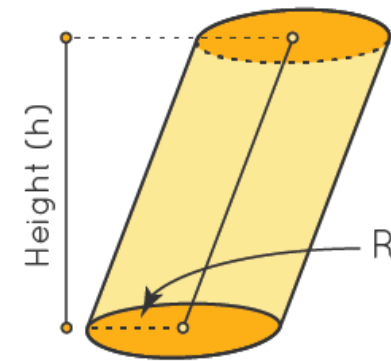


Pentagonal pyramid

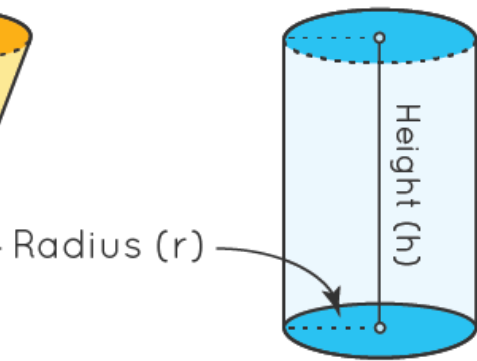
CLASSIFICATION/TYPES OF SOLIDS

- B. **Solids of revolution:** When some of the plane figures are revolved about one of their sides – solids of revolution is generated.
- This solids falls in following categories,
 - **Cylinder** – When a rectangle is revolved about one of its sides, the other parallel side generates a cylinder.
 - **Cone** – When a right triangle is revolved about one of its sides, the hypotenuse of the right triangle generates a cone.
 - **Sphere** – When a semi circle is revolved about one of its diameter, a sphere is generated.

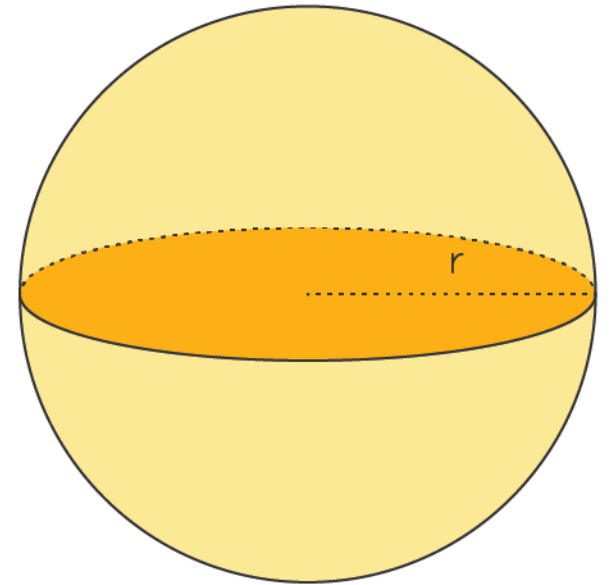
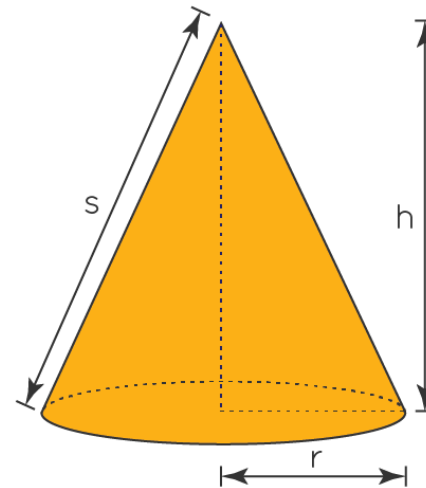
SOLIDS OF REVOLUTION



Oblique
Circular Cylinder



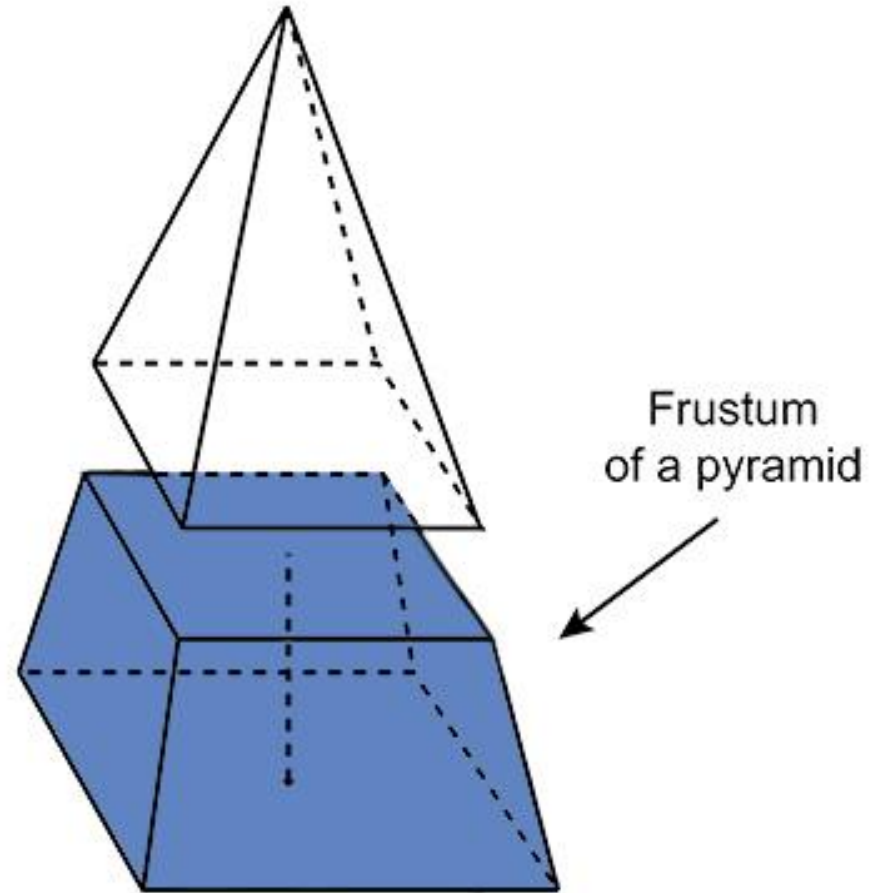
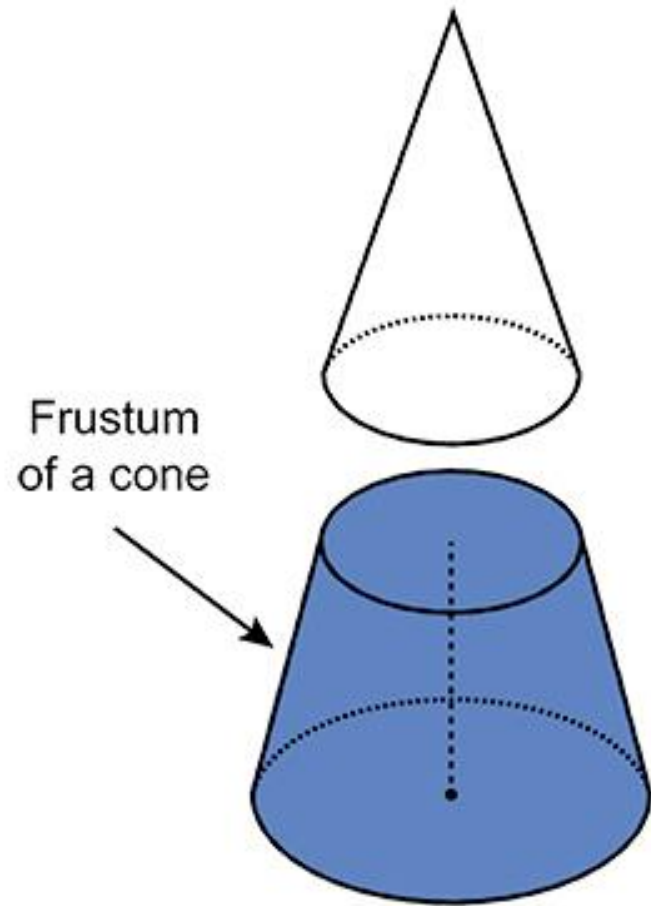
Right
Circular Cylinder



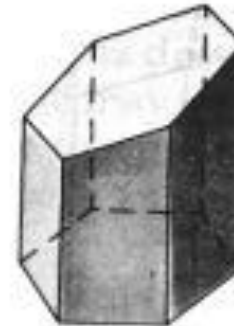
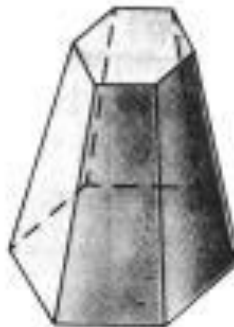
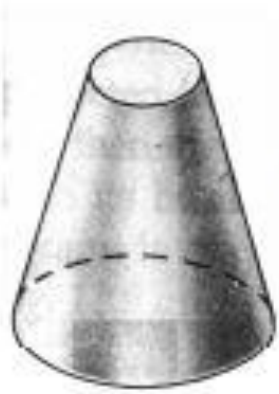
CLASSIFICATION/TYPES OF SOLIDS

- Apart from above two categories, the solids may be of different types like,
 1. **Regular solid** – When the base of the solid is a regular polygon or a true circle, the solid is said to be regular.
 2. **Irregular solid** – When the base of the solid is not regular polygon or not a true circle, the solid is said to be irregular.
 3. **Right solid** – When the axis of the solid is at right angle to its base.
 4. **Oblique solid** – When axis of the solid is not at right angle to its base.
 5. **Full solid** – When a solid is having its shape full, it is said to be a full solid.
 6. **Frustrum of a solid** – When a solid is cut by a plane parallel to the base, then the cut solid is said to be the frustrum of that solid. (for Pyramid and Cone only)
 7. **Truncated solid** – When a solid is cut by a plane inclined to the base, then the cut solid is said to be truncated of that solid.

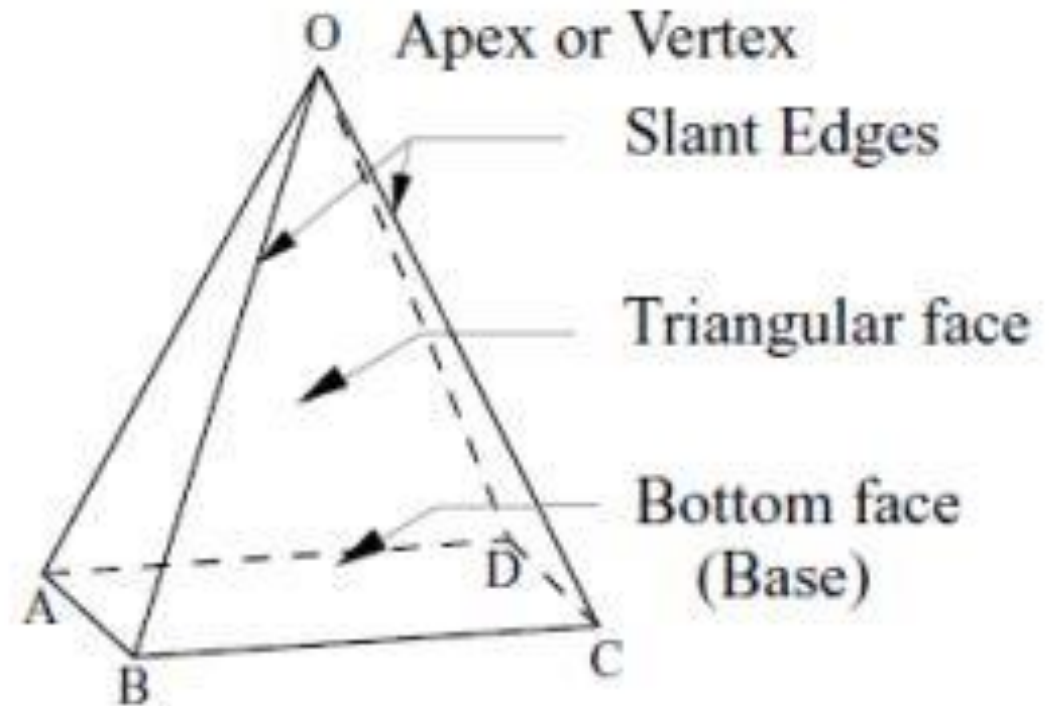
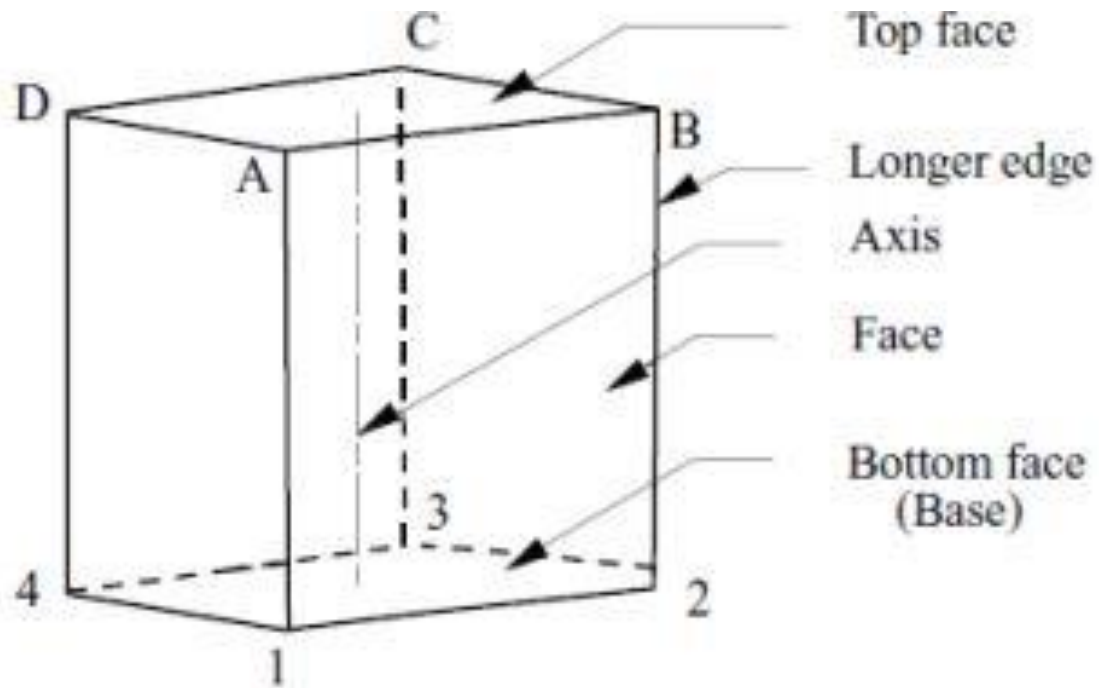
FRUSTUM AND TRUNCATED OF SOLID



FRUSTRUM AND TRUNCATED OF SOLID



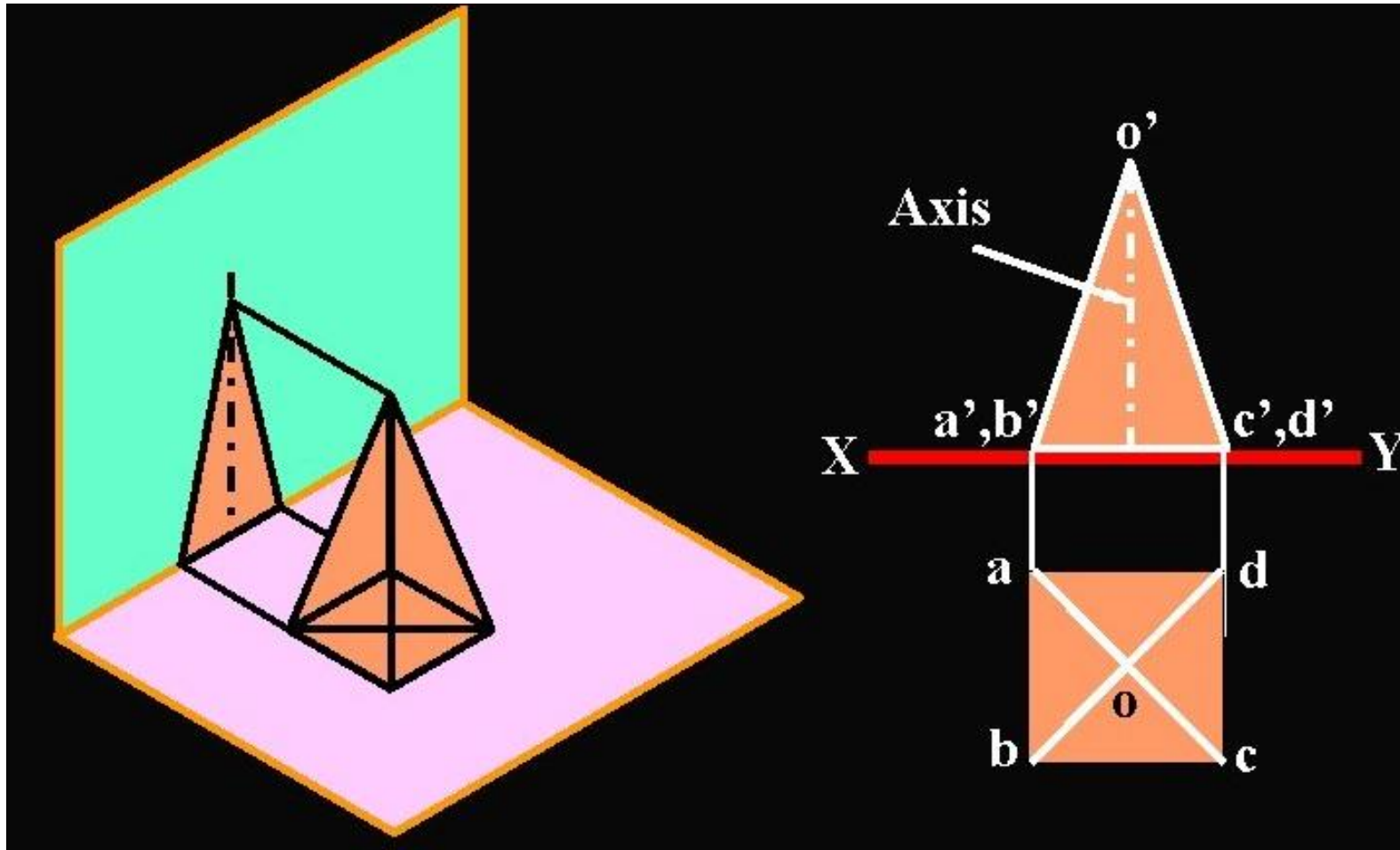
TERMINOLOGY OF SOLIDS



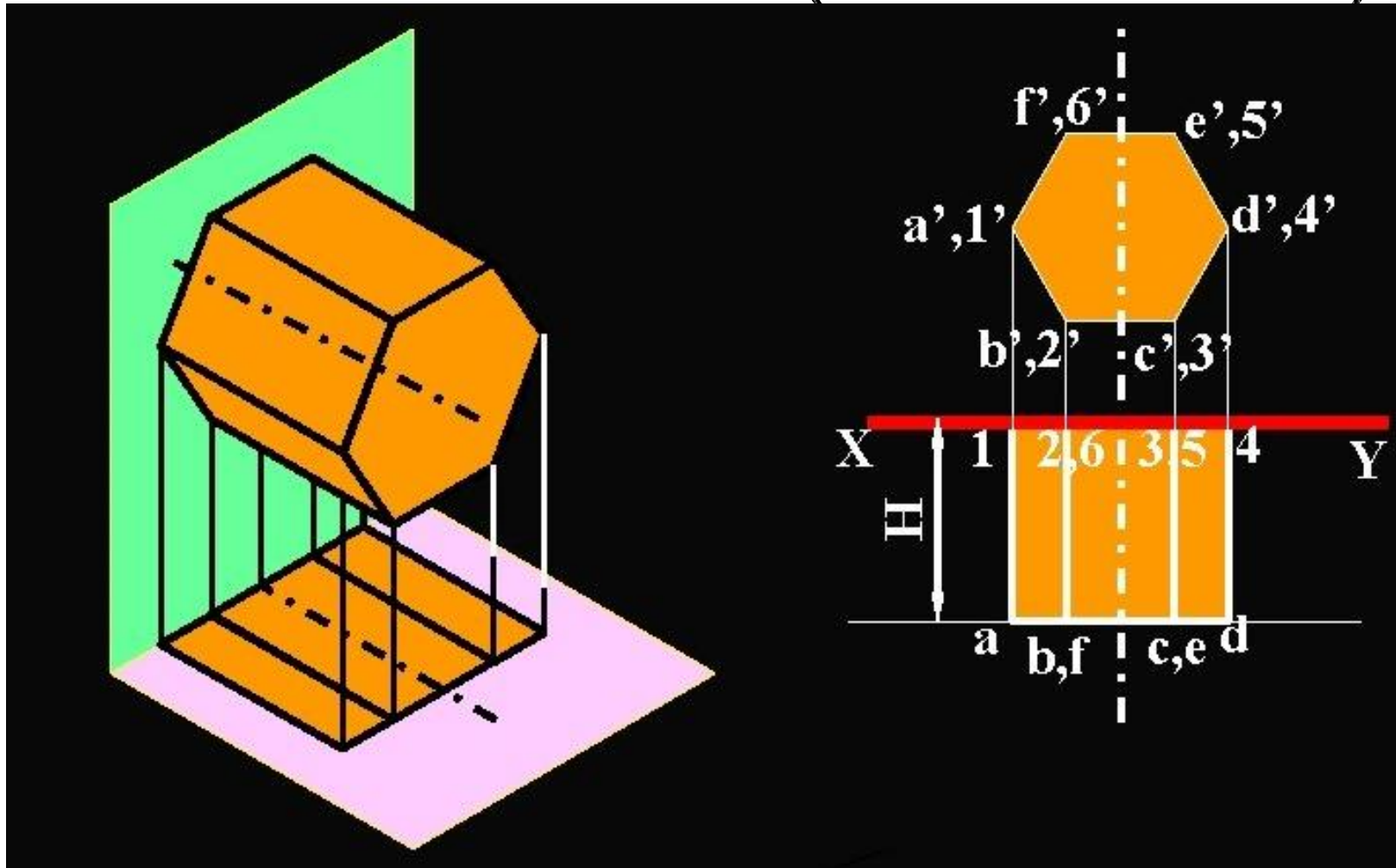
VARIOUS POSITION OF SOLIDS

- Solids have three different types of positions with respect to the principal planes.
 1. Axis of solid is parallel to one of the principal planes and perpendicular to the other principal plane.
 - Axis parallel to VP and Perpendicular to HP. (solid on HP)
 - Axis parallel to HP and perpendicular to VP. (solid on VP)
 - Axis parallel to both the HP and VP. (solid on PP)
 2. Axis of the solid is parallel to one of the principal planes and inclined to other.
 - Axis parallel to VP and inclined to HP (θ).
 - Axis parallel to HP and inclined to VP (ϕ).
 3. Axis of the solid is inclined to both the principal planes.

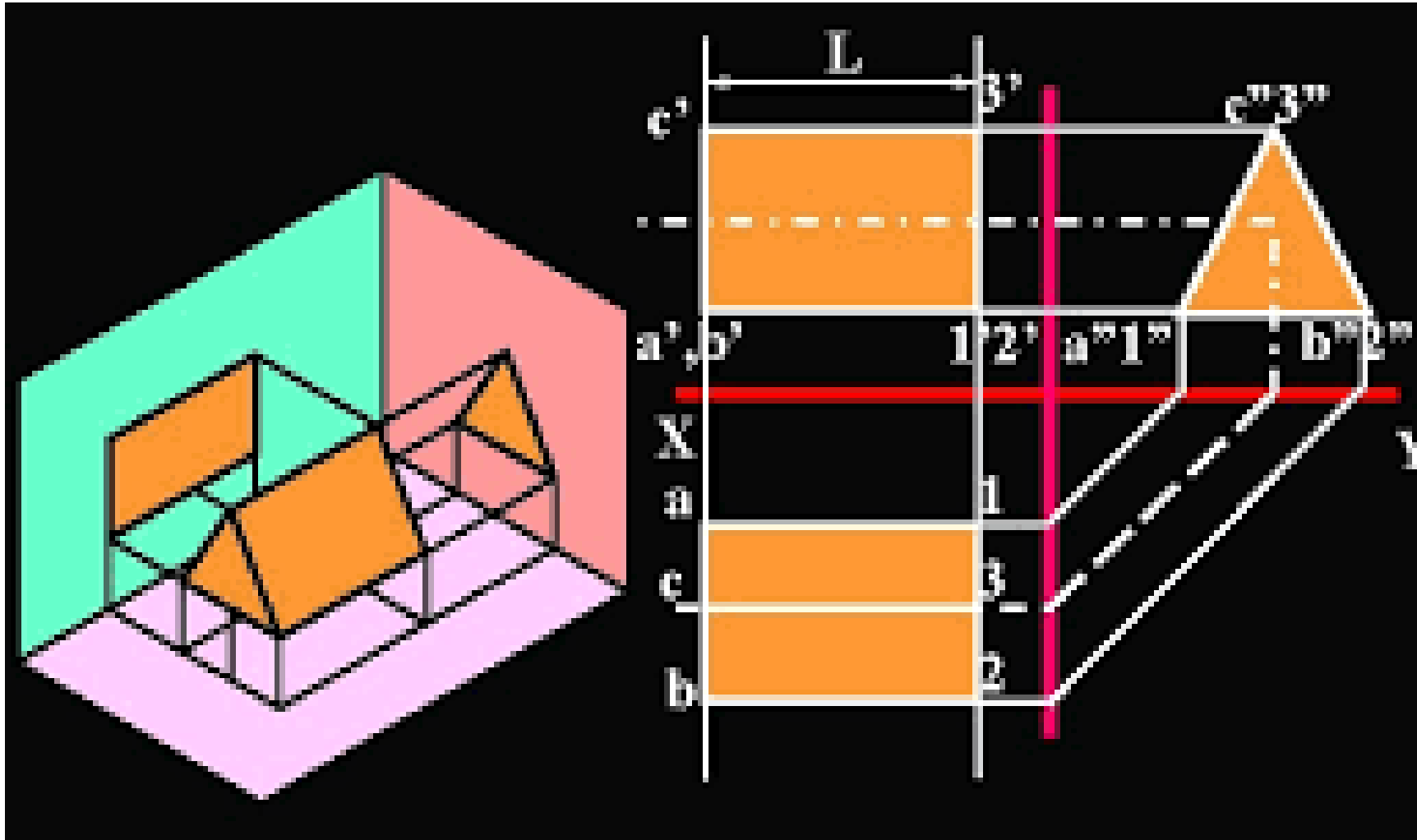
AXIS PARALLEL TO VP AND PERPENDICULAR TO HP (SOLID ON HP)



AXIS PARALLEL TO HP AND PERPENDICULAR TO VP (SOLID ON VP)



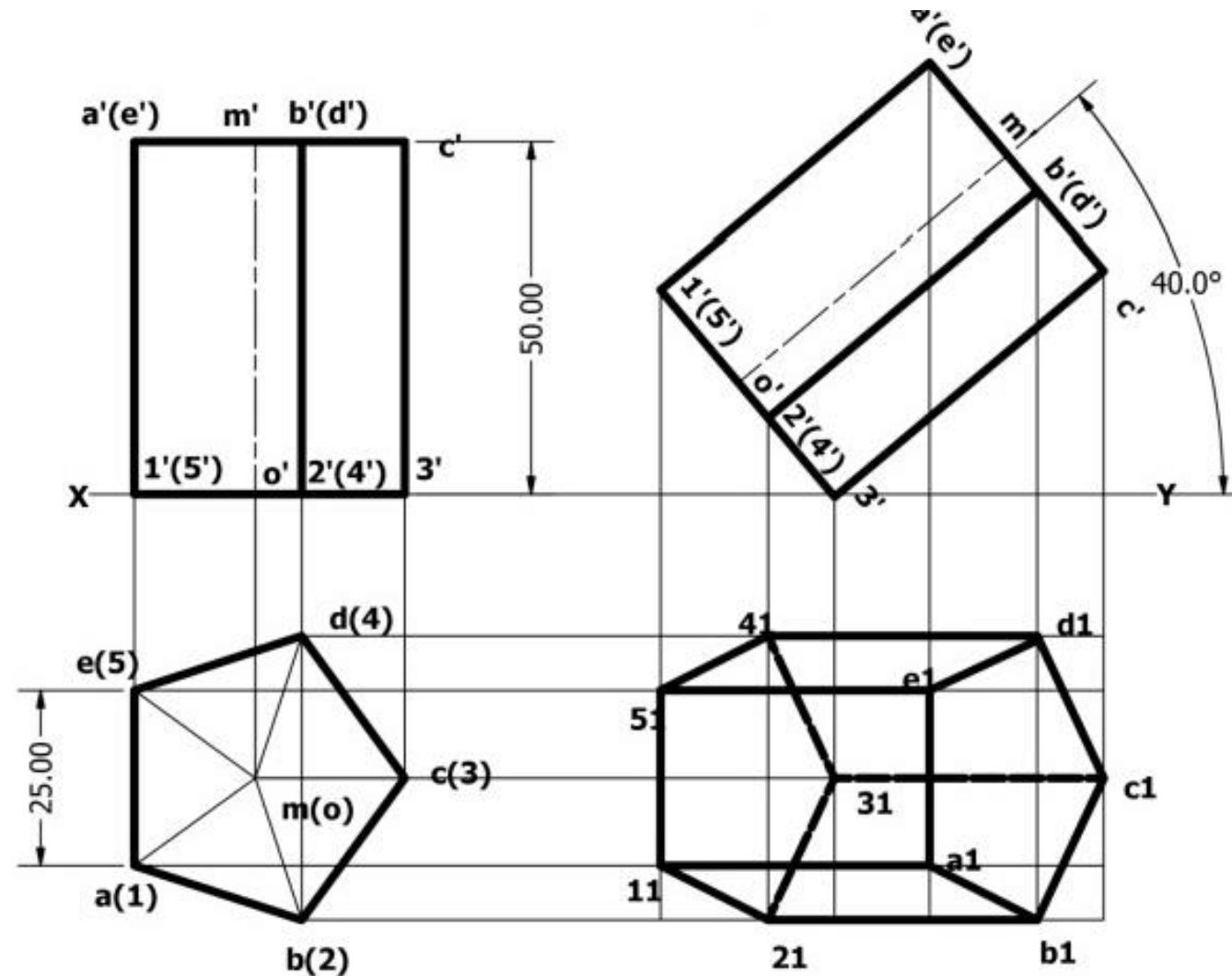
AXIS PARALLEL TO BOTH THE HP AND VP



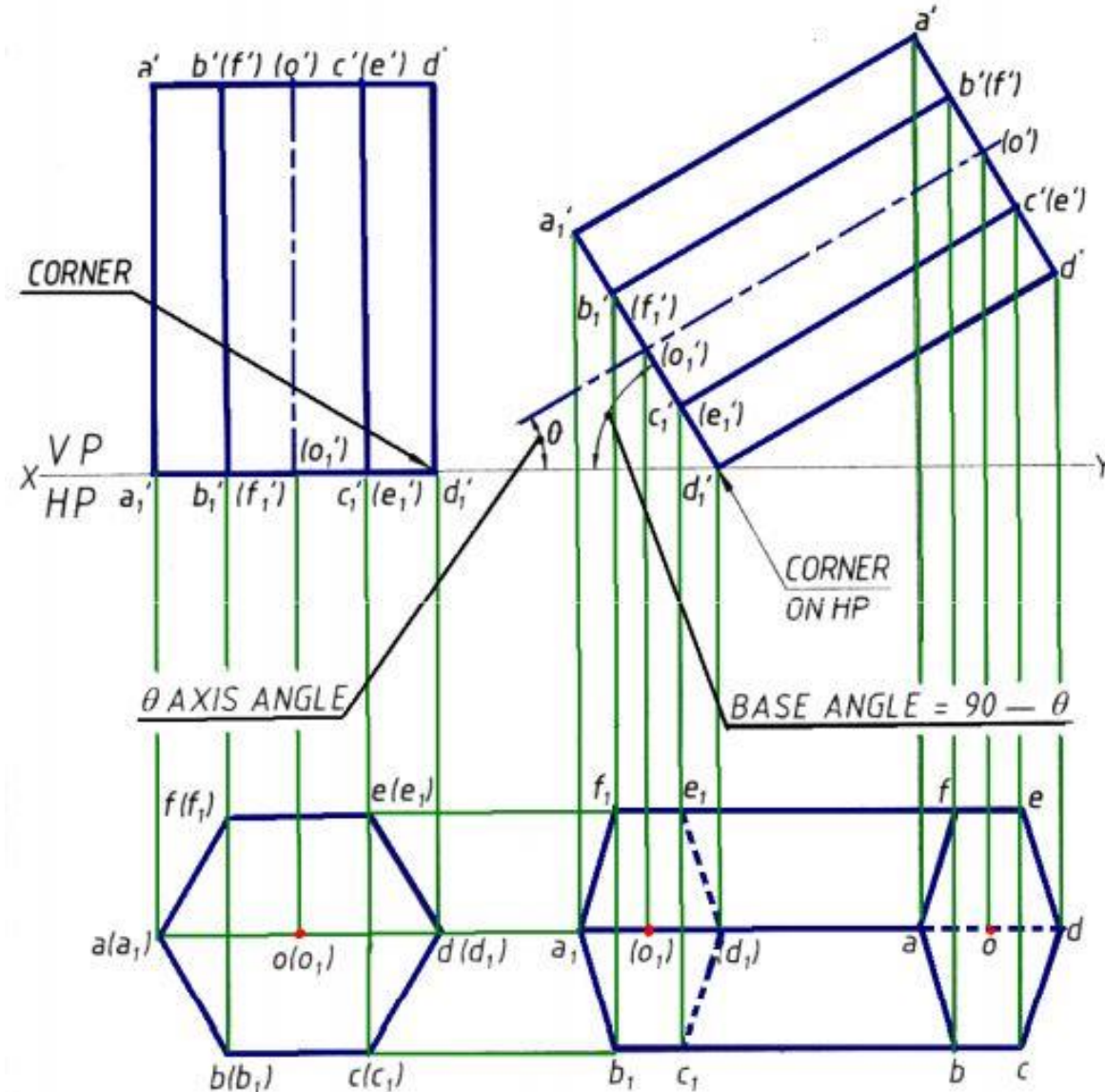
AXIS PARALLEL TO VP AND INCLINED TO HP (θ)

- When a solid is placed on HP (axis is perpendicular to HP) with its axis inclined to HP, the elemental portion of the solid that lies on HP depends upon the type of the solid.
- When a **Prism** is placed on HP with its axis inclined to HP, then it will lie either on one of its **base edges** or on one of **its corners** on HP.
- When a **Pyramid** is placed on HP with its axis inclined to HP, then we will have one of its **base edges** on HP or one of its **base corners** on HP or one of its **slant edges** on HP or one of its **triangular faces** on HP or an apex on HP.

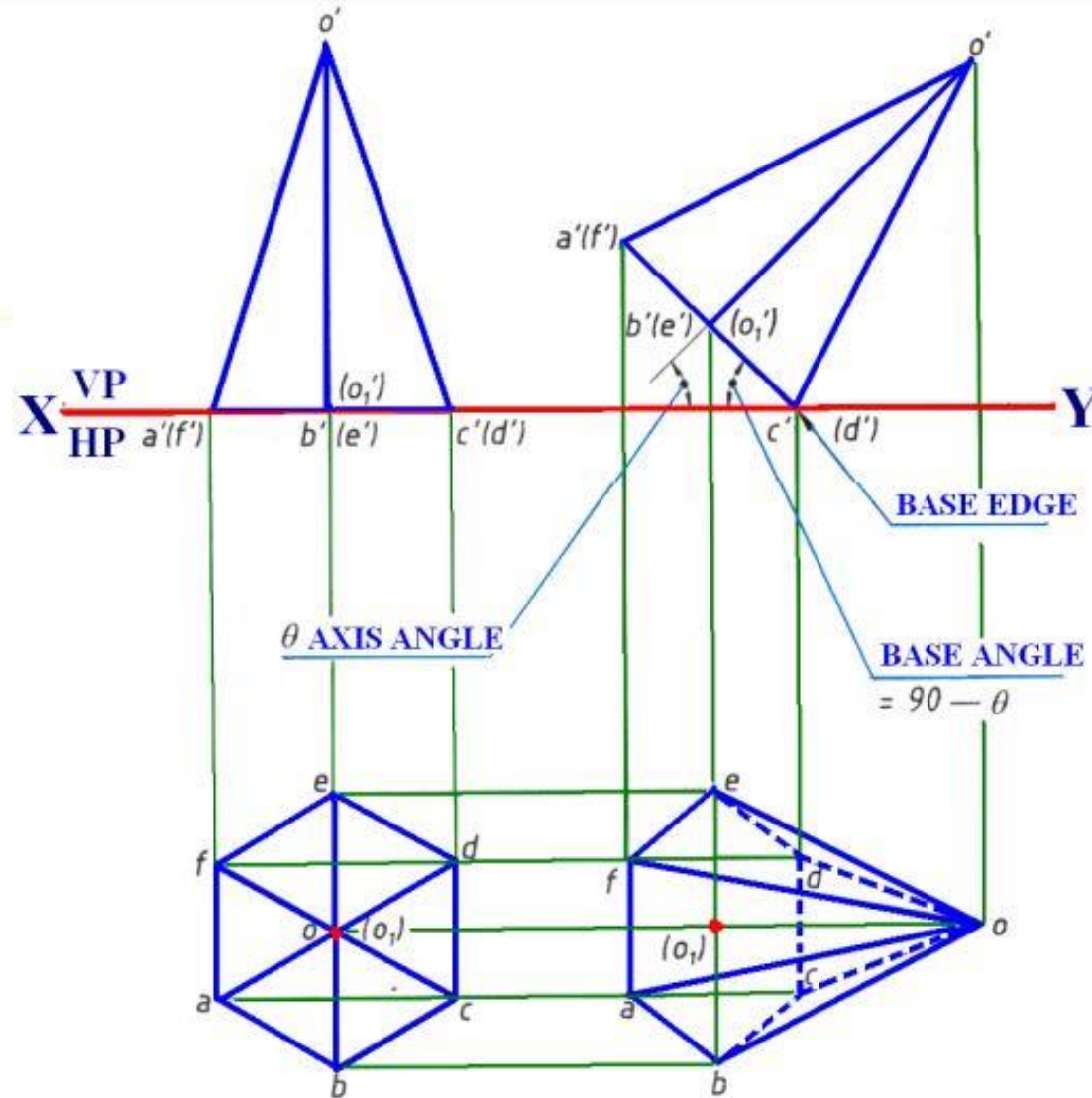
PRISM WITH AN EDGE OF BASE ON HP



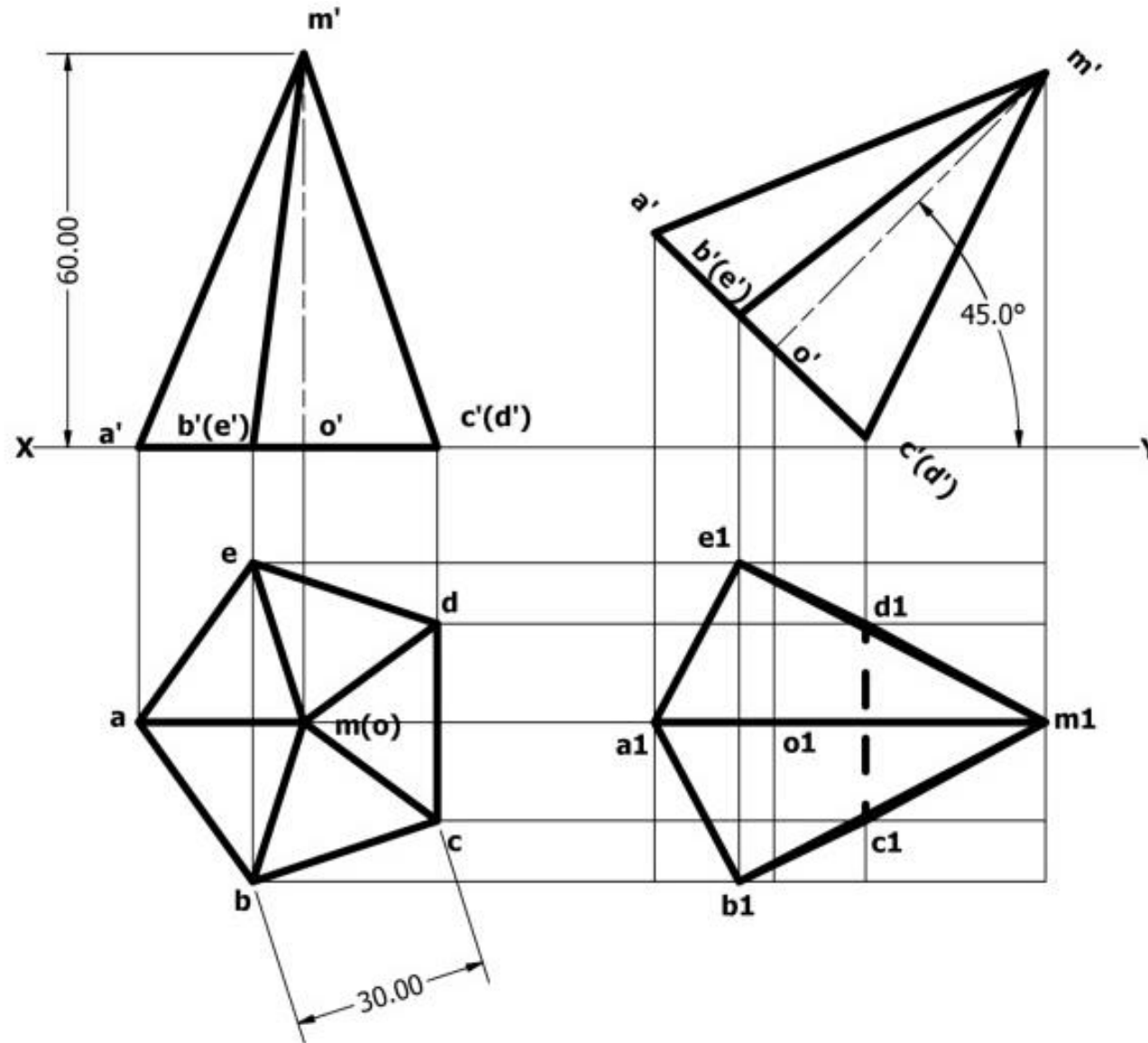
PRISM WITH A CORNER OF BASE ON HP



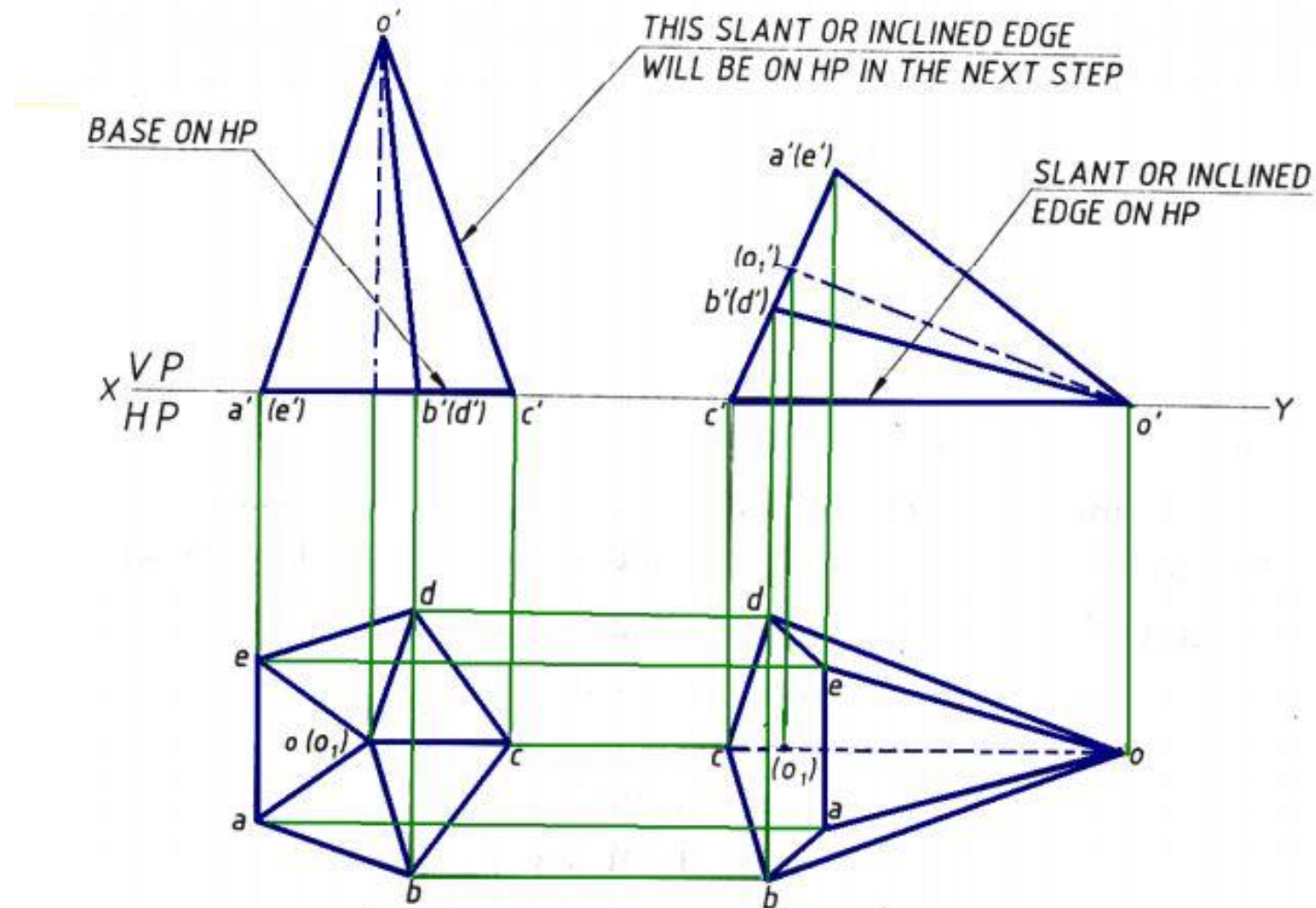
PYRAMID WITH AN EDGE OF BASE ON HP



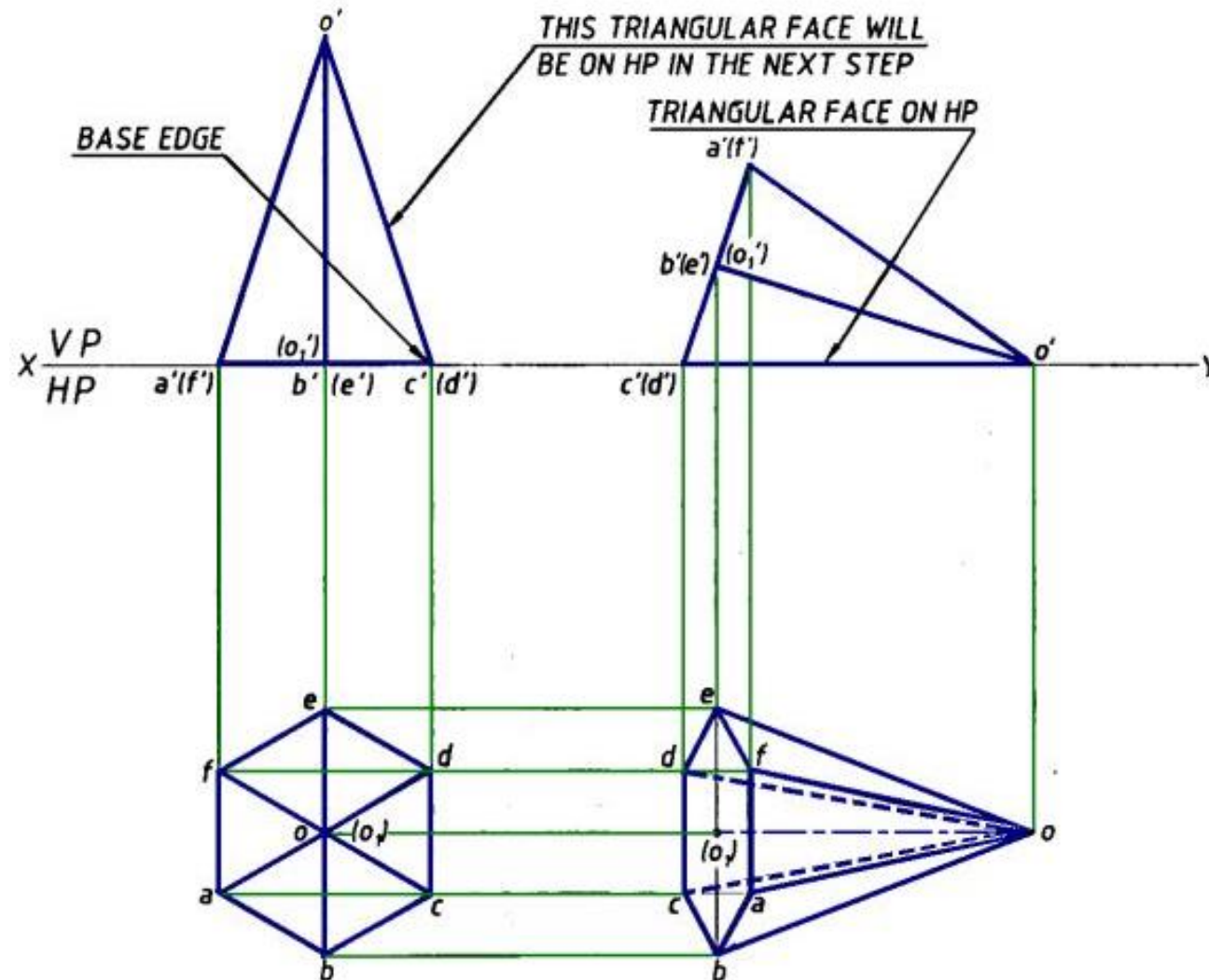
PYRAMID WITH A CORNER OF BASE ON HP



PYRAMID WITH A SLANT EDGE OF BASE ON HP



PYRAMID WITH A TRIANGULAR FACE ON HP



AXIS PARALLEL TO HP AND INCLINED TO VP (\emptyset)

- When a solid is placed on VP (axis is perpendicular to VP) with its axis inclined to VP, the elemental portion of the solid that lies on VP depends upon the type of the solid.
- When a **Prism** is placed on VP with its axis inclined to VP, then it will lie either on one of its **base edges** or on one of **its corners** on VP.
- When a **Pyramid** is placed on VP with its axis inclined to VP, then we will have one of its **base edges** on VP or one of its **base corners** on VP or one of its **slant edges** on VP or one of its **triangular faces** on VP or an apex on VP.

AXIS OF THE SOLID IS INCLINED TO BOTH THE PRINCIPAL PLANES.

- When the axis of the solid is inclined to both HP and VP the projections of the solids are drawn in three stages.
 1. Initial stage/position.
 2. Intermediate stage/position.
 3. Final stage/position.
- We can divide the solids into two types when their axes are inclined to both HP and VP.
- When the solid is kept on the HP on one of its base edges or corners.
- When the solid is kept on the VP on one of its base edges or corners.

THANK YOU