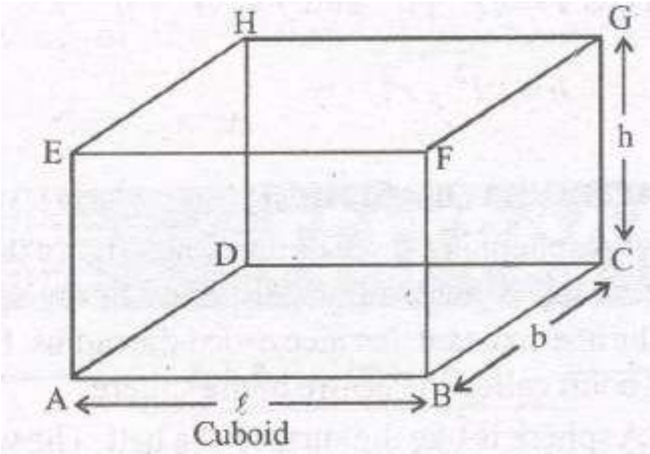
Maths Class 9 Notes for Volume and Surface Area

SOLIDS : The bodies occupying space (i.e. have 3-dimension) are called solids such as a cuboid, a cube, a cylinder, a cone, a sphere etc.

VOLUME (CAPACITY) OFA SOLID: The measure of space occupied by a solid-body is called its volume. The units of volume are cubic centimeters (written as cm3) or cubic meters (written as m3).

CUBOID: A solid bounded by six rectangular faces is called a cuboid.



In the given figure, ABCDEFGH is a cuboid whose

(i) **6 faces are :**
ABCD, EFGH, ABFE, CDHQ ADHE, and BCGF Out of these, the four faces namely ABFE, DCGH, ADHE and BCGF are called lateral faces of the cuboid.

(ii) **12 edges are :**
AB, BC, CD, DA, EF, FG GH, HE, CG BF, AE and DH

(iii) **8 vertices are :**
A, B, C, D, E, F, and H.

Remark : A rectangular room is in the form of a cuboid and its 4 walls are its lateral surfaces.

Cube : A cuboid whose length, breadth and height are all equal, is called a cube.

A cube has 6 faces, each face is square, 12 edges, all edges are of equal lengths and 8 vertices.

SURFACE AREA OF A CUBOID:

Let us consider a cuboid of length = 1 units
Breadth = b units and height = h units

Then we have :
(i) Total surface area of the cuboid
=2(l * b + b * h + h * l) sq. units

(ii) Lateral surface area of the cuboid
= [2 (1 + b)* h] sq. units

(iii) Area of four walls of a room = [2 (1 + b)* h] sq. units.
= (Perimeter of the base * height) sq. units

(iv) Surface area of four walls and ceiling of a room
= lateral surface area of the room + surface area of ceiling
=2(1+b)*h+l*b

(v) Diagonal of the cuboid = $\sqrt{l^2 + b^2 + h^2}$

SURFACE AREA OF A CUBE : Consider a cube of edge a unit.

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

(ii) Lateral surface area of the cube = $4a^2$ sq. units.

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

SURFACE AREA OF THE RIGHT CIRCULAR CYLINDER

Cylinder: Solids like circular pillars, circular pipes, circular pencils, road rollers and gas cylinders etc. are said to be in cylindrical shapes.

Curved surface area of the cylinder
= Area of the rectangular sheet
= length * breadth
= Perimeter of the base of the cylinder * height
= $2\pi r$ * h

Therefore, curved surface area of a cylinder = $2\pi rh$

Total surface area of the cylinder =$2\pi rh + 2\pi r^2$

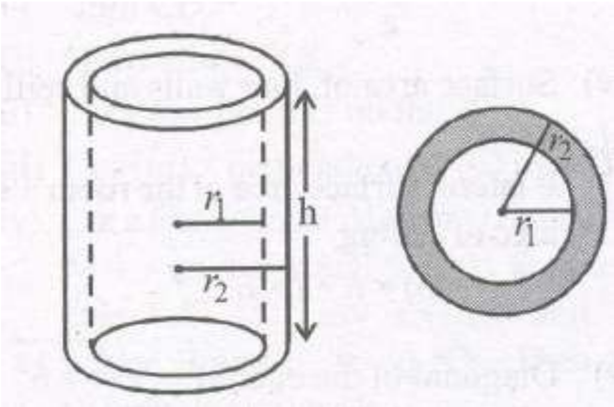
So total area of the cylinder=$2\pi r(r + h)$

Remark : Value of TE approximately equal to 22 / 7 or 3.14.

APPLICATION:

If a cylinder is a hollow cylinder whose inner radius is r1 and outer radius r2 and height h then

Total surface area of the cylinder
$= 2\pi r_1 h + 2\pi r_2 h + 2\pi(r^2{}_2 - r^2{}_1)$
$= 2\pi(r_1 + r_2)h + 2\pi\,(r_2 + r_1)\,(r_2 - r_1)$
$= 2\pi(r_1 + r_2)\,[h + r_2 - r_1]$



SURFACE AREA OF A RIGHT CIRCULAR CONE

RIGHT CIRCULAR CONE

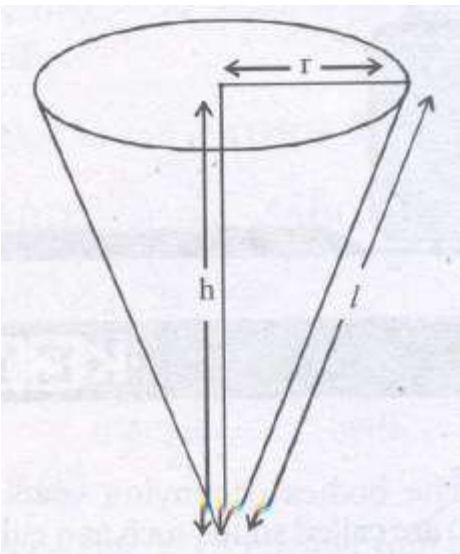
A figure generated by rotating a right triangle about a perpendicular side is called the right circular cone.

SURFACE AREA OF A RIGHT CIRCULAR CONE:

curved surface area of a cone = 1 / 2 * l * 2πr = πrl

where r is base radius and l its slant height

Total surface area of the right circular cone



= curved surface area + Area of the base

= $\pi rl + \pi r2 = \pi r(l + r)$

Note : $l^2 = r^2 + h^2$

By applying Pythagorus

Theorem, here h is the height of the cone.

Thus $l = \sqrt{r^2 + h^2}$ and $r = \sqrt{l^2 - h^2}$

$h = \sqrt{l^2 + r^2}$

SURFACE AREA OF A SPHERE

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 centre of the sphere.

Note : A sphere is like the surface of a ball. The word solid sphere is used for the solid whose surface is a sphere.

Surface area of a sphere: The surface area of a sphere of radius r = 4 x area of a circle of radius $r = 4 * \pi r^2$
$= 4\pi r^2$

Surface area ofa hemisphere = $2\pi r^2$

Total surface area of a hemisphere = $2\pi r^2 + \pi r^2$
$= 3\pi r^2$

Total surface area of a hollow hemisphere with inner and outer radius r_1 and r_2 respectively
$= 2\pi r^2{}_1 + 2\pi r^2{}_2 + \pi(r^2{}_2 — r^2{}_1)$
$= 2\pi(r^2{}_1 + r^2{}_2) + \pi(r^2{}_2 —r^2{}_1)$

VOLUMES

VOLUME OF A CUBOID :

Volume : Solid objects occupy space.
The measure of this occupied space is called volume of the object.

Capacity of a container : The capacity of an object is the volume of the substance its interior can accommodate.

The unit of measurement of either of the two is cubic unit.

Volume of a cuboid : Volume of a cuboid =Area of the base * height V=l * b * h

So, volume of a cuboid = base area * height = length * breadth * height

Volume of a cube : Volume of a cube = edge * edge * edge = a^3
where a = edge of the cube

VOLUME OF A CYLINDER

Volume of a cylinder = $\pi r^2 h$

volume of the hollow cylinder $\pi r^2{}_2 h — \pi r^2{}_1 h$
$= \pi(r^2{}_2 – r^2{}_1)h$

VOLUME OF A RIGHT CIRCULAR CONE

volume of a cone = $1 / 3\ \pi r^2 h$, where r is the base radius

and h is the height of the cone.

VOLUME OF A SPHERE

volume of a sphere the sphere = $4 / 3\ \pi r^3$, where r is the radius of the sphere.

Volume of a hemisphere = $2 / 3\ \pi r^3$

APPLICATION : Volume of the material of a hollow sphere with inner and outer radii r_1 and r_2 respectively

$= 4 / 3\ \pi r^3{}_2 – 4 / 3\ \pi r^3{}_1 = 4 / 3\pi(r^3{}_2 – r^3{}_1)$

Volume of the material of a hemisphere with inner and

outer radius r_1 and r_2 respectively = $2 / 3\pi(r^3{}_2 – r^3{}_1)$