UDAAN

2026

Surface Area and Volumes

MATHS LECTURE-3

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Topics *to be covered*

A Important Questions Part-02

Volume (V)	Total Surface Area	Lateral Surface Area
$V = a^3$	$TSA = 6a^2$	$LSA = 4a^2$
$V = l \times b \times h$	$RSA = 2(lb + bh + hl)$	$LSA = 2h(l + b)$
$V = \pi r^2 h$	$TSA = 2\pi r(h + r)$	$CSA = 2\pi rh$
$V = \frac{4}{3}\pi r^3$	$TSA = 4\pi r^2$	$CSA = 4\pi r^2$
$V = \frac{2}{3}\pi r^3$	$TSA = 3\pi r^2$	$CSA = 2\pi r^2$

#Q. Two cones of equal height have their radii in the ratio 3 : 2. The ratio of their volumes will be equal to

A 3 : 2

B 9 : 4

C 27 : 8

D 81 : 16

$$\frac{V}{V'} = \frac{\frac{1}{3}\pi(3x)^2 h}{\frac{1}{3}\pi(2x)^2 h}$$

$$= \frac{9x^2}{4x^2}$$

$$= \boxed{\frac{9}{4}}$$

I	II
h	h
3x	2x
V	V'

#Q. A cone and a cylinder have the same radii but the height of the cone is 3 times that of the cylinder. Find the ratio of their volumes.

CBSE 2020

Cone	Cylinder
r	r
$3x$	x
V	V_1

$$\frac{V}{V_1} = \frac{\frac{1}{3}\pi r^2 (3x)}{\pi r^2 (x)}$$

$$= \frac{1}{3} \cdot \frac{3x}{x}$$

$$= \frac{1}{1}$$

A. 1 : 1

B. 2 : 1

C. 1 : 2

D. NOTA

#Q. A juice seller was serving his customers using glasses. The inner diameter of the cylindrical glass was 5 cm, but the bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass. if the height of the glass was 10 cm, find what the apparent capacity of the glass was and what the actual capacity was (Use $\pi = 3.14$)

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

$h = 10cm$.

Abba. capacity = $V_{cylinder}$

Actual capacity = $V_{cylinder} - V_{hemi}$

NCERT, CBSE 2009

Ans. Apparent capacity = 196.25 cm^3
Actual capacity = 163.54 cm^3

#Q. A solid wooden toy is in the form of a hemisphere surmounted by a cone of same radius. The radius of hemisphere is 3.5 cm and the total wood used in the making of toy is $166\frac{5}{6}$ cm^3. Find the height of the toy. Also, find the cost of painting the hemispherical part of the toy at the rate of ₹10 per cm^2. (Take π = 22/7).

CBSE 2015

$V_{wood} = 166\frac{5}{6}\ cm^3$

$V_{cone} + V_{hemi} = \frac{1001}{6}$

$\frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3 = \frac{1001}{6}$

$\frac{1}{3}\pi r^2 \left[h + 2r\right] = \frac{1001}{6}$

$\frac{1}{3}\cdot\frac{22}{7}\cdot\frac{35}{10}\cdot\frac{35}{10}\left[h + 2\cdot\frac{35}{10}\right] = \frac{1001}{6}$

Ans. Height = 9.5 cm
Cost = ₹770

$$\frac{11 \times 3^2}{3 \times 2}\left[h+7\right] = \frac{1001}{6}$$

$$h+7 = \frac{91 \times 3 \times 2}{6 \times 11 \times 7}$$

$$\boxed{h = 6\,cm}$$

$1\,cm^2 = 10\,RS.$

$77\,cm^2 = (77 \cdot 10)\,RS$

$= 770\,RS$

Area to be painted = C.S.A of hemisphere

$= 2\pi r^2$

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

$= 77\,cm^2$

Height of toy

$= h_{cone} + h_{hemi}$

$= 6 + 3.5$

$= 9.5\,cm$

#Q. A building is in the form of a cylinder surmounted by a hemispherical vaulted dome and contains $41\frac{19}{21}$ m^3 of air. If the internal diameter of dome is equal to its total height above floor, find the height of the building?

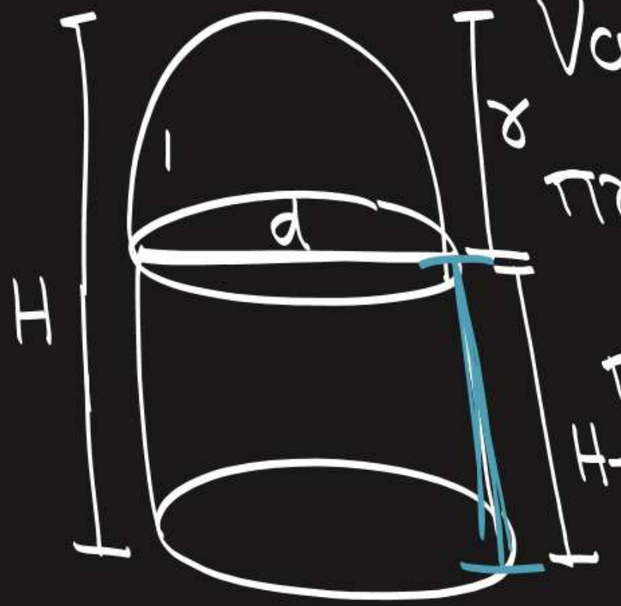
CBSE 2023

Amount of air $= 41\frac{19}{21}\ m^3$

$d = H$

$2r = H$

$r = \frac{H}{2}$



$V_{cy.} + V_{hemi} = \frac{880}{21}$

$\pi r^2 h + \frac{2}{3}\pi r^3 = \frac{880}{21}$

$\pi r^2 \left[h + \frac{2}{3}r\right] = \frac{880}{21}$

$H - r$

Ans. 4m

$$\pi r^2\left[h+\frac{2}{3}r\right]=\frac{880}{21}$$

$$\pi\left(\frac{H}{2}\right)^2\left[\frac{H}{2}+\frac{2}{3}\cdot\frac{H}{2}\right]=\frac{880}{21}$$

$$\frac{22}{7}\cdot\frac{H^2}{4}\left[\frac{H}{2}+\frac{H}{3}\right]=\frac{880}{21}$$

$$\frac{11H^2}{14}\left[\frac{3H+2H}{6}\right]=\frac{880}{21}$$

$$\frac{5H^3\cdot 11}{14\cdot 6}=\frac{880}{21}$$

$$h=H-r$$

$$h=H-\frac{H}{2}$$

$$=\frac{2H-H}{2}$$

$$h=\frac{H}{2}$$

$$H^3=\frac{880\cdot 14\cdot 6\cdot 2}{5\cdot 11\cdot 21}$$

$$H^3=64$$

$$H=\sqrt[3]{64}=4m$$

Ans ||

#Q. An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $(1/6)^{th}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find the volume of ice-cream. (Take $\pi = 3.14$).

#OR

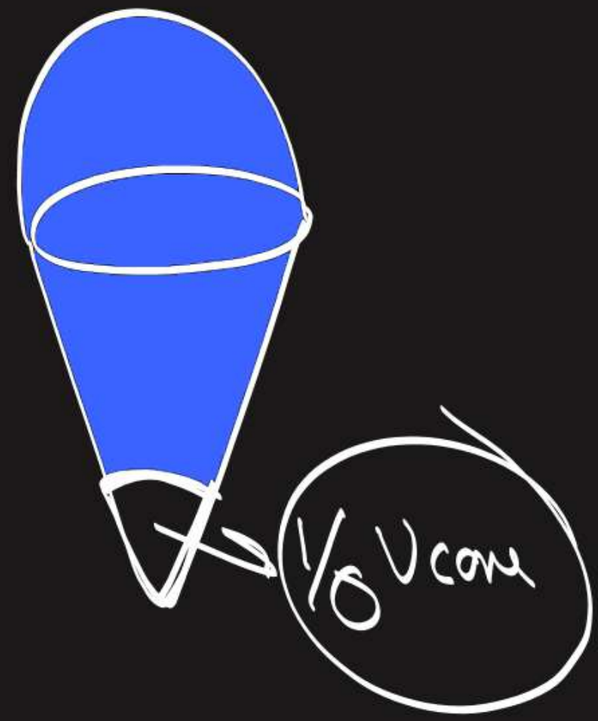
CBSE 2023

lower part $= \left(\frac{1}{6}\right) V_{cone}$.

$V_{icecream} = V_{cone} + V_{hemi} - \frac{1}{6} V_{cone}$.

$= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3 - \frac{1}{6}\cdot\frac{1}{3}\pi r^2 h$

$= \frac{\pi r^2}{3}\left[h + 2r - \frac{h}{6}\right]$



Ans. 150.72 cm^3

$$= \frac{\pi r^2}{3}\left[\frac{sh}{6} + 2a\right]$$

$$= \frac{314}{100} \cdot \frac{5 \cdot 3}{\cancel{5}} \left[\frac{5 \cdot \cancel{12}^{2}}{\cancel{6}} + 2 \cdot 3\right]$$

$$= \frac{314 \cdot 3}{100} \cdot 16$$

$$= \boxed{150.72\ cm^3}$$

#Q. Metallic silos are used by farmers for storing grains. Farmer Girdhar has decided to build a new metallic silo to store his harvested grains. It is in the shape of a cylinder mounted by a cone.

CBSE 2024

Dimensions of the conical part of a silo is as follows:

Radius of base = 1.5 m

Height = 2 m

Dimensions of the cylindrical part of a silo is as follows:

Radius = 1.5 m

Height = 7 m

#Gpy

Case based

On the basis of the above information answer the following questions.

(i) Calculate the slant height of the conical part of one silo.

(ii) Find the curved surface area of the conical part of one silo.

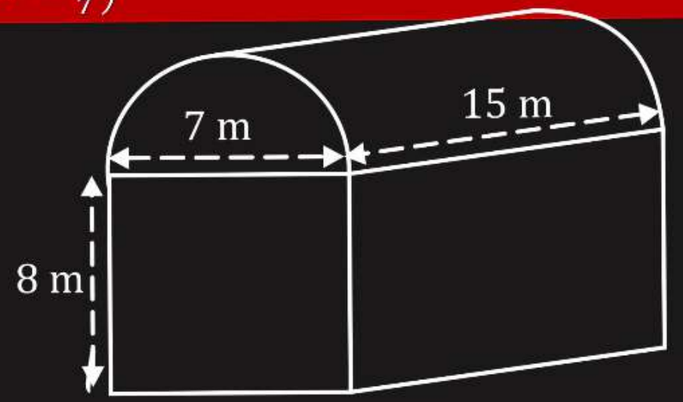
(iii) (A) Find the cost of metal sheet used to make the curved cylindrical part of 1 silo at the rate of ₹2000 per m^2.

OR

(B) Find the total capacity of one silo to store grains.

#GPY

#Q. Shanta runs an industry in a shed which is in the shape of a cuboid surmounted by a half cylinder (see Fig. 12.12). If the base of the shed is of dimension 7m * 15m and the height of the cuboidal portion is 8 m, find the volume of air that the shed can hold. Further, suppose the machinery in the shed occupies a total space of $300m^3$ and there are 20 workers, each of whom occupy about $0.08m^3$ space on an average. Then, how much air is in the shed? $\left(\text{Take } \pi = \frac{22}{7}\right)$



$V_{air} = V_{cuboid} + V.\ half\ cylinder$

$= lbh + \frac{1}{2} \cdot \pi r^2 h$

$= 7 \cdot 15 \cdot 8 + \frac{1}{2} \cdot \frac{22}{7} \cdot \frac{7}{2} \cdot 15$

$= 840 + 288.75$

$= \boxed{1128.75\ m^3}$

$V_{air\ in\ the\ shed} = 1128.75m^3 - 300 - 1.6$

$= 828.75 - 1.6$

$= \boxed{827.15m^3}$

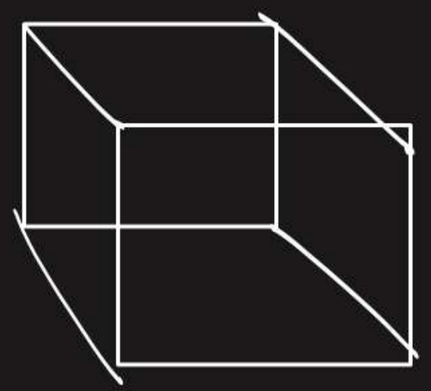
$1\ Worker = 0.08m^3$

$2\ Workers = 20 \times 0.08$

$= \boxed{1.60m^3}$

#Q. A wooden cubical die is formed by forming hemispherical depressions on each face of the cube such that face 1 has one depression, face 2 has two depressions and so on. The sum of number of hemispherical depressions on opposite faces is always 7. If the edge of the cubical die measures 5 cm and each hemispherical depression is of diameter 1.4 cm, find the total surface area of the die so formed.

CBSE 2025



Total hemispherical depressions

$= 1+2+3+4+5+6$

$= 21$

edge of cube = 5cm.

$d = 1.4$ cm

$r = \frac{1.4}{2} = \frac{14}{20} = \boxed{\frac{7}{10}\text{ cm}}$

$$T.S.A_{dic} = T.S.A_{cube} - 21 \cdot \pi r^2 + 21 (C.S.A_{hemi})$$

$$= 6a^2 - 21\pi r^2 + 21 (2\pi r^2)$$

$$= 6a^2 - 21\pi r^2 + 42\pi r^2$$

$$= 6a^2 + 21\pi r^2$$

$$= 6(5)^2 + 21 \cdot \frac{22}{7} \cdot \frac{7}{10} \cdot \frac{7}{10}$$

$$= 150 + 32.34$$

$$= \boxed{182.34 \text{ cm}^2}$$

Capacity of tank =

$V_{cylinder} + V_{cone}$

#Q. Fermentation tanks are designed in the form of cylinder mounted on a cone as shown below:

The total height of the tank is 3.3 m and height of conical part is 1.2 m. The diameter of the cylindrical as well as conical part is 1 m. Find the capacity of the tank. If the level of liquid in the tank is 0.7 m from the top, find the surface area of the tank in contact with liquid.

CBSE 2025

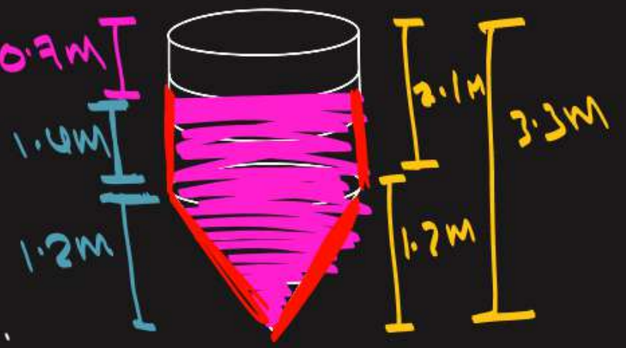
S.A of tank = C.S.A of cylinder ($h = 1.4$ m) + C.S.A of cone

$= 2\pi r(1.4) + \pi r l$

$= \pi r [2.8 + l]$

$= \frac{22}{7} \cdot \frac{1}{2} [2.8 + 1.3]$

$= \frac{11}{7} \cdot 4.1 =$ ◯ m^2



$d = 1$ m

$r = \frac{1}{2}$ m

$H = 2.1$ m

$h = 1.2$ m

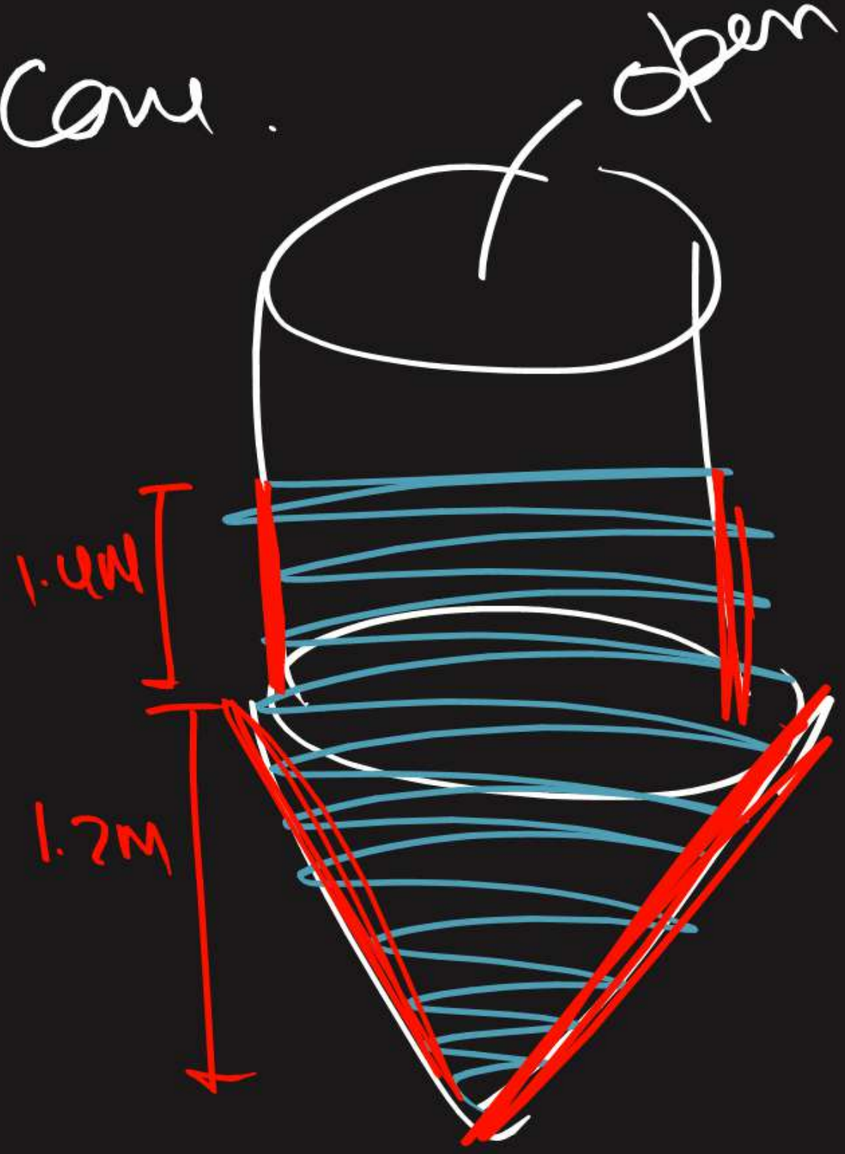
$l^2 = h^2 + r^2$

$= \left(\frac{12}{10}\right)^2 + \left(\frac{1}{2}\right)^2$

$= \frac{144}{100} + \frac{1}{4} = \frac{144+25}{100} = \frac{169}{100}$

$l = 13/10$

$$TSA = C.S.A_{cy} + C.S.A_{cone}$$



#Q. If a cone of greatest possible volume is hollowed out from a solid wooden cylinder, then the ratio of the volume of remaining wood to the volume of cone hollowed out is

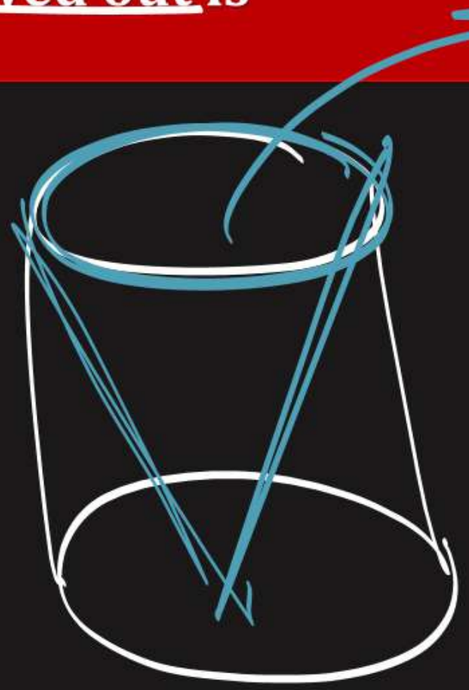
CBSE 2025

A 1 : 1

B 1 : 3

C 2 : 1

D 3 : 1



$V_{remaining\ wood} = V_{cy.} - V_{cone.}$

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

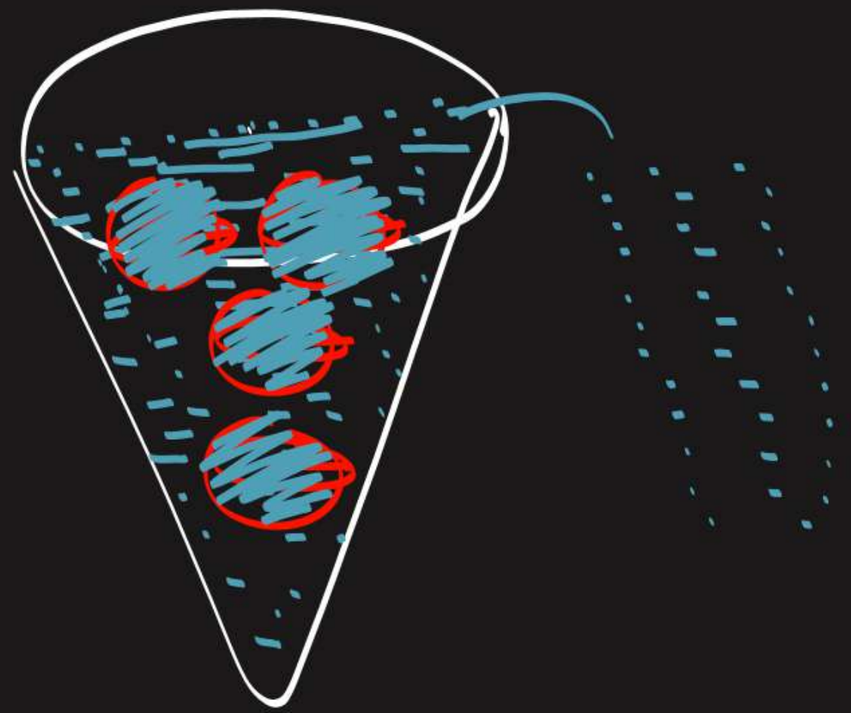
$= \pi r^2 h\left[1 - \frac{1}{3}\right]$

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

#GPU

$\frac{V_R}{V_{Co.}} = \frac{\frac{2}{3}\pi r^2 h}{\frac{1}{3}\pi r^2 h} = \frac{2}{1}$

V. water that flows out
= 4 · V. 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.

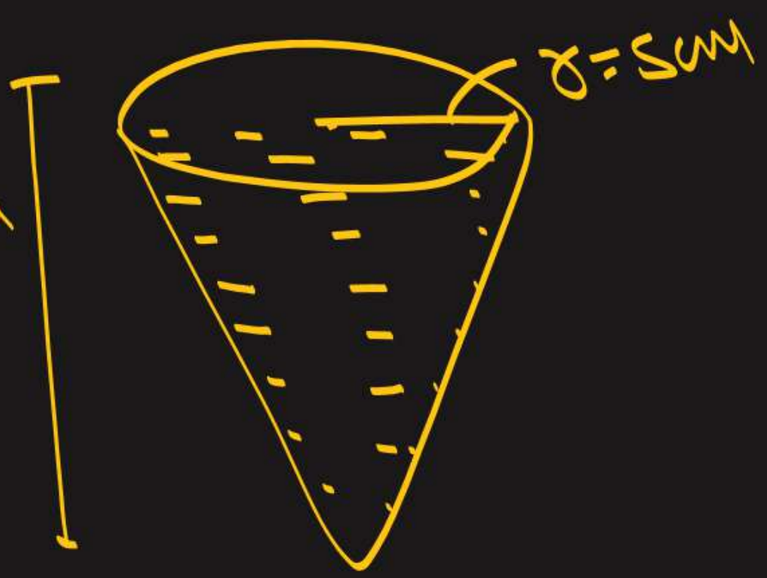
Let no. of lead shots = n

Volume of n lead shots = $\frac{1}{4}$ V_{cone}

$n \cdot \frac{4}{3}\pi r'^3 = \frac{1}{4} \cdot \frac{1}{3}\pi R^2 h$

$n \cdot 4 \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} = 1 \cdot \frac{1}{4} \cdot \frac{1}{3} \cdot 25 \cdot 8$

$n = \frac{10 \cdot 10 \cdot 10 \cdot 25 \cdot 2}{3 \cdot 4 \cdot 4 \cdot 1} = 100$ Ans.



#Q. A cylindrical glass tube with radius 10 cm has water upto a height of 9 cm. A metal cube of 8 cm edge is immersed completely. By how much the water level will rise in the glass tube?

CBSE Term-II, 2015

A 1.8 cm

B 1.6 cm

C 1.4 cm

D NOTA

V. metal cube = V. water rose in the glass tube.

$a = 8$ cm

$a^3 = \pi r^2 h$

$8^3 = \frac{22}{7} \cdot 10 \cdot 10 \cdot h$

$\frac{256 \times 7}{22 \cdot 10 \cdot 10} = h$

$h = 1.6$ cm

Ans. B

#Q. A sphere of diameter 6 cm is dropped in a right circular cylindrical vessel partly filled with water. The diameter of the cylindrical vessel is 12 cm. If the sphere is completely submerged in water, by how much will the level of water rise in the cylindrical vessel?

A 2 cm

B 3 cm

C 4 cm

D NOTA

#GPH

Ans. D


WORK HARD
DREAM BIG
NEVER GIVE UP

Thank You