

5. Join I', II', III', IV', and V' mutually, by straight lines, to obtain the section and draw section lines in the area in section.

Section of solid 2-28 Q-1

PROBLEM 14.12. A right circular cone, diameter of base 54 mm and height 64 mm, lies on one of its elements in HP with its axis parallel to VP. A vertical section plane, parallel to the VP and 10 mm away from the axis, cuts the cone. Draw the top view and sectional front view of the cut cone.

SOLUTION: Refer Fig. 14.12.

1. Draw the projections of the cone satisfying the given conditions, as shown.
2. Draw the cutting plane line HT, which is the horizontal trace of the section plane, at a distance of 10 mm and parallel to the axis in top view.
3. The cutting plane line HT cuts the ellipse for the base rim at **a** and **g**, and elements **o2**, **o3**, **o4**, **o5** and **o6** at points **b**, **c**, **d**, **e**, and **f** in the final top view.
4. Project the points **a** and **g** vertically upwards to points **a'** and **g'** lying on the projection of the base rim in front view. Also project points **b**, **c**, **d**, **e**, and **f** on the final front view of the corresponding elements **o'2'**, **o'3'** etc. As **b'**, **c'**, **d'**, **e'**, **f'**.
5. Join points **a'**, **b'**, **c'**, **d'**, **e'**, **f'**, and **g'** by a smooth curve, as the cone is a solid of revolution. Draw section lines in this sectioned area.
6. Fair out the view for the cut cone (leaving the projections for cut away portion as thin double chain lines).

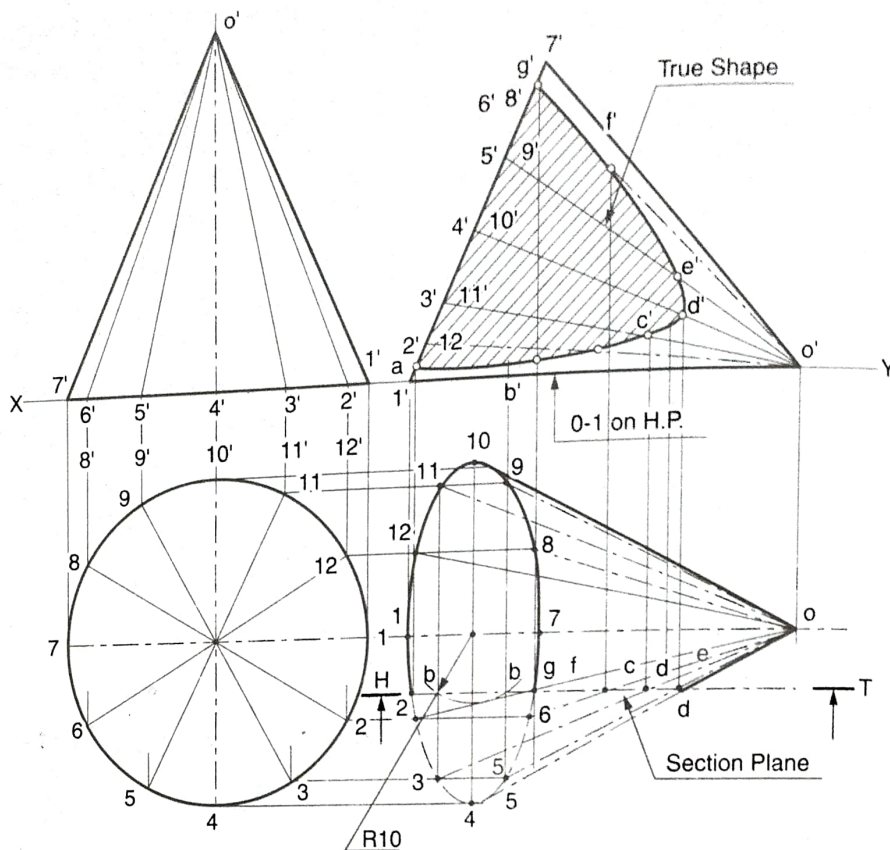


Fig. 14.12.

7. It should be noted, that as section is projected on a plane parallel to the section plane, it shows its true shape and size.

PROBLEM 14.13. A right circular cylinder, base diameter 40 mm and height 65 mm, is lying on HP on one of its elements, such that its axis is inclined to VP at 30° . A vertical section plane, parallel to the VP, cuts the cylinder meeting its axis at a distance of 7 mm from its end face away from the VP. Draw the sectional front view and top view of the cut cylinder.

SOLUTION: Refer Fig. 14.13. The procedure followed to solve this problem is same as explained in problem 12. The interpretation of the solution is left to the reader.

14.9. SECTION PLANE PERPENDICULAR TO VP AND INCLINED TO HP

A section plane perpendicular to VP and inclined to HP is called an *auxiliary inclined plane*, AIP. It is represented by its vertical trace VT drawn in front view, as shown in Fig. 14.14. Its HT is purposely omitted as it is perpendicular to the XY line and serves no useful purpose in drawing the

sectional view. The angle at which such a plane is inclined to the HP is made by its VT with the XY line. The projection of such a section in front view is a line, coincident with the cutting plane line VT. Whereas, its top view is a geometric figure. In other words we can say that such a section plane gives sectional top view.

Further it should be noted here, that as the section plane and hence the section is inclined to the HP, its projection on the HP does not show its true shape and size. The area of section is smaller than that of its true section exposed by the section plane, as seen perpendicular to the cutting plane, and is called *apparent section*.

The *true shape* of such a section is found by *auxiliary plane method*, as discussed in chapter 11. In other words, we draw the auxiliary projection of the section on an auxiliary plane taken parallel to the section plane, as shown in Fig. 14.15.

PROBLEM 14.14. A right regular hexagonal pyramid, edge of base 25 mm and height 55 mm, rests on its base; (1) on ground plane, (2) on HP, with one of its base edges parallel to VP. A section plane perpendicular to VP and inclined to HP (or ground plane) at 30° ,

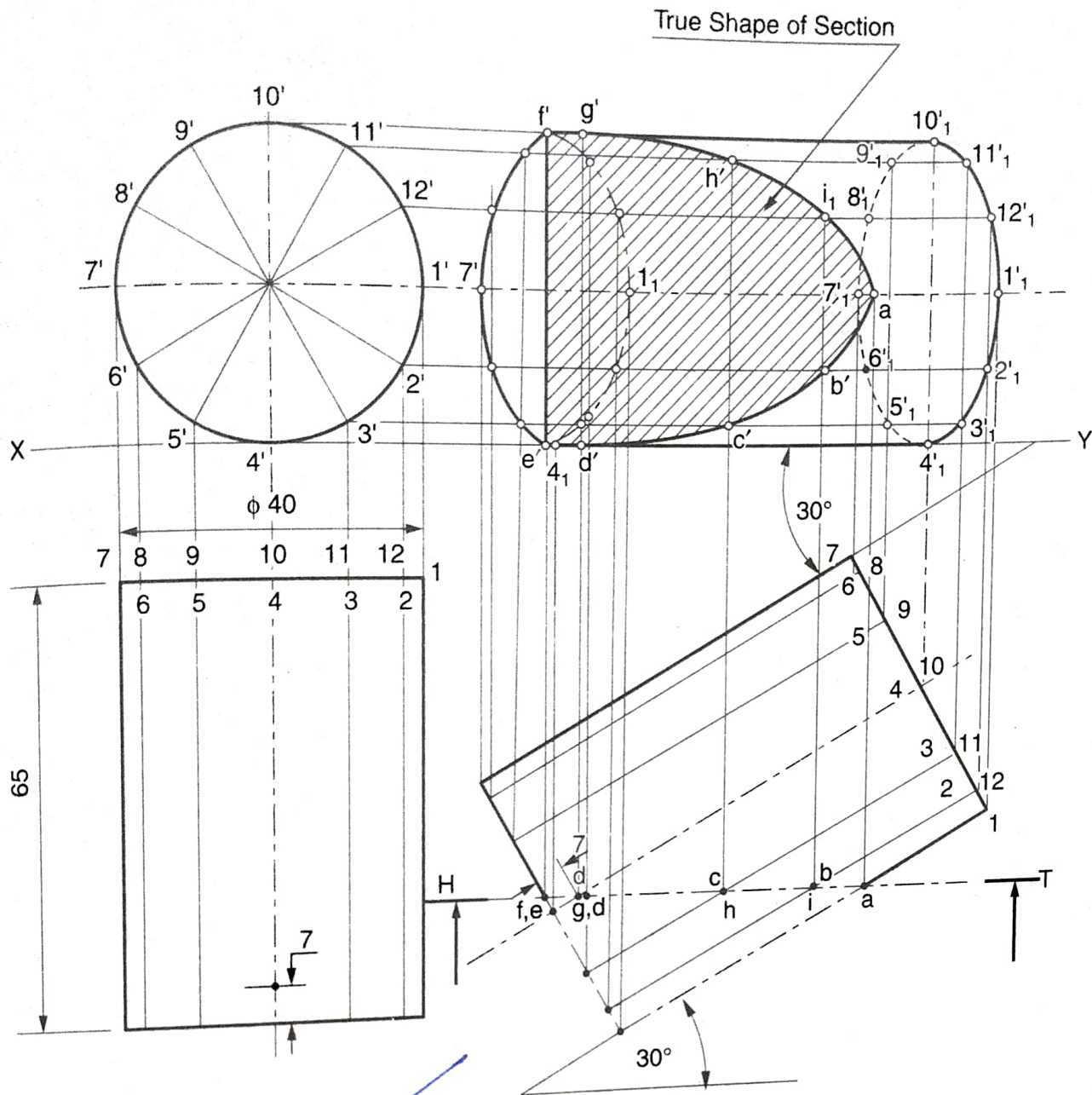


Fig. 14.13. First Angle Projection

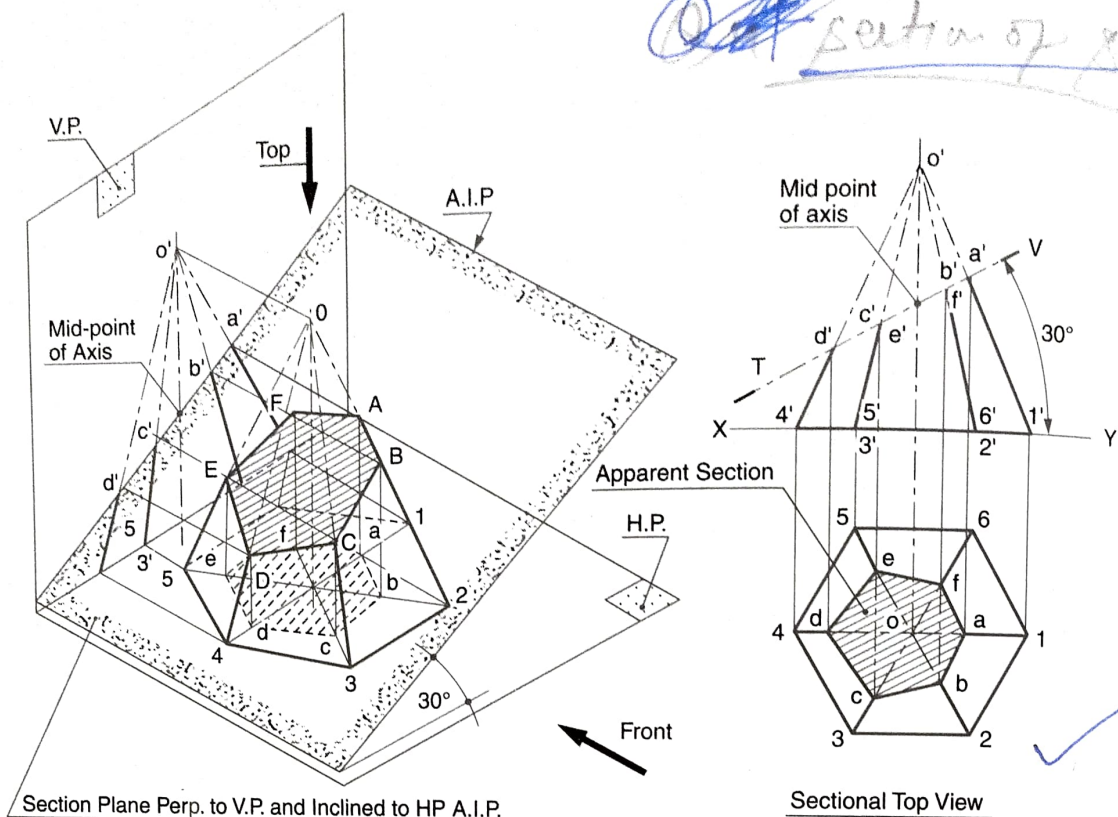


Fig. 14.14. (b) First Angle Projection

cuts the pyramid and passes through the centre of its axis. Draw its front view and sectional top view.

SOLUTION: Refer Fig. 14.14.

1. Draw, in light lines, the projections of the pyramid in the given position.
2. Then draw the vertical trace VT of the section plane, inclined to XY or GL at 30° .
3. The slant edge in front view $o'1'$ is cut by the section plane at a' . The projection a of this point in top view lies vertical, (1) above a' , (2) below a' and on the top view $o1$.
4. Similarly plot, in top view, other points of intersection b' , c' , d' , e' , and f' of the cutting plane line with the other slant edges $o'2'$, $o'3'$, $o'4'$, $o'5'$ and $o'6'$.
5. Join points a , b , c , d , e and f by straight lines, as shown, to obtain the projection of the section in top view. Draw section lines in this closed area.
6. Finish the views by fairing out the lines on the projections, representing the cut pyramid only. The projections for the cut away portion of the pyramid should be left as thin lines or preferably drawn in thin short double chain lines.

PROBLEM 14.15. A pentagonal pyramid, side of base 25 mm and height 50 mm, rests on its base on HP with one of its base edges perpendicular to VP. An auxiliary inclined plane (AIP), inclined to HP at 45° cuts the pyramid, bisecting its axis. Draw its front view, sectional top view and true shape of the section.

SOLUTION: Refer Fig. 14.15.

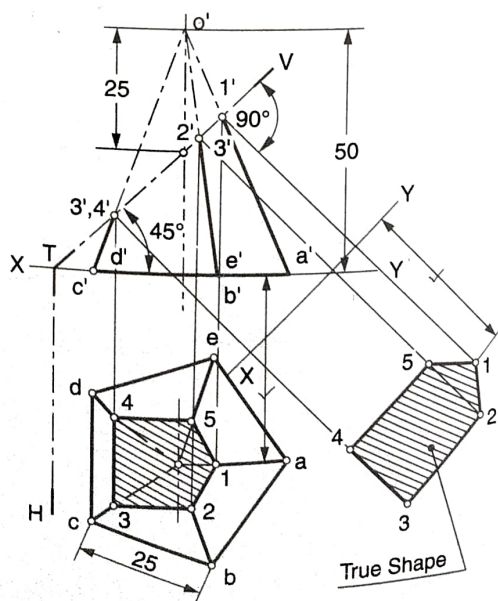


Fig. 14.15.

d', e' on their corresponding edges $o'5', o'4', o'3'$, $o'1', 2'3'$, and $1'2'$ in the final front view. Join $a'b'c'd'e'$ by straight lines and draw section lines in this area to complete the section in front view.

Finish the views by fairing out the projections of the truncated pyramid and leaving the projections of the cut away part of it as light thin short double chain lines as shown.

PROBLEM 14.27. A right regular pentagonal prism, side of base 25 mm and height 65 mm, rests on an edge of its base on HP, such that the rectangular face containing the base edge is inclined to the HP at 30° , (or the base inclined at 60° to the HP). A section plane perpendicular to the HP and inclined to the VP at 45° cuts the prism such that the long edge farthest away from the VP is bisected. Draw the top view and sectional front view of the cut prism.

SOLUTION: Refer Fig. 14.27.

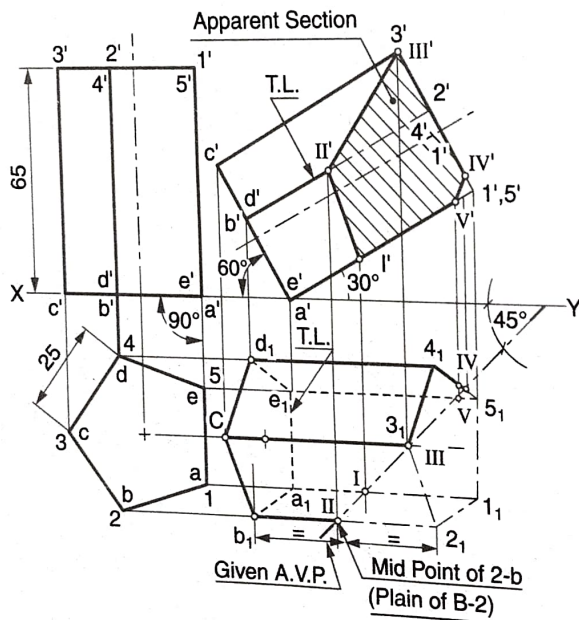


Fig. 14.27.

Draw, in light lines, the projections of the prism. The long edge farthest away from the VP is farthest away from the XY line in the top view. Therefore, through the mid-point of the edge $b_1 2_1$ in the top view, draw the section plane line HT, inclined to the XY line at 45° .

The point of intersection of the cutting plane line HT with the edge $b_1 2_1$ in the top view when projected up to be on $b'2'$ in front view, gives point II' lying on the boundary of the section there. Similarly other points of intersection of the cutting plane line with the other base and long edges,

when projected to their respective positions in front view, give the remaining points on boundary of the section in front view.

Join I', II', III', IV' and V' by straight lines and draw section lines in the area enclosed by these points. Finish the views by making the hatched area dark, (thick 100%) and thin (33%) as shown.

PROBLEM 14.28. A right circular cone, diameter of base 60 mm and height 70 mm, rests on its base on HP. A section plane perpendicular to HP and inclined to VP at 45° cuts the cone and is 10 mm in front of the axis. Draw its top view, sectional front view, and true shape of the section.

SOLUTION: Refer Fig. 14.28.

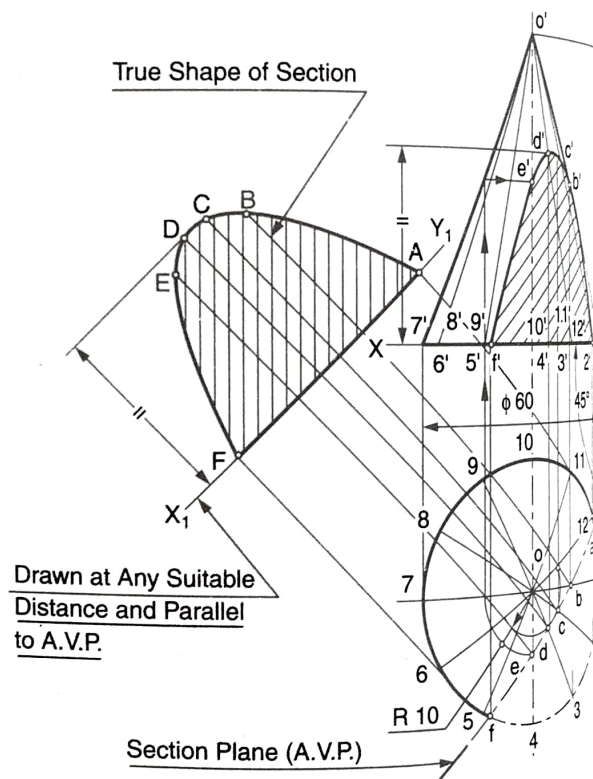


Fig. 14.28.

1. Draw the projections of the cone, in the given position, in light lines.
2. Draw, with o as centre, a circle arc of 10 mm radius in the top view. Draw the cutting plane line HT inclined at 45° to the XY line tangential to this arc in top view.
3. Project the points of intersection a, b, c, d, e, f of this cutting plane line with the generators and base rim in the top view to their respective positions a', b', c', d', e', f' on the front elevation of their corresponding generators and base rim, as the case may be.

shape of the section.



14.10. SECTION PLANE PERPENDICULAR TO HP AND INCLINED TO VP (AVP)

Figure 14.24, shows a right regular hexagonal pyramid, resting on its base on ground plane, cut by a section plane perpendicular to HP and inclined to VP. It can be seen in this figure that such a plane is represented by its horizontal trace HT, drawn in the top view, inclined to XY line at the same angle at which the plane is inclined to VP. Its VT is perpendicular to the XY line and is omitted as it serves no useful purpose in the solution of problems of this type.

The cutting or section plane is passed through the top view and hence the top view of the section is a line coincident with the HT. The projection of the section in the front view is an *apparent section*, as the cutting plane is inclined to the VP.

PROBLEM 14.24. A right circular hexagonal pyramid, edge of base 25 mm and height 65 mm, rests on its base; on HP, with one of its sides parallel to VP. A section plane perpendicular to HP and inclined to

A diagram showing a curved surface with a point labeled 'd' and a vertical line segment labeled 'e'.

Draw, in light lines, the projections of the pyramid in the given position and label the corner points, as shown.

points, as shown.



Fig. 14.24

- (i) Draw a top view and an front view of the cylinder.
- (ii) Draw x_1y_1 at 30° to xy in such a way that the chord length in the top view is 40 mm. Project points 1, 2, 3 and 4 and draw the rectangle of 40 mm \times 80 mm as shown.

Problem 14-37. (fig. 14-43): A hexagonal pyramid, base 30 mm side and axis 70 mm long resting on its slant edge of the face on the horizontal plane.

A section plane, perpendicular to the V.P., inclined to the H.P. passes through the highest corner of the base and intersecting the axis at 25 mm from the base. Draw the projections of the solid and determine the inclination of the section plane with the H.P.

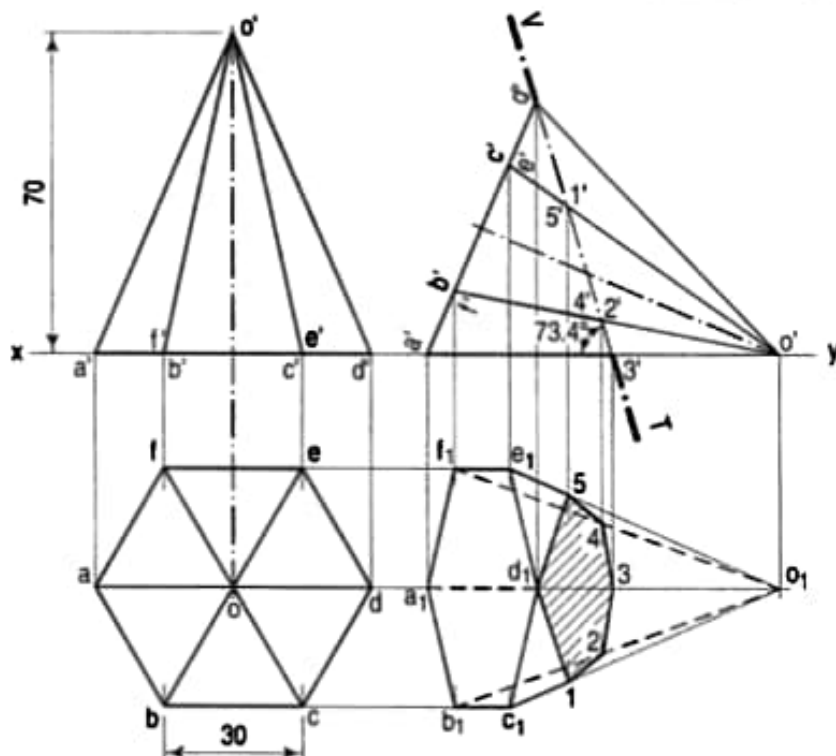


FIG. 14-43

- (i) Draw the top view and the front view keeping one of the sides of the base parallel to xy .
- (ii) With a' and o' , as centres and radii equal to $a'd'$ and $o'd'$ draw arcs intersecting each other at point d' . Draw a section plane passing through d' and point 25 mm away from the base along the axis as shown.
- (iii) Measure the angle by V.T. with xy .

Problem 14-38. (fig. 14-44): A pentagonal pyramid, base side 30 mm, length of axis 80 mm is resting on a base edge on the H.P. with a triangular face containing that edge being perpendicular to the V.P. and inclined to the H.P. at 60° . It is cut by a horizontal section plane whose V.T. passes through the mid-point of the axis. Draw the front view, sectional top view and add a profile view.

- (i) Draw the top view and the front view keeping one of the sides of the base perpendicular to xy .
- (ii) Tilt the front view on the points c' , d' as shown.
- (iii) Draw a line parallel to xy and passing through the mid-point of the axis representing V.T. of the section plane.
- (iv) Complete the projection as shown.