SURFACE AREAS AND VOLUMES

Solid Figures: The objects which occupy space (i.e. they are 3 – dimensional figures having width, depth and height.) are called solids. The solid figures are derived from the plane figures.
Example: Sphere, cone, cube, cylinder, rectangular prism, etc.

Surface Area: The sum of the areas of the plane figures making up the boundary of a solid figure is called its **surface area**.

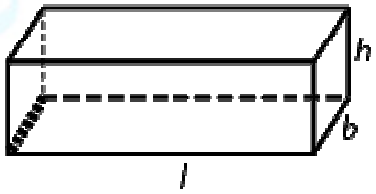
Volume: The measure of part of space occupied by a solid is called its **volume**.

Lateral Surface Area: Lateral surface area is the area of all the sides of an object where we don't have to count the areas of the top and the bottom.
i.e. **Lateral area = Surface area – Area of two ends**

Cuboid: A cuboid is a box-shaped solid object. It has six flat sides and all the angles are right angles. All of its faces are rectangles.

- **Lateral Surface Area =** $2(l+b)h$
- **Total Surface Area =** $2(lb+bh+hl)$
- **Volume of cuboid =** $l \times b \times h$

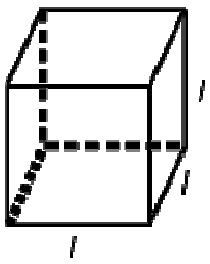
Where, l = length
b = breadth
h = height



Cube: If the faces of a rectangular parallelepiped be squares, then it is called **cube**.

- **Lateral Surface Area =** $4a^2$
- **Total Surface Area =** $6a^2$
- **Volume of cube =** $(a)^3$

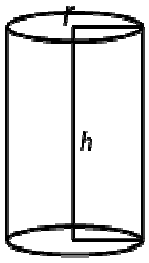
Where, a = side.



Right Circular Cylinder: A solid obtained by revolving a rectangular lamina about one of its sides is called a right circular cylinder.

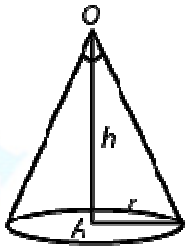
- **Curved Surface Area =** $2\pi rh$
- **Total Surface Area =** $2\pi r(r+h)$
- **Volume =** $\pi r^2 h$

Where, r = radius of circular base.
h = height



SURFACE AREAS AND VOLUMES

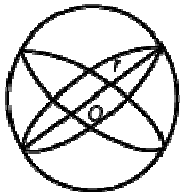
Right Circular Cone: A right circular cone is a solid generated by the revolution of a right angled triangle about one of its side containing the right angle as axis.



- **Curved Surface Area** = πrl
  $= \pi r\sqrt{r^2 + h^2}$
- **Total Surface Area** = $\pi r(l + r)$
- **Volume** = $\frac{1}{3}\pi r^2 h$

Where, r = radius of base.
h = height
l = slant height

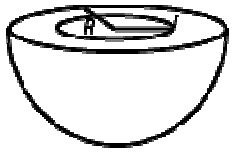
Sphere: A sphere is a solid generated by the revolution of a semi-circle about its diameter.



- **Curved Surface Area** = $4\pi r^2$
- **Total Surface Area** = $4\pi r^2$
- **Volume** = $\frac{4}{3}\pi r^3$

Where, r = radius

Spherical shell: A spherical shell is a generalization of an annulus to three dimensions.

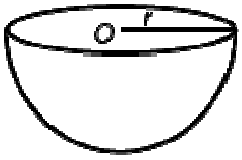


- **Volume** = $\frac{4}{3}\pi(r_1^3 - r_2^3)$

Where, r_1 and r_2 are its **external** and **internal radii** respectively.

- **Total Surface Area** = $4\pi(r_1^2 + r_2^2)$

Hemisphere: A plane passing through the centre of a sphere cuts the sphere in two equal parts each called a hemisphere.



- **Curved Surface Area** = $2\pi r^2$
- **Total Surface Area** = $3\pi r^2$
- **Volume** = $\frac{2}{3}\pi r^3$

Where, r = radius.

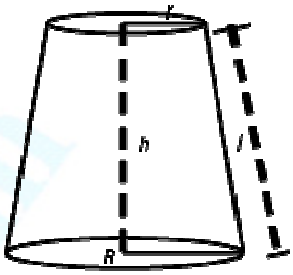
SURFACE AREAS AND VOLUME

Frustum of a Cone: If a cone is cut by a plane parallel to the base of the cone, then the portion between the plane and base is called the **frustum of a cone**.

- **Curved Surface Area** = $\pi l(r_1 + r_2)$

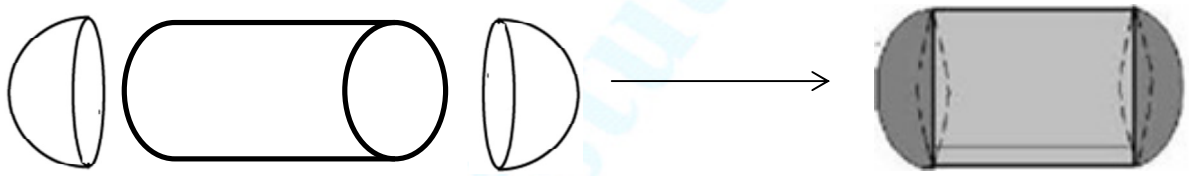
Where, $l = \sqrt{h^2 + (r_1 - r_2)^2}$

- **Total Surface Area** = $\pi l(r_1 + r_2) + \pi(r_1^2 + r_2^2)$
- **Volume** = $\frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$



Where, h = vertical height
l = slant height
r_1, r_2 = radii of the two bases.

Surface Area of a Combination of solid: The total surface area of the new solid is the sum of the curved surface areas of each of the individual parts.
Example:



TSA of new solid = CSA of one hemisphere + CSA of cylinder + CSA of other hemisphere
Where, TSA= Total Surface Area
and CSA=Curved Surface Area

Volume of a Combination of Solids: The volume of combination of the solid formed by joining two basics solids will actually be the sum of the volumes of the constituents.