CHAPTER 13

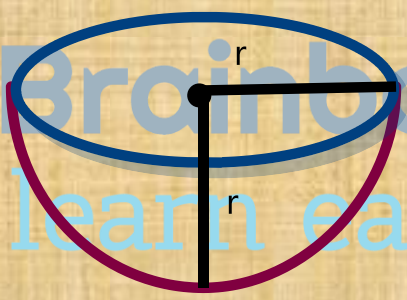
Surface areas and Volumes

Volume of hemispheres:

Volume of hemisphere = $\frac{1}{2} \times$ Volume of a sphere

$$= \frac{1}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{3} \pi r^3$$

Volume of a hemisphere = $2\pi r^3$

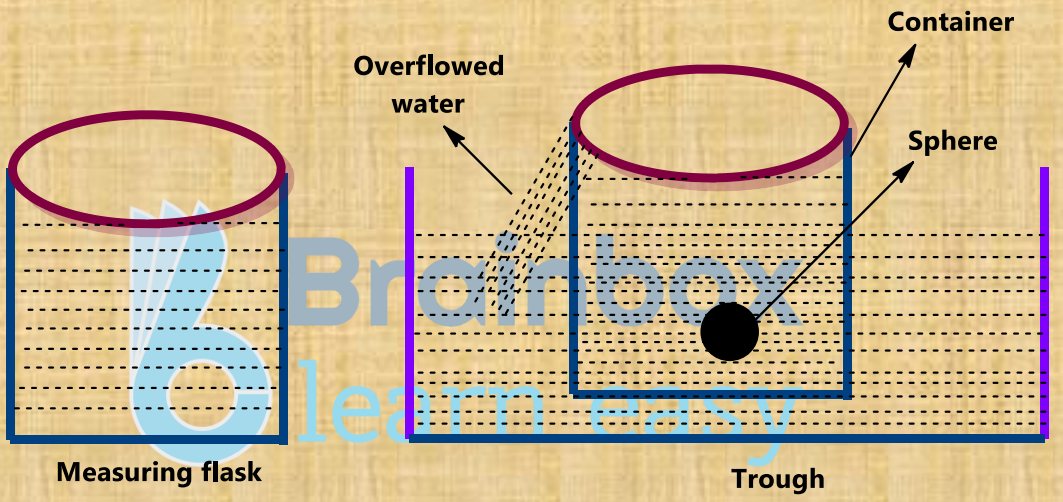


We take a trough and place the container full of water in it. Now we place a sphere in the container. Some of the water will overflow into the trough. We measure the volume of the over flowed water with the help of measuring cylinder. Suppose the radius of the immersed sphere is 'r'. Then we evaluates $\frac{4}{3}\pi r^3$, this value is equal to the measure of volume of the water displaced by the sphere.

Then the volume of the over flowed water = The volume of the sphere immersed in the water of container = $\frac{4}{3}\pi r^3$,

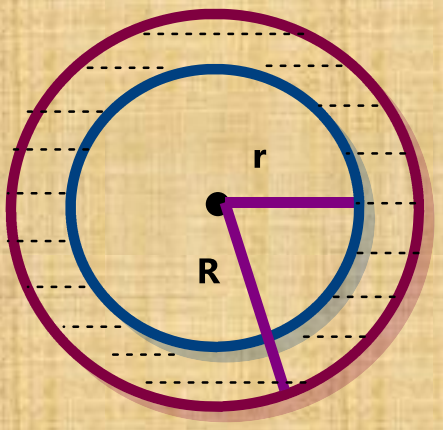
Where 'r' is radius of the sphere. We repeat the experiment with two or more sphere of different radii.

$\therefore$ Volume of sphere = $\frac{4}{3}\pi r^3$



Hollow sphere (or) Shell:

Let radii of outer and inner sphere be 'R' cm and 'r' cm.



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Thickness of the material = R – r

Volume of hollow sphere (or) shell =

{Outer sphere volume} – {Inner sphere volume}

$$= \frac{4}{3}\pi R^3 - \frac{4}{3}\pi r^3$$

Volume of hollow sphere (or) Shell = $\frac{4}{3}\pi\left(R^3 - r^3\right)$ cm^3

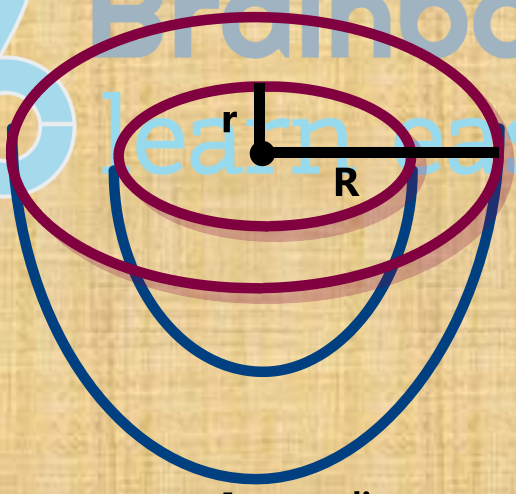
Exterior surface area = $4\pi R^2$

Interior surface area = $4\pi r^2$

Hemispherical shell:

The solid enlaced between two concentric hemispherical shell.

- Thickness of the shell = (R – r) units
- External curved surface area = $2\pi R^2$ Sq. units
- Internal curved surface area = $2\pi r^2$ Sq. units
- Total surface area = $2\pi R^2 + 2\pi r^2 + \pi\left(R^2 - r^2\right) = \pi\left(3R^2 + r^2\right)$ Sq. units
- $V = \frac{2}{3}\pi\left(R^3 - r^3\right)$ Cubic units



r = Inner radius

R = Outer radius

Example:

A hemispherical bowl is made up of stone whose thickness in 5cm. If the inner radius is 35 cm, find the total surface area of the bowl.

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Let R = Outer Radius

r = Inner radius = 35 cm

Thickness of ring = 5 cm

$\therefore R - r = 5$

$\Rightarrow R = 5 + r$

$= 5 + 35$

$\Rightarrow R = 40$ cm

Total surface area =

Curved surface area of outer hemisphere + Curved inner hemisphere + Area of the ring

$= 2\pi R^2 + 2\pi r^2 + \pi\left(R^2 - r^2\right)$

$= \pi\left(2R^2 + 2r^2 + R^2 - r^2\right)$

$$= \frac{22}{7}\left(3R^2 + R^2\right)$$

$$= \frac{6025 \times 22}{7}$$

$\therefore$ **Total surface area = 18935.71 cm^2 (Approx.)**