DAY 2

Surface Area of Combination of Solids:

In this section, we shall learn to find the surface are of combining two solids. In this part, students often confused in terms Surface Area/ Lateral Surface Area or Total Surface Area. All these three terms depends on the solid what is given. To understand this, lets discuss some examples:

1. 2 cubes each of volume 64 cm^3 are joined end to end. Find the surface area of the resulting Cuboid. [Ex 13.1, Q1]

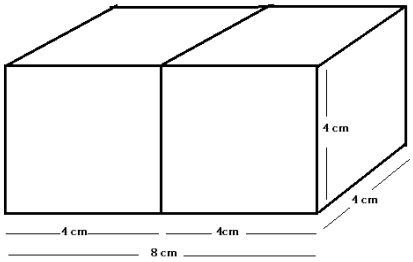
Sol:- Given Volume of each cube $= 64\ cm^3$

$\Rightarrow \quad (\text{Side})^3 = 64 = 4^3$

$\Rightarrow \quad \text{Side} = 4$

Now Given condition, two cubes are joined end to end then we have cuboid with sides $4cm, 4cm$ and $8cm$

$i.e.\ l = 4, b = 4, h = 8$



Surface area of the Cuboid $= 2(lb + bh + hl)$

$= 2(4 \times 4 + 4 \times 8 + 8 \times 4)$

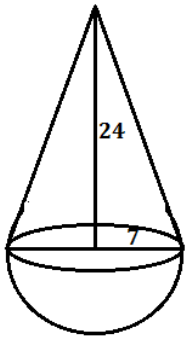
$= 2(16 + 32 + 32) = 2 \times 80 =$ **$160\ cm^2$**

2. A toy is in the form of a cone of radius 7 *cm* mounted on a hemisphere of same radius, If the height of cone is 24 *cm* then find the surface area of the toy.

Sol:- Given Radius of cone = Radius of hemisphere $= r = 7\ cm$

Slant height of cone $(l) = \sqrt{h^2 + r^2} = \sqrt{24^2 + 7^2}$

$= \sqrt{576 + 49} = \sqrt{625} = 25$



Surface area of the toy = (LSA of the cone) + (LSA of hemisphere)

$= \pi rl + 2\pi r^2 = \pi r(l + 2r)$

$= \frac{22}{7} \times 7(25 + 2 \times 7) = 22 \times (25 + 14)$

$= 22 \times 39 =$ **$858\ cm^2$**

3. A vessel in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 *cm* and the total height of the vessel is 13 *cm*. Find the inner surface area of the solid.

[Ex 13.1, Q2]

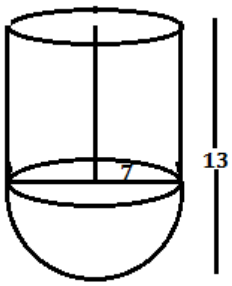
Sol:- Given Diameter of the hemisphere $= 14cm$

$\therefore$ Radius of Hemisphere = Radius of Cylinder $= r = 7\ cm$

Given Total height of the **vessel** $= 13\ cm$

$\therefore$ **Height of the cylinder** $(h) = \left(\begin{matrix}\textbf{Total height}\\ \textbf{of the vessel}\end{matrix}\right) - \left(\begin{matrix}\textbf{Radius(height) of}\\ \textbf{the hemisphere}\end{matrix}\right)$

$= 13 - 7 = 6cm$

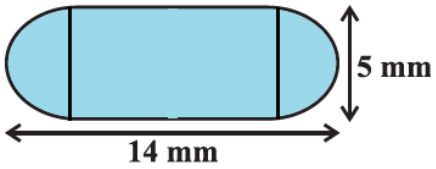


Now Inner Surface area of the vessel $= \begin{pmatrix}\textbf{LSA of the}\\ \textbf{Cylinder}\end{pmatrix} + \begin{pmatrix}\textbf{LSA of}\\ \textbf{Hemisphere}\end{pmatrix}$

$= 2\pi rh + 2\pi r^2 = 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 7(6 + 7) = 2 \times 22 \times 13 = \mathbf{572\ cm^2}$

4. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 *mm* and the diameter of the capsule is 5 *mm*. Find its surface area. **[Ex 13.1, Q6]**



Sol:- Given Diameter of the capsule $= 5\ mm$

$\therefore$ Radius of Hemisphere $=$ Radius of Cylinder

$i.e.\ \ r = \frac{5}{2}\ mm$

Given Total height/length of the **Capsule** $= 14\ mm$

$\therefore$ **Height of the cylinder**$(\boldsymbol{h}) = \begin{pmatrix}\textbf{Total height}\\ \textbf{of the vessel}\end{pmatrix} - \mathbf{2}\begin{pmatrix}\textbf{Radius(height)of}\\ \textbf{the hemisphere}\end{pmatrix}$

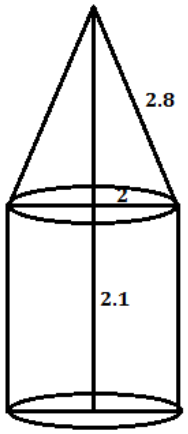
$= 14 - 2 \times \frac{5}{2} = 14 - 5 = 9\ mm$

Now Surface area of the Capsule $= \begin{pmatrix}\textbf{LSA of the}\\ \textbf{Cylinder}\end{pmatrix} + 2 \times \begin{pmatrix}\textbf{LSA of}\\ \textbf{Hemisphere}\end{pmatrix}$

$= 2\pi rh + 2 \times 2\pi r^2 = 2\pi r(h + 2r)$

$= 2 \times \frac{22}{7} \times \frac{5}{2}\left(9 + 2 \times \frac{5}{2}\right) = 2 \times \frac{22}{7} \times \frac{5}{2} \times 14 = \mathbf{220\ mm^2}$

5. A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are 2.1 *m* and 4 *m* respectively, and the slant height of the top is 2.8 *m*. find the area of the canvas used for making the tent at the rate of ₹ 500 per m^2. **[Ex 13.1, Q7]**



Sol:- Given Diameter of the cylinder $=$ Diameter of the cone $= 4\ m$

$\therefore$ Radius of Cylinder $=$ Radius of Cone $= r = 2\ m$

and Height/length of the cylinder $(\boldsymbol{h}) = 2.1m$

and slant height of the cone $(l) = 2.8\ m$

Now Area of the Canvas $= \begin{pmatrix}\textbf{LSA of the}\\ \textbf{Cylinder}\end{pmatrix} + \begin{pmatrix}\textbf{LSA of}\\ \textbf{Cone}\end{pmatrix}$

$= 2\pi rh + \pi rl = \pi r(2h + l)$

$= \frac{22}{7} \times 2 \times (2 \times 2.1 + 2.8) = \frac{44}{7} \times (4.2 + 2.8)$

$= \frac{44}{7} \times 7 = \mathbf{44\ m^2}$

Cost of the canvas used for making the tent for $1m^2$ = ₹ 500

Cost of the canvas used for making the tent for $44m^2 = 44 \times 500 = \mathbf{22000}$ ₹

EXERCISE

1. A toy is in the form of a hemisphere surmounted by a cone. If radius of the base is 5 cm and slant height is 11 cm, find the total area of the surface.
2. A toy is in the form of a hemisphere surmounted by a right circular cone. If the radius of the base is 6 cm and slant height is 9 cm, find the total surface area of the toy. Also find the cost of polishing the surface at the rate of ₹2 per cm^2.
3. A solid is in the form of a cylinder 104 cm long with hemispherical ends each of radius 7 cm. Find the area of the curved surface.
4. A solid with two hemispherical ends, is in the form of a cylinder. If the total length is 15.5 cm. and radius of hemispherical ends is 3.5 cm each, find the area of the curved surface.
5. A cylinder roller has radius of its base 5 cm. On both sides, two hemispherical with same radius have been fixed to make a toy. If the total height of a toy is 27cm., find the area of the total surface. (Use $\pi = 3.14$)
6. A canvas tent of height 9 m is in the form of a right cylinder with radius of base 3 m and height 5 m, surmounted by a cone of the same base. Find the cost of the canvas of the tent at the rate of ₹50 per m^2.