TOPIC

- Sum based on Cylinder and Cone
- based on Cylinder and Hemisphere (Part II)
- based on Cone and Sphere

SURFACE AREAS AND VOLUMES

- **Sum based on Cylinder and Cone**

Q. **From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface are** **e rema** **d to the n** **m².**

πr^2 ✓ ?

$2 \pi r h$? ✓ ✓

$\pi r l$ ✓ ? ✓ ?

TSA (remaining solid) = Area of base + CSA of cylinder (S_1) + CSA of cone (S_2)

Sol. Diameter = 1.4 cm

$$\therefore \boxed{r} = \frac{d}{2} = \frac{\overset{0.7}{\cancel{1.4}}}{\cancel{2}} = \boxed{0.7 \text{ cm}}$$

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

$$= \sqrt{(0.7)^2 + (2.4)^2}$$

$$= \sqrt{0.49 + 5.76}$$

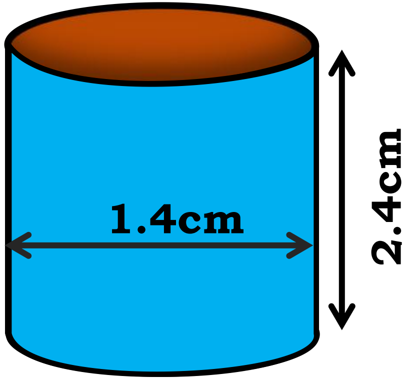
What is the formula to find slant height (l)?

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

?

$$= \sqrt{\frac{625}{100}} = \frac{25}{10}$$

$$\therefore \quad l = 2.5 \text{ cm}$$



Q. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface are e rema d to the n m².

πr^2

$2 \pi r h$

$\pi r l$

TSA (remaining solid) = Area of base + CSA of cylinder (S_1) + CSA of cone (S_2)

Sol. $r = 0.7$ cm, $h = 2.4$ cm, $l = 2.5$ cm

Area of the base of cylinder

$= \pi r^2$

$= \pi \times (0.7)^2$

$= 0.49\pi$ cm²

CSA of cyl. (S_1) $= 2\pi rh$

$= \underline{2} \times \pi \times \underline{0.7} \times 2.4$

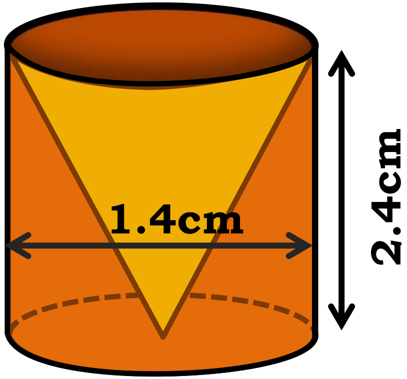
$= 0.14 \times \pi \times 2.4$

∴ CSA of cyl. (S_1) $= 3.36\pi$ cm²

CSA of cone (S_2) $= \pi r l$

$= \pi \times 0.7 \times 2.5$

∴ CSA of cone (S_2) $= 1.75\pi$ cm²



Q. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface are … e rema … d to the n … m^2.

πr^2 $\quad 2\pi r h$ $\quad \pi r l$

TSA (remaining solid) = Area of base + CSA of cylinder (S_1) + CSA of cone (S_2)

Sol.

TSA of the remaining solid

$= \boxed{\text{Area of the base}} + \boxed{S_1} + \boxed{S_2}$

$= 0.49\pi + 3.36\pi + 1.75\pi$

$= 5.6\pi$

$= \overset{0.8}{\cancel{5.6}} \times \frac{22}{\cancel{7}}$

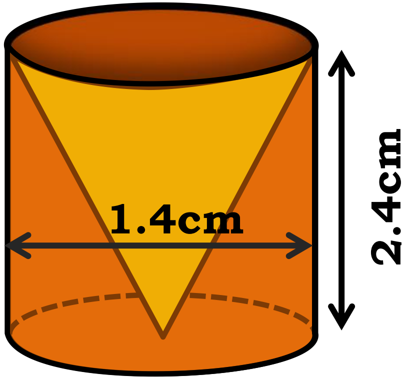
$= 0.8 \times 22$

$= 17.6\ cm^2$

$\boxed{S_1 = 3.36\pi}$

$\boxed{S_2 = 1.75\pi}$

$\boxed{\text{Area of base} = 0.49\pi}$



$\therefore$ TSA of the remaining solid is 18 cm^2

SURFACE AREAS AND VOLUMES

- **Sum based on Cylinder and hemisphere**

Q. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in figure. If the height of the cylinder is 10cm, and $2\ \pi\ r\ h$ ✓✓ **s of radius 3.5 cm,** $2\ \pi\ r^2$ ✓ **find the total surface area o the article.**

TSA of article = CSA of cylinder (S_1) + 2 CSA of hemisphere (S_2)

Sol.

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

$= \underline{2} \times \pi \times \underline{3.5} \times 10$

$= 7 \times \pi \times 10$

∴ CSA of the cyl. (S_1) $= 70\pi\ \text{cm}^2$

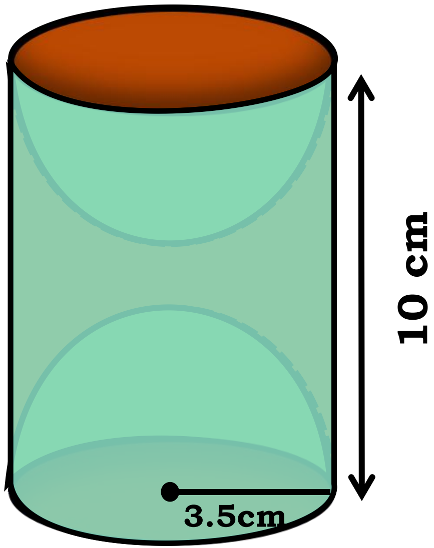
CS $\boxed{r}^2$

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

$\times\ \pi \times \underline{(3.5)^2}$

$= 4 \times \pi \times 12.25$

∴ CSA of 2 hemispheres (S_2) $= 49\pi\ \text{cm}^2$



Q. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in figure. If the height of the cylinder is 10cm, and … **s of radius 3.5 cm, find the total surface area o**… **the article.**

$2\ \pi\ r\ h$

$2\ \pi\ r^2$

TSA of article = CSA of cylinder (S_1) + 2 CSA of hemisphere (S_2)

Sol.

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

$= 70\pi + 49\pi$

$= 119\pi$

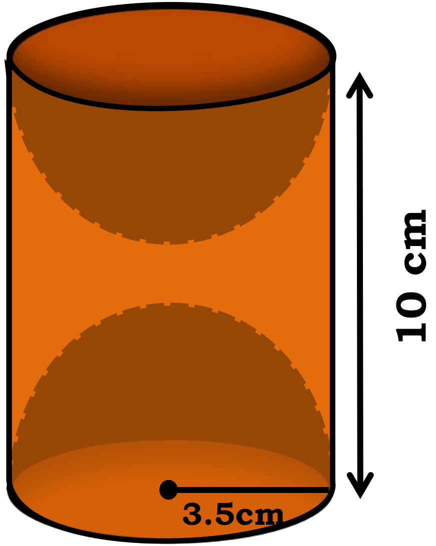
$= \cancel{119}^{17} \times \frac{22}{\cancel{7}}$

$= 374\ \text{cm}^2$

$\boxed{S_1 = 70\pi}$

$\boxed{S_2 = 49\pi}$

$\therefore$ **TSA of the article is 374 cm²**



SURFACE AREAS AND VOLUMES

- Sum based on Cone and Hemisphere

Q. A solid is in the shape of a cone standing on a hemisphere with both their radii bei 1 cm and th the cone is equal to its radiu volume of t terms of π.

$\frac{1}{3}\pi r^2 h$ ✓✓

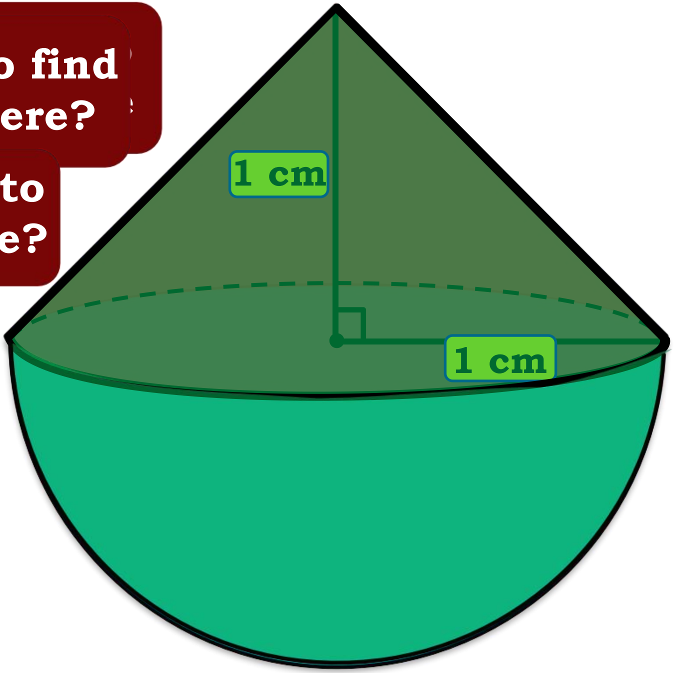
$\frac{2}{3}\pi r^3$ ✓

Volume of solid = Volume of cone (V_1) + Volume of hemisphere (V_2)

Sol.

What is the formula to find volume of a hemisphere?

What is the formula to find volume of a cone?

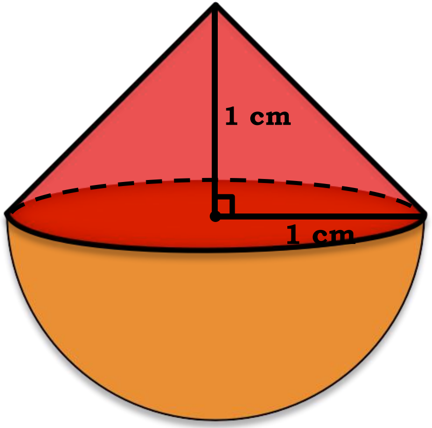


Q. A solid is in the shape of a cone standing on a hemisphere with both their radii bei 1 cm and th the cone is equal to its radiu volume of t erms of π.

$\frac{1}{3}\pi r^2 h$

$\frac{2}{3}\pi r^3$

Volume of solid = Volume of cone (V_1) + Volume of hemisphere (V_2)



Sol. Now $\boxed{h = r = 1\text{cm.}}$

$$\text{Volume of cone } (V_1) = \frac{1}{3} \times \pi\boxed{r^2}\boxed{h}$$

$$= \frac{1}{3} \times \pi \times 1 \times 1 \times 1$$

$$\therefore \text{ Volume of cone } (V_1) = \frac{1}{3}\pi \text{ cm}^3$$

$$\text{Volume of hemisphere } (V_2) = \frac{2}{3} \times \pi\boxed{r^3}$$

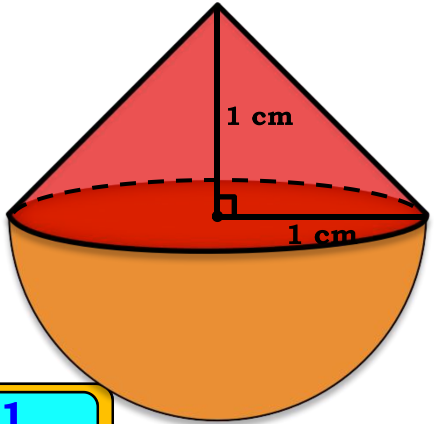
$$= \frac{2}{3} \times \pi \times 1 \times 1 \times 1$$

$$\therefore \text{ Volume of hemisphere } (V_2) = \frac{2}{3}\pi \text{ cm}^3$$

Q. A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π.

Volume of solid = Volume of cone (V_1) + Volume of hemisphere (V_2)

Sol.



$$\text{Volume of the solid} = \boxed{V_1} + \boxed{V_2}$$

$$= \frac{1}{3}\pi + \frac{2}{3}\pi$$

$$= \frac{\pi + 2\pi}{3}$$

$$= \frac{\cancel{3}\pi}{\cancel{3}}$$

$$= \pi \text{ cm}^3$$

$$\boxed{V_1 = \frac{1}{3}\pi}$$

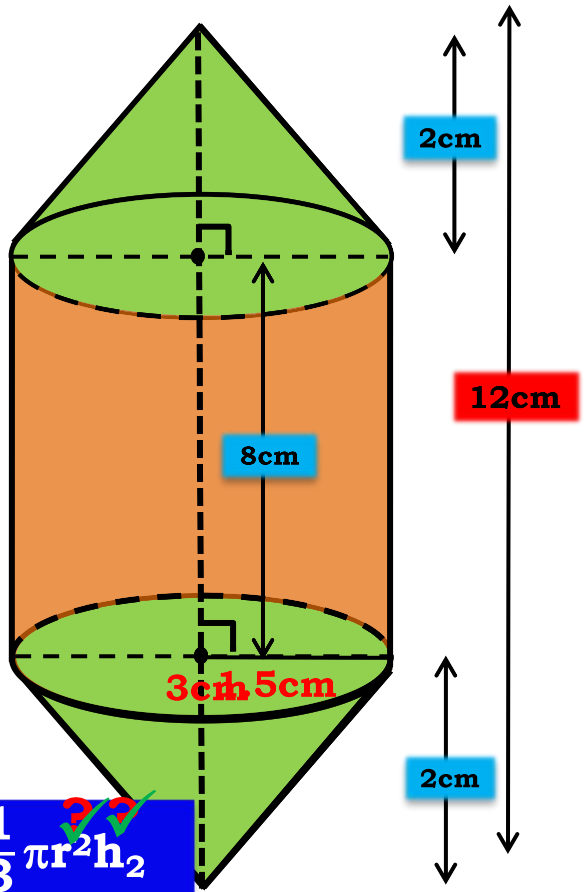
$$\boxed{V_2 = \frac{2}{3}\pi}$$

$\therefore$ **Volume of the solid = π cm^3**

SURFACE AREAS AND VOLUMES

- **Sum based on Cylinder and Cone**

Q. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model that Rachel made. (Assume the outer and inner dimensions of the model to be nearly the same)



Sol. Diameter = 3 cm

Th der nd
& two

Let us find the height of the cylinder

Length of the cyl. $(h_1) = 12 - 2 - 2$

$= 8$ cm

$\pi r^2 h_1$

$\frac{1}{3}\pi r^2 h_2$

Vol. of air in the model = Vol. of cyl. (V_1) + 2 × Vol. of cone (V_2)

Q. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model that Rachel made. (Assume the outer and in

$\pi\ r^2\ h_1$

$\frac{1}{3}\pi r^2 h_2$

model to be nearly the same)

Vol. of air in the model = Vol. of cyl. + 2 × Vol. of cone (V_2)

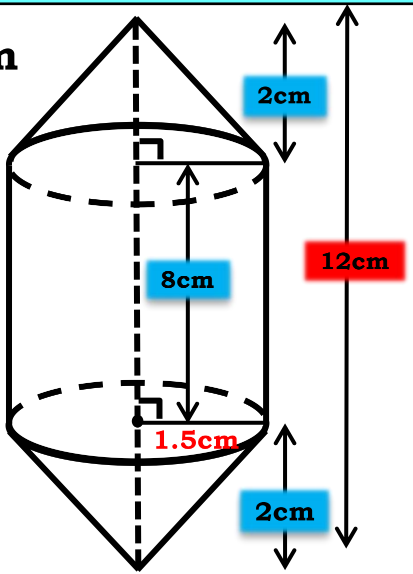
Sol. $\boxed{r = 1.5\text{ cm}}$, $\boxed{h_1 = 8\text{ cm}}$, $h_2 = 2$ cm

Vol. of cyl. (V1) $= \pi \boxed{r^2}\boxed{h_1}$

$= \pi \times \underline{1.5 \times 1.5} \times 8$

$= \pi \times 2.25 \times 8$

∴ Vol. of cyl. (V1) = $18\pi\text{ cm}^3$



Q. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model that Rachel made. (Assume the outer and in n model to be nearly the same)

$\pi r^2 h_1$

$\frac{1}{3}\pi r^2 h_2$

Vol. of air in the model = Vol. of cyl. + 2 × Vol. of cone (V_2)

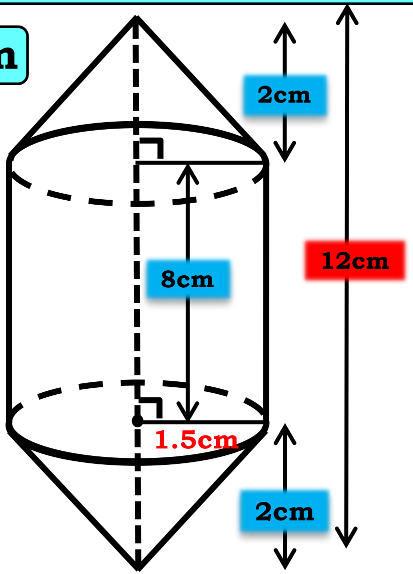
Sol. $\boxed{r = 1.5 \text{ cm}}$, $h_1 = 8$ cm, $\boxed{h_2 = 2 \text{ cm}}$

$$\text{Vol. of 2 cones } (V_2) = 2 \times \frac{1}{3}\pi \boxed{r^2}\boxed{h_2}$$

$$= 2 \times \frac{1}{3} \times \pi \times 1.5 \times 1.5 \times 2$$

$$= \cancel{2} \times \frac{1}{\cancel{3}} \times \pi \times \frac{\cancel{3}}{\cancel{2}} \times \frac{3}{\cancel{2}} \times \cancel{2}$$

$$= 3\pi \text{cm}^3$$



Q. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model that Rachel made. (Assume the outer and in n model to be nearly the same)

$\pi r^2 h_1$

$\frac{1}{3}\pi r^2 h_2$

Vol. of air in the model = Vol. of cyl. + 2 × Vol. of cone (V_2)

Sol.

Vol. of air in model $= \boxed{V_1} + \boxed{V_2}$

$= 18\pi + 3\pi$

$= 21\pi$

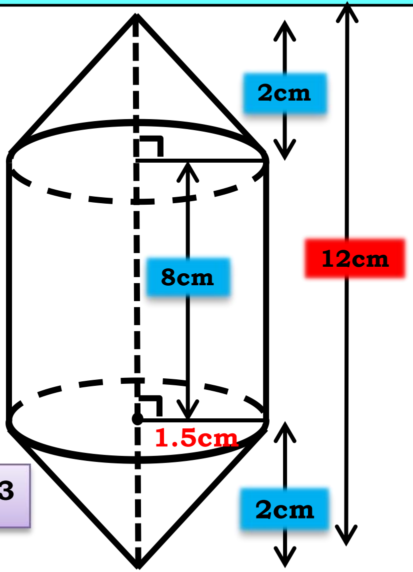
$= \overset{3}{\cancel{21}} \times \frac{22}{\cancel{7}}$

$= 66 \text{ cm}^3$

$V_1 = 18\pi \text{ cm}^3$

$V_2 = 3\pi \text{ cm}^3$

∴ Volume of air in the model is 66 cm^3



SURFACE AREAS AND VOLUMES

- **Sum based on Cylinder and Hemisphere**

Q. A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would b in 45 gulab jamuns, each sh ke a cylinder with t herical ends with length 5 cm and r 2.8 cm.

$\pi r^2 h$

$\frac{2}{3} \times \pi r^3$

Volume of 1 'Gulab jamun' = Volume of cylinder (V_1) + 2 × Volume of hemisphere (V_2)

Sol.

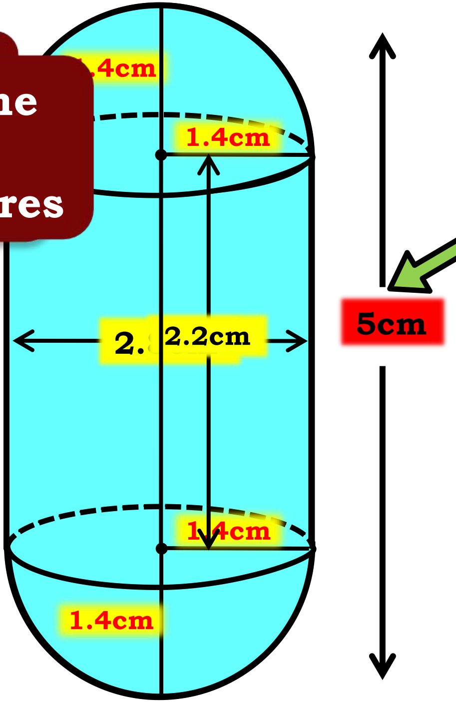
Each 'gulab jamun' is in the shape of a cylinder surmounted by 2 hemispheres

Height of cylinder

= 5 – 1.4 – 1.4

= 5 – 2.8

= 2.2 cm



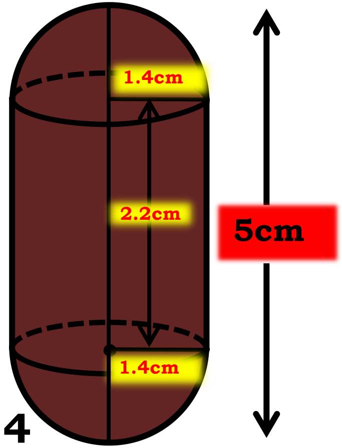
Q. A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would b in 45 gulab jamuns, each sh ke a cylinder with t herical ends with length 5 cm and r 2.8 cm.

$\pi r^2 h$

$\frac{2}{3} \times \pi r^3$

Volume of 1 'Gulab jamun' = Volume of cylinder (V_1) + 2 × Volume of hemisphere (V_2)

Sol. $\boxed{r = 1.4 \text{ cm}}$, $\boxed{h = 2.2 \text{ cm}}$



Volume of cylinder(V_1) $= \pi r^2 h$

$= \pi \times \underline{1.4 \times 1.4} \times 2.2$

$= \pi \times 1.96 \times 2.2$

∴ Volume of cylinder(V_1) $= 4.312\pi \text{ cm}^3$

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

$= \frac{2}{3} \times \pi \times \underline{1.4 \times 1.4 \times 1.4}$

$= \frac{\underline{2} \times \pi \times \underline{2.744}}{3}$

∴ Volume of hemisphere $= \frac{5.488\pi}{3}$

Q. A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm.

Volume of 1 'Gulab jamun' = Volume of cylinder (V_1) + 2 × Volume of hemisphere (V_2)

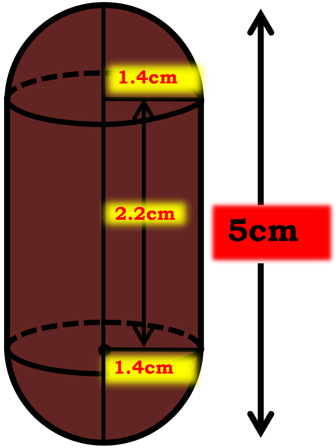
Sol.

$$\therefore \text{Volume of hemisphere} = \frac{5.488\pi}{3}$$

$$\text{Volume of 2 hemispheres } (V_2) = 2 \times \frac{5.488\pi}{3}$$

$$= \frac{10.976\pi}{3}$$

$$\therefore \boxed{\text{Volume of 2 hemispheres } (V_2) = 3.66\pi \text{ cm}^3}$$



$$\text{V (1 Gulab Jamun)} = \boxed{V_1} + \boxed{V_2}$$

$$= 4.312\pi + 3.66\pi$$

$$\boxed{V_1 = 4.312\,\pi}$$

$$\text{ulab Jamun)} = 7.972\pi$$

SURFACE AREAS AND VOLUMES

- based on Cylinder and Hemisphere (Part II)

Q. A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm.

Sol. $\boxed{\text{V (1 Gulab Jamun)} = 7.972\pi}$

$$\text{V(45 Gulab Jamuns)} = 45 \times 7.972\pi$$

$$= \underline{45 \times 7.97} \times \frac{22}{7}$$

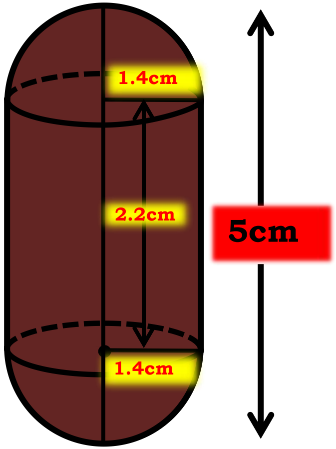
$$= 358.65 \times \frac{22}{7}$$

7890.3

∴ V(45 Gulab

Volume of 45 'gulab jamuns' =

45 × Volume of 1 gulab jamun



Q. A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm.

Sol.

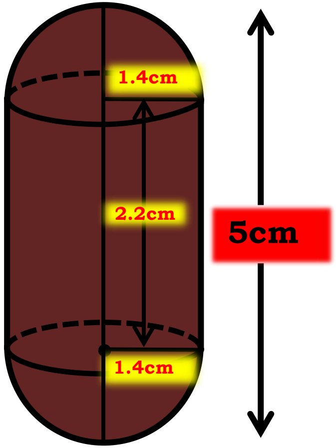
$$\boxed{V(45\text{ Gulab Jamuns}) = 1127.14\text{ cm}^3}$$

$$30\%\text{ of }V(45\text{ Gulab Jamuns}) = \frac{3\cancel{0}}{10\cancel{0}} \times 1127.14$$

$$= \frac{3 \times 1127.14}{10}$$

$$= \frac{3381.42}{10}$$

$$= 338.14\text{ cm}^3$$



$$\boxed{\therefore 30\%\text{ of }V(45\text{ Gulab Jamuns}) \text{ is } 338.14\text{ cm}^3}$$

SURFACE AREAS AND VOLUMES

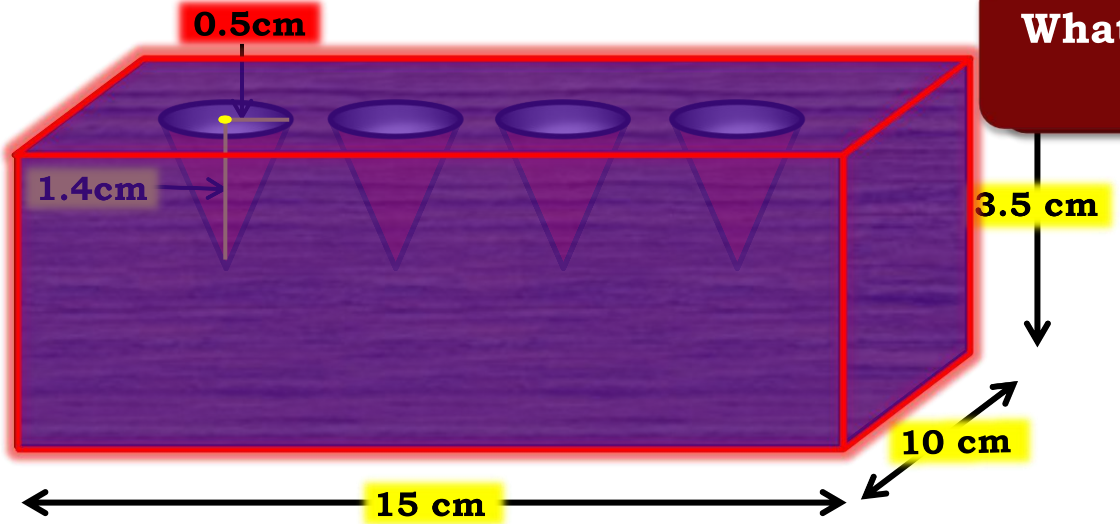
- **Sum based on Cuboid and Cone**

Q. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and depth is 1.4 cm. Fin lume of wo tire stand.

$l\ b\ h_1$ ✓✓✓

$\frac{1}{3}\pi r^2 h_2$ ✓✓

Volume of wood in the stand = Volume of cuboid (V_1) – Volume of 4 cones (V_2)



What is the formula to find volume of a cone?

Q. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and depth is 1.4 cm. Fin lume of wo tire stand.

$l\ b\ h_1$

$\frac{1}{3}\pi r^2 h_2$

Vol. of wood in the entire stand = Volume of cuboid (V_1) – Volume of 4 cones (V_2)

Sol. Vol. of the cuboid(V_1) = $l\ b\ h_1$

$= 15 \times 10 \times 3.5$

$= 15 \times 35$

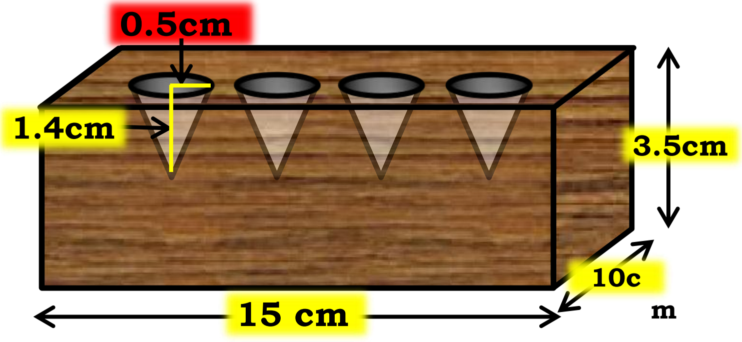
$\therefore$ Vol. of the cuboid(V_1) = $525\ cm^3$

Vol. of the 4 cones(V_2) = $4 \times \frac{1}{3}\pi r^2 h_2$

$= 4 \times \frac{1}{3} \times \frac{22}{7} \times 0.5 \times 0.5 \times 1.4$

$= 4 \times \frac{1}{3} \times \frac{22}{\cancel{7}} \times \frac{5}{10} \times \frac{5}{10} \times \frac{\cancel{14}^{2}}{10}$

$\therefore$ Vol. of the 4 cones(V_2) = $\frac{4 \times 22 \times 5 \times 5 \times 2}{3 \times 1000}$



Q. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and depth is 1.4 cm. Find the volume of wood in the entire stand.

Vol. of wood in the entire stand = Volume of cuboid (V_1) – Volume of 4 cones (V_2)

Sol.

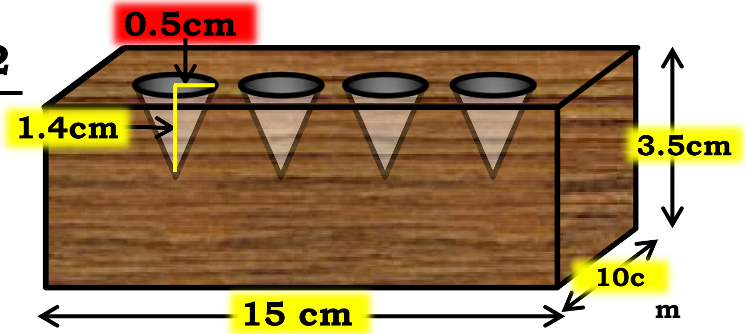
Vol. of the 4 cones(V_2) $= \dfrac{4\times 22\times 5\times 5\times 2}{3\times 1000}$

$= \dfrac{44\cancel{00}}{3\times 10\cancel{00}}$

$= \dfrac{44}{3\times 10}$

$= \dfrac{14.66}{10}$

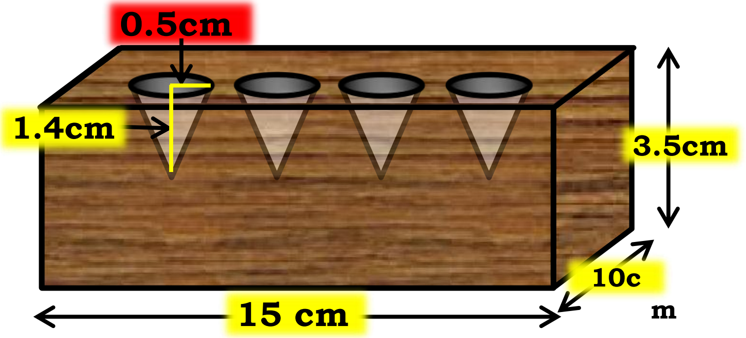
∴ Vol. of the 4 cones(V_2) = 1.47 cm³



Q. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and depth is 1.4 cm. Find the volume of wood in the entire stand.

Vol. of wood in the entire stand = Volume of cuboid (V_1) – Volume of 4 cones (V_2)

Sol.



Volume of the wood in the entire stand $= \boxed{V_1} - \boxed{V_2}$

$\boxed{V_1 = 525 \text{ cm}^3}$

$= 525 - 1.47$

$\boxed{V_2 = 1.47 \text{ cm}^3}$

$= 523.53 \text{ cm}^3$

$\therefore$ Volume of the wood in the entire stand is 523.53 cm^3

SURFACE AREAS AND VOLUMES

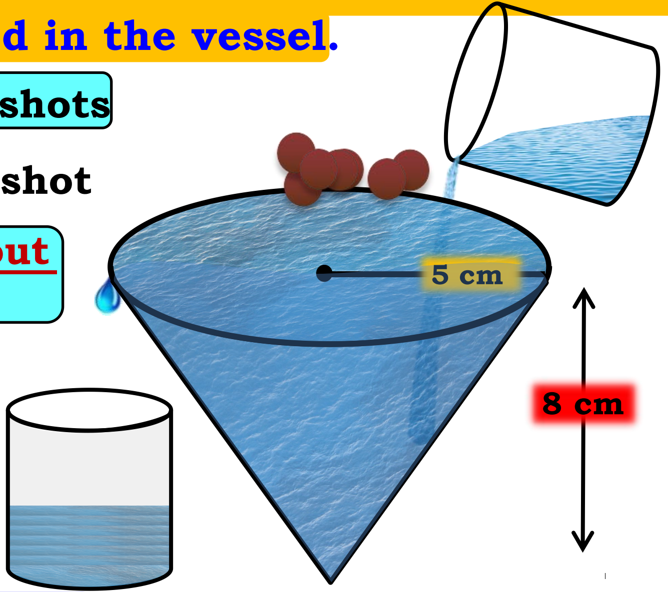
- **based on Cone and Sphere**

Q. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.

Sol. Vol. of water flows out = Vol. of N lead shots

Vol. water flows out = N × Vol. 1 lead shot

$$N = \frac{\text{Vol. of water flows out}}{\text{Vol. 1 lead shot}}$$



Water flows out

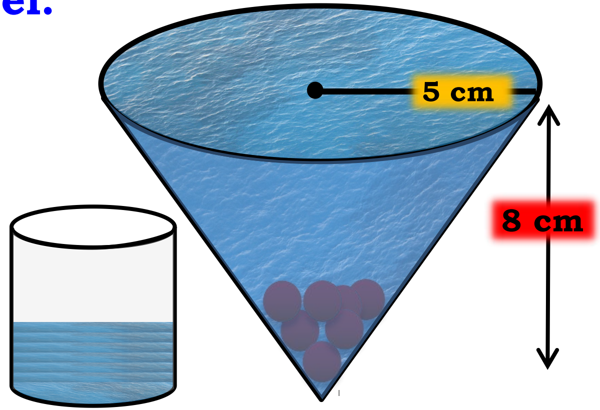
ing to Arch

lead shots

e,

Volume of water displaced = Volume of submerged body

Q. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.



Sol.

$$N = \frac{\text{Vol. of water flows out}}{\text{Vol. 1 lead shot}}$$

$$\text{Vol. water flows out} = \frac{1}{4} \times \boxed{\text{Vol. of water in the cone}}$$

$$= \frac{1}{4} \times \frac{1}{3}\, \pi \boxed{r^2} \boxed{h}$$

$$= \frac{1}{4} \times \frac{1}{3} \times \pi \times 5 \times 5 \times \overset{2}{\cancel{8}}$$

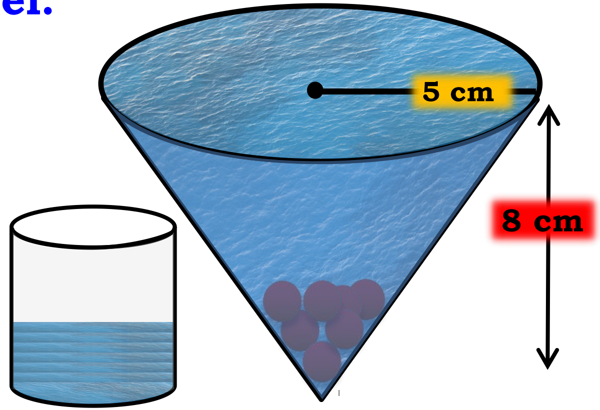
What is the formula to find volume of a cone?

$$\frac{1}{3} \times \pi r^2 h$$

$$5 \times \pi$$

$$\therefore \text{Vol. water flows out} = \frac{50\pi}{3}\ \text{cm}^3 \qquad \ldots\text{(i)}$$

Q. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.



Sol.

$$N = \frac{\text{Vol. of water flows out}}{\text{Vol. 1 lead shot}}$$

$$\text{Vol. water flows out} = \frac{50\pi}{3}\,\text{cm}^3 \qquad \ldots\text{(i)}$$

Lead shot is in the form of sphere,

$$\text{Vol. of one lead shot} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \pi \times (0.5)^3$$

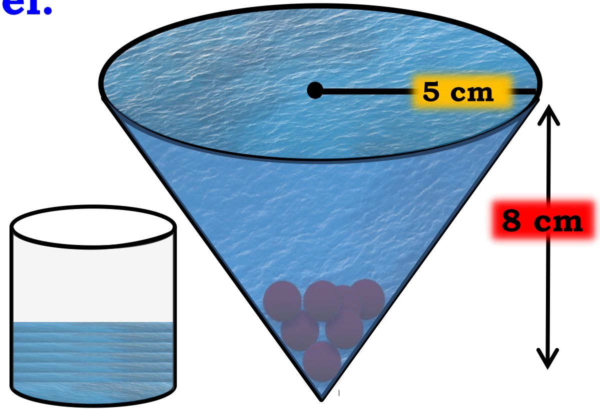
What is the formula to find volume of sphere?

$$\frac{4}{3} \times \pi r^3$$

$$\times \pi \times 0.125$$

$$\therefore \quad \text{Vol. of one lead shot} = \frac{0.5\pi}{3}\,\text{cm}^3 \qquad \ldots\text{(ii)}$$

Q. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.



Sol.

$$N = \frac{\text{Vol. of water flows out}}{\text{Vol. 1 lead shot}}$$

$$N = \frac{\text{Vol. of water flows out}}{\text{Vol. 1 lead shot}}$$

$$= \frac{50\,\pi}{3} \div \frac{0.5\,\pi}{3}$$

$$\frac{\cancel{3}}{0.5\,\cancel{\pi}}$$

10

$$= \frac{\cancel{50} \times 10}{\cancel{5}}$$

$$= 100$$

Vol. water flow out $= \frac{50\,\pi}{3}$ ...(i)

Vol. of 1 lead $= \frac{0.5\,\pi}{3}$ ...(ii)

∴ **Number of lead shots is 100**

SURFACE AREAS AND VOLUMES

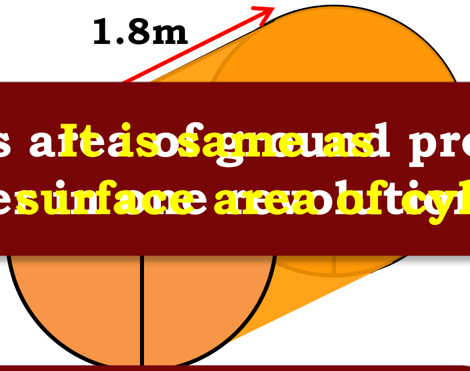
- **Sum based on Cylinder**

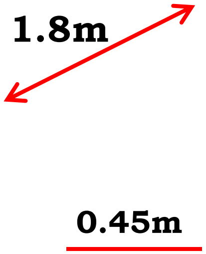
Q. A roller of diameter 0.9m and length 1.8m is used to press the ground. Find the area of ground pressed by it in 500 revolutions. ($\pi = 3.14$)

Sol. Radius $= \dfrac{0.9}{2} = 0.45$ m

What is shape of roller?

Cylinder





What is area of ground pressed by roller in one revolution?

It is same as curved surface area of cylinder

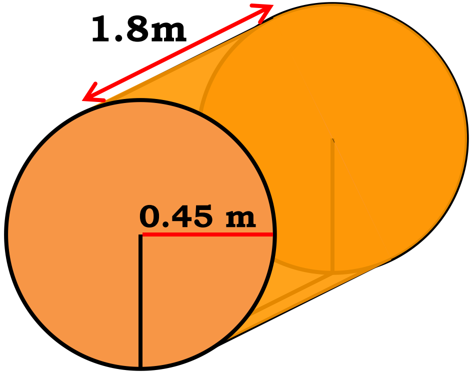
Let us find area pressed by the roller in one revolution

A of roller

er

Q. A roller of diameter 0.9m and length 1.8m is used to press the ground. Find the area of ground pressed by it in 500 revolutions. ($\pi = 3.14$)

Sol. Radius = $\frac{0.9}{2}$ = 0.45 m



Area of ground pressed in 1 rev = CSA of roller

= $2\pi rh$

.14 × 0.45 × 1.8

× 0.81

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

$2\pi rh$

∴ Area of ground pressed in 1 rev = 5.0868 m²

Area of ground pressed in 500 revolutions

= 500 × Area of ground pressed in 1 rev

= 500 × 5.0868

= 2543.4 m²

∴ Area of ground pressed in 500 revolutions is 2543.4 m²

Thank You