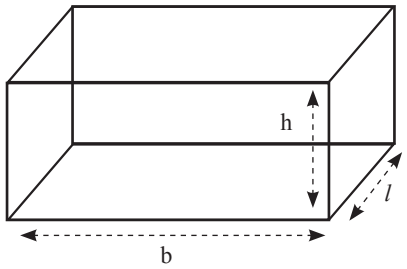
MENSURATION (3-D)

CUBOID (Parallelepiped) घनाभ (समांतर षट्फलक)



1) Volume (आयतन) = Area of base x height

2) Volume = l x b x h

3) Volume = $\sqrt{A_1 \times A_2 \times A_3}$ where A_1, A_2 & A_3 are area of three adjacent faces.

4) Diagonal (विकर्ण) = $\sqrt{l^2 + b^2 + h^2}$

5) Lateral surface Area or Area of four walls (पार्श्वीय सतह का क्षेत्रफल या चारों दीवारों का क्षेत्रफल) = Perimeter of base x height

6) Lateral surface Area = 2 (l + b) h

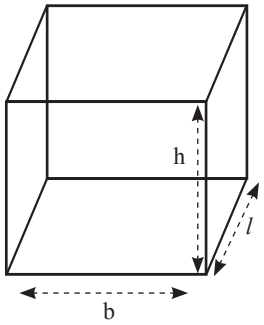
7) Total surface area (सम्पूर्ण सतह का क्षेत्रफल)
= 2 (lb + bh + hl)

8) Total surface Area =
$(l + b + h)^2$ - (diagonal)^2

9) For a box having closed top (ढक्कनदार बॉक्स)
(i) Internal length (भीतरी लम्बाई) =
External length – 2 (thickness of material)
(ii) External length = Internal length +
2 (thickness of material)
(iii) Internal breadth = External breadth -
2 (thickness of material)
(iv) External breadth= Internal breadth+
2 (thickness of material)
(v) Internal height = External height –
2(thickness of material)
(vi) External height = Internal height +
2 (thickness of material)

10) A box having open top (बिना ढक्कन का बॉक्स)
(i) Internal length (भीतरी लम्बाई) =
External length – 2 (thickness of material)
(ii) External length = Internal length +
2 (thickness of material)
(iii) Internal breadth = External breadth -
2 (thickness of material)
(iv) External breadth= Internal breadth+
2 (thickness of material)
(v) Internal height = External height –
(thickness of material)
(vi) External height = Internal height +
(thickness of material)

CUBE (घन / समषट्फलक)



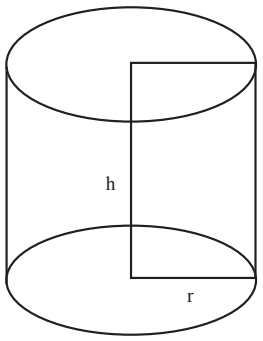
1) Volume = a^3 (a = length of side)

2) Lateral surface Area = $4a^2$

3) Total surface Area = $6a^2$

4) Diagonal = $\sqrt{3}$ a

Right Circular cylinder (लम्ब वृत्तीय बेलन)



1) Volume = Area of base x height

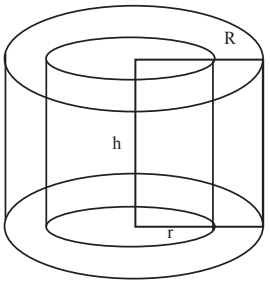
2) Volume = $\pi r^2 h$

3) Curved surface Area (वक्र पृष्ठ क्षेत्रफल) = Perimeter of base x height

4) Curved surface Area = $2\pi rh$

5) Total surface Area = $2\pi rh + 2\pi r^2$
$= 2\pi r (h + r)$

<u>Hollow Cylinder (खोखला बेलन)</u>



1) Thickness of material = R – r

2) Area of each end = $\pi (R^2 – r^2)$

3) External surface Area = $2\pi Rh$

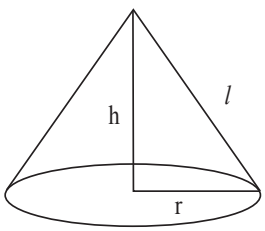
4) Internal surface Area = $2\pi rh$

5) Curved surface Area = $2\pi Rh + 2\pi rh$
$= 2\pi (R + r) h$

6) Total surface Area = $2\pi RH + 2\pi rh$
$+ 2 (\pi R^2 - \pi r^2)$
$= 2\pi (R + r) (R – r + h)$

7) Volume of material =
External volume – Internal Volume
$= \pi R^2 h – \pi r^2 h = \pi (R^2 – r^2) h$

<u>Right Circular Cone</u> (लंब वृत्तीय शंकु)



h = height of cone
ℓ = slant height (तिरछी ऊँचाई) of cone
r = radius of cone

1) Slant height = $\sqrt{h^2 + r^2}$

2) Volume = $\frac{1}{3} \times$ Area of base x height

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

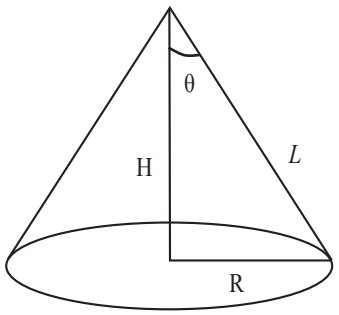
4) Curved surface Area = $\frac{1}{2} \times$ Perimeter of base x slant height = $\pi r \ell$

5) Total surface Area = $\pi r \ell + \pi r^2$
$= \pi r (\ell + r)$

6) If a cone is formed by sector of a circle then
(i) Slant height of cone
= Radius of sector
(ii) Circumference of base of cone
= length of arc of sector

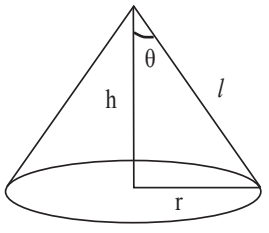
7) Two cones having equal vertex angle

<u>Cone – I</u>



Volume of cone-I = A
Curved surface Area of cone-I = B

<u>Cone – II</u>



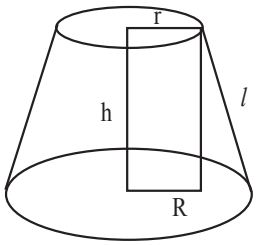
Volume of cone-II = a
Curved surface Area of cone-II = b

(i) $\frac{H}{h} = \frac{L}{l} = \frac{R}{r}$

(ii) $\frac{A}{a} = \frac{H^3}{h^3} = \frac{L^3}{l^3} = \frac{R^3}{r^3}$

(iii) $\frac{B}{b} = \frac{H^2}{h^2} = \frac{L^2}{l^2} = \frac{R^2}{r^2}$

Frustum of Cone (छिन्नक)



1) Slant height of frustum = $\sqrt{h^2 + (R-r)^2}$

2) Volume = $\frac{1}{3} \times \pi$ ($R^2 + r^2 + R \cdot r$) h

3) Volume = $\frac{h}{3}$ ($A_1 + A_2 + \sqrt{A_1 A_2}$)

Where A_1 & A_2 are area of base and top.

4) Curved surface Area = π (R + r) l

5) Total surface Area = π (R + r) l +

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

6) Height of cone of which frustum is a part = $\frac{hR}{R-r}$

7) Slant height of cone of which frustum is a part

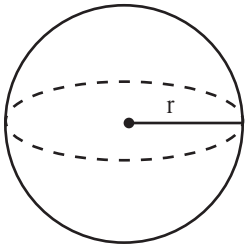
= $\frac{lR}{R-r}$

8) Height of cone of upper part of frustum = $\frac{hr}{R-r}$

9) Slant height of cone of upper part of

frustum = $\frac{lR}{R-r}$

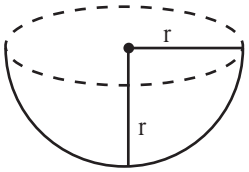
SPHERE (गोला)



1) Volume = $\frac{4}{3}$ π r^3

2) Surface Area = 4 πr^2

HEMISPHERE (अर्द्धगोला)

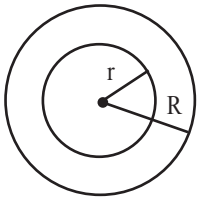


1) Volume = $\frac{2}{3}$ πr^3

2) Curved surface Area = $2\pi r^2$

3) Total surface Area = $3\pi r^2$

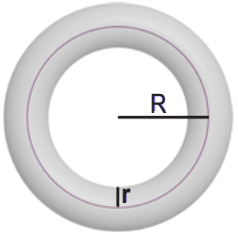
SPHERICAL SHELL (गोलाकार खोल)



1) Volume of material = $\frac{4}{3}$ π ($R^3 - r^3$)

2) Outer surface Area = $4\pi R^2$

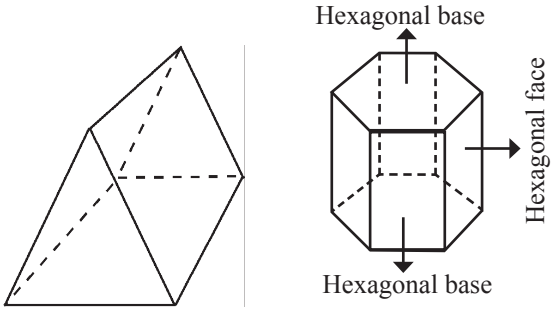
TORUS



1) Volume = 2 x π^2 x R x r^2

2) Surface Area = 4 x π^2 x R x r

PRISM (प्रिज्म)

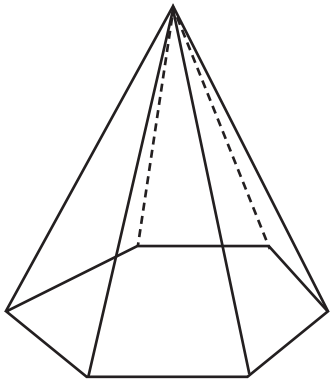


1) Volume = Area of base x height

2) Lateral surface Area = Perimeter of base x height

3) Total surface Area = Lateral surface area + 2 x Area of base

PYRAMID

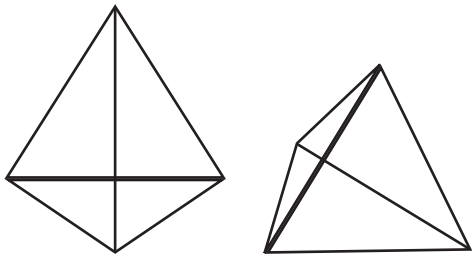


1) Volume = $\frac{1}{3}\times$ Area of base x height

2) Lateral surface Area = $\frac{1}{2}\times$ Perimeter of base x slant height

3) Total surface Area = Lateral surface Area + Area of base

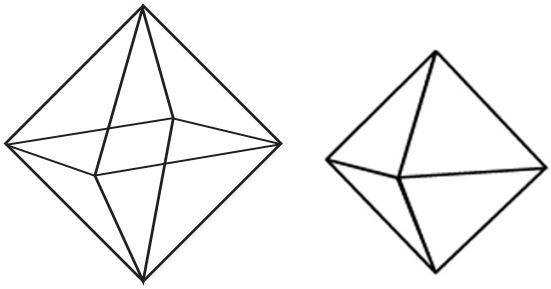
TETRAHEDRON (समचतुष्फलक)



1) Volume = $\frac{\sqrt{2}}{12}a^3$

2) Total surface Area = $\sqrt{3}$ a^2

OCTAHEDRON (समअष्टफलक)



1) Volume = $\frac{\sqrt{2}}{3}$ a^3

2) Total surface Area = $2\sqrt{3}$ a^2