

(15)

Exercise 22.2

Q.1 Use $\pi = \frac{22}{7}$, unless otherwise indicated.

1. Find the volume of a cylinder whose

(i) $r = 3.5 \text{ cm}$, $h = 40 \text{ cm}$

(ii) $r = 2.8 \text{ m}$, $h = 15 \text{ m}$

Sol: Volume $= \pi r^2 h$
 $= \frac{22}{7} \times 3.5 \times 3.5 \times 40$
 $= 1540 \text{ cm}^3$

(ii) Volume $= \pi r^2 h$
 $= \frac{22}{7} \times 2.8 \times 2.8 \times 15 = 369.6 \text{ cm}^3$

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

(i) $d = 21 \text{ cm}$, $h = 10 \text{ cm}$

(ii) $d = 7 \text{ m}$, $h = 24 \text{ m}$

Sol: (i) $d = 21 \text{ cm}$

$\therefore r = \frac{21}{2} \text{ cm}$, $h = 10 \text{ cm}$

Volume $= \pi r^2 h$

$= \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 10 = 3465 \text{ cm}^3$

(ii) $d = 7 \text{ m}$, $h = 24 \text{ m}$

$V = \pi r^2 h = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 24 = 924 \text{ m}^3$

Q.3 The area of the base of a right circular cylinder is 616 cm^2 and its height is 25 cm . Find the volume of the cylinder.

Sol: Area of base = 616 , $h = 25 \text{ cm}$

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

$$\Rightarrow \frac{22}{7} r^2 = 616 \quad \Rightarrow r^2 = \frac{616 \times 7}{22}$$

$$\Rightarrow r^2 = 28 \times 7$$

$$r^2 = 196$$

$$\Rightarrow r = 14 \text{ cm}$$

$$\text{Now, volume} = \pi r^2 h$$

$$= \frac{22}{7} \times 14 \times 14 \times 25 = 15400 \text{ cm}^3$$

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

Sol: Circumference of base = 88 , $h = 15 \text{ cm}$

$$\Rightarrow 2 \times \frac{22}{7} \times r = 88$$

$$\Rightarrow r = \frac{88 \times 7}{22 \times 2}$$

$$= 14 \text{ cm.}$$

$$\begin{aligned}
 \therefore \text{Volume} &= \pi r^2 h \\
 &= \frac{22}{7} \times 14 \times 14 \times 15 \\
 &= 9240 \text{ cm}^3
 \end{aligned}$$

Q.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.

Sol: outer diameter = 10 cm
 outer radius = $\frac{10}{2} = 5 \text{ cm} = r_2$

Inner diameter = 6 cm

Inner radius = $\frac{6}{2} \text{ cm} = 3 \text{ cm} = r_1$

length = 21 dm $\{ 1 \text{ dm} = 10 \text{ cm} \}$
 $= 210 \text{ cm}$

$$\begin{aligned}
 \therefore \text{Volume of copper used} &= \pi (r_2^2 - r_1^2) h \\
 &= \frac{22}{7} [(5)^2 - (3)^2] \times 210 \\
 &= \frac{22}{7} (25 - 9) \times 210 \\
 &= 22 \times 16 \times 30 \\
 &= 10560 \text{ cm}^3
 \end{aligned}$$

Q6 Find the (i) curved surface area. (ii) TSA
(iii) volume of right circular cylinder whose height is 15 cm and radius of its base is 7 cm.

Sol: here, $r = 7\text{ cm}$, $h = 15\text{ cm}$.

$$(i) \text{ CSA} = 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 15 = 660 \text{ cm}^2$$

$$(ii) \text{ TSA} = 2\pi r(h+r) \\ = 2 \times \frac{22}{7} \times 7 (15+7) = 44 \times 22 = 968 \text{ cm}^2$$

$$(iii) \text{ Volume} = \pi r^2 h \\ = \frac{22}{7} \times 7 \times 7 \times 15 = 2310 \text{ cm}^3$$

Q7 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.

Sol: diameter = 42 cm
 $\therefore$ radius = $\frac{42}{2} = 21\text{ cm}$, $h = 10\text{ cm}$.

$$\text{Volume} = \pi r^2 h \\ = \frac{22}{7} \times 21 \times 21 \times 10 = 13860 \text{ cm}^3.$$

Q.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.

Sol: here, $d = 7 \text{ cm}$

$$\therefore r = \frac{7}{2} \text{ cm}, h = 60 \text{ cm}$$

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

$$\therefore 1000 \text{ cm}^3 = 1 \text{ litre}$$

$$= \frac{2310}{1000} \text{ litre} = 2.310 \text{ litre.}$$

Q.9 A rectangular strip $25 \text{ cm} \times 7 \text{ cm}$ is rotated about the longer side. Find the volume of the solid thus generated.

Sol: here, $h = 25 \text{ cm}$, $r = 7 \text{ cm}$.

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

Q.10 A rectangular sheet of paper, $44 \text{ cm} \times 20 \text{ cm}$, is rolled along its length to form a cylinder. Find the volume of cylinder thus generated.

Sol: here $h = 20 \text{ cm}$,

Circumference of base $= 44 \text{ cm}$

$$2\pi r = 44$$

$$\Rightarrow 2 \times \frac{22}{7} \times r = 44$$

$$\Rightarrow r = 7 \text{ cm.}$$

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

$$= \frac{22}{7} \times 7 \times 7 \times 20 = 3080 \text{ cm}^3$$

Q.11 The volume and curved surface area of a cylinder are 1650 cm^3 and 660 cm^2 respectively. Find the radius and height of the cylinder.

Sol: Volume $= 1650 \text{ cm}^3$

$$\Rightarrow \pi r^2 h = 1650 \quad \text{--- (1)}$$

$$\text{CSA} = 660 \text{ cm}^2$$

$$\Rightarrow 2\pi r h = 660 \quad \text{--- (2)}$$

Now, dividing equations (1) by equation (2)

$$\frac{\pi r^2 h}{2\pi r h} = \frac{1650}{660}$$

$$\Rightarrow \frac{r}{2} = \frac{15}{6} \Rightarrow r = \frac{15}{6} \times 2$$

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

$$\therefore 2\pi rh = 660$$

$$\Rightarrow 2 \times \frac{22}{7} \times 5 \times h = 660$$

$$\Rightarrow h = \frac{660 \times 7}{2 \times 22 \times 5}$$

$$= 21 \text{ cm}$$

$$\therefore r = 5 \text{ cm}, h = 21 \text{ cm}.$$

Q.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.

Sol: $\frac{r_1}{r_2} = \frac{2}{3}, \frac{h_1}{h_2} = \frac{5}{3}$

$$\begin{aligned} \text{Now, } \frac{V_1}{V_2} &= \frac{\pi r_1^2 h_1}{\pi r_2^2 h_2} = \left(\frac{r_1}{r_2}\right)^2 \times \left(\frac{h_1}{h_2}\right) \\ &= \left(\frac{2}{3}\right)^2 \times \left(\frac{5}{3}\right) \\ &= \frac{4}{9} \times \frac{5}{3} = \frac{20}{27} \end{aligned}$$

$$\therefore V_1 : V_2 = 20 : 27$$

Q.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 cm^2 .

Sol: We are given

$$\frac{\text{CSA of cylinder}}{\text{TSA of cylinder}} = \frac{1}{2}$$

$$\Rightarrow \frac{2\pi r h}{2\pi r (h+r)} = \frac{1}{2}$$

$$\Rightarrow \frac{h}{h+r} = \frac{1}{2} \quad \Rightarrow 2h = h+r$$

$$\Rightarrow 2h - h = r$$

$$\Rightarrow h = r$$

$$\therefore \text{TSA} = 616$$

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

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

$$\Rightarrow 2\pi r \times 2r = 616$$

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

$$\Rightarrow 4 \times \frac{22}{7} r^2 = 616 \quad \Rightarrow r^2 = \frac{616 \times 7}{4 \times 22}$$

$$\Rightarrow r^2 = 49 \quad \Rightarrow r = 7 \text{ cm}$$

$$\therefore h = 7 \text{ cm}$$

Now, Volume = $\pi r^2 h$

$$= \frac{22}{7} \times 7 \times 7 \times 7 = 154 \times 7$$

$$= 1078 \text{ cm}^3$$

Q.14 The curved surface area of cylinder is 1320 cm^2 and its base has diameter 21 cm . Find the volume of cylinder.

Sol: $\therefore \text{CSA} = 2\pi rh$, $D = 21 \text{ cm}$
 $\therefore r = \frac{21}{2} \text{ cm}$

$$\Rightarrow 2\pi rh = 1320$$

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

$$\Rightarrow h = \frac{1320}{66}$$

$$\Rightarrow h = 20 \text{ cm}$$

Now, $\text{Volume} = \pi r^2 h$
 $= \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 20 = 6930 \text{ cm}^3$

Q.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 cm^3 .

Sol: we are given, $\frac{r}{h} = \frac{2}{3} \Rightarrow r = \frac{2}{3}h$

$$\therefore \text{Volume} = 1617$$

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

$$= \frac{22}{7} \times \left(\frac{2}{3}h\right)^2 \times h = 1617$$

$$\Rightarrow \frac{22}{7} \times \frac{4}{9} h^2 \times h = 1617$$

$$\Rightarrow h^3 = \frac{\overset{147}{\cancel{1617}} \times 7 \times 9}{\cancel{22} \times 4}$$

$$\Rightarrow h^3 = \frac{9261}{8} = \left(\frac{21}{2}\right)^3$$

$$\Rightarrow h = \frac{21}{2} \text{ cm.}$$

$$\therefore r = \frac{2}{3} h = \frac{2}{3} \times \frac{21}{2} = 7 \text{ cm.}$$

$$\begin{aligned} \text{Now, TSA} &= 2\pi r(h+r) \\ &= 2 \times \frac{22}{7} \times 7(10.5+7) \\ &= 44 \times 17.5 = 770 \text{ cm}^2 \end{aligned}$$

Q.16 The curved surface area of a cylindrical pillar is 264 m^2 and its volume is 924 m^3 . Find the diameter and height of the pillar.

Sol: $\therefore \text{CSA} = 264$
 $\text{Volume} = 924$

$$\Rightarrow \frac{\text{CSA}}{\text{Volume}} = \frac{264}{924}$$

$$\Rightarrow \frac{2\pi rh}{\pi r^2 h} = \frac{66}{231} \Rightarrow \frac{2}{r} = \frac{66}{231}$$

$$\Rightarrow r = \frac{462}{66} = 7 \text{ m.}$$

$$\therefore \text{Diameter} = 7 \times 2 = 14 \text{ m.}$$

$$\therefore 2\pi rh = 264$$

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

$$\Rightarrow h = \frac{264}{44}$$

$$h = 6 \text{ m.}$$

$$\therefore \text{Diameter} = 14 \text{ m, } h = 6 \text{ m.}$$

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

Sol: we are given, $V_1 = V_2$

$$\text{also } \frac{h_1}{h_2} = \frac{1}{2}$$

$$\therefore V_1 = V_2$$

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

$$\Rightarrow \frac{h_1}{h_2} = \left(\frac{r_2}{r_1}\right)^2$$

$$\Rightarrow \frac{1}{2} = \left(\frac{r_2}{r_1}\right)^2$$

$$\Rightarrow \frac{r_2}{r_1} = \frac{1}{\sqrt{2}}$$

$$\therefore r_1 : r_2 = \sqrt{2} : 1$$

Q.18 The height of a right circular cylinder is 10.5 cm. 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.

Sol: $h = 10.5 \text{ cm},$

$$\text{Now } 3(\pi r^2 + \pi r^2) = 2 \times (2\pi rh)$$

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

$$\Rightarrow 6r = 4h$$

$$\Rightarrow r = \frac{4}{6}h = \frac{2}{3}h.$$

$$\Rightarrow r = \frac{2}{3} \times 10.5 = 7 \text{ cm}.$$

$$\text{Now, Volume} = \pi r^2 h$$

$$= \frac{22}{7} \times 7 \times 7 \times 10.5 = 1617 \text{ cm}^3$$

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

Sol: depth (h) = 21 m, $D = 6 \text{ m}$
 $r = 3 \text{ m}.$

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

$$= \frac{22}{7} \times 3 \times 3 \times 21 = 22 \times 27$$

$$= 594 \text{ m}^3.$$

Q.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. (23)

Sol:

$$\text{Circumference} = 176 \text{ cm}$$

$$\Rightarrow 2\pi r = 176$$

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

$$\Rightarrow r = 28 \text{ cm.}$$

$$h = 3 \text{ m} = 300 \text{ cm.}$$

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

$$= \frac{22}{7} \times 28 \times 28 \times 300 = 739200 \text{ cm}^3.$$

$$= \frac{739200}{1000000} \text{ m}^3$$

$$= 0.7392 \text{ m}^3$$

$$= 0.74 \text{ m}^3.$$

Q.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 platform's height.

Sol:

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

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

$$r = \frac{7}{2} \text{ m}$$

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

dimension of platform = $22\text{ m} \times 14\text{ m}$.

let height of platform = $h\text{ m}$.

$\Rightarrow$ V of platform = V of earth dug out

$$22 \times 14 \times h = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 20$$

$$\Rightarrow h = \frac{22 \times 7 \times 7 \times 20^5}{7 \times 2 \times 2 \times 22 \times 14_2}$$

$$\Rightarrow h = \frac{5}{2} \text{ m}$$

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

Sol! diameter of well = 14 m
 radius = $\frac{14}{2} = 7\text{ m}$.
 depth = 8 m

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

width of embankment = 21 m

outer radius = $21 + 7 = 28\text{ m} = r_2$

inner radius = $7\text{ m} = r_1$

$\therefore$ Vol. of embankment = V of earth dug out

$$\Rightarrow \pi (r_2^2 - r_1^2) h = 1232$$

$$\Rightarrow \frac{22}{7} [(28)^2 - (7)^2] \times h = 1232$$

$$= \frac{22}{7} \times (784 - 49) \times h = 1232$$

$$= \frac{22}{7} \times 735 \times h = 1232$$

$$\Rightarrow h = \frac{1232 \times 7}{22 \times 735} = \frac{56}{105}$$

$$= 0.5333 \dots$$

$$= 53.33 \text{ cm}$$

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

Sol: Diameter of base = 56 cm

$$\text{Radius} = \frac{56}{2} = 28 \text{ cm.}$$

Dimension of rectangular vessel = 32 cm x 22 cm x 14 cm

$$\text{Volume} = 32 \times 22 \times 14 = 9856 \text{ cm}^3.$$

Let rise in water level = h cm

Volume of cylindrical container = V of rectangular vessel

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

$$\Rightarrow \frac{22}{7} \times 28 \times 28 \times h = 9856$$

$$\Rightarrow h = \frac{9856}{22 \times 4 \times 28} = 4 \text{ cm.}$$

Q.24 A rectangular sheet of paper $30 \text{ cm} \times 18 \text{ cm}$ 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 volume of the two cylinders thus formed.

Sol: We have, dimension of sheet = $30 \text{ cm} \times 18 \text{ cm}$.

Case-I: When paper is rolled along length

$$2\pi r = 30$$

$$r = \frac{30}{2\pi}$$

$$h = 18 \text{ cm.}$$

$$\text{Volume} = \pi r^2 h = \pi \times \left(\frac{30}{2\pi}\right)^2 \times 18$$

Case-II: When paper is rolled along breadth

$$2\pi r = 18$$

$$\Rightarrow r = \frac{18}{2\pi}$$

$$h = 30 \text{ cm}$$

$$V_2 = \pi r^2 h$$

$$= \pi \left(\frac{18}{2\pi}\right)^2 \times 30.$$

$$\text{Now, } \frac{V_1}{V_2} = \frac{\pi \left(\frac{30}{2\pi}\right)^2 \times 18}{\pi \left(\frac{18}{2\pi}\right)^2 \times 30}$$

$$= \frac{\frac{900}{4\pi^2} \times 18}{\frac{324}{4\pi^2} \times 30} = \frac{\frac{30}{900 \times 18}}{\frac{324 \times 30}{18}} = \frac{15}{9} \text{ cm} = \frac{5}{3} \text{ cm}$$

$$\therefore V_1 : V_2 = 5 : 3$$

Q.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 in water level of tank due to it?

Sol: dimension of roof = 18 m × 16.5 m.

rain fall = 10 cm = 0.1 m.

diameter of cylindrical tank = 8 m

radius = $\frac{8}{2} = 4$ m.

let water level rise = h m.

then Vol. of water fall = V of cylindrical tank.

$$= 18 \text{ m} \times 16.5 \times 0.01 = \frac{22}{7} \times 4 \times 4 \times h$$

$$\Rightarrow h = \frac{18 \times 16.5 \times 0.01 \times 7}{22 \times 4 \times 4} = \frac{207.9}{352} = 59.06 \text{ cm.}$$

Q. 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.

Sol:

$$\text{diameter of cylinder} = 1 \text{ cm}$$

$$\text{radius} = \frac{1}{2} = 0.5 \text{ cm}$$

$$\text{length} = 5 \text{ cm.}$$

$$\text{diameter of wire} = 1 \text{ mm}$$

$$\text{radius} = \frac{1}{2} \text{ mm} = 0.5 \text{ mm}$$

$$= 0.05 \text{ cm.}$$

$$\text{let length of wire} = h \text{ cm.}$$

$$\text{Now } V. \text{ of cylinder} = V. \text{ of wire}$$

$$\Rightarrow \pi \times (0.5)^2 \times 5 = \pi \times (0.05)^2 \times h$$

$$\Rightarrow \frac{0.5 \times 0.5 \times 5}{0.05 \times 0.05} = h$$

$$\Rightarrow h = 5 \text{ cm}$$

Q. 27 Find the length of 13.2 kg of copper wire of diameter 4 mm, when 1 cm^3 of copper weighs 8.4 gm.

Sol:

$$\text{Weight of copper wire} = 13.2 \text{ kg} = 13200 \text{ gm}$$

$$D = 4 \text{ mm}$$

$$r = \frac{4}{2} = 2 \text{ mm} = 0.2 \text{ cm}$$

$$\text{let length} = h \text{ cm.}$$

So, weight of 1 cm^3 wire = 8.4 gm .

$$\therefore V = \frac{\text{weight}}{\text{density}}$$

$$\Rightarrow \text{weight} = V \times \text{density} \\ = \pi r^2 h \times 8.4$$

$$13200 = \frac{22}{7} \times 0.2 \times 0.2 \times h \times 8.4$$

$$\Rightarrow h = \frac{13200 \times 7}{22 \times 0.2 \times 0.2 \times 8.4} \\ = 12500 \text{ cm} \\ = 125 \text{ m}$$

Q.28 2.2 cubic dm of brass is to be drawn into a cylindrical wire 0.25 cm in diameter. Find length of wire.

Sol:

Diameter of wire = 0.25 cm.

$$\text{Radius} = \frac{0.25}{2} = 0.125 \text{ cm.}$$

Let length of wire = h cm.

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

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

$$\Rightarrow \frac{22}{7} \times 0.125 \times 0.125 \times h = 2200$$

$$h = \frac{2200 \times 7}{22 \times 0.125 \times 0.125} = \frac{156800}{0.34375} \\ = 44800 \text{ cm} \\ = 448 \text{ m.}$$

Q.29 The difference between inside and outside surfaces of a cylindrical tube 14 cm long is 88 sq. cm. If the volume of the ~~fig~~ tube is 176 cubic cm. find the inner and outer radii of the tube. (30)

Sol: length of cylinder = 14 cm
 let outer radius = r_2 cm
 inner radius = r_1 cm.

$$\begin{aligned} \text{outer CSA} - \text{inner CSA} &= 88 \\ \Rightarrow 2\pi r_2 h - 2\pi r_1 h &= 88 \\ \Rightarrow 2\pi (r_2 - r_1) h &= 88 \quad \text{--- (i)} \end{aligned}$$

also, volume = 176

$$\Rightarrow \pi (r_2^2 - r_1^2) h = 176 \quad \text{--- (ii)}$$

Dividing (i) by (ii)

$$\Rightarrow \frac{2\pi (r_2 - r_1) h}{\pi (r_2^2 - r_1^2) h} = \frac{88}{176}$$

$$\Rightarrow \frac{2(r_2 - r_1)}{(r_2 - r_1)(r_2 + r_1)} = \frac{1}{2}$$

$$\Rightarrow 4 = r_2 + r_1 \quad \text{--- (iii)}$$

from equation (ii)

$$\pi (r_2^2 - r_1^2) h = 176$$

$$\Rightarrow \frac{22}{7} (r_2 + r_1) (r_2 - r_1) \times 14 = 176$$

$$\Rightarrow \frac{22}{7} \times 4 \times (r_2 - r_1) \times 14 = 176$$

$$\Rightarrow r_2 - r_1 = 1 \quad \text{--- (iv)}$$

By solving equation (iii) and (iv) we get

$$2r_2 = 5$$

$$r_2 = \frac{5}{2} = 2.5$$

$$\therefore r_1 = 2.5 - 1 \\ = 1.5$$

$$\therefore r_1 = 1.5 \text{ cm}, r_2 = 2.5 \text{ cm}.$$

Q.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.

Sol: Internal diameter of pipe = 2 cm.

$$\text{Int. radius} = \frac{2}{2} = 1 \text{ cm}.$$

$$\text{Rate of flow} = 6 \text{ m/s} = 600 \text{ cm/s}.$$

$$\text{radius of base} = 60 \text{ cm}.$$

$$\text{let water level rise} = h \text{ cm}$$

$\therefore$ v of water thrown in 30 min = v of cylind. tank

$$\Rightarrow \pi (1)^2 \times 600 \times 30 \times 60 = \pi \times 60 \times 60 \times h$$

$$\Rightarrow h = \frac{600 \times 30 \times 60}{60 \times 60} = 300 \text{ cm} = 3 \text{ m}.$$

Q.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 metal.

Sol: Internal diameter = 10.4 cm
 Internal radius (r_1) = $\frac{10.4}{2} = 5.2$ cm.
 Thickness = 8 mm = 0.8 cm.

$$\therefore \text{outer radius} = 5.2 + 0.8 \\ = 6 \text{ cm} = r_2$$

$$\text{length} = 25 \text{ cm.}$$

$$\therefore \text{volume of metal} = \pi (r_2^2 - r_1^2) h \\ = \frac{22}{7} (6^2 - 5.2^2) \times 25 \\ = \frac{22}{7} \times (36 - 27.04) \times 25 \\ = 704 \text{ cm}^3$$

Q32 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.

Sol: radius of pipe = 0.75 cm.
 length of water column in 1 second = 7 m.

$$\therefore \text{vol. of water delivered in 1 sec} = \pi r^2 h \\ = \frac{22}{7} \times 0.75 \times 0.75 \times 7$$

$$= 1237.5 \text{ cm}^3$$

∴ vol. of water delivered in 1 hour (3600 sec)

$$= \frac{1237.5 \times 3600}{1000} \text{ litres}$$

$$= 4455 \text{ litres}$$

Q.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 m/sec. In how much time the tank will be filled?

Sol:

$$\text{diameter of tank} = 1.4 \text{ m}$$

$$\text{radius} = \frac{1.4}{2} = 0.7 \text{ m.}$$

$$h = 2.1 \text{ m.}$$

$$\text{diameter of pipe} = 3.5 \text{ cm}$$

$$\text{radius} = \frac{3.5}{2} \text{ cm} = 1.75 \text{ cm}$$

$$= 0.0175 \text{ m.}$$

$$\text{Rate of water flow} = 2 \text{ m/sec.}$$

$$\therefore \text{Time taken} = \frac{\text{Vol. of tank}}{\text{Vol. of pipe} \times \text{rate of flow}}$$

$$= \frac{\pi \times 0.7 \times 0.7 \times 2.1}{\pi \times 0.0175 \times 0.0175 \times 2} = \frac{1.029}{0.00061250}$$

$$= 1680 \text{ seconds}$$

$$= \frac{1680}{60} = 28 \text{ minutes.}$$

Q.34 A rectangular sheet of paper $30\text{cm} \times 18\text{cm}$ (34) 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 cylinder thus formed.

Sol! Dimension of sheet = $30\text{cm} \times 18\text{cm}$ } Same solution as Q.24 {
Case (i) : when rolled along length

Q.35 How many litres of water flow out of a pipe having an area of cross section of 5cm^2 in one minute, if the speed of water in the pipe is 30cm/sec .

Sol! Area of cross section = 5cm^2
 Speed of water = 30cm/sec
 $T = 1\text{ min}$

$\therefore$ vol of water flows through pipe = Area of cross se. $\times$ Speed

$$= 5 \times 30 \times 60$$

$$= 9000\text{ cm}^3$$

$$= 9\text{ litres.}$$

Q.36 A solid cylinder has a total surface area of 231 cm^2 . If its CSA is $\frac{2}{3}$ of TSA. Find volume.

Sol: $TSA = 231 \text{ cm}^2$

$$CSA = \frac{2}{3} \times 231 = 2 \times 77 = 154 \text{ cm}^2$$

$$\Rightarrow \frac{TSA}{CSA} = \therefore 2\pi rh = \frac{2}{3} \times 2\pi r(h+r)$$

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

$$\Rightarrow h = 2r$$

$$\therefore 2\pi rh = 154$$

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

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

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

$$\therefore h = 2r = 2 \times \frac{7}{2} = 7 \text{ cm.}$$

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

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 7 = 269.5 \text{ cm}^3.$$

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

Sol: Depth of tube well = 280 m
Diameter = 3 m

$$\text{radius} = \frac{3}{2} \text{ m} = 1.5 \text{ m}$$

$$\begin{aligned} \text{Volume} &= \pi r^2 h \\ &= \frac{22}{7} \times 1.5 \times 1.5 \times 280 = 1980 \text{ m}^3. \end{aligned}$$

$$\begin{aligned} \therefore \text{Cost of sinking @ Rs } 3.60/\text{m}^3 &= 1980 \times 3.60 \\ &= \text{Rs } 7128 \end{aligned}$$

$$\begin{aligned} \text{Curved surface area} &= 2\pi r h \\ &= 2 \times \frac{22}{7} \times 1.5 \times 280 = 2640 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{Cost of cementing its inner CSA @ Rs } 2.50/\text{m}^2 \\ &= 2.50 \times 2640 \\ &= \text{Rs } 6600 \end{aligned}$$

Q.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

Sol: Weight of copper wire = 13.2 kg = 13200 gm.

$$D = 4 \text{ mm}$$

$$r = \frac{4}{2} = 2 \text{ mm} = 0.2 \text{ cm.}$$

$$\text{Let length} = h \text{ cm.}$$

So, weight (density) of 1 cubic cm = 8.4 gm.

$$\text{Vol} = \frac{\text{weight}}{\text{density}}$$

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

$$\Rightarrow \frac{22}{7} \times 0.2 \times 0.2 \times h \times 8.4 = 13200$$

$$h = \frac{13200 \times 7}{22 \times 0.2 \times 0.2 \times 8.4} = \frac{92400}{7.392}$$

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

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

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

Sol: we have,

Diameter of cylindrical wire = 0.25 cm.

Radius of wire = $\frac{d}{2}$ cm.

$$= \frac{0.25}{2} = 0.125 \text{ cm.}$$

Let length of wire = h cm.

Volume of brass wire = 2.2 dm³

$$\pi r^2 h = 2200 \text{ cm}^3$$

$$\Rightarrow \frac{22}{7} \times 0.125 \times 0.125 \times h = 2200$$

$$h = \frac{2200 \times 7}{22 \times 0.125 \times 0.125} = \frac{15400}{0.34375}$$

$$= 44800 \text{ cm} = 448 \text{ m.}$$

(38)

Q.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 embankment.

Sol: $D = 10 \text{ m}$

$$r = \frac{10}{2} = 5 \text{ m}$$

$$\text{depth of well} = 8.4 \text{ m } (h_1)$$

earth is spread out on width = 7.5 m.

$$\text{inner radius } r_1 = 5 \text{ m.}$$

$$\text{out radius } r_2 = 5 + 7.5 = 12.5 \text{ m.}$$

Vol. of earth dug out = Vol. of embankment

$$\Rightarrow \pi r_1^2 h_1 = \pi (r_2^2 - r_1^2) h$$

$$\Rightarrow (5)^2 \times 8.4 = [(12.5)^2 - (5)^2] \times h$$

$$\Rightarrow 25 \times 8.4 = (156.25 - 25) \times h$$

$$\Rightarrow \frac{25 \times 8.4}{131.25} = h$$

$$\Rightarrow h = 1.6 \text{ m.}$$

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

Sol: we have

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

$$\text{Thickness} = 4 \text{ cm}$$

$$\text{Girth (Perimeter)} = 440 \text{ cm}$$

$$\Rightarrow 2\pi r = 440$$

$$\Rightarrow 2 \times \frac{22}{7} \times r = 440 \Rightarrow r = 70 \text{ cm}$$

$$\begin{aligned} \text{inner radius} &= R - \text{thickness} \\ &= 70 - 4 = 66 \text{ cm} \end{aligned}$$

$$\therefore \text{Volume of cylindrical iron} = \pi (R^2 - r^2) h$$

$$= \frac{22}{7} (70^2 - 66^2) \times 63$$

$$= \frac{22}{7} \times 594 \times 63 = 107712 \text{ cm}^3$$

Q2) 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 of 2.5 mm?

Solution: diameter of solid cylinder = 2 cm
radius = $\frac{2}{2} = 1 \text{ cm}$

$$\text{external diameter of hollow cylinder} = 20 \text{ cm}$$

$$\text{external radius } (r_2) = \frac{20}{2} = 10 \text{ cm}$$

$$\text{Thickness} = 2.5 \text{ mm}$$

$$= 0.25 \text{ cm}$$

$$\text{Internal radius} = 10 - 0.25$$

$$= 9.75 \text{ cm.}$$

$$\text{length} = 16 \text{ cm.}$$

(40)

Now volume of cylinder = vol. of hollow cylinder

$$\Rightarrow \pi r^2 h = \pi (r_2^2 - r_1^2) h$$

$$\Rightarrow \pi \times 1 \times 1 \times h = \pi [10^2 - 9.75^2] \times 16$$

$$\Rightarrow h = 79 \text{ cm.}$$

$\therefore$ The length of the solid cylinder = 79 cm.

Q.43 In the middle of a rectangular field measuring $30\text{m} \times 20\text{m}$, a well of 7m diameter and 10m 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?

Sol: here, Diameter of well = 7m, radius = $\frac{7}{2}\text{m}$
depth = 10m.

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

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

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

$$\Rightarrow 385 = 561.5 \times h$$

$$\Rightarrow h = \frac{385}{561.5} = 0.6856 \text{ m}$$

$$= 68.56 \text{ cm}$$

$\therefore$ Height of embankment = 68.56 cm.