

## Chapter 20. Mensuration II

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### Ex 20.1

#### Answer 1.

i) Height = 12 cm, radius = 5 cm

$$\begin{aligned}\text{Curved surface area} &= (\pi r \sqrt{h^2 + r^2}) \\ &= \frac{22}{7} \times 5 \times \sqrt{12^2 + 5^2} \\ &= \frac{22}{7} \times 5 \times \sqrt{169} \\ &= \frac{22}{7} \times 5 \times 13 \\ &= 204.29\end{aligned}$$

$$\text{Curved surface area} = 204.29 \text{ cm}^2$$

Total surface area = area of circular base + curved surface area

$$\begin{aligned}&= \pi r^2 + (\pi r \sqrt{h^2 + r^2}) \\ &= \frac{22}{7} \times 5 \times 5 + 204.29 \\ &= 78.57 + 204.29 \\ &= 282.86\end{aligned}$$

$$\text{Total surface area} = 282.86 \text{ cm}^2$$

$$\begin{aligned}\text{Volume} &= \frac{1}{3} \times (\pi r^2) \times h \\ &= \frac{1}{3} \times \frac{22}{7} \times 5 \times 5 \times 12 \\ &= 314.29\end{aligned}$$

$$\text{Volume of the cone} = 314.29 \text{ cm}^3$$

ii) Height = 15 cm, radius = 8 cm

$$\text{Curved surface area} = (\pi r \sqrt{h^2 + r^2})$$

$$= \frac{22}{7} \times 8 \times \sqrt{15^2 + 8^2}$$

$$= \frac{22}{7} \times 8 \times \sqrt{289}$$

$$= \frac{22}{7} \times 8 \times 17$$

$$= 427.43$$

$$\text{Curved surface area} = 427.43 \text{ cm}^2$$

Total surface area = area of circular base + curved surface area

$$= \pi r^2 + (\pi r \sqrt{h^2 + r^2})$$

$$= \frac{22}{7} \times 8 \times 8 + 427.43$$

$$= 201.14 + 427.43$$

$$= 628.57$$

$$\text{Total surface area} = 628.57 \text{ cm}^2$$

$$\text{Volume} = \frac{1}{3} \times (\pi r^2) \times h$$

$$= \frac{1}{3} \times \frac{22}{7} \times 8 \times 8 \times 15$$

$$= 1005.71$$

$$\text{Volume of the cone} = 1005.71 \text{ cm}^3$$

iv) Height = 8 cm, diameter = 12 cm

Diameter = 12 cm  $\Rightarrow r=6$  cm

$$\text{Curved surface area} = (\pi r \sqrt{h^2 + r^2})$$

$$= \frac{22}{7} \times 6 \times \sqrt{8^2 + 6^2}$$

$$= \frac{22}{7} \times 6 \times \sqrt{100}$$

$$= \frac{22}{7} \times 6 \times 10$$

$$= 188.57$$

$$\text{Curved surface area} = 188.57 \text{ cm}^2$$

Total surface area = area of circular base + curved surface area

$$= \pi r^2 + (\pi r \sqrt{h^2 + r^2})$$

$$= \frac{22}{7} \times 6 \times 6 + 188.57$$

$$= 113.14 + 188.57$$

$$= 301.71$$

$$\text{Total surface area} = 301.71 \text{ cm}^2$$

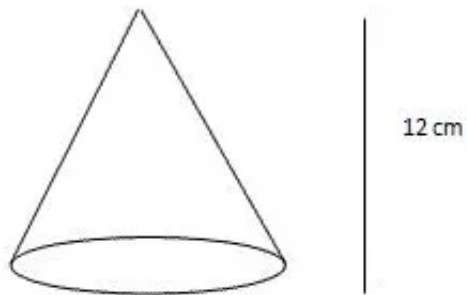
$$\text{Volume} = \frac{1}{3} \times (\pi r^2) \times h$$

$$= \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 8$$

$$= 301.71$$

$$\text{Volume of the cone} = 301.71 \text{ cm}^3$$

**Answer 2.**



Volume of the cone =  $154 \text{ cm}^3$

$$\Rightarrow \frac{1}{3} \times (\pi r^2) \times h = 154$$

$$\Rightarrow \frac{1}{3} \times (\pi r^2) \times 12 = 154$$

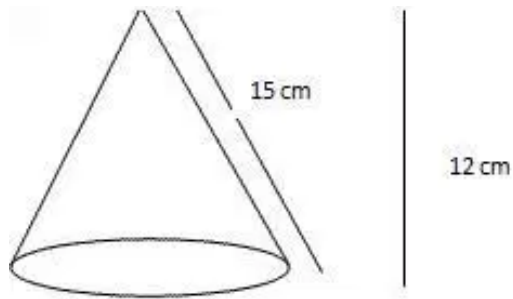
$$\Rightarrow r^2 = \frac{154 \times 3 \times 7}{12 \times 22}$$

$$\Rightarrow r^2 = 12.25$$

$$\Rightarrow r = 3.5 \text{ cm}$$

Radius of the circular base of the cone is 3.5 cm

**Answer 3.**



Slant length =  $l$  = 15 cm

Height =  $h$  = 12 cm

Radius of the base =  $r$

We know,

$$\begin{aligned}l^2 &= h^2 + r^2 \\ \Rightarrow r^2 &= l^2 - h^2 \\ \Rightarrow r &= \sqrt{l^2 - h^2} \\ \Rightarrow r &= \sqrt{15^2 - 12^2} \\ \Rightarrow r &= 9\text{cm}\end{aligned}$$

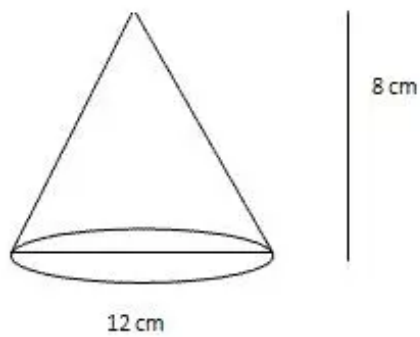
Radius = 9 cm

$$\text{Volume} = \frac{1}{3} \times (\pi r^2) \times h$$

$$\begin{aligned}&= \frac{1}{3} \times 3.14 \times 9 \times 9 \times 12 \\ &= 1017.36\text{cm}^3\end{aligned}$$

Volume of the cone = 1017.36 cm<sup>3</sup>

**Answer 4.**



$$\text{Diameter} = 12 \text{ cm} \Rightarrow r=6 \text{ cm}$$

$$\text{Curved surface area} = \left( \pi r \sqrt{h^2 + r^2} \right)$$

$$= \frac{22}{7} \times 6 \times \sqrt{8^2 + 6^2}$$

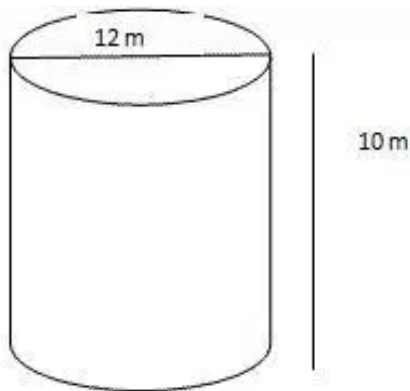
$$= \frac{22}{7} \times 6 \times \sqrt{100}$$

$$= \frac{22}{7} \times 6 \times 10$$

$$= 188.57$$

$$\text{Curved surface area} = 188.57 \text{ cm}^2$$

**Answer 5.**



Diameter of the cylinder = 12 m  $\Rightarrow$  radius = 6 m

Curved surface area = circumference of the base  $\times$  height

$$\begin{aligned} &= 2\pi r \times h \\ &= 2 \times \frac{22}{7} \times 6 \times 10 \\ &= 377.14 \text{ m}^2 \end{aligned}$$

Curved Surface Area = 377.14 m<sup>2</sup>

Total surface area = Curved surface area + (2  $\times$  base area)

$$\begin{aligned} &= 2\pi rh + 2\pi r^2 \\ &= 2\pi r(h + r) \\ &= 2 \times \frac{22}{7} \times 6 \times (10 + 6) \\ &= 2 \times \frac{22}{7} \times 6 \times 16 \\ &= 603.42 \text{ m}^2 \end{aligned}$$

Total Surface Area = 603.42 m<sup>2</sup>

**Answer 6.**

Let radius of first cone be  $3r$  and height be  $h$ , then radius of second cone will be  $r$  and height will be  $3h$ .

$$\text{Volume of cone} = \frac{1}{3} \times (\pi r^2) \times h$$

$$\text{Ratio of volumes of cone} = \frac{\text{Volume of first cone}}{\text{Volume of second cone}}$$

$$\begin{aligned} &= \frac{\frac{1}{3} \times (\pi(3r)^2) \times h}{\frac{1}{3} \times (\pi r^2) \times 3h} \\ &= \frac{\frac{1}{3} \pi 9r^2 h}{\frac{1}{3} \pi r^2 3h} \\ &= \frac{3}{1} \end{aligned}$$

$$\text{Ratio of volumes of cone} = 3:1$$

**Answer 7.**

The base circumferences of the cones are equal, therefore the radius of base are equal.

Let radius be  $r$ .

Ratio between slant heights =  $5:4$

Let slant height of first cone =  $5x$  and of second cone =  $4x$

Curved surface area of cone =  $\pi r l$  (where  $l$  = slant height)

Ratio of curved surface areas =

$$\begin{aligned} &= \frac{\pi r \times 5x}{\pi r \times 4x} \\ &= \frac{5}{4} \end{aligned}$$

Ratio of curved surface areas =  $5:4$

**Answer 8.**

$$\text{Volume of cone} = \frac{1}{3} \times (\pi r^2) \times h$$

$$\Rightarrow 75\pi = \frac{1}{3} \times \pi \times 5 \times 5 \times h$$

$$\Rightarrow h = \frac{225}{25}$$

$$\Rightarrow h = 9\text{cm}$$

Height of the cone = 9 cm

**Answer 9.**

$$\text{Curved surface area} = 710 \text{ cm}^2$$

$$\text{Radius (r) of base} = 11.3 \text{ cm}$$

Let slant height be l.

$$\therefore \pi r l = 710$$

$$\Rightarrow \frac{22}{7} \times 11.3 \times l = 710$$

$$\Rightarrow l = \frac{710 \times 7}{11.3 \times 22}$$

$$\Rightarrow l = 19.99\text{cm} = 20\text{cm}$$

The slant height is 20 cm.

**Answer 10.**

Curved surface area of the tent =  $264 \text{ m}^2$

Slant height ( $l$ ) =  $12 \text{ m}$ .

$$\Rightarrow \pi r l = 264$$

$$\Rightarrow \frac{22}{7} \times r \times 12 = 264$$

$$\Rightarrow r = \frac{264 \times 7}{22 \times 12}$$

$$\Rightarrow r = 7 \text{ m}$$

Radius of cone =  $7 \text{ m}$

Let  $h$  be the vertical height.

We know,

$$l^2 = r^2 + h^2$$

$$\Rightarrow h = \sqrt{l^2 - r^2}$$

$$\Rightarrow h = \sqrt{12^2 - 7^2}$$

$$\Rightarrow h = \sqrt{144 - 49} = \sqrt{95}$$

$$\Rightarrow h = 9.75 \text{ m}$$

Vertical height of cone =  $9.75 \text{ m}$

**Answer 11.**

ircular base =  $160\text{m}^2$

$$\pi r^2 = 160$$

$$\Rightarrow r = \sqrt{\frac{160 \times 7}{22}}$$

$$\Rightarrow r = \sqrt{50.909} = 7.134\text{m}$$

Therefore, radius =  $7.134\text{ m}$

Capacity or volume of the tent =  $600\text{ m}^3$

$$\frac{1}{3}\pi r^2 h = 600$$

$$\Rightarrow \frac{1}{3} \times \frac{22}{7} \times 7.13 \times 7.13 \times h = 600$$

$$\Rightarrow h = \frac{600 \times 3 \times 7}{7.13 \times 7.13 \times 22}$$

$$\Rightarrow h = 11.265\text{m}$$

Therefore, vertical height =  $11.265\text{ m}$

ow slant height (l) =

$$l = \sqrt{r^2 + h^2}$$

$$\Rightarrow l = \sqrt{7.134^2 + 11.265^2}$$

$$\Rightarrow l = \sqrt{177.624} = 13.327$$

Therefore, slant height =  $13.327\text{ m}$

The curved surface area =

$$\pi r l = \frac{22}{7} \times 7.134 \times 13.327 = 298.9\text{m}^2$$

Hence, the area of the canvas =  $298.9\text{ m}^2$

**Answer 12.**

Internal radius of the hollow cylinder =  $r = 3.5$  cm

Height =  $h = 21$  cm

Thickness of the metal =  $0.5$  cm

Therefore, Outer radius =  $R = (3.5 + 0.5)$  cm =  $4$  cm

Now, Volume of metal used =  $\pi h(R^2 - r^2)$

$$\begin{aligned} &= \frac{22}{7} \times 21 \times (4^2 - 3.5^2) \\ &= \frac{22}{7} \times 21 \times (16 - 12.25) \\ &= \frac{22}{7} \times 21 \times 3.75 \\ &= 247.5 \text{ cm}^3 \end{aligned}$$

Volume of metal used =  $247.5 \text{ cm}^3$

Therefore, Volume of cone =  $247.5 \text{ cm}^3$  and height =  $7$  cm

Let  $r_1$  be the radius of cone.

$$\therefore \text{Volume} = \frac{1}{3} \pi r_1^2 h$$

$$\begin{aligned} \Rightarrow \frac{1}{3} \pi r_1^2 h &= 247.5 \\ \Rightarrow \frac{1}{3} \times \frac{22}{7} \times r_1^2 \times 7 &= 247.5 \\ \Rightarrow r_1^2 &= \frac{247.5 \times 3 \times 7}{22 \times 7} \\ \Rightarrow r_1^2 &= 33.75 \\ \Rightarrow r_1 &= 5.8 \text{ cm} \end{aligned}$$

Radius of the cone =  $5.8$  cm

**Answer 13.**

height of the cylindrical part =  $H = 8$  m

Height of the conical part =  $h = 4$  m

Diameter = 14 m  $\Rightarrow$  radius =  $r = 7$  m

Slant height of the cone =  $l =$

$$l = \sqrt{r^2 + h^2}$$

$$l = \sqrt{7^2 + 4^2}$$

$$l = \sqrt{65} = 8.06\text{m}$$

Slant height of cone = 8.06 m

Area of the canvas used = Curved surface area of cylinder + curved  
surface area  
of cone

$$= 2\pi rH + \pi rl$$

$$= \left(2 \times \frac{22}{7} \times 7 \times 8\right) + \left(\frac{22}{7} \times 7 \times 8.06\right)$$

$$= 352 + 177.32$$

$$= 529.32\text{m}^2$$

Area of the canvas used = 529.32 m<sup>2</sup>

**Answer 14.**

Height of the cylinder =  $h = 5$  m

Slant height of the cone =  $l = 53$  m

Diameter = 42 m  $\Rightarrow$  radius =  $r = 21$  m

Area of the canvas used = Curved surface area of cylinder + curved surface area of cone

$$\begin{aligned}
 &= 2\pi rh + \pi rl \\
 &= \left(2 \times \frac{22}{7} \times 21 \times 5\right) + \left(\frac{22}{7} \times 21 \times 53\right) \\
 &= 660 + 3498 \\
 &= 4158\text{m}^2
 \end{aligned}$$

Area of the canvas required = 4158 m<sup>2</sup>

**Answer 15.**

Height of the cylinder =  $h_1 = 32$  cm

Radius of bucket =  $r_1 = 18$  cm

Height of conical heap =  $h_2 = 24$  cm

Let radius of conical heap =  $r_2$

Volume of sand in the bucket = volume of sand in conical heap

$$\begin{aligned}
 \Rightarrow \pi \times r_1^2 \times h_1 &= \frac{1}{3} \times \pi \times r_2^2 \times h_2 \\
 \Rightarrow 18 \times 18 \times 32 &= \frac{1}{3} \times r_2^2 \times 24 \\
 \Rightarrow r_2^2 &= \frac{10368 \times 3}{24} \\
 \Rightarrow r_2^2 &= 1296 \\
 \Rightarrow r_2 &= 36\text{cm}
 \end{aligned}$$

Radius of the conical heap = 36 cm

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**Ex 20.2****Answer 4.**

Surface area = volume

$$\Rightarrow 4\pi r^2 = \frac{4}{3}\pi r^3$$

$$\Rightarrow 3r^2 = r^3$$

$$\Rightarrow r = 3$$

Radius of the sphere = 3 units

**Answer 5.**

Diameter of circle = 2.8 cm  $\Rightarrow$  radius =  $r = 1.4$  cm

Area of a circle =  $\pi r^2$

$$= \pi (1.4)^2$$

$$= 1.96\pi$$

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

Given,

Surface area of sphere = Area of the circle

$$\Rightarrow 4\pi r^2 = 1.96\pi$$

$$\Rightarrow r^2 = \frac{1.96}{4}$$

$$\Rightarrow r^2 = 0.49$$

$$\Rightarrow r = 0.7\text{cm}$$

Radius of the sphere = 0.7 cm

**Answer 6.**

lid sphere = 9 m

$$\begin{aligned}\text{Volume of sphere} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3} \times \frac{22}{7} \times 9 \times 9 \times 9 \\ &= 3054.857\text{m}^3 \dots\dots\dots (i)\end{aligned}$$

Diameter of cylindrical wire = 4 m

Therefore, radius = 2 m

Let length of wire be h

$$\begin{aligned}\therefore \text{Volume} &= \pi r^2 h \\ &= \frac{22}{7} \times 2 \times 2 \times h \\ &= \frac{88h}{7} \text{m}^3 \dots\dots\dots (ii)\end{aligned}$$

From (i) and (ii)

$$\begin{aligned}\Rightarrow \frac{88h}{7} &= 3054.857 \\ \Rightarrow h &= \frac{3054.857 \times 7}{88} \\ \Rightarrow h &= 243\text{m}\end{aligned}$$

Length of the wire = 243 m

**Answer 7.**

radius of sphere = 9 cm

$$\begin{aligned}
 \text{Volume of sphere} &= \frac{4}{3} \pi r^3 \\
 &= \frac{4}{3} \times \frac{22}{7} \times 9 \times 9 \times 9 \\
 &= 3054.857 \text{ cm}^3 = 30.55 \times 10^{-4} \text{ m}^3 \dots\dots\dots (i)
 \end{aligned}$$

Diameter of cylindrical wire = 2 mm

Therefore, radius = 1 mm = 0.001 m

Let length of wire be h

$$\begin{aligned}
 \therefore \text{Volume} &= \pi r^2 h \\
 &= \frac{22}{7} \times 0.001 \times 0.001 \times h \\
 &= 3.142h \times 10^{-6} \text{ m}^3 \dots\dots\dots (ii)
 \end{aligned}$$

From (i) and (ii)

$$\begin{aligned}
 \Rightarrow 3.142 \times 10^{-6} h &= 30.55 \times 10^{-4} \\
 \Rightarrow h &= \frac{30.55 \times 10^{-4}}{3.142 \times 10^{-6}} \\
 \Rightarrow h &= 972 \text{ m}
 \end{aligned}$$

Length of the wire = 972 m

**Answer 8.**

Let r be the radii of sphere and cone.

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3 = \frac{1}{3} \pi r^2 h \quad (h = 2r \text{ for sphere})$$

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

But h = 2r for sphere

Therefore, h = 2r for cone also.

Hence, proved.

**Answer 9.**

Let  $r$ ,  $h$  be the radius and height of Cylinder, Cone and Sphere.

$$\text{Volume of cylinder} = \pi r^2 h$$

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3 \quad (h = 2r \text{ for sphere})$$

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

$$\pi r^2 h : \frac{1}{3} \pi r^2 h : \frac{4}{3} \pi r^3$$

The volume of a cylinder is three times the volume of a cone with equal height and radius. The volume of a sphere is two times the volume of a cone with equal height and radius.

So the ratio of volumes is 3:1:2.

**Answer 10.**

of spherical marble = 1.4 cm

Therefore, radius = 0.7 cm

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

$$= \frac{4}{3} \times \pi \times (0.7)^3 \text{ cm}^3 \dots\dots\dots (i)$$

Diameter of beaker = 7 cm

Therefore, radius = 3.5 cm

Height of water = 5.6 cm

$$\text{Volume of water} = \pi r^2 h$$

$$= \pi \times (3.5)^2 \times 5.6 \text{ cm}^3 \dots\dots\dots (ii)$$

$$\text{No. of balls dropped} = \frac{\text{Volume of water}}{\text{Volume of ball}}$$

$$\begin{aligned} &= \frac{\pi \times (3.5)^2 \times 5.6}{\frac{4}{3} \times \pi \times (0.7)^3} \\ &= \frac{3 \times (3.5)^2 \times 5.6}{4 \times (0.7)^3} \\ &= 150 \end{aligned}$$

$$\text{No. of balls dropped} = 150$$

**Answer 11.**

Radius of sphere = 10 cm

$$\begin{aligned}\text{Volume of sphere} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3} \times \frac{22}{7} \times 10 \times 10 \times 10 \text{cm}^3 \\ &= 4190.476 \text{cm}^3\end{aligned}$$

Therefore, volume of water = 4190.476 cm<sup>3</sup>

Radius of base of cylinder = 20 cm

Let h be the height of the water

$$\begin{aligned}\Rightarrow \pi r^2 h &= 4190.476 \\ \Rightarrow \frac{22}{7} \times 20 \times 20 \times h &= 4190.476 \\ \Rightarrow 1257.143h &= 4190.476 \\ \Rightarrow h &= 3.33 \text{cm}\end{aligned}$$

Increase in water level = 3.33 cm

**Answer 12.**

one = 8 cm

Radius = 5 cm

$$\text{Volume} = \frac{1}{3}\pi r^2 h$$

$$\begin{aligned} &= \frac{1}{3} \times \frac{22}{7} \times 5 \times 5 \times 8 \text{ cm}^3 \\ &= \frac{4400}{21} \text{ cm}^3 \end{aligned}$$

Therefore, volume of water that flowed out =

$$\begin{aligned} &= \frac{1}{4} \times \frac{4400}{21} \text{ cm}^3 \\ &= \frac{1100}{21} \text{ cm}^3 \end{aligned}$$

Radius of each ball = 0.5 cm =  $\frac{1}{2}$  cm

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

$$\begin{aligned} &= \frac{4}{3} \times \frac{22}{7} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \text{ cm}^3 \\ &= \frac{11}{21} \text{ cm}^3 \end{aligned}$$

$$\text{Therefore, No. of balls} = \frac{1100}{21} \div \frac{11}{21} = 100$$

Hence, number of lead balls = 100

**Answer 13.**

Radius = 10 cm

$$\begin{aligned}\text{Total surface area} &= 3\pi r^2 \\ &= 3 \times \frac{22}{7} \times 10 \times 10 \text{ cm}^2 \\ &= 942.86 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Volume of hemisphere} &= \frac{2}{3}\pi r^3 \\ &= \frac{2}{3} \times 3.14 \times 10 \times 10 \times 10 \text{ cm}^3 \\ &= 2093.3 \text{ cm}^3\end{aligned}$$

Total surface area = 942.86 cm<sup>2</sup> and volume = 2093.3 cm<sup>3</sup>

**Answer 14.**

Diameter of the hemispherical dome = 10 m

Therefore, radius of dome = 5 m

$$\begin{aligned}\text{Curved surface area} &= 2\pi r^2 \\ &= 2 \times \frac{22}{7} \times 5 \times 5 \\ &= 157.14 \text{ m}^2\end{aligned}$$

Cost of painting one sq. metre = Rs. 1.40

$$\begin{aligned}\text{Cost of painting } 157.14 \text{ m}^2 &= \text{Rs.}(1.40 \times 157.14) \\ &= \text{Rs. } 219.99 = \text{Rs } 220\end{aligned}$$

Therefore, cost of painting the dome = Rs 220

**Answer 15.**

$$\text{Diameter of the sphere} = 3\frac{1}{3} \text{ cm} = \frac{10}{3} \text{ cm}$$

$$\text{Therefore, radius} = \frac{5}{3} \text{ cm}$$

$$\text{Total curved surface area of each hemisphere} = 3\pi r^2$$

$$\begin{aligned} &= 3 \times \frac{22}{7} \times \frac{5}{3} \times \frac{5}{3} \\ &= 26.19 \text{ cm}^2 \end{aligned}$$

$$\text{Total curved surface area of each hemisphere} = 26.19 \text{ cm}^2$$

**Answer 16.**

$$\text{diameter of the room} = \text{height of the hall} \Rightarrow 2r = h$$

$$\text{Volume of the hall} =$$

$$\text{But } r = h/2$$

$$\Rightarrow \pi \frac{h^2}{4} h + \frac{2}{3} \pi \frac{h^3}{8} = 5236$$

$$\Rightarrow \pi \frac{h^3}{4} + \frac{2}{24} \pi h^3 = 5236$$

$$\Rightarrow \pi h^3 \left( \frac{1}{4} + \frac{2}{24} \right) = 5236$$

$$\Rightarrow \pi h^3 = \frac{5236 \times 24}{8}$$

$$\Rightarrow h^3 = \frac{5236 \times 24 \times 7}{8 \times 22}$$

$$\Rightarrow h^3 = 4998$$

$$\Rightarrow h = 17.09 \text{ m}$$

$$\text{Height of the hall} = 17.09 \text{ m}$$

**Answer 17.**

Inner diameter = 8 cm

Inner radius = r = 4 cm

Outer radius = R = 4cm + 1cm thick material = 5 cm

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

Required Volume =  $\frac{4}{3}\pi(R^3 - r^3)$

$$= \frac{4}{3} \times \frac{22}{7} \times (5^3 - 4^3)$$
$$= \frac{4}{3} \times \frac{22}{7} \times 61$$
$$= 255.6\text{cm}^3$$

Required volume = 255.6 cm<sup>3</sup>

**Answer 18.**

diameter = 8 cm

Therefore, Radius (R) = 4 cm

Internal diameter = 4 cm

Therefore, Radius (r) = 2 cm

Volume of metal used =  $\frac{4}{3}\pi(R^3 - r^3)$

$$= \frac{4}{3} \times \frac{22}{7} \times (4^3 - 2^3)$$
$$= \frac{4}{3} \times \frac{22}{7} \times 56$$
$$= 234.66\text{cm}^3\text{.....(i)}$$

Diameter of the cone = 8 cm

Therefore, radius = 4 cm

Let height of the cone = h

Volume =  $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 4 \times 4 \times h = \frac{352h}{21}\text{.....(ii)}$

From (i) and (ii)

$$\Rightarrow \frac{352h}{21} = 234.66$$
$$\Rightarrow 352h = 4927.86$$
$$\Rightarrow h = 13.99\text{cm} = 14\text{cm}$$

The height of the cone = 14 cm

**Answer 19.**

Internal diameter of hollow sphere = 12 cm

External radius =  $R = 6$  cm

Internal diameter of hollow sphere =  $(12 - 4)$  cm = 8 cm

Internal radius =  $r = 4$  cm

$$\text{Volume of metal used} = \frac{4}{3}\pi(R^3 - r^3)$$

$$= \frac{4}{3} \times \frac{22}{7} \times (6^3 - 4^3)$$

$$= \frac{4}{3} \times \frac{22}{7} \times 152$$

$$= 636.95 \text{ cm}^3$$

Volume of metal used =  $636.95 \text{ cm}^3$  = volume of solid sphere

$$\Rightarrow \frac{4}{3}\pi r^3 = 636.95$$

$$\Rightarrow \frac{4}{3} \times \frac{22}{7} \times r^3 = 636.95$$

$$\Rightarrow r^3 = \frac{636.95 \times 3 \times 7}{4 \times 22}$$

$$\Rightarrow r^3 = 151.99 = 152$$

$$\Rightarrow r = 5.34 \text{ cm}$$

Radius of the solid sphere = 5.34 cm

**Answer 20.**

Radius of hemispherical part ( $r$ ) = 3.5 m =  $\frac{7}{2}$  m

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

$$\begin{aligned} &= \frac{2}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} \\ &= \frac{539}{6} \text{ m}^3 \end{aligned}$$

Volume of conical part =  $\frac{2}{3} \times \frac{539}{6} \text{ m}^3$  (2/3 of hemisphere)

Let height of the cone =  $h$

Then,

$$\begin{aligned} \frac{1}{3}\pi r^2 h &= \frac{2 \times 539}{3 \times 6} \\ \Rightarrow \frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times h &= \frac{2 \times 539}{3 \times 6} \\ \Rightarrow h &= \frac{539 \times 2 \times 2 \times 7 \times 3}{3 \times 6 \times 22 \times 7 \times 7} \\ \Rightarrow h &= \frac{14}{3} \text{ m} = 4\frac{2}{3} \text{ m} = 4.67 \text{ m} \end{aligned}$$

Height of the cone = 4.67 m

Surface area of buoy =  $2\pi r^2 + \pi r l$

But  $l = \sqrt{r^2 + h^2}$

$$\begin{aligned} l &= \sqrt{\left(\frac{7}{2}\right)^2 + \left(\frac{14}{3}\right)^2} \\ &= \sqrt{\frac{49}{4} + \frac{196}{9}} = \sqrt{\frac{1225}{36}} = \frac{35}{6} \text{ m} \end{aligned}$$

Therefore, Surface area =

$$\begin{aligned} &= \left(2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}\right) + \left(\frac{22}{7} \times \frac{7}{2} \times \frac{35}{6}\right) \text{ m}^2 \\ &= \frac{77}{1} + \frac{385}{6} = \frac{847}{6} \\ &= 141.17 \text{ m}^2 \end{aligned}$$

**Answer 21.**

Radius of solid cylinder (r) = 2 cm

Height of cylinder (h) = 45 cm

Volume of cylinder =  $\pi r^2 h$

$$= \frac{22}{7} \times 2 \times 2 \times 45$$

$$= \frac{3960}{7} \text{ cm}^3$$

Diameter of metallic sphere = 6 cm

Therefore, Radius (r1) = 3 cm

Volume of sphere =  $\frac{4}{3} \pi (r1)^3$

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

$$= \frac{792}{7} \text{ cm}^3$$

Therefore, No. of spheres =  $\frac{3960}{7} \div \frac{792}{7} = 5$

Number of spheres that can be made = 5

**Answer 22.**

Radius of cone = 15 cm

Height of cone = 36 cm

Curved surface of the cone =  $\pi r l$

$$l = \sqrt{r^2 + h^2} = \sqrt{15^2 + 36^2} = \sqrt{1521} = 39$$

$$\text{Curved surface of cone} = \frac{22}{7} \times 15 \times 39 = 1838.571 \text{ cm}^2$$

Curved surface of cone = curved surface of sphere

$$\Rightarrow 4\pi r^2 = 1838.571$$

$$\Rightarrow 4 \times \frac{22}{7} \times r^2 = 1838.571$$

$$\Rightarrow r^2 = \frac{1838.571 \times 7}{4 \times 22}$$

$$\Rightarrow r^2 = 146.25$$

$$\Rightarrow r = 12.09 \text{ cm}$$

The radius of the sphere = 12.09 cm