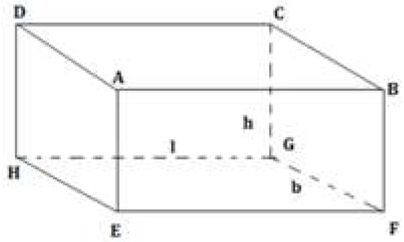
Surface Area and Volume

Cuboid

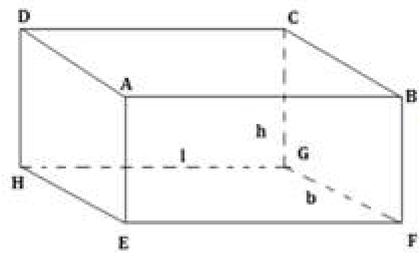
Cuboid is a three dimensional Shape.
Cuboid is made from six rectangular faces, which are placed at right angles.
The total surface area of a cuboid is equal to the sum of the areas of its six rectangular faces.

Total Surface Area of a Cuboid



Consider a cuboid whose length is l cm, breadth is b cm and height h cm.
Area of face ABCD = Area of Face EFGH $= (l \times b)cm^2$
Area of face AEHD = Area of face BFGC $= (b \times h)cm^2$
Area of face ABFE = Area of face DHGC $= (l \times h)cm^2$
Total surface area (TSA) of cuboid = Sum of the areas of all its six faces
$= 2(l \times b) + 2(b \times h) + 2(l \times h)$
TSA (cuboid)= 2(lb + bh +lh)

Lateral Surface Area of a Cuboid

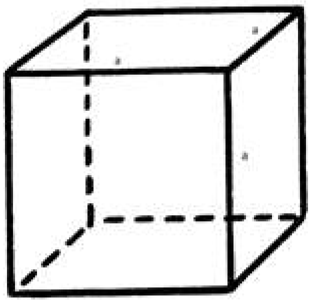


Lateral surface area (LSA) is the area of all the sides apart from the top and bottom faces.
Lateral surface area of the cuboid
= Area of face AEHD + Area of face BFGC + Area of face ABFE + Area of face DHGC
$= 2(b \times h) + 2(l \times h)$
LSA (cuboid) = 2h(l + b)

Cube

A **cuboid** whose length, breadth and height are all **equal**, is called a **cube**. It is a three-dimensional shape bounded by **six equal squares**. It has 12 edges and 8 vertices.

Total Surface Area of a cube



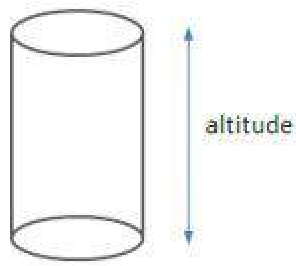
For cube, length = breadth = height
Suppose length of an edge = a
Total surface area(TSA) of the cube $= 2(a \times a + a \times a + a \times a)$
TSA(cube) $= 2 \times (3a^2) = 6a^2$

Lateral Surface area of a cube

Lateral surface area (LSA) is the area of all the sides apart from the top and bottom faces.
Lateral surface area of cube = $2(a \times a + a \times a) = 4a^2$

Right Circular Cylinder

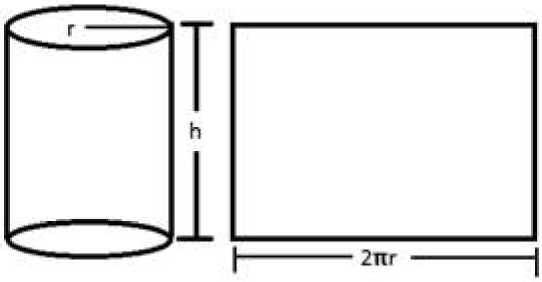
A right circular cylinder is a closed solid that has two parallel circular bases connected by a curved surface in which the two bases are exactly over each other and the axis is at right angles to the base.



Right Cylinder

Curved Surface area of a right circular cylinder

Take a cylinder of base radius *r* and height *h* units. The curved surface of this cylinder, if opened along the diameter (d = 2r) of the circular base can be transformed into a rectangle of length $2\pi r$ and height h units. Thus,



Curved surface area(CSA) of a cylinder of base radius r and height $h = 2\pi \times r \times h$

Total surface area of a right circular cylinder

Total surface area(TSA) of a cylinder of base radius r and height h = $2\pi \times r \times h +$ area of two circular bases

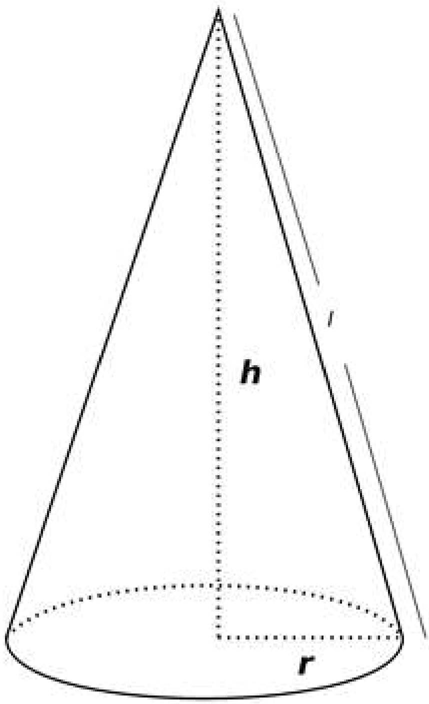
$\Rightarrow \text{TSA} = 2\pi \times r \times h + 2 \times \pi r^2$

$\Rightarrow \text{TSA} = 2\pi r(h + r)$

Right Circular Cone

A right circular cone is a circular cone whose axis is perpendicular to its base.

Relation between slant height and height of a right circular cone

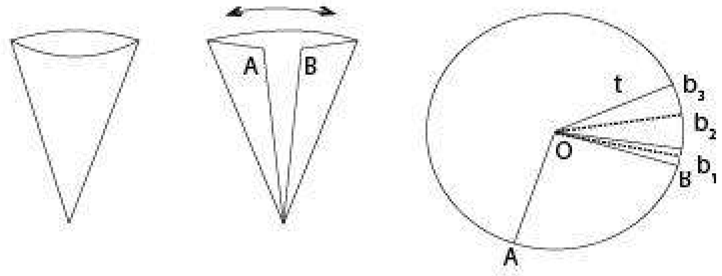


A right-circular cone.

The relationship between slant height(l) and height(h) of a right circular cone is:
$l^2 = h^2 + r^2$ (Using Pythagoras Theorem)
Where r is the radius of the base of the cone.

Curved Surface Area of a Right Circular Cone

Consider a right circular cone with slant length l and radius r.
If a perpendicular cut is made from a point on the circumference of the base to the vertex and the cone is opened up, a sector of a circle with radius l is produced as shown in the figure below:



Label A and B and corresponding b1, b2 ...bn at equal intervals, with O as the common vertex. The Curved surface area(CSA) of the cone will be the sum of areas of the small triangles : $\frac{1}{2} \times (b1 + b2 \ldots bn) \times l$
$(b1 + b2 \ldots bn)$ is also equal to circumference of base $= 2\pi r$
CSA of right circular cone $= \frac{1}{2} \times (2\pi r) \times l = \pi rl$ (On substituting the values)

Total Surface Area of a Right Circular Cone

Total surface area(TSA) = Curved surface area(CSA) $+$ area of base $= \pi rl + \pi r^2 = \pi r(l + r)$

Sphere

A sphere is a three-dimensional figure (solid figure), which is made up of all points in the space which lie at a constant distance called the radius, from a fixed point called the center of the sphere.

Surface area of a Sphere

The surface area of a sphere of radius r = 4 times the area of a circle of radius $r = 4 \times (\pi r^2)$
For a sphere Curved surface area(CSA) = Total Surface area(TSA) = $4\pi r^2$

Volume of a Cuboid

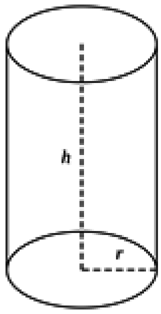
The volume of a cuboid is the product of its dimensions.
Volume of a cuboid = $length \times breadth \times height = lbh$
Where l is the length of the cuboid, b is the breadth, and h is the height of the cuboid.

Volume of a Cube

Volume of a cube = $base\ area \times height.$
Since all dimensions are identical, volume of the cube $= a^3$
Where a is the length of the edge of the cube.

Volume of a Right Circular Cylinder

Volume of a right circular cylinder is equal to base area $\times$ its height.



Volume of cylinder $= \pi r^2 h$
Where r is the radius of the base of the cylinder and h is the height of the cylinder.

Volume of a Right Circular Cone

The volume of a Right circular cone is $\frac{1}{3}$ times the volume of a cylinder with same radius and height. In other words, three cones make one cylinder of the same height and base.
Volume of right circular cone $= \frac{1}{3}\pi r^2 h$
Where r is the radius of the base of the cone and h is the height of the cone.

Volume of a Sphere

The volume of a sphere of radius $r = \frac{4}{3}\pi r^3$

Volume and Capacity

The **volume** of an object is the measure of the space it occupies and the **capacity** of an object is the volume of substance its interior
can accommodate.The unit of measurement of either volume or capacity is cubic unit.