TOPIC

- HEMISPHERE- Introduction
- based on Hemisphere
- Sum based on Cylinder and Hemisphere

SURFACE AREAS AND VOLUMES

- **HEMISPHERE- Introduction**

Half

Hemisphere

- **Hemisphere is half of a sphere**

Let us consider examples of hemisphere

Examples :

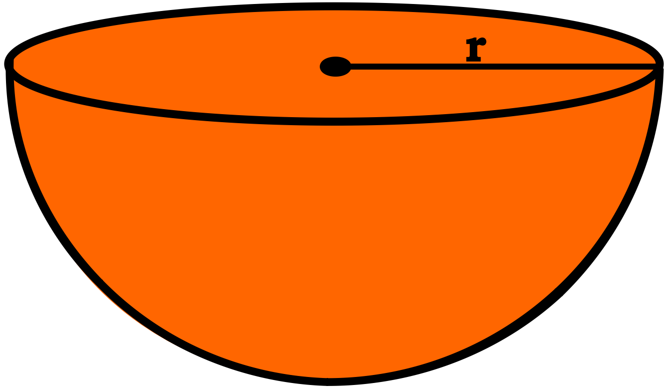
Half-cut sweet lime

Hemispherical bowls

Hemisphere

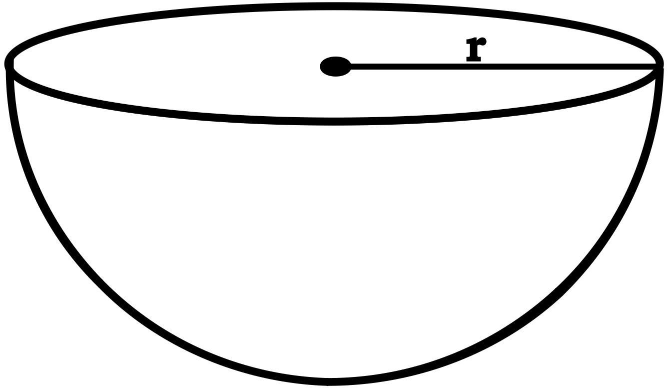
- A Hemisphere has two faces.
  - One circular face
  - One curved face

Let the radius be r



CURVED SURFACE AREA OF HEMISPHERE

$$\text{CSA} = 2\pi r^2$$



We know that,
Hemisphere is half of sphere

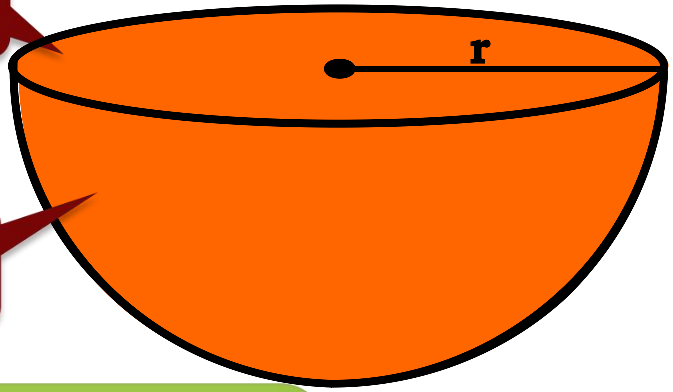
$$\text{CSA} = \frac{\text{Curved surface area of sphere}}{2}$$

$$= \frac{\overset{2}{\cancel{4}}\pi r^2}{\cancel{2}}$$

TOTAL SURFACE AREA OF HEMISPHERE

TSA = 3

Area of circular face = πr^2



Curved surface area = $2\pi r^2$

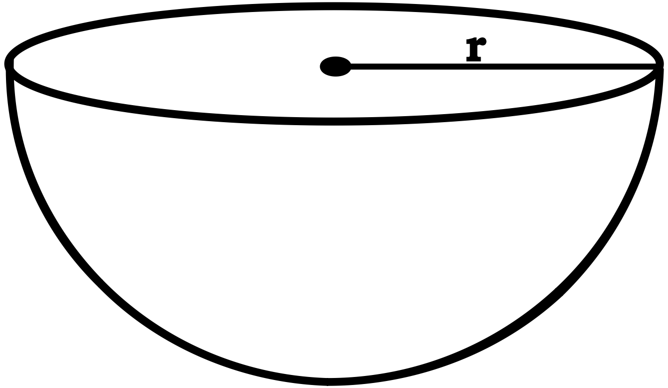
TSA = $\boxed{\text{Curved surface area}}$ + $\boxed{\text{Area of circular face}}$

$= 2\pi r^2 + \pi r^2$

VOLUME OF HEMISPHERE

$$\text{Volume} = \frac{2}{3}\pi r^3$$

We know that,
Hemisphere is half
of sphere



$$\text{Volume} = \frac{1}{2} \times \boxed{\text{Volume of sphere}}$$

$$= \frac{1}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{3}\pi r^3$$

SURFACE AREAS AND VOLUMES

- based on Hemisphere

Q. The curved surface area of a hemisphere is $905\frac{1}{7}$ cm², What is its volume?

Sol.

Hint :To find: r

CSA of hemisphere $= 905\frac{1}{7}$ cm²

$$= \frac{(905 \times 7) + 1}{7}$$

$$= \frac{6335 + 1}{7}$$

CSA of hemisphere $= \frac{6336}{7}$ cm²

CSA of hemisphere $= 2 \quad r^2$

What is formula for finding surface area of Hemisphere ?

$2\pi r^2$

$$\therefore \quad \frac{6336}{7} = 2 \times \frac{22}{7} \times r^2$$

$$\therefore \quad \frac{\overset{\overset{144}{\cancel{3168}}}{\cancel{6336}} \times \cancel{7}}{\cancel{7} \times \cancel{2} \times \cancel{22}} = r^2$$

$$\therefore \quad r^2 = 144$$

$$\therefore \quad r = 12 \text{ cm}$$

[Taking square roots]

Q. The curved surface area of a hemisphere is $905\frac{1}{7}$ cm², What is its volume?

Sol.

r = 12 cm

Volume of hemisphere $= \frac{2}{3}\square r^3$

$$= \frac{2}{\cancel{3}} \times \frac{22}{7} \times \overset{4}{\cancel{12}} \times 12 \times 12$$

$$= \frac{2 \times 22 \times 4 \times 12 \times 12}{7}$$

$$= \frac{25344}{7}$$

$= 3620.57$ cm³

```
      3620.57
  7 ) 25344
     -21
      43
    - 42
       14
     - 14
        040
     -   35
          50
     -    49
           1
```

∴ Volume of the hemisphere is 3620.57 cm³

SURFACE AREAS AND VOLUMES

- Sum based on Cylinder and Hemisphere

Q. A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter

$2 \pi r h$ ✓ ✓

sphere is 1

$2 \pi r^2$ ✓

e total height of the vessel is 13cm. F inner surface a vessel.

Inner surface area of vessel = CSA of cylinder (S_1) + CSA of hemisphere (S_2)

Sol. Diameter = 14 cm

$\therefore$ Radius = $\frac{d}{2}$ = $\frac{\cancel{14}^{7}}{2}$ = 7 cm

What is the formula to find curved surface area of cylinder?

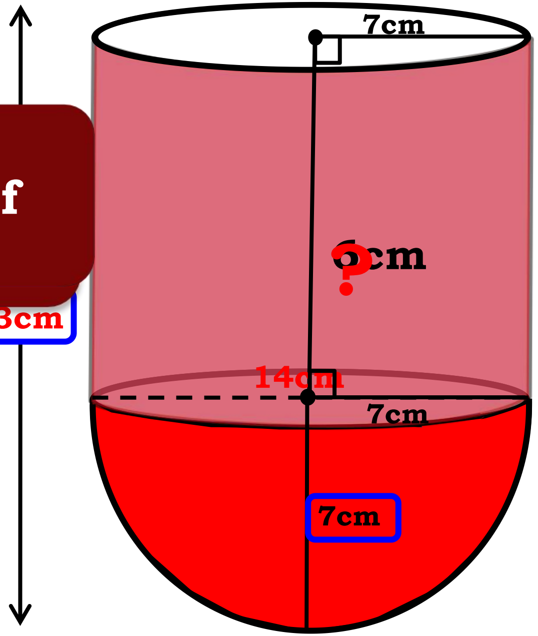
– Height of Hemisphere

= 13 – 7

= 6 cm

We know that,
In Hemisphere,
Radius = Height

e up
a



Q. A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter [illegible] sphere is 1 [illegible] e total height of the vessel is 13cm. F [illegible] er surface a [illegible] vessel.

$2\ \pi\ r\ h$

$2\ \pi\ r^2$

Inner surface area of vessel = CSA of cylinder (S_1) + CSA of hemisphere (S_2)

Sol.

$$\text{CSA of Cylinder } (S_1) = 2\ \pi \boxed{r}\boxed{h}$$

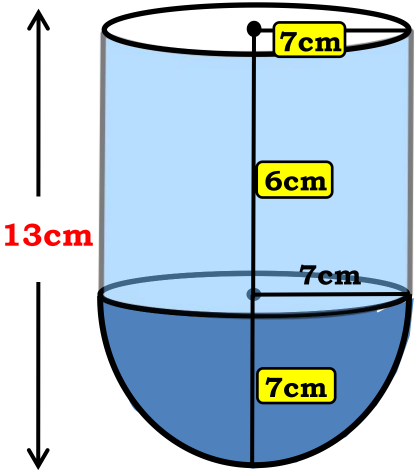
$$= 2 \times \pi \times 7 \times 6$$

$$\therefore \text{CSA of Cylinder } (S_1) = 84\pi \text{ cm}^2$$

$$\text{CSA of Hemisphere } (S_2) = 2\ \pi \boxed{r}^2$$

$$= 2 \times \pi \times 7 \times 7$$

$$\therefore \text{CSA of Hemisphere } (S_2) = 98\pi \text{ cm}^2$$



Q. A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter sphere is 1 e total height of the vessel is 13cm. F er surface ar vessel.

$2\ \pi\ r\ h$

$2\ \pi\ r^2$

Inner surface area of vessel = CSA of cylinder (S_1) + CSA of hemisphere (S_2)

$\boxed{S_1 = 84\pi}$

$\boxed{S_2 = 98\pi}$

Sol.

Inner surface area of the vessel

$$= \boxed{S_1} + \boxed{S_2}$$

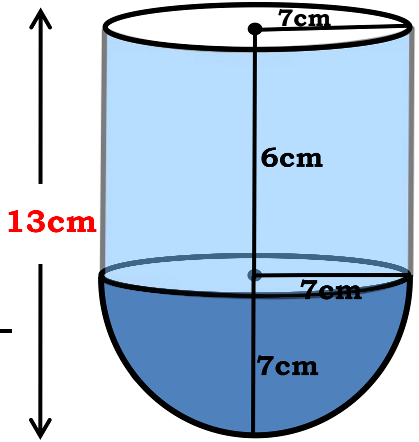
$$= 84\pi + 98\pi$$

$$= 182 \times \pi$$

$$= \overset{26}{\cancel{182}} \times \frac{22}{\cancel{7}}$$

$$= 26 \times 22$$

$$= 572\ \text{cm}^2$$



∴ Inner surface area of the vessel is 572 cm²

SURFACE AREAS AND VOLUMES

- Sum based on Cone and Hemisphere

Q. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius. The eight of the to 5 cm. Find the total surface area of th

π r l

2 π r²

Total surface area of toy = CSA of cone (S_1) + CSA of hemisphere (S_2)

Sol.

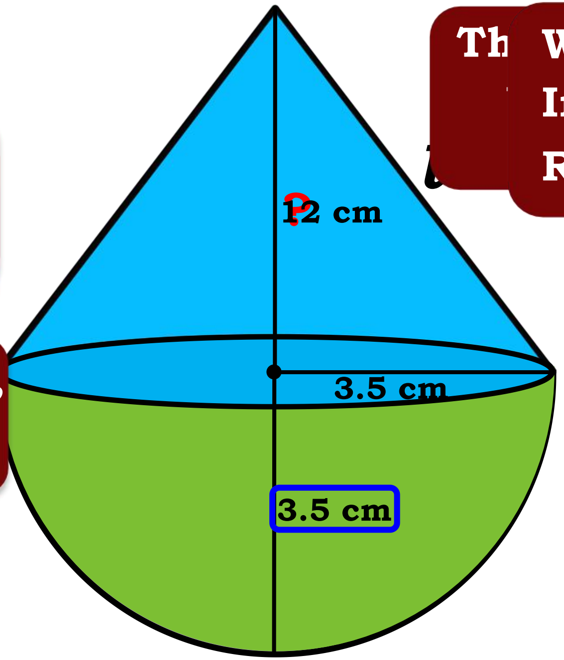
Height of cone

What is the formula to find

What is the formula to find slant height (l)?

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

For getting the slant height (l), Let us first find height (h)



We know that,
In Hemisphere,
Radius = Height

Q. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius. The **eight of the to** **cm. Find the total surface area of th**

$\pi \ r \ l$ ✓✓

$2 \ \pi \ r^2$ ✓

Total surface area of toy = CSA of cone (S_1) + CSA of hemisphere (S_2)

Sol.

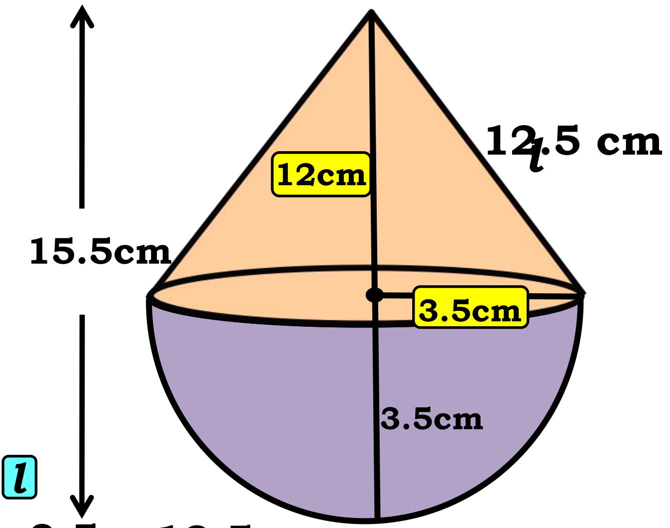
$$\text{Slant height } (l) = \sqrt{r^2 + h^2}$$

$$= \sqrt{(3.5)^2 + 12^2}$$

$$= \sqrt{12.25 + 144}$$

$$= \sqrt{156.25}$$

$$\therefore \quad \boxed{l = 12.5 \text{ cm}}$$



$$\text{Surface area of cone } (S_1) = \pi \boxed{r}\boxed{l}$$

$$= \pi \times 3.5 \times 12.5$$

$$\therefore \ \text{Surface area of cone } (S_1) = 43.75\pi \text{cm}^2$$

Q. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius. The $\pi r l$ **eight of the to** $2 \pi r^2$ **cm. Find the total surface area of th oy.**

Total surface area of toy = CSA of cone (S_1) + CSA of hemisphere (S_2)

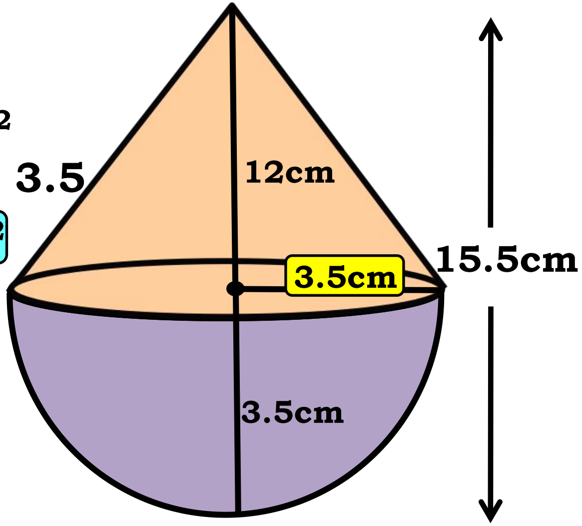
Sol.

Surface area of hemisphere(S_2) $= 2\pi \boxed{r^2}$

$= 2\pi \times (3.5)^2$

$= 2\pi \times 3.5 \times 3.5$

∴ Surface area of hemisphere(S_2) = $24.5\pi cm^2$



$S_1 = 43.75\pi$

Total surface area of the toy $= \boxed{S_1} + \boxed{S_2}$

$= 43.75\pi + 24.5\pi$

$= 68.25\pi$

$= \overset{9.75}{\cancel{68.25}} \times \frac{22}{\cancel{7}}$

$= 214.25 \ cm^2$

∴ Total surface area of the toy is 214.25 cm².

SURFACE AREAS AND VOLUMES

- Sum based on Cube and Hemisphere

Q. A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest di… he hem… e can have ? Find the surface area o… id.

$6l^2$ ✓

πr^2 ✓

$2\pi r^2$ ✓

Surface area of the solid = TSA (cube) − Base Area (hemisphere) + CSA (hemisphere)

Sol. Greatest diameter = Side of a square = 7 cm

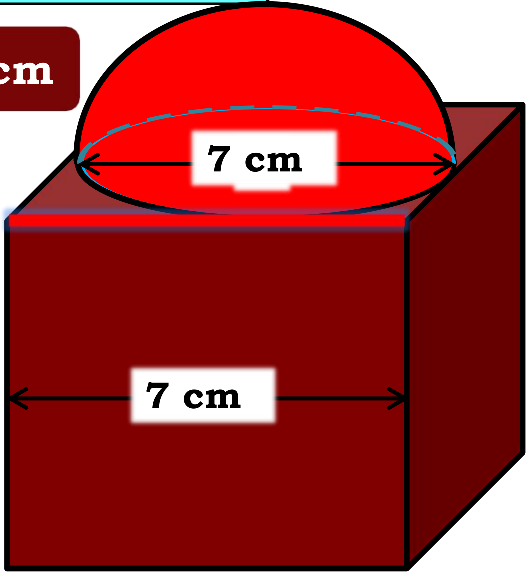
W
to

re = 7 cm

Diameter = 7 cm

$\therefore r = \frac{d}{2} = \frac{7}{2}$ cm

What is the formula to find area of a circle?



Q. A cubical block of side 7 cm is surmounted by a hemisphere.
What is the greatest di he hem e can have ?
Find the surface area o id.

$6l^2$

πr^2

$2 \pi r^2$

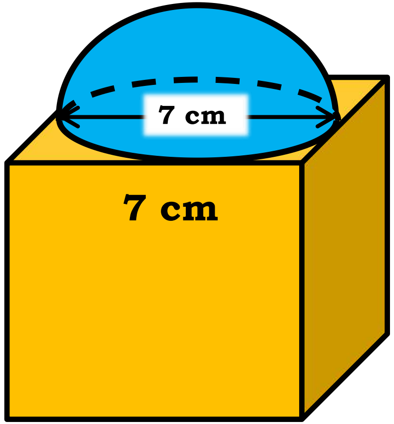
Surface area of the solid = TSA (cube) − Base Area (hemisphere) + CSA (hemisphere)

Sol. TSA of cube $= 6l^2$

$= 6 \times 7^2$

$= 6 \times 49$

$= 294 \text{ cm}^2$



Q. A cubical block of side 7 cm is surmounted by a hemisphere.
What is the greatest di he hem e can have ?
Find the surface area o id.

$6l^2$ πr^2 $2 \pi r^2$

Surface area of the solid = TSA (cube) − Base Area (hemisphere) + CSA (hemisphere)

Sol.

Surface area of the solid

$= \text{TSA (cube)} - \text{Base Area (hemisphere)} + \text{CSA (hemisphere)}$

$= 294 - \pi r^2 + 2\pi r^2$

$= 294 + \pi r^2$

$$= 294 + \frac{\overset{11}{\cancel{22}}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{2}} \times \frac{7}{2}$$

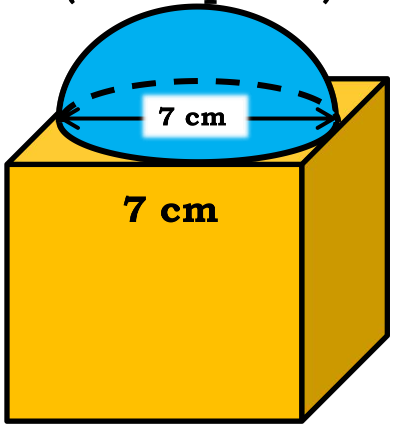
$$= 294 + \frac{77}{2}$$

$= 294 + 38.5$

$= 332.5 \text{ cm}^2$

TSA (cube) = 294

Radius $= \frac{7}{2}$ cm

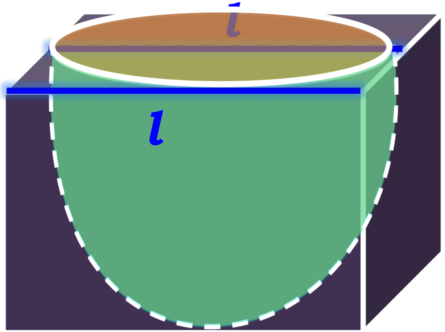


∴ **Surface area of the solid is 332.5 cm²**

SURFACE AREAS AND VOLUMES

- Sum based on Cube and Hemisphere

Q. A hemispherical depression is cut out from one face of a cubical wooden block such that the diameter 'l' of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.



Sol. Edge of the cube = Diameter of hemisphere = l

Radius of hemisphere (r) = $\frac{l}{2}$

Surface area of the remaining solid

= SA (cube) – A (hemispherical top) + CSA (hemisphere)

$= 6l^2 - \pi r^2 + 2\pi r^2$ | $= 6l^2 + \frac{\pi l^2}{4}$

= 6 | $\frac{24l^2 + \pi l^2}{}$

Radius (r) = $\frac{\text{Diameter}}{}$

What is the formula to find curved surface area of hemisphere?

$2\pi r^2$

$+ \pi)$ sq.units

∴ Surface area of the remaining solid = $\frac{1}{4} l^2 (24 + \pi)$ sq.units

SURFACE AREAS AND VOLUMES

- **Sum based on Cylinder and Hemisphere**

Q. 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 14mm and the dian capsule is Find its surface area.

$2\pi rh$ ✓✓

$2\pi r^2$ ✓

Total surface area of capsule = CSA of cylinder (S_1) + 2 CSA of hemisphere(S_2)

Sol. Diameter = 5 mm

$\therefore$ $\boxed{\text{Radius } (r) = \frac{d}{2} = \frac{5}{2} = 2.5 \text{ mm}}$

Length of the cylinder (h) = 14 – 2.5 – 2.5

$\therefore$ $\boxed{h = 9\text{mm}}$

CSA of the cylinder (S_1) = $2\pi \boxed{r}\boxed{h}$

We know that,
In Hemisphere,
Radius = Height

to find

ght of

l

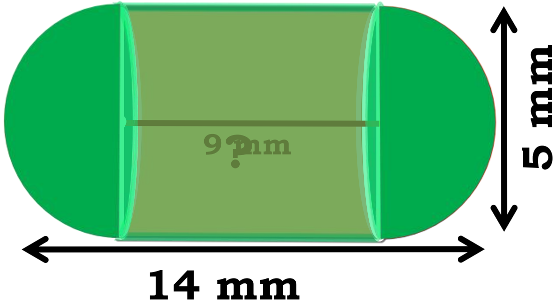
$\pi \times 2.5 \times 9$

$\therefore$ mm²

$2\pi \boxed{r}^2$

$= 2 \times 2 \times \pi \times (2.5)^2$

$\therefore$ CSA of 2 hemispheres (S_2) = 25π mm²



Q. 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 14mm and the dian capsule is Find its surface area.

$2 \pi r h$

$2 \pi r^2$

Total surface area of capsule = CSA of cylinder (S_1) + 2 CSA of hemisphere(S_2)

Sol.

$$\text{TSA of the capsule} = \boxed{S_1} + \boxed{S_2}$$

$$= 45\pi + 25\pi$$

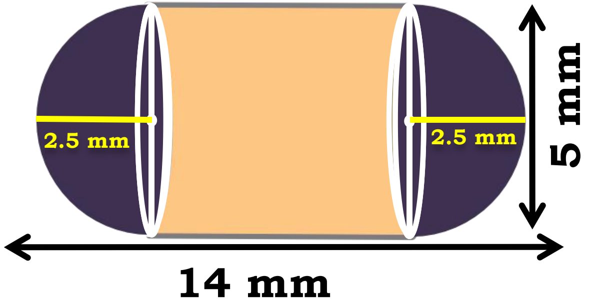
$$= 70\pi$$

$$= \overset{10}{\cancel{70}} \times \frac{22}{\cancel{7}}$$

$$= 220 \text{ mm}^2$$

$$\boxed{S_1 = 45\pi}$$

$$\boxed{S_2 = 25\pi}$$



∴ Surface area of the capsule is 220 mm²

SURFACE AREAS AND VOLUMES

- **Sum based on Cylinder and Cone**

Q. 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. Also, find the cost of the canvas of the t e rate of er m^2. (Note that the base of the te t will not be co ed with canvas.)

$\pi r l$

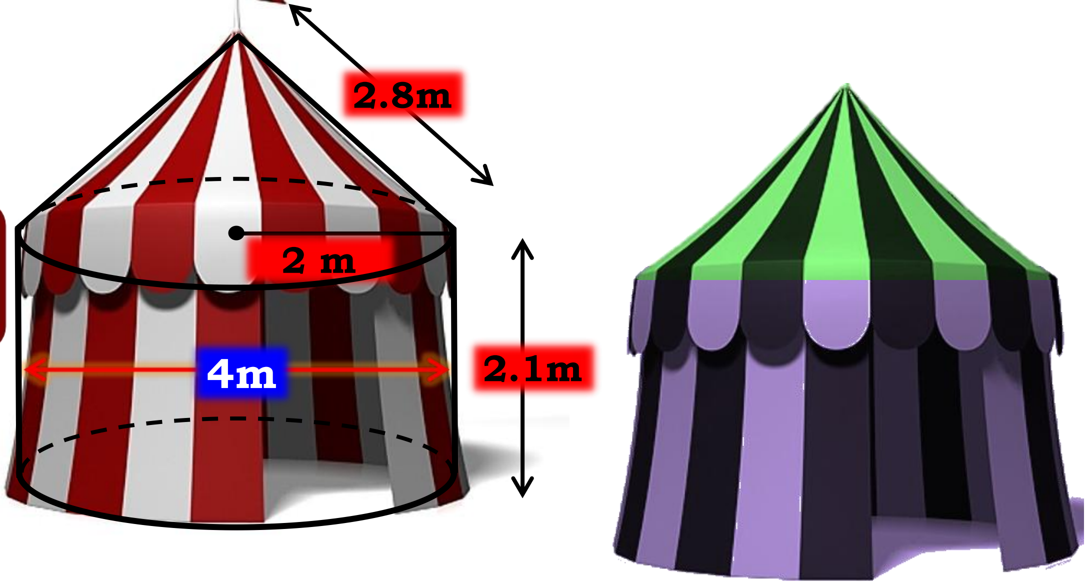
$2 \pi r h$

TSA of tent = CSA of cone (S_1) + CSA of cylinder (S_2)

Sol. Diameter = 4 m

$$\therefore \text{Radius} = \frac{d}{2} = \frac{\overset{2}{\cancel{4}}}{\cancel{2}} = 2 \text{ m}$$

i.e. we need to total surface area of the tent



Q. 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. Also, find the cost of the canvas of the the rate of er m². (Note that the base of the ent will not be co ed with canvas.)

$\pi\ r\ l$

$2\ \pi\ r\ h$

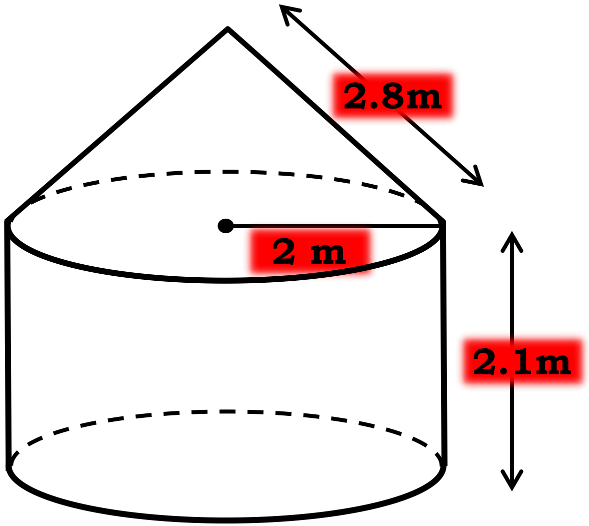
TSA of tent = CSA of cone (S_1) + CSA of cylinder (S_2)

Sol.

CSA of cone (S_1) = $\pi \boxed{r} \boxed{l}$

= $\pi \times 2 \times 2.8$

$\therefore$ CSA of cone (S_1) = $5.6\pi\ m^2$



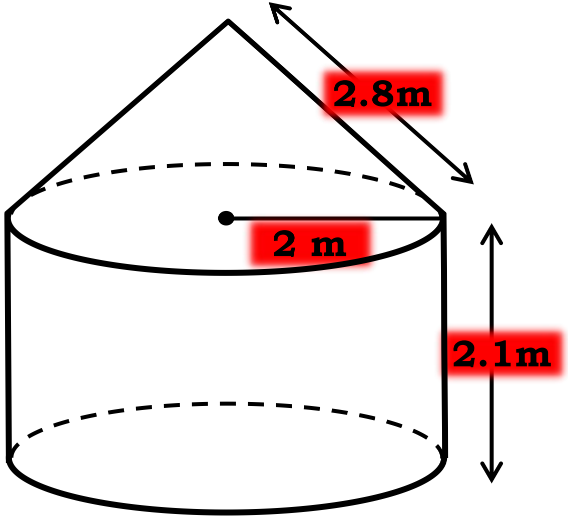
CSA of cylinder (S_2) = $2\ \pi \boxed{r} \boxed{h}$

= $2 \times \pi \times 2 \times 2.1$

$\therefore$ CSA of cylinder (S_2) = $8.4\pi m^2$

Q. 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. Also, find the cost of the canvas of the tent at the rate of Rs. 500 per m^2.
(Note that the base of the tent will not be covered with canvas.)

TSA of tent = CSA of cone (S_1) + CSA of cylinder (S_2)



Sol. TSA of tent $= \boxed{S_1} + \boxed{S_2}$

$= 5.6\pi + 8.4\pi$

$= 14 \times \pi$

Total cost of the canvas of the tent =
TSA of tent × Rate

$\therefore$ TSA of tent $= 44m^2$

Total cost of the canvas

$= \boxed{\text{TSA of tent}} \times \boxed{\text{rate}}$

$= 44 \times 500$

$\therefore$ Total cost of the canvas = Rs. 22000

Thank You