SURFACE AREAS AND VOLUMES

SUBJECT : MATHEMATICS

CHAPTER NO: 13

CHAPTER NAME: SURFACE AREAS AND VOLUMES

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PPT-3

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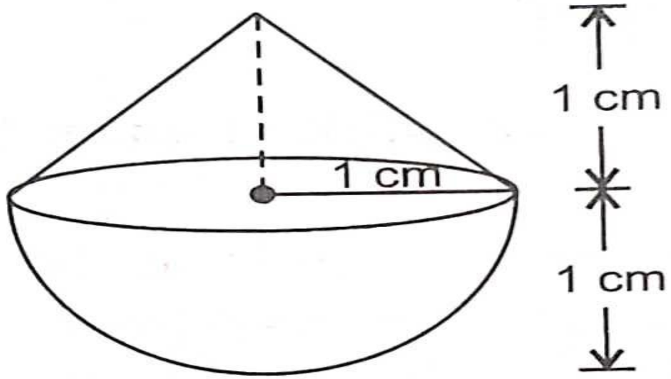
1. **A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π.**

Sol. Radius of hemisphere = 1 cm



$$\text{Volume of hemisphere} = \frac{2}{3}\pi(r^3) = \frac{2}{3}\pi(1)^3 = \frac{2}{3}\pi \text{ cm}^3$$

Radius of base of cone = 1 cm,

Height of cone = 1 cm

$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$

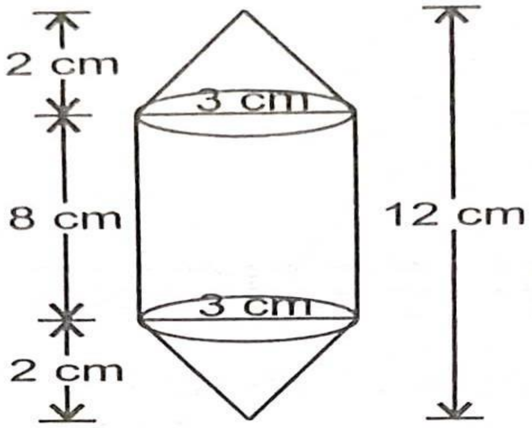
$$= \frac{1}{3}\pi(1)^2 \times 1 = \frac{1}{3}\pi \text{ cm}^3$$

Total volume of solid = volume of hemisphere + volume of cone

$$= \frac{2}{3}\pi\, cm^3 + \frac{1}{3}\pi\, cm^3 = \pi \text{ cm}^3$$

2. 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. Volume of air contained in model = total volume of solid



Diameter of base of cone = 3 cm

$\therefore$ Radius of base of cone = $\frac{3}{2}$ cm

Height of cone = 2 cm

Volume of a cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi\left(\frac{3}{2}\right)^2 \times 2 \text{ cm}^3$

$= \frac{1}{3}\pi \frac{9 \times 2}{4} = \frac{3}{2}\pi \, cm^3$

$\therefore$ Volume of both cones $= 2 \times \frac{3}{2}\pi \text{ cm}^3 = 3\pi \text{ cm}^3$

Volume of cylindrical portion $= \pi r^2 h$

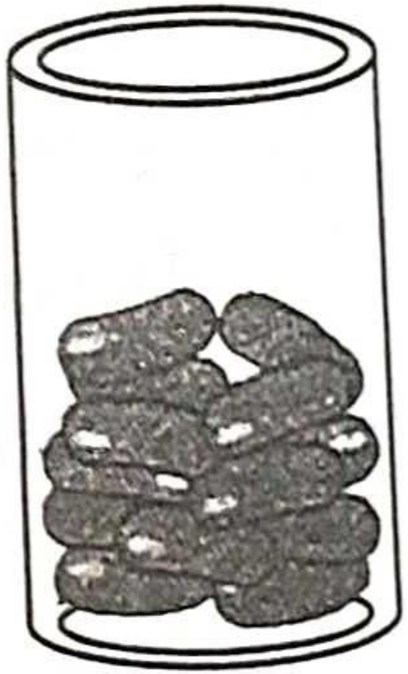
$= \pi\left(\frac{3}{2}\right)^2 \times 8 \text{ cm}^3 = \frac{\pi \times 9 \times 8}{4} \text{ cm}^3 = 18\pi \text{ cm}^3$

Volume of air contained in the model

= Total volume of solid $= 3\pi \text{ cm}^3 + 18\pi \text{ cm}^3$

$= 21\pi \text{ cm}^3 = \frac{21 \times 22}{7} \text{ cm}^3 = 66 \text{ cm}^3$

3. 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 (See figure).



Sol. Radius of hemispherical portion $= \frac{2.8}{2} = 1.4$ cm

Volume of hemispherical ends

$= \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7}(1.4)^3 \text{ cm}^3$

$= \frac{2}{3} \times \frac{22}{7} \times 1.4 \times 1.4 \times 1.4 \text{ cm}^3$

$= \frac{2 \times 22 \times 2 \times 14 \times 14}{3 \times 10 \times 10 \times 10} \text{ cm}^3 = 5.74 \text{ cm}^3$

Volume of both hemispherical ends

$= 2 \times 5.74 \text{ cm}^3 = 11.48 \text{ cm}^3$

Height of cylindrical portion

= (total height) – (radius of both hemispherical ends)

$= 5 \text{ cm} - 2(1.4) \text{ cm} = 5 \text{ cm} - 2.8 \text{ cm} = 2.2 \text{ cm}$

Radius of cylindrical portion = 1.4 cm

Volume of cylindrical portion of gulab jamun

$= \pi r^2 h = \frac{22}{7} \times (1.4)^2 \times 2.2 \text{ cm}^3$

$= \frac{22 \times 1.4 \times 1.4 \times 2.2}{7} \text{ cm}^3 = 13.55 \text{ cm}^3$

Total volume of one piece gulab jamun

= volume of two hemispherical ends

+ volume of cylindrical portion

$= 11.48 \text{ cm}^3 + 13.55 \text{ cm}^3 = 25.03 \text{ cm}^3$

Volume of sugar syrup for a gulab jamum

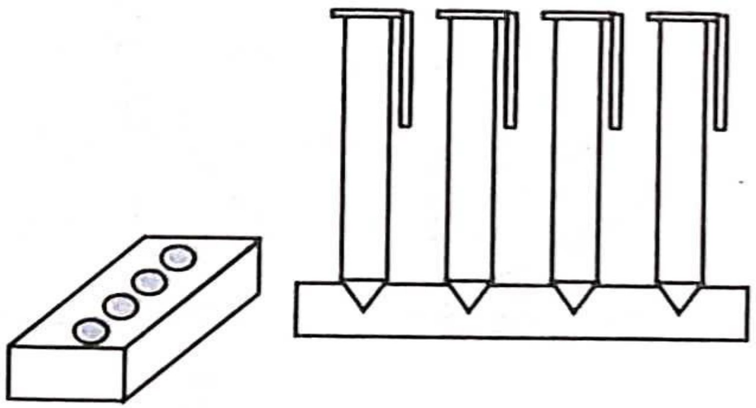
= 30% of volume of a gulab jamun

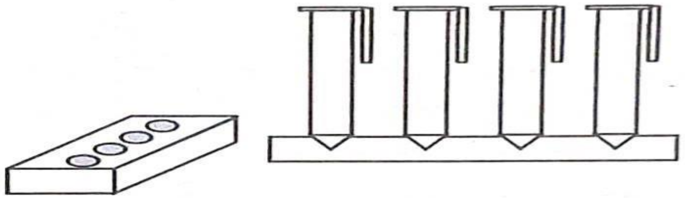
$= \frac{30}{100} \times 25.03 \text{ cm}^3 = 7.50 \text{ cm}^3$

$\therefore$ Volume of sugar syrup in 45 gulab jamuns

$= 45$ (volume of one gulab jamun) $= 45 \times 7.50 \text{ cm}^3$

4. 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 depression is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand (See figure).





Sol. Radius of one conical depression = 0.5 cm
Depth of one conical depression = 1.4 cm
Volume of one conical depression = $\frac{1}{3}\pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times (0.5)^2 \times 1.4 \text{ cm}^3$$

$$= \frac{1}{3} \times \frac{22}{7} \times 0.5 \times 0.5 \times 1.4 \text{ cm}^3 = 0.366 \text{ cm}^3$$

$\therefore$ Volume of four conical depressions

$= 4 \times 0.366 \text{ cm}^3 = 1.465 \text{ cm}^3$

Volume of cuboidal box

$= l \times b \times h = 15 \times 10 \times 3.5 \text{ cm}^3 = 525 \text{ cm}^3$

Remaining volume of box

= volume of cubical box

− volume of four conical depressions

$= 525 \text{ cm}^3 - 1.465 \text{ cm}^3 = 523.5 \text{ cm}^3$

THANKING YOU

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