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# **UNIT-III**

# **Content**

**Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere**

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## **Unit-III**

### **Projections 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. Sometimes, additional views projected on auxiliary planes become necessary to make the description of a solid complete.

### **This chapter deals with the following topics:**

1. Types of solids.
2. Projections of solids in simple positions.
  - (a) Axis perpendicular to the H.P.
  - (b) Axis perpendicular to the V.P.
  - (c) Axis parallel to both the H.P. and the V.P.
3. Projections of solids with axes inclined to one of the reference planes and parallel to the other.
  - (a) Axis inclined to the V.P. and parallel to the H.P.
  - (b) Axis inclined to the H.P. and parallel to the V.P.
4. Projections of solids with axes inclined to both the H.P. and the V.P.
5. Projections of spheres.

### 3. PROJECTION OF SOLIDS

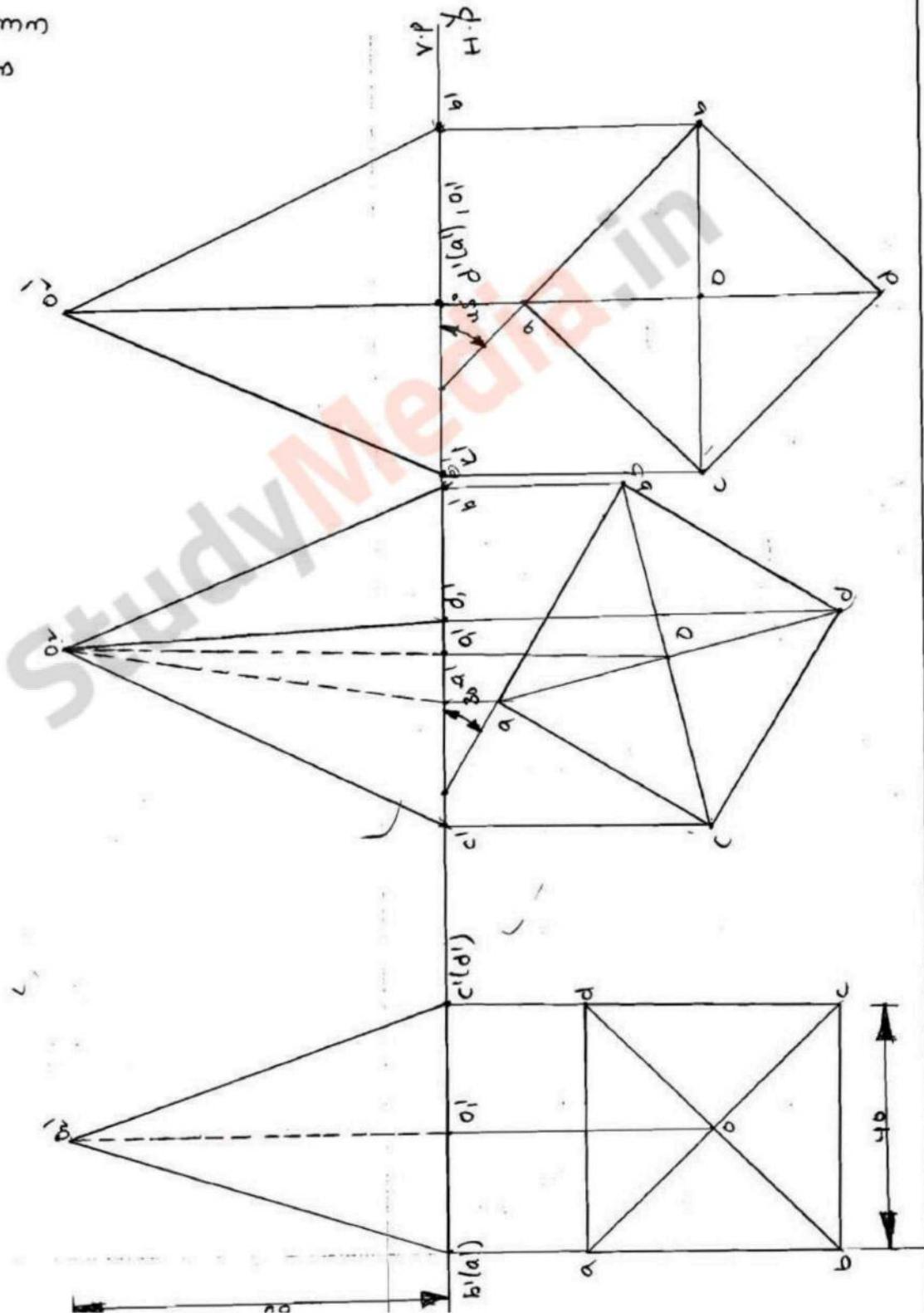
1. A square Pyramid side of base 40mm and axis 60mm is resting on its base on the H.P. Draw its projections when
- Aside of the base is parallel to V.P.
  - Aside of the base is inclined at  $30^\circ$  to V.P.
  - All sides of the base are equally inclined to V.P.

Sol: Square Pyramide

Base = 40mm

Axis = 60mm

$\phi = 30^\circ$



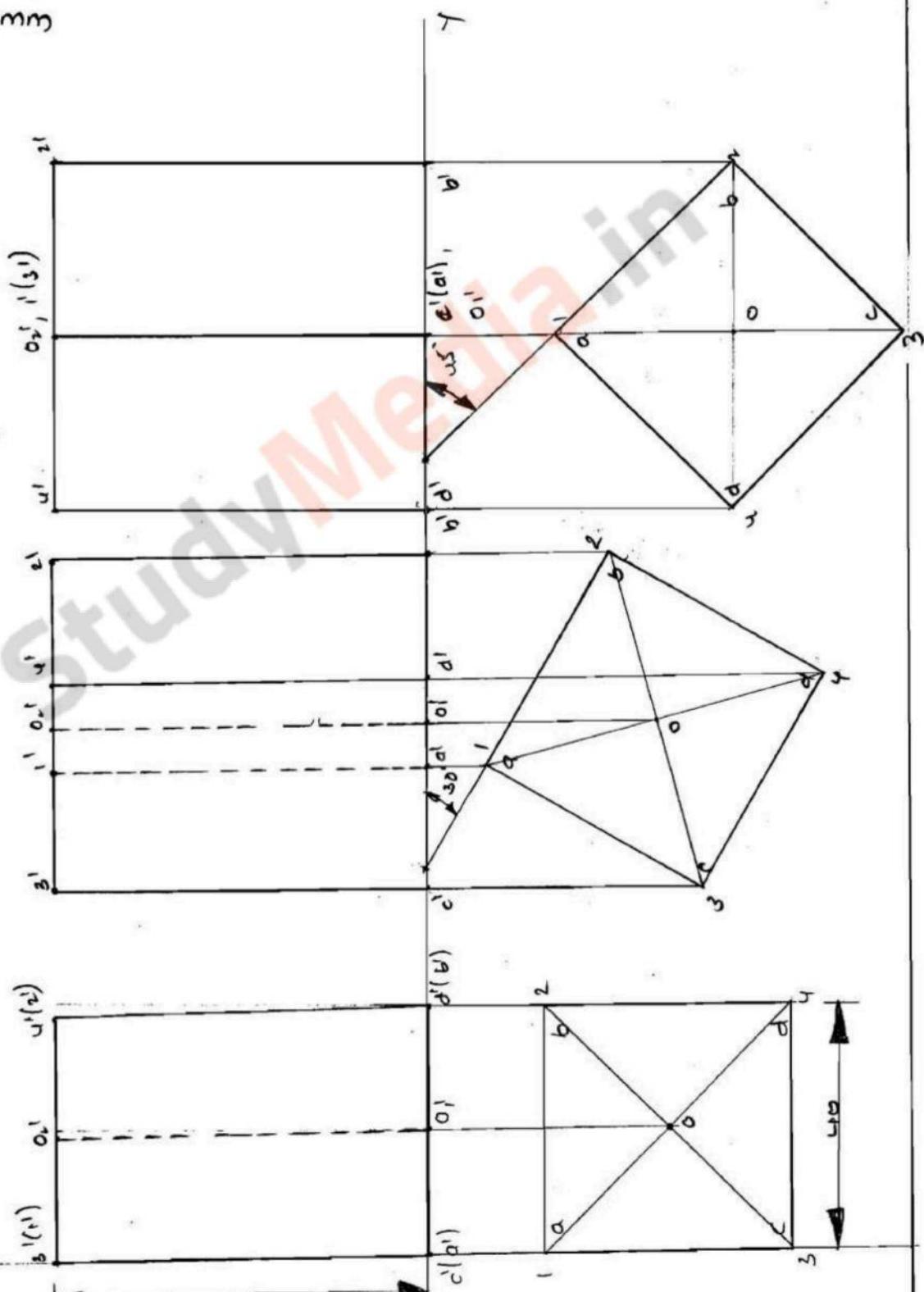
- Q. A square prism of 40mm above edges and 60mm long axis is resting on its base on the ground. Draw its projections when
- A face is perpendicular to v.p
  - A face is inclined at  $30^\circ$  to v.p
  - All the faces are equally inclined.

Ans: Square prism.

$$\text{Base} = 40\text{mm}$$

$$\text{Axis} = 60\text{mm}$$

$$\phi = 30^\circ$$



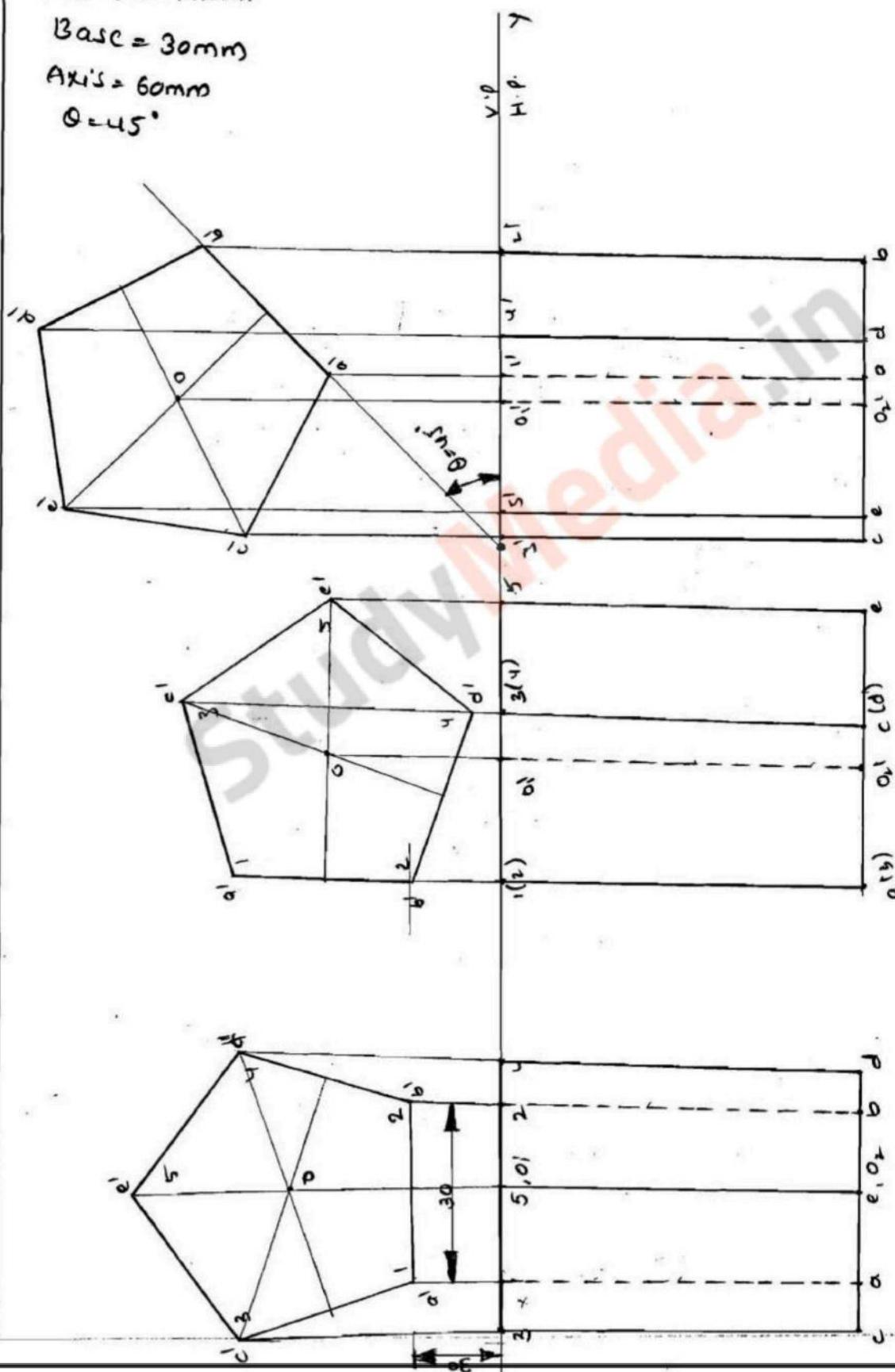
3. A Pentagonal Prism of 30mm base edges and 60mm long axis has one of its bases in the V.P. Draw its projections when
- A rectangular face is parallel to and 15mm above H.P.
  - A face is perp to H.P.
  - A face is inclined at  $45^\circ$  to H.P.

Sol:- Pentagonal Prism.

$$\text{Base} = 30\text{mm}$$

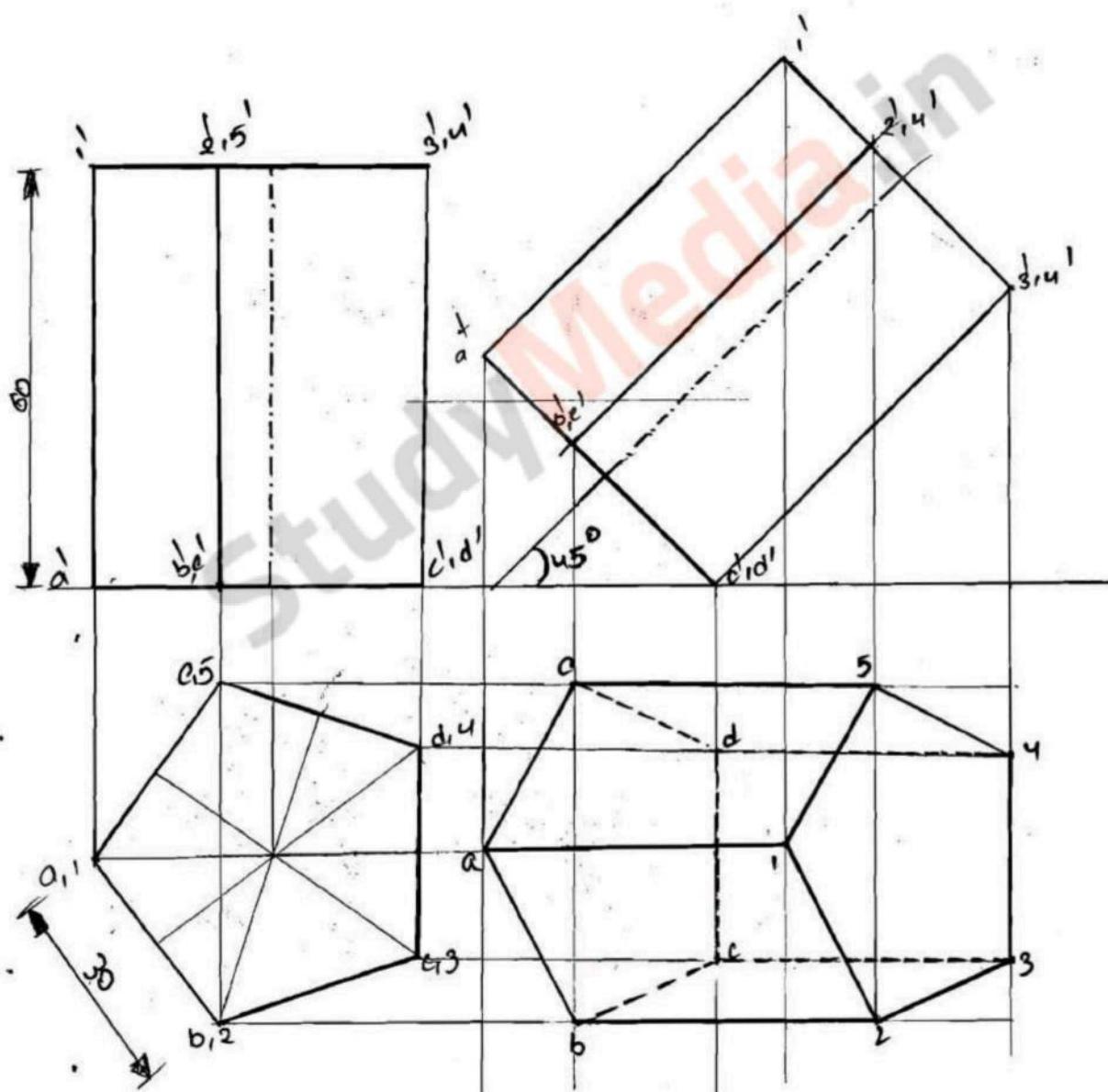
$$\text{Axis} = 60\text{mm}$$

$$\theta = 45^\circ$$

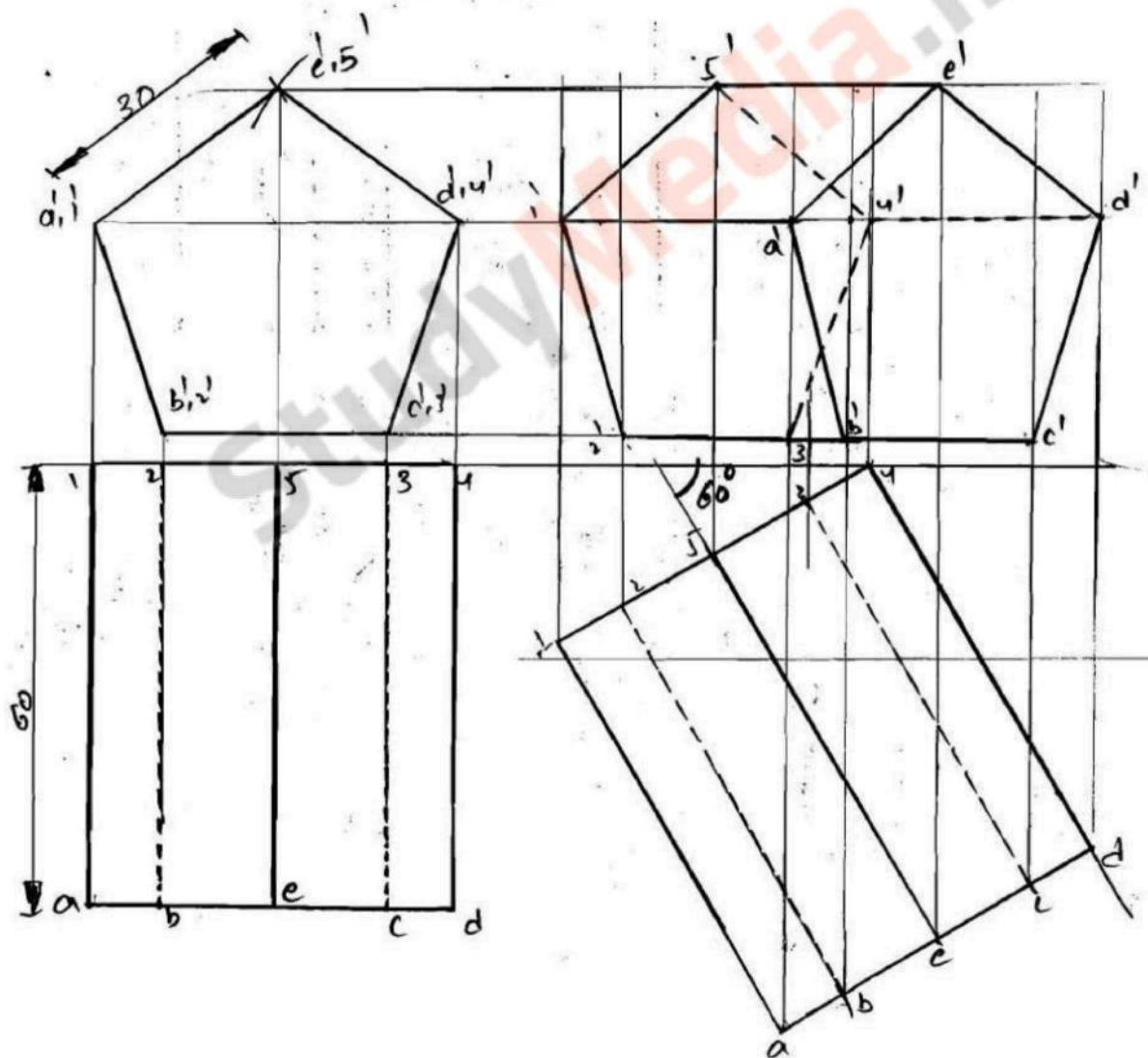


Pentagonal Prism

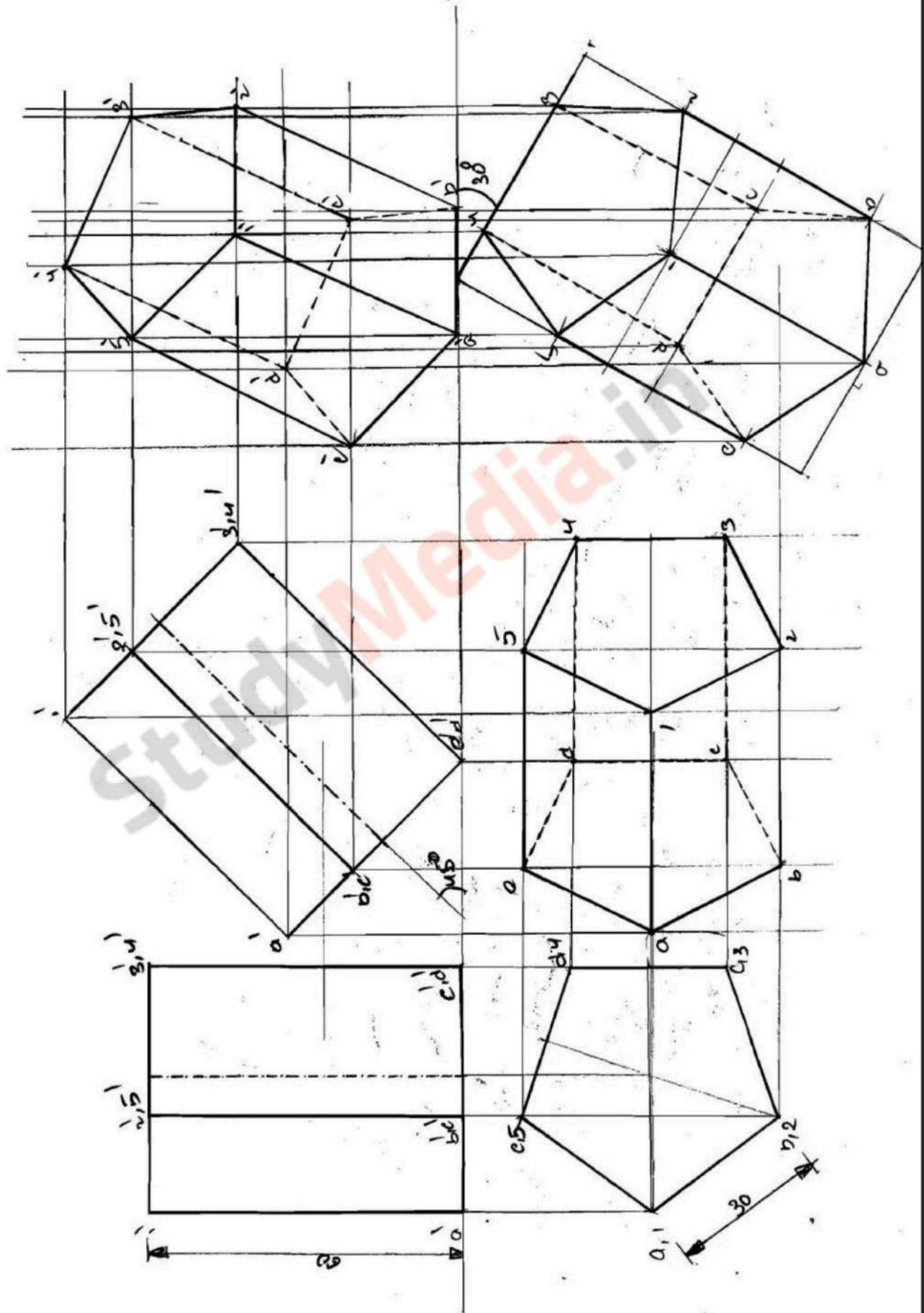
## \* Pentagonal Prism Inclined to H.P



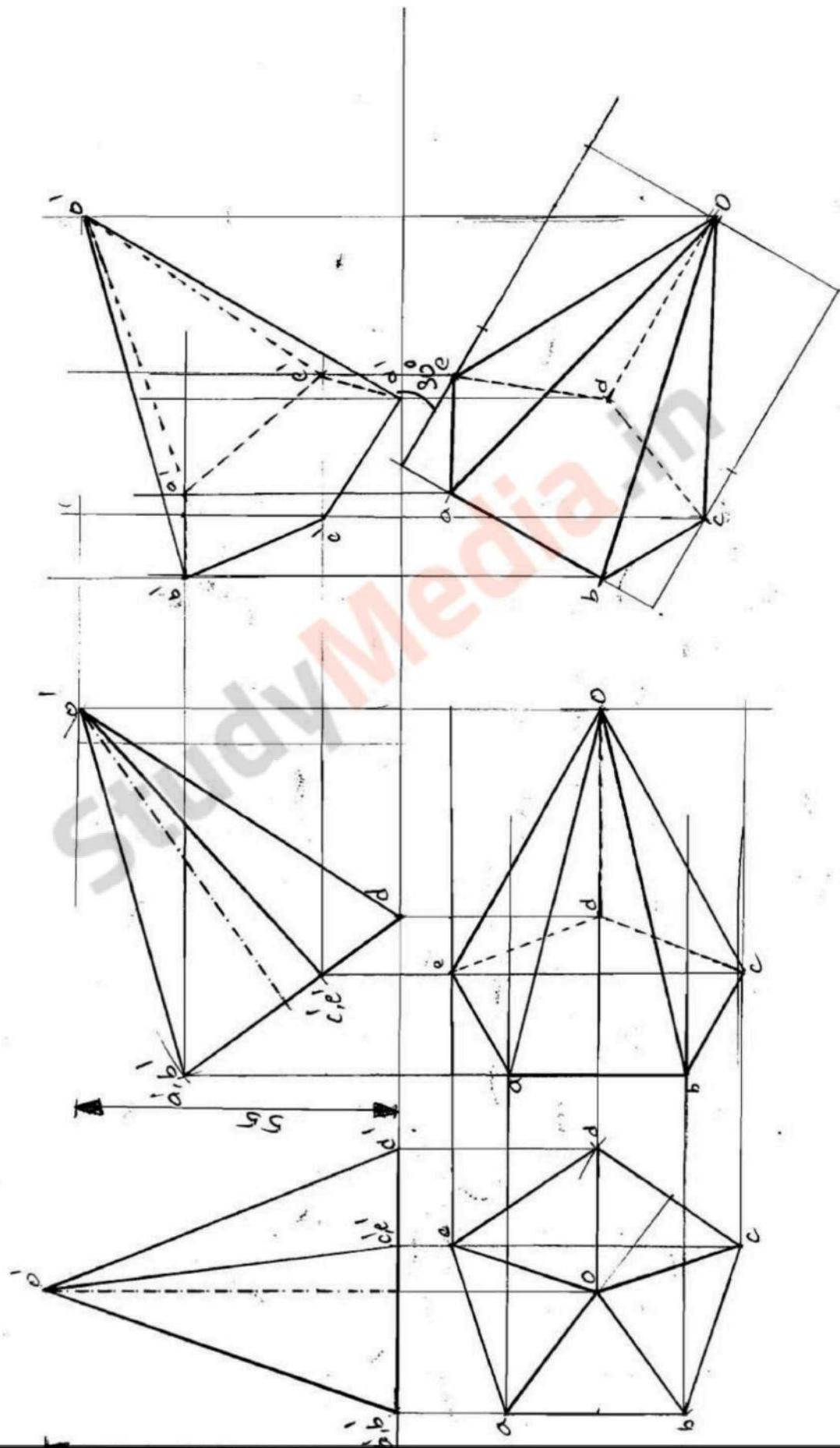
\* Pentagonal Prism Projected to V.P



\* Pentagonal Prism Axis inclined to the plane VP & H.P



\* Pentagonal Pyramid Axis inclined both the plane H.T & V.P

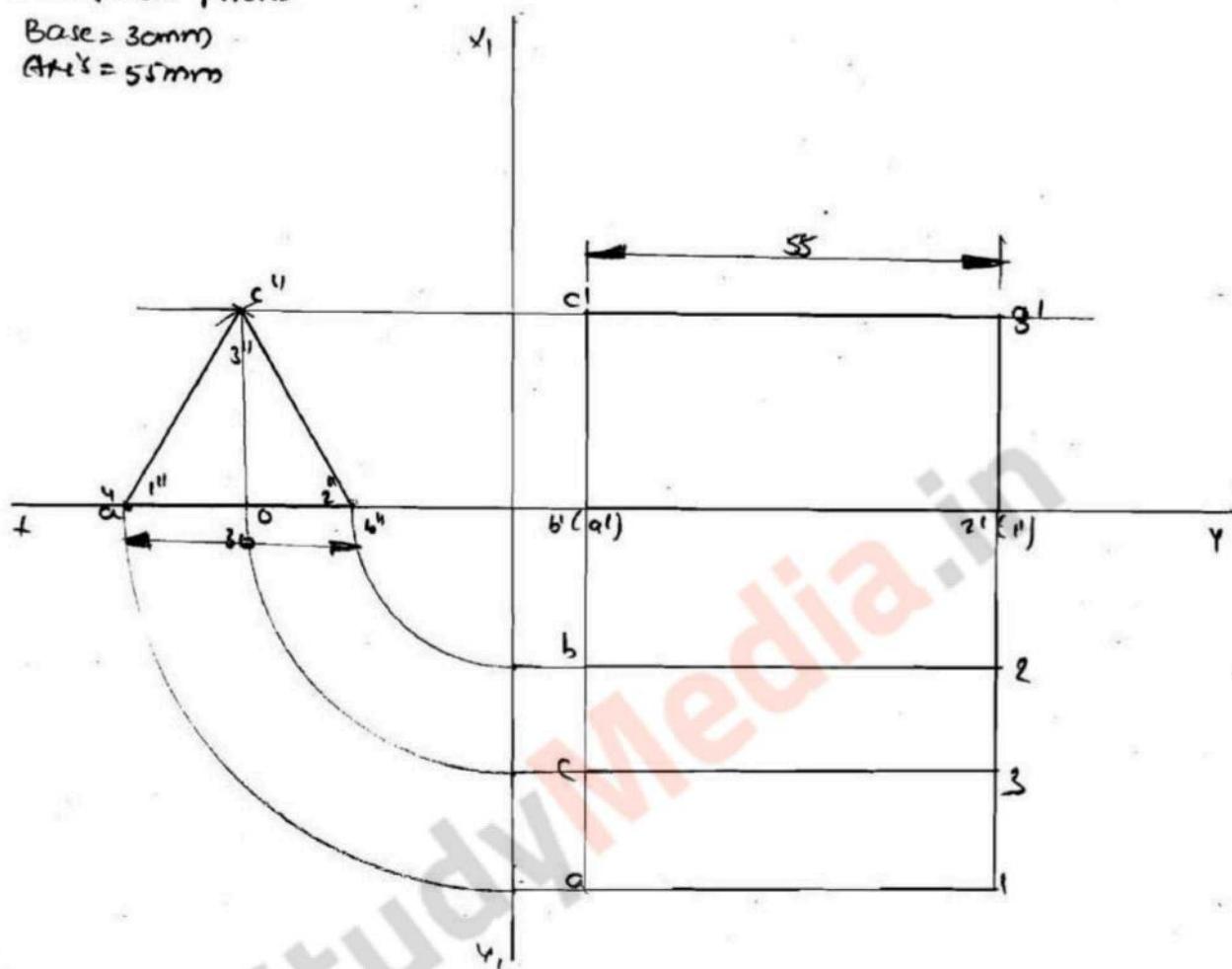


2. A triangular prism of base 30mm and axis 55mm long lies on its rectangular face in H.P. with its axis parallel to V.P. Draw the three views of the prism.

Triangular Prism

Base = 30mm

Axis = 55mm



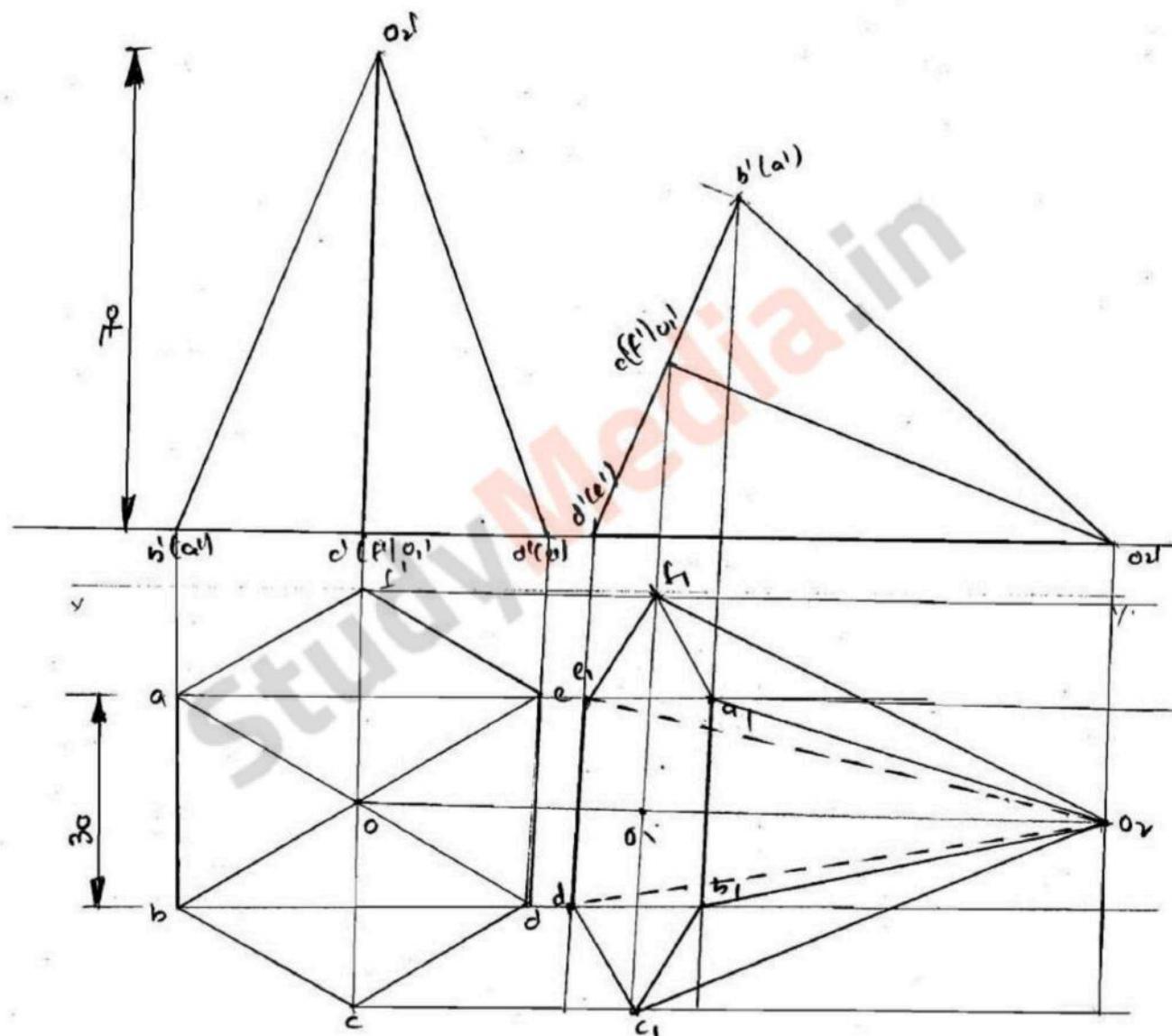
Q:

A Hexagonal pyramid with 30mm base edge and 70mm long axis as a triangular face on the ground. and the axis parallel to the v.p. draw its projections

Hexagonal Pyramid

Base = 30mm

Axis = 70mm.



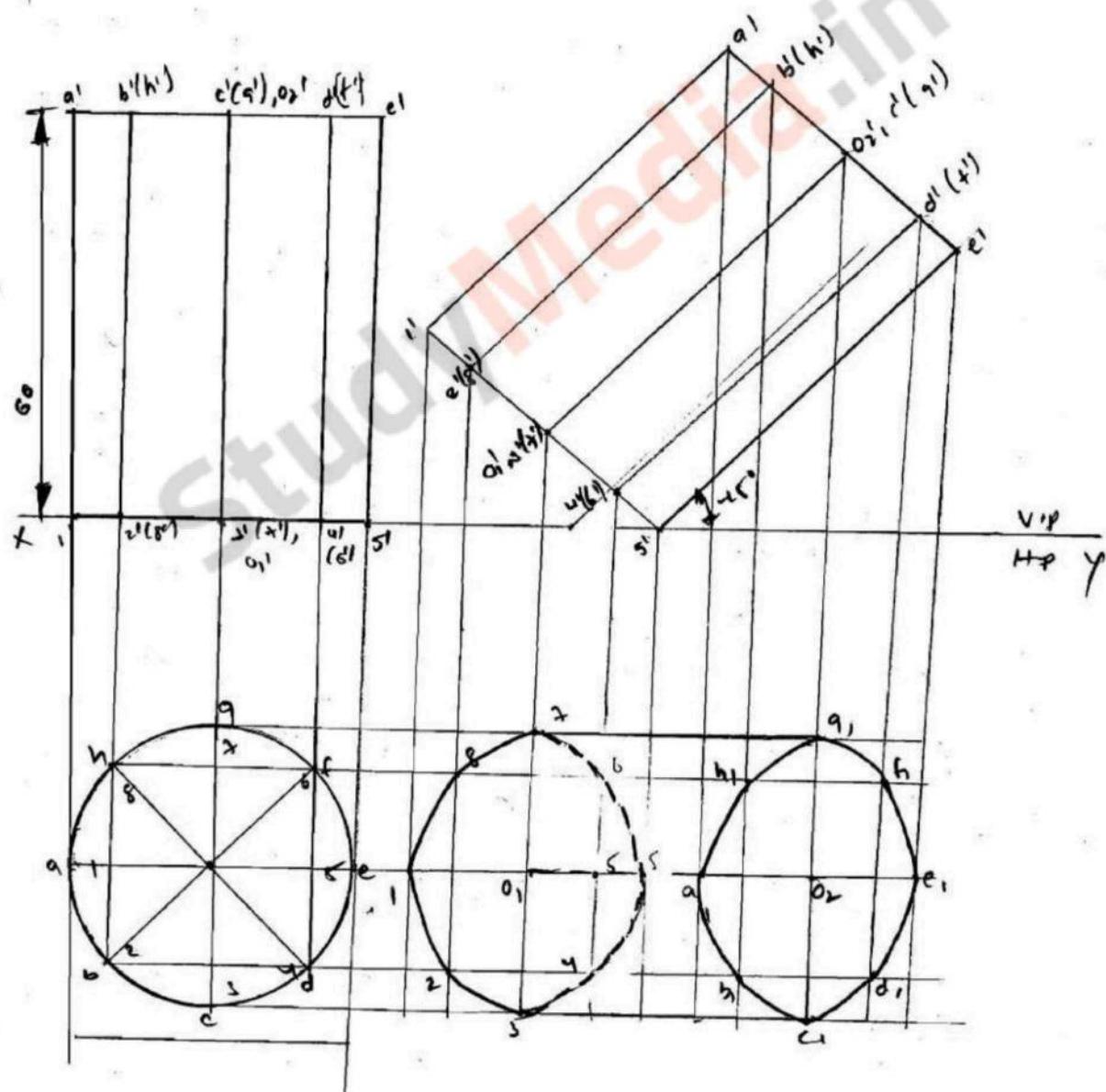
Q: Draw the projections of a cylinder of 40mm diameter and 60mm long axis, when it is lying on the H.P. with axis inclined at  $45^\circ$  to H.P and parallel to V.P.

cylinder

diameter ( $\phi$ ) = 40mm

Axis = 60mm

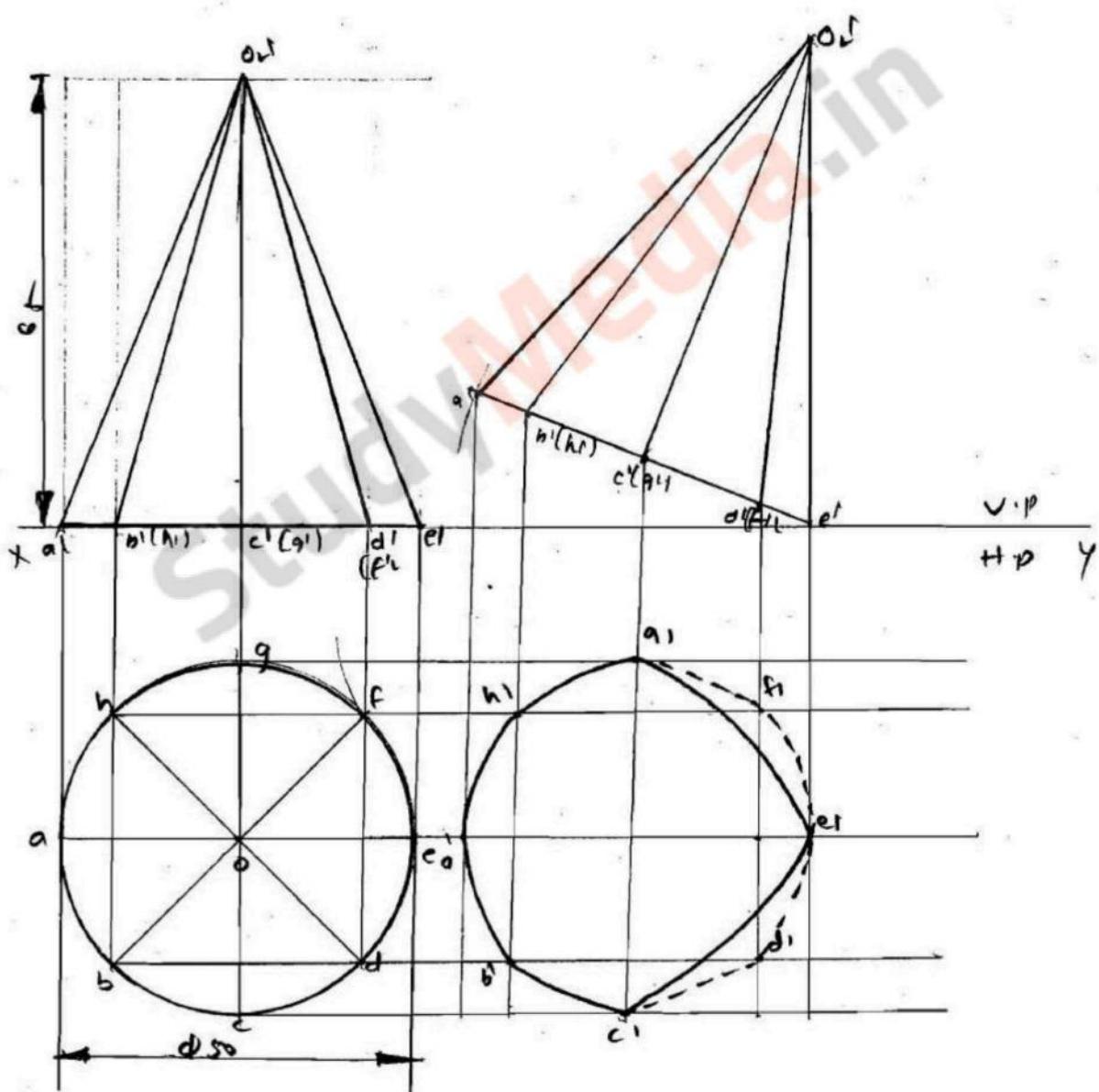
$\theta = 45^\circ$  / parallel to V.P



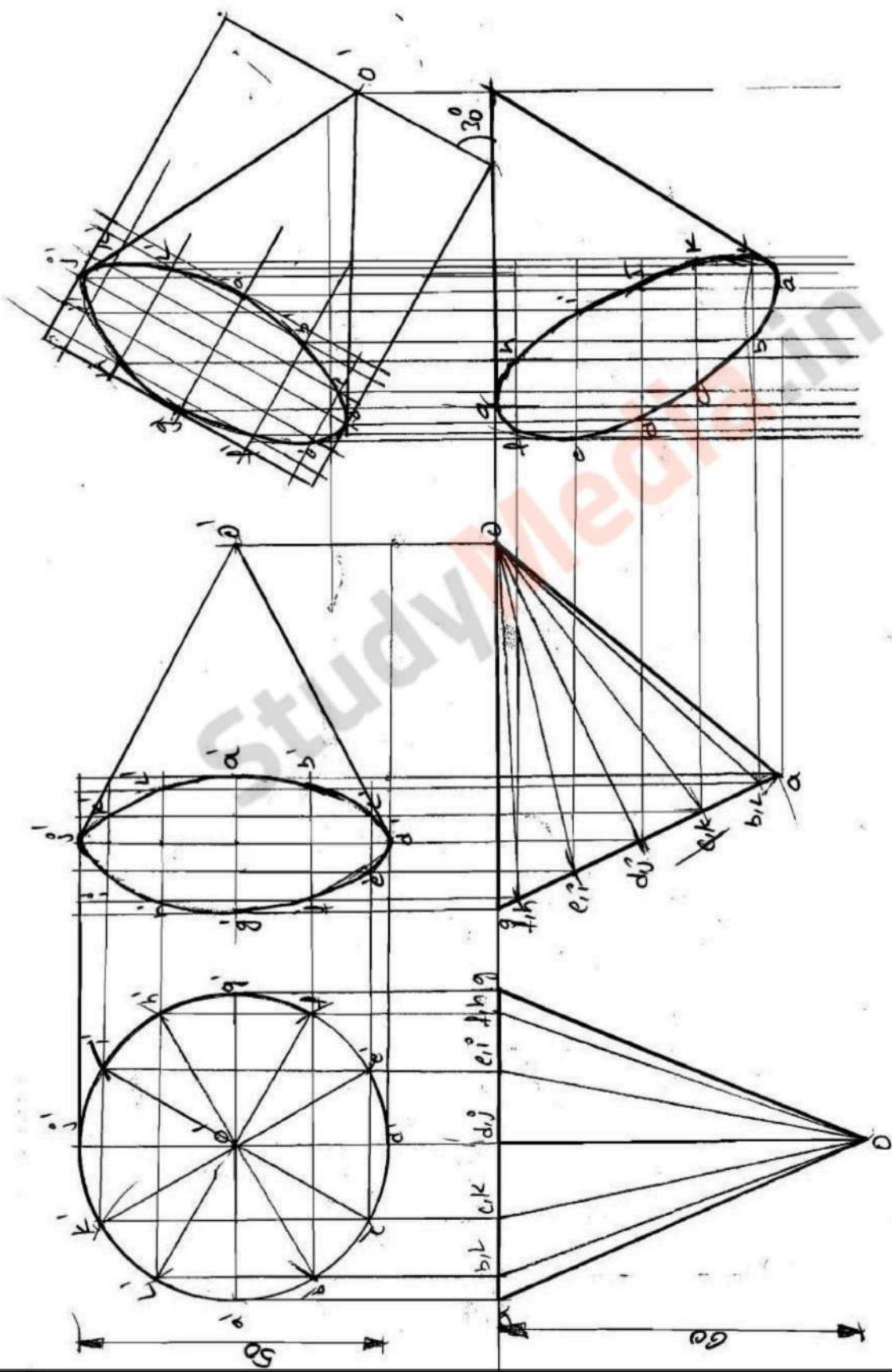
a: A right circular cone with 50mm diameter base and 65mm long axis rest on its base rim on the H.P. with its axis parallel to V.P and one of the generator perpendicular to H.P. Draw the projections of the cone.

Cone  
diameter =  $\phi$  50mm

Axis = 65mm.



\* cone Ans Reckined the both plane V.P & H.P

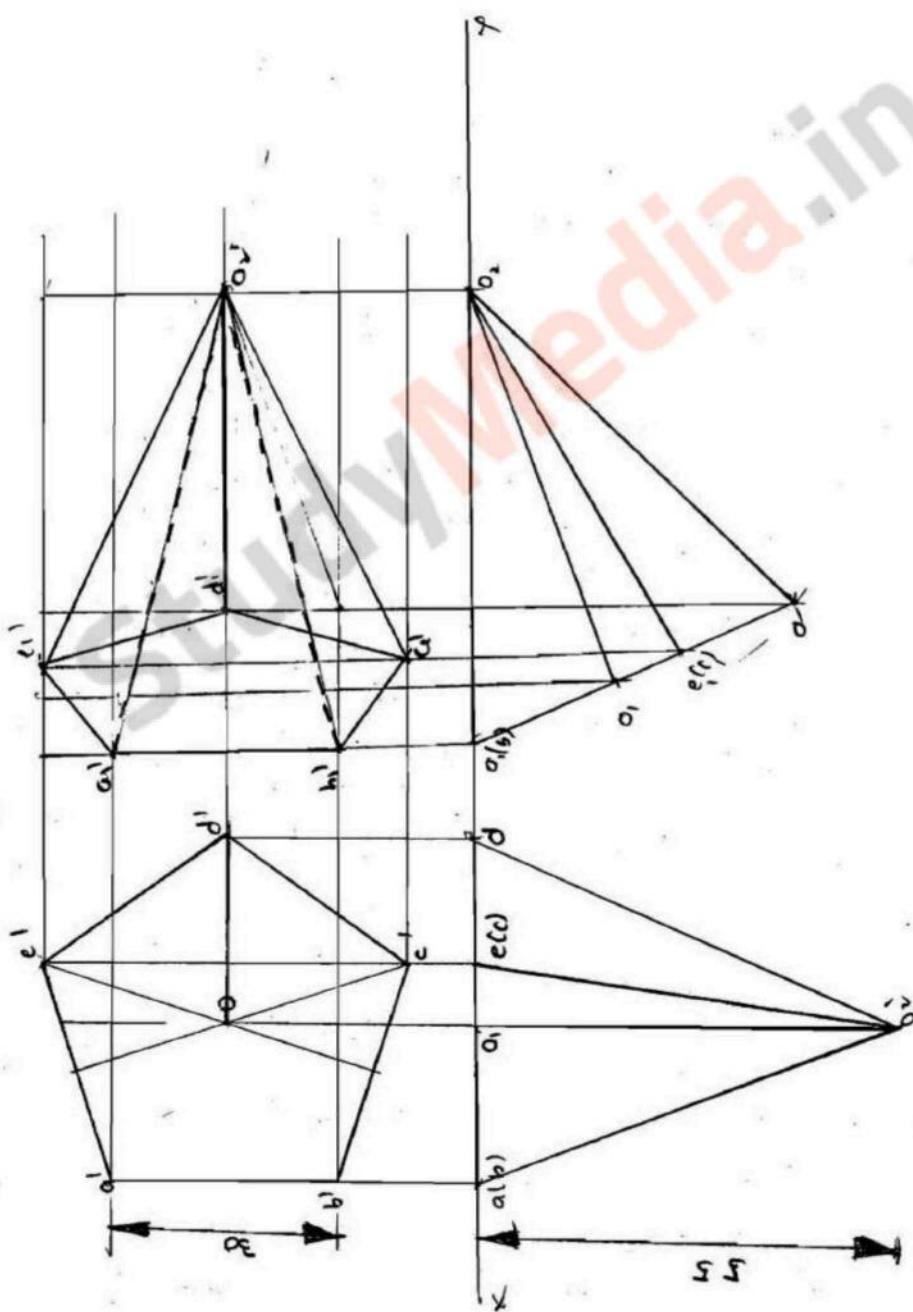


Q: A Pentagonal Pyramid base side 30mm and axis 55mm long, has a triangular face in the V.P. and axis parallel to H.P. Draw its projections.

### Pentagonal Pyramid

B.C.U.C = 30mm

A.X.I.S = 55mm



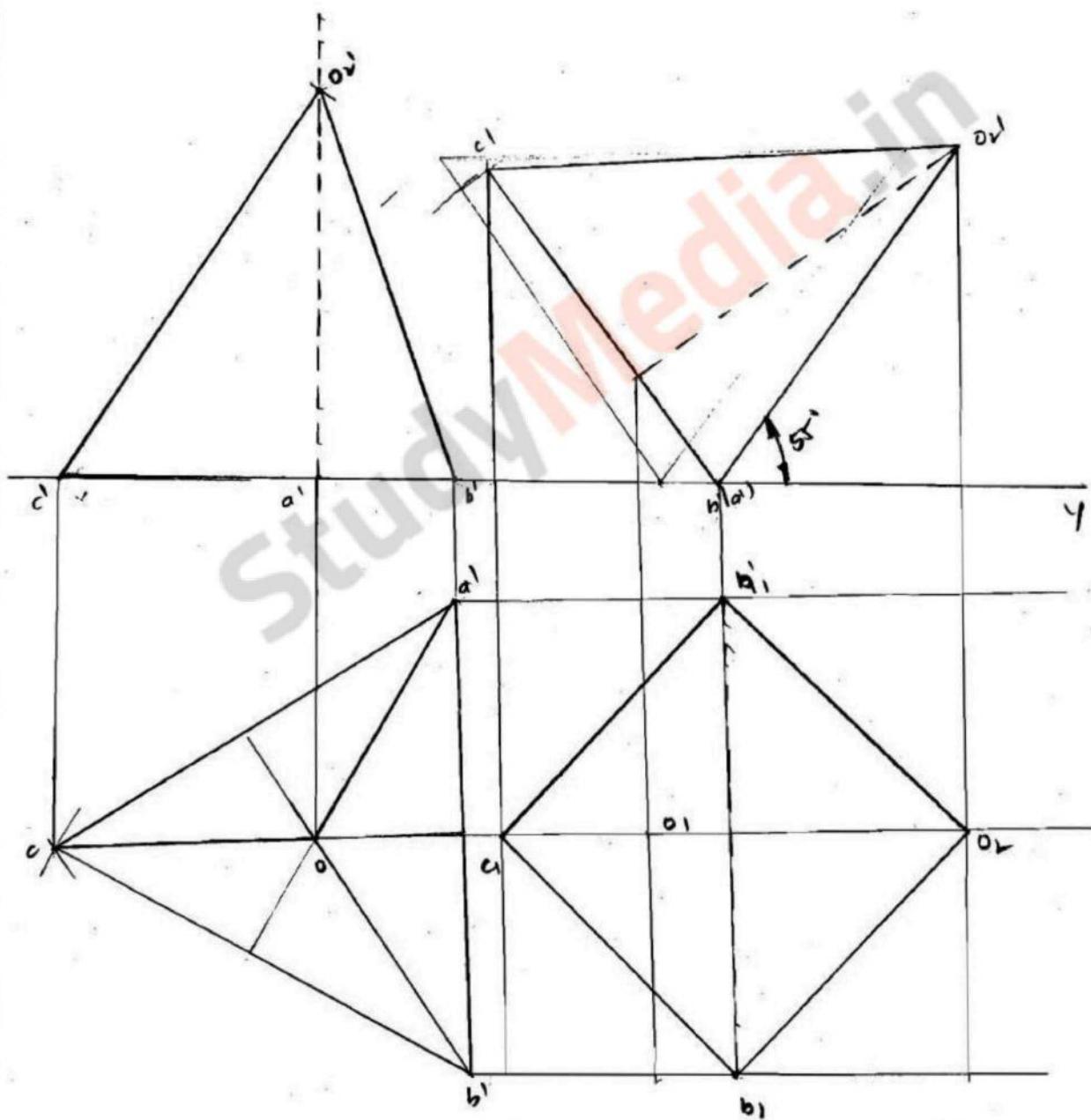
d: A tetrahedron of 70mm long edge on the ground and the faces containing that edge are equally inclined to the H.P. Draw its projections when the edge lying on the ground lies to V.P.

Tetrahedron

Side = 70mm

Long edge on H.P.

$\theta = 45^\circ$



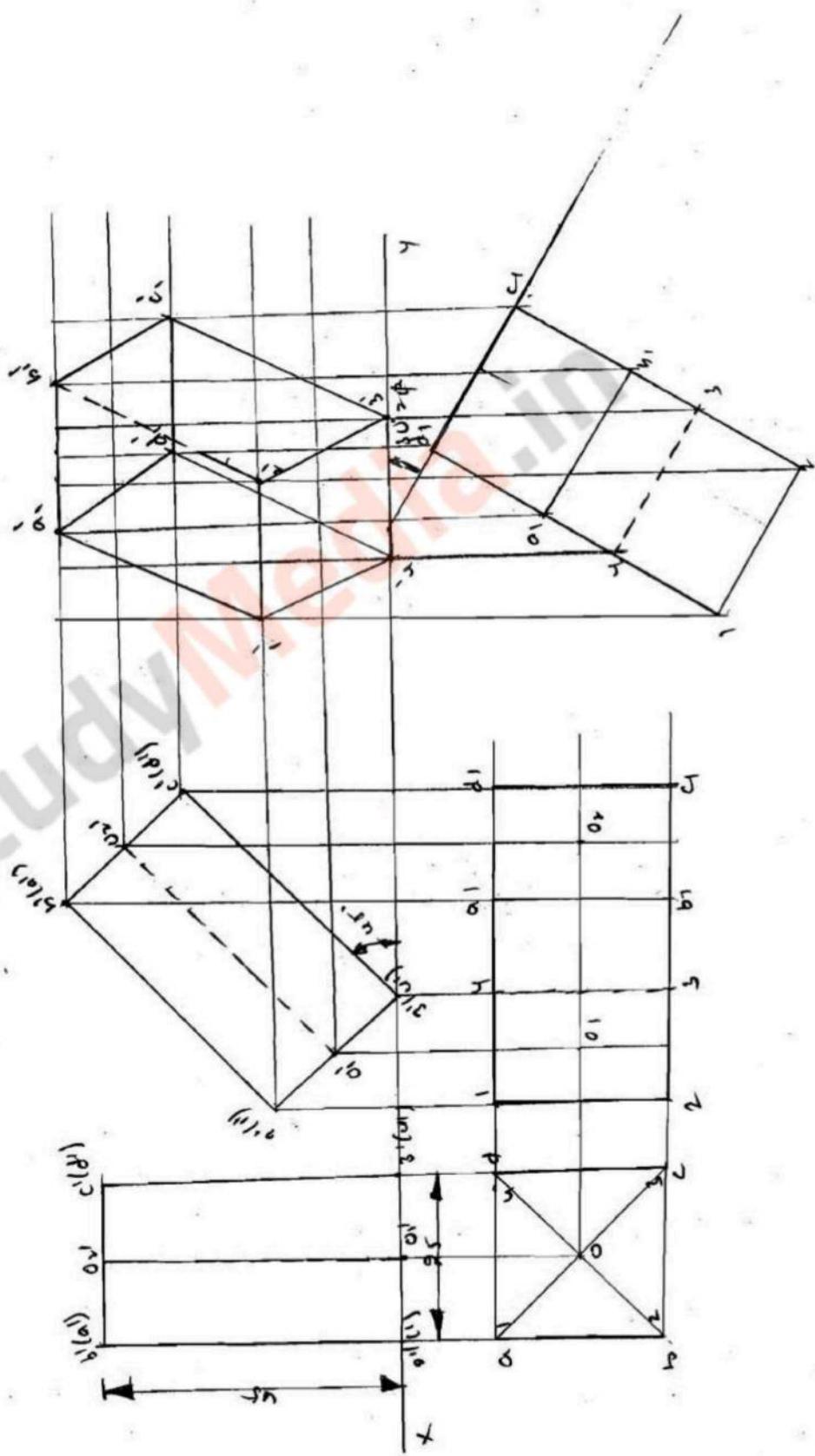
Q: A square Prism 25mm edge base and 45mm long axis has its axes inclined at  $45^\circ$  to H.P and edge of its base on which the prism rests is inclined at  $30^\circ$  to V.P. Draw its projections.

Square Prism

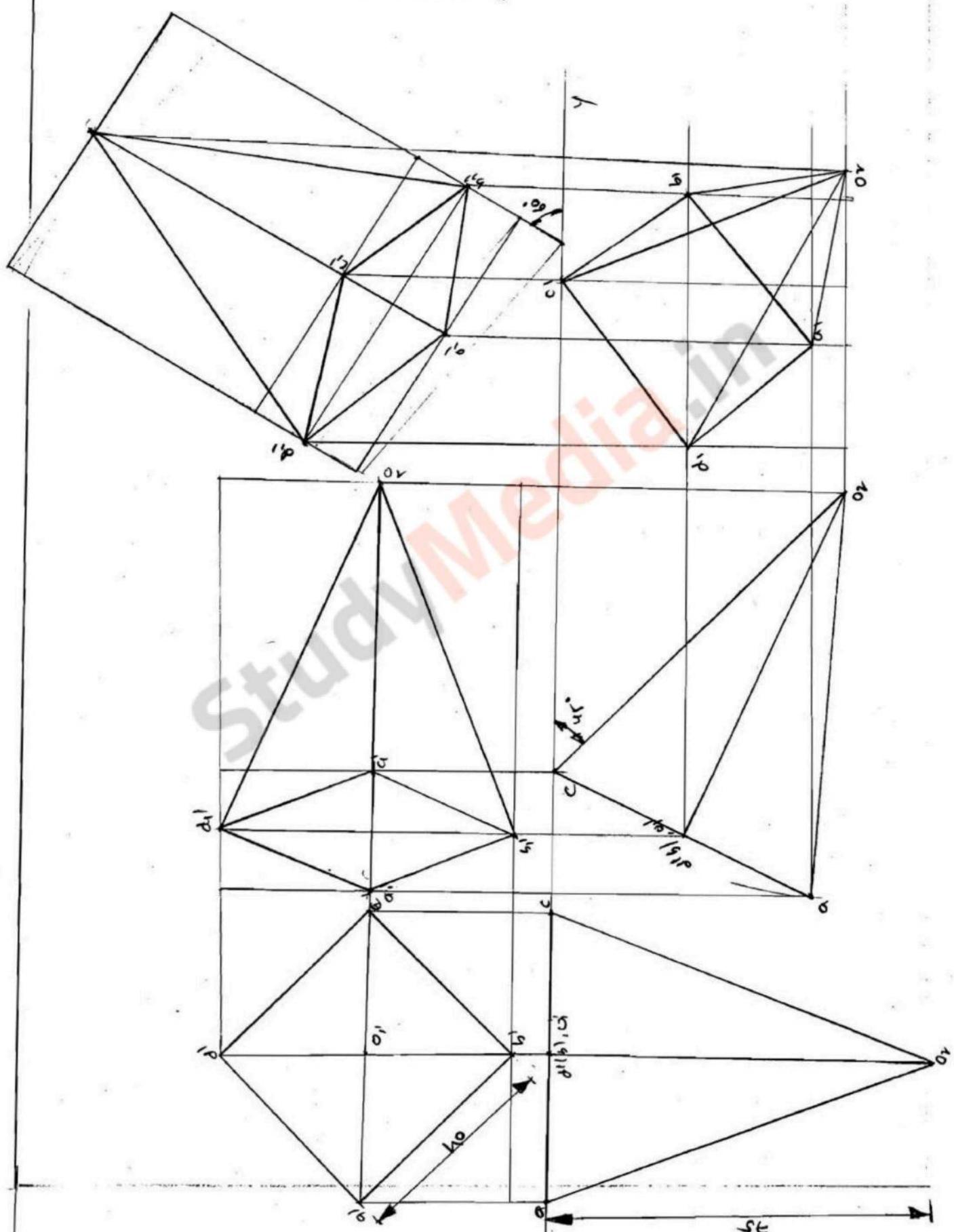
Base = 25mm

Ax's = 45mm

$\phi = 30^\circ$ ,  $\theta = 45^\circ$



Q: A square pyramid of 40mm base side and 75mm long axis has a corner of its base on the V.P. The slant edge contained by that corner is inclined at  $45^\circ$  to V.P. and the plane containing the slant edge and the axis is inclined at  $60^\circ$  to H.P. - Draw its projections.



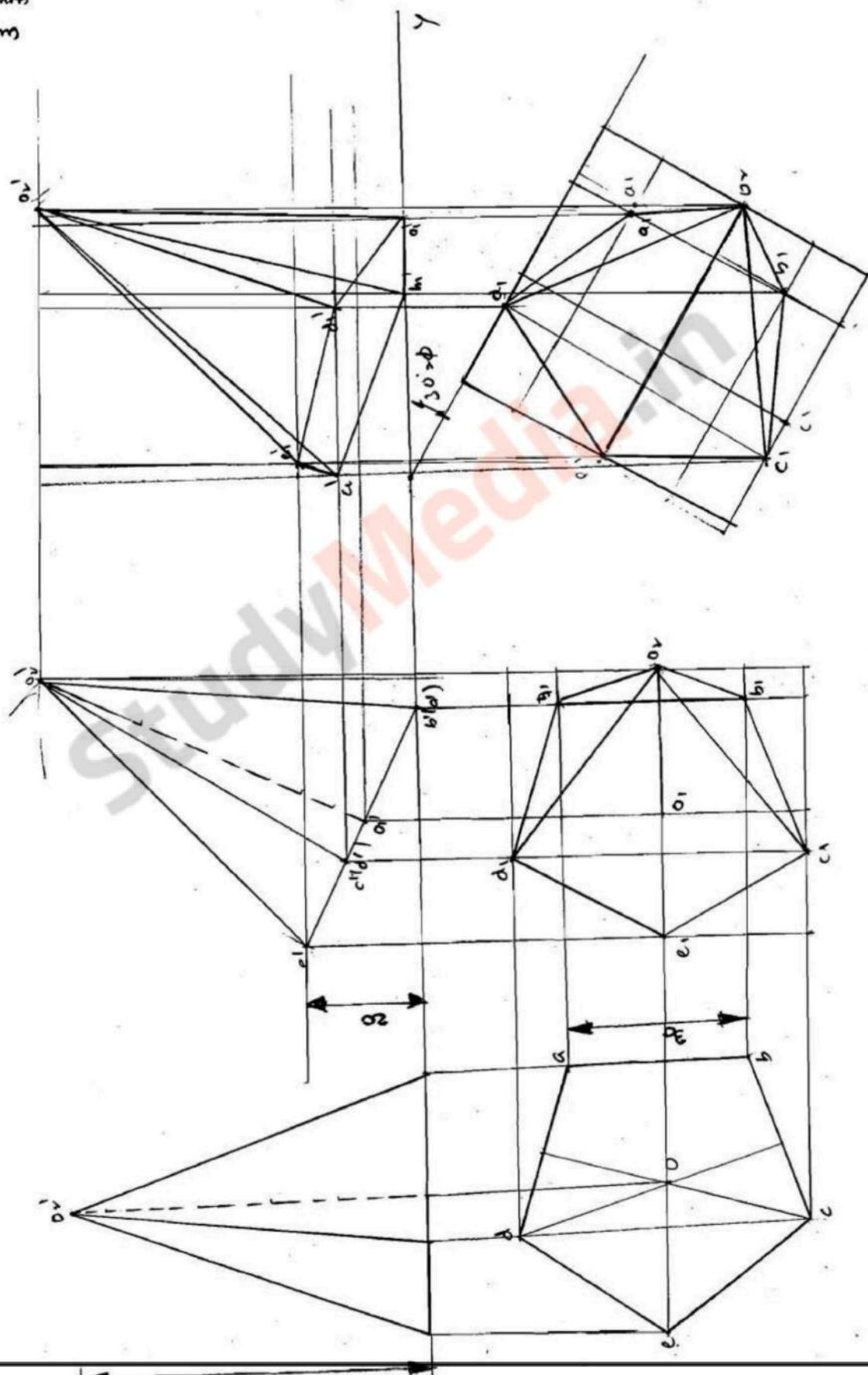
2. A Pentagonal Pyramid of 30mm base side and 60mm long axis resting on an edge of its base on the ground so that the highest point on the base is 20mm above the ground. Draw its projections if the vertical plane containing the axis is inclined at  $30^\circ$  to V.P.

### Pentagonal Pyramid

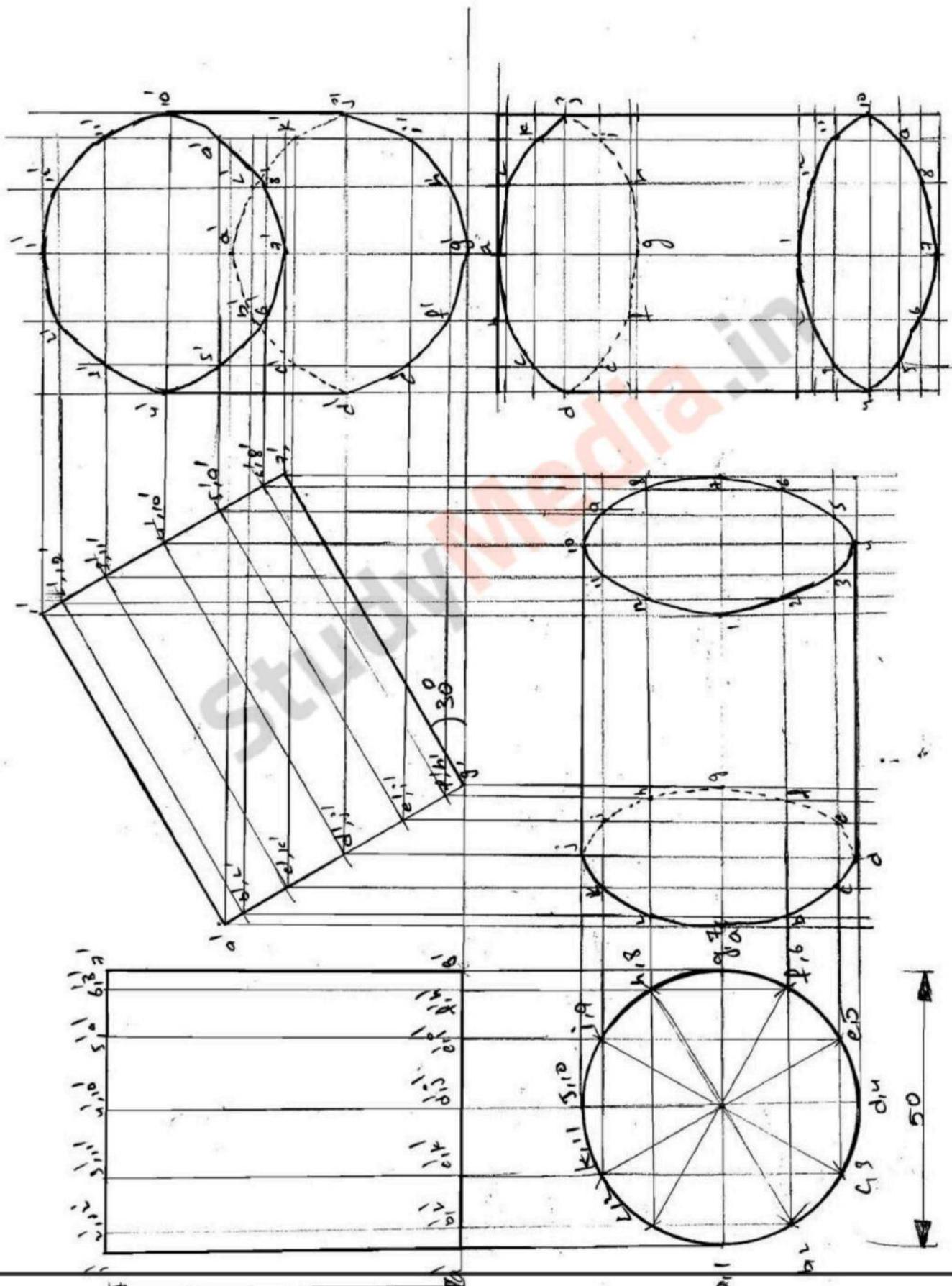
$$B = 30\text{mm}$$

$$A = 60\text{mm}$$

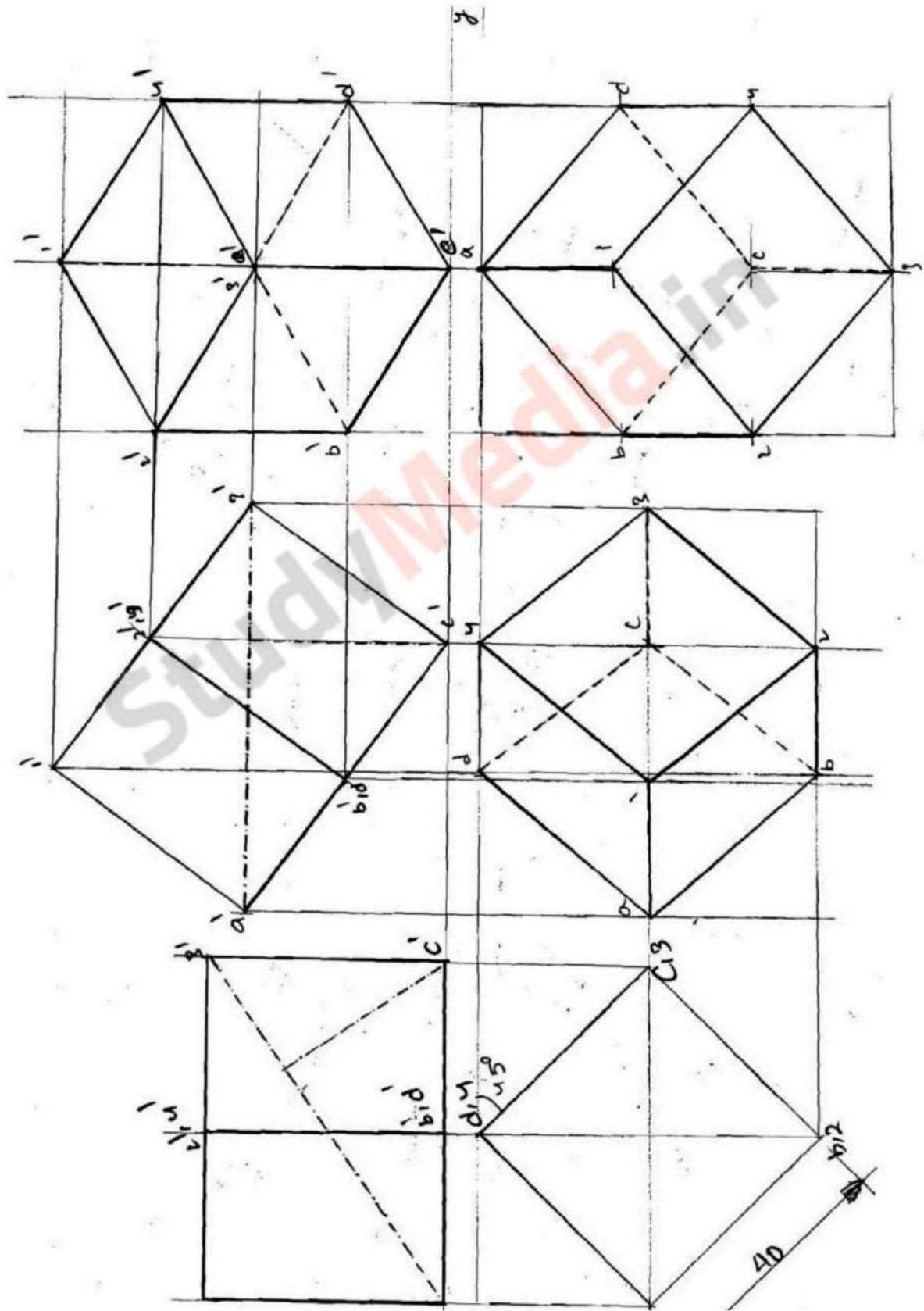
$$d = 30^\circ$$



\* Cylinder Reclined w.r.t. the plane V.P & H.P



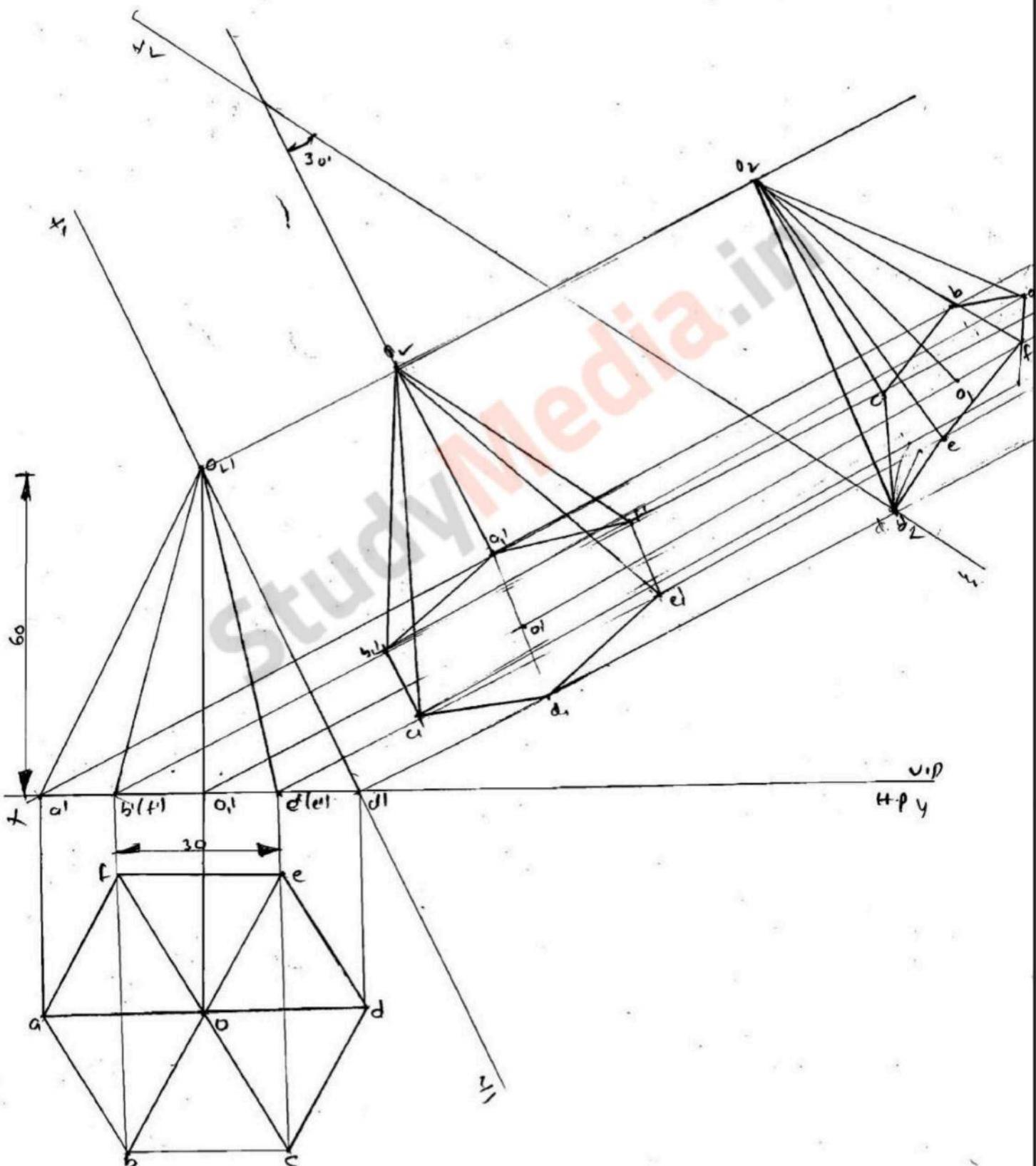
\* Cube Diagonal Parallel to the H.P. (Included both A-P & V.P.)



A Hexagonal Pyramid of base side 30mm and axis 60mm has one of its slant edges on the H.P. and inclined at 30° to the V.P. Draw its projections when the base is visible.

B = 30mm      Hexagonal Pyramid.

Axial = 60mm

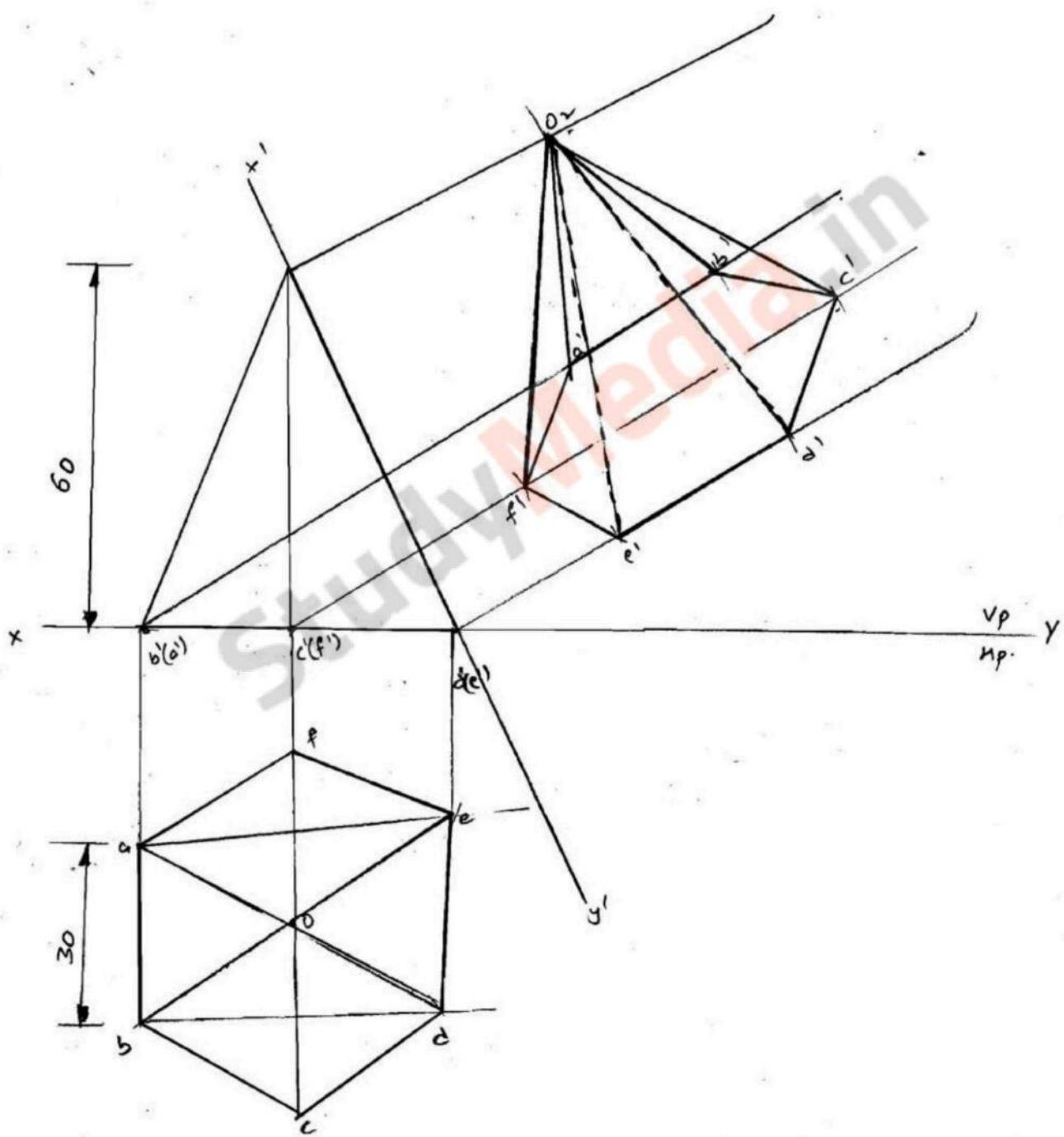


1. A Hexagonal Pyramid base side 30mm and axis 60mm as a triangular face on the ground and the axis parallel to V.P. Draw its projections

Pyramid

$$B = 30\text{mm}$$

$$A = 60\text{mm}$$



## **Sections of solids:**

Invisible features of an object are shown by dotted lines in their projected views. But when such features are too many, these lines make the views more complicated and difficult to interpret. In such cases, it is customary to imagine the object as being cut through or sectioned by planes. The part of the object between the cutting plane and the observer is assumed to be removed and the view is then shown in section.

The imaginary plane is called a section plane or a cutting plane. The surface produced by cutting the object by the section plane is called the section. It is indicated by thin section lines uniformly spaced and inclined at  $45^\circ$ .

The projection of the section along with the remaining portion of the object is called a sectional view. Sometimes, only the word section is also used to denote a sectional view.

**Section planes:** Section planes are generally perpendicular planes. They may be perpendicular to one of the reference planes and either perpendicular, parallel or inclined to the other plane. They are usually described by their traces. It is important to remember that the projection of a section plane, on the plane to which it is perpendicular, is a straight line. This line will be parallel, perpendicular or inclined to xy, depending upon the section plane being parallel, perpendicular or inclined respectively to the other reference plane.

**Sections:** The projection of the section on the reference plane to which the section plane is perpendicular, will be a straight line coinciding with the trace of the section plane on it. Its projection on the other plane to which it is inclined is called apparent section. This is obtained by

- (i) Projecting on the other plane, the points at which the trace of the section plane intersects the edges of the solid and
- (ii) Drawing lines joining these points in proper sequence.

**True shape of a section:** The projection of the section on a plane parallel to the section plane will show the true shape of the section. Thus, when the section plane is parallel to the H.P. or the ground, the true shape of the section will be seen in sectional top view. When it is parallel to the V.P., the true shape will be visible in the sectional front view. But when the section plane is inclined, the section has to be projected on an auxiliary plane parallel to the section plane, to obtain its true shape. When the section plane is perpendicular to both the reference planes, the sectional side view will show the true shape of the section.

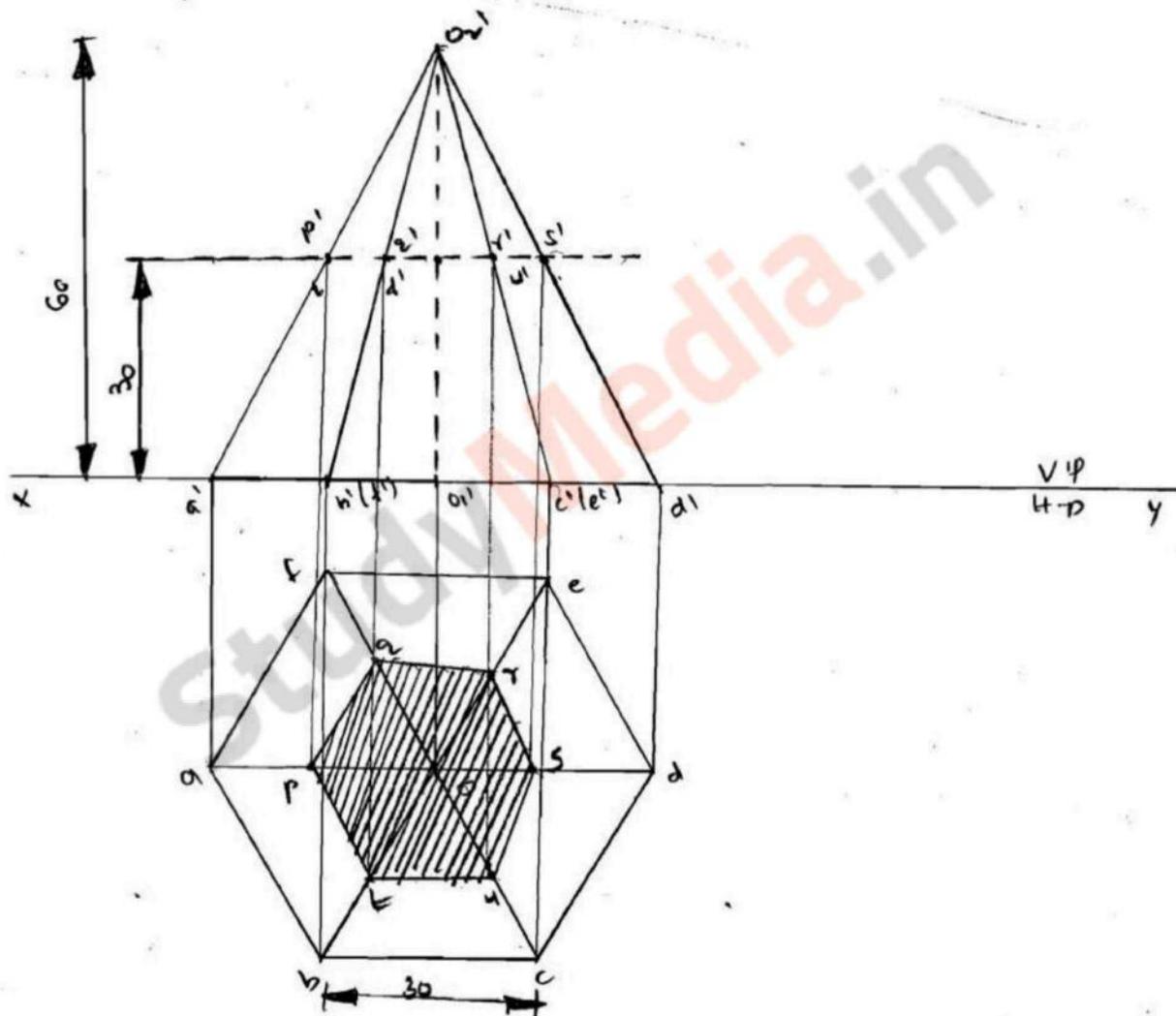
## Section of solids.

1. A hexagonal Pyramid of 30mm base side and 60mm long axis's rest with its base on H.P. and one of the edges of the base is parallel to V.P. It is cut by a horizontal section plane at a distance of 30mm above the base. Draw the F.V and sectional T.V

Hexagonal Pyramid.

$$B = 30\text{mm}$$

$$A = 60\text{mm}$$

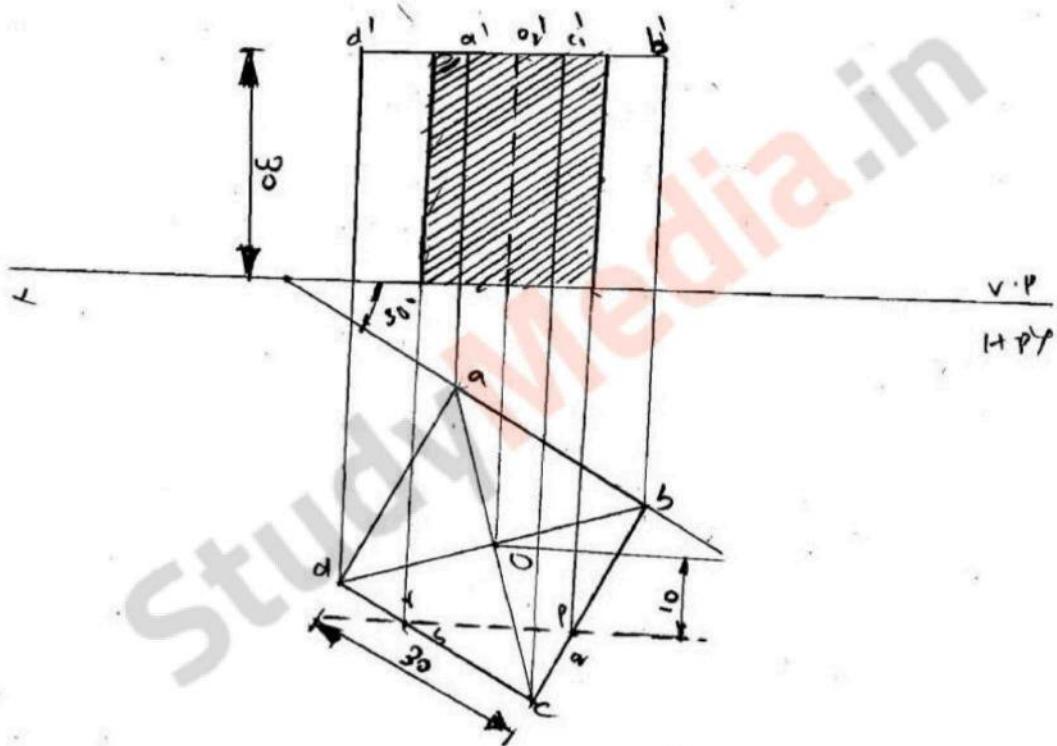


A cube of 30mm long edges is resting on the H.P. on one of its faces with a vertical face inclined at  $30^\circ$  to the V.P. It is cut by a sectional plane parallel to the V.P. and 10mm away from the axis and further away from the V.P. Draw the sectional front view and top-view of the cube.

Cube -

$$b = 30\text{mm}$$

$$\phi = 30^\circ$$



3. A triangular prism of 30mm base side and 50mm long axis is lying on the H.P on one of its rectangular faces - with its axis inclined at  $30^\circ$  to V.P. It is cut by a horizontal section plane at a distance of 12mm above the ground. Draw its F.V and S.T.V.

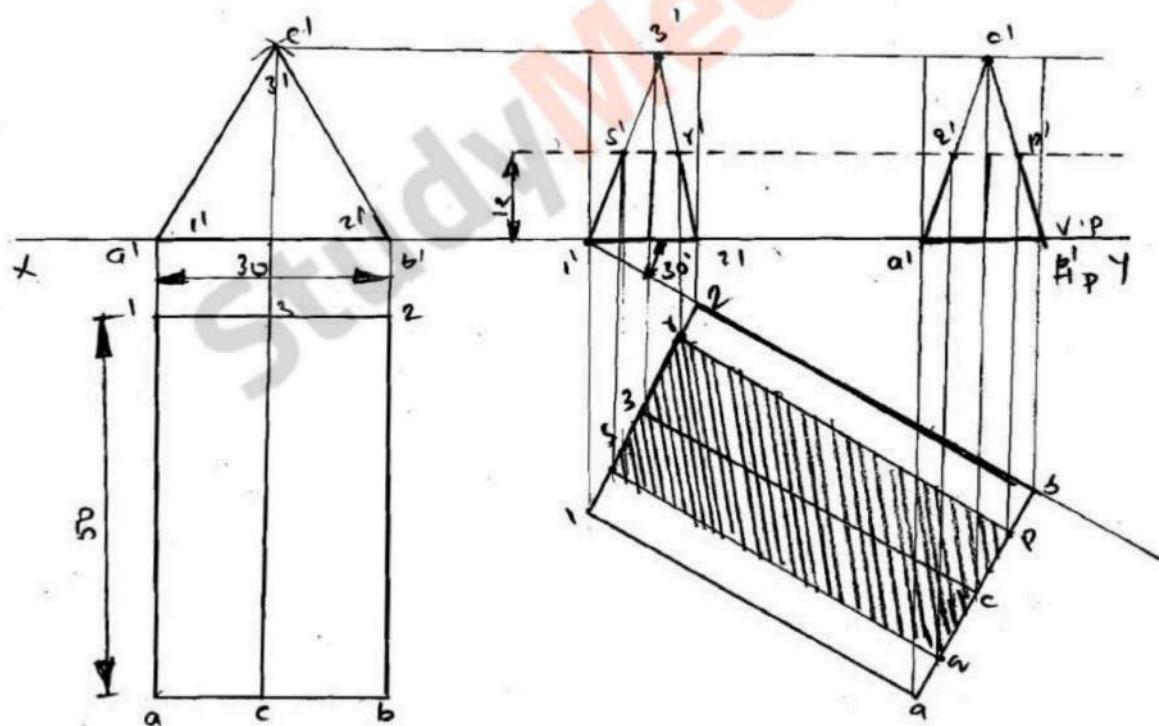
Triangular prism

Base = 30mm

Ax's = 50mm

$\theta = 30^\circ$

Horizontal sectional plane = 12mm ↑ ground.



Q: A Hexagonal Prism of 20mm base and 60mm height is resting on one of its edges on the ground. with the base making 60° with the ground. The axis is parallel to V.P. A sectional plane parallel to H.P and perp to V.P cuts the object such that it is 15mm from the base as measured along the axis. Draw I.B. Sectional view from the above and the view from the front.

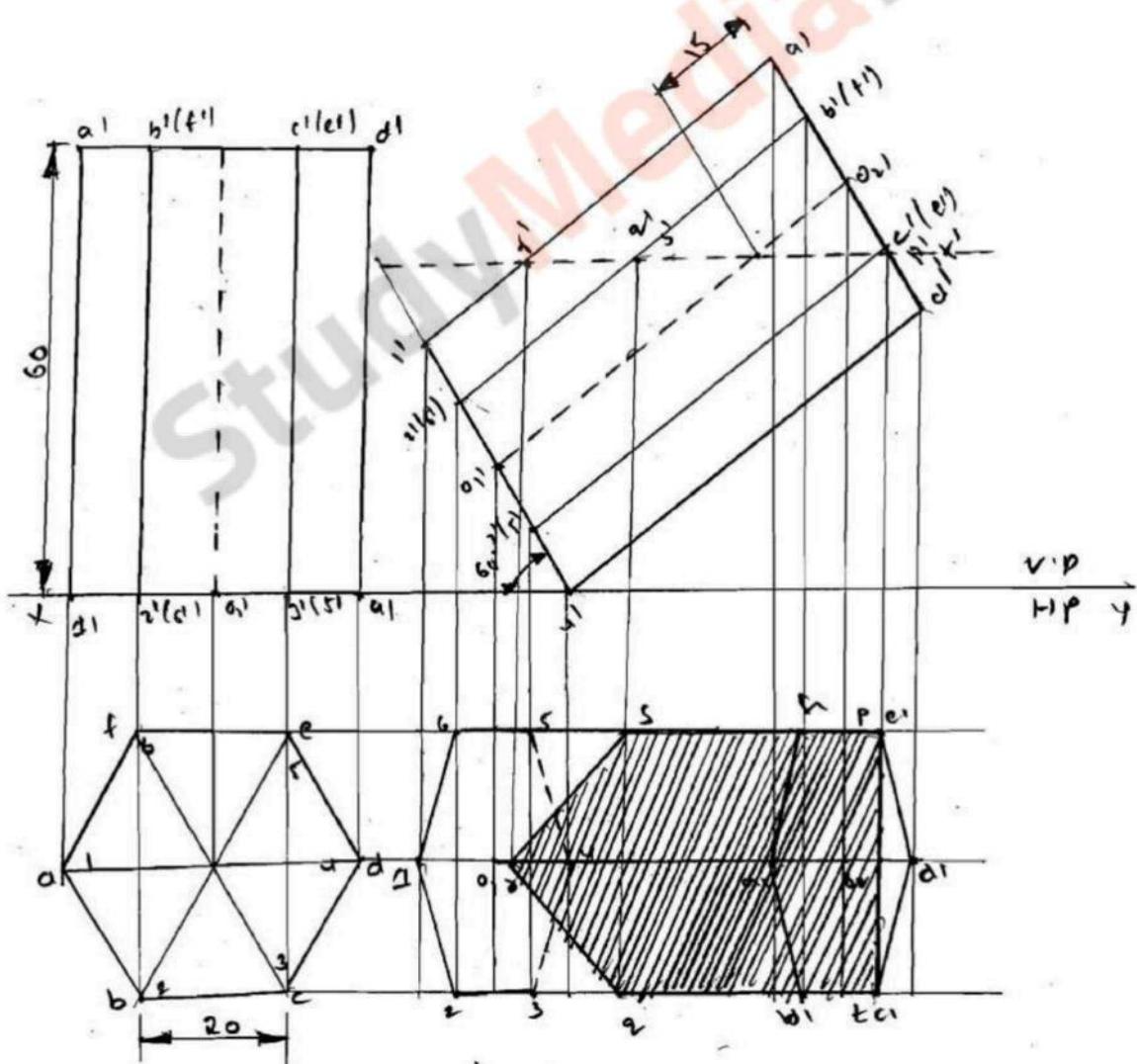
Hexagonal Prism

$$\theta = 60^\circ$$

Height = 60mm

Base = 20mm

$$A \cdot O \cdot S.P = 15\text{mm}$$



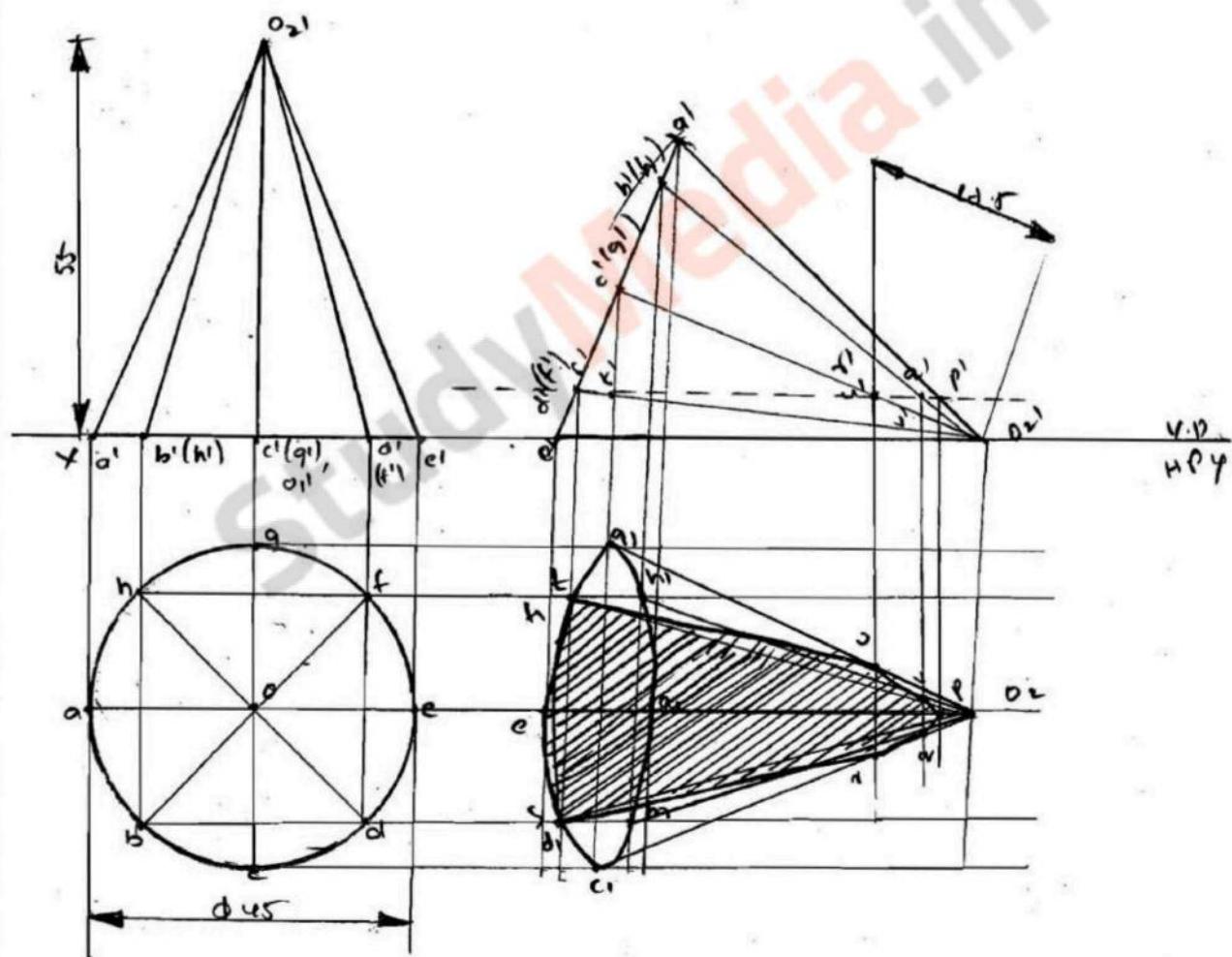
5. A right circular cone of the 45mm base diameter and 55mm axis long is lying on the one of its generator on the H.P. It is cut by a horizontal sectional plane passing through the midpoint of axis. Draw the projections of the cone and its true section.

Cone

$$d = 45\text{mm}$$

$$\text{Axis} = 55\text{mm}$$

H-U.S.P. passing through mid-point



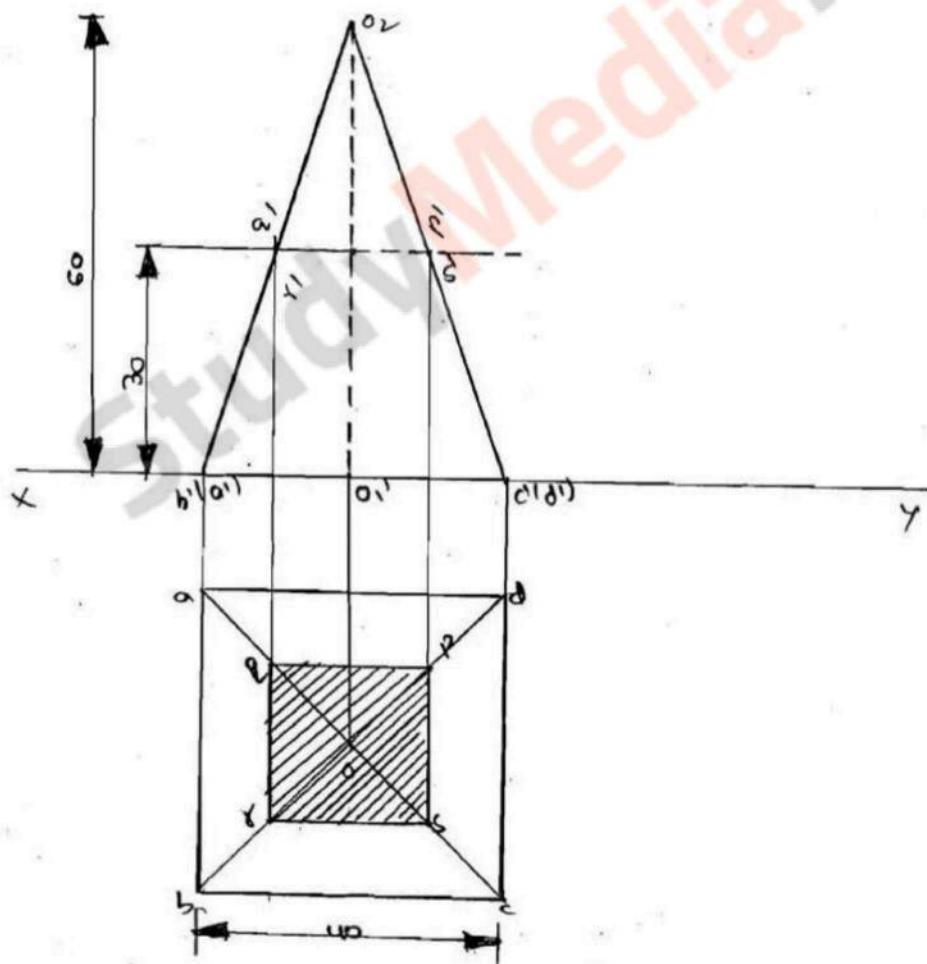
Q:- A square pyramid base side 40mm and axis 60mm is resting on the base on the H.P. with a side of base incl to V.P. Draw its sectional view and the sphere of the section, if it is cut by a sectional plane perp to V.P., bisecting the axis

- a)  $\parallel$  to H.P
- b) inclined at  $45^\circ$  to H.P
- c) inclined at  $60^\circ$  to H.P
- (a) Parallel to H.P

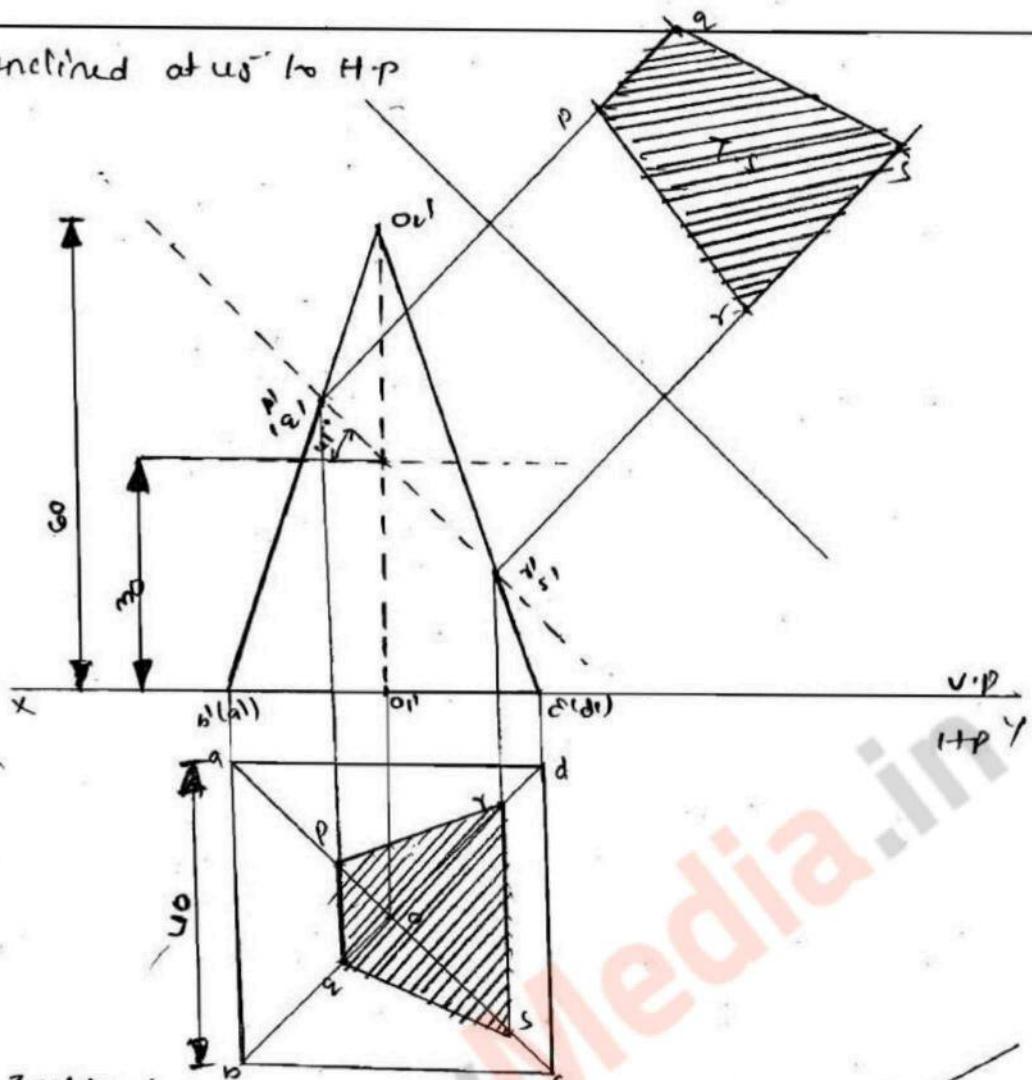
Square Pyramid

Base = 40mm

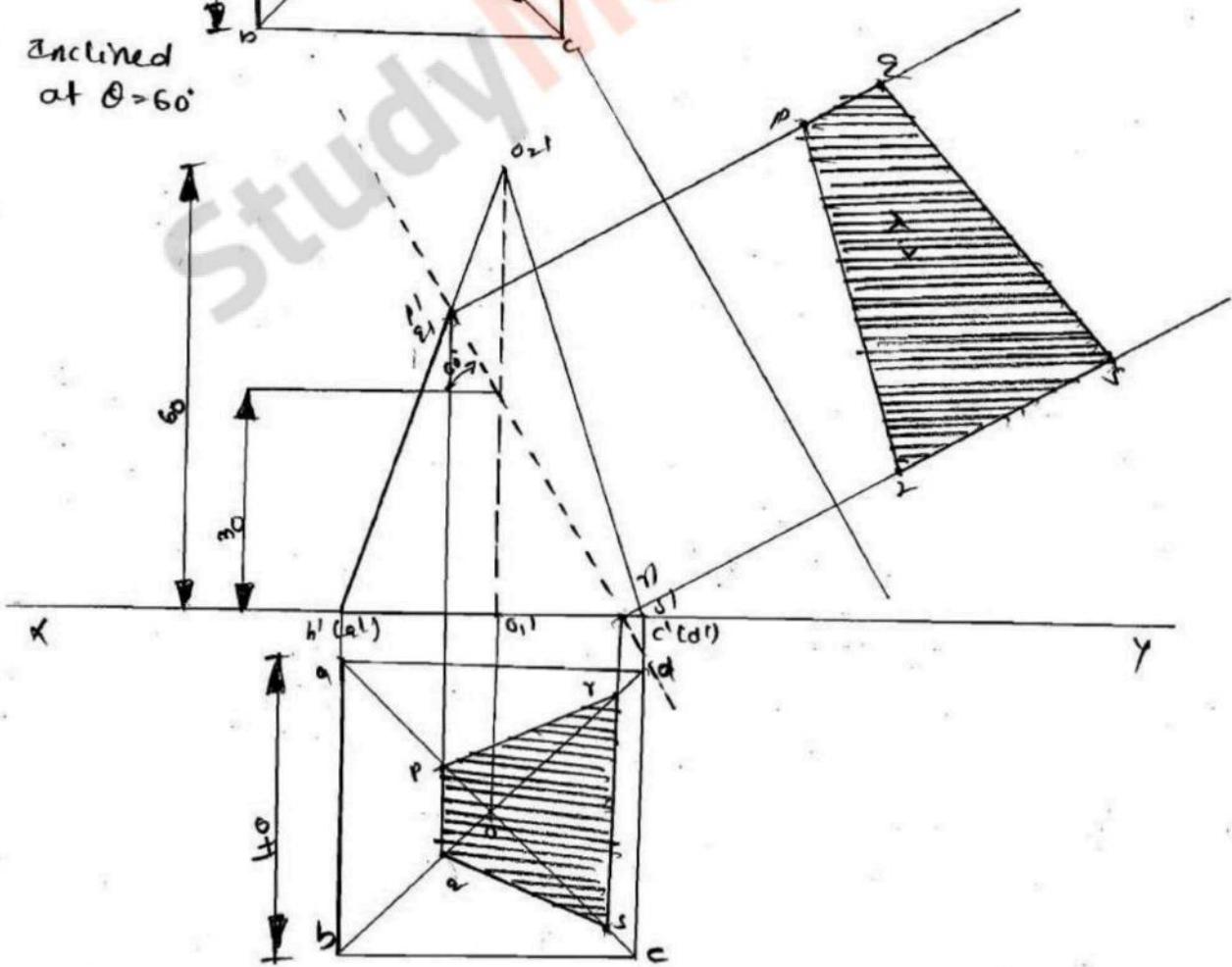
Ax's = 60mm



(b) Inclined at  $\theta = 45^\circ$  to H.P.



(c) Inclined at  $\theta = 60^\circ$



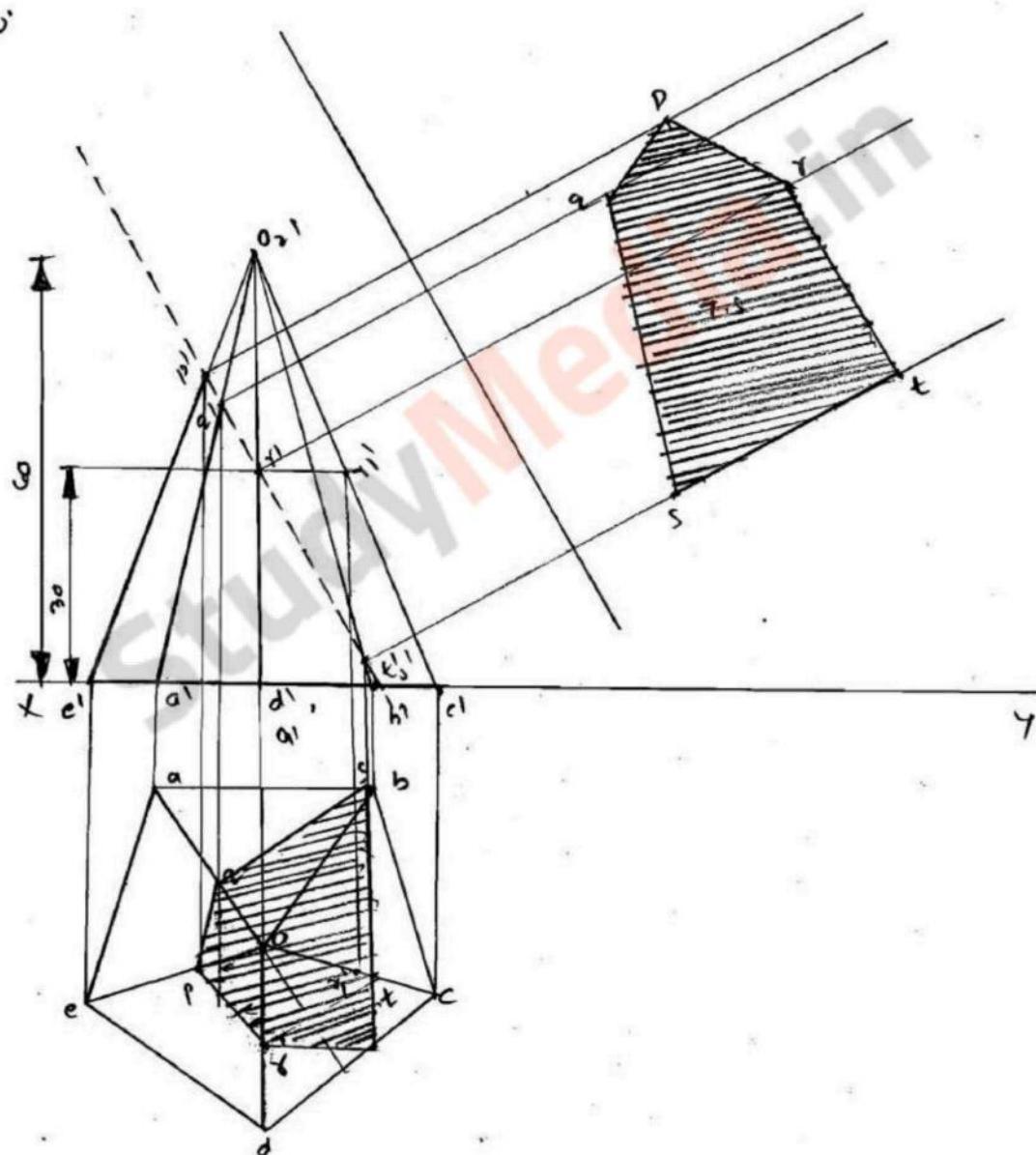
2. A Pentagonal Pyramid base side 30mm and axis 60mm is resting on its base on the H.P with one edge of its base parallel to V.P. It is cut by a sectional plane perpendicular to V.P., inclined at 60° to H.P and bisecting the axis. Draw its front view and sectional T.V and True shape of the section.

Pentagonal Pyramid

Base = 30mm

Axis = 60mm

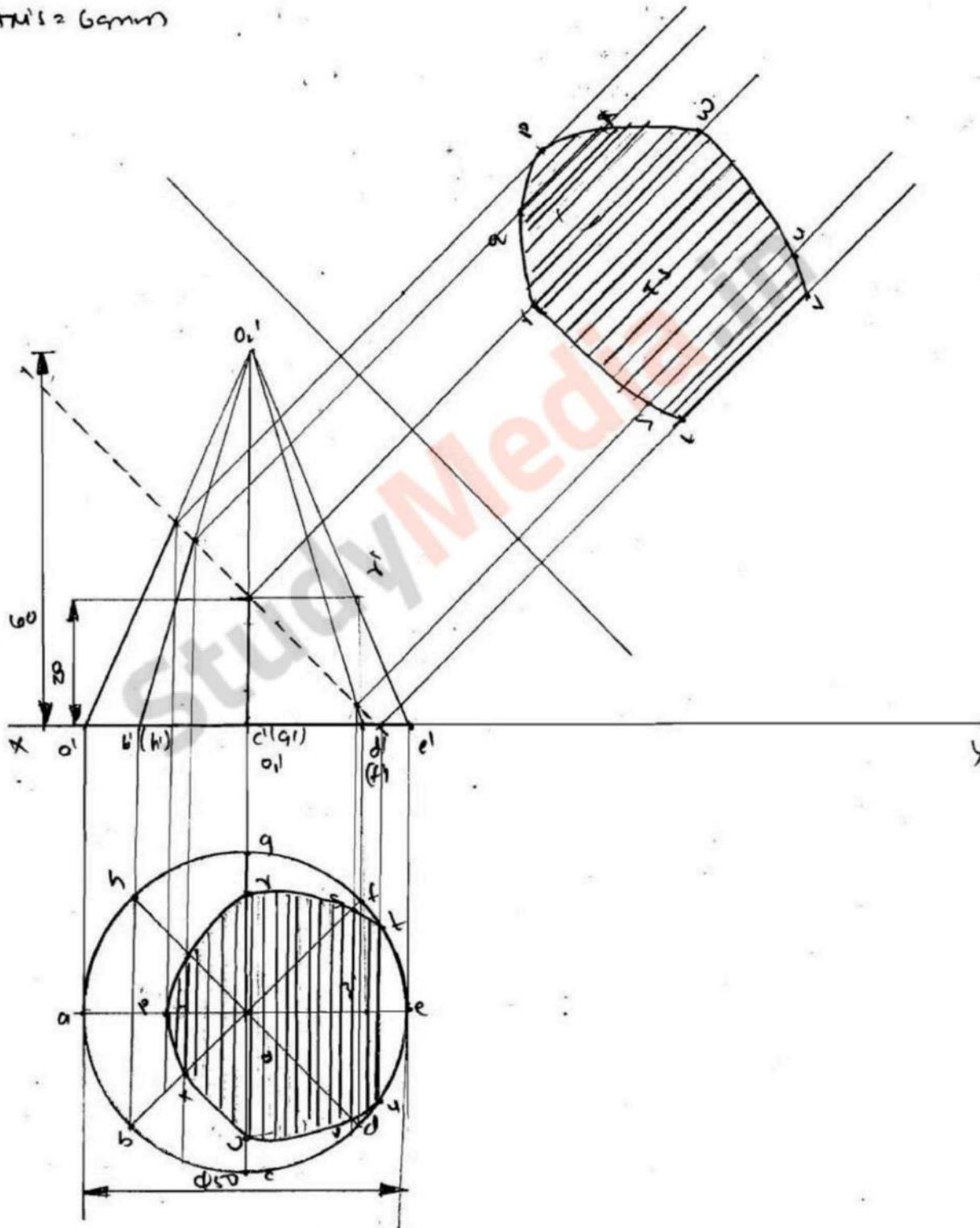
$\theta = 60^\circ$



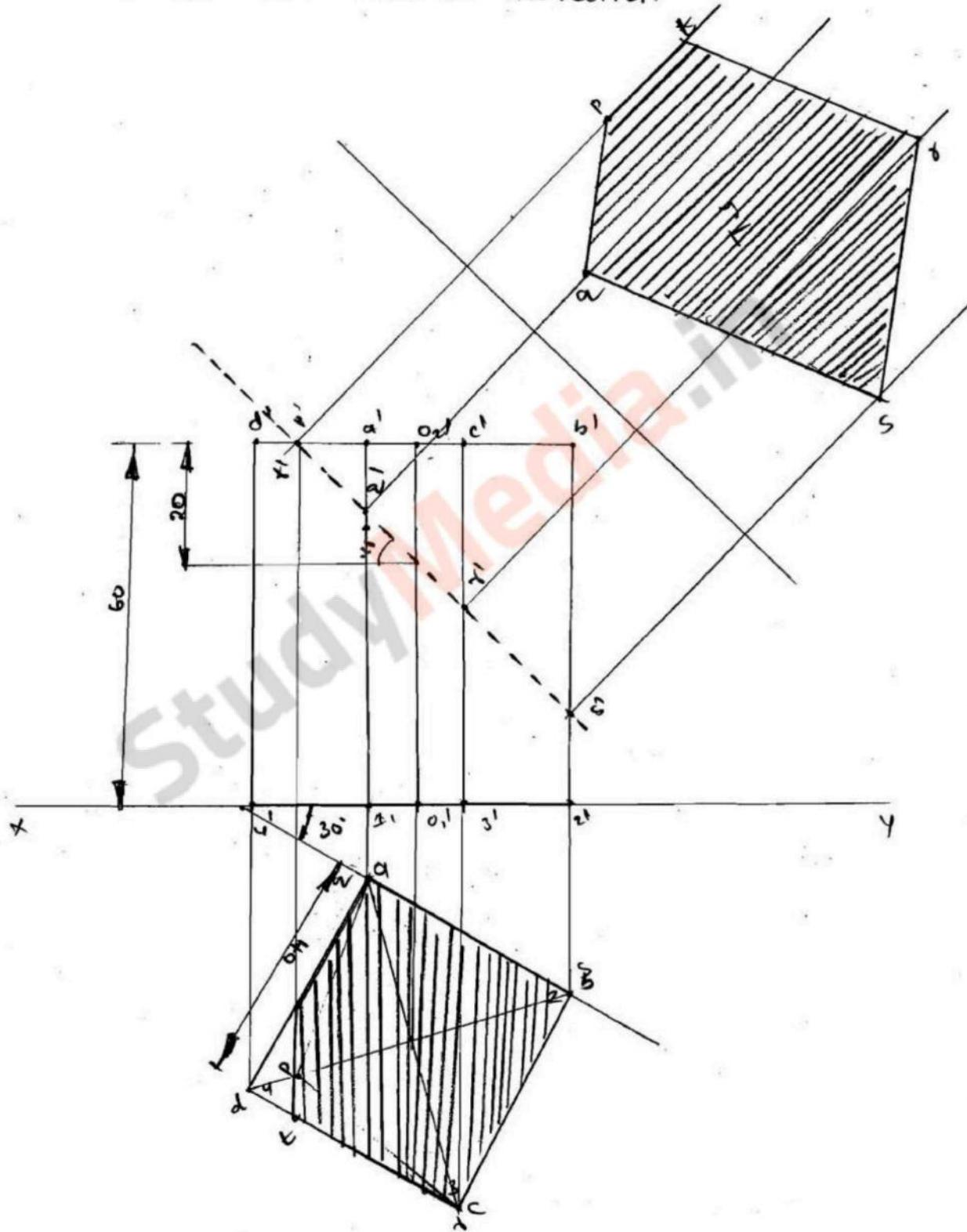
A cone of base diameter 50mm and axis 60mm is resting on its base on the H.P. It is cut by an A.I.P. inclined at  $45^\circ$  to H.P and passing through a point on the axis, 20mm above the base. Draw its sectional T.V and obtain the true shape of the section.

diameter  $d = 50\text{mm}$

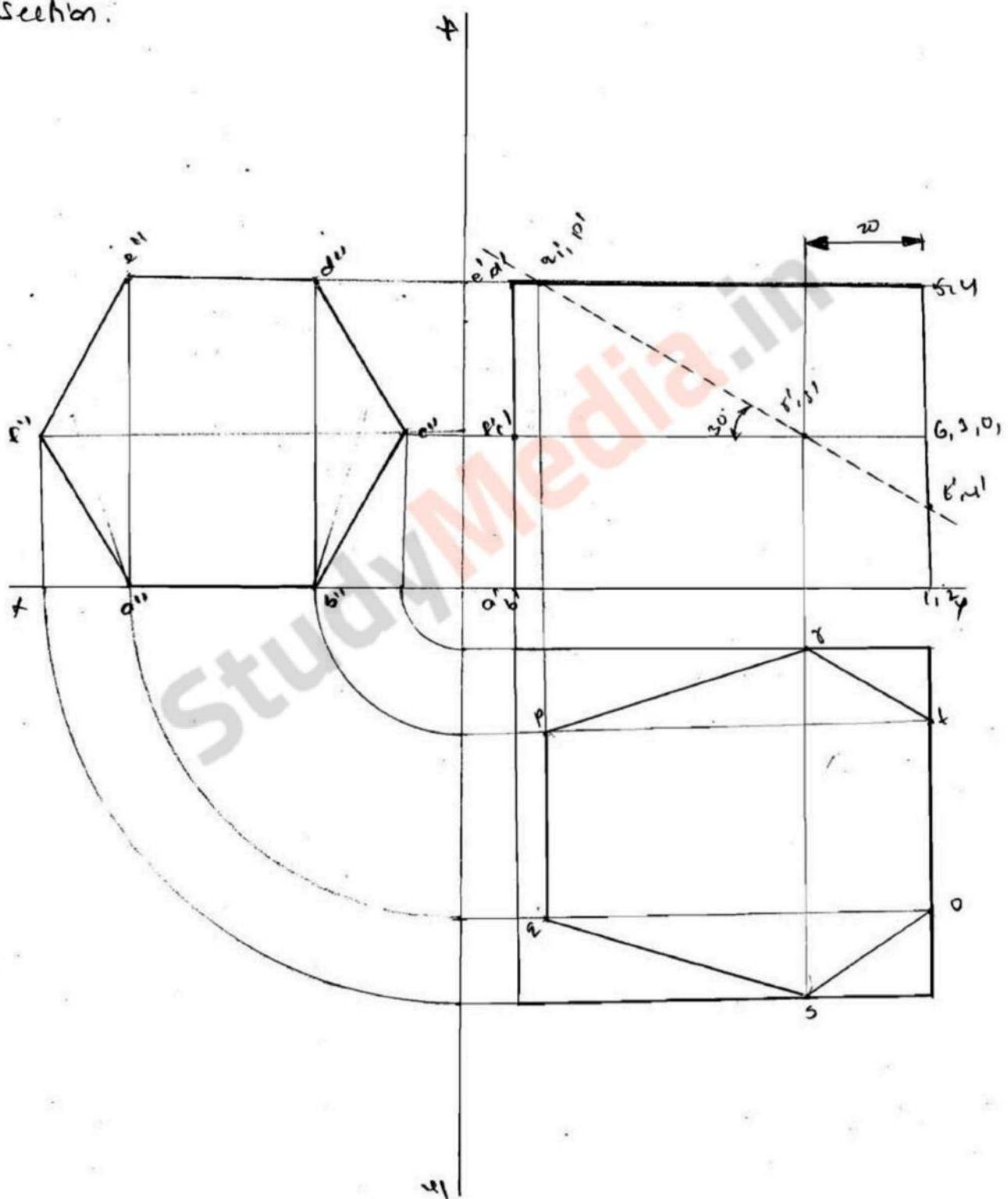
Axis = 60mm



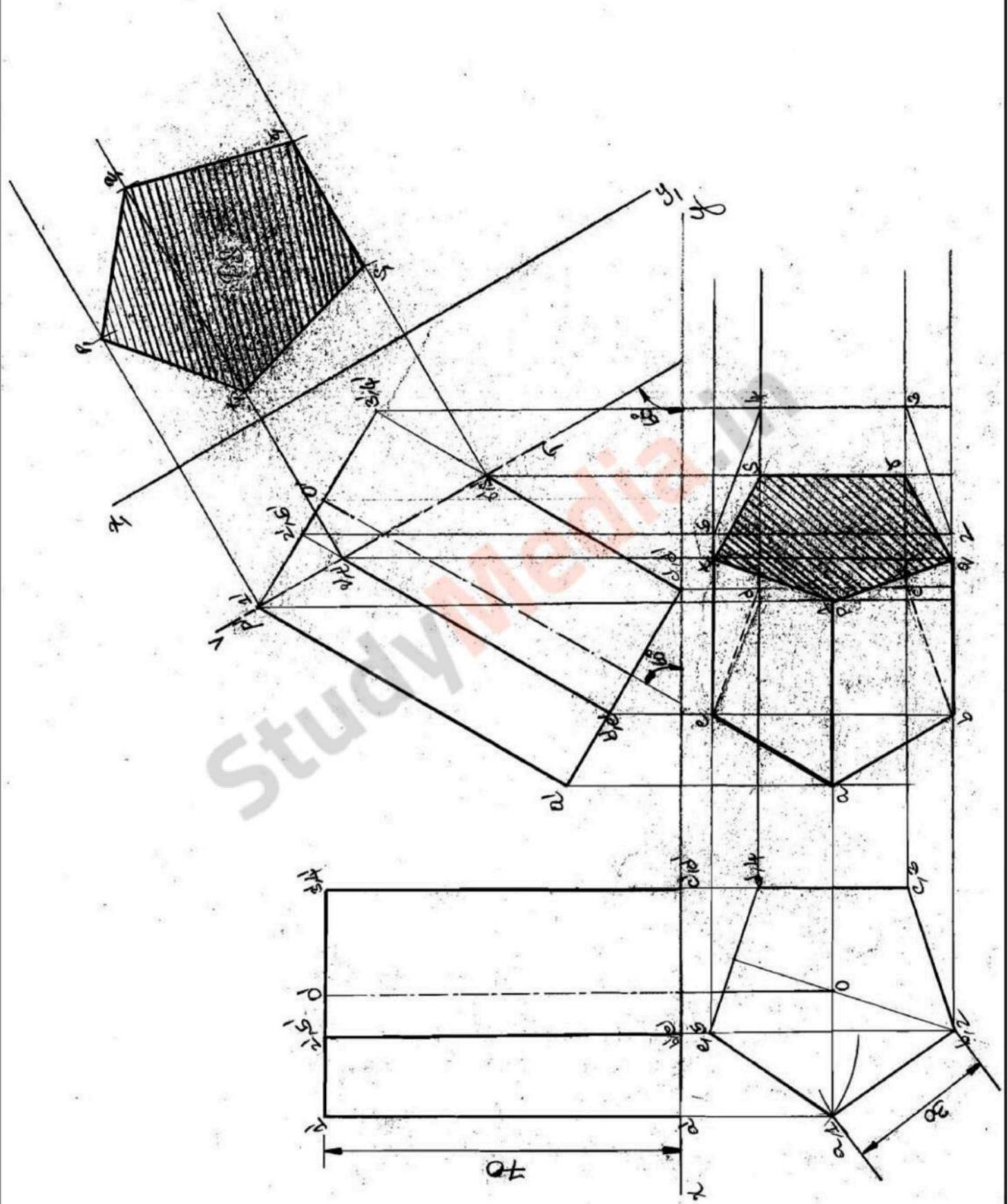
A square Prism of base side 80mm and axis 60mm rest on its base on the H.P. such that one of the V.T. inclined at  $30^\circ$  to V.P. A sectional Plane perpendicular to V.P., inclined at  $45^\circ$  to H.P. passing through the axis at a point 30mm from its top end cuts the prism draw its T.V. and true shape of the section.



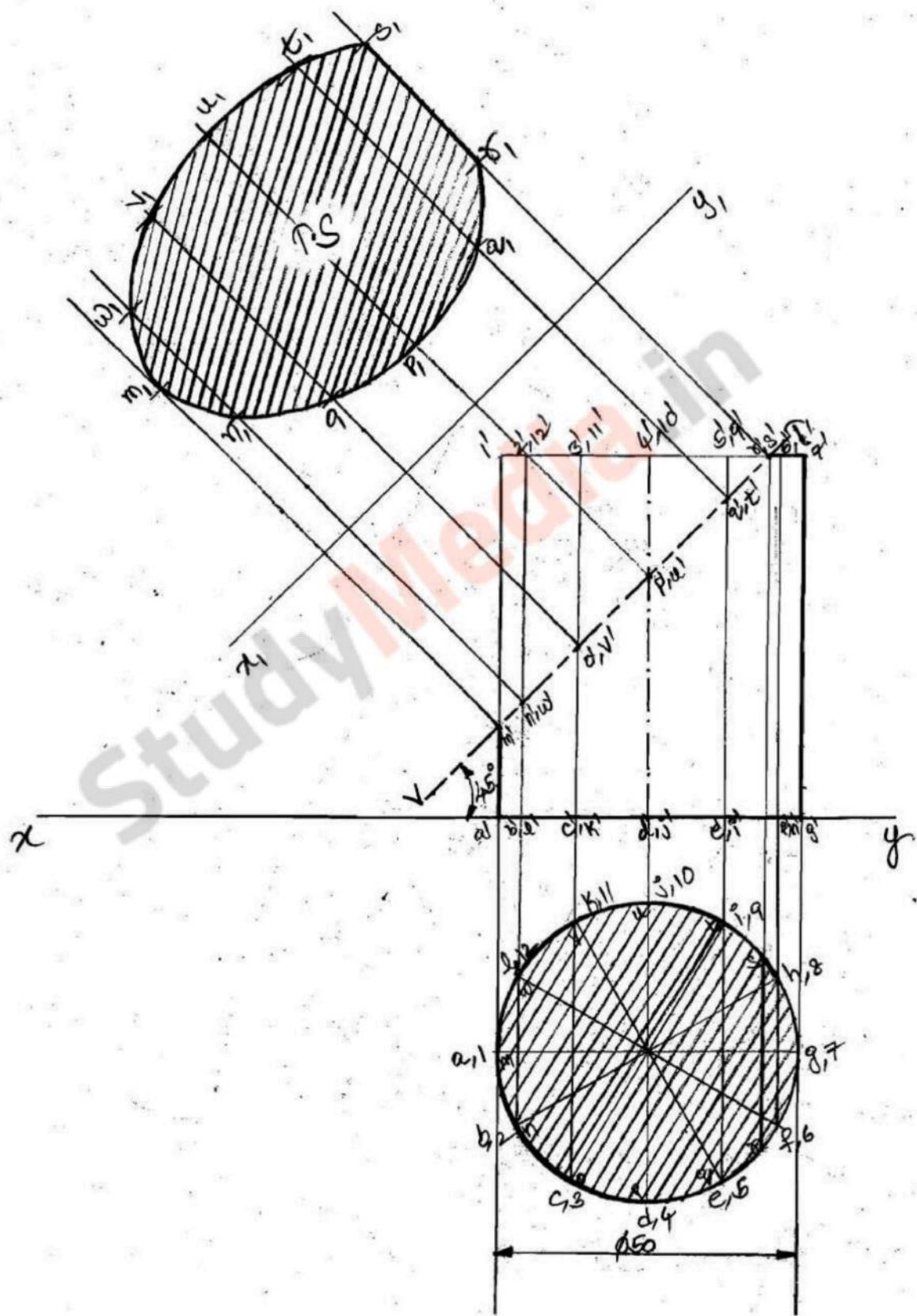
A Hexagonal Prism of base side 30mm and axis 70mm is resting on a face on the H.P. with the axis L.L. to the V.P. It is cut by a Plane whose V.T. is inclined at  $30^\circ$  to the reference line and passes through a point on the axis 20mm from one of its ends. Draw its sectional Top view and obtain the true shape of the section.



\* Pentagonal Prism inclined to plane



## \* Cylinder Sectional View



\* Hexagonal Prism sections

