UNIT-IV

04/05/24

PROJECTIONS OF SOLIDS

Definition

A Solid is a 3D object having 3 dimensions length, breadth and thickness (or) height

Types of Solids:

Solids may be divided into 2 groups

a) polyhedra
b) Solids of revolution

a) polyhedra

1. Tetrahedron:
   It has 4 Equal Equilateral triangles as faces
2. Cube (or)
   It has 6 faces all are equal squares
3. Octahedron:
   It has 8 Equal Equilateral triangle as faces
4. Dodecahedron:
   It has 12 regular pentagons as faces
5. Icosahedron:
   It has 20 faces, all are equal Equilateral triangles
6. prism:
   This is a polyhedron having two equal and similar faces all its ends (or) bases parallel to each other and joined by other faces which are rectangles.
7. pyramid:
   This is a polyhedron having a plane figure as a base and a no. of triangular faces meeting at a point called its vertex or apex
   → prisms & pyramids are named according to the shape of their bases.

b) Solids of revolution:

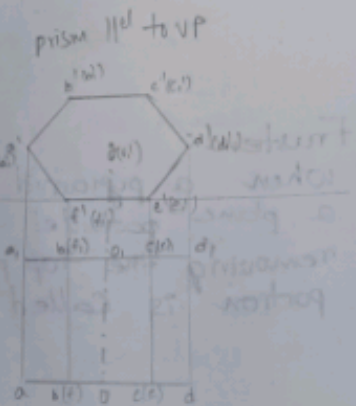
1. Cylinder:
   A right circular Cylinder is a solid generated by the revolution of a rectangle about one of its sides remains fixed
2. Cone:
   ~~It is a solid~~ A right circular Cone is a solid generated by the revolution of its right angled triangle about one of its ⊥r sides remains fixed.
3. Sphere:
   A sphere is a solid generated by the revolution of a semicircle about its diameter as the axis

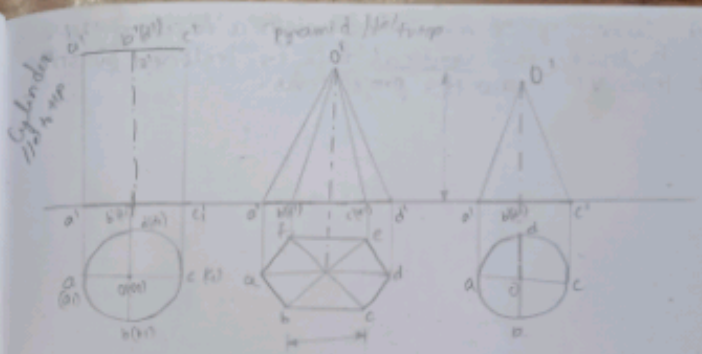
Frustem:

When a pyramid (or) a Cone is cut by a plane parallel to its base, & Thus removing the top portion, the remaining portion is called "frustem".

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

Projections of solids in Simple positions
→ A solid in simple position may have its axis ⊥ⁿ to one reference plane (or) parallel to both.
→ The projection of a solid on the plane to which its axis is ⊥ⁿ will show the True shape and size of its base.
→ When the axis ⊥ⁿ to the ground i.e., to the HP The top view should be drawn first and the front view projected from it.
→ When the axis is ⊥ⁿ to V.P The front view should be drawn first and the Top view projected from it.
→ When the axis is parallel to both HP & VP the Sideview must be drawn first, The front view & the top view then projected from the Side view.

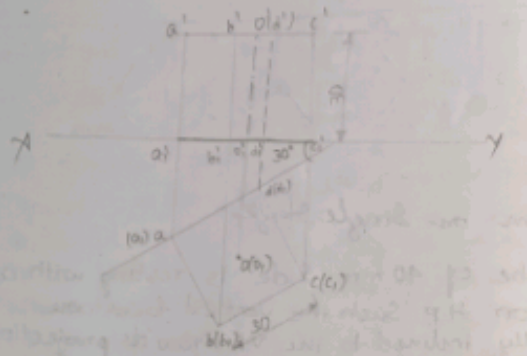




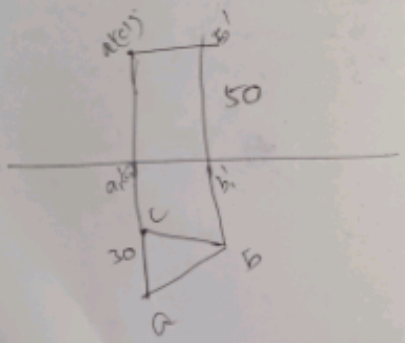
Problem on Single Stage

DA Cube of 40 mm Side is resting with a face on H.P Such the vertical faces are Equally inclined to the V.P Draw its projections

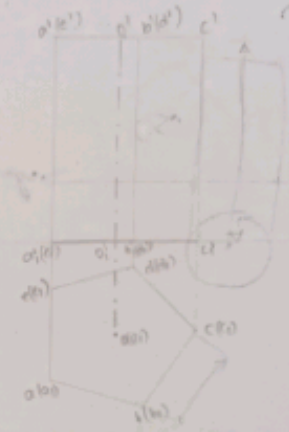
2) A Cube of 30 mm rests with a face on H.P. Such that the vertical face is inclined @ 30° to the V.P. Draw its projections.



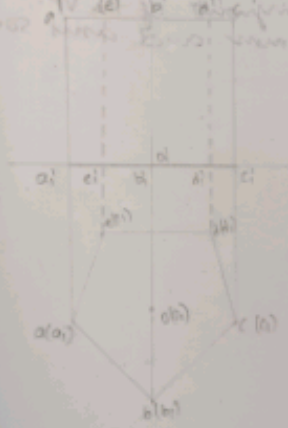
3) A triangular prism of base 30 mm side and axis 50mm long is resting on the H.P on one of its base with a face ⊥r to the V.P. Draw its projections.



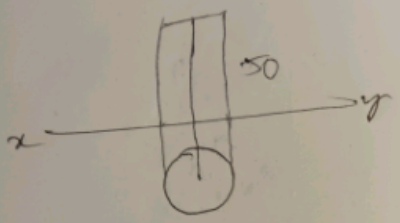
4) A pentagonal prism of side of base 20mm & axis 50 mm long is resting on its base on H.P with one of its rectangular face ⊥r to V.P Draw its projections.



5) A pentagonal prism of side of base 30mm and axis 60 mm long is resting on its base on H.P with one of its rectangular face ||el to V.P. Draw its projections.

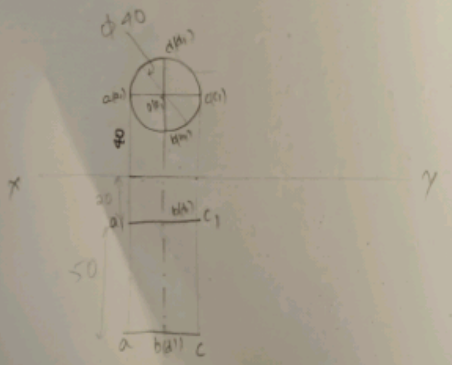


6) Draw the projections of a Cylinder, base 40 mm diameter and axis 50 mm long resting on the H.P on its base.

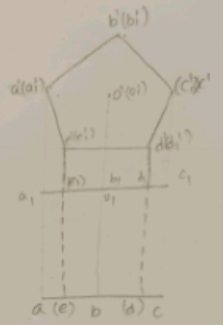


7) Draw the projections of a pentagonal prism of base 25 mm side and axis 50 mm long is resting on one of its rectangular faces on H.P. The axis of the solid is ⊥ to V.P.

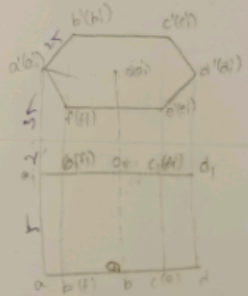
7) Draw the projections of a cylinder with axis ⊥ to the VP of 40 mm above the HP, one end 20 mm infront of the VP. Base diameter 40 mm and axis 50 mm long.



8) Draw the projections of a pentagonal prism of base 25 mm side and axis 50 mm long is resting on one of its rectangular faces on HP. The axis of the solid is ⊥ to the V.P.



9) A hexagonal prism has one of its rectangular face parallel to HP. Its axis is ⊥ to the V.P and 3.5 cms above the ground. Draw its projections when the nearer end is 2 cms infront of the V.P Side of the base 2.5 cms long, axis 5 cms long.



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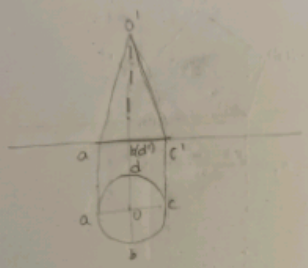
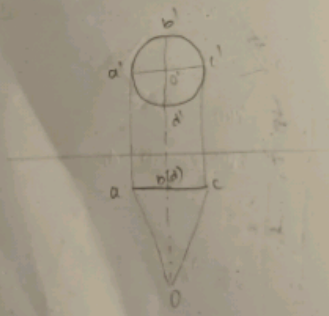
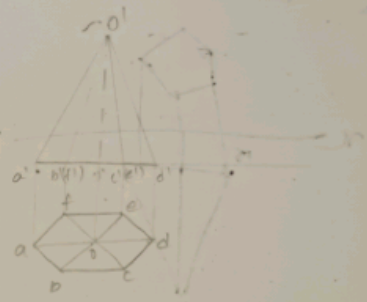
10) Draw the projections of a Cone, base 40 mm diameter and axis 50 mm long resting on HP. on its base.



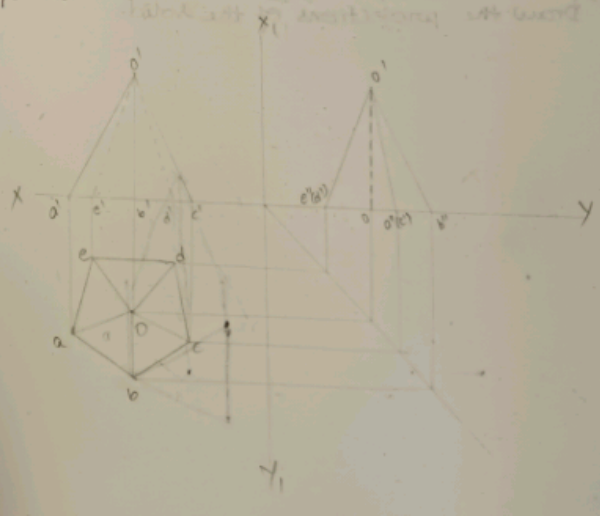
11) Draw the projections of a Cone of base diameter 40 mm and altitude 45 mm when its base is kept parallel to the V.P.



12) Draw the projections of hexagonal pyramid, base on the HP and a side of the base parallel to and 25 mm infront of the V.P. Base edge 40mm and axis length 65 mm.



13) Draw the projections of a pentagonal pyramid, base 30 mm edge and axis 50 mm long, having its base on the HP and an edge of the base parallel to V.P Also draw its side view.



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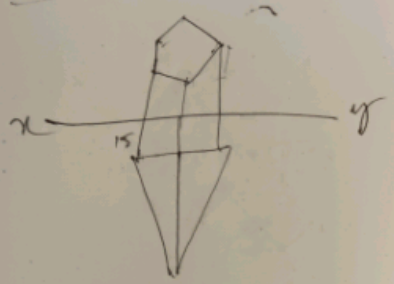
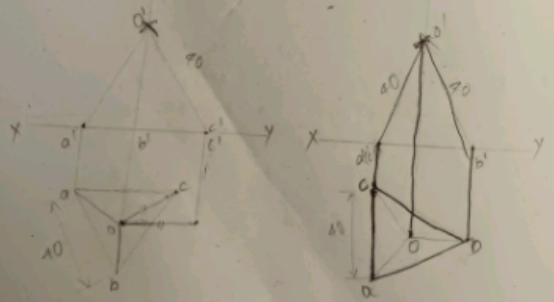
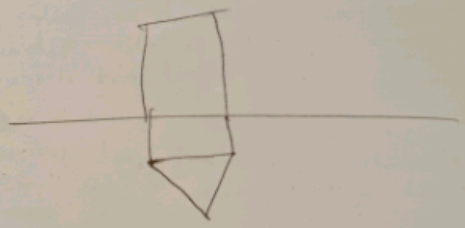
14) A pentagonal pyramid of base 25 mm side and axis 60 mm long is resting on an edge of the base. Draw the projections of the pyramid, when its axis is ⊥r to the V.P and the base is @ 15mm from V.P.



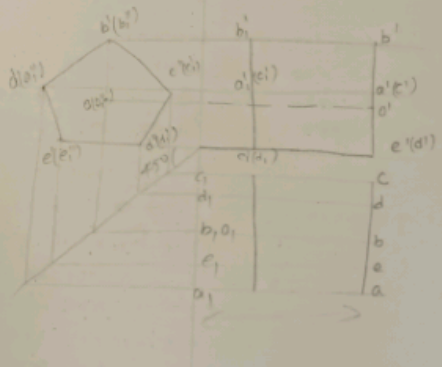
15) A tetrahedron of 40 mm long edges is resting on H.P on one of its faces with an edge of that face.
a) parallel to V.P b) ⊥r to V.P
Draw the projections of the solid.
Base edge = Slant edge = 40 (Given)



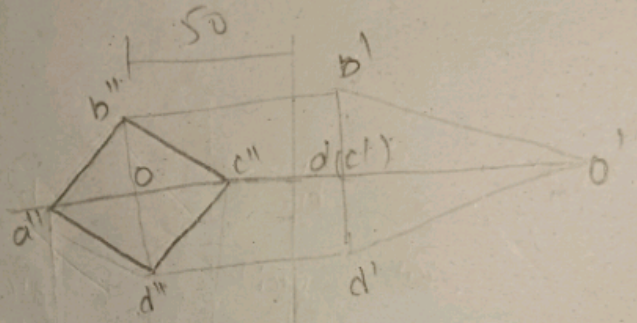
16) A triangular prism, base 40 mm & height 65 mm is resting on the H.P on one of its rectangular faces with axis ||el to the V.P. Draw its projections.

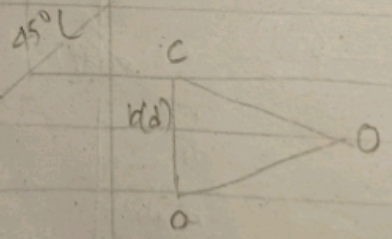


17) A pentagonal prism with side of base 35 mm and height of the axis 60 mm rests on one of its rectangular faces on H.P. The axis of the prism is parallel to both H.P and V.P. Draw its projections



19) A Square pyramid, all edges of base Equally inclined to HP. and axis 11° to and 50 mm away from both the HP. and the VP. Base Edge 40 mm and axis length 65 mm.





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Projections of Solids (2 stage):

projections of solids with axis inclined to one of the reference planes and parallel to other:

When a solid has its axis inclined to one plane and parallel to other its projections are drawn in two stages.

Stage-I:

→ In the initial stage the solid is assumed to be in simple position i.e., its axis ⊥r to one the reference plane.

→ If the axis is to be inclined to the ground, i.e., HP, it is assumed to be ⊥r to the HP.

→ If the axis is to be inclined to the V.P, it is assumed to be ⊥r to V.P.

Stage-II:

Final projections may be obtained by one of the following 2 methods.

(A) Alteration of position (or) Change of position method:

The position of one of the views is altered as required and the other view projected from it.

(B) Alteration of reference line (or) Auxilary plane method:

A new reference line is drawn according to the required conditions to represent an auxillary plane and the final view projected on it.

Auxilary plane:

There are two types of auxilary planes.

1) Auxiliary inclined plane:

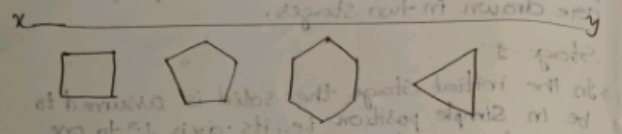
The plane which is ⊥r to V.P and inclined to H.P is known as Auxilary inclined plane (A.I)

2) Auxillary Vertical plane:

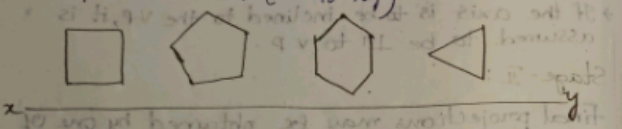
The plane which is ⊥r to HP and inclined to V.P is known as Auxiliary vertical plane.

Important points :-

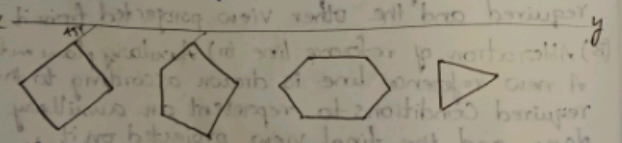
→ If the solid has an edge of its base on the H.P (or) on the ground (or) parallel to H.P, that edge should be kept ⊥r to V.P (i.e., to xy) :



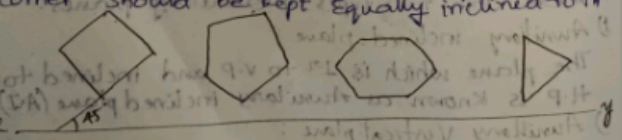
→ If the solid has an edge of its base in the VP i.e., parallel to V.P, that edge should be kept ⊥r to H.P (ie to xy)



→ If the solid has a corner of its base in the H.P (or) on the ground, the sides of the base containing that corners should be kept Equally inclined.



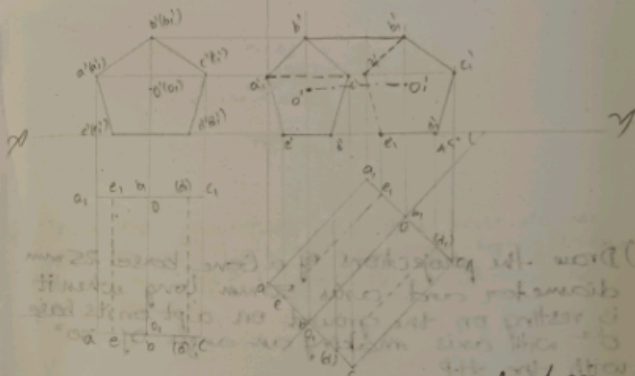
→ If the solid has a corner of its base in the VP, the sides of the base containing that corner should be kept Equally inclined to H.P.



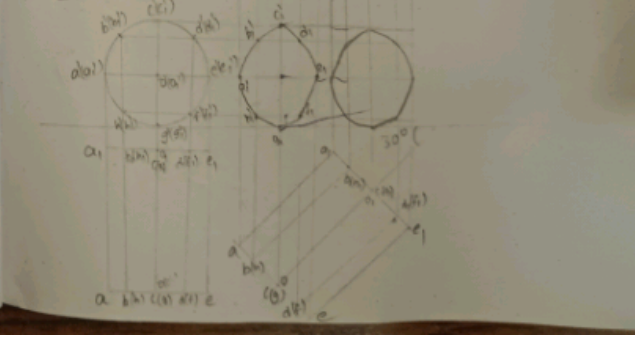
Problems :

1) Draw the projections of a pentagonal prism, base 25mm side and axis 50 mm long, resting on one of its rectangular faces H.P with the axis inclined @ 45° to V.P

base edge a,'b',a,'b'
longer edge a,c,



2) Draw the projections of a cylinder 75 mm diameter of 100 mm long, lying on the ground with its axis inclined @ 30° to VP & 11°1 to the ground



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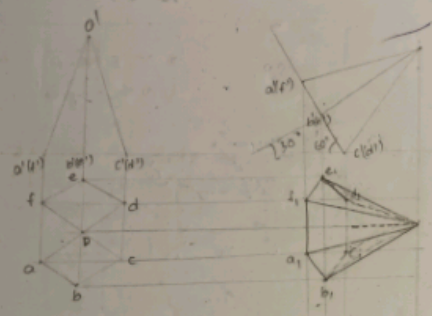
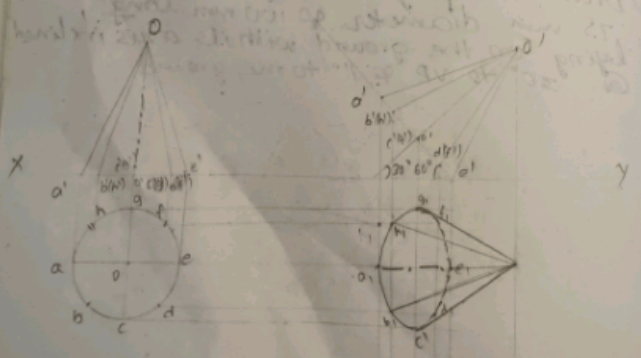
3) A Hexagonal pyramid base 25 mm side and axis 55 mm long, has an edge of the its base on the ground its axis is inclined @ 30° to the ground and ∥el to the VP. Draw its projections.

Axis 30°
Base = 90 - 30 = 60°
c'd' Base edge b_1c_1, c_1d_1, d_1e_1

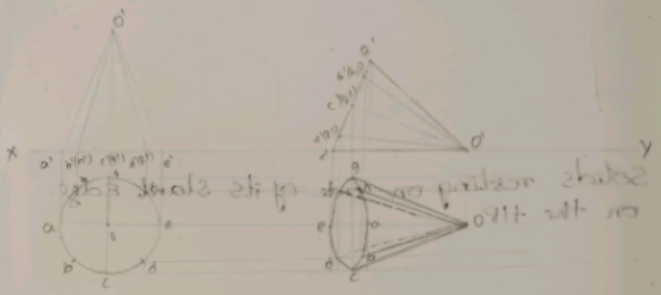


4) Draw the projections of a Cone base 25 mm diameter and axis 50 mm long when it is resting on the ground on a pt on its base ℓe with axis making an angle of 30° with the H.P.

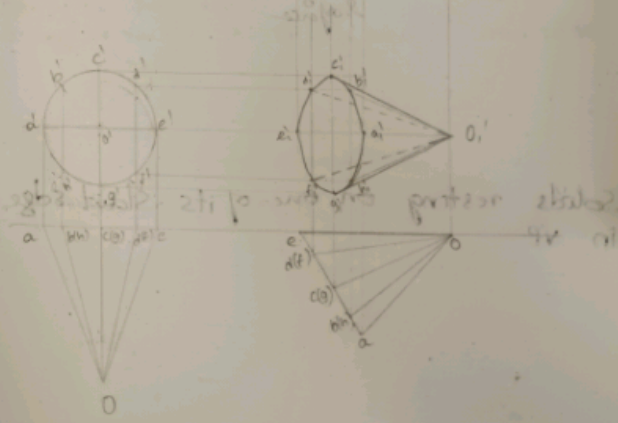


5) Draw the projections of a Cone, base 75 mm diameter and axis 100 mm long lying on the HP on one of its generators with the axis ∥el to the VP.

generator on HP → axis inclined to HP



6) Draw the projections of a Cone base 40 mm diameter and axis 50 mm long lying in the VP on one of its generators with the axis ∥el to the HP.



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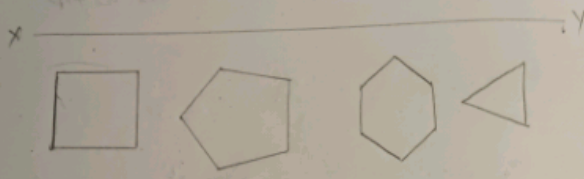
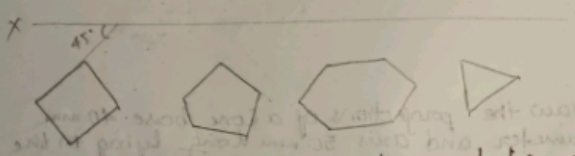
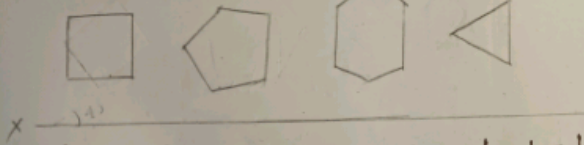
Solids resting on one of its slant surface (a) triangular base on the HP (or) on the ground.



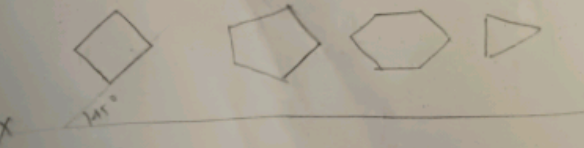
Solids resting on one of its slant edge on the HP



Solids resting on one of its ~~rect~~ triangular face (a) slant ~~edge~~ surface in the V.P

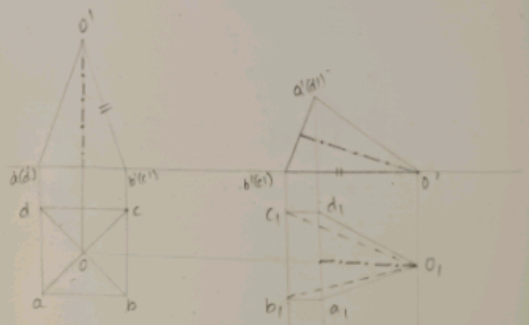


Solids resting on one of its slant edge in VP



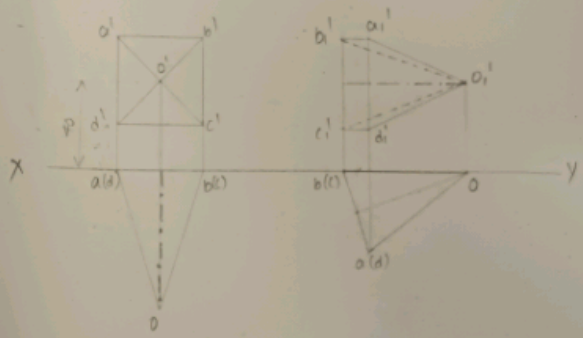
7) A Square pyramid of base side 30 mm and axis 50 mm is resting on HP on one of its triangular faces with its axis parallel to VP Draw its projections.

Triangular face on H.P → axis inclined to HP.



8) A Square pyramid of base side 30 mm and axis 75 mm is resting on VP on one of its ~~Δ~~ faces with its axis ||el to and 40 mm above HP. Draw its projections.

Triangular face in the VP → axis inclined to VP



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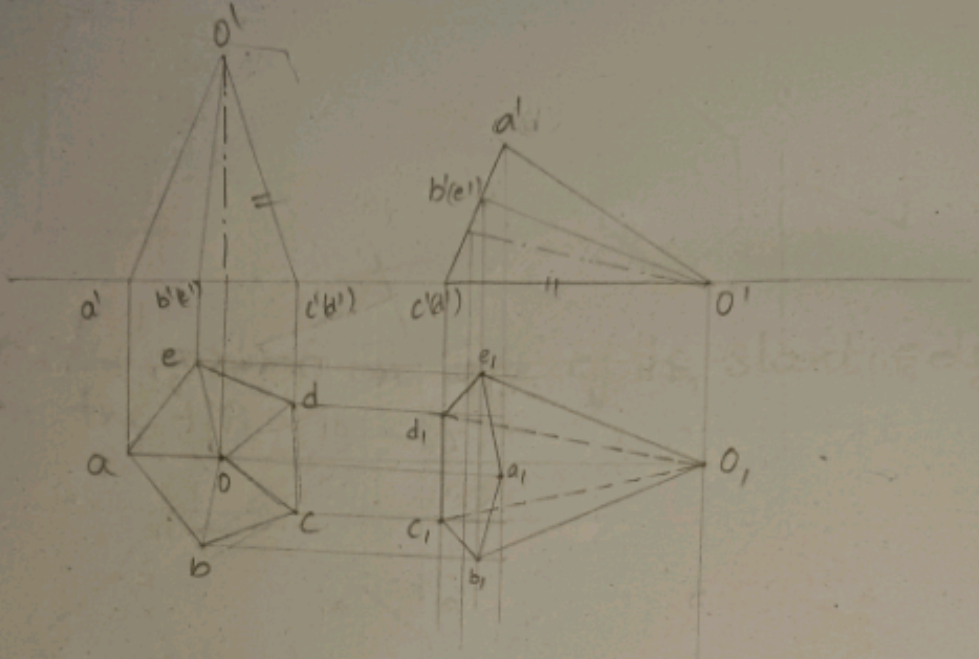
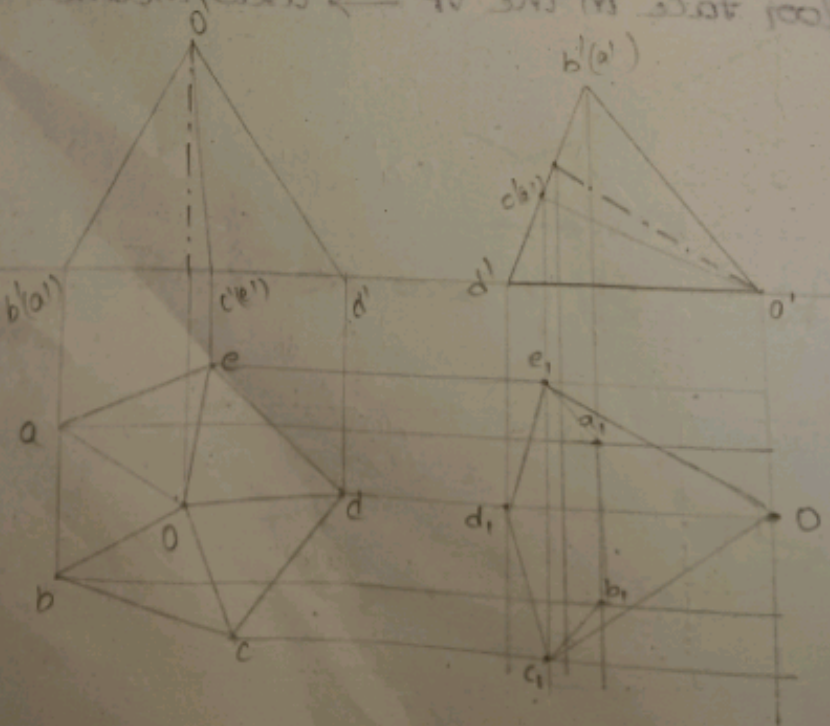
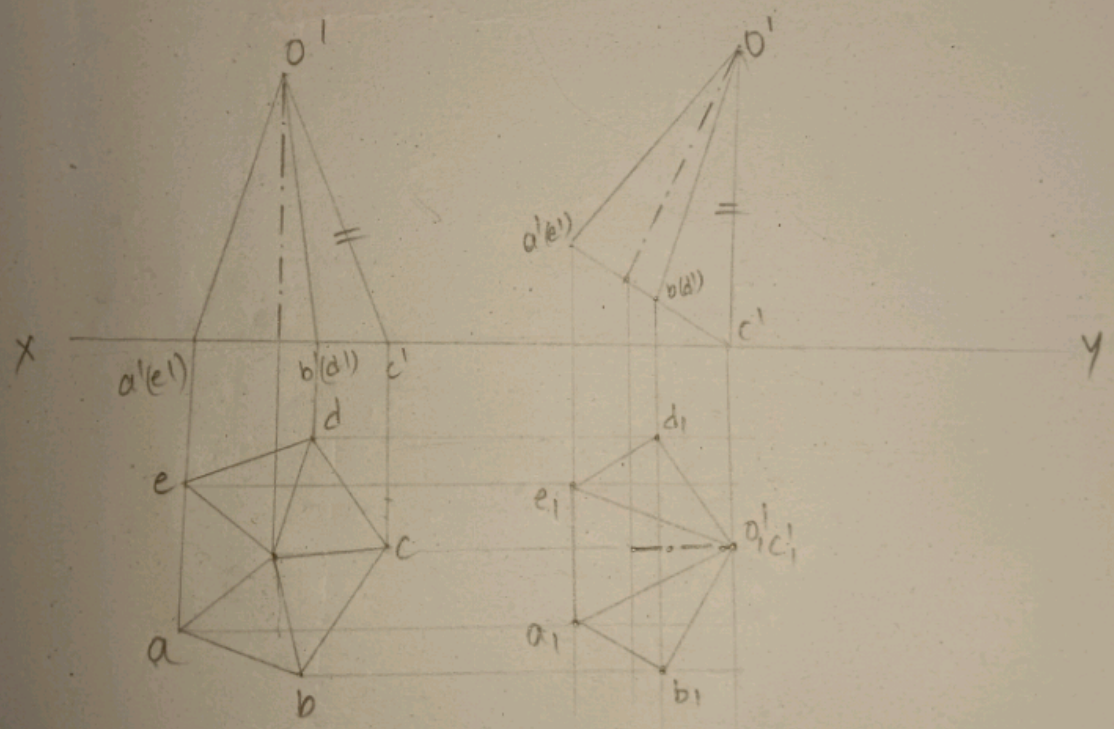
10) A pentagonal pyramid of base 30 mm and axis 60 mm is resting on HP on one of its slant surfaces with its axis ||el to VP. Draw its projections.



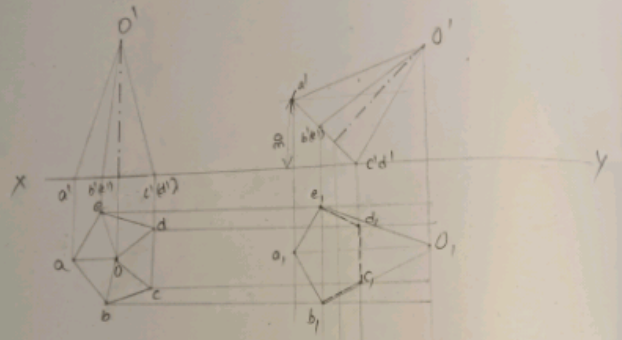
11) A pentagonal pyramid of base 30 mm and axis 60 mm is resting on HP on one of its slant edges with its axis parallel to VP. Draw its projections.



13) A pentagonal pyramid of base 30 mm and axis 60 mm is resting on HP on one of its base corners with its axis ||el to VP. Draw its projections when the slant edge containing the resting corner is vertical.



14) A pentagonal pyramid of base 30 mm and axis 60 mm is resting on one edge of its base on the ground, so that the highest in the base is 30 mm above the ground. Draw its projections, when the axis is ∥el to V.P.

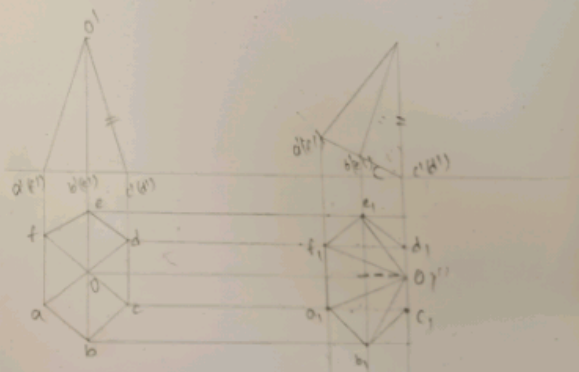


15) A hexagonal pyramid of base 30 mm and axis 60 mm is resting on HP on one of its slant edges with its axis ∥el to V.P. Draw its projections.

16) A hexagonal pyramid of base 30 mm and axis 60 mm is resting on HP on one of its ΔLOER faces with its axis ∥el to VP Draw its projections

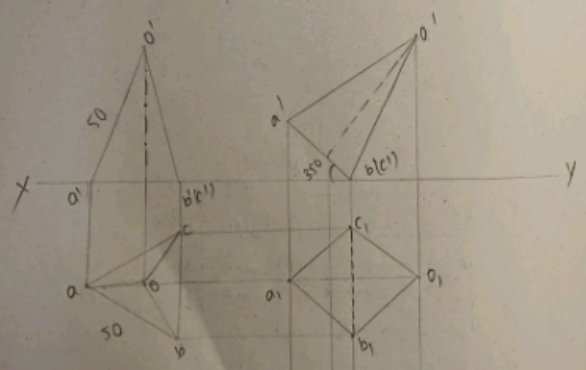
ND

19) A hexagonal pyramid of base 30 mm and axis 60 mm is resting on HP one one of its base edge, when the ΔLOER face containg the resting edge is ⊥r to both HP & VP. Draw its projections.



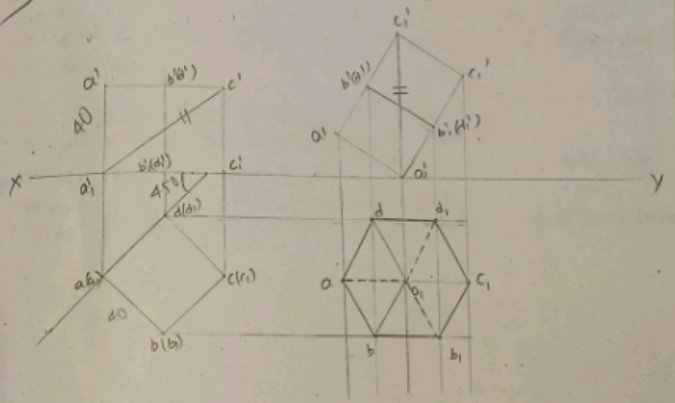
16) ND Bhatt Ex-13b, problem 3, 301-pg

17) A tetrahedron of edge 50 mm is resting on HP on one of its edge with the face containing that edge inclined @ 35° to the HP & ⊥ⁿ to VP. Draw its projections.



22) Draw the projections of a cube of 40 mm Edge resting on HP on one of its corners with a solid diagonal
(a) vertical (b) Horizontal

a)



b)