

Exercise 13.8

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1. Find the volume of a sphere whose radius is

(i) 7 cm (ii) 0.63 m

(Assume $\pi=22/7$)

Solution:

(i) Radius of sphere, $r = 7$ cm

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

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

$$= 4312/3$$

Volume of the sphere is $4312/3$ cm³

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

Using, volume of sphere = $\frac{4}{3} \pi r^3$

$$= \frac{4}{3} \times \frac{22}{7} \times 0.63^3$$

$$= 1.0478$$

Volume of the sphere is 1.05 m³ (approx).

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

(i) 28 cm (ii) 0.21 m

(Assume $\pi=22/7$)

Solution:

(i)

Diameter = 28 cm

Radius, $r = 28/2$ cm = 14 cm

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

$$\text{Volume of the ball} = \frac{4}{3} \times \frac{22}{7} \times 14^3 = 34496/3$$

Volume of the ball is $34496/3$ cm³

(ii)

Diameter = 0.21 m

Radius of the ball = $0.21/2$ m = 0.105 m

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

$$\text{Volume of the ball} = \frac{4}{3} \times \frac{22}{7} \times 0.105^3 \text{ m}^3$$

Volume of the ball = 0.004851 m³

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 cm³? (Assume $\pi = 22/7$)

Solution:

diameter of a metallic ball = 4.2 cm

Radius(r) of the metallic ball, $r = 4.2/2$ cm = 2.1 cm

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

Volume of the metallic ball = $\frac{4}{3} \times \frac{22}{7} \times 2.1$ cm³

Volume of the metallic ball = 38.808 cm³

Now, using relationship between, density, mass and volume,

Density = Mass/Volume

Mass = Density x volume

= (8.9 x 38.808) g

= 345.3912 g

Mass of the ball is 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?

Solution:

Let the diameter of earth be “d”. Therefore, the radius of earth will be $d/2$

Diameter of moon will be $d/4$ and the radius of moon will be $d/8$

Find the volume of the moon :

Volume of the moon = $\frac{4}{3} \pi r^3 = \frac{4}{3} \pi (d/8)^3 = \frac{4}{3} \pi (d^3/512)$

Find the volume of the earth :

Volume of the earth = $\frac{4}{3} \pi r^3 = \frac{4}{3} \pi (d/2)^3 = \frac{4}{3} \pi (d^3/8)$

Fraction of the volume of the earth is the volume of the moon

Volume of the moon / volume of the earth = $\frac{\frac{4}{3} \pi (\frac{d^3}{512})}{\frac{4}{3} \pi (\frac{d^3}{8})} = \frac{8}{512} = 1/64$

Answer: Volume of moon is of the 1/64 volume of earth.

5. How many litres of milk can a hemispherical bowl of diameter 10.5 cm hold? (Assume $\pi = 22/7$)

Solution:

Diameter of hemispherical bowl = 10.5 cm

Radius of hemispherical bowl, $r = 10.5/2 \text{ cm} = 5.25 \text{ cm}$

Formula for volume of the hemispherical bowl = $\frac{2}{3} \pi r^3$

Volume of the hemispherical bowl = $\frac{2}{3} \times \frac{22}{7} \times 5.25^3 = 303.1875$

Volume of the hemispherical bowl is 303.1875 cm^3

Capacity of the bowl = $(303.1875)/1000 \text{ L} = 0.303 \text{ litres (approx.)}$

Therefore, hemispherical bowl can hold 0.303 litres of milk.

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. (Assume $\pi = 22/7$)

Solution:

Inner Radius of the tank, $(r) = 1 \text{ m}$

Outer Radius $(R) = 1.01 \text{ m}$

Volume of the iron used in the tank = $\frac{2}{3} \pi (R^3 - r^3)$

Put values,

Volume of the iron used in the hemispherical tank = $\frac{2}{3} \times \frac{22}{7} \times (1.01^3 - 1^3) = 0.06348$

So volume of the iron used in the hemispherical tank is 0.06348 m^3 .

7. Find the volume of a sphere whose surface area is 154 cm^2 . (Assume $\pi = 22/7$)

Solution:

Let r be the radius of a sphere.

Surface area of sphere = $4\pi r^2$

$4\pi r^2 = 154 \text{ cm}^2$ (given)

$r^2 = (154 \times 7)/(4 \times 22)$

$r = 7/2$

Radius is $7/2 \text{ cm}$

Now,

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

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

Volume of the sphere is $179 \frac{2}{3} \text{ cm}^3$

8. A dome of a building is in the form of a hemi sphere. From inside, it was white-washed at the cost of Rs. 4989.60. If the cost of white-washing is Rs 20 per square meter, find the (i) inside surface area of the dome, (ii) volume of the air inside the dome (Assume $\pi = 22/7$)

Solution:

(i) Cost of white-washing the dome from inside = Rs 4989.60

Cost of white-washing 1m^2 area = Rs 20

CSA of the inner side of dome = $4989.60/20 = 249.48\text{ m}^2$

(ii) Let the inner radius of the hemispherical dome be r .

CSA of inner side of dome = 249.48 m^2 (from (i))

Formula to find CSA of a hemi sphere = $2\pi r^2$

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

$$2 \times 22/7 \times r^2 = 249.48$$

$$r^2 = (249.48 \times 7) / (2 \times 22)$$

$$r^2 = 39.69$$

$$r = 6.3$$

Radius is 6.3 m

Volume of air inside the dome = Volume of hemispherical dome

Using formula, volume of the hemisphere = $2/3 \pi r^3$

$$= 2/3 \times 22/7 \times 6.3 \times 6.3 \times 6.3$$

$$= 523.908$$

$$= 523.9 \text{ (approx.)}$$

Answer: Volume of air inside the dome is 523.9 m^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' .

Solution:

Volume of the solid sphere = $4/3 \pi r^3$

Volume of twenty seven solid sphere = $27 \times 4/3 \pi r^3 = 36 \pi r^3$

(i)

New solid iron sphere radius = r'

Volume of this new sphere = $4/3 \pi (r')^3$

$$4/3 \pi (r')^3 = 36 \pi r^3$$

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

$$r' = 3r$$

Radius of new sphere will be $3r$ (thrice the radius of original sphere)

ii) Surface area of iron sphere of radius r , $S = 4\pi r^2$

Surface area of iron sphere of radius $r' = 4\pi (r')^2$

Now

$$S/S' = (4\pi r^2)/(4\pi (r')^2)$$

$$S/S' = r^2/(3r')^2 = 1/9$$

The ratio of S and S' is 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? (Assume $\pi = 22/7$)

Solution:

Diameter of capsule = 3.5 mm

Radius of capsule, say $r = \text{diameter}/2 = (3.5/2) \text{ mm} = 1.75 \text{ mm}$

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

Volume of spherical capsule = $\frac{4}{3} \times \frac{22}{7} \times (1.75)^3 = 22.458$

Answer: The volume of the spherical capsule is 22.46 mm^3 .