

CHAPTER-13

SURFACE AREAS AND VOLUMES

DAY 1

INTRODUCTION

We have already studied in class IX about cuboids, cubes, right circular cylinders, right circular cones, spheres, hemispheres etc. we also derived formulae for surface area and volumes of these solids.

In our day-to-day life, we come across a number of solids which are either a part of such a solid or a combination of them. e.g. a bucket or a tumbler is a part of right circular cone and a cone and a conical circus tent with cylindrical base is a combination of a right circular cylinder and a right circular cone.

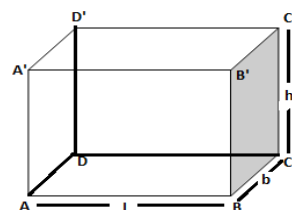
In this chapter we will discuss with the solids which are combinations of two and problems involving converting one type of metallic solids into another and frustum of a cone.

Before we do that let us recall, what we have done in earlier classes:

FORMULAE FOR SURFACE AREA AND VOLUME OF DIFFERENT SOLIDS:-

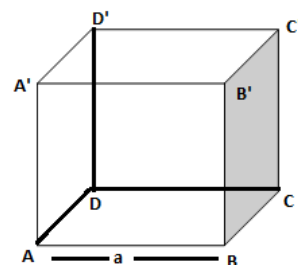
CUBOID

1. Lateral (Curved) Surface Area = (Perimeter of **Base**) \times height
Or Area of four walls = (Perimeter of **Rectangle**) \times height
 $= 2(l + b) \times h$
2. Total Surface Area = Lateral Surface Area + 2(Area of **Base**)
 $= 2(l + b)h + 2lb = 2(lb + bh + hl)$
3. Volume = Area of **Base** \times height
 $= lb \times h = lbh$



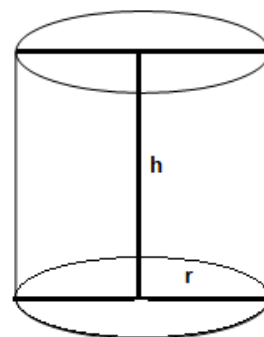
CUBE

1. Lateral (Curved) Surface Area = (Perimeter of **Base**) \times height
 $=$ (Perimeter of **Square**) \times height
 $= 4a \times a = 4a^2$
2. Total Surface Area = Lateral Surface Area + 2 \times (Area of **Base**)
 $= 4a^2 + 2a^2 = 6a^2$
3. Volume = (Area of **Base**) \times height
 $= (a \times a) \times a = a^3$



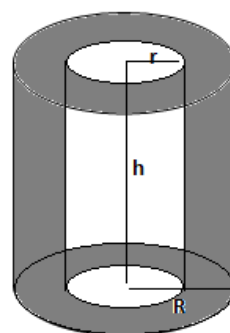
RIGHT CIRCULAR CYLINDER

1. Lateral (Curved) Surface Area = (Perimeter of **Base**) \times height
= (Perimeter of **Circle**) \times height
= $2\pi r \times h = 2\pi rh$
2. Total Surface Area = Lateral Surface Area + 2 \times (Area of **Base**)
= $2\pi rh + 2\pi r^2 = 2\pi r(h + r)$
3. Volume = (Area of **Base**) \times height
= $\pi r^2 \times h = \pi r^2 h$



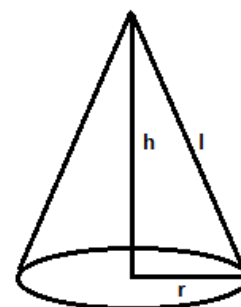
HOLLOW CYLINDER (CYLINDRICAL SHELL)

- Area of each **Base** (Circular Ring) = $\left(\text{Area of Outer Circle} \right) - \left(\text{Area of Inner Circle} \right)$
= $\pi R^2 - \pi r^2$
1. Lateral Surface Area = $\left(\text{External Surface Area} \right) + \left(\text{Internal Surface Area} \right)$
= $2\pi Rh + 2\pi rh$
 2. Total Surface Area = Lateral Surface Area + 2 (Area of base)
= $2\pi Rh + 2\pi rh + 2(\pi R^2 - \pi r^2)$
 3. Volume = Outer Volume - Inner Volume
= $\pi R^2 h - \pi r^2 h = \pi h(R^2 - r^2)$



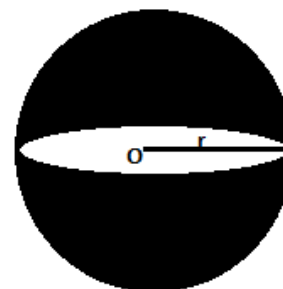
RIGHT CIRCULAR CONE

1. Lateral Surface Area = πrl where $l^2 = h^2 + r^2$
2. Total Surface Area = Lateral Surface Area + Area Of Base
= $\pi rl + \pi r^2 = \pi r(l + r)$
3. Volume = $\frac{1}{3} \times (\text{Area Of Base}) \times \text{height}$
= $\frac{1}{3} \pi r^2 \times h = \frac{1}{3} \pi r^2 h$



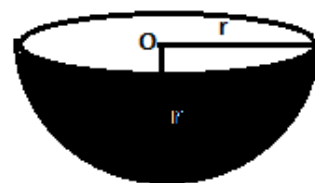
SPHERE

1. Lateral or Total Surface Area = $4\pi r^2$
2. Volume = $\frac{4}{3} \pi r^3$



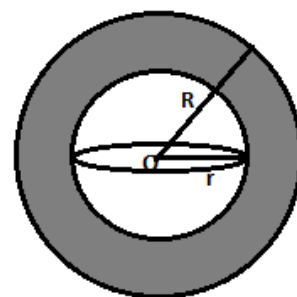
HEMI-SPHERE

1. Lateral Surface Area = $2\pi r^2$
2. Total Surface Area = Lateral Surface area + Area Of Base
 $= 2\pi r^2 + \pi r^2 = 3\pi r^2$
3. Volume = $\frac{2}{3}\pi r^3$



SPHERICAL SHELL

1. Lateral or Surface Area = $4\pi R^2 + 4\pi r^2$
2. Volume = $\frac{4}{3}\pi R^3 - \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(R^3 - r^3)$



	Volume	Curved Surface Area	Total Surface Area
1. Cube	$(side)^3$	$4(side)^2$	$6(side)^2$
2. Cuboid	$l \times b \times h$	$2(l + b)h$	$2(lb + bh + hl)$
3. Cylinder	$\pi r^2 h$	$2\pi r h$	$2\pi r(h + r)$
4. Cone	$\frac{1}{3}\pi r^2 h$	$\pi r l$	$\pi r(l + r)$
5. Sphere	$\frac{4}{3}\pi r^3$	$4\pi r^2$	$4\pi r^2$
6. Hemi Sphere	$\frac{2}{3}\pi r^3$	$2\pi r^2$	$3\pi r^2$
7. Hollow Cylinder	$\pi(R^2 - r^2)h$	$2\pi R h + 2\pi r h + 2\pi(R^2 - r^2)$	

1. Find the area of the base of cylinder.

Sol:- The base of cylinder is *a circle*

$$\therefore \text{Area of the base of cylinder} = \text{Area of circle} = \pi r^2$$

2. If side of a cube is 6 cm then find the total surface area of the cube.

Sol:- Total surface area of the base of cube = $6(\text{side})^2 = 6 \times (6)^2 = 6 \times 6 \times 6 = 216\text{cm}^3$

3. The sides of a cuboid are 4cm, 5cm and 6cm, find the volume.

Sol:- Volume of the cuboid = $l \times b \times h = 4 \times 5 \times 6 = 120\text{cm}^3$

4. The radius of a hemisphere is 7 m, find the surface area of the hemisphere.

Sol:- \therefore Surface area of the Hemisphere = $3\pi r^2 = 3 \times \frac{22}{7} \times 7 \times 7 = 616\text{m}^2$

5. The volume of a cube is 125m^3 , find the side of the cube.

Sol:- \therefore Surface area of the Hemisphere = $3\pi r^2 = 3 \times \frac{22}{7} \times 7 \times 7 = 616\text{m}^2$

EXERCISE

1. Find the area of the base of cylinder if radius is 7 cm and height is 10 cm.
2. Find the surface area of the cube if its side is 8 cm.
3. Find the slant height of the cone if the radius is 5 cm and height is 12 cm.
4. Find the area of the base if sides of a cuboid are 3cm, 4cm and 5cm.
5. Find the volume of the sphere if radius is 10 cm. (Use $\pi = 3.14$)

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