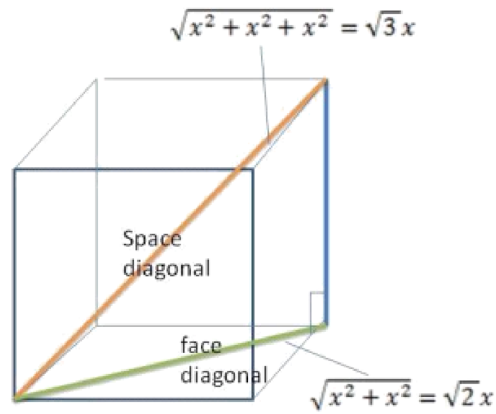
Board –CBSE | **Class –10th** | **Topic – Suraface Area and Volume**

Cube: If the length of each edge of a cube is a units, then,

(i) Total surface area of the cube = $6a^2$ square units

(ii) Volume of the cube = a^3 cubic units.

(iii) Diagonal of the cube = $\sqrt{3}$a units.



Example: If the length of each edge of a cube is 4 cm units then find the total surface area, the volume of the cube, and diagonal of the cube.

Solution:

(i) Total Surface area = $6a^2\ cm^2$

$A = 6(4)^2\ cm^2$

$A = 96\ cm^2$

(ii) Volume of the cube = $a^3\ cm^3$

$V = (4)^3\ cm^3$

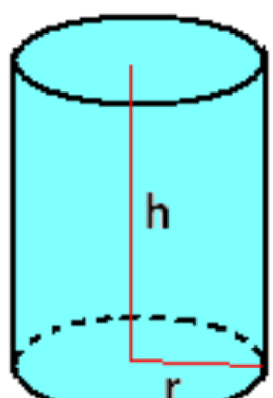
$V = 64\ cm^3$

(iii) Diagonal of the cube = $\sqrt{3}a\ cm$

$l = \sqrt{3}(4)cm$

$l = 6.92\ cm$

Right circular cylinder: If r and h denote respectively the radius of the base and height of a right circular cylinder, then,



(i) Area of each end = πr^2

(ii) Curved surface area of hollow cylinder = $2\pi rh$

(iii) Total surface area = $2\pi r(h + r)$

(iv) Volume = $\pi r^2 h$

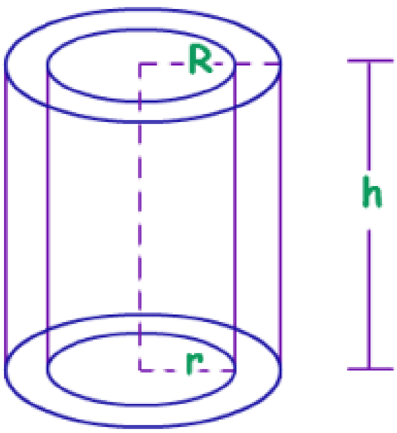
Right Circular Hollow Cylinder: If R and r denote respectively the external and internal radii of a hollow right circular cylinder, then,

(i) Area of each end = $\pi\left(R^2 - r^2\right)$

(ii) Curved surface area of hollow cylinder = $2\pi(R + r)h$

(iii) Total surface area = $2\pi(R + r)(R + h - r)$

(iv) Volume of material = $\pi h\left(R^2 - r^2\right)$



Example: The external and internal radii of a hollow cylinder are 8 cm and 6 cm respectively and height is 10 cm. Find

(i) Curved surface area

(ii) Total surface area

(iii) Volume

Solution:

(i) $Curved\ surface\ area\ = 2\pi h(R + r)$

$A = 2\times3.14\times10\times(8 + 6)$

$A = 879.2\ cm^2$

(ii) Total surface area = $2\pi(R + r)(R + h - r)$

$A = 2\times3.14\times(8 + 6)(8 + 10 - 6)$

$A = 2\times3.14\times14\times12$

$A = 1055.04\ cm^2$

(iii) Volume of material = $\pi h\left(R^2 - r^2\right)$

$V = 3.14\times10\times\left((8)^2 - (6)^2\right)$

$V = 879.2\ cm^3$

Right Circular Cone: If r, h , and l denote respectively the radius of the base, height, and slant height of a right circular cone, then,

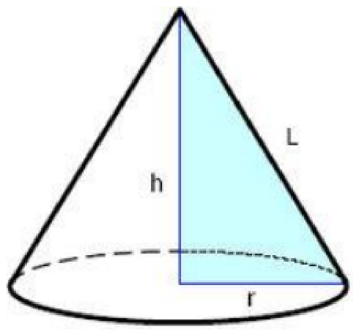
(i) $l^2 = r^2 + h^2$

(ii) Curved surface area $= \pi rl$

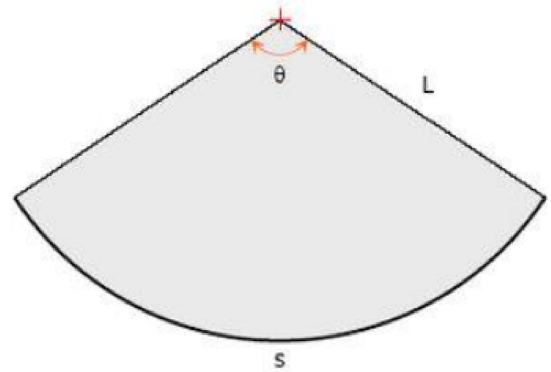
(iii) Total surface area

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

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



Right Circular Cone



Unrolled Lateral Area

Example: A right circular cone is of height $8.4\ cm$, the radius of its base is $2.1\ cm$. Find

(i) Slant height

(ii) Total surface area

(iii) Volume

Solution:

(i) Slant height $1^2 = r^2 + h^2$

$l^2 = (2.1)^2 + (8.4)^2$

$l^2 = 74.97\ cm^2$

$l = 8.66\ cm$

(ii) Total surface area $= \pi r(1 + r)$

$A = 3.14 \times 2.1(8.66 + 2.1)$

$A = 70.95\ cm^2$

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

$V = \frac{1}{3}\times 3.14\times (2.1)^2\times 8.4$

$V = 38.77\ cm^3$

Sphere: For a sphere of radius r, we have

(i) Surface area $= 4\pi r^2$

(ii) Volume $= \frac{4}{3}\pi r^3$.

Example: The radius of a sphere is 4 cm, then find the surface area and volume.

Solution:

(i) Surface area $= 4\pi r^2$

$A = 4\times 3.14\times (4)^2$

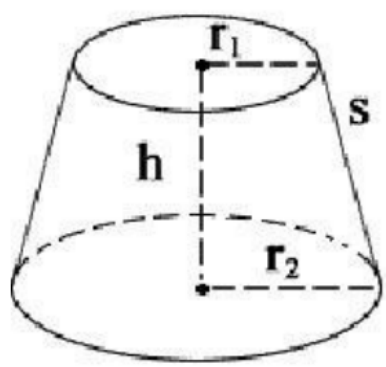
$A = 200.96\ cm^2$

(ii) Volume $= \frac{4}{3}\times \pi r^3$

$V = (4/3)\times 3.14\times (4)^3$

$V = 66.99\ cm^3$

Frustum of a right circular cone: If h is the height, l the slant height, and r_1 and r_2, the radii of the circular bases of a frustum of a cone, then.



(i) Volume of the frustum $= \frac{\pi}{3}\left(r_1^2 + r_1 r_2 + r_2^2\right)h$

(ii) Lateral surface area $= \pi\left(r_1 + r_2\right)l$

(iii) Total surface area $= \pi\left\{\left(r_1 + r_2\right)1 + r_1^2 + r_2^2\right\}$

(iv) Slant height of the frustum $= \sqrt{h^2 + \left(r_1 - r_2\right)^2}$

(v) Height of the cone of which the frustum is a part $= \frac{hr_1}{r_1 - r_2}$

(vi) Slant height of the cone of which the frustum is a part = $\frac{lr_1}{r_1 - r_2}$

(vii) Volume of the frustum = $\frac{h}{3}\left\{A_1 + A_2 + \sqrt{A_1 A_2}\right\}$, where A_1 and A_2 denote the areas of circular bases of the frustum.

Example: If 4 cm is the height, 4. 12 cm is the slant height, and 2. 5 cm and 1. 5 cm, are radii of the circular bases of a frustum of a cone, then find

(i) Volume of the frustum

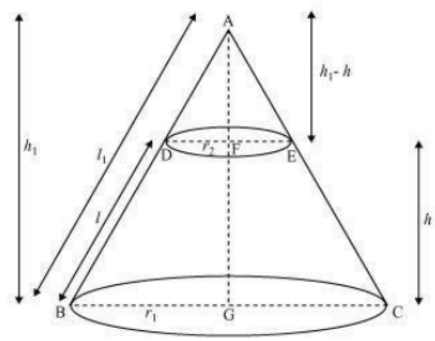
(ii) Lateral surface area

(iii) Total surface area

(iv) Height of the cone of which the frustum is a part

(v) Slant height of the cone of which the frustum is a part

(vi) Volume of the frustum



Solution:

(i) Volume of the frustum = $\frac{\pi}{3}\left(r_1^{\ 2} + r_1 r_2 + r_2^{\ 2}\right)h$

$V = \frac{\pi}{3}\left((2.5)^2 + 2.5\times1.5 + (1.5)^2\right)4$

$V = \frac{\pi}{3}\times12.25\times4$

$V = 51.28\ cm^3$

(ii) Lateral surface area = $\pi\left(r_1 + r_2\right)l$

$A = 22/7\times(2.5 + 1.5)\times4.13$

$A = 51.74\ cm^2$

(iii)Total surface area $= \pi\left(\left(r_1 + r_2\right)1 + r_1^2 + r_2^{\ 2}\right)$

$A = 3.14x\left((2.5 + 1.5)4.13 + (2.5)^2 + (1.5)^2\right)$

$A = 78.56\ cm^2$.

(iv) Height of the cone of which the frustum is a part $H = h\cdot r_1/\left(r_1 - r_2\right)$

$H = 4 \times 2.5/(2.5 - 1.5)$

$H = 10/1$

$H = 10\ cm$

(v) Slant height of the cone of which the frustum is a part = $lr_1/(r_1 - r_2)$

$L = 4.13 \times 2.5/(2.5 - 1.5)$

$L = 10.325\ cm.$

(vi) Volume of the frustum = $\frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$

$A_1 = \pi r_1^2 = 3.14 \times (2.5)^2 = 19.625$

$A_2 = \pi r_2^2 = 3.14 \times (1.5)^2 = 7.065$

$V = 4/3(19.625 + 7.065 + \sqrt{19.625 \times 7.065}$

$V = 4/3(26.69 + \sqrt{138.65}$

$V = 51.28\ cm^3$