UDAAN 2024

– FOR CLASS 10th STUDENTS

Lecture No.- 02

- Subject Name- Mathematics
- Chapter Name- Surface Area and Volume

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Topic to be Covered

Topic Surface areas and volumes of combination of figures

Important Questions

Name of Solid	Volume	Total Surface Area	Lateral Surface Area
Cube	$V = a^3$	$TSA = 6a^2$	$LSA = 4a^2$
Cuboid	$V = l \times b \times h$	$TSA = 2(lb + bh + hl)$	$LSA = 2h(l + b)$
Cylinder	$V = \pi r^2 h$	$TSA = 2\pi r(h + r)$	$CSA = 2\pi rh$
Hollow Cylinder ($R > r$)	$V = \pi(R^2 - r^2)h$	$TSA = 2\pi(R + r)(h + R - r)$	$2\pi(R + r)$
Cone	$V = \frac{1}{3}\pi r^2 h$	$TSA = \pi r(l + r)$	$CSA = \pi rl$
Sphere	$V = \frac{4}{3}\pi r^3$	$TSA = 4\pi r^2$	$CSA = 4\pi r^2$
Hemisphere	$V = \frac{2}{3}\pi r^3$	$TSA = 3\pi r^2$	$CSA = 2\pi r^2$

#Q. A solid cylinder of radius r and height h is placed over other cylinder of same height and radius. The total surface area of the shape so formed is $4\pi rh + 4\pi r^2$.

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

$= 4\pi r^2 + 4\pi rh + \pi r^2$

A) True

B) False

C) –

D) –

Topic : surface area of combination of solids

#Q. The capacity of a cylindrical vessel with a hemispherical portion raised upward at the bottom as shown in the figure is $\frac{\pi r^2}{3}[3h - 2r]$.

A) True

B) False

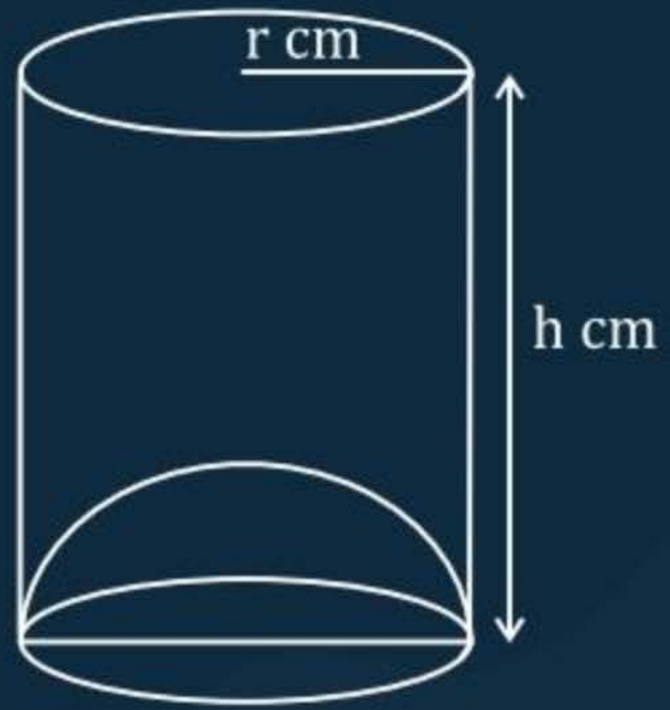
C) –

D) –

$= \pi r^2 h - \frac{2}{3}\pi r^3$

$= \pi r^2 \left[h - \frac{2}{3}r\right]$

$= \frac{\pi r^2}{3}\left[3h - 2r\right]$



#Q. The decorative block shown in fig. is made of two solids - a cube and a hemisphere. The base of the block is a cube with edge 5 cm, and the hemisphere fixed on the top has a diameter of 4.2 cm. Find the total surface area of the block. (Take π = 22/7)

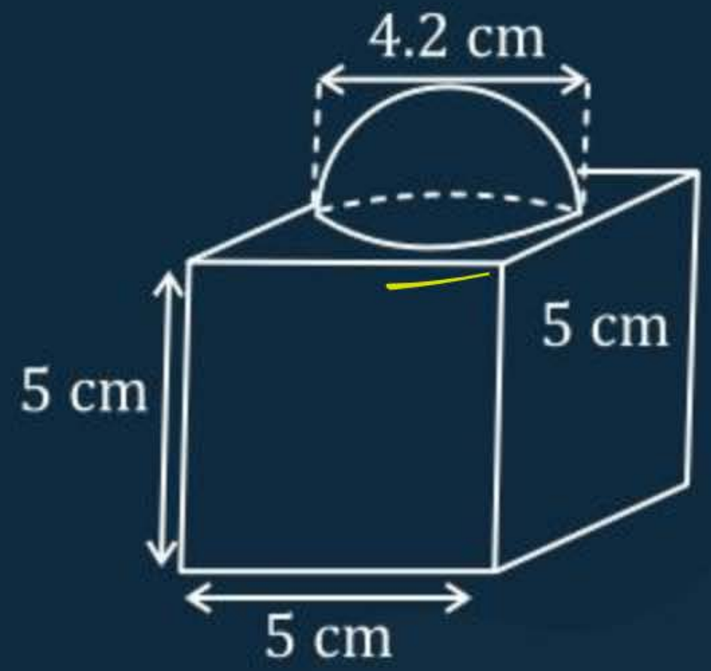
$T.S.A = 6a^2 - \pi r^2 + 2\pi r^2$ ($+\pi r^2$)

$a = 5cm$

$d = 4.2cm$

$\Rightarrow r = \frac{4.2}{2}$

$r = \frac{42}{20} = \boxed{\frac{21}{10}\ cm}$



$$= 6a^2 + \pi a^2$$

$$= 6 \times 5 \times 5 + \frac{22}{\cancel{7}_{1}} \times \frac{\cancel{21}^{3}}{10} \times \frac{21}{10}$$

$$= 150 + \frac{66 \times 21}{100}$$

$$= 150 + \frac{1386}{100}$$

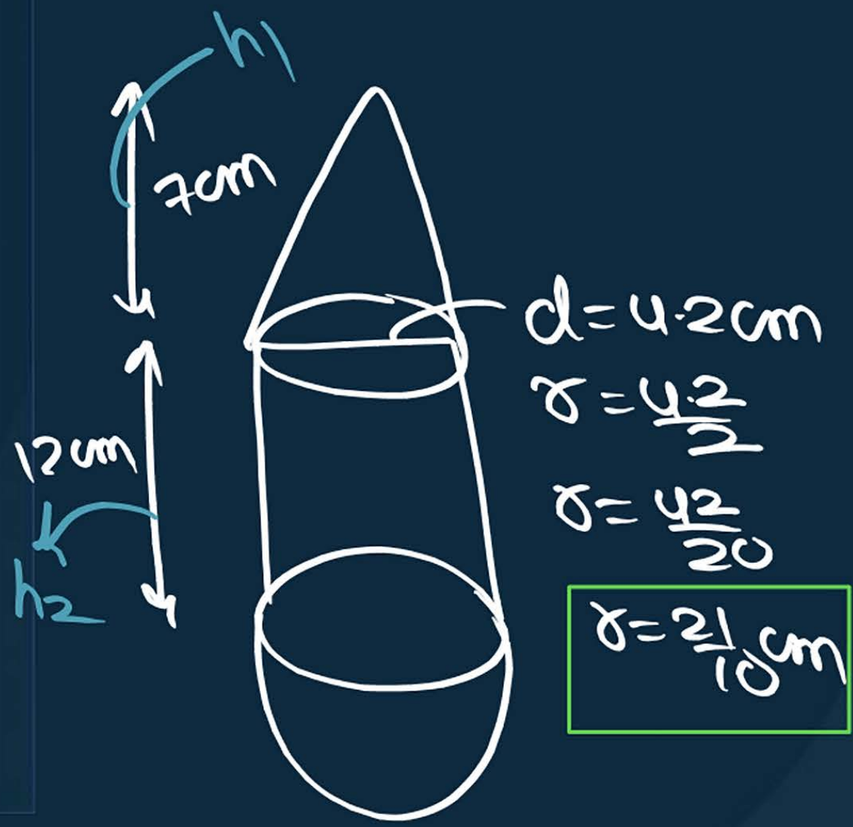
$$= 150 + 13.86$$

$$= \boxed{163.86\ cm^2}$$

Topic : surface area of combination of solids

#Q. A solid toy is in the form of a right circular cylinder with a hemispherical shape at one end and a cone at the other end. Their common diameter is 4.2 cm and the height of the cylindrical and conical portions are 12 cm and 7 cm respectively. Find the volume of the solid toy. (Use $\pi = 22/7$)

[NCERT, CBSE 2002 C]



Volume of solid toy = V. of cone + V. of cylinder + V. of hemisphere

$$= \frac{1}{3}\pi r^2 h_1 + \pi r^2 h_2 + \frac{2}{3}\pi r^3$$

$$= \pi r^2 \left[\frac{1}{3}h_1 + h_2 + \frac{2}{3}r\right]$$

$$= \frac{22}{7} \times \frac{21}{10} \times \frac{21}{10}\left[\frac{1}{3}\times 7 + 12 + \frac{2}{3}\times\frac{21}{10}\right]$$

$$= \frac{66 \times 21}{100}\left[\frac{7}{5}+\frac{12}{7}+\frac{7}{5}\right]$$

$$= \frac{66 \times 21}{100} \times \left[\frac{35+180+21}{15}\right]$$

$$= \frac{66 \times \cancel{21}^{7} \times 236}{100 \times \cancel{15}_{5}}$$

$$= \frac{21806.4}{\cancel{10803}2 / \cancel{5}_{1}}$$

$$= \frac{218064}{100}$$

218.064 cm^3

Topic : surface area of combination of solids

#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 500 per m^2.Note that the base of the tent will not be covered with canvas.)

dom

Area of canvas = C.S.A of cylinder + C.S.A of cone

$= 2\pi rh + \pi rl$

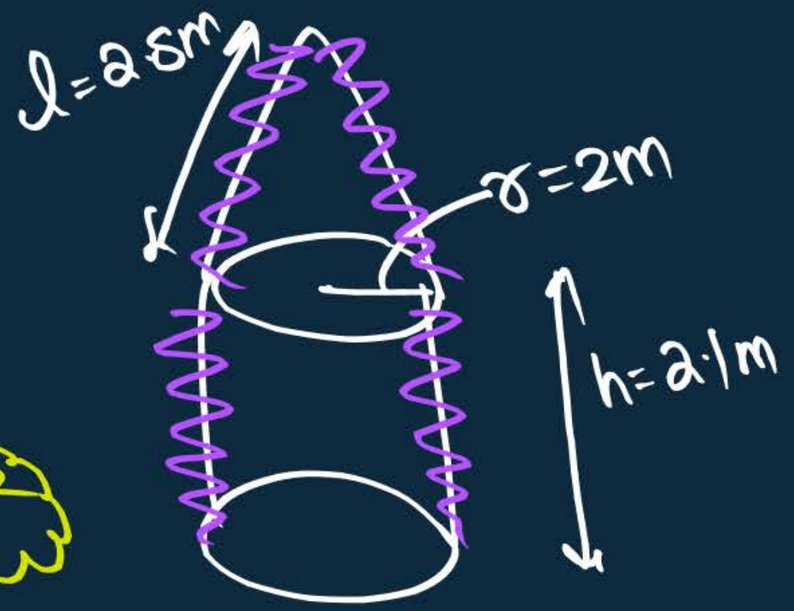
$= \pi r[2h + l]$

$= \frac{22}{7} \times 2\left[2 \times \frac{21}{10} + \frac{28}{10}\right]$

$= \frac{22}{7} \times 2 \times \left[\frac{42}{10} + \frac{28}{10}\right]$

$= \frac{22}{7} \times 2 \times \frac{70^{7}}{10}$

44 m^2



Rate = 500 per m^2

$1m^2 = 500$ Rs

$2m^2 = (2 \times 500)$ Rs

$15m^2 = (15 \times 500)$ Rs

$44m^2 = (44 \times 500)$ Rs

$= \boxed{22000 \text{ Rs}}$

#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 area of the remaining solid to the nearest cm^2.

T.S.A = base area of cylinder + C.S.A of cylinder + C.S.A of cone

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

$= \pi r[r + 2h + l]$

$= \frac{22}{7} \times \frac{7}{10}\left[\frac{7}{10} + 2 \times \frac{24}{10} + \frac{25}{10}\right]$

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

$l^2 = \left(\frac{12}{5}\right)^2 + \left(\frac{7}{10}\right)^2$

$l^2 = \left(\frac{144}{25} + \frac{49}{100}\right)$

$l^2 = \frac{576 + 49}{100}$

$l^2 = \frac{625}{100}$

$l = \sqrt{\frac{625}{100}}$

$d = 1.4$

$\Rightarrow r = \frac{1.4}{2}$

$r = \frac{14}{20}$

$\boxed{r = \frac{7}{10}}$

$\boxed{l = \frac{25}{10}\text{ cm}}$

$h = 24$

$= \left(\frac{24}{10}\right)^2$

$\boxed{h = \frac{12}{5}}$

$\frac{22}{10}\left[\frac{7}{10} + \frac{24}{5} + \frac{25}{10}\right]$

$= \frac{22}{10}\left[\frac{7 + 48 + 25}{10}\right]$

$= \frac{22}{10}\left[\frac{80}{10}\right]$

$= \frac{1760}{100}$

$= 17.6\text{cm}^2 = 18\text{cm}^2$

Topic : surface area of combination of solids

$\triangle$ = TSA of cy $- 2\pi r^2 + 2\pi r^2 + 2\pi r^2$

#Q. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in Fig. 12.11. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the total surface area of the article.

$h = 10\text{cm}$

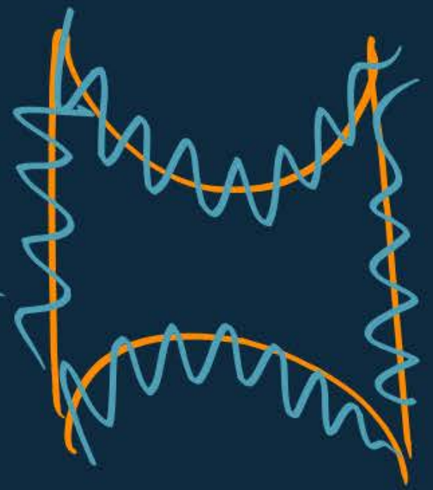
$r = \frac{35}{10}\text{cm}$

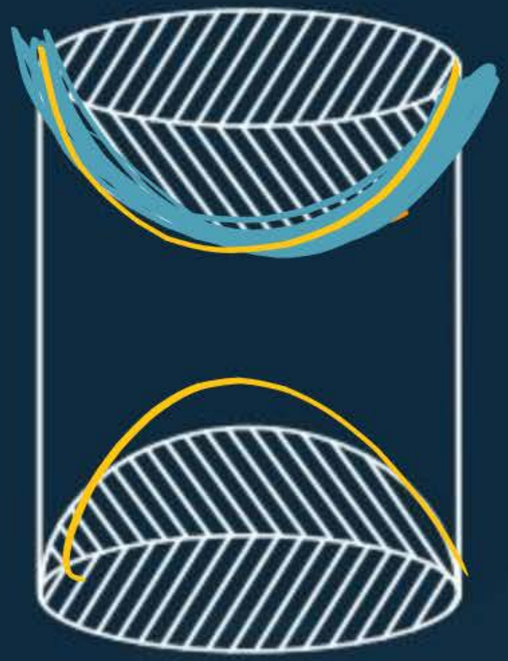
TSA = C.S.A of cylinder + $2 \times$ C.S.A of hemisphere

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

$= 2\pi rh + 4\pi r^2$

$= 2\pi r[h + 2r]$





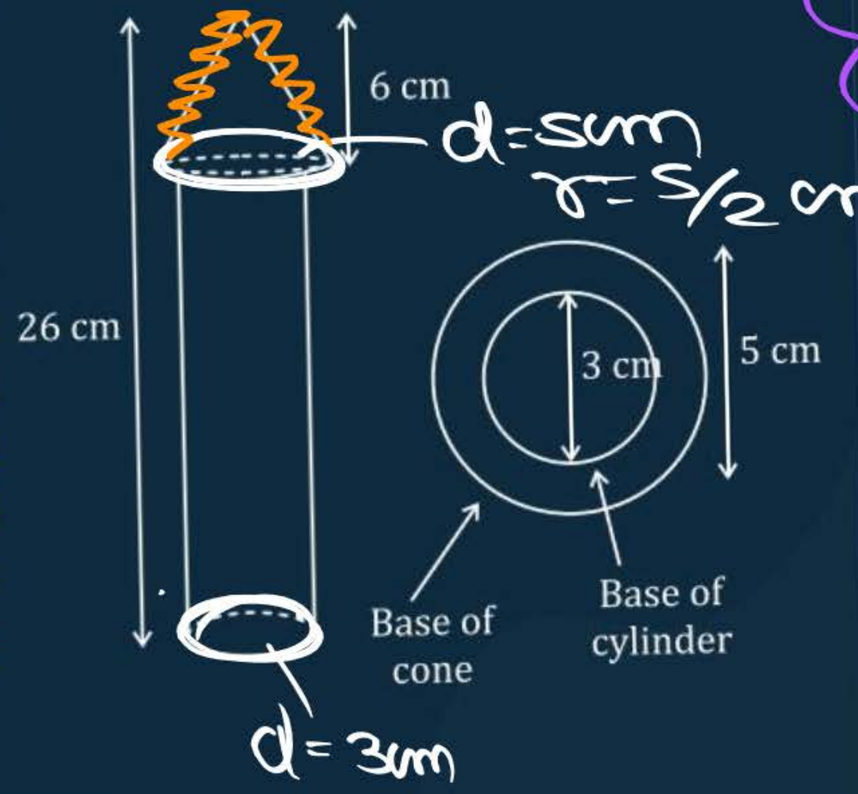
$$= \frac{1}{2} \times \frac{22}{7} \times \frac{5}{10} \left[10 + \frac{1}{2} \times 34 \right]$$

$$= 22 \times 17$$

$$= 374\ cm^2$$

Topic : surface area of combination of solids

#Q. A wooden toy rocket is in the shape of a cone mounted on a cylinder, as shown in figure. The height of the entire rocket is 26 cm, while the height of the conical part is 6 cm. The base of the conical portion has a diameter of 5 cm, while the base diameter of the cylindrical portion is 3 cm. If the conical portion is to be painted orange and the cylindrical portion yellow, find the area of the rocket painted with each of these colours. (Take $\pi = 3.14$)



d = 5cm
$r = 5/2$ cm

d = 3cm
$r = 3/2$ cm

Area of orange paint = C.S.A of Cone + πr^2 − upper area of cylinder

$l^2 = h_1^2 + r_1^2$

$= 36 + \frac{25}{4}$

$= \frac{169}{4}$

$l = \frac{13}{2}$

$\rightarrow r_1 = 5/2$

$\rightarrow r_2 = 3/2$

$$= \pi r_1 l + \pi r_1^2 - \pi r_2^2$$

$$= \pi \left[r_1 l + r_1^2 - r_2^2 \right]$$

$$= 3.14 \left[\frac{5}{2} \times \frac{13}{2} + \left(\frac{5}{2}\right)^2 - \left(\frac{3}{2}\right)^2 \right]$$

$$= \frac{314}{100} \left[\frac{65}{4} + \frac{25}{4} - \frac{9}{4} \right]$$

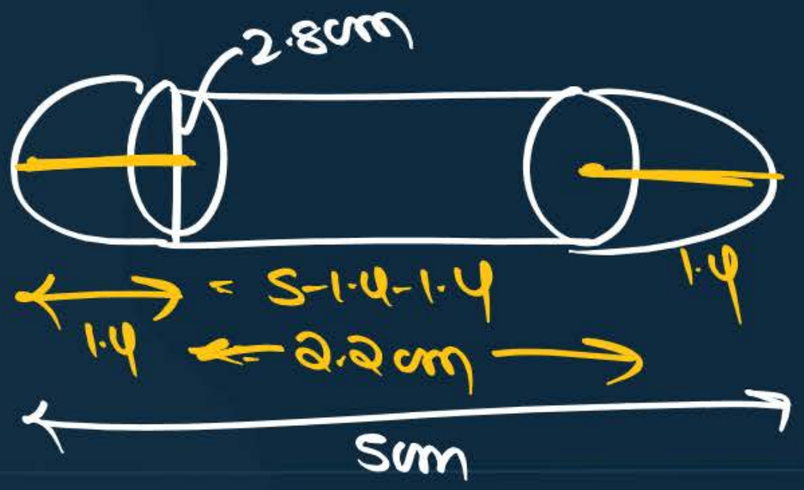
$$= \boxed{\frac{314}{100} \times \frac{81}{4}} \text{ cm}^2$$

Area to be painted yellow = base area of cylinder + CSA of cylinder

Topic : surface area of combination of solids

#Q. A Gulab Jamun when completely ready for eating contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 Gulab Jamun shaped like a cylinder with two hemispherical ends, if the complete length of each of the Gulab Jamun is 5 cm and its diameter is 2.8 cm. [NCERT]

Sugar syrup = 30% of its volume.



$d = 2.8\,cm$

$r = \frac{28}{20}\,cm$

$r = \frac{14}{10}$

$r = 1.4\,cm$

Volume of 1 (gulab) $= \pi r^2 h + 2 \times \frac{2}{3}\pi r^3$

$= \pi r^2 h + \frac{4}{3}\pi r^3$

$= \pi r^2 \left[h + \frac{4}{3} r \right]$

Vol of 45 gulab Jamun

$= 45 \times \pi r^2 \left[h + \frac{4}{3} r \right]$

If $V = 100 m^3$

$S.S = 30\% \text{ of } V$

$= 30\% \text{ of } 100$

$= \frac{30}{100} \times 100$

$= 30 m^3$

Sugar syrup

$= 30\% \text{ of } V \text{ of us (G.V)}$

$= \frac{30}{100} \times \text{us} \times \pi a^2 \left[h + \frac{a}{3}\right]$

$= \frac{3}{100} \times \frac{9}{45} \times \frac{22}{7} \times \frac{1}{14} \times \frac{14}{10} \left[\frac{22}{10} + \frac{4}{3} \times \frac{14}{10}\right]$

$= \frac{27 \times 22 \times 14}{100} \left[\frac{22}{10} + \frac{56}{30}\right]$

$= \frac{27 \times 22 \times 14}{100} \left[\frac{66 + 56}{30}\right]$

$= \frac{22 \times 27 \times 14 \times 122}{100 \quad 30}$

$338 \; cm^3$

TSA

#Q. 2 cubes each of volume 64 cm^3 are joined end to end. Find the surface area of the resulting cuboid.

$V = 64$

$a^3 = 64$

$a = \sqrt[3]{64}$

$a = \sqrt[3]{4 \times 4 \times 4}$

$a = 4cm$

T.S.A of cuboid $= 2(lb + bh + hl)$

$= 2(32 + 16 + 32)$

$= 2(80)$

$= 160 cm^2$

Topic : surface area of combination of solids

#Q. Rachel, an engineering student was asked to make a model in her workshop, which was shaped like a cylinder with two cones attached to its two ends, using 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. **[NCERT]**

H.w


THANK
YOU