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

Sol:

(i) radius of sphere = 7cm

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

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

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

$= \frac{88 \times 49}{3} cm^3$

$= \frac{4312}{3} cm^3$

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

(ii) radius of sphere = 0.63 m

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

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

$= \frac{4}{\cancel{3}} \times \frac{22}{\cancel{7}} \times \cancel{0.09}\,0.\cancel{63} \times \cancel{0.63} \times 0.63 \times 0.63\ m^3$

$= 4 \times 22 \times 0.3 \times 0.63 \times 0.63\ m^3$

$= 10.47816\ m^3$ Ans

2 Sum: 13.8 Find the amount of water displaced by a solid spherical ball of diameter (i) 28 cm (ii) 0.21 m.

Sol (i) Diameter of sphere = 28 cm

Radius of sphere = $\frac{28}{2}$ cm

= 14 cm

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

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

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

$= \frac{34496}{3}$ cm^3 $= 11498\frac{2}{3}$ cm^3 Ans

(ii) Diameter of sphere = 0.21 m

Radius of sphere = $\frac{0.21}{2}$ m

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

$= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{0.21}{2}\right)^3$ m^3

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

$= \frac{11}{21} \times 0.01 \times 0.21 \times 0.21$ m^3

$= 0.004851$ m^3 Ans

3. Sum: 13.8 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 metallic ball = 4.2 cm

Radius of metallic ball = $\frac{4.2}{2}$ cm $= 2.1$

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

$= \frac{4}{3} \times \frac{22}{7} \times (2.1)^3 \ cm^3$

$= \frac{4}{\cancel{8}} \times \frac{22}{\cancel{7}} \times \cancel{0.3}\,0.1 \times 2.1 \times 2.1 \ cm^3$

$= 88 \times 0.1 \times 2.1 \times 2.1 \ cm^3$

$= 38.808 \ cm^3$

Density = 8.9 g per cm^3

Mass = Density × volume

$= 8.9 \times 38.808$

$= 345.3912$ g Ans

Illustration 13.8 : 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 the diameter of earth = d

(R) radius of earth = $\frac{d}{2}$

the diameter of moon = $\frac{d}{4}$

(r) radius of moon = $\frac{d}{2\times 4} = \frac{d}{8}$

$$\text{Fraction} = \frac{\text{volume of earth}}{\text{volume of moon}}$$

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

$$= \frac{R^3}{r^3}$$

$$= \frac{\left(\frac{d}{2}\right)^3}{\left(\frac{d}{8}\right)^3}$$

$$= \frac{d^3}{(2)^3} \times \frac{(8)^3}{d^3}$$

$$= \frac{8\times 8\times 8}{2\times 2\times 2}$$

$$= \frac{64}{1}$$

$$= 64:1 \text{ Ans}$$

5 Sum 13.8 : How many litres of milk can a hemispherical bowl of diameter 10.5 cm hold?

Sol :- diameter = 10.5 cm

radius = $\frac{10.5}{2}$ cm

Volume of hemisphere = $\frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \frac{22}{7} \times \left(\frac{10.5}{2}\right)^3$

$= \frac{2}{3} \times \frac{22}{7} \times \frac{10.5}{2} \times \frac{10.5}{2} \times \frac{10.5}{2}$

$= \frac{2}{3} \times \frac{22}{7} \times \frac{105}{2 \times 10} \times \frac{105}{2 \times 10} \times \frac{105}{2 \times 10}$

$= \frac{11 \times 5 \times 105 \times 105}{2 \times 1000}$ cm^3

$= \frac{606375}{2 \times 1000}$ cm^3

$= \frac{303187.5}{1000}$ cm^3

$= 303.1875$ cm^3

$= \frac{303.1875}{1000}$ l

$= 0.3031875$ l

$= \underline{0.303 \text{ l (approx)}}$

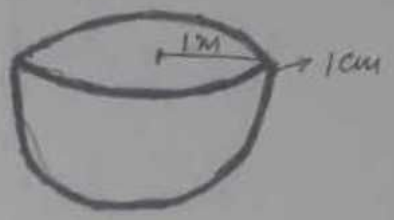
Ans

6 Sum: 13.8 A hemispherical tank is made up of an iron sheet 1 cm thick. If the inner radius is 1m, then find the volume of the iron used to make the tank.

Sol

$1\text{cm} = \frac{1}{100}\text{m}$

$= 0.01\text{m}$



$r = 1\text{m}$

$R = 1 + 0.01$

$= 1.01\text{m}$

Volume of iron used to make the tank =

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

$$= \frac{2}{3}\pi\left(R^3 - r^3\right)$$

$$= \frac{2}{3}\pi\left[(1.01)^3 - (1)^3\right] \text{ m}^3$$

$$= \frac{2}{3} \times \frac{22}{7}\left[1.030301 - 1\right] \text{ m}^3$$

$$= \frac{44}{21}\left(0.030301\right) \text{ m}^3$$

$$= \frac{1.333244}{21} \text{ m}^3$$

$$= 0.0634 \text{ m}^3 \text{ (approx).}$$ Ans

7 Sum / 13-8 : Find the volume of a sphere whose surface area is $154 cm^2$.

Sol : surface area of sphere $= 154 cm^2$

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

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

$$r^2 = \frac{\cancel{154}^{\cancel{77}^{7}} \times 7}{\cancel{4}^{2} \times \cancel{22}^{2}}$$

$$r^2 = \frac{7 \times 7}{2 \times 2}$$

$$r = \sqrt{\frac{7 \times 7}{2 \times 2}}$$

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

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

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

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

$$= \frac{\cancel{1078}^{539}}{\cancel{6}_{3}} cm^3$$

$$= \frac{539}{3} cm^3$$

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

Exam 13.8 : 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 Rs 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 = Rs 498.96
Rate = Rs 2.00 / m^2.

(i) Surface area × Rate = Cost
Surface area × 2 = 498.96
Surface area = $\frac{498.96}{2}$ = 249.48 m^2 Ans

(ii) Surface area = 249.48
$2\pi r^2 = 249.48$
$2 \times \frac{22}{7} \times r^2 = 249.48$
$r^2 = \frac{249.48 \times 7}{2 \times 22}$

$r^2 = 5.67 \times 7$
$r^2 = 39.69$
$r = \sqrt{39.69}$
$r = 6.3$

	6.3
6	39.69
	36
123	369
	369
	x

Volume of the air inside the dome = $\frac{2}{3}\pi r^3$
$= \frac{2}{3} \times \frac{22}{7} \times 6.3 \times 6.3 \times 6.3\ m^3$
$= 44 \times 0.3 \times 6.3 \times 6.3\ m^3$
$= 523.908\ m^3$ Ans

Q.Sum 10.8: 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: (i) Volume of new sphere = Volume of 27 sphere

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

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

$$r'^3 = 27 r^3$$

$$r' = \sqrt[3]{3\times3\times3\times r\times r\times r}$$

$$r' = 3r$$

(ii) $$\text{Ratio} = \frac{S}{S'} = \frac{4\pi r^2}{4\pi r'^2}$$

$$\frac{S}{S'} = \frac{r^2}{r'^2}$$

$$\frac{S}{S'} = \frac{r^2}{(3r)^2} \quad [r' = 3r]$$

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

$$\frac{S}{S'} = \frac{1}{9}$$

$$\text{Ratio} = 1:9 \text{ Ans}$$

3.8 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: diameter of sphere = 3.5 mm

radius of sphere = $\frac{3.5}{2}$ mm

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

$= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{3.5}{2}\right)^3$

$= \frac{4}{3} \times \frac{11}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times \frac{3.5}{2}$ mm^3

$= \frac{11 \times 0.5 \times 3.5 \times 3.5}{3}$ mm^3

$= \frac{67.375}{3}$ mm^3

$= 22.458$ mm^3 Ans.