Mathematics

(www.tiwariacademy.com)

(Chapter –11) (Surface Areas and Volumes) (Exercise 11.4)

(Class – 9)

Question 1:

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

Answer 1:

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

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

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

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

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

Hence, the volume of sphere is $1437\frac{1}{3}$ cm^3.

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

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

$= \frac{4}{3} \times \frac{22}{7} \times 0.63 \times 0.63 \times 0.63 \;\; = 4 \times 22 \times 0.03 \times 0.63 \times 0.63 \;\; = 1.05$ m^3 (approx.)

Hence, the volume of sphere is 1.05 m^3.

Question 2:

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

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

Answer 2:

(i) Radius of spherical ball $r = 28/2 = 14$ cm

Volume of water displaced by spherical ball $= \frac{4}{3}\pi r^3$

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

$= \frac{4}{3} \times 22 \times 2 \times 14 \times 14 \;\; = 11498\frac{2}{3}$ cm^3

Hence, the volume of water displaced by spherical ball is $11498\frac{2}{3}$ cm^3.

(ii) Radius of spherical ball $r = 0.21/2 = 0.105$ m

Volume of water displaced by spherical ball $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 0.105 \times 0.105 \times 0.105 \;\; = 4 \times 22 \times 0.005 \times 0.63 \times 0.63 \;\; = 0.004861$ m^3

Hence, the volume of water displaced by spherical ball is 0.004861 m^3.

Question 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?

Answer 3:

Radius of metallic ball $r = 4.2/2 = 2.1$ cm

Therefore, the volume of metallic ball $= \frac{4}{3}\pi r^3$

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

$= 4 \times 22 \times 0.1 \times 2.1 \times 2.1 = 38.808$ cm^3

Here, the mass of 1 cm^3 = 8.9 g

So, the mass of 38.808 cm^3 = $8.9 \times 38.808 = 345.39$ g (approx.)

Hence, the mass of the ball is 345.39 gram.

Question 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?

Answer 4:

Let, the radius of Earth be R

Therefore, the diameter of Earth = $2R$

According to question, diameter of Moon $=\frac{1}{4}(2R)$

So, the radius of Moon $= \dfrac{\frac{1}{4}(2R)}{2} = \dfrac{1}{4}R$

Now,

$$\frac{\text{Volume of Moon}}{\text{Volume of Earth}} = \frac{\frac{4}{3}\pi\left(\frac{1}{4}R\right)^3}{\frac{4}{3}\pi(R)^3} = \frac{\frac{1}{64}R^3}{R^3} = \frac{1}{64}$$

$$\Rightarrow \text{Volume of Moon} = \frac{1}{64} \times \text{Volume of Earth}$$

Hence, the volume of Moon is $\frac{1}{64}$ the volume of Earth.

Question 5:

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

Answer 5:

Radius of hemispherical bowl $r = 10.5/2 = 5.25$ cm

Therefore, the volume of hemispherical bowl $= \dfrac{2}{3}\pi r^3$

$= \dfrac{2}{3} \times \dfrac{22}{7} \times 5.25 \times 5.25 \times 5.25 \;\; = 2 \times 22 \times 0.25 \times 5.25 \times 5.25 \;\; = 303 \text{ cm}^3$ (Approx.)

$= \dfrac{303}{1000}$ Litre $\left[\because 1\ cm^3 = \dfrac{1}{1000} \text{ litre}\right]$

$= 0.303$ Litre

Hence, the hemispherical bowl holds 0.303 litres of milk.

Question 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.

Answer 6:

The internal radius of hemispherical tank $r = 1$ m and thickness 1 cm = 0.01 m

Therefore, the outer radius $R = 1 + 0.01 = 1.01$ m

Volume of hemispherical tank $= \frac{2}{3}\pi(R^3 - r^3)$

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

$= \dfrac{2}{3} \times \dfrac{22}{7} \times (1.030301 - 1)$

$= \dfrac{2}{3} \times \dfrac{22}{7} \times 0.030301 = 0.06348\ m^3$

Hence, the volume of the iron used to make the tank is 0.06348 m^3.

Question 7:

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

Answer 7:

Surface area of sphere A = 154 cm^2

Let, the radius of sphere = r cm

We know that the surface area of sphere = $4\pi r^2$

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

$$\Rightarrow r = \sqrt{\frac{49}{4}} = \frac{7}{2}$$

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

$$= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} = \frac{539}{3} = 179\frac{2}{3} \text{ cm}^3$$

Hence, the volume of sphere is $179\frac{2}{3}$ cm^3.

Question 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.

Answer 8:

(i) Let the internal radius of dome = r m

Internal surface area of dome = $2\pi r^2$

Cost of white washing at the rate of ₹2 = $2\pi r^2 \times ₹2 = ₹4\pi r^2$

$$\Rightarrow ₹4\pi r^2 = ₹498.96$$

$$\Rightarrow 4 \times \frac{22}{7} \times r^2 = 498.96$$

$$\Rightarrow r^2 = \frac{498.96 \times 7}{4 \times 22} = 39.69$$

$$\Rightarrow r = \sqrt{39.69} = 6.3 \text{ m}$$

Therefore, the internal surface of dome = $2\pi r^2$

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

$$= 2 \times \frac{22}{7} \times 6.3 \times 6.3$$

$$= 2 \times 22 \times 0.9 \times 6.3$$

$$= 249.48 \text{ m}^2$$

Hence, the inside surface area of the dome is 249.48 m^2.

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

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

$$= \frac{2}{3} \times \frac{22}{7} \times 6.3 \times 6.3 \times 6.3$$

$$= 2 \times 22 \times 0.3 \times 6.3 \times 6.3$$

$$= 523.9 \text{ cm}^3$$

Hence, the volume of the air inside the dome is 523.9 cm^3.

Question 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′.

Answer 9:

(i) Given that the radius of solid sphere is r and the radius of new sphere is r'.

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

Therefore, the volume of 27 solid spheres $= 27 \times \frac{4}{3}\pi r^3$

According to question:

Volume of new sphere = Volume of 27 solid spheres

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

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

$$\Rightarrow r' = 3 \times r$$

Hence, the radius of new sphere is $3r$.

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

Surface area of new sphere $S' = 4\pi(r')^2 = 4\pi(3r)^2 = 36\pi r^2$

Therefore,

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

Hence, the ratio of S and S′ is 1: 9.

Question 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?

Answer 10:

Radius of capsule $r = 3.5/2 = 1.75$ mm

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

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

$$= \frac{4}{3} \times 22 \times 0.25 \times 1.75 \times 1.75$$

$= 22.46\ mm^3$ (approx.)

Hence, 22.46 mm^3 medicine is required to fill this capsule.