Exercise 11.4

Assume $\pi = \frac{22}{7}$, unless stated otherwise.

1. *Find the volume of a sphere whose radius is*

(*i*) *7 cm* (*ii*) *0.63 m.*

Sol. (*i*) Radius (r) = 7 cm

$$\therefore \text{ Volume } = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (7)^3 \text{ cm}^3$$

$$= 1437\frac{1}{3} \text{ cm}^3.$$

(*ii*) Volume $= \frac{4}{3} \times \frac{22}{7} \times (0.63)^3 \text{ cm}^3$

$= 1.05 \text{ m}^3$ (approx.).

2. *Find the amount of water displaced by a solid spherical ball of diameter*

(*i*) *28 cm* (*ii*) *0.21 m.*

Sol. Volume of water displaced = Volume of solid spherical ball.

(*i*) Diameter = 28 cm $\Rightarrow$ Radius = 14 cm.

$$\therefore \text{ Volume of water displaced } = \frac{4}{3} \times \frac{22}{7} \times (14)^3 \text{ cm}^3$$

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

(*ii*) Diameter = 0.21 m $\Rightarrow$ Radius = 0.105 m.

$\therefore$ Volume of water displaced = $\frac{4}{3} \times \frac{22}{7} \times (0.105)^3$ cm^3

= 0.004851 m^3.

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. Diameter of the ball = 4.2 cm.

$\Rightarrow$ Radius of the ball = 2.1 cm.

Volume of the ball = $\frac{4}{3} \times \frac{22}{7} \times (2.1)^3$ cm^3 = 38.808 cm^3.

Mass of the ball = density × volume

= 8.9 × 38.808 g

= 345.39 g (approx.)

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 = d units.

$\Rightarrow$ Radius of the earth = $\frac{d}{2}$ units.

Diameter of the moon = $\frac{d}{4}$ units.

$\Rightarrow$ Radius of the moon = $\frac{d}{8}$ units.

$$\frac{\text{Volume of the earth}}{\text{Volume of the moon}} = \frac{\frac{4}{3}\pi\left(\frac{d}{2}\right)^3}{\frac{4}{3}\pi\left(\frac{d}{8}\right)^3} = 64.$$

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

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

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

Sol. Volume of the hemisphere $= \frac{2}{3} \times \frac{22}{7} \times (5.25)^3 \text{ cm}^3$

$= 303.19 \text{ cm}^3$

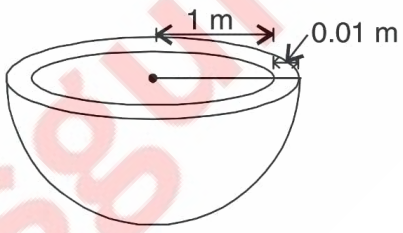
So, the capacity of the bowl $= \frac{303.19}{1000} \ l$

$= 0.303 \ l$ (approx.)

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. Inner radius = 1 m, thickness

= 1 cm = 0.01 m



Outer radius = 1 + 0.01 m

= 1.01 m

Volume of iron used

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

$= \frac{44}{21} \times \{1.0303 - 1\} \text{ m}^3 = \frac{44}{21} \times 0.0303 \text{ m}^3$

$= 0.06348 \text{ m}^3$ (approx.)

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

Sol. Surface area = 154 cm^2

$\Rightarrow \quad 4 \times \frac{22}{7} \times r^2 = 154 \quad \Rightarrow \quad r^2 = \frac{154 \times 7}{88} = 12.25$

$\Rightarrow \quad r = 3.5 \text{ cm}.$

Volume of the sphere $= \frac{4}{3} \times \frac{22}{7} \times (3.5)^3 \text{ cm}^3 = 179\frac{2}{3} \text{ cm}^3.$

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

(*i*) *inside surface area of the dome,*

(*ii*) *volume of the air inside the dome.*

Sol. Cost of white washing = ₹ 498.96.

Rate of white-washing = ₹ 2 per sq. m.

(*i*) Inside surface area = $\frac{498.96}{2}$ m^2 = 249.48 m^2.

(*ii*) We have $2 \times \frac{22}{7} \times r^2 = 249.48$

$\Rightarrow \quad r^2 = \frac{249.48 \times 7}{44} = 39.69 \quad \Rightarrow \quad r = 6.3$ m

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

$= \frac{2}{3} \times \frac{22}{7} \times (6.3)^3$ m^3

= 523.90 m^3 (approx.).

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. Total volume of 27 sphere = $27 \times \frac{4}{3}\pi r^3 = 36\pi r^3$

(*i*) Volume of a new sphere = $\frac{4}{3}\pi r'^3$ ...(*i*)

$\therefore \quad \frac{4}{3}\pi r'^3 = 27 \times \frac{4}{3}\pi r^3$

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

(*ii*) Surface area of each of 27 spheres (S) = $4\pi r^2$ ...(*a*)

Surface area of a new sphere (S′) = $4\pi(3r)^2 = 36\pi r^2$ ...(*b*)

From (*a*) and (*b*), we get

$$\frac{S}{S'} = \frac{4\pi r^2}{36\pi r^2} = \frac{1}{9}$$

Hence, S : S′ = 1 : 9.

10. *A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in mm^3) is needed to fill this capsule?*

Sol. $\because$ Diameter (d) = 3.5 mm

$\therefore$ Radius (r) = $\frac{3.5}{2}$ = 1.75 mm

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

$= \frac{4}{3} \times \frac{22}{7} \times (1.75)^3$

m= 22. 46 mm3

(approx.). m^3