

13. Surface Areas and Volumes

(A) RIGHT CIRCULAR CYLINDER:

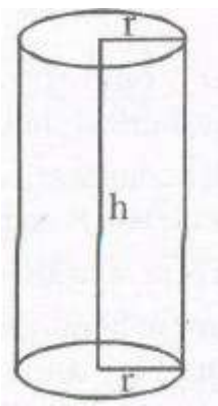
A right circular cylinder is solid generated by the revolution of a rectangle about of its sides.

NOTE : If a paper, cylinder open at both the ends is cut along a vertical line on the curved surface and stretched on a plane surface, we obtain a rectangle of length i.e., $27\pi r$ and breadth= Height of cylinder h .

So, curved surface area (C.S.A) or lateral surface area = $2\pi r * \text{height}$

Important Formula For Cylinder

1. C. S. A of cylinder = (Perimeter of base) * Height = $2\pi rh$



2. Area of each end of cylinder = $2\pi r^2$

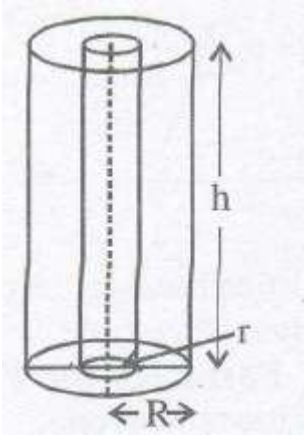
3. Total surface area (including both circular ends) = $2\pi rh + 2\pi r^2 = 27\pi r(h + r)$

4. Volume of cylinder — $\pi r^2 h = [(\text{Area of base}) * \text{height}]$

Hollow Cylinder's formulae e.g., (Rubber tubes pipes, etc.)

1. Volume of material = Exterior volume — Interior volume = $\pi R^2 h - \pi r^2 h = \pi h(R^2 - r^2)$

2. C. S. A or L. S. A = external surface area + internal surface area



$$= 2\pi Rh + 2\pi rh$$

3. T. S. A. of hollow cylinder = C. S. A + 2 (area of base ring)

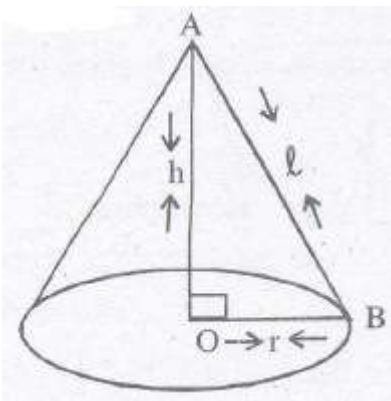
$$= (2\pi Rh + 2\pi rh) + 2(\pi R^2 - \pi r^2)$$

NOTE:

1. Two end faces of right circular cylinder are circles having each area = πr^2
2. Mass of cylinder = Volume * density
3. When rectangular sheet of paper is rolled along its length , we get a cylinder whose base circumference is length of sheet and height is same as breadth of sheet.

(B) CONE

From figure, AO = height of cone and is denoted by 'h'



OB = radius of the base of cone, AB = slant height of a cone (l)

Important Formula Of rt. Circular Cone :

1. Volume of cone = $1 / 3 \pi r^2 h$

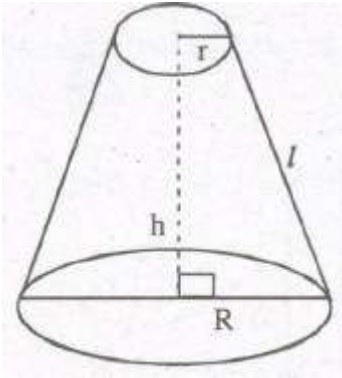
2 C. S. A or L. S. A = $\pi r l$ where slant height

$$= l = \sqrt{r^2 + h^2}$$

3. T. S. A of cone = $\pi r l + \pi r^2$

(C) FRUSTUM OF A CONE

FRUSTUM : A cone is cut by a plane parallel to the base of the cone,



then the portion between the plane and base is called frustum of the cone

Important Formulae for Frustum :

1. Volume of frustum of cone

$$= \frac{\pi h}{3} [R^2 + r^2 + Rr] \text{ cubic unit}$$

2. L. S. A or C. S. A = $\pi l(R + r)$ Sq units where $l^2 = h^2 + (R - r)^2$

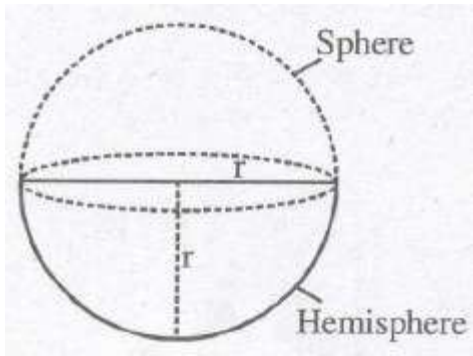
3. T. S. A = $\pi R^2 + \pi r^2 + \pi l(R + r)$ Sq. units.

(Area of base + Area of top + Area of lateral)

4. Slant height (l) = $\sqrt{h^2 + (R - r)^2}$

(D) IMPORTANT FORMULA FOR SPHERE AND HEW-SPHERE

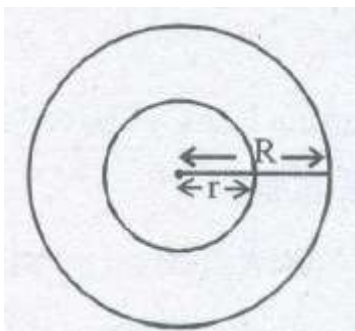
(a) Surface area of sphere = $4\pi r^2$



- (b) Volume of sphere = $\frac{4}{3} \pi r^3$
- (c) Volume of hemisphere = $\frac{2}{3} \pi r^3$
- (d) C.S.A. of hemisphere = $2\pi r^2$
- (e) Total surface area of Hemi-sphere = $2\pi r^2 + \pi r^2 = 3\pi r^2$

(E) IMPORTANT FORMULA FOR SPHERICAL SHELL/ HEMISPHERICAL SHELL

- (a) Outer surface area of spherical shell = $4\pi R^2$
- (b) Inner S.A. of spherical shell = $4\pi r^2$
- (c) Total surface area of spherical shell = $4\pi(R^2 + r^2)$
- (d) Volume of spherical shell of external radius R and internal radius 'r' = $\frac{4}{3}\pi(R^3 - r^3)$
- (e) Outer curved surface area hemispherical shell = $2\pi R^2$



- (f) Inner curved surface area of hemispherical shell = $2\pi r^2$
- (g) Thick hemispherical bowl of external and internal radii R and r,
Total S.A. = $\pi(3R^2 + r^2)$

(h) Volume of hemispherical shell of external radius 'R' and internal radius 'r'
 $= \frac{2}{3}\pi(R^3 - r^3)$.

