CBSE Class 9 Mathematics

NCERT Solutions

CHAPTER 13

Surface Areas and Volumes(Ex. 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

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

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

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

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

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

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

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

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

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

(ii) Diameter of spherical ball = 0.21 m

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

According to question,

Volume of water replaced = Volume of spherical ball

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

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

$= 11\times\frac{441}{100\times100\times100} = 0.004851\ m^3$

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

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

Volume of metallic ball $= \frac{4}{3}\pi r^3 = \frac{4}{3}\times\frac{22}{7}\times2.1\times2.1\times2.1$

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

Density of metal = 8.9 g per cm^3

∵ Mass of 1 cm^3 = 8.9 g

∴ Mass of 38.808 cm^3 = 8.9 x 38.808

= 345.3912 g = 345.39 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

∴ Radius of earth (r) = $\frac{x}{2}$

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

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

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

According to question,

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

∴ Radius of moon (R) = $\frac{x}{8}$

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

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

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

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

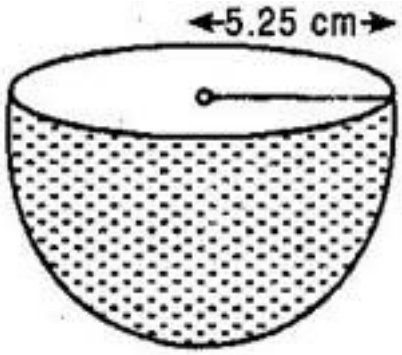
= $\frac{1}{64}$ x Volume of Earth [From eq. (i)]

∴ 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

∴ Radius of hemispherical bowl (r) = $\frac{10.5}{2}$ = 5.25 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 cm^3

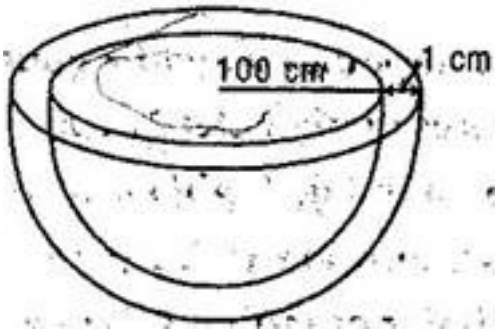
= $\frac{303.187}{1000}$ liters $\left[\because 1000\ cm^3 = 1l\right]$

= 0.303187 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

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

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

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

$= 63487.81\ cm^3$

$= 0.06348\ m^3$

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

Ans. Surface area of sphere = 154 cm^2

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

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

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

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

Now, Volume of sphere

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

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

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

$= 179\frac{2}{3}$ 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 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

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

Inside surface area of the dome = 249.48 cm^2

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

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

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

=> r^2 = 5.67 x 7 = 39.69 cm

$\Rightarrow r$ = 6.3 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 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

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

$=> 27r^3 = (r')^3$

$\Rightarrow$ 3r= r'

$\Rightarrow r' = 3r$

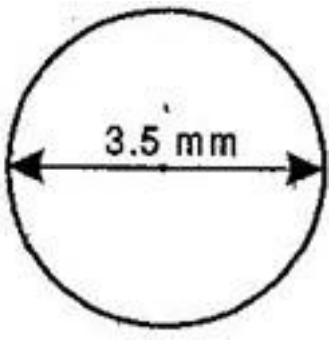
(ii) $\frac{Surface\ area\ of\ old\ sphere\ (S)}{Surface\ area\ of\ New\ sphere\ (S')} = \frac{\frac{4}{3}\pi r^2}{\frac{4}{3}\pi (r')^2}$

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

$\Rightarrow$ 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



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

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

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

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

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

= 22.46 mm^3 (Approx.)