SURFACE AREAS AND VOLUMES

SUBJECT : MATHEMATICS

CHAPTER NO: 13

CHAPTER NAME: SURFACE AREAS AND VOLUMES

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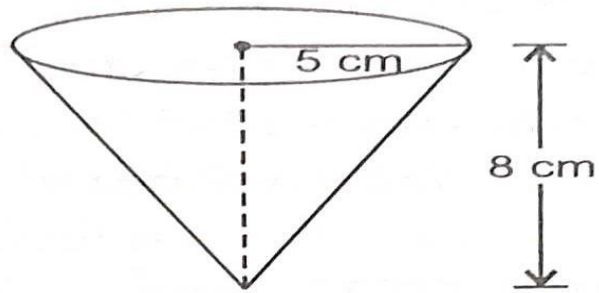
5. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of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

Sol. Given, height of the cone = 8 cm and radius of the cone = 5 cm



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

$= \frac{1}{3}\pi(5)^2 8 \text{ cm}^3 = \frac{200}{3}\pi \text{ cm}^3$

Radius of one spherical lead shot = 0.5 cm

$\therefore$ Volume of one spherical lead shot $= \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi(0.5)^3 \text{ cm}^3 = \frac{4 \times 0.125}{3}\pi \text{ cm}^3 = \frac{0.5}{3}\pi \text{ cm}^3$

When spherical lead are dropped in the vessel, one fourth of water flows out

Let number of lead shots be n

Volume of n spherical shots

$= \frac{1}{4}$ volume of conical vessel

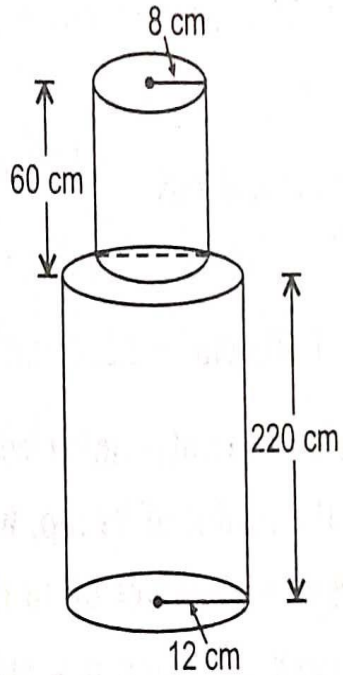
$\Rightarrow \quad n\left(\frac{0.5}{3}\pi\right) = \frac{1}{4}\left(\frac{200}{3}\pi\right) \Rightarrow n\,(0.5) = 50$

$\Rightarrow \quad n = \frac{50 \times 10}{5} = 100$

6. A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, which is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass. (Use $\pi = 3.14$)

Sol. Given, Radius of 1st cylinder = 12 cm

Height of 1st cylinder = 220 cm



12 cm

$\therefore$ Volume of 1st cylinder $= \pi r^2 h = \pi(12)^2\ (220)\ cm^3$

$= 144 \times 220\pi\ cm^3 = 144 \times 220 \times 3.14\ cm^3$

$= 99475.2\ cm^3$ ...(*i*)

Radius of 2nd cylinder = 8 cm

Height of 2nd cylinder = 60 cm

$\therefore$ Volume of 2nd cylinder $= \pi r^2 h$

$= \pi(8)^2\ (60)\ cm^3 = 64 \times 60\pi\ cm^3$

$= 64 \times 60 \times 3.14\ cm^3 = 12057.6\ cm^3$ ...(*ii*)

Total volume of solid = volume of 1st cylinder + volume of 2nd cylinder

$= 99475.2\ cm^3 + 12057.6\ cm^3 = 111532.8\ cm^3$

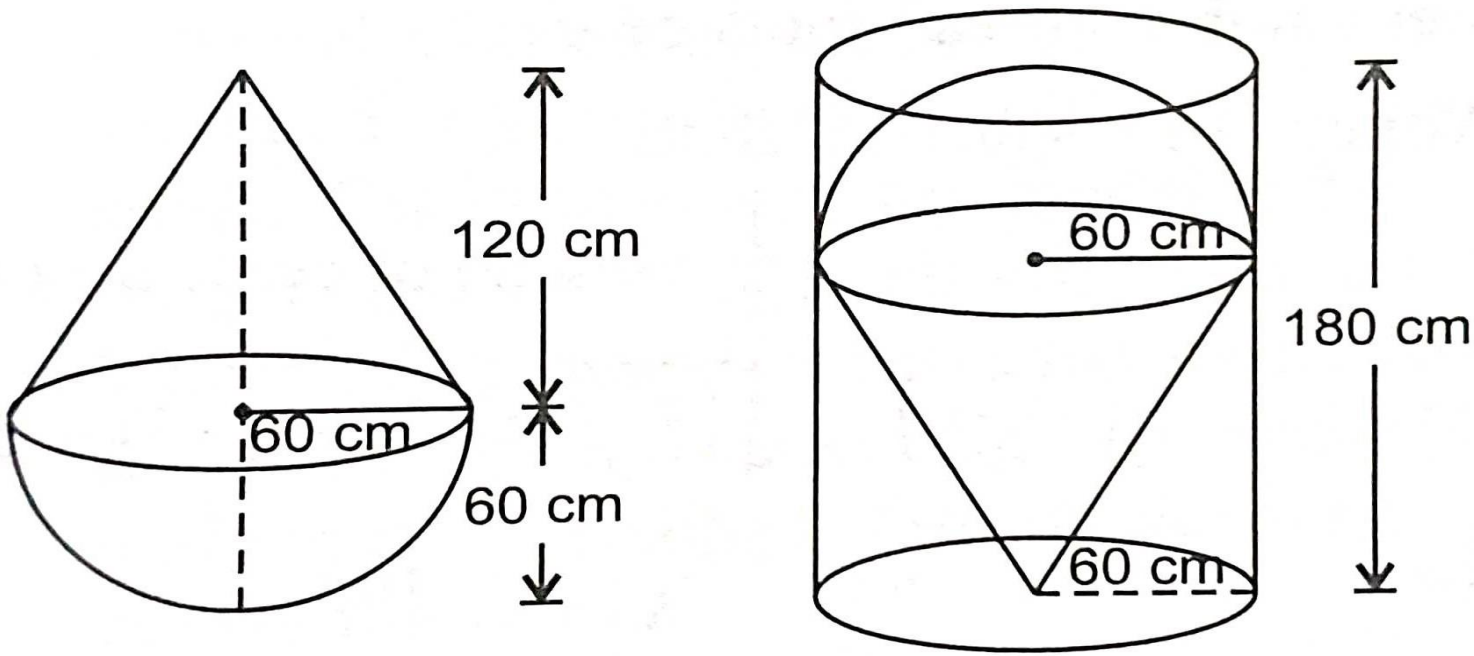
Given, mass of $1cm^3$ of iron = 8g

$\therefore$ Mass of $111532.8\ cm^3$ of iron $= 111532.8 \times 8g$

$= 892262.4g = 892.262\ kg$

7. A solid consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm is placed upright in a right circular cylinder full of water such that it touches the bottom. Find the volume of water left in the cylinder, if the radius of the cylinder is 60 cm and its height is 180 cm.

Sol. Radius of hemisphere = 60 cm



Volume of hemisphere $= \frac{2}{3}\pi(60)^3$ cm^3

Radius of conical base = 60 cm

Height of conical portion = 120 cm

Volume of conical portion $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi(60)^2 \times 120$ cm^3

Total volume of hemisphere and conical solid

= volume of hemisphere + volume of conical portion

$= \frac{2}{3}\pi\ (60)^3$ cm^3 $+ \frac{1}{3}\pi(60)^2\ 120$ cm^3

$= \frac{1}{3}\pi(60)^2\ [2(60) + 120]$ cm^3

$= \frac{1}{3}\pi\ 60 \times 60 \times 240$ cm^3 $= \pi(60)^2 \times 80$ cm^3

Volume of cylindrical solid $= \pi r^2 h = \pi(60)^2 \times 180$ cm^3

[where $r = 60$ cm and $h = 180$ cm]

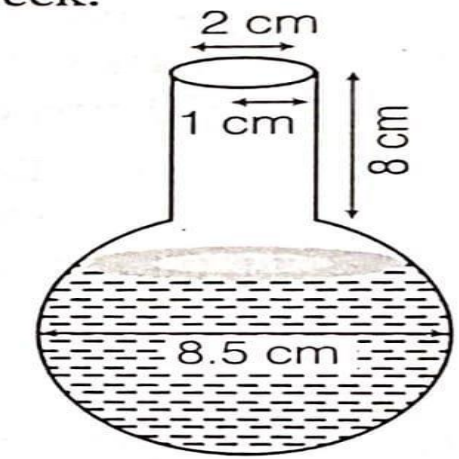
When (hemisphere + conical) solid kept in cylindrical solid then volume of water left in cylinder = volume of cylinder – (volume of hemisphere + volume of cone)

$= [\pi(60)^2 \times 180 - \pi(60)^2 \times 80]$ cm^3 $= \pi(60)^2\,(180-80)$ cm^3

$= \pi \times 3600 \times 100$ cm^3 $= 1130400$ cm^3 $= 1.130$ m^3

8 A spherical glass vessel has a cylindrical neck 8 cm long, 2 cm in diameter; the diameter of the spherical part is 8.5 cm. By measuring the amount of water it holds, a child finds its volume to be 345 cm^3. Check whether she is correct, taking the above as the inside measurements and $\pi = 3.14$.

Sol. Not correct. Given, spherical glass vessel is a combination of a sphere as its base and a cylinder as its neck.



For cylindrical portion,

Height of the cylinder, $h_1 = 8$ cm

Radius of the cylinder,

$$r_1 = \frac{2}{2} = 1 \text{ cm}$$

For spherical portion,

Radius of the sphere,

$$r_2 = \frac{8.5}{2} \text{ cm}$$

$\therefore$ Volume of water filled in a spherical glass vessel

= Volume of the cylinder + Volume of the sphere

$$= \pi r_1^2 h_1 + \frac{4}{3} \pi r_2^3$$

$$= 3.14 \times 1 \times 1 \times 8 + \frac{4}{3} \times 3.14 \times \frac{8.5}{2} \times \frac{8.5}{2} \times \frac{8.5}{2}$$

$$= 25.12 + \frac{1928.3525}{6}$$

$$= 25.12 + 321.39 = 346.51$$

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