Mathematics

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(Chapter – 13) (Surface Areas and Volumes)

(Class – IX)

EXERCISE 13.8

Q.1. *Find the volume of a sphere whose radius is*
(i) 7 cm (ii) 0.63 m

Sol. (i) Here, $r = 7$ cm

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

$= \frac{4}{3} \times \frac{22}{7} \times 7 \times 7 \times 7 \text{ cm}^3 = \mathbf{1437\frac{1}{3}\ cm^3\ Ans.}$

(ii) Here, $r = 0.63$ m

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

$= \frac{4}{3} \times \frac{22}{7} \times (0.63)^3 \text{ m}^3 = \mathbf{1.05\ m^3\ (approx)\ Ans.}$

Q.2. *Find the amount of water displaced by a solid spherical ball of diameter*
(i) 28 cm (ii) 0.21 m

Sol. (i) Here, $r = \frac{28}{2}$ cm $= 14$ cm

Volume of water displaced by the spherical ball

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

$= \frac{4}{3} \times \frac{22}{7} \times 14 \times 14 \times 14 \text{ cm}^3$

$= \mathbf{11498\frac{2}{3}\ cm^3\ Ans.}$

(ii) Here, $r = \frac{0.21}{2}$ m $= 0.105$ m

Volume of the water displaced by the spherical ball

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

$= \frac{4}{3} \times \frac{22}{7} \times 0.105 \times 0.105 \times 0.105 \text{ m}^3$

$= \mathbf{0.004851\ m^3\ Ans.}$

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Q.3. *The diameter of a metallic ball is 4.2 cm. What is the mass of the ball, if the density of the metal is 8.9 g per cm^3?*

Sol. Here, $r = \frac{4.2}{2}$ cm = 2.1 cm

Volume of the ball = $\frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 2.1 \text{ cm}^3$

$= 38.808 \text{ cm}^3$

Density of the metal = 8.9 g/cm^3

$\therefore$ Mass of the ball = 8.9×38.808 g

= 345.39 g (approx) Ans.

Q.4. *The diameter of the moon is approximately one fourth of the diameter of the earth. What fraction of the volume of the earth is the volume of the moon?*

Sol. Let diameter of the earth be $2r$.

Then radius of the earth = r

So, diameter of the moon = $\frac{2r}{4} = \frac{r}{2}$

$\Rightarrow$ Radius of the moon = $\frac{r}{4}$

Volume of the earth = $\frac{4}{3}\pi r^3$ ... (i)

Volume of the moon = $\frac{4}{3}\pi\left(\frac{r}{4}\right)^3$ ... (ii)

$$\frac{\text{Volume of the earth}}{\text{Volume of the moon}} = \frac{\frac{4}{3}\pi r^3}{\frac{4}{3}\pi\left(\frac{r}{4}\right)^3}$$ [From (i) and (ii)]

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$$\frac{r^3}{\frac{r^3}{64}} = \frac{64}{1} = 64 \textbf{ Ans.}$$

$\Rightarrow$ Volume of the moon = $\frac{1}{64}$ × volume of the earth

Hence, volume of the moon is $\frac{1}{64}$ of volume of the earth. **Ans.**

Q.5. *How many litres of milk can a hemispherical bowl of diameter* 10.5 *cm hold?*

Sol. Here, $r = \frac{10.5}{2}$ cm = 5.25 cm

Volume of the hemispherical bowl = $\frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \frac{22}{7} \times 5.25 \times 5.25 \times 5.25 \text{ cm}^3 = 303 \text{ cm}^3$ (approx)

Hence, the hemispherical bowl can hold $\frac{303}{1000}$ litres **= 0.303 liters of milk. Ans.**

Q.6. *A hemispherical tank is made up of an iron sheet* 1 *cm thick. If the inner radius is* 1 *m, then find the volume of the iron used to make the tank.*

Sol. Here, inner radius of the tank (r) = 1 m

Thickness of the iron sheet = 1 cm = 0.01 m

$\therefore$ External radius of the tank (R) = (1 + 0.01) m = 1.01 m

Volume of the iron used to make the tank

$$= \frac{2}{3}\pi (R^3 - r^3)$$

$$= \frac{2}{3} \times \frac{22}{7} \times [(1.01)^3 - 1^3] \text{ m}^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times 0.030301 \text{ m}^3$$

$$= \textbf{0.06348 m}^3 \textbf{ Ans.}$$

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Q.7. *Find the volume of a sphere whose surface area is* 154 cm^2.

Sol. Here, $4\pi r^2 = 154$

$$\Rightarrow r^2 = 4 \times \frac{22}{7} \times r^2 = 154$$

$$\Rightarrow r^2 = \frac{154 \times 7}{4 \times 22} = \frac{49}{4}$$

$$\Rightarrow r = \frac{7}{2} = 3.5 \text{ cm}$$

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

$$= \frac{4}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 3.5 \text{ cm}^3 = \mathbf{179\frac{2}{3}\ cm^3\ Ans.}$$

Q.8. *A dome of a building is in the form of a hemisphere. From inside, it was white-washed at the cost of Rs* 498.96. *If the cost of white-washing is Rs* 2.00 *per square metre, find the*

(i) inside surface area of the dome,

(ii) volume of the air inside the dome.

Sol. (i) Inner surface of the dome

$$= \frac{\text{Total cost}}{\text{Cost of white washing per m}^2}$$

$$= \frac{498.96}{2} \text{ m}^2 = \mathbf{249.48\ m^2\ Ans.}$$

(ii) Let radius of the dome be r m.

Then $2\pi r^2 = 249.48$

$$\Rightarrow \quad 2 \times \frac{22}{7} \times r^2 = 249.48$$

$$\Rightarrow \quad r^2 = \frac{249.48 \times 7}{2 \times 22} = 39.69$$

$$\Rightarrow \quad r = 6.3 \text{ cm}$$

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$\therefore$ Volume of the air inside the dome $= \frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \frac{22}{7} \times 6.3 \times 6.3 \times 6.3 \text{ m}^3 =$ **523.9 m³ Ans.**

Q.9. *Twenty seven solid iron spheres, each of radius r and surface area S are melted to form a sphere with surface area S′. Find the*
(i) radius r′ of the new sphere.
(ii) ratio of S and S′.

Sol. (i) Volume of a sphere of radius $r = \frac{4}{3}\pi r^3$

$\therefore$ Volume of 27 such spheres $= 27 \times \frac{4}{3}\pi r^3 = 36\pi r^3$

Volume of the sphere with radius $r' = \frac{4}{3}\pi r'^3$

$\therefore 36\pi r^3 = \frac{4}{3}\pi r'^3$

$\Rightarrow 27r^3 = r'^3$

$\Rightarrow r' = \sqrt[3]{27\, r^3}$

$\Rightarrow$ **$r' = 3r$ Ans.**

(ii) Surface area (S) of the sphere with radius $r = 4\pi r^2$

Surface area (S′) of the sphere with radius $r' = 4\pi r'^2$

$= 4\pi (3r)^2 = 36\pi r^2$

$\therefore \quad \frac{S}{S'} = \frac{4\pi r^2}{36\pi r^2} = \frac{1}{9}$ **= 1 : 9 Ans.**

Q.10. *A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in mm³) is needed to fill this capsule?*

Sol. Here, $r = \frac{3.5}{2}$ mm = 1.75 mm

Volume of the capsule $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 1.75 \times 1.75 \times 1.75 \text{ mm}^3$

$= 22.46 \text{ mm}^3$ (approx)

Hence, 22.46 mm³ of medicine is needed to fill the capsule **Ans.**