

## EXERCISE 22.2

Use  $\pi = 22/7$ , unless otherwise indicated

**1. Find the volume of a cylinder whose**

**(i)  $r = 3.5$  cm,  $h = 40$  cm**

**(ii)  $r = 2.8$  m,  $h = 15$  m**

**Solution:**

**(i)** Given,

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

$$h = 40 \text{ cm}$$

By using the formula,

$$\begin{aligned} \text{Volume of a cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times 3.5 \times 3.5 \times 40 \\ &= 1540 \text{ cm}^3 \end{aligned}$$

**(ii)** Given,

$$r = 2.8 \text{ m}$$

$$h = 15 \text{ m}$$

By using the formula,

$$\begin{aligned} \text{Volume of cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times 2.8 \times 2.8 \times 15 \\ &= 369.6 \text{ m}^3 \end{aligned}$$

**2. Find the volume of a cylinder, if the diameter (d) of its base and its altitude (h) are:**

**(i)  $d = 21$  cm,  $h = 10$  cm**

**(ii)  $d = 7$  m,  $h = 24$  m**

**Solution:**

**(i)** Given,

$$d = 21 \text{ cm}$$

$$r = d/2 = 21/2 \text{ cm}$$

$$h = 10 \text{ cm.}$$

By using the formula,

$$\begin{aligned} \text{Volume of cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 10 \\ &= 3465 \text{ cm}^3 \end{aligned}$$

**(ii)** Given,

$$d = 7 \text{ m}$$

$$r = d/2 = 7/2 \text{ m}$$

$$h = 24 \text{ m}$$

By using the formula,

$$\begin{aligned} \text{Volume of cylinder} &= \pi r^2 h \\ &= 22/7 \times 7/2 \times 7/2 \times 24 \\ &= 924 \text{ m}^3 \end{aligned}$$

**3. The area of the base of a right circular cylinder is  $616 \text{ cm}^2$  and its height is 25 cm. Find the volume of the cylinder.**

**Solution:**

We have,

$$\text{Area of base of right circular cylinder} = 616 \text{ cm}^2$$

$$\text{Height of cylinder} = 25 \text{ cm}$$

Let the radius of cylinder be 'r' cm

By using the formula,

$$\text{Area of base of right circular cylinder} = \pi r^2$$

So,

$$\pi r^2 = 616$$

$$22/7 \times r^2 = 616$$

$$r^2 = 616 \times 7/22$$

$$= 196$$

$$r = \sqrt{196}$$

$$= 14 \text{ cm}$$

$$\begin{aligned} \text{Volume of cylinder} &= \text{Area of base of right circular cylinder} \times \text{height} \\ &= 616 \times 25 \\ &= 15400 \text{ cm}^3 \end{aligned}$$

**4. The circumference of the base of a cylinder is 88 cm and its height is 15 cm. Find the volume of the cylinder.**

**Solution:**

We have,

$$\text{Circumference of base of cylinder} = 88 \text{ cm}$$

$$\text{Height of cylinder} = 15 \text{ cm}$$

Let 'r' be the radius of the cylinder.

By using the formula,

$$\text{Circumference of base of cylinder} = 2\pi r$$

So,

$$2\pi r = 88$$

$$2 \times 22/7 \times r = 88$$

$$r = 88 \times 7 / 2 \times 22$$

$$= 616/44$$

$$= 14\text{cm}$$

Radius of cylinder = 14 cm

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

$$= 22/7 \times 14 \times 14 \times 15$$

$$= 9240 \text{ cm}^3$$

**5. A hollow cylindrical pipe is 21 dm long. Its outer and inner diameters are 10 cm and 6 cm respectively. Find the volume of the copper used in making the pipe.**

**Solution:**

We have,

Length of cylinder = 21 dm = 210 cm

Outer diameter = 10 cm

Outer radius,  $R = 10/2 = 5\text{cm}$

Inner diameter = 6 cm

Inner radius,  $r = 6/2 = 3\text{cm}$

$$\begin{aligned} \therefore \text{Volume of copper used in making the pipe} &= \pi (R^2 - r^2)h \\ &= 22/7 (5^2 - 3^2) 210 \\ &= 22/7 (25-9) 210 \\ &= 10560 \text{ cm}^3 \end{aligned}$$

**6. Find the (i) curved surface area (ii) total surface area and (iii) volume of a right circular cylinder whose height is 15 cm and the radius of the base is 7 cm.**

**Solution:**

We have,

Height of cylinder = 15 cm

Radius of base = 7 cm

$$\begin{aligned} \text{(i) Curved surface area} &= 2\pi rh \\ &= 2 \times 22/7 \times 7 \times 15 \\ &= 660 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{(ii) Total surface area} &= 2\pi r(h+r) \\ &= 2 \times 22/7 \times 7 (15+7) \\ &= 968 \text{ cm}^2 \end{aligned}$$

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

$$\begin{aligned} &= 22/7 \times 7 \times 7 \times 15 \\ &= 2310 \text{ cm}^3 \end{aligned}$$

**7. The diameter of the base of a right circular cylinder is 42 cm and its height is 10 cm. Find the volume of the cylinder.**

**Solution:**

We have,

Diameter of base of cylinder = 42 cm

Radius of base =  $d/2 = 42/2 = 21$  cm

Height = 10 cm

$$\begin{aligned} \therefore \text{Volume of cylinder} &= \pi r^2 h \\ &= 22/7 \times 21 \times 21 \times 10 \\ &= 13860 \text{ cm}^3 \end{aligned}$$

**8. Find the volume of cylinder, the diameter of whose base is 7 cm and height being 60 cm. Also, find the capacity of the cylinder in litres.**

**Solution:**

We have,

Diameter of base = 7 cm

Radius of base =  $d/2 = 7/2$  cm

Height of cylinder = 60 cm

$$\begin{aligned} \text{Volume of cylinder} &= \pi r^2 h \\ &= 22/7 \times 7/2 \times 7/2 \times 60 \\ &= 2310 \text{ cm}^3 \end{aligned}$$

Capacity of cylinder in litres =  $2310 / 1000 = 2.31$  litres.

**9. A rectangular strip 25 cm × 7 cm is rotated about the longer side. Find the volume of the solid, thus generated.**

**Solution:**

Given,

Dimensions of rectangular strip = 25 cm × 7 cm

When it rotated about longer side it becomes,

Radius of base = 7 cm

Height of cylinder = 25 cm

$$\begin{aligned} \text{Volume of cylinder} &= \pi r^2 h \\ &= 22/7 \times 7 \times 7 \times 25 \\ &= 3850 \text{ cm}^3 \end{aligned}$$

**10. A rectangular sheet of paper, 44 cm × 20 cm, is rolled along its length to form a**

**cylinder. Find the volume of the cylinder so formed.**

**Solution:**

We have,

Dimensions of rectangular sheet =  $44\text{cm} \times 20\text{cm}$

When it rolled along its length it becomes,

$$\begin{aligned}\text{Radius of base} &= \text{length}/2\pi \\ &= 44 \times 7 / 2 \times 22 \\ &= 7\text{cm}\end{aligned}$$

Height of cylinder =  $20\text{ cm}$

$$\begin{aligned}\therefore \text{Volume of cylinder} &= \pi r^2 h \\ &= 22/7 \times 7 \times 7 \times 20 \\ &= 3080\text{ cm}^3\end{aligned}$$

**11. The volume and the curved surface area of cylinder are  $1650\text{ cm}^3$  and  $660\text{ cm}^2$  respectively. Find the radius and height of the cylinder.**

**Solution:**

We have,

Volume of cylinder =  $1650\text{ cm}^3$

Curved surface area =  $660\text{ cm}^2$

Volume of cylinder/curved surface area =  $1650/660$

$$\pi r^2 h / 2\pi r h = 1650/660$$

$$r/2 = 5/2$$

$$r = 5\text{cm}$$

Surface area =  $660\text{ cm}^2$

$$2\pi r h = 660$$

$$2 \times 22/7 \times 5 \times h = 660$$

$$h = 660 \times 7 / 2 \times 22 \times 5$$

$$= 4620/220$$

$$= 21\text{cm}$$

$\therefore$  Radius =  $5\text{cm}$  and height =  $21\text{cm}$

**12. The radii of two cylinders are in the ratio 2:3 and their heights are in the ratio 5:3. Calculate the ratio of their volumes.**

**Solution:**

We have,

Ratio of radii of two cylinder =  $2:3$

Radius of cylinder 1 =  $r_1$

Radius of cylinder 2 =  $r_2$

$$r_1/r_2 = 2/3$$

Ratio of their heights = 5:3

Height of cylinder 1 =  $h_1$

Height of cylinder 2 =  $h_2$

$$h_1/h_2 = 5/3$$

Volume of cylinder 1 =  $v_1$

Volume of cylinder 2 =  $v_2$

$$\begin{aligned}v_1 / v_2 &= \pi r_1^2 h_1 / \pi r_2^2 h_2 \\ &= 2^2 \times 5 / 3^2 \times 3 \\ &= 4 \times 5 / 9 \times 3 \\ &= 20/27\end{aligned}$$

∴ Ratio of volumes of two cylinder is 20:27

**13. The ratio between the curved surface area and the total surface area of a right circular cylinder is 1:2. Find the volume of the cylinder, if its total surface area is  $616 \text{ cm}^2$ .**

**Solution:**

We have,

Total surface area of cylinder =  $616 \text{ cm}^2$

Ratio between curved surface area and total surface area of cylinder = 1:2

$$2\pi r h / 2\pi r (h+r) = 1/2$$

$$h / (h+r) = 1/2$$

$$2h = h+r$$

$$h = r$$

We know,  $2\pi r (h+r) = 616$

$$2\pi r (r+r) = 616$$

$$2\pi r (2r) = 616$$

$$4\pi r^2 = 616$$

$$r^2 = 616/4\pi$$

$$= 616 \times 7 / 4 \times 22$$

$$= 4312 / 88$$

$$= 49$$

$$r = \sqrt{49}$$

$$= 7$$

Radius = 7cm

Height = 7cm

$$\begin{aligned}\therefore \text{Volume of cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times 7 \times 7 \times 7 \\ &= 1078 \text{ cm}^3\end{aligned}$$

**14. The curved surface area of a cylinder is  $1320 \text{ cm}^2$  and its base has diameter 21 cm. Find the volume of the cylinder.**

**Solution:**

We have,

Diameter of base = 21 cm

Radius of base =  $d/2 = 21/2$  cm

Curved surface area =  $1320 \text{ cm}^2$

$$2\pi r h = 1320$$

$$2 \times \frac{22}{7} \times \frac{21}{2} \times h = 1320$$

$$h = \frac{1320 \times 7 \times 2}{2 \times 22 \times 21}$$

$$= \frac{18480}{924}$$

$$= 20 \text{ cm}$$

$$\begin{aligned}\therefore \text{Volume of cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 20 \\ &= 6930 \text{ cm}^3\end{aligned}$$

**15. The ratio between the radius of the base and the height of a cylinder is 2:3. Find the total surface area of the cylinder, if its volume is  $1617 \text{ cm}^3$ .**

**Solution:**

We have,

Ratio between radius and height of a cylinder = 2:3

$$r/h = 2/3$$

$$h = 3/2 r$$

Volume of cylinder =  $1617 \text{ cm}^3$

$$\pi r^2 h = 1617$$

$$\frac{22}{7} \times r^2 \times \frac{3}{2} r = 1617$$

$$r^3 = \frac{1617 \times 7 \times 2}{22 \times 3}$$

$$= 343$$

$$r = \sqrt[3]{343}$$

$$= 7 \text{ cm}$$

Radius = 7 cm

Height =  $3/2 r = 3/2 \times 7 = 21/2 = 10.5 \text{ cm}$

$$\begin{aligned}\therefore \text{Total surface area of cylinder} &= 2\pi r (h+r) \\ &= 2 \times \frac{22}{7} \times 7 (10.5+7) \\ &= 770 \text{ cm}^2\end{aligned}$$

**16. The curved surface area of a cylindrical pillar is  $264 \text{ m}^2$  and its volume is  $924 \text{ m}^3$ . Find the diameter and the height of the pillar.**

**Solution:**

We have,

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

Volume =  $924 \text{ m}^3$

Volume / Curved surface area of cylinder

$$\frac{\pi r^2 h}{2\pi r h} = 924 / 264$$

$$r / 2 = 924 / 264$$

$$r = 924 \times 2 / 264$$

$$= 7 \text{ m}$$

Radius = 7 m

Diameter of cylinder =  $2 \times \text{radius} = 2 \times 7 = 14 \text{ m}$

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

$$2\pi r h = 264$$

$$2 \times \frac{22}{7} \times 7 \times h = 264$$

$$h = 264 \times 7 / 2 \times 22 \times 7$$

$$= 6 \text{ m}$$

$\therefore$  Height of cylinder is 6m

Diameter of cylinder is 14m

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**17. Two circular cylinders of equal volumes have their heights in the ratio 1:2. Find the ratio of their radii.**

**Solution:**

We have,

Ratio of their height = 1:2

Height of cylinder 1 =  $h_1$

Height of cylinder 2 =  $h_2$

$$h_1 / h_2 = 1/2$$

Volume of cylinder 1,  $V_1$  = volume of cylinder 2,  $V_2$

$$V_1 = V_2$$

$$\pi r_1^2 h_1 = \pi r_2^2 h_2$$

$$r_1^2 / r_2^2 = 2/1$$

$$r_1 / r_2 = \sqrt{(2/1)}$$

$$= \sqrt{2} / 1$$

$\therefore$  Ratio of their radii is  $\sqrt{2}:1$

**18. The height of a right circular cylinder is  $10\frac{1}{5}$  m. Three times the sum of the areas of its two circular faces is twice the area of the curved surface. Find the volume of the cylinder.**

**Solution:**

We have,

Height of cylinder =  $10\frac{1}{5}$  m

$3(A+A) = 2$  curved surface area (where,  $A$  = circular area of box)

$$3 \times 2A = 2(2\pi rh)$$

$$6A = 4\pi rh$$

$$6\pi r^2 = 4\pi rh$$

$$r^2/r = 4\pi h/6\pi$$

$$r = 2/3 h$$

$$= 2 \times 10\frac{1}{5} / 3$$

$$= 7\text{m}$$

$$\begin{aligned} \therefore \text{Volume of cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times 7 \times 7 \times 10\frac{1}{5} \\ &= 1617 \text{ m}^3 \end{aligned}$$

**19. How many cubic metres of earth must be dug-out to sink a well 21 m deep and 6m diameter?**

**Solution:**

We have,

Height of cylinder = 21m

Diameter of well = 6m

Radius of well =  $d/2 = 6/2 = 3\text{m}$

Then,

$$\begin{aligned} \therefore \text{Volume of earth that must be dug out from this well} &= \pi r^2 h \\ &= \frac{22}{7} \times 3 \times 3 \times 21 \\ &= 594 \text{ m}^3 \end{aligned}$$

**20. The trunk of a tree is cylindrical and its circumference is 176 cm. If the length of the trunk is 3 m, find the volume of the timber that can be obtained from the trunk.**

**Solution:**

We have,

Length of the trunk = 3m = 300 cm

Circumference of trunk of tree = 176 cm

$$2\pi r = 176$$

$$2 \times \frac{22}{7} \times r = 176$$

$$r = 176 \times 7 / 2 \times 22$$

$$= 28\text{cm}$$

$$\text{Radius} = 28\text{cm}$$

$$\begin{aligned}\therefore \text{Volume of timber can be obtained from trunk of tree} &= \pi r^2 h \\ &= \frac{22}{7} \times 28 \times 28 \times 300 \\ &= 7392 \text{ cm}^3 \\ &= 0.74 \text{ m}^3\end{aligned}$$

**21. A well is dug 20 m deep and it has a diameter of 7 m. The earth which is so dug out is spread out on a rectangular plot 22 m long and 14 m broad. What is the height of the platform so formed?**

**Solution:**

We have,

$$\text{Depth of well} = 20\text{m}$$

$$\text{Diameter of well} = 7 \text{ m}$$

$$\text{Radius of well} = d/2 = 7/2 \text{ m}$$

$$\text{Dimension of rectangular field} = 22\text{m} \times 14\text{m}$$

$$\begin{aligned}\text{Volume of earth dug out from well} &= \pi r^2 h \\ &= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 20 \\ &= 770 \text{ m}^3\end{aligned}$$

When this earth is spread on rectangular field,

Then,

$$\begin{aligned}\therefore \text{Height of platform formed on rectangular field} &= \text{volume of earth dug out} / \text{area of field} \\ &= 770 / (22 \times 14) \\ &= 2.5\text{m}\end{aligned}$$

**22. A well with 14 m diameter is dug 8 m deep. The earth taken out of it has been evenly spread all around it to a width of 21 m to form an embankment. Find the height of the embankment.**

**Solution:**

We have,

$$\text{Diameter of well} = 14 \text{ m}$$

$$\text{Radius of well} = d/2 = 14/2 = 7\text{m}$$

$$\text{Depth of well} = 8 \text{ m}$$

$$\begin{aligned}\text{Volume of earth dug out from well} &= \pi r^2 h \\ &= \frac{22}{7} \times 7 \times 7 \times 8 \\ &= 1232 \text{ m}^3\end{aligned}$$

This earth is spread out on width of 21 m.

$$\text{Area} \times h = 1232$$

$$\begin{aligned}\pi(R^2 - r^2) h &= 1232 \\ \pi(28^2 - 7^2) h &= 1232 \\ 22/7 (735) h &= 1232 \\ h &= 1232 \times 7 / 22 \times 735 \\ &= 8624 / 16170 \\ &= 0.533 \text{ m} \\ &= 53.3 \text{ cm}\end{aligned}$$

∴ Height of embankment is 53.3 cm

**23. A cylindrical container with diameter of base 56 cm contains sufficient water to submerge a rectangular solid of iron with dimensions 32 cm×22 cm×14 cm. Find the rise in the level of the water when the solid is completely submerged.**

**Solution:**

We have,

Diameter of base of cylindrical vessel = 56 cm

Radius of base =  $d/2 = 56/2 = 28\text{cm}$

Dimensions of rectangular solid vessel = 32cm × 22cm × 14cm

Volume of rectangular solid vessel =  $32 \times 22 \times 14 = 9856 \text{ cm}^3$

Let the rise of water level be 'h' cm

Volume of cylindrical container = Volume of rectangular solid vessel

$$\pi r^2 h = 9856$$

$$22/7 \times 28 \times 28 \times h = 9856$$

$$h = 9856 \times 7 / 22 \times 28 \times 28$$

$$= 68992 / 17248$$

$$= 4\text{cm}$$

∴ Rise in water level is 4cm.

**24. A rectangular sheet of paper 30 cm × 18 cm can be transformed into the curved surface of a right circular cylinder in two ways i.e., either by rolling the paper along its length or by rolling it along its breadth. Find the ratio of the volumes of the two cylinders thus formed.**

**Solution:**

We have,

Dimensions of rectangular sheet = 30 cm × 18 cm

Case (i)

When paper is rolled along its length

$$2 \pi r = 30$$

$$r = 30 / 2\pi \text{ cm}$$

$$\text{Height} = 18 \text{ cm}$$

$$\begin{aligned}\text{Volume of cylinder, } V_1 &= \pi r^2 h \\ &= \pi \times (30/2\pi)^2 \times 18 \text{ cm}^3\end{aligned}$$

Case (ii)

When paper is rolled along its breadth

$$2\pi r = 18$$

$$r = 18/2\pi \text{ cm}$$

Height = 30 cm

$$\begin{aligned}\text{Volume of cylinder, } V_2 &= \pi r^2 h \\ &= \pi \times (18/2\pi)^2 \times 30 \text{ cm}^3\end{aligned}$$

Hence,

$$\begin{aligned}\text{Volume of cylinder, } V_1 / \text{Volume of cylinder, } V_2 &= \{\pi \times (30/2\pi)^2 \times 18\} / \{\pi \times (18/2\pi)^2 \times 30\} \\ &= \{\pi \times (30/2\pi)^2 \times 18\} \times 1 / \{\pi \times (18/2\pi)^2 \times 30\} \\ &= 30^2 \times 18 / 18^2 \times 30 \\ &= 30/18 \\ &= 5/3\end{aligned}$$

∴ The ratio of two volumes is 5:3

**25. The rain which falls on a roof 18 m long and 16.5 m wide is allowed to be stored in a cylindrical tank 8 m in diameter. If it rains 10 cm on a day, what is the rise of water level in the tank due to it?**

**Solution:**

We have,

Dimensions of roof = 18 m × 16.5 m

Diameter of cylindrical tank = 8 m

Radius of tank =  $d/2 = 8/2 = 4\text{m}$

Given that, it rains 10 cm a day or 0.1m a day

Let the rise in level of tank be 'h'

Volume of tank = volume of roof

$$\pi r^2 h = lbh$$

$$22/7 \times 4 \times 4 \times h = 18 \times 16.5 \times 0.1$$

$$h = (18 \times 16.5 \times 0.1 \times 7) / 22 \times 4 \times 4$$

$$= 207.9/352$$

$$= 0.5906\text{m} = 59.06\text{cm}$$

∴ Rise in water level is 59.06cm

**26. A piece of ductile metal is in the form of a cylinder of diameter 1 cm and length 5 cm. It is drawn-out into a wire of diameter 1 mm. What will be the length of the**

**wire so formed?**

**Solution:**

We have,

Diameter of metallic cylinder = 1 cm

Radius of metallic cylinder =  $d/2 = 1/2 = 0.5$  cm

Length of cylinder = 5 cm

Diameter of wire drawn from it = 1 mm = 0.1 cm

Radius of wire = 0.5mm = 0.05cm

Let length of wire be 'h' cm

Length of wire drawn from metal = volume of metal/ volume of wire

$$\begin{aligned} &= \pi r^2 h / \pi r^2 \\ &= (1/2)^2 \times 5 / (0.05)^2 \\ &= (5/4) / 0.0025 \\ &= 1.25/0.0025 \\ &= 500 \text{ cm} \\ &= 5\text{m} \end{aligned}$$

$\therefore$  Length of the wire is 5m.

**27. Find the length of 13.2 kg of copper wire of diameter 4 mm, when 1 cubic cm of copper weighs 8.4 gm.**

**Solution:**

We have,

Weight of copper wire = 13.2 kg = 13200 gm

Diameter of wire = 4 mm

Radius of wire =  $d/2 = 4/2 = 2$ mm = 0.2cm

Let length of wire be 'h' cm

So,

Weight (Density) of 1 cubic cm wire = 8.4 gm

We know, volume = weight/density

Volume  $\times$  density = weight

$$\pi r^2 h \times 8.4 = 13200$$

$$22/7 \times 0.2 \times 0.2 \times h \times 8.4 = 13200$$

$$h = 13200 \times 7 / 22 \times 0.2 \times 0.2 \times 8.4$$

$$= 92400/7.392$$

$$= 12500 \text{ cm} = 125\text{m}$$

$\therefore$  Length of 13.2kg of copper wire is 125 m.

**28. 2.2 cubic dm of brass is to be drawn into cylindrical wire 0.25 cm in diameter.**

**Find the length of the wire.**

**Solution:**

We have,

Diameter of cylindrical wire = 0.25 cm

Radius of wire =  $d/2 = 0.25/2 = 0.125$ cm

Let length of wire be 'h' cm

Volume of brass wire =  $2.2 \text{ dm}^3 = 2200 \text{ cm}^3$

$$\pi r^2 h = 2200$$

$$22/7 \times 0.125 \times 0.125 \times h = 2200$$

$$h = 2200 \times 7 / 22 \times 0.125 \times 0.125$$

$$= 15400 / 0.34375$$

$$= 44800 \text{ cm}$$

$$= 448 \text{ m}$$

$\therefore$  Length of the wire is 448m.

**29. The difference between inside and outside surfaces of a cylindrical tube 14 cm long is 88 sq. cm. If the volume of the tube is 176 cubic cm, find the inner and outer radii of the tube.**

**Solution:**

We have,

Length of cylindrical tube = 14 cm

Let outer radius of tube = R cm

Let inner radius of tube = r cm

Difference between inside and outside surface =  $88 \text{ cm}^2$

$$2\pi (R-r) h = 88 \dots\dots (i)$$

Volume of cylinder =  $176 \text{ cm}^3$

$$\pi (R^2 - r^2) h = 176 \dots\dots (ii)$$

Dividing equation (i) by equation (ii)

$$2\pi (R-r) h / \pi (R^2 - r^2) h = 88/176$$

$$2 / R + r = 1/2$$

$$R+r = 4 \dots\dots\dots (iii)$$

From equation (ii)

$$\pi (R^2 - r^2) h = 176$$

$$\pi (R+r) (R-r) h = 176$$

$$22/7 \times 4 \times (R-r) \times 14 = 176$$

$$\begin{aligned}R-r &= 176 \times 7 / 22 \times 4 \times 14 \\ &= 1232 / 1232 \\ R-r &= 1 \dots \dots \dots (iv)\end{aligned}$$

By adding equation (iii) and (iv)

$$\begin{aligned}R+r &= 4 \\ \underline{R-r} &= 1 \\ 2R &= 5 \\ R &= 5/2 = 2.5\text{cm}\end{aligned}$$

$$\begin{aligned}R-r &= 1 \\ r &= 2.5 - 1 \\ &= 1.5\text{cm}\end{aligned}$$

$\therefore$  Inner and outer radii are 2.5cm and 1.5cm

**30. Water flows out through a circular pipe whose internal diameter is 2 cm, at the rate of 6 metres per second into a cylindrical tank, the radius of whose base is 60 cm. Find the rise in the level of water in 30 minutes?**

**Solution:**

We have,  
Internal diameter of pipe = 2 cm  
Internal radius of pipe =  $d/2 = 2/2 = 1\text{cm}$

$$\begin{aligned}\text{Rate of flow of water} &= 6 \text{ m/s} = 600 \text{ cm/s} \\ \text{Radius of base of cylindrical tank} &= 60 \text{ cm} \\ \text{Rise in height in cylindrical tank} &= \frac{\text{rate of flow of water} \times \text{total time} \times \text{volume of pipe}}{\text{volume of cylindrical tank}} \\ &= \frac{(600 \times 30 \times 60 \times \pi \times 1 \times 1)}{(\pi \times 60 \times 60)} \\ &= 1080000/3600 \\ &= 300 \text{ cm} \\ &= 3\text{m}\end{aligned}$$

$\therefore$  Rise in water level is 3m.

**31. A cylindrical tube, open at both ends, is made of metal. The internal diameter of the tube is 10.4 cm and its length is 25 cm. The thickness of the metal is 8 mm everywhere. Calculate the volume of the metal.**

**Solution:**

We have,  
Internal diameter of cylindrical tube = 10.4 cm

Internal radius of tube =  $d/2 = 10.4/2 = 5.2\text{ cm}$

Length of tube = 25 cm

Thickness of metal = 8 mm = 0.8 cm

Outer radius of tube =  $R = 5.2 + 0.8 = 6\text{ cm}$

$$\begin{aligned}\therefore \text{Volume of metal} &= \pi (R^2 - r^2) \times l \\ &= 22/7 \times (6^2 - 5.2^2) \times 25 \\ &= 22/7 \times (36 - 27.04) \times 25 \\ &= 704\text{ cm}^3\end{aligned}$$

**32. From a tap of inner radius 0.75 cm, water flows at the rate of 7 m per second. Find the volume in litres of water delivered by the pipe in one hour.**

**Solution:**

We have,

Inner radius of tap = 0.75 cm

Length of water flowing in 1s = 7m = 700 cm

$$\begin{aligned}\text{Volume of water per second derived from tap} &= \pi r^2 l \\ &= 22/7 \times 0.75 \times 0.75 \times 700 \\ &= 1237.5\text{ cm}^3\end{aligned}$$

$$\begin{aligned}\therefore \text{Volume of water derived in 1 hour (3600 sec)} &= (1237.5 \times 3600)/1000 \\ &= 4455\text{ litres}\end{aligned}$$

**33. A cylindrical water tank of diameter 1.4 m and height 2.1 m is being fed by a pipe of diameter 3.5 cm through which water flows at the rate of 2 metre per second. In how much time the tank will be filled?**

**Solution:**

We have,

Diameter of cylindrical tank = 1.4 m

Radius of tank =  $d/2 = 1.4/2 = 0.7\text{ m}$

Height of tank = 2.1 m

Diameter of pipe flowing water in tank = 3.5 cm

Radius of pipe =  $d/2 = 3.5/2\text{ cm}$

Rate of flow of water = 2 m/s

$$\begin{aligned}\text{Time taken to fill the tank} &= \text{volume of tank} / \text{volume of pipe} \times \text{rate of flow} \\ &= \pi r^2 h / (\pi r^2 \times 2) \\ &= (\pi \times 0.7 \times 0.7 \times 2.1) / (\pi \times 3.5/2 \times 3.5/2 \times 2) \\ &= 1.029 / 6.125 \\ &= 0.168\end{aligned}$$

$$= 1680 \text{ seconds}$$

$$= 28 \text{ minutes.}$$

∴ Time taken to fill the tank is 28 minutes.

**34. A rectangular sheet of paper 30 cm × 18 cm be transformed into the curved surface of a right circular cylinder in two ways i.e., either by rolling the paper along its length or by rolling it along its breadth. Find the ratio of the volumes of the two cylinders thus formed.**

**Solution:**

We have,

Dimensions of rectangular sheet = 30 cm × 18 cm

Case (i)

When paper is rolled along its length

$$2\pi r = 30$$

$$r = 30 / 2\pi \text{ cm}$$

Height = 18 cm

Volume of cylinder,  $V_1 = \pi r^2 h$

$$= \pi \times (30/2\pi)^2 \times 18 \text{ cm}^3$$

Case (ii)

When paper is rolled along its breadth

$$2\pi r = 18$$

$$r = 18/2\pi \text{ cm}$$

Height = 30 cm

Volume of cylinder,  $V_2 = \pi r^2 h$

$$= \pi \times (18/2\pi)^2 \times 30 \text{ cm}^3$$

Hence,

$$\begin{aligned} \text{Volume of cylinder, } V_1 / \text{Volume of cylinder, } V_2 &= \{\pi \times (30/2\pi)^2 \times 18\} / \{\pi \times (18/2\pi)^2 \times 30\} \\ &= \{\pi \times (30/2\pi)^2 \times 18\} \times 1 / \{\pi \times (18/2\pi)^2 \times 30\} \\ &= 30^2 \times 18 / 18^2 \times 30 \\ &= 30/18 \\ &= 5/3 \end{aligned}$$

∴ The ratio of two volumes is 5:3

**35. How many litres of water flows out of a pipe having an area of cross section of 5 cm<sup>2</sup> in one minute, if the speed of water in the pipe is 30 cm/sec?**

**Solution:**

We have,

Cross section area of pipe =  $5 \text{ cm}^2$

Speed of water =  $30 \text{ cm/s}$

Time = 1 minute =  $60 \text{ sec}$

$$\begin{aligned}\text{Volume of water flows through pipe} &= \text{Area of cross section} \times \text{speed of flow} \times \text{time} \\ &= 5 \times 30 \times 60 \\ &= 9000 \text{ cm}^3 \\ &= 9000/1000 = 9 \text{ litres}\end{aligned}$$

$\therefore$  9 litres of water flows out of pipe.

**36. A solid cylinder has a total surface area of  $231 \text{ cm}^2$ . Its curved surface area is  $2/3$  of the total surface area. Find the volume of the cylinder.**

**Solution:**

We have,

Total surface area of cylinder =  $231 \text{ cm}^2$

Curved surface area =  $2/3$  total surface area =  $2/3 \times 231 = 154 \text{ cm}^2$

$$2\pi rh = 2/3 \cdot 2\pi r(h + r)$$

$$3h = 2(h+r)$$

$$3h = 2h + 2r$$

$$h = 2r \dots\dots\dots (i)$$

And,

$$2\pi r(h + r) = 231$$

$$2 \times 22/7 \times r \times (2r+r) = 231$$

$$2 \times 22/7 \times r \times 3r = 231$$

$$3r^2 = 231 \times 7 / 2 \times 22$$

$$= 1617 / 44$$

$$= 36.75$$

$$r^2 = 36.75 / 3$$

$$= 12.25$$

$$r = \sqrt{12.25}$$

$$= 3.5 \text{ cm}$$

Since,  $h = 2r = 2 \times 3.5 = 7 \text{ cm}$

$$\begin{aligned}\therefore \text{Volume of cylinder} &= \pi r^2 h \\ &= 22/7 \times 3.5 \times 3.5 \times 7 \\ &= 269.5 \text{ cm}^3\end{aligned}$$

**37. Find the cost of sinking a tube well 280 m deep, having diameter 3 m at the rate of Rs 3.60 per cubic metre. Find also the cost of cementing its inner curved surface at Rs 2.50 per square metre.**

**Solution:**

We have,

Depth of tube well = 280 m

Diameter of tube well = 3 m

Radius of well =  $d/2 = 3/2 = 1.5$  m

Volume =  $\pi r^2 h$

$$= 22/7 \times 1.5 \times 1.5 \times 280$$

$$= 1980 \text{ m}^3$$

$\therefore$  Cost of sinking tube well at rate Rs 3.60/m<sup>3</sup> =  $1980 \times 3.60 = \text{Rs } 7128$

Curved surface area =  $2\pi r h$

$$= 2 \times 22/7 \times 1.5 \times 280$$

$$= 2640 \text{ m}^2$$

$\therefore$  Cost of cementing its inner curved surface at rate Rs 2.50/m<sup>2</sup> =  $2.50 \times 2640 = \text{Rs } 6600$

**38. Find the length of 13.2 kg of copper wire of diameter 4 mm, when 1 cubic cm of copper weighs 8.4 gm.**

**Solution:**

We have,

Weight of copper wire = 13.2 kg = 13200 gm

Diameter of wire = 4 mm

Radius of wire =  $d/2 = 4/2 = 2\text{mm} = 0.2\text{cm}$

Let length of wire be 'h' cm

So,

Weight (Density) of 1 cubic cm wire = 8.4 gm

We know, volume = weight/density

Volume  $\times$  density = weight

$$\pi r^2 h \times 8.4 = 13200$$

$$22/7 \times 0.2 \times 0.2 \times h \times 8.4 = 13200$$

$$h = 13200 \times 7 / 22 \times 0.2 \times 0.2 \times 8.4$$

$$= 92400 / 7.392$$

$$= 12500 \text{ cm} = 125 \text{ m}$$

$\therefore$  Length of 13.2kg of copper wire is 125 m.

**39. 2.2 cubic dm of brass is to be drawn into a cylindrical wire 0.25 cm in diameter. Find the length of the wire.**

**Solution:**

We have,

Diameter of cylindrical wire = 0.25 cm

$$\text{Radius of wire} = d/2 = 0.25/2 = 0.125\text{cm}$$

Let length of wire be 'h' cm

$$\text{Volume of brass wire} = 2.2 \text{ dm}^3 = 2200 \text{ cm}^3$$

$$\pi r^2 h = 2200$$

$$22/7 \times 0.125 \times 0.125 \times h = 2200$$

$$h = 2200 \times 7 / 22 \times 0.125 \times 0.125$$

$$= 15400 / 0.34375$$

$$= 44800 \text{ cm}$$

$$= 448\text{m}$$

∴ Length of the wire is 448m.

**40. A well with 10 m inside diameter is dug 8.4 m deep. Earth taken out of it is spread all around it to a width of 7.5 m to form an embankment. Find the height of the embankment.**

**Solution:**

We have,

$$\text{Diameter of well} = 10 \text{ m}$$

$$\text{Radius of well} = d/2 = 10/2 = 5\text{m}$$

$$\text{Depth of well} = 8.4 \text{ m}$$

$$\begin{aligned} \text{Volume of earth dug out from well} &= \pi r^2 h \\ &= 22/7 \times 5 \times 5 \times 8.4 \\ &= 660 \text{ m}^3 \end{aligned}$$

This earth is spread out on width of 7.5 m.

$$\text{inner radii, } r = 5\text{m and outer radii, } R = (5+7.5) = 12.5\text{cm}$$

$$\text{Area} \times h = 660$$

$$\pi(R^2 - r^2) h = 660$$

$$\pi(12.5^2 - 5^2) h = 660$$

$$22/7 (131.25) h = 660$$

$$h = 660 \times 7 / 22 \times 131.25$$

$$= 4620/2887.5$$

$$= 1.6 \text{ m}$$

∴ Height of embankment is 1.6m.

**41. A hollow garden roller, 63 cm wide with a girth of 440 cm, is made of 4 cm thick iron. Find the volume of the iron.**

**Solution:**

We have,

$$\text{Width of roller} = 63 \text{ cm}$$

Thickness of roller = 4 cm

Girth (perimeter) = 440 cm

$$2\pi R = 440$$

$$2 \times \frac{22}{7} \times R = 440$$

$$R = \frac{440 \times 7}{2 \times 22}$$

$$= 70 \text{ cm}$$

Inner radius = R - thickness = 70 - 4 = 66 cm

$$\begin{aligned} \text{Volume of cylindrical iron} &= \pi(R^2 - r^2) l \\ &= \frac{22}{7} \times (70^2 - 66^2) \times 63 \\ &= \frac{22}{7} \times 594 \times 63 \\ &= 107712 \text{ cm}^3 \end{aligned}$$

∴ The volume of iron is 107712 cm<sup>3</sup>

**42. What length of a solid cylinder 2 cm in diameter must be taken to recast into a hollow cylinder of length 16 cm, external diameter 20 cm and thickness 2.5 mm?**

**Solution:**

We have,

Length of solid cylinder = L

Diameter of cylinder = 2 cm

Radius of cylinder =  $d/2 = 2/2 = 1 \text{ cm}$

Volume of cylinder =  $\pi r^2 L$ ..... (i)

Length of hollow cylinder = 16 cm

External diameter = 20 cm

External radius =  $20/2 = 10 \text{ cm}$

Thickness = 2.5 mm = 0.25 cm

Inner radius =  $10 - 0.25 = 9.75 \text{ cm}$

Volume =  $\pi (R^2 - r^2) l$ ..... (ii)

From (i) and (ii)

$$\pi r^2 L = \pi (R^2 - r^2) l$$

$$\pi \times 1 \times 1 \times L = \pi \times (10^2 - 9.75^2) \times 16$$

$$L = 79 \text{ cm}$$

∴ The length of the solid cylinder should be 79 cm.

**43. In the middle of a rectangular field measuring 30m × 20m, a well of 7 m diameter and 10 m depth is dug. The earth so removed is evenly spread over the remaining part of the field. Find the height through which the level of the field is**

**raised.**

**Solution:**

We have,

Diameter of well = 7 m

Radius of well =  $d/2 = 7/2 = 3.5\text{m}$

Depth of well = 10 m

$$\begin{aligned}\text{Volume of well} &= \pi r^2 h \\ &= \frac{22}{7} \times 3.5 \times 3.5 \times 10 \\ &= 385 \text{ m}^3\end{aligned}$$

$$\begin{aligned}\text{Area of embankment field} &= 30 \times 20 - \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \\ &= 600 - 38.5 = 561.5 \text{ m}^2\end{aligned}$$

Volume of well = Area of embankment field  $\times$  height of embankment

$$385 = 561.5 \times h$$

$$h = 385/561.5$$

$$= 0.6856\text{m}$$

$$= 68.56 \text{ cm}$$

$\therefore$  Height of embankment is 68.56 cm





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