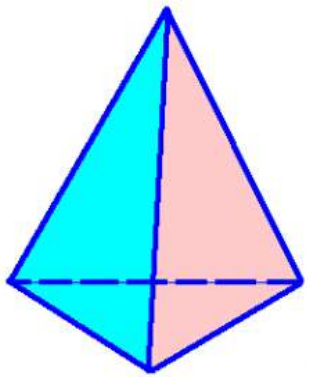
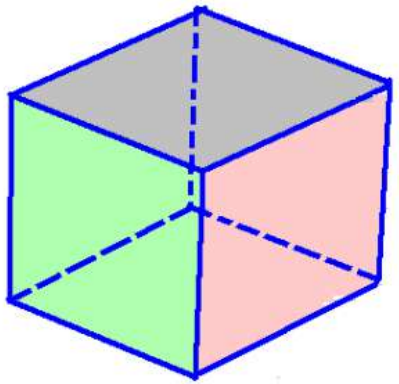
Projection of Solids

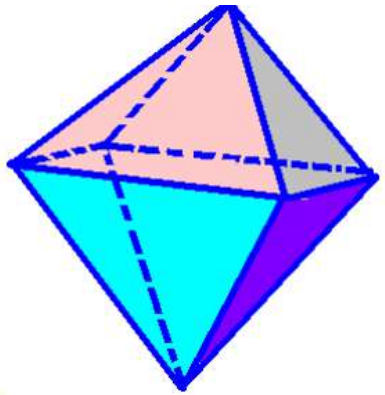
A solid has three dimensions, viz. length, breadth and thickness.
To represent a solid on a flat surface having only length and breadth, at least two orthographic views are necessary



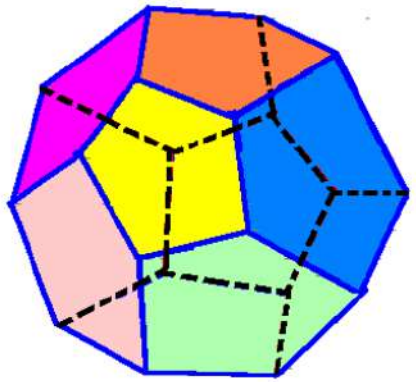
Tetrahedron – four equal equilateral triangular faces



Cube/hexahedron – six equal square faces



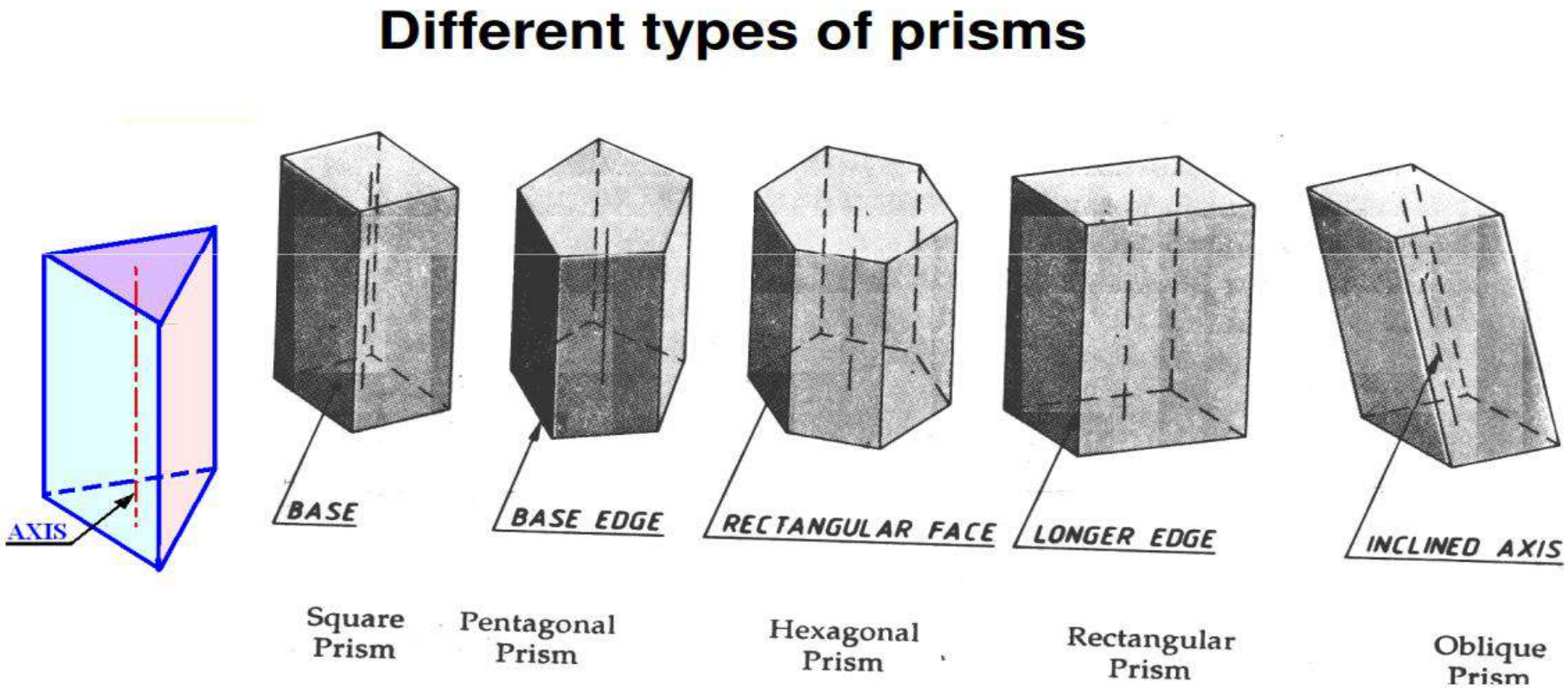
Octahedron– eight equal equilateral triangular faces



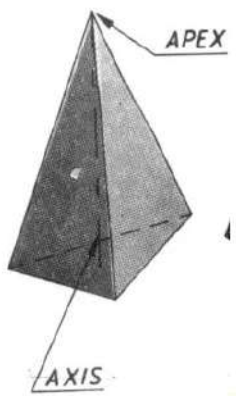
Dodecahedron – twelve equal regular pentagonal faces

Prism: This is a polyhedron having two equal and similar faces called its bases, parallel to each other and joined by other faces, which are parallelograms. The imaginary line joining the centers of the bases is called the axis

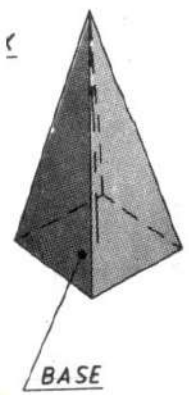
Polyhedron: A solid bounded by planes called faces.



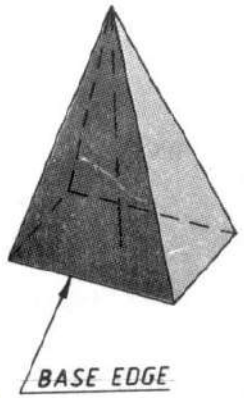
Pyramids – A polyhedron formed by a plane surface as its base and a number of triangles as its side faces, all meeting at a point, called vertex or apex.



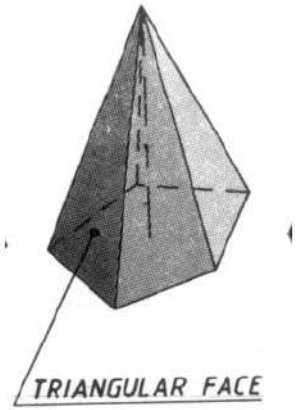
Triangular pyramid



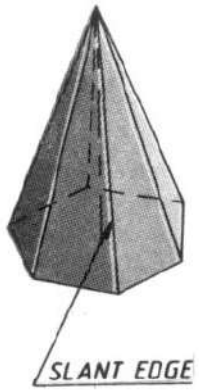
Square pyramid



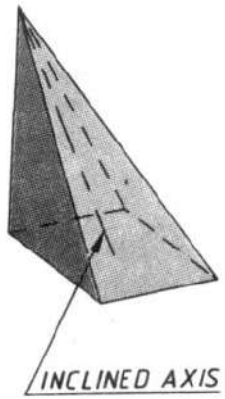
Rectangular pyramid



Pentagonal pyramid

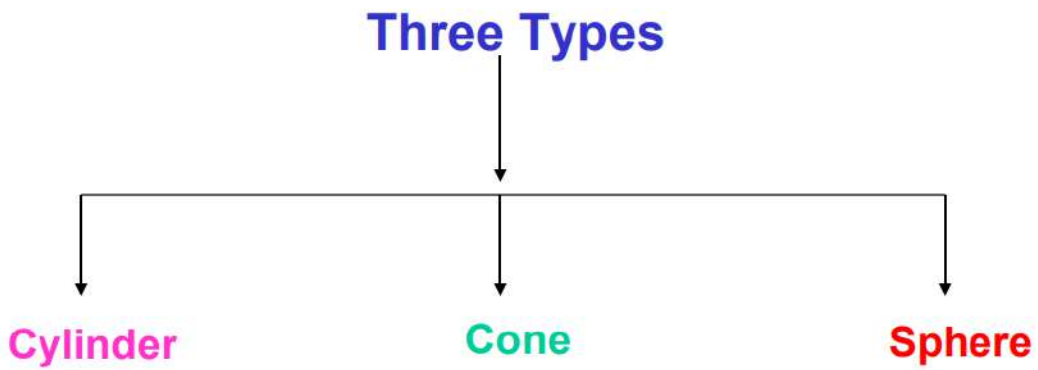


Hexagonal pyramid

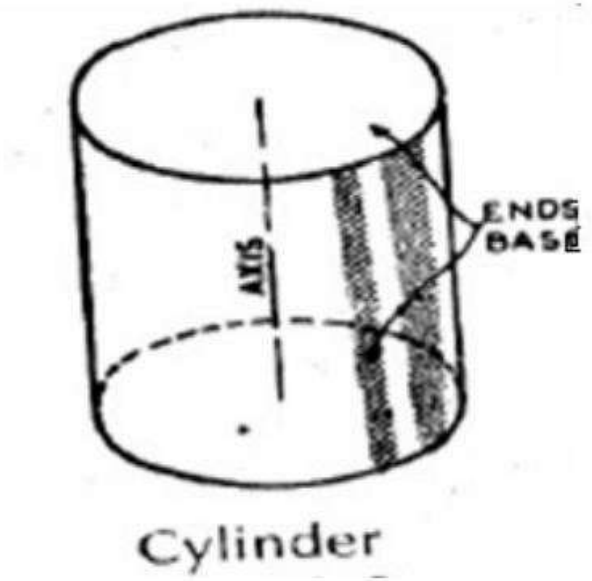


Oblique pyramid

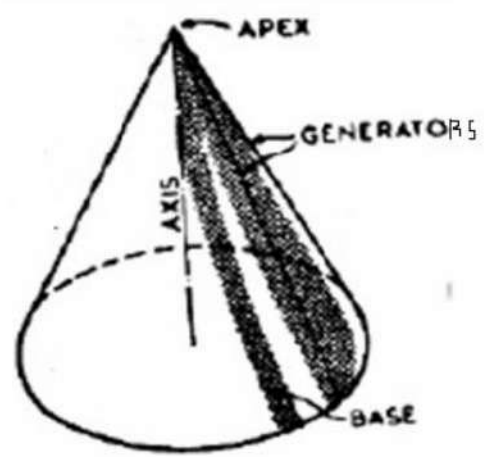
Solids of Revolution: Solids are generated by rotating a plane surface about one of its sides



Cylinder: A right circular cylinder is a solid generated by the revolution of a rectangle about one of its sides, which remains fixed. It has two equal circular bases. The line joining the centers of the bases is the axis. It is perpendicular to the bases.



Cone – when a right triangle is revolved about one of its sides, the hypotenuse of the right triangle generates a cone.
Straight lines drawn from the apex to the circumference of the base-circle are all equal and are called generators of the cone.



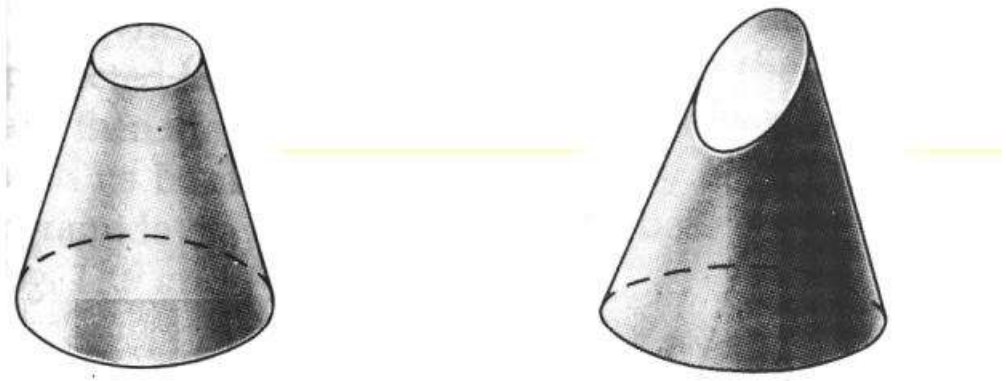
Cone

Sphere : A sphere is a solid generated by the revolution of a semi-circle about its diameter as the axis. The mid-point of the diameter is the centre of the sphere. All points on the surface of the sphere are equidistant from its centre.


Sphere

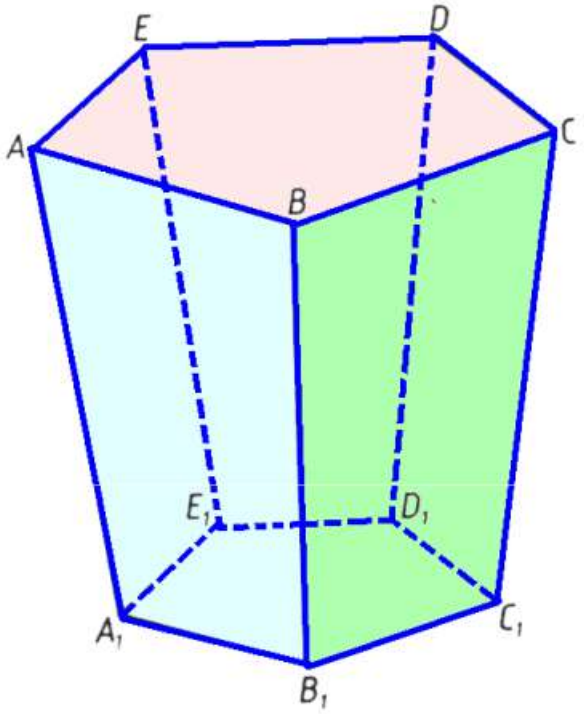
Frustum: When a prisms, pyramids, cylinders is cut by a plane parallel to its base, thus removing the top portion, the remaining portion is called its frustum.

Truncated: When a solid is cut by a plane inclined to base it is said to be truncated.

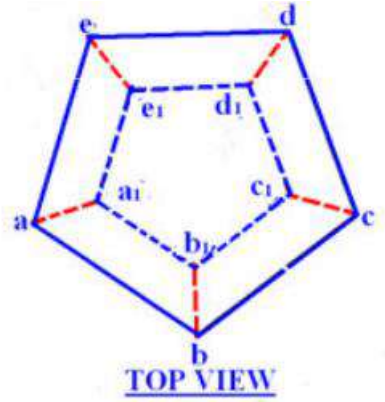


Rules of visibility

- The outlines of all the views are shown by full lines
- Hidden details as invisible shown by dashed lines

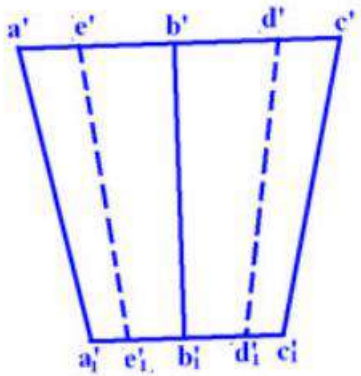


Object pentagonal pyramid



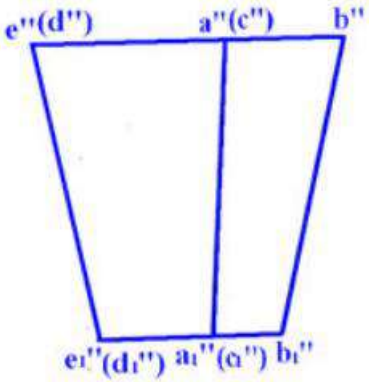
TOP VIEW

In the top view, edges ab, bc, cd, de and ea are shown as full lines. The bottom pentagonal faces A1B1C1D1E1 is smaller than the top face, hence invisible. The slant edges AA1, BB1, CC1, DD1 and EE1 are invisible in the top view, hence they are shown as lines of dashes.



FRONT VIEW

In the front view, the corners a, b, c and a1, b1, c1 are visible to the observer. Hence in the front view, the lines a'a'1, b'b'1 and c'c'1 are shown as full lines.



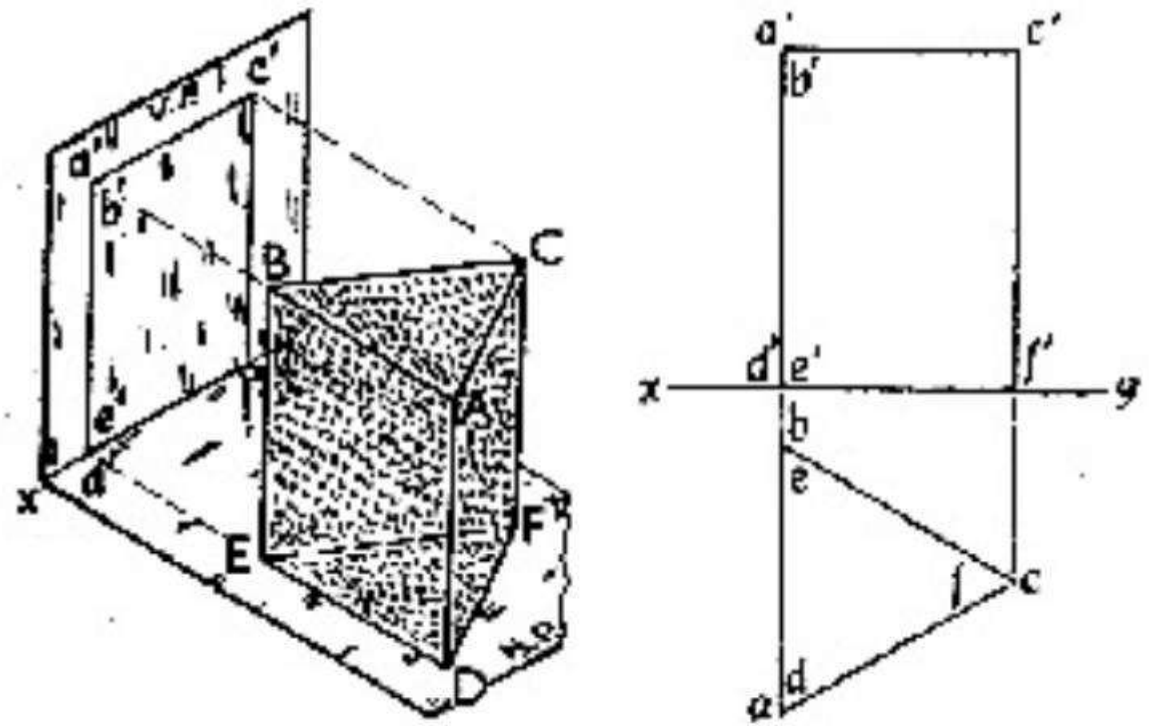
LEFT VIEW

Projection if Solid with respect to HP or VP

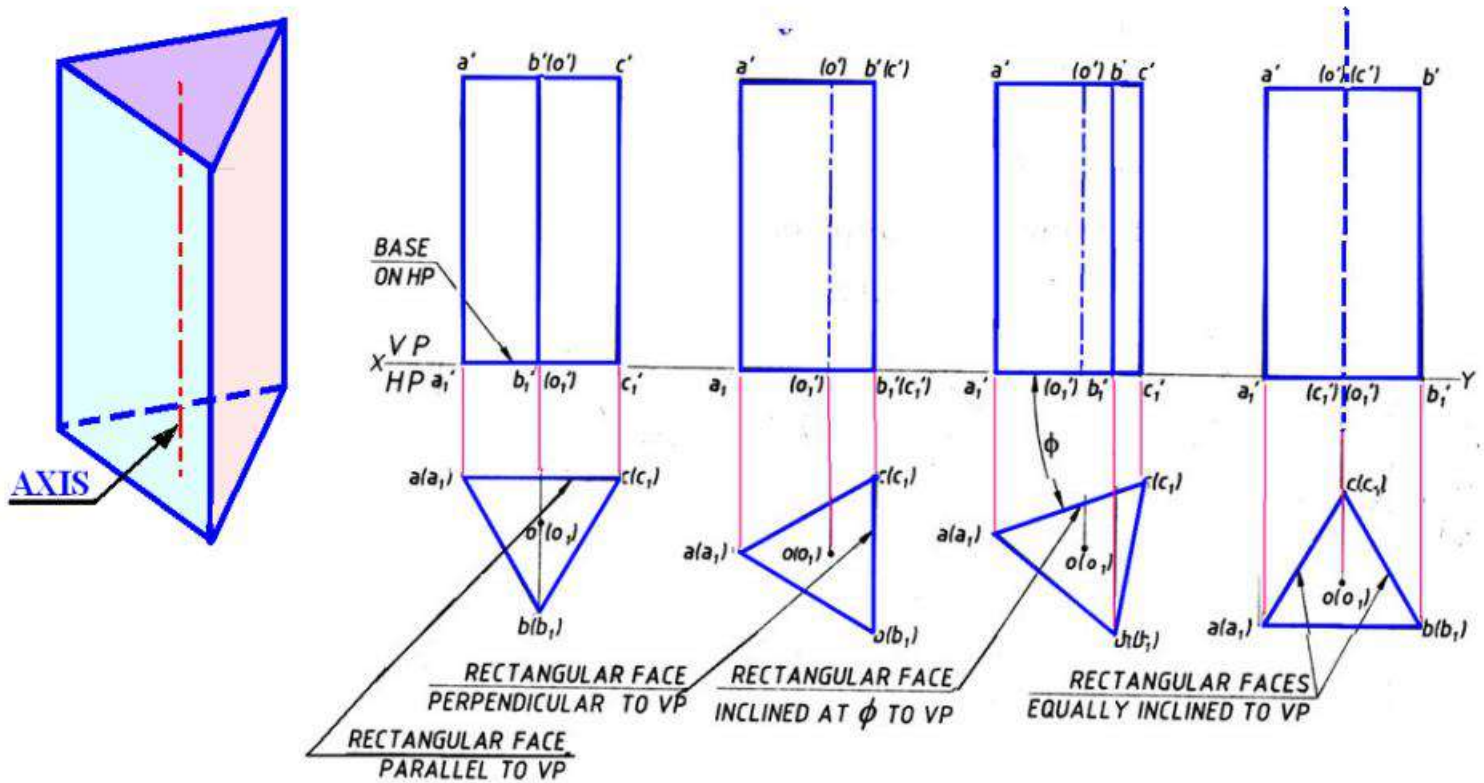
- Perpendicular to HP or VP
- Parallel to either HP or VP and inclined to the other
- Inclined to both HP and VP
- A solid in simple position may have its axis perpendicular to one reference plane or parallel to both.
- When the axis is perpendicular to one reference plane, it is parallel to the other. Also, when the axis of a solid is perpendicular to a plane, its base will be parallel to that plane.
- When the base of the solid is on HP, the top view is drawn first and then the front view and the side views are projected from it.

Axis perpendicular to the H.P

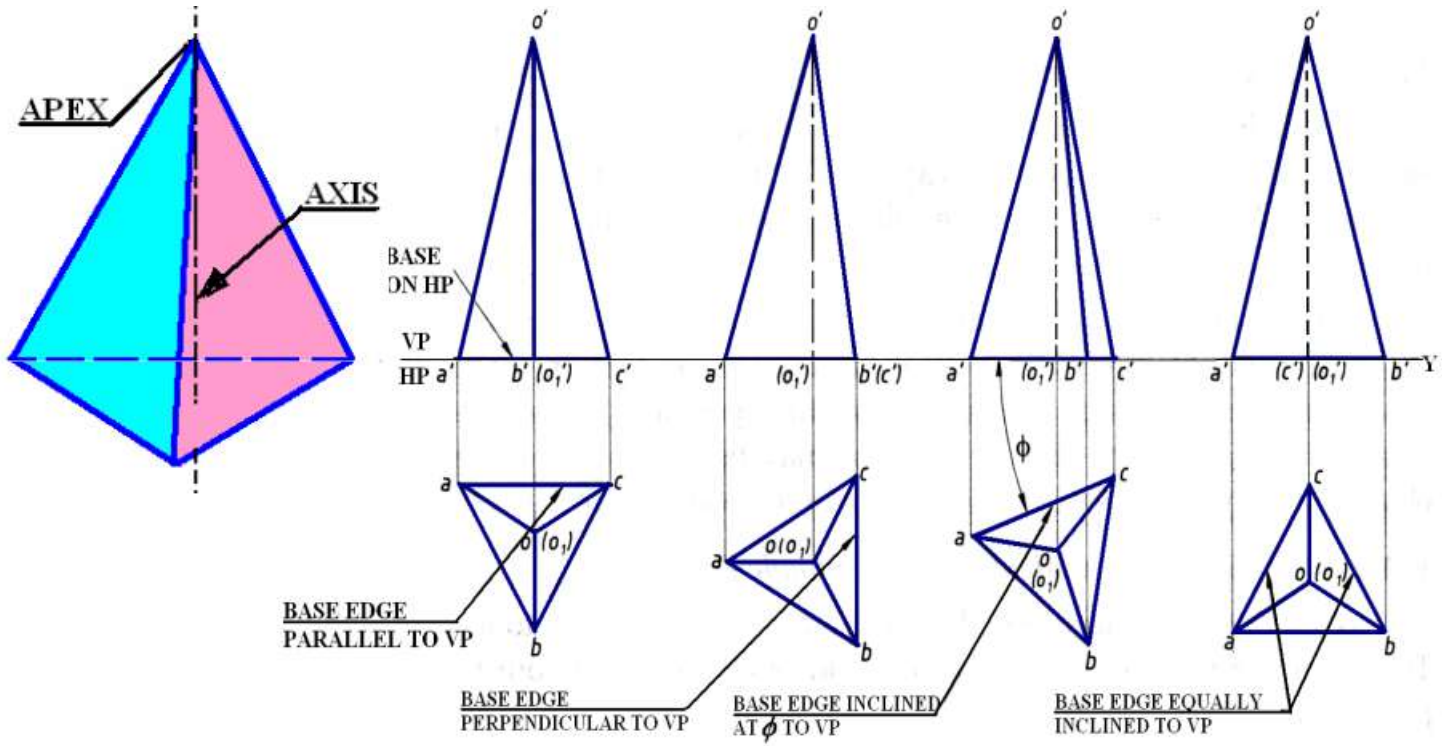
Draw the projections of a triangular prism, base 40 mm side and axis 50 mm long, resting on one of its bases on the H.P. with a vertical face perpendicular to the V.P.



Positions of a prism with base on HP.



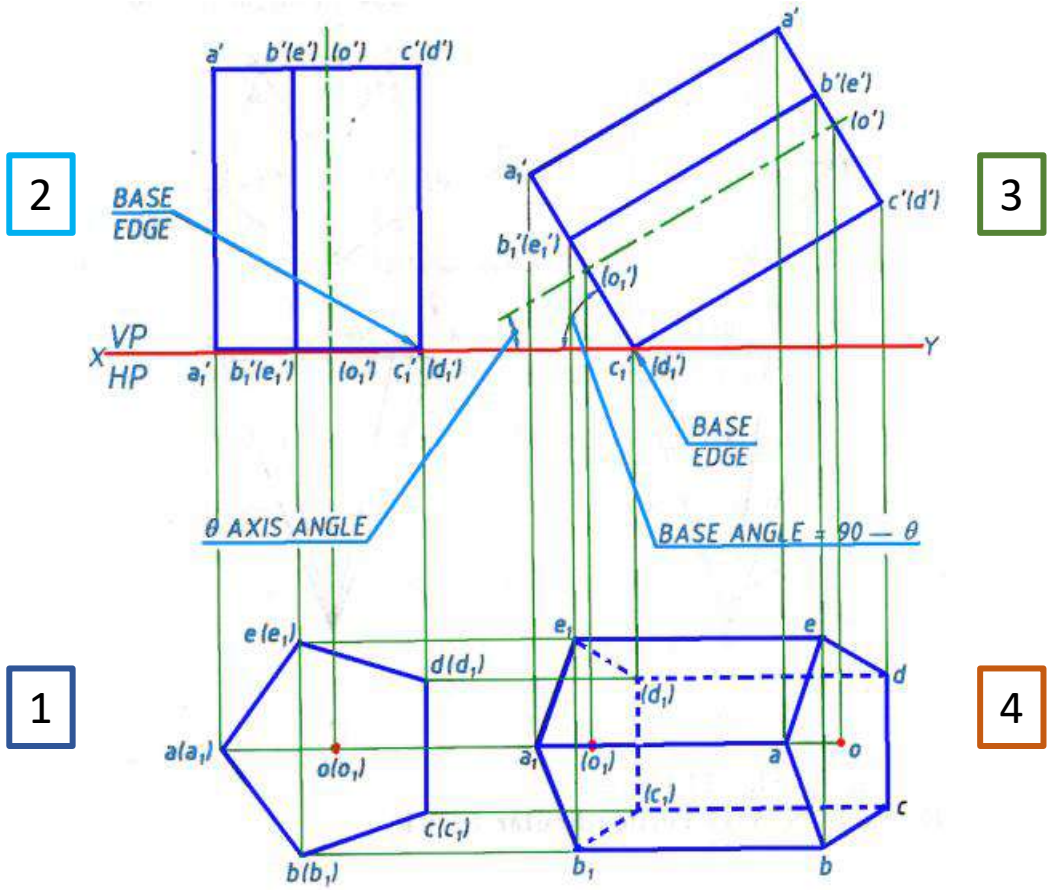
Triangular pyramid base on HP



When the solid lies with an edge of base on HP

A pentagonal prism has to be placed with an edge of base on HP such that the base or axis is inclined to HP

Meaning: Prism has to be placed with its base on HP such that an edge of the base is perpendicular to VP

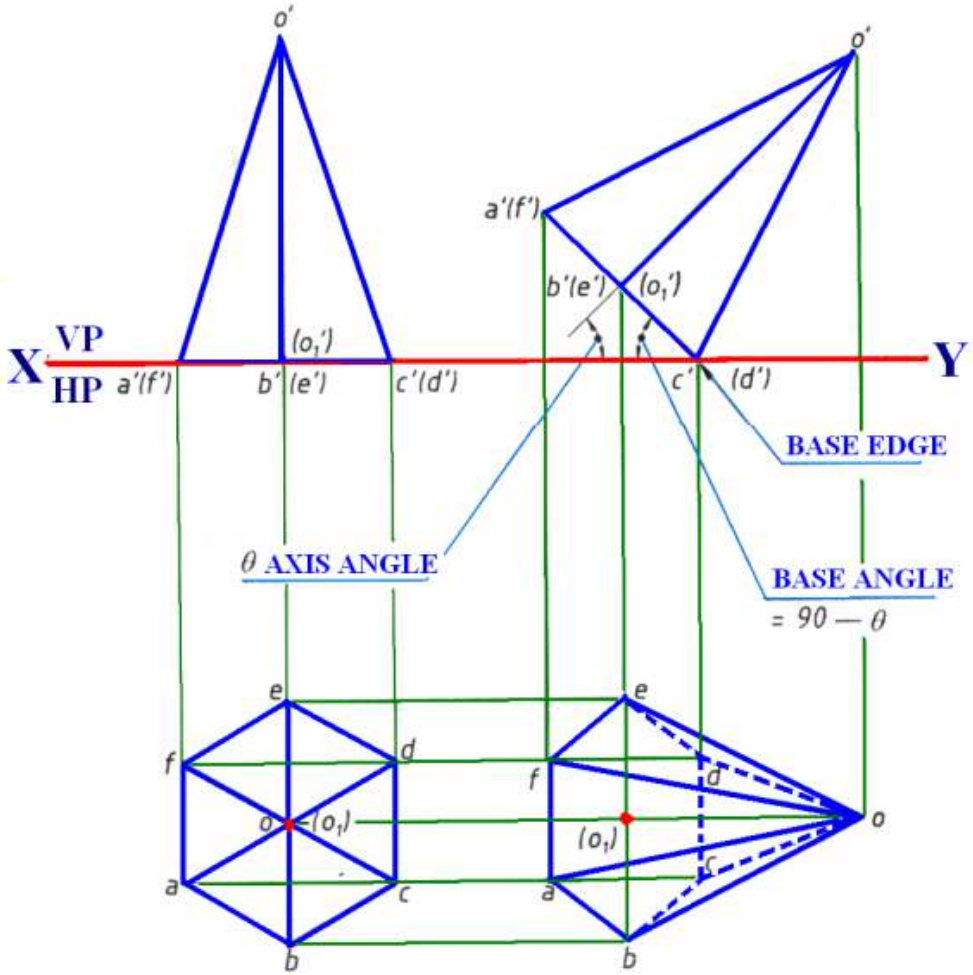


1. Top View
2. Front View
3. If inclination of axis θ with HP is given, first the base is drawn at (90-θ) in the front view.
4. The second top view is projected by drawing the vertical projectors from the corners of the second front view and the horizontal projectors from the first top view.

Rule for joining line
- Outer point dark
- Draw base
- Draw edges
- Draw axis

- Never cross dark with dark line
- Never cross dotted line with dotted line

Top and the front views of a hexagonal pyramid when it lies on HP on one of its base edges with its axis or the base inclined to HP.

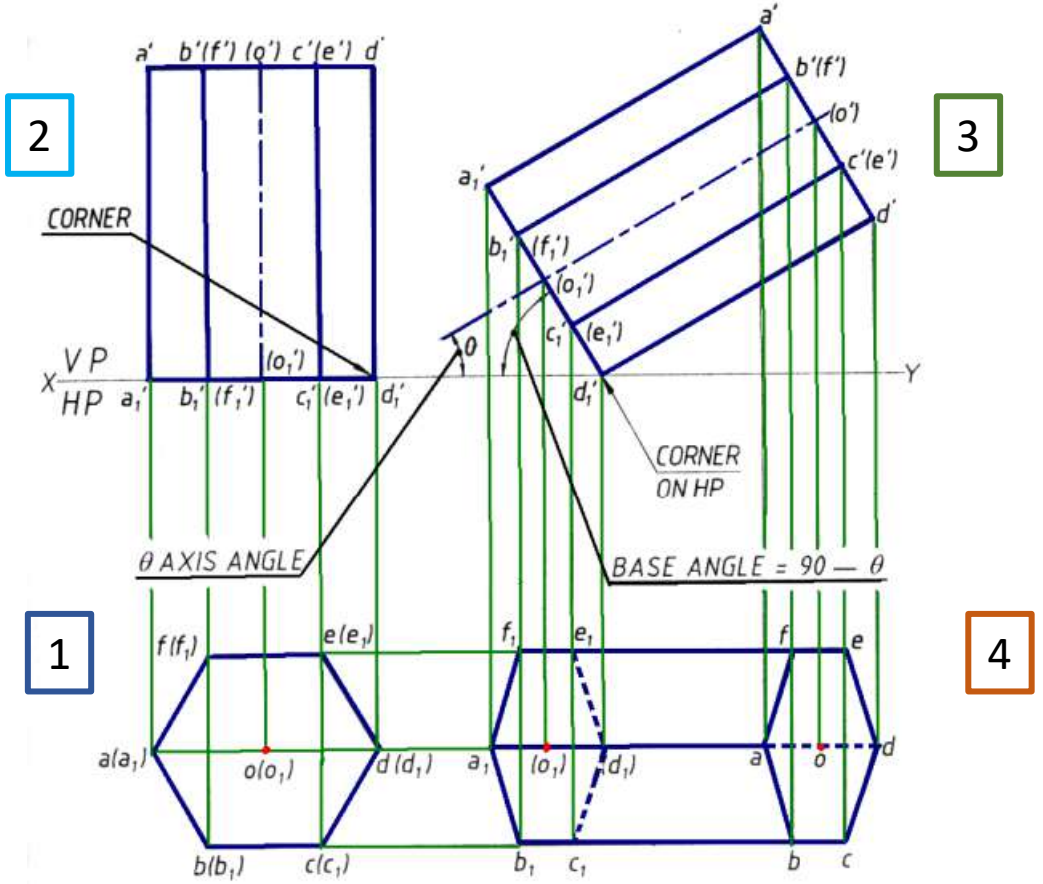


Rules for easily understand

For internal points, if two lines are dark/dotted then third one will be dark/dotted.

When the solid lies on one of its corners of the base on HP

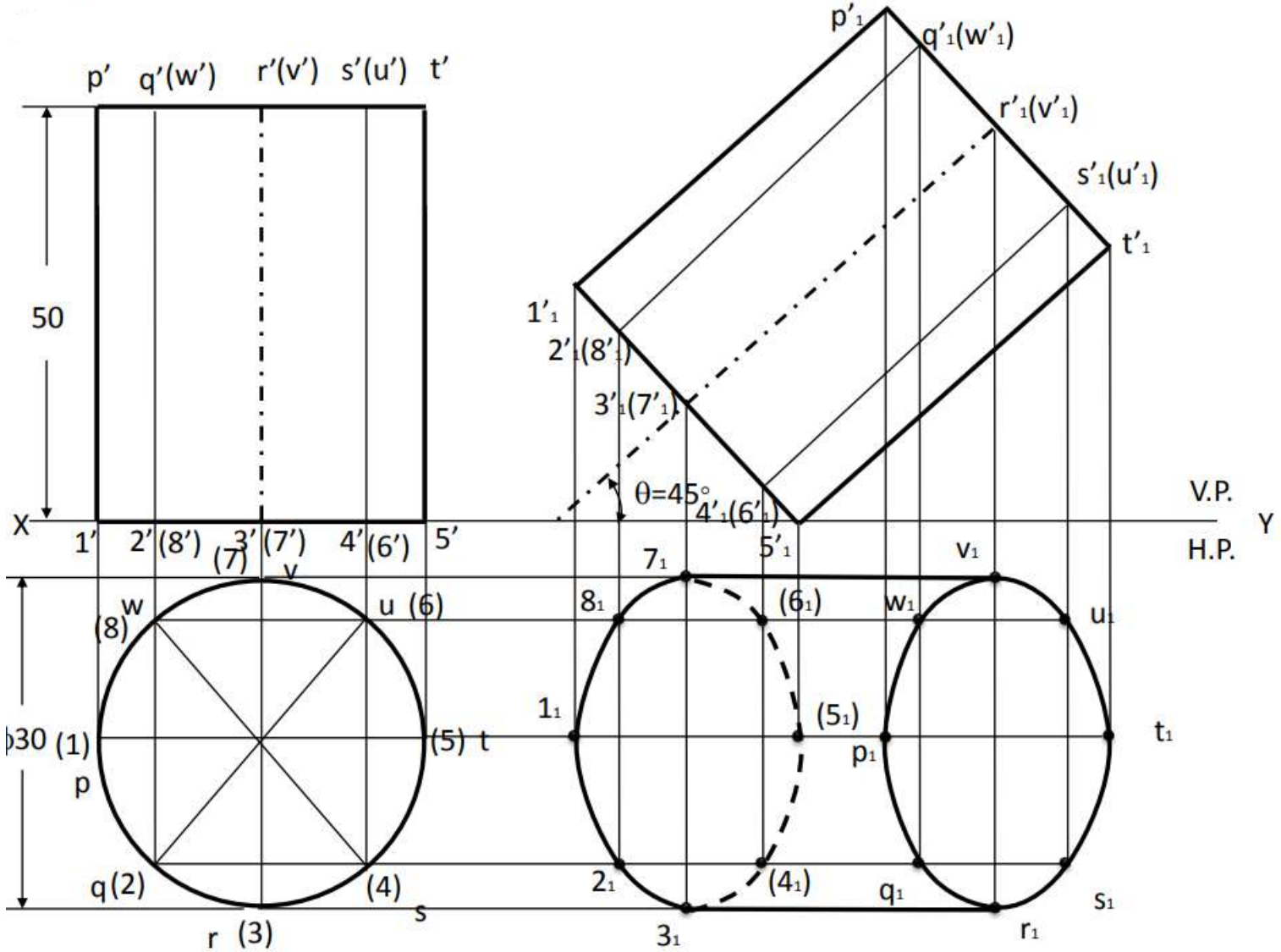
Initially the solid should be placed with its base on HP such that an imaginary line connecting the center of the base and one of its corners is parallel to VP and preferably to lie on the right side



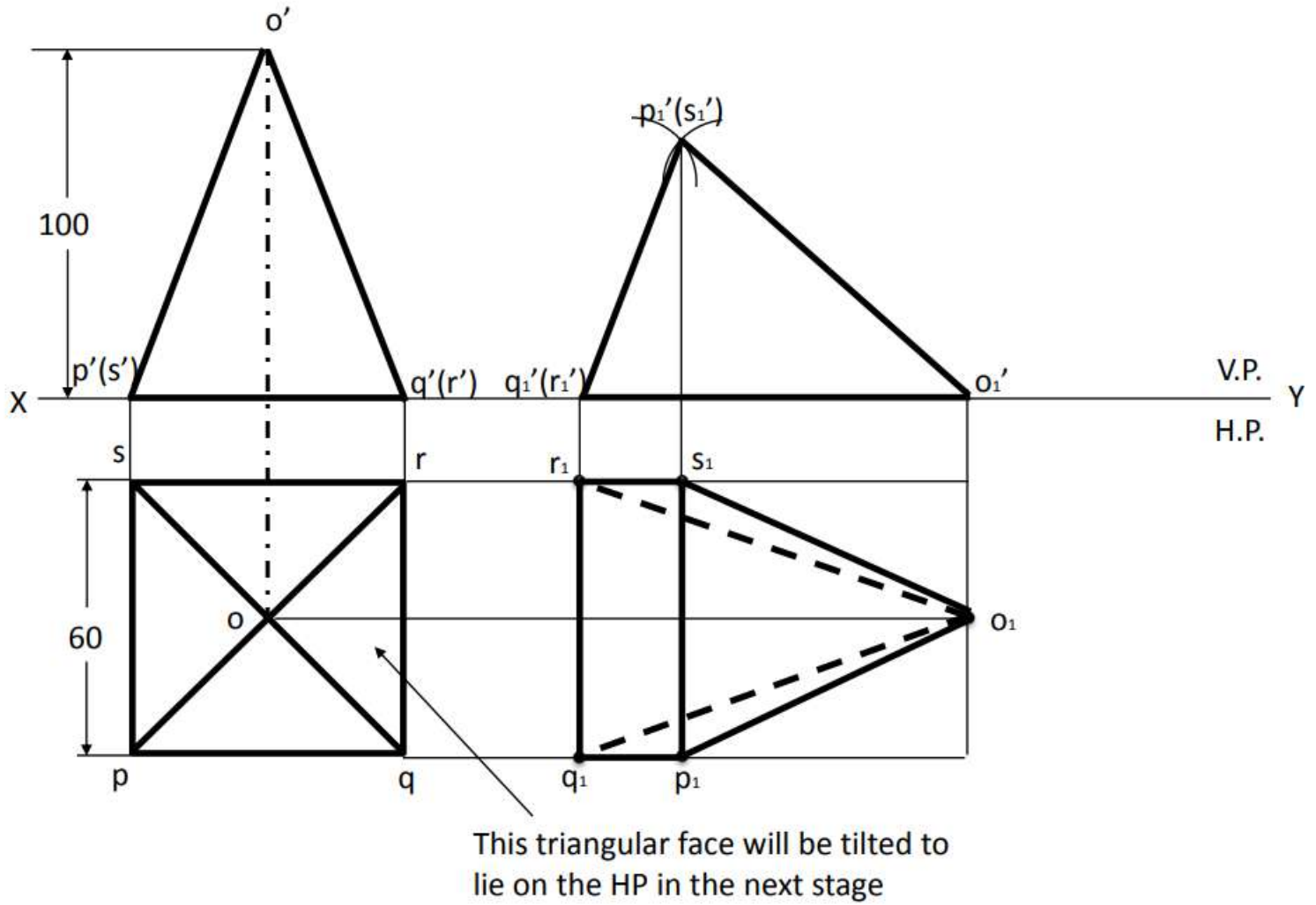
Initially, the prism is placed with its base on HP such that an imaginary line connecting the center of the base and a corner is parallel to VP and it lies on the right side.

1. Top View
2. Front View
3. Prism has to lie on one of its corners of the base on HP. The base edge is drawn at (90- θ) in the front view.
4. The second top view is projected by drawing the vertical projectors from the corners of the second front view and the horizontal projectors from the first top view.

A cylinder of diameter 30 mm and axis length 50 mm is resting on the HP on a point so that its axis is inclined at 45 degree to the HP and parallel to the VP. Draw its top and front views.



A square pyramid of base side 60 mm and altitude 100 mm lies on the HP on one of its triangular faces parallel to the VP. Draw its projections



A cube of 30 mm sides is held on one of its corners on HP such that the bottom square face containing that corner is inclined at 30 degree to HP. Two of its adjacent base edges containing the corner on which it rests are equally inclined to VP. Draw the top and front views of the cube.