KSU CET UNIT

FIRST YEAR NOTES

CET UNIT

6
Isometric projection

6.1. Introduction.

Isometric projection is a three dimensional view of an object drawn on a two dimensional sheet of paper. Consider a cube kept with one of its corners on HP with one of its body diagonals perpendicular to VP. The front view of cube in this position is the isometric projection of the cube. It is shown in Fig. 6.1. The three axes, OX, OY and OZ are equally inclined to VP and are called isometric axes. The body diagonal BS is perpendicular to VP.

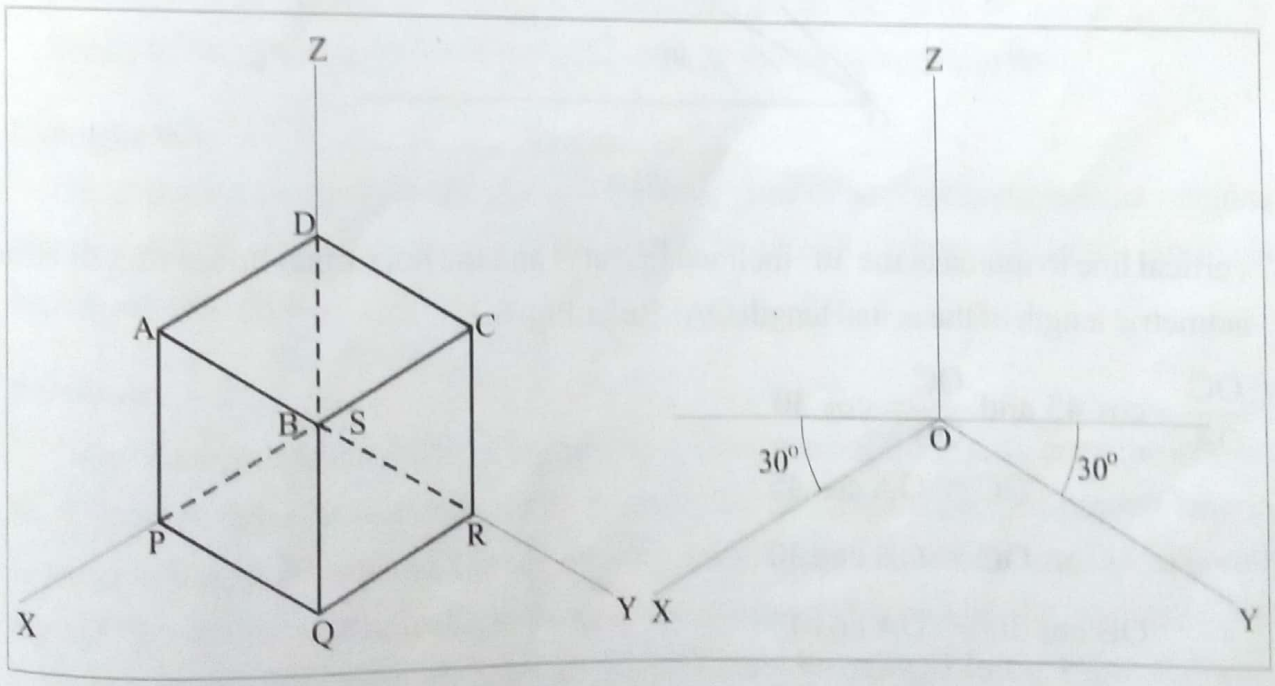

Fig.6.1.

In the isometric projection, the isometric axis OZ is seen to be vertical and the axes OX and OY are seen to be inclined at 30^0 with horizontal. The edges of the cube AP, BQ, CR

and DS are parallel to the isometric axis OZ. The edges AD, BC, PS and QR are parallel to the isometric axis OX. Similarly the edges AB, CD, PQ and RS are parallel to the isometric axis OY. Actually the isometric axes OX, OY and OZ are equally inclined to VP and hence all the edges of the cube are foreshortened in the isometric projection. Lines parallel to the isometric axes are called isometric lines. The foreshortened length of an isometric line is called isometric length of the line. A scale showing isometric length corresponding to actual length is called isometric scale.

6.2. Construction of isometric scale.

From a point O, draw three lines, first line horizontal, second line inclined at 30^o with horizontal and the third line inclined at 45^o with the horizontal. Mark a point A on the 45^o inclined line such that OA is the actual length of a line. From the point A, draw a

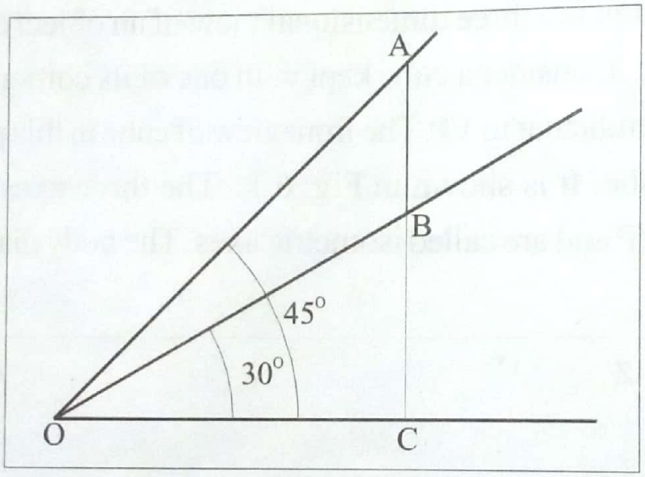

Fig. 6.2

vertical line to intersect the 30^o inclined line at B and the horizontal line at C. OB is the isometric length of the actual length OA. Refer Fig. 6.2.

$$\frac{OC}{OA} = \cos 45 \text{ and } \frac{OC}{OB} = \cos 30$$

$$OC = OA \cos 45$$

$$OC = OB \cos 30$$

$$OB \cos 30 = OA \cos 45$$

$$OB = \frac{OA \cos 45}{\cos 30} = 0.816\ OA$$

$$OB = 0.816\ OA$$

Isometric length = 0.816 × Actual length.

A three dimensional view of an object drawn with isometric length is called isometric projection and the three dimensional view of an object drawn with actual length is called isometric view or isometric drawing of the object.

6.3. General rules for drawing isometric projection and isometric view.

Rule 1.

All the vertical lines in the elevation of an object which are the elevation of vertical edges of the object are to be drawn vertical in the isometric projection as well as in the isometric view.

Rule 2.

All the horizontal lines in the elevation which are the elevation of edges parallel to both HP and VP are to be drawn at an angle of 30^{o} with horizontal.

Rule 3.

All the vertical and horizontal lines in the plan which are the plan of edges parallel to HP are to be drawn inclined at 30^{o} with horizontal.

In isometric projection, the invisible edges need not be shown by dotted lines. But for clarity of the drawing the invisible edges can be shown by very thin lines.

Example 6.1.

Draw the isometric projection and isometric view of a rectangular lamina of sides 20mm and 25mm, kept with its surface parallel to VP. The 25mm side of the lamina is kept parallel to HP.

Solution.

Draw the plan and elevation of the lamina as shown in Fig.6.3 (a). To draw the isometric projection, draw the isometric scale. From the isometric scale, get the isometric lengths corresponding to 20mm and 25mm. From a point D, draw a vertical line DA of length equal to the isometric length of 20mm, and from the point D draw a line DC inclined at 30^{o} with horizontal and of length equal to the isometric length of 25mm. From C draw a vertical line and from A draw a line parallel to DC (inclined at 30^{o} with horizontal). The intersecting point of these two lines is the point B. To draw the isometric view as shown

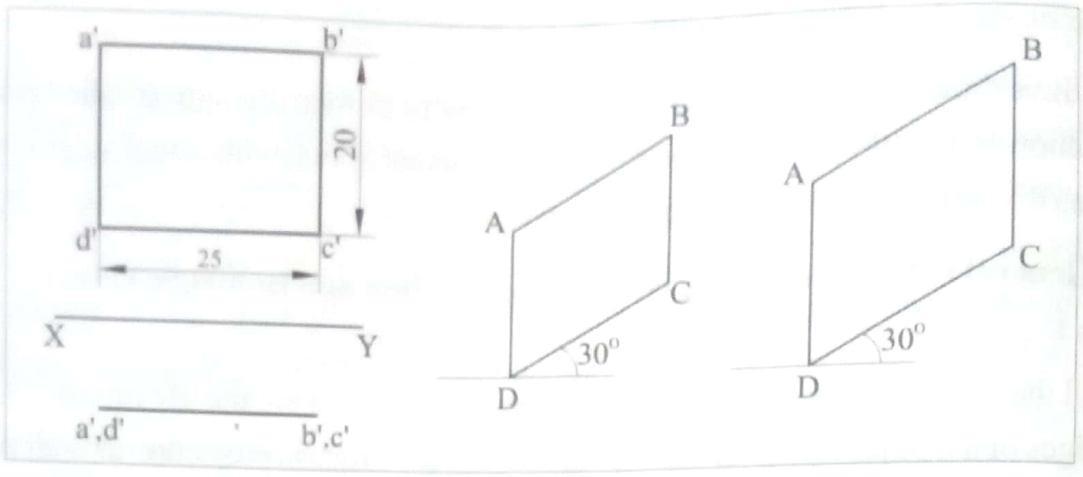

Fig. 6.3.(a). Fig. 6.3.(b). Fig. 6.3.(c).

in Fig.6.3 (c), take the length of line DA equal to the actual length 20mm and take the length of line DC equal to the actual length 25mm.

Example 6.2.

Draw the isometric projection and isometric view of a rectangular lamina of sides 20mm and 25mm, kept with its surface parallel to HP. The 25mm edge is kept parallel to VP.

Solution.

Draw the plan and elevation of the lamina as shown in Fig.6.4.(a). From a point A, draw lines inclined at 30° with horizontal and mark B and D such that AB is the isometric

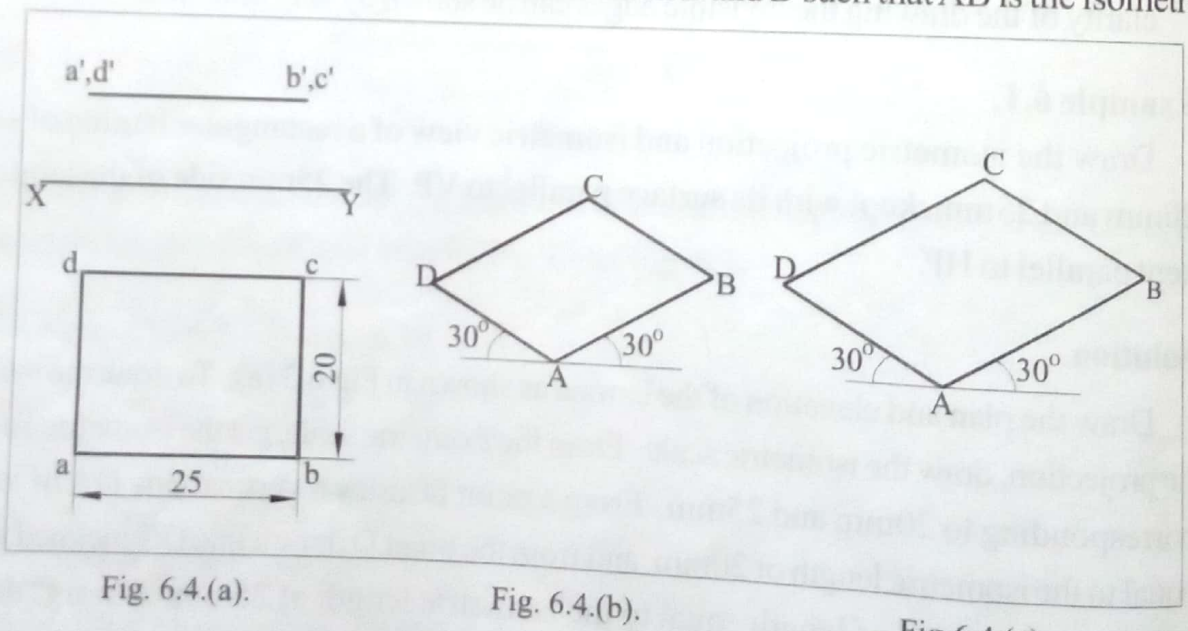

Fig. 6.4.(a). Fig. 6.4.(b). Fig.6.4.(c).

length of 25mm and AD is the isometric length of 20mm. Draw the line DC parallel to AB and equal to AB. Join B and C. To draw the isometric view take AB = 25mm and AD = 20mm as shown in Fig.6.4(c).

Example 6.3.

A hexagonal lamina of side 20mm is kept with its surface parallel to VP. One of the sides is kept parallel to HP. Draw its isometric view.

Solution.

Draw the elevation of hexagonal lamina with one side parallel to XY line. Mark the corners as a′, b′, c′, d′, e′ and f′. Inscribe this hexagon in a rectangle 1′, 2′, 3′, 4′ as shown

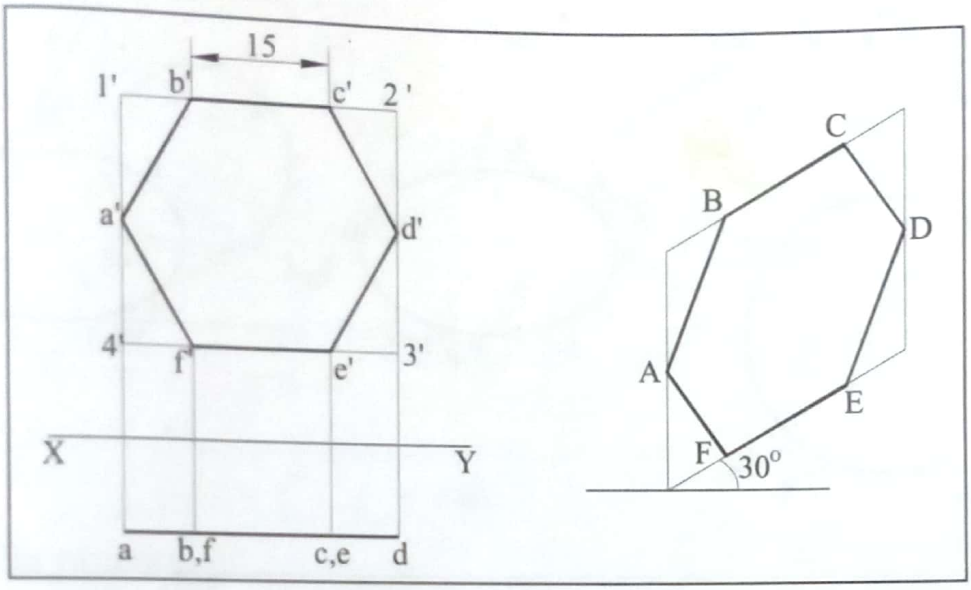

Fig 6.5.

in Fig.6.5. Draw the isometric view of this rectangle with line 4-3 inclined at 30° with horizontal and line 4-1 vertical. Mark points A, B, C, D, E and F such that 1 - A = 1′ - a′, 2 - B = 2′ - b′ etc. Join these points by straight lines.

Problem for practice.

1. A pentagonal lamina of sides 25mm is kept with its surface on HP with one of the sides parallel to VP and nearer to it. Draw its isometric projection.

Example 6.4.

A circular lamina of diameter 30mm is kept with its surface parallel to HP. Draw its isometric projection.

Solution.

Draw the plan of the circular lamina which is a circle of radius 15 mm. Inscribe this circle in a square 1 - 2 - 3 - 4 as shown in Fig. 6.6.

Divide the circle into eight or twelve number of equal divisions and mark the points as a, b, c, d etc. Join h and b and extend it to get point p and join f and d to get q on the

line 1 - 2. Draw the isometric projection of the square 1 - 2 - 3 - 4. Points A, C, E and G are the mid-points of lines 1 - 4, 1 - 2, 2 - 3 and 3 - 4 respectively. B and H are on the line PS and D and F are on the line QR. Locate these points and join these points by a smooth curve as shown in Fig. 6.6. The isometric projection can also be drawn by four centre method as shown in Fig. 6.6. Out of the four centres, two centres are the end

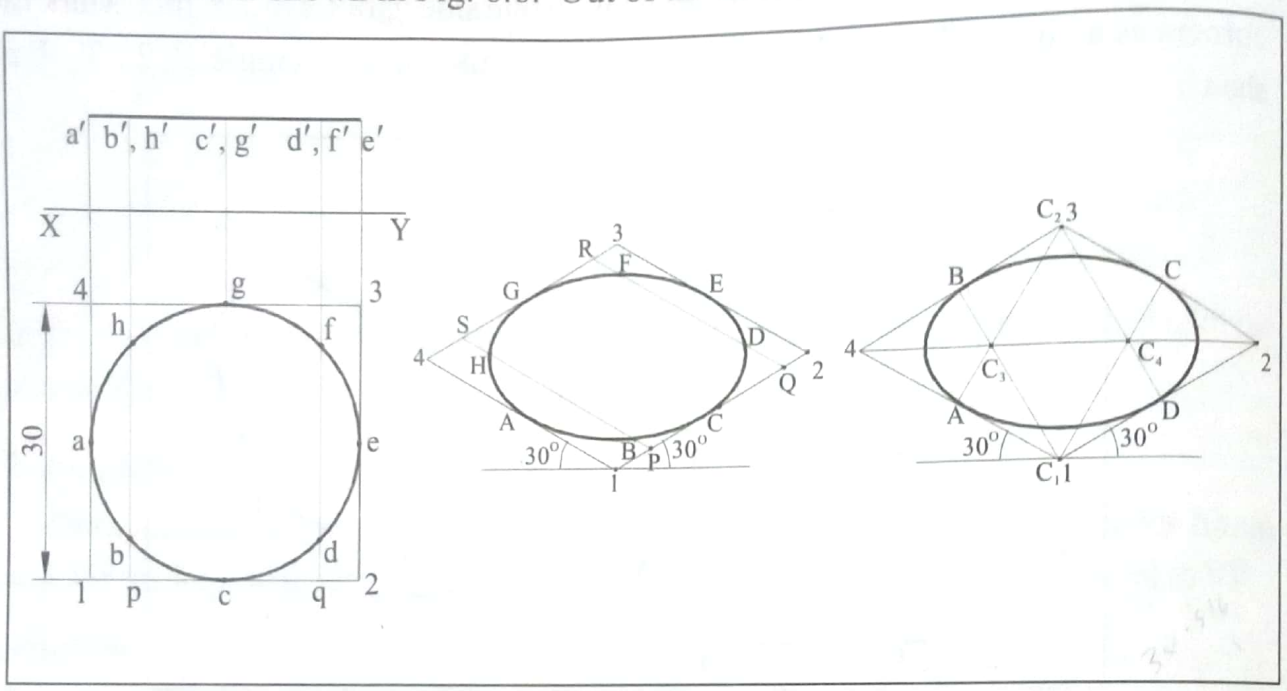

Fig. 6.6.

points of shorter diagonal and the other two centres are on the longer diagonal. Join the end points of the shorter diagonal with the mid-points of opposite sides. The point of intersection of these lines which are in the longer diagonal are the two centres. Draw circular arc AB with C_3 as centre, arc CD with C_4 as centre, arc BC with C_1 as centre and arc AD with C_2 as centre.

Problem for practice.

A circular lamina of diameter 50mm is kept with its surface parallel to VP. Draw its isometric projection.

Example 6.5.

Draw the isometric view of a hexagonal lamina of sides 20mm having a central hole of diameter 20mm. The surface of the lamina is kept parallel to HP with one of the sides of the hexagon parallel to VP.

Solution.

Draw the top view of the hexagonal lamina with one side parallel to XY line. Draw a circle of radius 10mm, with centre of circle at the centre of hexagonal lamina. Inscribe the

hexagon in a rectangle and inscribe the circle in a square. Mark the points as shown in Fig. 6.7. Draw the isometric view of the rectangle and on it locate the points A, B, C, D, E and F. Mark the points 5 and 8 on the line BF and the points 6 and 7 on the line CE. Join these points 5,6,7 and 8. Draw the isometric view of the circle as shown in Fig. 6.7.

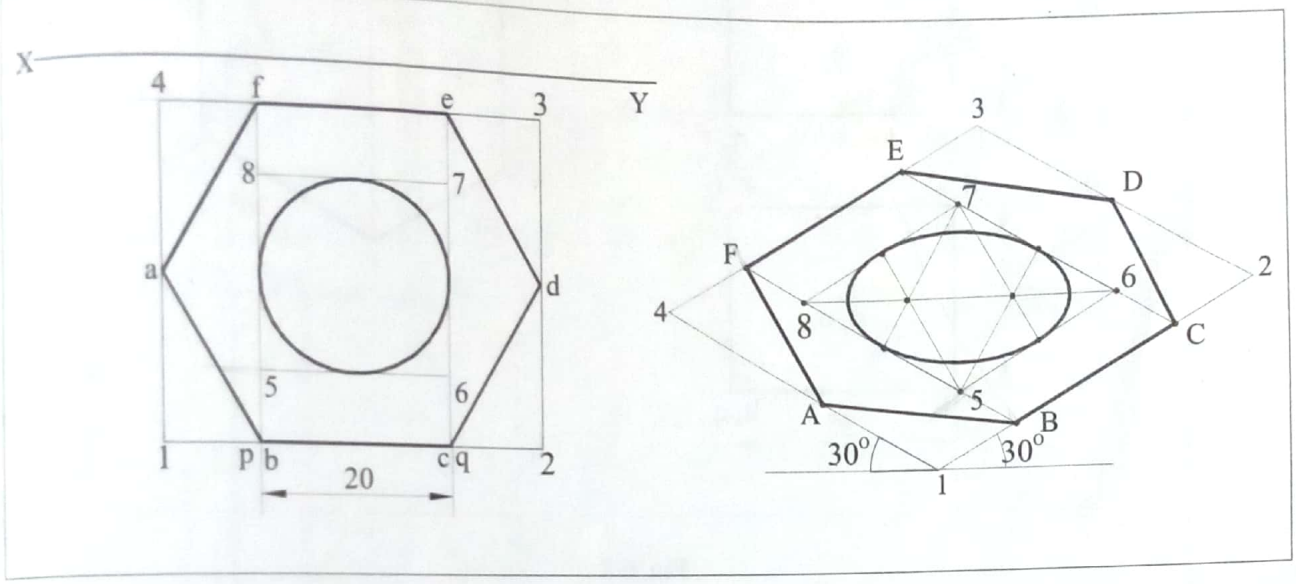

Fig. 6.7.

Problem for practice.

A circular lamina of diameter 50mm has a square hole of side 25mm at the centre. The surface of the lamina is kept parallel to VP with one of the sides of the square hole parallel to HP. Draw its isometric projection.

Example 6.6.

A rectangular prism side of base 20mm x 25mm and axis height 30mm is kept with its base on HP with 25mm base edge parallel to VP. Draw its isometric projection.

Solution.

Draw the top view and front view of the prism. Draw the isometric projection of the rectangle pqrs. PQ and PS are to be drawn inclined at 30^0 with horizontal and PQ should be isometric length of 25mm and PS should be isometric length of 20mm. From P, Q, R and S, draw vertical lines of length equal to isometric length of 30mm and mark the points A, B, C and D. Join these points by straight lines. In isometric projection the top face is always visible. Therefore the lines AB, BC, CD and DA are visible lines. The boundary lines PS, SD, PQ and QB are visible lines. R is an invisible point and hence the lines CR, QR and SR are invisible lines.

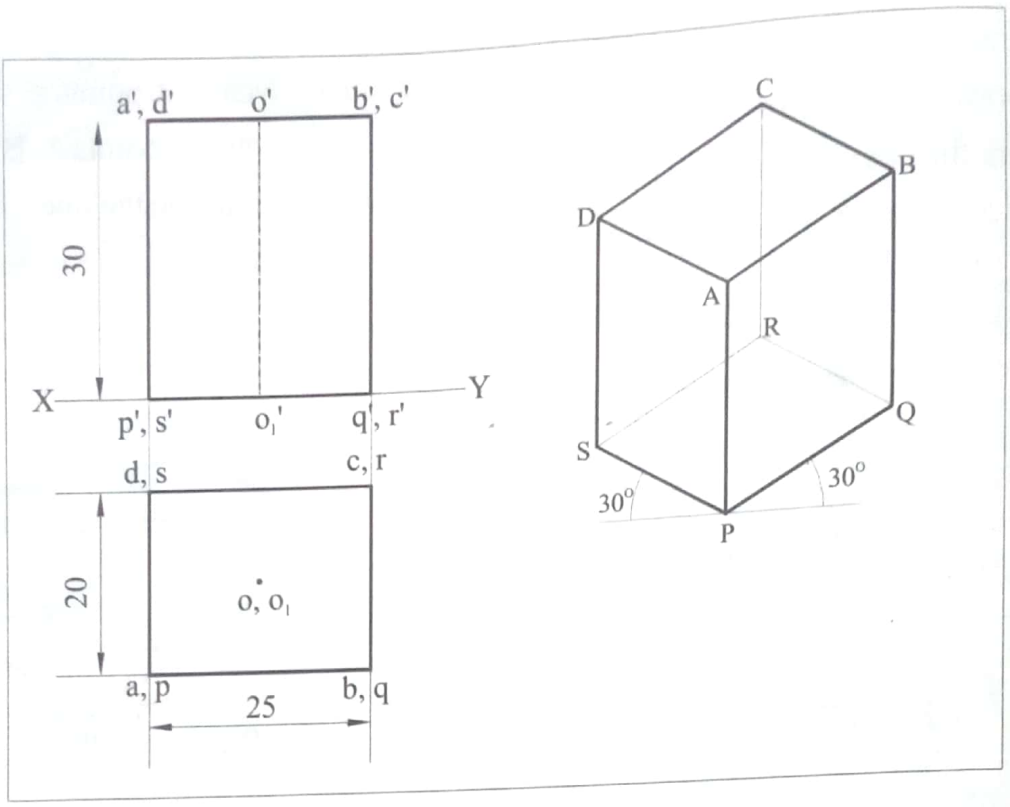

Fig. 6.8.

Example 6.7.

A hexagonal prism side of base 15mm and height 30mm is kept with one of its rectangular faces on HP with axis perpendicular to VP. Draw its isometric view.

Solution.

Draw the elevation and plan of the prism. Elevation is a regular hexagon of side 15mm with one side on XY line. Inscribe this hexagon on a rectangle 1′ 2′ 3′ 4′. Draw the isometric view of this rectangle and mark points A,B,C,D,E and F as shown in Fig.6.9. From the points 1,2,3 and 4 in the isometric view, draw lines inclined at 30° with horizontal and of length 30mm. Mark the end points of these lines as 1,2,3 and 4. Join these points. Locate points P,Q,R,S,T and U as shown in Fig. 6.9. Join these points. The edges QR, RS and ST are visible lines because they are part of the boundary of the view. The remaining edges of the end face TU, UP and PQ are invisible. Since P and U are invisible points, the lines AP and FU are invisible lines.

Problem for practice.

A pentagonal prism side of base 20mm and height 50mm is kept with one of its rectangular faces on HP with axis perpendicular to VP. Draw its isometric view.

University question.

Draw the isometric view of a hexagonal prism side of base 30mm and height 70mm when it lies with one of this rectangular faces on HP.

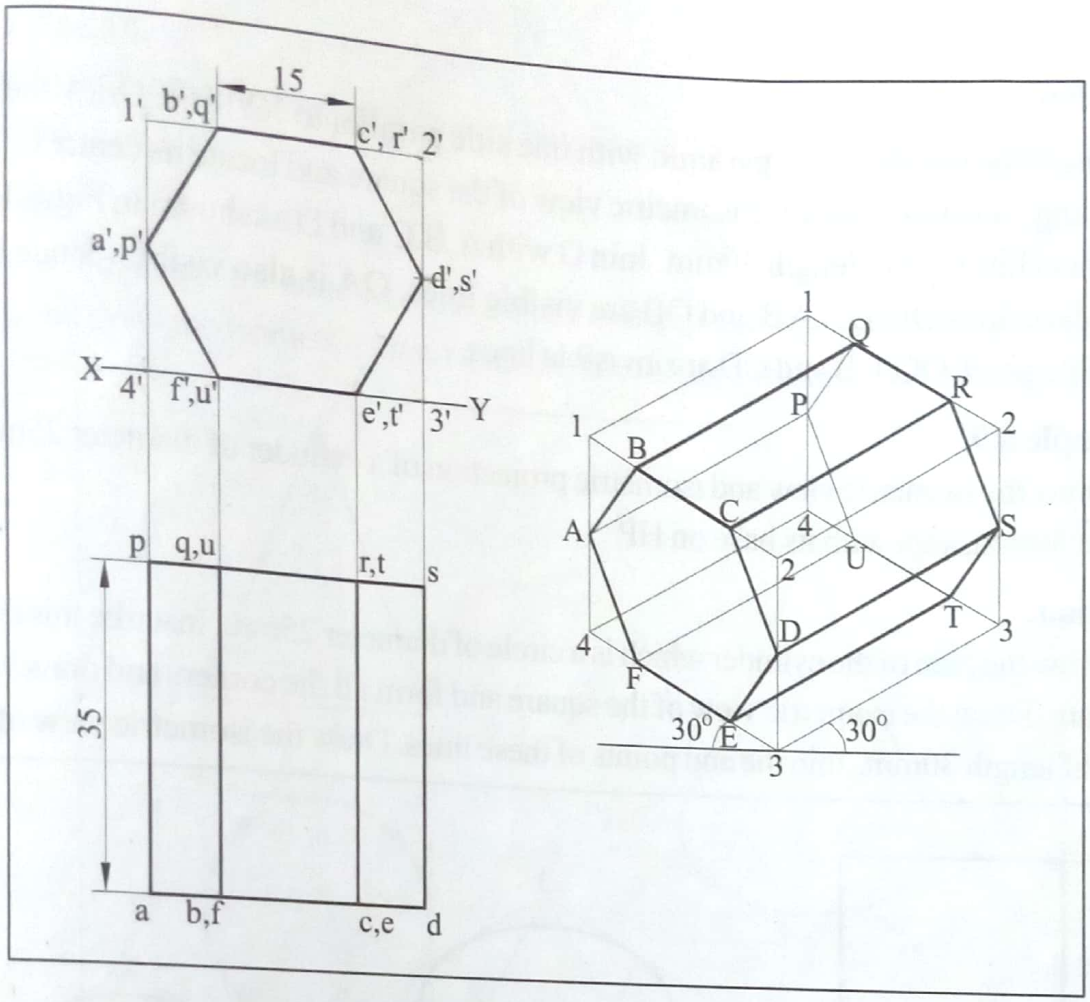

Fig. 6.9.

Example 6.8.

A square pyramid side of base 20 mm and axis height 30 mm is kept with its base on HP with one of its base edges parallel to VP. Draw its isometric view.

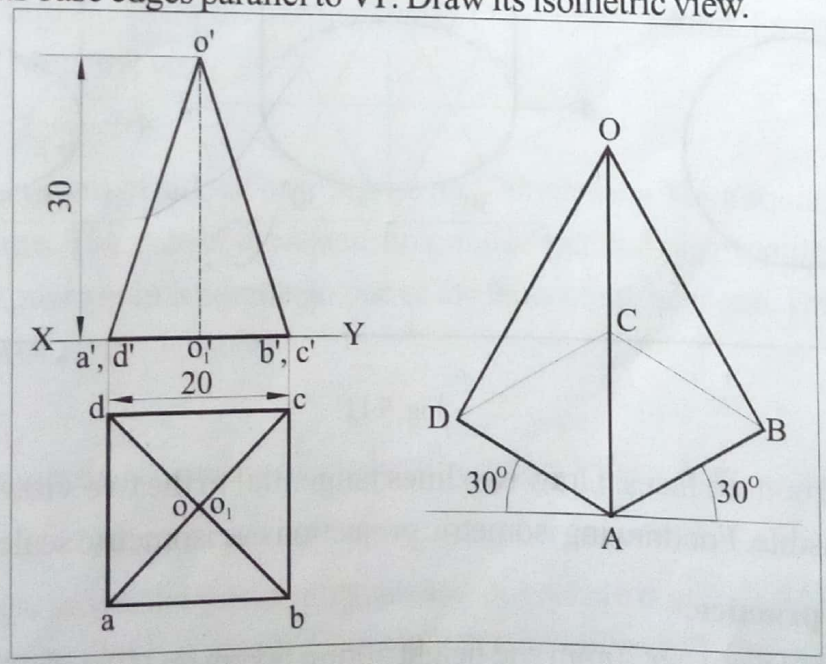

Fig. 6.10.

Solution.

Draw the top view of a pyramid with one side parallel to XY line. Draw the corresponding elevation. Draw the isometric view of the square and locate its centre O_1. Draw a vertical line O_1O of length 30mm. Join O with A,B,C and D as shown in Fig.6.10. The boundary lines OD,DA,AB and OB are visible lines. OA is also visible. Since C is an invisible point OC, CB and CD are invisible lines.

Example 6.9.

Draw the isometric view and isometric projection of a cylinder of diameter 25mm and height 30mm, kept with its base on HP.

Solution.

Draw the plan of the cylinder which is a circle of diameter 25mm. Inscribe this circle in a square. Draw the isometric view of the square and form all the corners and draw vertical lines of length 30mm. Join the end points of these lines. Draw the isometric view of circle

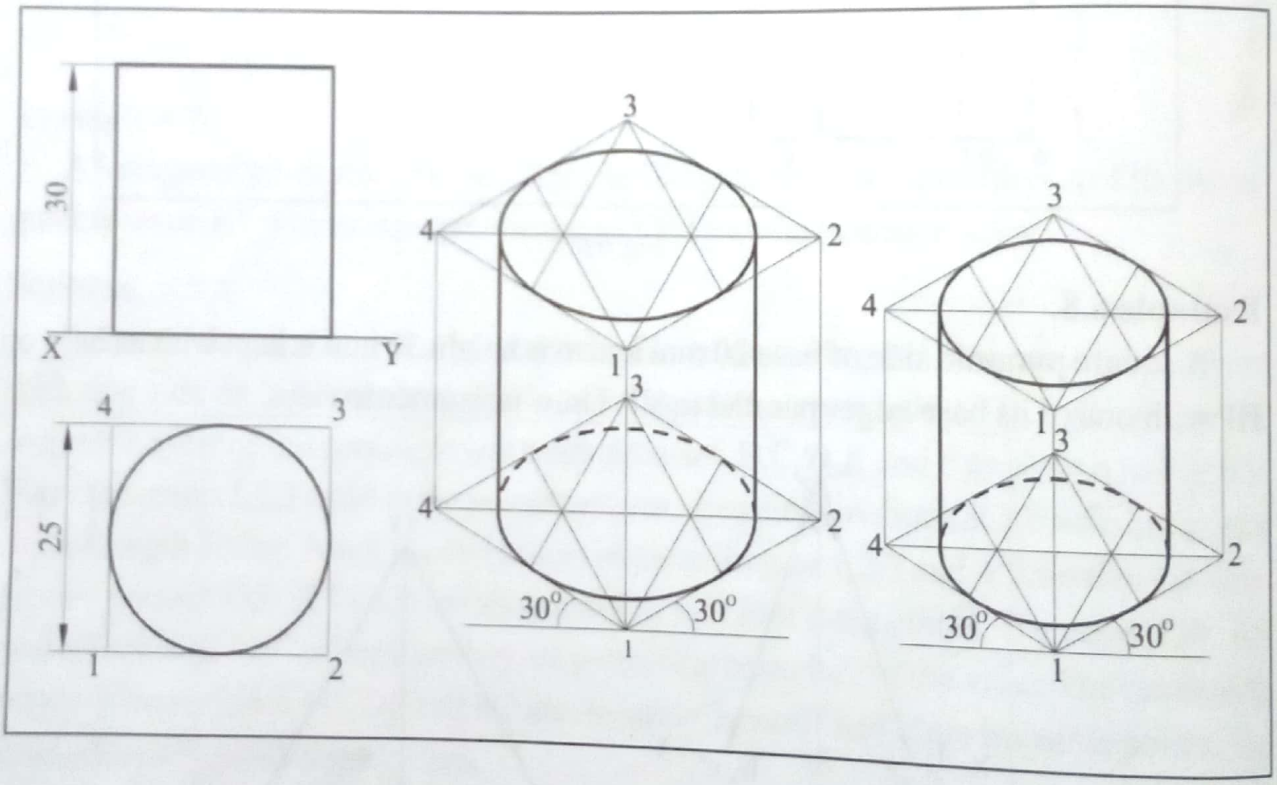

Fig. 6.11.

at the top and bottom faces. Draw two lines tangential to the two views. The top face is completely visible. For drawing isometric projection use isometric scale.

Problem for practice.

A cylinder of diameter 30mm and height 50mm is kept on HP with its axis perpendicular to VP. Draw its isometric projection.

Example 6.10.

Draw the isometric view of a cone of base diameter 25mm, axis height 30mm, kept with its base on HP.

Solution.

Draw the plan of the cone which is a circle of diameter 25mm. Inscribe this circle in a square and draw the isometric view of this square. Draw the isometric view of the circle

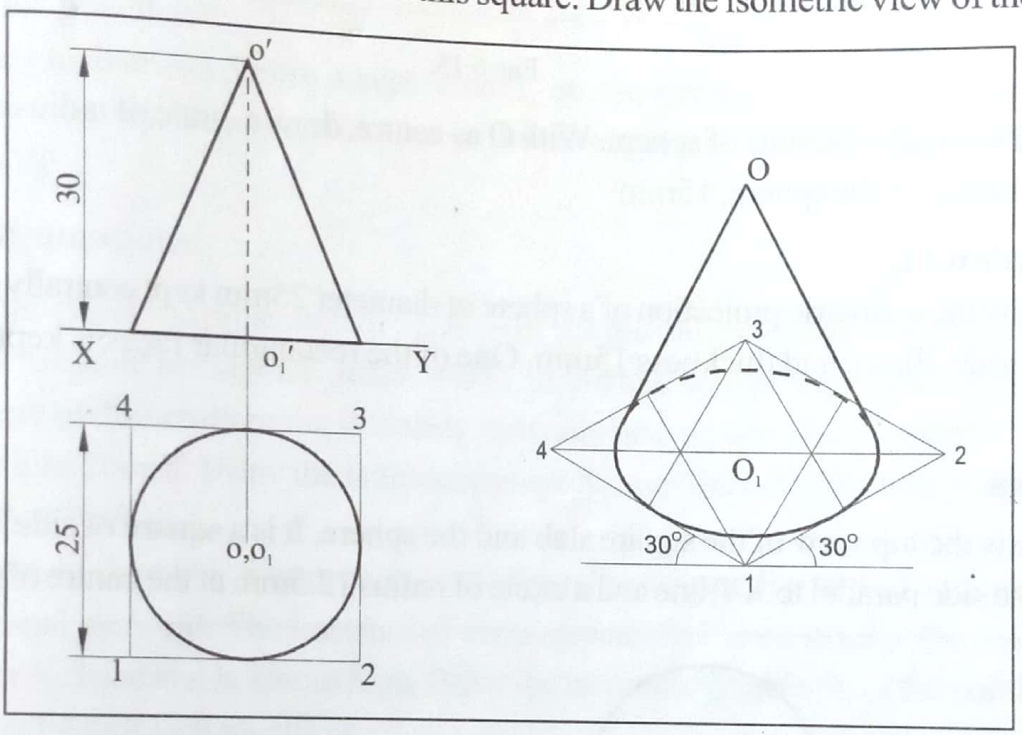

Fig. 6.12.

and locate its centre O_1. Draw the vertical line O_1O of length 30mm. From O, draw lines tangential to the isometric view.

University question.

A hexagonal prism of side of base 30mm and 70mm long has a square hole of sides 20mm at the centre. The axes of the square hole and hexagonal prism coincide, and one of the faces of the square hole is parallel to one of the faces of the hexagon. Draw the isometric view of the prism with the hole.

Example 6.11.

Draw the isometric projection of a sphere of radius 15mm, kept on HP.

Solution.

Isometric view as well as isometric projection of a sphere is a circle. Draw a horizontal line and mark point O_1 on it. From O_1 draw a vertical line O_1O of length equal to the

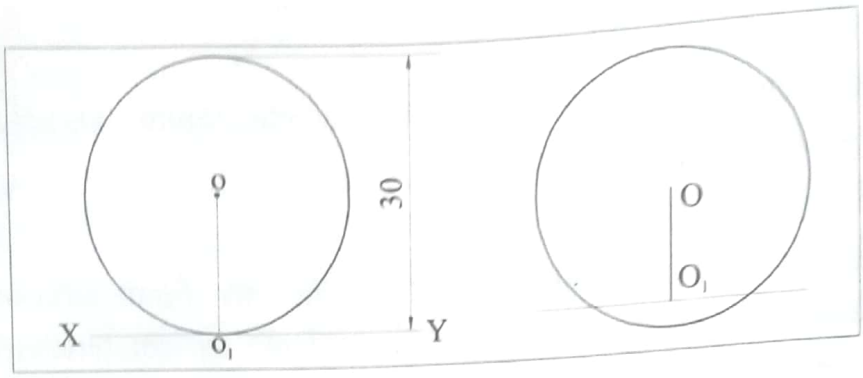

Fig. 6.13.

isometric length of radius of sphere. With O as centre, draw a circle of radius equal to the actual radius of the sphere, 15mm.

Example 6.12.

Draw the isometric projection of a sphere of diameter 25mm kept centrally on a square slab of side 30mm and thickness 15mm. One of the rectangular faces is kept parallel to VP.

Solution.

Draw the top view of the square slab and the sphere. It is a square of side 30mm kept with one side parallel to XY line and a circle of radius 12.5mm at the centre of this square.

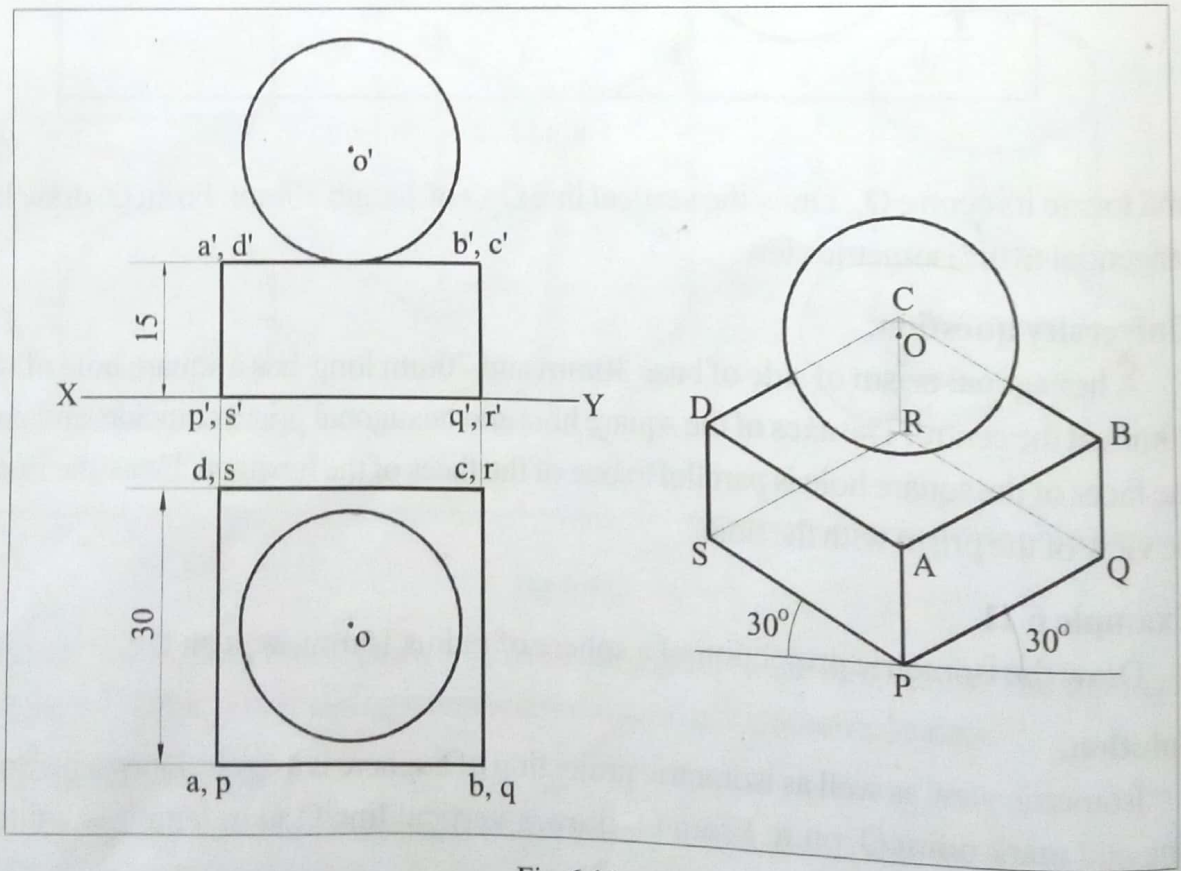

Fig. 6.14.

Draw the isometric projection of the square pqrs. From all the four corners, draw vertical lines of length equal to the isometric length of 15mm. Join the end point of these lines to get the isometric projection of top face ABCD of the square slab. Locate the centre of this face and from this point draw a vertical line of length equal to the isometric length of radius of sphere. With the end point of this line as centre, draw a circle of radius equal to actual radius of sphere, 12.5mm.

Problem for practice.

A sphere of diameter 50mm is kept centrally on a square slab of side 60mm and 30mm thick. Draw its isometric projection. One of the rectangular faces of the square slab is kept parallel to VP.

University questions.

1. Draw the isometric projection of a sphere of 20mm radius resting centrally on the top face of a regular pentagonal prism of side 30mm and height 50mm. [KU June 2006].
2. A sphere of 30mm diameter is resting centrally on a square slab of side 40mm edge and height 20mm. Draw the isometric projection of the combination of the solids. [KU Dec 2006].
3. A sphere of diameter 40mm rests centrally at the top smaller end of a frustrum of a hexagonal pyramid. The frustrum of the pyramid has 25mm sides at the top, 40mm sides at the base and is 80mm high. Draw the isometric projection of the combination of the solids. [KU June 2012].
4. A sphere of radius 20mm is resting centrally on the top surface of a square slab of side 50mm and thickness 30mm. Draw the isometric projection and isometric view. [CUSAT June 2012].

Example 6.13.

A square slab of 25mm side and 15mm thick is surmounted by a cone of base diameter 20mm and height 30mm. The axes of the solids are in a same vertical line. Draw the isometric projection of the solids.

Solution.

Draw the top view of the solids. It is a square of side 25mm with a circle of radius 10mm at the centre of the square. Inscribe this circle in a square 1,2,3,4 as shown in Fig.6.15. Draw the isometric projection of the square slab. On the top face locate the points 1, 2, 3 and 4 and join these points. Draw the isometric projection of the circle and locate its centre O_1. Draw a vertical line O_1O of length equal to the isometric length of

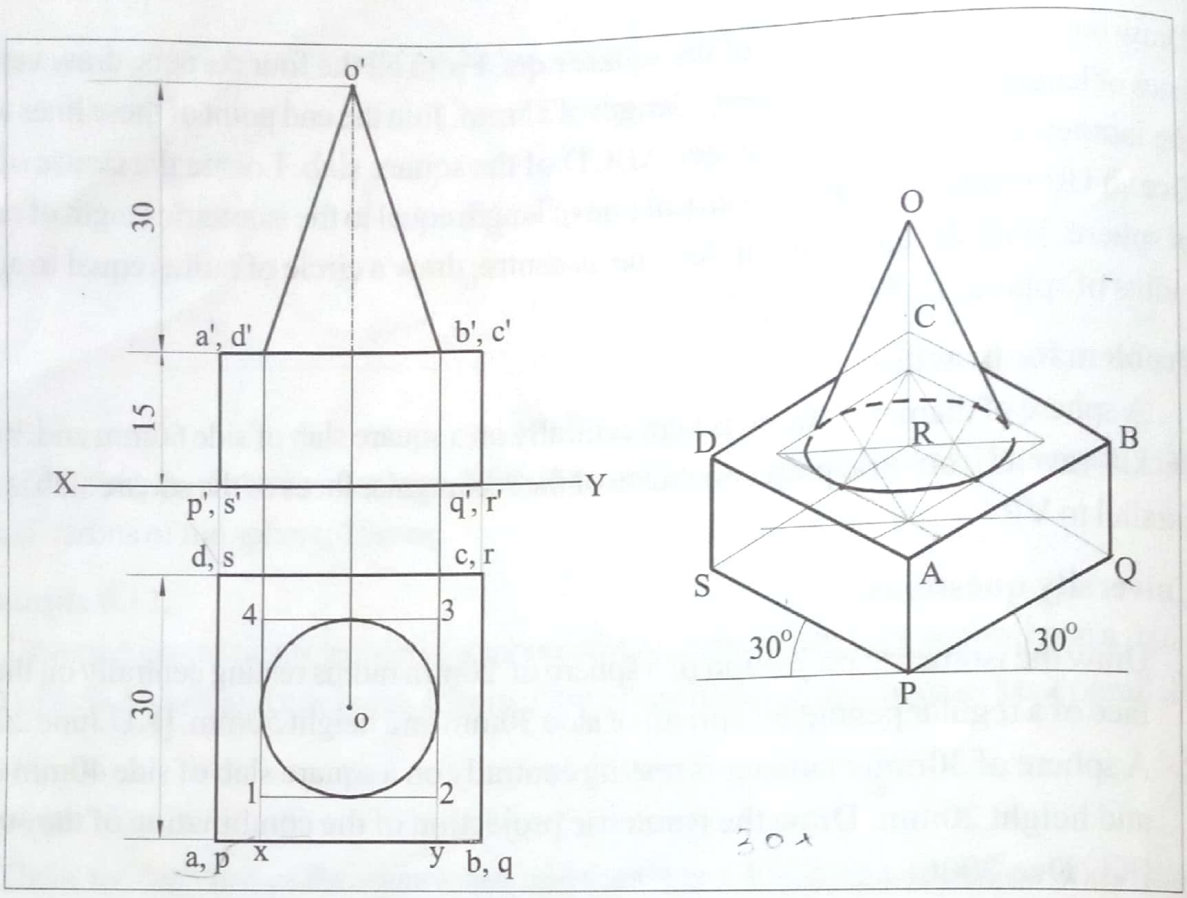

Fig. 6.15.

30mm. From O, draw lines tangential to the isometric projection of the circle as shown in Fig.6.15.

Problem for practice.

A hexagonal slab of side 25mm and 20mm thick is surmounted by a cone of base diameter 30mm and height 40mm. One of the rectangular faces of the slab is kept parallel to VP. Draw the isometric view of the combination of solids.

University questions.

1. A cone of diameter 32mm base and 40mm height is surmounted over a square slab of 40mm side and 25mm thickness kept on HP so that one edge of the square is parallel to VP. Draw isometric view of the combination of solids. [CUSAT June 2013].
2. A cone of radius 15mm and height 30mm is resting centrally on the top surface of a square slab of side 40mm and thickness 25mm. Draw the isometric projection and isometric view. [CUSAT June 2013].
3. A cone of diameter of base 45mm and height 50mm is mounted centrally on the top of a square slab of thickness 10mm and side 65mm. Draw the isometric projections of the combined solids.[CUSAT May 2007].

4. A right circular cone of base 50mm diameter and height 60mm rests symmetrically over a rectangular block of 50mm × 40mm base and 30mm height. Draw the isometric view. [KU June 2010].

Example 6.14.

A hemisphere of diameter 20mm rests centrally over a cube of side 30mm. The top flat surface of the hemisphere is kept horizontal. Draw the isometric projection.

Solution.

Draw the plan of the solids which is a square of side 30mm with a circle of diameter 20mm at the centre of the square. Inscribe this circle in a square 1,2,3,4 as shown in the plan. Draw the isometric projection of the cube and locate points 1,2,3 and 4 at the top face.

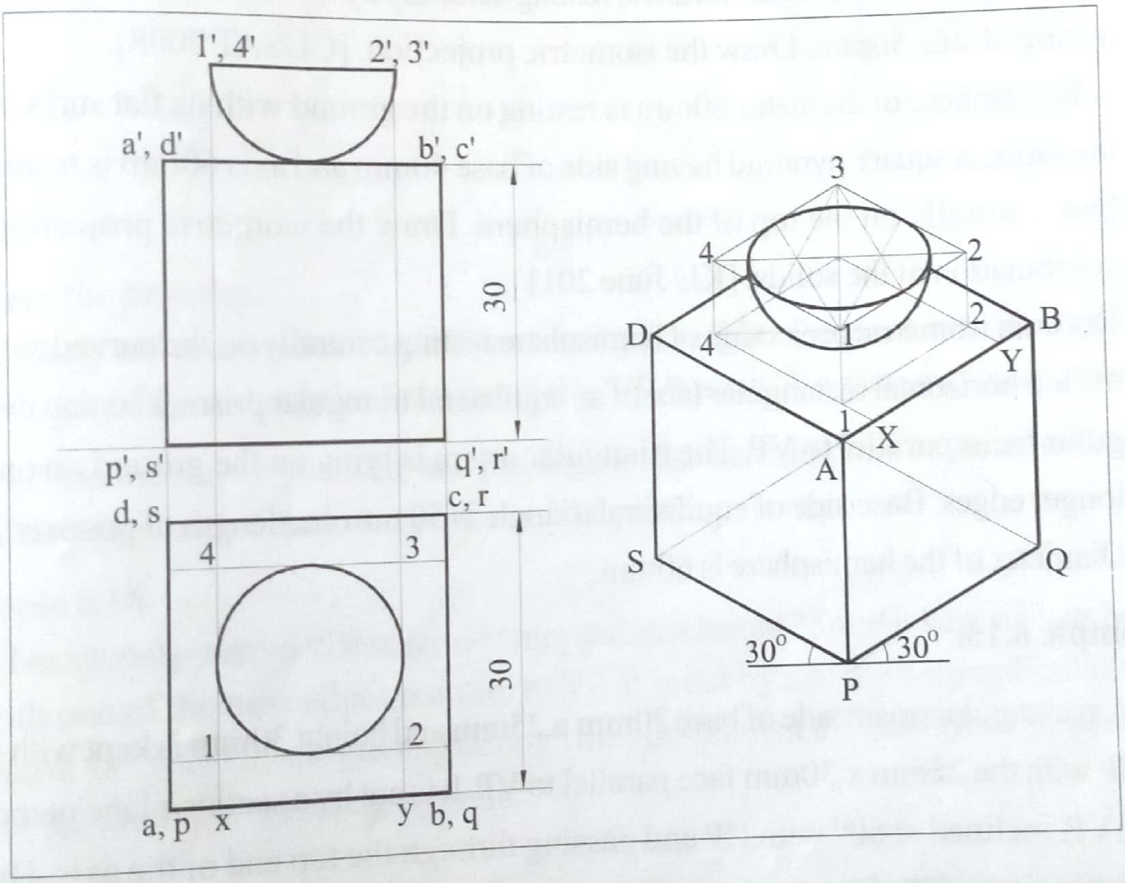

Fig. 6.16.

Join these points. From these points, draw vertical lines of length equal to the isometric length of radius of hemisphere and join the end points of these lines. Length of lines 1-1 = 2-2 = 3-3 = 4-4 = isometric length of 10mm. Draw the isometric projection of the circle. It is the isometric projection of the flat face of the hemisphere. The bottom portion of the hemisphere is a part of sphere and hence its isometric projection is a semicircular arc of radius equal to semi major azis of the ellipse.

Problem for practice.

A hemisphere of diameter 30mm is kept centrally over a hexagonal slab of sides 25mm and thickness 20mm. The curved surface of the hemisphere is in contact with the slab and the flat surface is horizontal. Draw its isometric projection.

University questions.

1. A hemisphere of 60mm diameter is resting on its curved surface centrally on the top of a square prism side of base 60mm and length of axis 40mm. Draw the isometric projection using isometric scale. [KU June 2011].
2. A hemisphere of diameter 40mm is resting centrally by its curved surface on the top of a cube of side 50mm. Draw the isometric projection. [CUSAT 2008].
3. A hemisphere of diameter 80mm is resting on the ground with its flat surface facing upwards. A square pyramid having side of base 40mm and axis 60mm is resting on its base centrally on the top of the hemisphere. Draw the isometric projection of the combination of the solids. [KU June 2011].
4. Draw an isometric projection of hemisphere resting centrally on the curved surface on the top horizontal rectangular face of an equilateral triangular prism, keeping two triangular faces parallel to VP. The triangular prism is lying on the ground on one of its longer edges. Base side of equilateral triangle is 50 mm and length of prism is 70 mm. Diameter of the hemisphere is 60mm.

Example 6.15.

A rectangular prism side of base 20mm x 25mm and height 30mm is kept with its base on HP with the 25mm x 30mm face parallel to VP. It is cut by a section plane perpendicular toVP, inclined at 60^{O} with HP and passing through the top end of the axis. Draw the isometric view of the larger portion of the prism.

Solution.

Draw the plan and elevation of the prism. Plan is a rectangle of sides 20mm and 25mm. The 25mm side should be kept parallel to XY line. Draw the section line and mark the points 1′, 2′, 3′ and 4′ as shown in Fig.9.17. Draw the isometric view of the entire prism. Mark points 1,2,3 and 4 in the isometric view such that P-1 = p′-1′, S-4 = s′-4′, A-2 = a′-2′ and D-3 = d′-3′. Join the points 1,2,3 and 4.

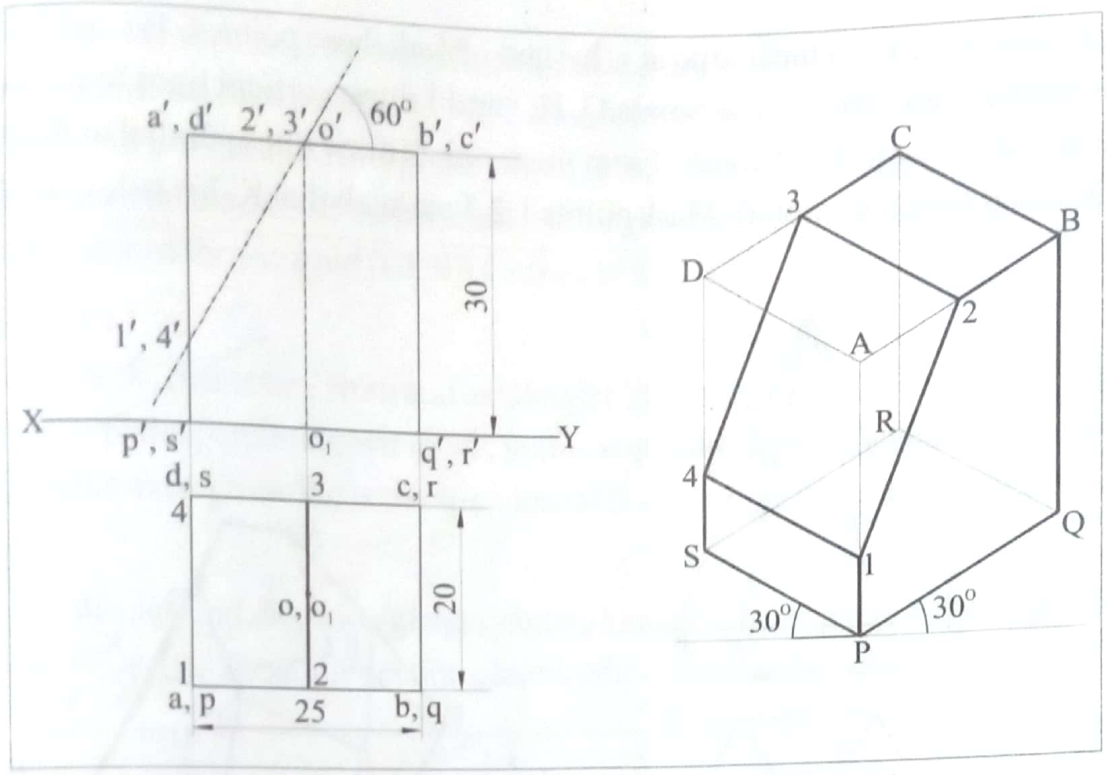

Fig. 6.17.

Problem for practice.

A hexagonal prism side of base 20mm and axis height 60mm is kept with its base on HP with one of the rectangular faces parallel to VP. It is cut by a section plane perpendicular to VP, inclined at 45° with HP and passing through the mid-point of the axis. Draw the isometric projection of the lower portion of the prism.

Example 6.16.

A hexagonal pyramid side of base 15mm and axis height 35mm is kept with its base on HP with one of the base edges parallel to VP. It is cut by a plane perpendicular to VP, inclined at 45° with HP and passing through the mid-point of the axis. Draw the isometric view of the lower portion of the pyramid.

Solution.

Draw the plan and elevation of the pyramid. Plan is a hexagon of side 15mm. One of the sides should be kept parallel to XY line. Show the section plane in the elevation and mark the points 1′, 2′ etc. Show these points in the plan. Inscribe the hexagon in a rectangle p q r s as shown in Fig.6.18. Draw the isometric view of this rectangle, P Q R S. Locate the points A, B, C, D, E and F in the isometric view of the rectangle. From p′ and q′ draw vertical lines to intersect the section line at t′, u′, v′ and w′. From P,Q,R and S, draw vertical lines and mark points T,U,V and W such that PT = SW = p′- t′ and QU = RV = q′u′. Join the points T, U, V and W. From the points 1, 2, 3 etc in the top view, draw

vertical lines to intersect the line pq at g, h, i and j. Mark these points G,H,I and J on PQ in the isometric view. From these points Q, H, I and J draw vertical lines to intersect the inclined line T U at K, L, M and N. From these points draw lines parallel to the line UV (30^o inclined with horizontal). Mark points 1,2,3 etc such that K-1 = g-1, L-2 = h-2,

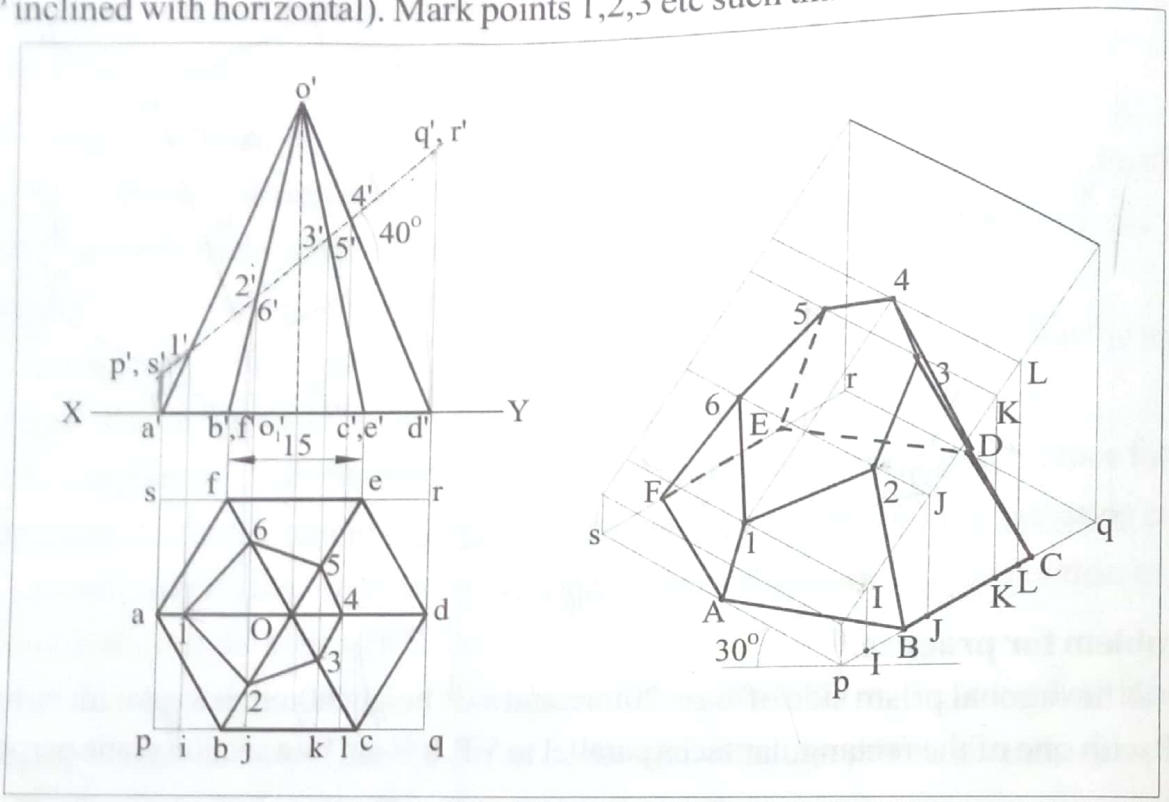

Fig. 6.18.

L-6 = h-6, M-3 = i-3, M-5 = i-5 and N-4 = j-4. Join these points 1, 2, 3 etc. Complete the isometric view by joining the points 1 and A, 2 and B, 3 and C, 4 and D, 5 and E and 6 and F. Since the point E is an invisible point, the lines FE, 5E, and DE are invisible lines.

Problem for practice.

A square pyramid side of base 30mm and axis height 60mm is kept with its base on HP with one of the base edges parallel to VP. It is cut by a section plane perpendicular to VP, inclined at 45^o with HP and passing through the mid-point of the axis. Draw the isometric projection of the lower portion of the pyramid.

University question.

1. A pentagonal pyramid, edge of base 30mm and height 65mm, stands on HP such that an edge of the base is parallel to VP and nearer to it. A section plane perpendicular to VP and inclined at 30^o to HP cuts the pyramid passing through a point on the axis at a height of 35mm from the base. Draw the isometric view of the truncated pyramid showing the cut surface. [CUSAT June 2009].

2. A solid in the form of a truncated hexagonal pyramid of base 30mm side, axis 60mm long and edge of the base parallel to VP, is resting on its base on HP. The truncated surface of the pyramid is contained in a plane which is inclined at 30° to HP. This plane passes through a point on the axis of the pyramid and the point is 30mm above the base. Draw the isometric view of the pyramid [CUSAT June 2013].

Example 6.17.

A cylinder of diameter 25mm and axis height 35mm is kept with its base on HP. It is cut by a section plane perpendicular to VP, inclined at 60° with HP and passing through the top end of the axis. Draw the isometric view of the lower portion of the cylinder.

Solution.

Draw the plan and elevation of the cylinder. Draw the isometric view of the cylinder as shown in Fig.6.19. Show the section plane in the elevation and mark the points 1′, 2′, 3′ etc.

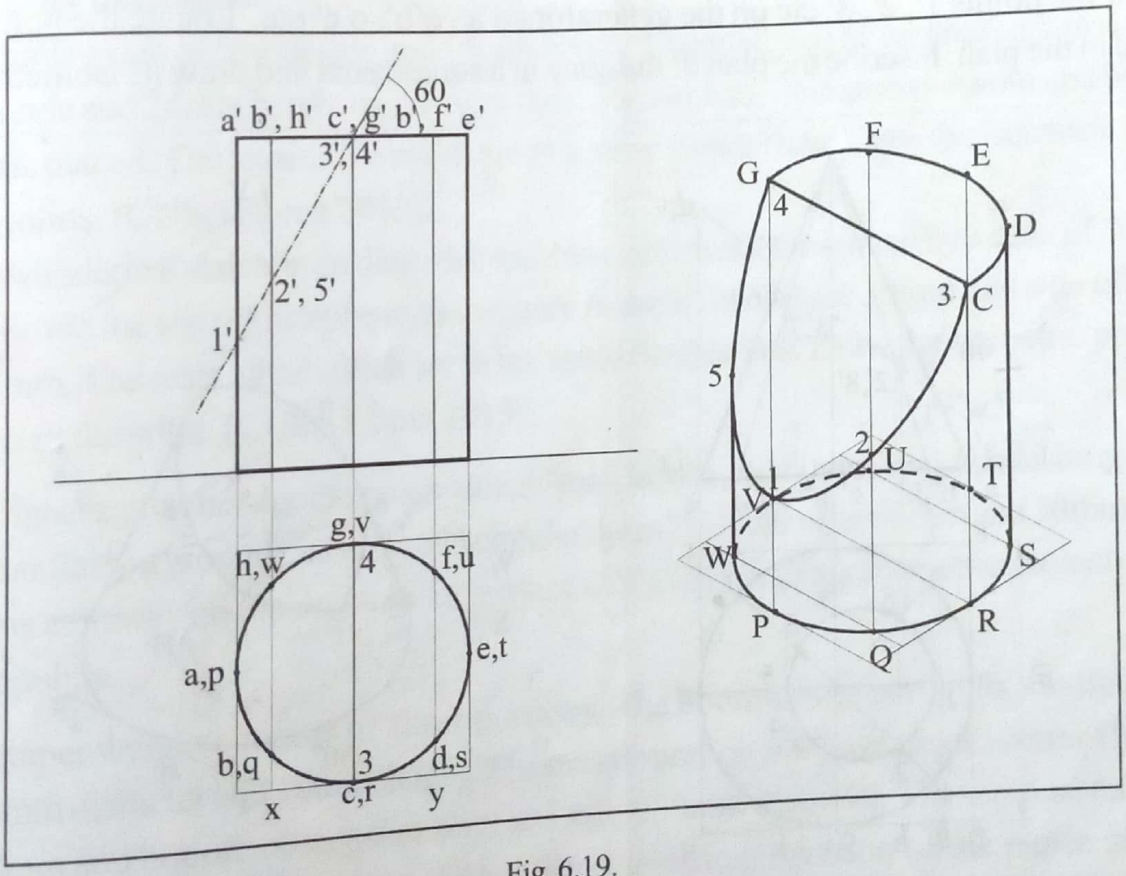

Fig. 6.19.

In the isometric view mark the points 1,2,3 etc on the generators such that P-1 = p′-1′, Q-2 = q′-2′, R-3 = r′-3′ etc. Join these points as shown in Fig.6.19.

Problem for practice.

A cylinder of diameter 50mm and height 60mm is kept with its base on HP. It is cut by a section plane perpendicular to VP, inclined at 60° with HP and passing through a point

on the axis 10mm below the top end of the axis. Draw the isometric projection of the cylinder, showing the cut surface.

University question.

A cylinder of 50mm diameter plane 60mm height, stands on HP. A section plane perpendicular to VP and inclined at 60° to HP bisects the axis. Draw the isometric projection of the truncated cylinder [KU Jan 2009].

Example 6.18.

A cone of base diameter 30mm and axis height 35mm is kept with its base on HP. It is cut by a plane perpendicular to VP, inclined at 40° with HP and passing through the mid-point of the axis. Draw the isometric view of the truncated cone.

Solution.

Draw the plan and elevation of the cone. Show the section plane in the elevation and mark the points 1′, 2′, 3′ etc on the generators o′a′, o′b′, o′c′ etc. Locate the points 1, 2, 3 etc in the plan. Inscribe the plan of the cone in a square pqrs and draw its isometric view

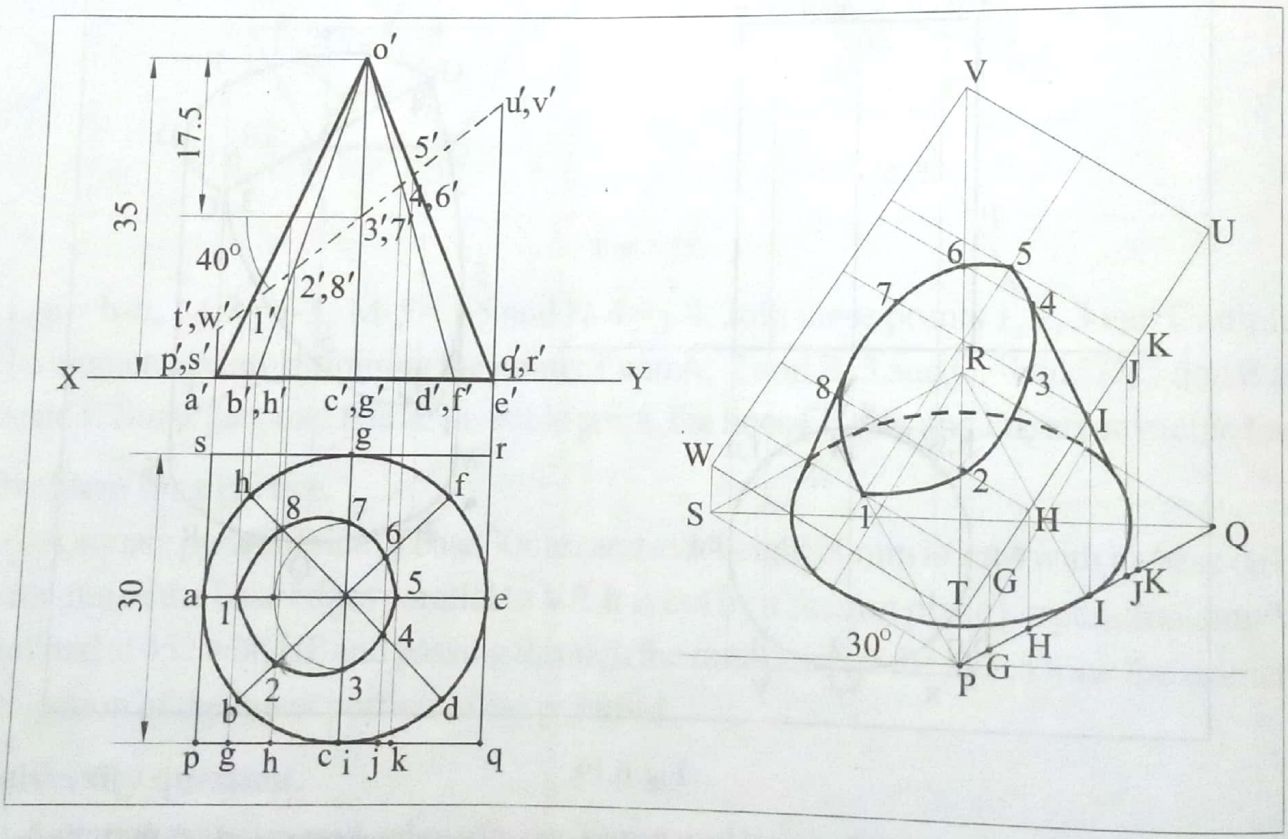

Fig. 6.20.

PQRS and draw the isometric view of the circle. Mark p′,q′,r′ and s′ in the elevation. From p′ and q′, draw vertical lines to intersect the section line at t′, u′, v′ and w′ as shown in Fig.6.20. Draw vertical lines from P,Q,R and S and locate points T,U,V and W such

that PT = SW = p′ t′ and QU = RV = q′v′. Join the points T U V and W. From the points in the plan 1, 2, 3 etc, draw vertical lines to intersect the line pq at g, h, i, j and k. Locate these points G, H, I, J and K in the isometric view. From these points draw vertical lines to intersect the inclined line TU at G,H, I, J and K. From these points, draw lines parallel to TW and locate points 1, 2, 3 etc on these lines such that G-1 = g-1, H-2 = h-2, I-3 = i-3, J-4 = j-4, K-5 = k-5,J-6 = j-6, I-7 = i-7, and H-8 = h-8. Join these points 1,2,3 etc by a smooth curve. Draw two lines connecting to this curve and the isometric view of the base as shown in Fig.6.20.

Problem for practice.

A cone of base diameter 50mm and axis height 60mm is kept with its base on HP. It is cut by a section plane perpendicular to VP, inclined at 45° with HP and bisecting the axis. Draw the isometric projection of the truncated cone.

University questions

1. A square slab of 60mm side and 15mm height is surmounted by another square slab of 45mm side and 24mm height on its top, a right circular cone of diameter 40mm and height 60mm is placed. The axes of the solids are in a same vertical line. Draw the isometric view of the solids. [CUSAT June 2013].
2. A cylinderical slab 60mm diameter and 16mm thick is surmounted by a cube of 30mm side. On the top of the cube rests a square pyramid of altitude 30mm and side of base 24mm. The axes of the solids are in the same straight line. Draw the isometric projection of the solid. [CUSAT June 2013].
3. A right regular hexagonal prism side of base 22mm and 60mm long lies on its rectangular face on ground plane. A right circular cylinder of diameter 35mm and 50mm long rests centrally on top rectangular surface of the prism. Draw isometric projection of the solids.
4. A paper weight consists of three portions. The bottom most portion is a cylinder of 60mm diameter and 10mm height. The middle portion is a frustrum of a cone of height 20mm and bottom 60mm diameter and top is 30mm diameter. The topmost part is a hemisphere of 15mm radius. Draw the isometric projection of the paper weight [CUSAT June 2011].

Problem 6.1

A hemisphere of diameter 80mm is resting on the ground with its flat surface facinf unwards. A square puramid havinf side of base 40mm and axis 60mm is resting on its base centrally on top of the hemisphere. Draw the isometric projection of the combination of solids.

Solution

1. Draw the XY line and draw the plan and elevation of the combination of solids.
2. Enclose the circle in a square 1 2 3 4.
3. Draw the isometric scale.
4. Draw the isometric projection of the square 1 2 3 4.
5. Draw the ellipse using four centre method.
6. Draw a semicircle with the major axis of the ellipse as diameter as shown in Fig 6.21.

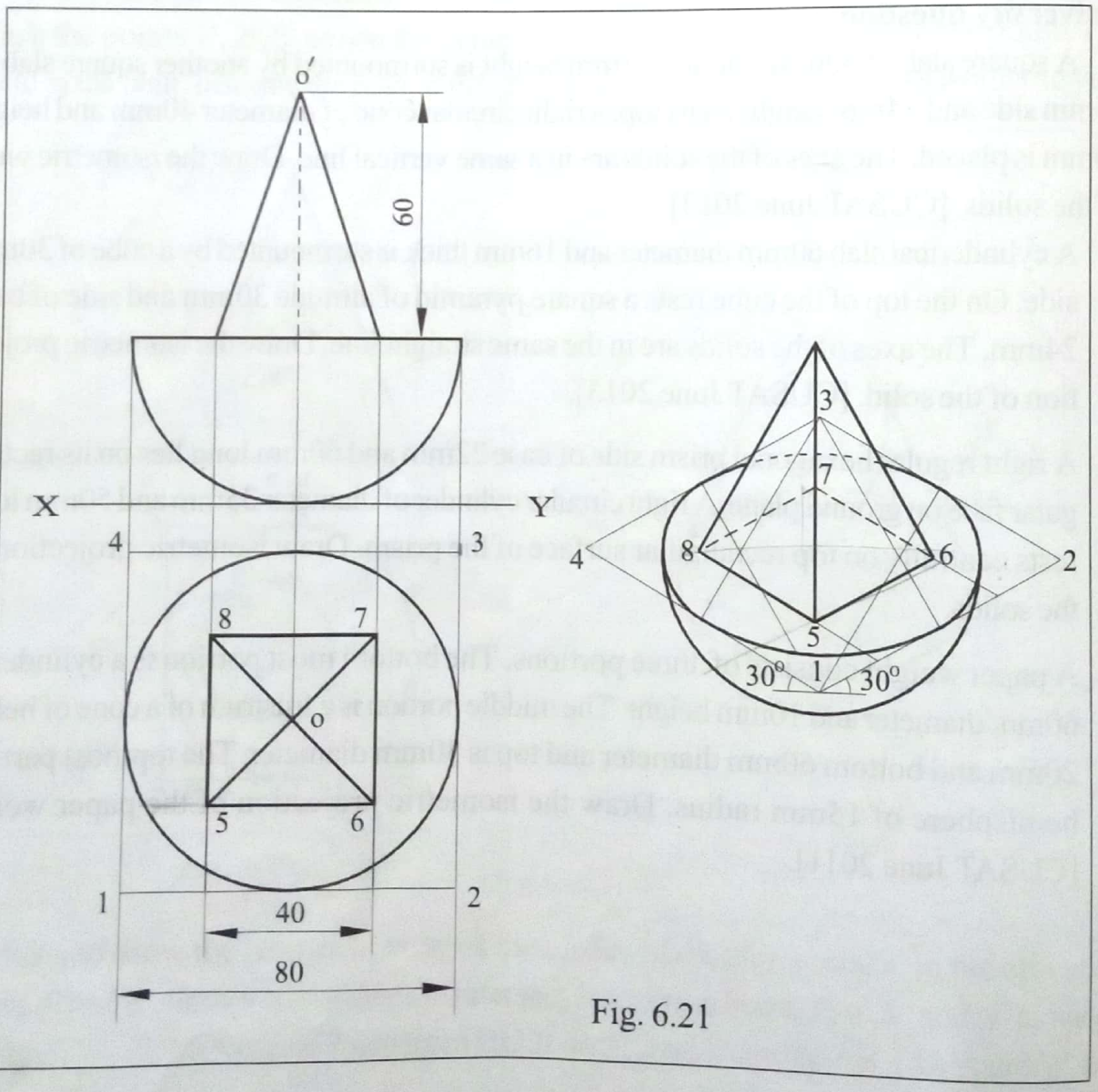

Fig. 6.21

7. Locate the centre of the rhombus 1 2 3 4 and through this point draw lines inclined at 30° with horizontal (lines parallel to 1-2 and 1-4)
8. On these lines locate points such that the distance of these points from the centre is equal to half of the isometric length of side of square pyramid.
9. Draw lines inclined at 30° from the end point of the lines to obtain the isometric projection of the base of pyramid.
10. Mark the midpoint of this rhombus and draw the vertical line o_1o equal to the isometric length of height of axis.
11. Complete the drawing as shown in Fig. 6.21

Problem 6.2

A hexagonal prism having base with a 30mm side and 40mm height is surmounted by a hemisphere such that the hemisphere is touching all the edges of the top face. Draw the isometric view of the arrangement.

Solution

1. Draw the plan and elevation of the combination of solids.
2. Enclose the the hexagon in a rectangle 1 2 3 4 and the circle in a square 5 6 7 8
3. Draw the isometric view of rectangle 1 2 3 4 and complete the isometric view of the hexagonal prism.
4. Locate the points 5678 and construct the ellipse using four contre method.
5. Draw a semicircle with the major axis of this ellipse as diameter.

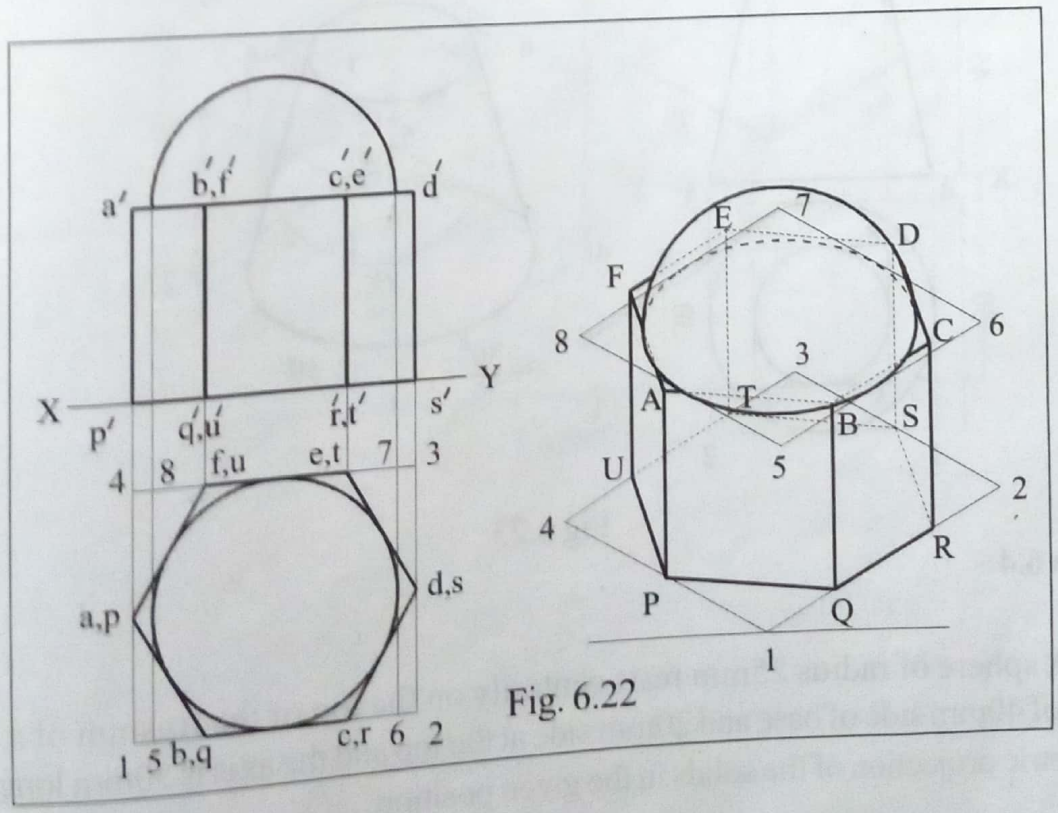

Fig. 6.22

Problem 6.3

A frustum of a cone of base diameter 50 mm. top diameter 30 mm and height 45 mm is resting upon its base on HP. Draw the isometric projection of the frustum.

Solution

1. Draw the XY line and draw the plan and elevation of the frustrum of the cone. The top view is two concentric circles of radius 25mm and 15mm.
2. Enclose these circles in squares and mark the points 1, 2, 3, 4 and 5, 6, 7, 8 as shown in Fig 6.23
3. Draw the isometric scale
4. In the isometric projection of the square 1, 2, 3, 4 construct an ellipse using four centre method.
5. Locate the centre of this rhonbus o_1 and form o_1 draw a vertical line o_1-o, of length equal to the isonetric length of 45mm
6. From o, draw lines parallel to 1-2 and 1-4 (30^0 inclined) of length equal to the isometric length of 30mm. Complete the rhombus 5678 and draw an ellipse using four centre method.
7. Draw two lines tangentical to the two ellipses and complete the drawing.

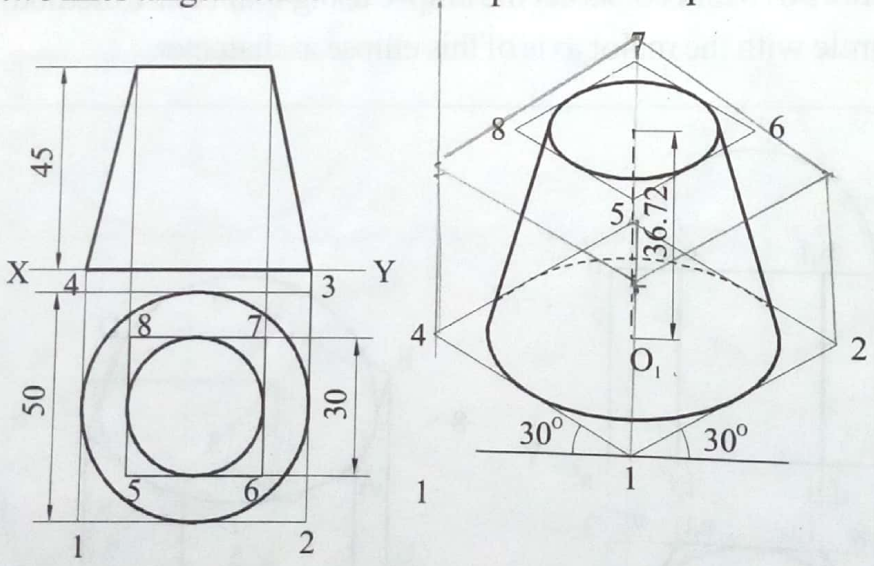

Fig 6.23

Problem 6.4

A sphere of radius 25mm rests centrally on the top of the frustum of a square pyramid of 40mm side of base and 20mm side at the top and the axis is 50mm long. Draw the isometric projection of the solids in the given position.

Solution

1. Draw the plan and elevation of the combination of solids.
2. In the plan mark points 1 2 3 4 and 5 6 7 8.
3. Draw the isometric projection of square 1 2 3 4.
4. Draw the isometric projection of square 5 6 7 8.
5. From the centre of rhombus 5 6 7 8, draw a vertical line of length equal to the isometric length of 25mm.
6. Draw a circle of radius 25mm with the top end of this line as centre.

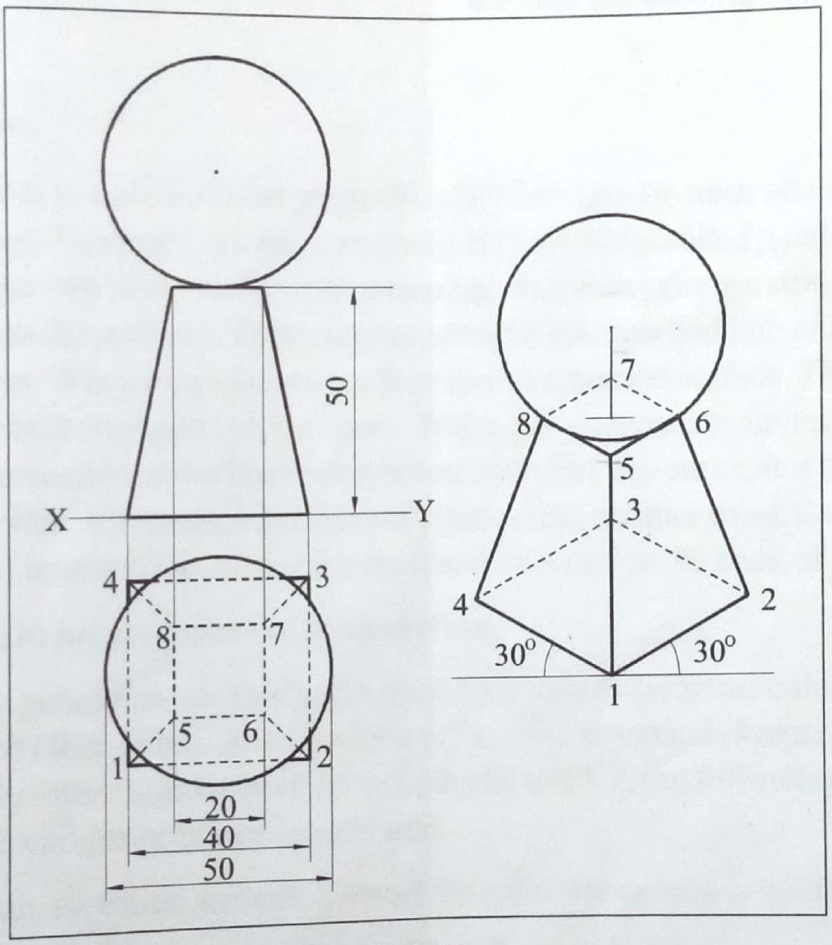

Fig 6.23