

Exercise-13.8

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

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

Ans.(i) Radius of sphere (r) = 7 cm

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 7 \times 7 \times 7$$

$$= \frac{4312}{2} = 1437 \frac{1}{2} \text{ cm}^3$$

(ii) Radius of sphere (r) = 0.63 m

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 0.63 \times 0.63 \times 0.63$$

$$= \frac{4}{2} \times \frac{22}{7} \times \frac{63}{100} \times \frac{63}{100} \times \frac{63}{100} = 1.047816 \text{ m}^3 = 1.05 \text{ m}^3 \text{ (approx.)}$$

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

(i) 28 cm (ii) 0.21 m

Ans. (i) Diameter of spherical ball = 28 cm

$$\therefore \text{Radius of spherical ball (r)} = \frac{28}{2} = 14 \text{ cm}$$

According to question, Volume of water replaced = Volume of spherical ball

$$= \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 14 \times 14 \times 14 = \frac{34496}{3}$$

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

(ii) Diameter of spherical ball = 0.21 m

$$\therefore \text{Radius of spherical ball}(r) = \frac{0.21}{2} \text{ m}$$

According to question,

Volume of water replaced = Volume of spherical ball

$$= \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{0.21}{2} \times \frac{0.21}{2} \times \frac{0.21}{2}$$

$$= \frac{4}{3} \times \frac{22}{7} \times \frac{21}{200} \times \frac{21}{200} \times \frac{21}{200}$$

$$= 11 \times \frac{441}{100 \times 100 \times 100} = 0.004851 \text{ m}^3$$

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

Ans. Diameter of metallic ball = 4.2 cm

$$\therefore \text{Radius of metallic ball}(r) = \frac{4.2}{2} = 2.1 \text{ cm}$$

$$\text{Volume of metallic ball} = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 2.1$$

$$= \frac{4}{3} \times \frac{22}{7} \times \frac{21}{10} \times \frac{21}{10} \times \frac{21}{10} = 38.808 \text{ cm}^3$$

Density of metal = 8.9 g per cm^3

$$\therefore \text{Mass of } 1 \text{ cm}^3 = 8.9 \text{ g}$$

$$\therefore \text{Mass of } 38.808 \text{ cm}^3 = 8.9 \times 38.808$$

$$= 345.3912 \text{ g} = 345.39 \text{ g (approx).}$$

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

Ans. Let diameter of earth be x

$$\therefore \text{Radius of earth (r)} = \frac{x}{2}$$

$$\text{Now, Volume of earth} = \frac{4}{3} \pi r^3 \quad [\because \text{Earth is considered to be a sphere}]$$

$$= \frac{4}{3} \times \pi \times \frac{x}{2} \times \frac{x}{2} \times \frac{x}{2}$$

$$= \frac{1}{8} \times \frac{4}{3} \pi x^3 \dots \dots \dots \text{(i)}$$

According to question,

$$\text{Diameter of moon} = \frac{1}{4} \times \text{Diameter of earth} = \frac{1}{4} \times x = \frac{x}{4}$$

$$\therefore \text{Radius of moon (R)} = \frac{x}{8}$$

$$\text{Now, Volume of Moon} = \frac{4}{3} \pi R^3 \quad [\because \text{Moon is considered to be a sphere}]$$

$$= \frac{4}{3} \times \pi \times \frac{x}{8} \times \frac{x}{8} \times \frac{x}{8}$$

$$= \frac{1}{512} \times \frac{4}{3} \pi x^3$$

$$= \frac{1}{64} \times \left[\frac{1}{8} \times \frac{4}{3} \pi x^3 \right]$$



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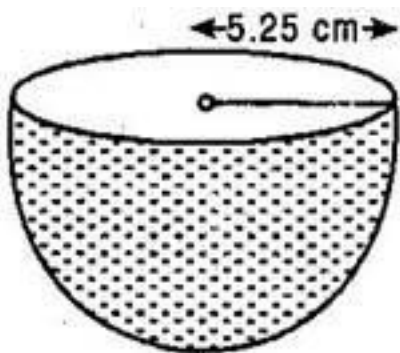
$$= \frac{1}{64} \times \text{Volume of Earth [From eq. (i)]}$$

∴ Volume of moon is $\frac{1}{64}$ th the volume of earth.

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

Ans. Diameter of hemispherical bowl = 10.5 cm

$$\therefore \text{Radius of hemispherical bowl}(r) = \frac{10.5}{2} = 5.25 \text{ cm}$$



Volume of milk in hemispherical bowl

$$= \frac{2}{3} \pi r^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times 5.25 \times 5.25 \times 5.25$$

$$= \frac{2}{3} \times \frac{22}{7} \times \frac{525}{100} \times \frac{525}{100} \times \frac{525}{100}$$

$$= 11 \times \frac{21}{4} \times \frac{21}{4} = 303.187 \text{ cm}^3$$

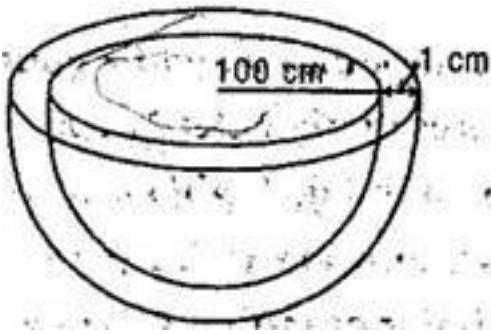
$$= \frac{303.187}{1000} \text{ liters } [\because 1000 \text{ cm}^3 = 1l]$$

$$= 0.303187 \text{ liters}$$

= 0.303 liters (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.

Ans. Inner radius of hemispherical tank (r) = 1 m = 100 cm



Thickness of sheet = 1 cm

∴ Outer radius of hemispherical tank (R) = $100 + 1 = 101$ cm

Volume of iron of hemisphere

$$= \frac{2}{3} \pi [R^3 - r^3]$$

$$= \frac{2}{3} \times \frac{22}{7} \times [(101)^3 - (100)^3]$$

$$= \frac{44}{21} [1030301 - 1000000]$$

$$= 63487.81 \text{ cm}^3$$

$$= 0.06348 \text{ m}^3$$

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

Ans. Surface area of sphere = 154 cm^2

$$\Rightarrow 4\pi r^2 = 154$$

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

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

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

Now, Volume of sphere

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

$$= \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2}$$

$$= \frac{1}{3} \times 11 \times 49 = \frac{539}{3}$$

$$= 179 \frac{2}{3} \text{ cm}^3$$



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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 at the rate of Rs. 2.00 per square meter, find:

(i) the inner surface area of the dome.

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

Ans. Cost of white washing from inside = Rs. 498.96

Rate of white washing = Rs. 2

$$\therefore \text{Area white washed} = \frac{498.96}{2} = 249.48 \text{ cm}^2$$

Inside surface area of the dome = 249.48 cm^2

$$\Rightarrow 2\pi r^2 = 249.48$$

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

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

$$\Rightarrow r^2 = 5.67 \times 7 = 39.69 \text{ cm}$$

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

So, Volume of the dome

$$= \frac{2}{3} \pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 6.3 \times 6.3 \times 6.3 = 523.91 \text{ cm}^3$$

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' .

Ans. (i) Let radius of sphere be r and radius of new sphere be r'

27 x Volume of sphere = Volume of new sphere

$$\Rightarrow 27 \times \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (r')^3$$

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

$$\Rightarrow 3r = r'$$

$$\Rightarrow r' = 3r$$

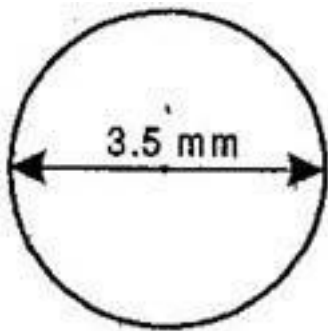
$$\text{(ii)} \frac{\text{Surface area of old sphere (S)}}{\text{Surface area of New sphere (S')}} = \frac{\frac{4}{3} \pi r^2}{\frac{4}{3} \pi (r')^2}$$

$$= \frac{r^2}{(r')^2} = \frac{r^2}{(3r)^2} = \frac{r^2}{9r^2} = \frac{1}{9}$$

$$\Rightarrow S : S' = 1 : 9$$

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?

Ans. Diameter of spherical capsule = 3.5 mm



$$\therefore \text{Radius of spherical capsule (r)} = \frac{3.5}{2} = \frac{35}{20} = \frac{7}{4} \text{ mm}$$

$$\text{Medicine needed to fill the capsule} = \text{Volume of sphere} = \frac{4}{3} \pi r^3$$

$$= \frac{4}{3} \times \frac{22}{7} \times \frac{7}{4} \times \frac{7}{4} \times \frac{7}{4}$$

$$= \frac{11 \times 7 \times 7}{3 \times 2 \times 4}$$

$$= \frac{539}{24} \text{ mm}^3$$

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