

Class X: Math
Chapter 13: Surface Areas and Volumes
Chapter Notes

Top Definitions

1. A Cube is a special type of cuboids in which length = breadth = height. Also called an edge of a cube.
2. A sphere is a perfectly round geometrical object in three-dimensional space, such as the shape of a round ball.
3. A cylinder is a solid or a hollow object that has a circular base and a circular top of the same size.
4. A hemisphere is half of a sphere.
5. If a right circular is cut off by a plane parallel to its base, then the portion of the cone between the plane and the base of the cone is called a frustum of the cone.

Top Concepts

1. The total surface area of the solid formed by the combination of solids is the sum of the curved surface area of each of the individual parts.
2. A solid is melted and converted to another, volume of both the solids remains the same, assuming there is no wastage in the conversions. The surface area of the two solids may or may not be the same.
3. A frustum can be obtained by cutting a cone by a plane, parallel to the base of the cone.
4. The solids having the same curved surface do not necessarily occupy the same volume.

Top Formulae

1. Cuboids:

Lateral surface area Or Area of four walls = $2(\ell + b) h$

Total surface area = $2(\ell b + bh + h\ell)$

Volume = $\ell \times b \times h$

Diagonal of a cuboids = $\sqrt{\ell^2 + b^2 + h^2}$

2. Cube

Lateral surface area Or Area of four walls = $4 \times (\text{edge})^2$

Total surface area = $6 \times (\text{edge})^2$

Volume = $(\text{edge})^3$

Diagonal of a cube = $\sqrt{3} \times \text{edge}$.

3. Right circular cylinder:

Area of each end or Base area = πr^2

Area of curved surface or lateral surface area

= perimeter of the base $\times$ height = $2\pi r h$

Total surface area (including both ends)

= $2\pi rh + 2\pi r^2 = 2\pi r (h + r)$

Volume = (Area of the base $\times$ height) = $\pi r^2 h$

4. Right circular hollow cylinder:

Area of curved surface

= (External surface) + (Internal surface)

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

= $[2\pi h(R + r) + 2\pi (R^2 - r^2)]$

= $[2\pi(R + r)(h + R - r)]$

Volume of the material

= (External volume) - (Internal volume)

= $(\pi R^2 h - \pi r^2 h) = \pi h (R^2 - r^2)$

5. Right circular cone:

Slant height (ℓ) = $\sqrt{h^2 + r^2}$

Area of curved surface = $\pi r \ell = \pi r \sqrt{h^2 + r^2}$

Total surface area = Area of curved surface + Area of base

= $\pi r \ell + \pi r^2 = \pi r (\ell + r)$

Volume = $\frac{1}{3} \pi r^2 h$

6. Sphere:

$$\text{Surface area} = 4 \pi r^2$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

7. Spherical shell:

$$\text{Surface area (outer)} = 4\pi R^2$$

$$\begin{aligned} \text{Volume of material} &= \frac{4}{3} \pi R^3 - \frac{4}{3} \pi r^3 \\ &= \frac{4}{3} \pi (R^3 - r^3) \end{aligned}$$

8. Hemisphere:

$$\text{Area of curved surface} = 2 \pi r^2$$

$$\text{Total surface Area} = \text{Area of curved surface} + \text{Area of base}$$

$$= 2 \pi r^2 + \pi r^2$$

$$= 3\pi r^2$$

$$\text{Volume} = \frac{2}{3} \pi r^3$$

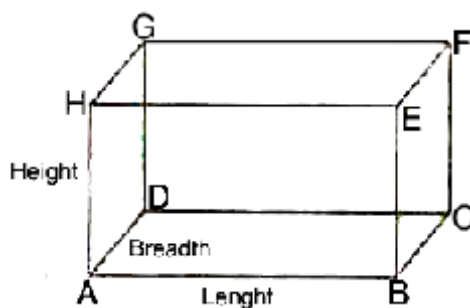
9. Frustum of a cone:

$$\text{Total surface area} = \pi[R^2 + r^2 + \ell(R + r)]$$

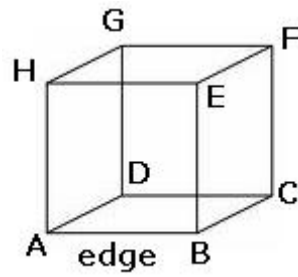
$$\text{Volume of the material} = \frac{1}{3} \pi h[R^2 + r^2 + Rr]$$

Top Diagrams

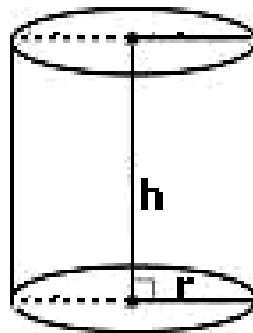
1. Cuboid



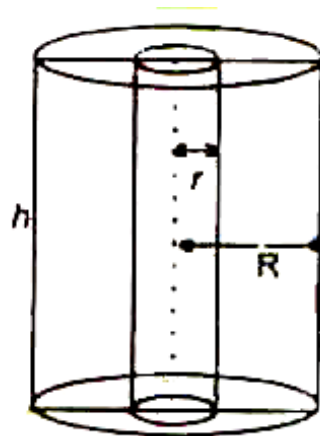
2. Cube



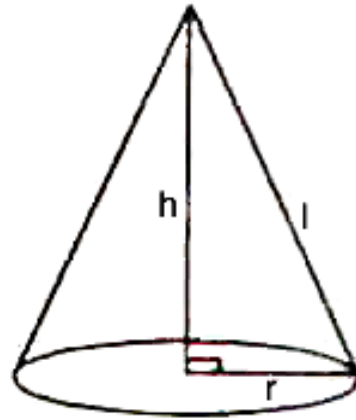
3. Right circular cylinder:



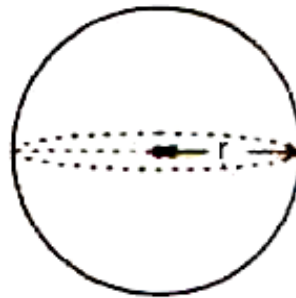
4. Right circular hollow cylinder:



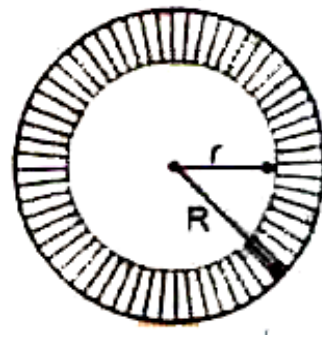
5. Right circular cone:



6. Sphere:



7. Spherical shell:



8. Hemisphere:



9. Frustum of a cone:

