

RD SHARMA
Solutions
Class 8 Maths
Chapter 22
Ex 22.2

Q1. Find the volume of a cylinder whose: (i) $r = 3.5$ cm, $h = 40$ cm (ii) $r = 2.81$ m, $h = 15$ m

Soln:

(i) Given : $r = 3.5$ cm, $h = 40$ cm

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

(ii) Given :

$r = 2.8$ in, $h = 15$ m

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

Q2. 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

Soln:

(i) Given :

$$d = 21 \text{ cm, radius, } r = \frac{d}{2} = 10.5 \text{ cm}$$

height, $h = 10$ cm

$$\begin{aligned}\text{Volume of the cylinder, } V &= \pi r^2 h \\ &= \frac{22}{7} \times (10.5)^2 \times 10 \\ &= 3465 \text{ cm}^3\end{aligned}$$

(ii) Given :

$$d = 7 \text{ m, radius, } r = \frac{d}{2} = 3.5 \text{ m}$$

height $h = 24$ m

$$\begin{aligned}\text{Volume of the cylinder, } V &= \pi r^2 h \\ &= \frac{22}{7} \times (3.5)^2 \times 24 \\ &= 924 \text{ m}^3\end{aligned}$$

Q3. 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.

Soln:

Let the area of the base of a right circular cylinder be $S \text{ cm}^2$.

Given :

$$S = 616 \text{ cm}^2$$

Height, $h = 25$ cm

Let the radius of a right circular cylinder be r cm.

$$S = \pi r^2$$

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

$$\begin{aligned}r^2 &= \frac{616 \times 7}{22} \\ r^2 &= 196\end{aligned}$$

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

$$\begin{aligned}\text{Volume of the cylinder, } V &= \pi r^2 h \\ &= \pi \times (14)^2 \times 25\end{aligned}$$

$$= 15400 \text{ cm}^3$$

Q4. The circumference of the base of a cylinder is 88 cm and its height is 15 cm. Find the volume of the cylinder.

Soln:

Let r cm be the radius of a cylinder.

Circumference of the cylinder, $S = 2\pi r$

Given :

Height, $h = 15$ cm

Circumference, $S = 88$ cm

$$S = 2\pi r$$

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

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

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

$$= \frac{22}{7} \times 14^2 \times 15$$

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

Q5. A hollow cylindrical pipe is 21 mm long. Its outer and inner diameters are 10 cm and 6 cm respectively. Find the volume of the copper used in making the pipe.

Soln:

Let the length of the cylinder pipe be $h = 21$, $dm = 210$ cm.

Let the outer and the inner radius of the pipe be R cm and r cm, respectively.

$$\therefore 2R = 10 \text{ and } 2r = 6$$

$$R = 5 \text{ cm and } r = 3 \text{ cm}$$

Volume of the copper used in making the pipe, $V = \Pi(R^2 - r^2)h$

$$= \frac{22}{7} \times (5^2 - 3^2) \times 210$$

$$= 22 \times (25 - 9) \times 30 = 22 \times 16 \times 30 = 10560 \text{ cm}^3.$$

Q6. 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.

Soln:

Given:

Height, $h = 15$ cm

Radius, $r = 7$ cm

(i) Curved surface area, $S_1 = 2\pi rh$

$$= 2 \times \frac{22}{7} \times 7 \times 15$$

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

(ii) Total surface area, $S_2 = 2\pi r(r + h)$

$$= 2 \times \frac{22}{7} \times 7 \times (7 + 15)$$

$$= 44 \times 22$$

$$= 968 \text{ cm}^2$$

(iii) Volume of the right circular cylinder, $V = \pi r^2 h$

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

$$= 2310 \text{ cm}^3$$

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.

Soln:

Given:

Diameter, $d = 42 \text{ cm}$

Radius, $r = 21 \text{ cm}$

Height, $h = 10 \text{ cm}$

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

$$= \frac{22}{7} \times 21^2 \times 10 = 13860 \text{ cm}^3$$

Q8. Find the volume of a cylinder, the diameter of whose base is 7 cm and height being 60 cm. Also, find the capacity of the cylinder in liters.

Soln:

Given:

Diameter, $d = 7 \text{ cm}$

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

Height, $h = 60 \text{ cm}$

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

$$= \frac{22}{7} \times (3.5)^2 \times 60$$

$$= 2310 \text{ cm}^3$$

Capacity of the cylinder in liters = $\frac{2310}{1000}$ (1 Liter = 1000 cubic cm)

$$= 2.31 \text{ L}$$

Q9. A rectangular strip 25 cm x 7 cm is rotated on the longer side. Find the volume of the solid, thus generated.

Soln:

Given:

Rectangular strip has radius, $r = 7 \text{ cm}$

Height, $h = 25 \text{ cm}$

Volume of the solid, $V = \pi r^2 h$

$$= \frac{22}{7} \times 7^2 \times 25$$

$$= 3850 \text{ cm}^3$$

Q10. A rectangular sheet of paper, 44 cm x 20 cm, is rolled along its length to form a cylinder. Find the volume of the cylinder so formed.

Soln:

Given:

The length (l) and breadth (b) of the rectangular sheet are 44 cm and 20 cm

Now, the sheet is rolled along the length to form a cylinder.

Let the radius of the cylinder be $r \text{ cm}$.

Height, $h = b = 20 \text{ cm}$

Circumference, $S = 44$ cm

$$2\pi r \frac{22}{7} \times 2 \times r = 44 \text{ cm}$$

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

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

$$\frac{22}{7} \times 7^2 \times 20$$

$$3080 \text{ cm}^3$$

Q11. The volume and the curved surface area of a cylinder are 1650 cm^3 and 660 cm^2 respectively. Find the radius and height of the cylinder.

Soln:

$$\text{Curved surface area of the cylinder} = 2\pi r h \text{ cm}^2 \dots\dots\dots (1)$$

$$\text{Volume of the cylinder } V = \pi r^2 h = 1650 \text{ cm}^3 \dots\dots\dots (2)$$

From (1) and (2), we can calculate the radius (r) and the height of cylinder (h).

We know the volume of the cylinder i.e. 1650 cm^3

$$\therefore 1650 = \pi r^2 h$$

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

Substitution h into (1)

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

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

$$660r = 2(1650)$$

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

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

$$h = \frac{1650}{\frac{22}{7} \times 5^2} = 21 \text{ cm}$$

Hence, the radius and the height of the cylinder are 5 cm and 21 cm, respectively.

Q12. 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.

Soln:

Here,

r_1 = Radius of cylinder 1

h_1 = Height of cylinder 1

r_2 = Radius of cylinder 2

h_2 = Height of cylinder 2

V_1 = Volume of cylinder 1

V_2 = Volume of cylinder 2

Ratio of the radii of two cylinders = 2:3

Ratio of the heights of two cylinders = 5:3

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

$$V_1 / V_2 = (\pi r_1^2 h_1) / (\pi r_2^2 h_2)$$

$$= (\pi (2r)^2 5h) / (\pi (3r)^2 3h)$$

$$= (\pi 4r^2 5h) / (\pi 9r^2 3h)$$

$$= 20 / 27$$

Hence, the ratio of their volumes is 20:27

Q13. 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 cm².

Soln:

Let r cm be the radius and h cm be the length of the cylinder. The curved surface area and the total surface area is 1:2.

The total surface area is 616 cm².

The curved surface area is the half of 616 cm², i.e. 308 cm².

$$\text{Curved area} = 2\pi rh$$

$$\text{So, } h = \frac{308}{2\pi r}$$

Total surface area = Curved surface area + Top and bottom area

$$\text{Top and bottom area} = 616 - 308 = 308 \text{ cm}^2 = 2\pi r^2$$

$$r^2 = \frac{308}{2 \times \frac{22}{7}}$$

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

$$h = \frac{308}{2\pi \times 7} = 7 \text{ cm}$$

Then, the volume of the cylinder can be calculated as follows:

$$V = \frac{22}{7} \times 7^2 \times 7 = 1078 = 1078$$

Hence, it is obtained that the volume of the cylinder is 1078 cm³.

Q14. The curved surface area of a cylinder is 1320 cm² and its base has diameter 21 cm. Find the volume of the cylinder.

Soln:

r cm = Radius of the cylinder

h cm = Height of the cylinder

The diameter of the cylinder is 21 cm. Thus, the radius is 10.5 cm.

Since the curved surface area has been known, we can calculate h by the given below:

$$\text{The curved surface area of the cylinder} = 2\pi rh$$

$$1320 \text{ cm}^2 = 2\pi rh$$

$$1320 \text{ cm}^2 = \frac{2 \times 22}{7} \times (10.5 \text{ cm}) \times h$$

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

$$\therefore \text{volume of the cylinder (V)} = \pi r^2 h$$

$$V = \frac{22}{7} (10.5 \text{ cm})^2 (20 \text{ cm})$$

$$V = 6930 \text{ cm}^3$$

Q15. 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 cm³.

Soln:

Let r cm be the radius and h cm be the height of the cylinder. It is given that the ratio of r and h is 2:3,

$$\text{So } h = 1.5r$$

The volume of the cylinder (V) is 1617 cm³

So, we can find the radius and the height of the cylinder from the equation given below:

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

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

$$1617 = \pi r^2 (1.5r)$$

$$r^3 = 343$$

$$r = 7 \text{ cm and } h = 10.5 \text{ cm}$$

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

Hence, the total surface area of the cylinder is 770 cm².

Q16. The curved surface area of a cylindrical pillar is 264 m³ and its volume is 924 m³. Find the diameter and the height of the pillar.

Soln:

Here, r = radius of the cylinder

h = height of the cylinder

$$\text{Curved surface area of the cylinder} = 2\pi r h \dots\dots(1)$$

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

$$924 = \pi r^2 h$$

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

Then, substitute h into equation (1)

$$264 = 2\pi r h$$

$$264 = 2\pi r \left(\frac{924}{\pi r^2} \right)$$

$$r = 7 \text{ m, so } d = 14 \text{ m}$$

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

$$h = \frac{924}{\frac{22}{7} \times 7^2} = 6 \text{ m}$$

Hence, the diameter and the height of the cylinder are 14 m and 6 m, respectively.

Q17. Two circular cylinders of equal volumes have their heights in the ratio 1 : 2. Find the ratio of their radii.

Sol:

Here, V₁ = Volume of cylinder 1

V₂ = Volume of cylinder 2

r₁ = Radius of cylinder 1

r₂ = Radius of cylinder 2

h₁ = Height of cylinder 1 h₂

h₂ = Height of cylinder 2

Volumes of cylinder 1 and 2 are equal.

Height of cylinder 1 is half the height of cylinder 2

$$\therefore V_{\{1\}} = V_{\{2\}}$$

$$(\pi r_1^2 h_1) = (\pi r_2^2 h_2) \quad (\pi r_1^2 h) = (\pi r_2^2 2h) \quad \frac{r_1^2}{r_2^2} = \frac{2}{1} \quad \frac{r_1}{r_2} = \sqrt{\frac{2}{1}}$$

Thus, the ratio of their radii is $\sqrt{2} : 1$

Q18. The height of a right circular cylinder is 10.5 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.

Soln:

It is known that three times the sum of the two circular faces, of the right circular cylinder, is twice the area of the curved surface.

Hence, it can be written using the following formula:

$$\begin{aligned} 3(2\pi r^2) + 2(2\pi r h) &= 2(2\pi r h) \\ 3\pi r^2 + 2\pi r h &= 2\pi r h \\ 3r &= 2h \end{aligned}$$

It is known that the height of the cylinder (h) is 10.5 m

Substituting this number in the equation:

$$3r = 2(10.5)$$

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

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

$$= \frac{22}{7}(7)^2(10.5)$$

$$= 1617 \text{ m}^3$$

Thus, the volume of the cylinder is 1617 m^3 .

Q19. How many cubic meters of earth must be dug-out to sink a well 21 m deep and 6 m diameter?

Soln:

The volume of the earth that must be dug out is similar to the volume of the cylinder which is equal to $\pi r^2 h$.

Height of the well = 21 m

Diameter of the well 6 m

$$\therefore \text{Volume of the earth that must be dug out} = (\pi(3^2)(21)) \text{ m}^3 = 594 \text{ m}^3$$

Q20. 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

Soln:

$$\text{Circumference of the tree} = 176 \text{ cm} = 2\pi r$$

$$\text{Length of the trunk, } h = 3 \text{ m} = 300 \text{ cm}$$

So, the radius (r) can be calculated by:

$$r = \frac{176}{2 \times \frac{22}{7}} = 28 \text{ cm}$$

Thus, the volume (V) of the timber can be calculated using the following formula:

$$V = \Pi r^2(h) = \frac{22}{7}(28)^2(300)\text{cm}^2 = 739200\text{cm}^3 = 0.74\text{m}^3$$

Q21. 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?

Soln:

$$\text{Height of the well} = h = 20 \text{ m}$$

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

$$\text{Radius of the well} = r = 3.5 \text{ m}$$

$$\text{Volume of the well} = \Pi r^2 h = \frac{22}{7}(3.5)^2(20)\text{m}^3 = 770\text{m}^3$$

Volume of the well = volume of the rectangular plot

$$\text{Length of the rectangle plot} = 22 \text{ m}$$

$$\text{Breadth of the rectangular plot} = 14 \text{ m}$$

$$\text{Volume of the rectangular plot} = 770 \text{ m}^3 = (\text{Length} \times \text{Breadth} \times \text{Height}) \text{ of the rectangle plot}$$

$$\text{Height} = \frac{770}{22 \times 14} = 2.5 \text{ m}$$

Thus, the height of the platform is 2.5 m

Q22. 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.

Soln:

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

Height of the well = 8 m

Radius of the well = $r = 7$ m

$$\text{Volume of the well} = \pi r^2 h = \pi (7\text{m})^2 (8\text{m}) = 1232\text{m}^3$$

Volume of the well = volume of the embankment

An embankment is a hollow cylinder with thickness. Its inner radius would be equal to be the radius of the well, i.e. $r = 7$ m, and its outer radius is $R = 7 + 21 = 28$ m

$$\text{Volume of the embankment} = \pi h (R^2 - r^2)$$

To find the height of the well (h), we use the fact that the volume of the well is equal to the volume of the embankment.

$$1232 = \pi h ((28)^2 - (7)^2)$$

$$h = \frac{1232}{\frac{22}{7} \times [(28)^2 - (7)^2]} = 0.533 \text{ m}$$

Hence, the height of the embankment is 0.533 m or 53.3 cm

Q23. A cylindrical container with the diameter of base 56 cm contains sufficient water to submerge a rectangular solid of iron with dimension 32 cm x 22 cm x 14 cm. Find the rise in the level of the water when the solid is completely submerged.

Soln:

Diameter of the cylinder container = $d = 56$ cm

Radius of the cylindrical container = $r = 28$ cm

Volume of cylindrical container = volume of the rectangle solid

Length of the rectangle solid = 32 cm

Breadth of the rectangle solid = 22 cm

Height of the rectangle solid = 14 cm

Volume of the rectangle solid = Length x Breadth x Height = 32 cm x 22 cm x 14 cm = 9856 cm³

Volume of the cylindrical container = 9856 cm³ = $\pi r^2 h$

$$9856 \text{ cm}^3 = \frac{22}{7} (28\text{cm})^2 h$$

$h = 4$ cm

Thus, when the solid is completely submerged, the water will rise up to 4 cm.

Q24. A rectangle sheet of paper 30 cm x 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.

Soln:

Case 1:

Height = $h = 30$ cm

Diameter = $d = 18$ cm

Radius = $r = 9$ cm

$$\therefore \text{Volume} = (\pi r^2 h) \text{ or } (\pi (9)^2 (30)) = 2430\pi \text{cm}^3$$

Case 2:

Height = $h = 18$ cm

Diameter = $d = 30$ cm

Radius = $r = 15$ cm

$$\therefore \text{Volume} = (\pi r^2 h) \text{ or } (\pi (15)^2 (18)) = 4050\pi \text{cm}^3$$

Hence, the ratio of the volumes of the volumes of the two cylinders formed is 3: 5

Q25. 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?

Soln:

Length of the water on a roof = 18 m

Breadth of the water on a roof = 16.5 m

Height of the water on a roof = 10 cm = 0.1 m

Volume of the water on a roof = Length x Breadth x Height = 18 m x 16.5 m x 0.1 m = 29.7 m³

Since water is to be stored in the cylindrical tank, the volume of water on a roof is equal to the volume of a cylindrical tank.

Volume of cylindrical tank = $\Pi r^2 h = 29.7 \text{ m}^3$

$$h = \frac{1232}{\frac{22}{7} \times (4)^2} = 0.5906 \text{ m} = 59.06 \text{ cm}$$

Thus, the rise of water level in the tank is 59.06 cm.

Q26. 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?

Soln:

Diameter of the ductile metal = 1 cm

Radius of the ductile metal = 0.5 cm

Volume of the ductile metal = $\Pi r^2 (\text{length}) = \Pi (0.5 \text{ cm})^2 (5 \text{ cm}) = 1.25 \Pi \text{ cm}^3$

Ductile metal is drawn into a wire of diameter 1 mm

Radius of the wire = 0.5 mm = 0.05 cm

$$\text{Length of wire} = \frac{1.25 \Pi \text{ cm}^3}{\Pi (0.05 \text{ cm})^2} = 500 \text{ cm} = 5 \text{ m}$$

Thus, the length of wire is 5 m.

Q27. Find the length of 13.2 kg of copper wire of diameter 4 mm, when 1 cubic cm of copper weighs 8.4 gm.

Soln:

Density of copper = Weight/ Volume = 8.4 gram/ 1 cm³

Volume = Weight/ Density = 13.2 kg x 1000 gram/kg / 8.4 grams/cm³ = 1571.43 cm³

$$L = \frac{V}{\Pi r^2} = \frac{1571.43 \text{ cm}^3}{\frac{22}{7} \times (0.2 \text{ cm})^2} = 123500.01 \text{ cm} = 125 \text{ m}$$

Thus, length of 13.2 kg of copper is 125 m.

Q28. 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.

Soln:

Diameter of the cylindrical wire = 0.25 cm

Radius of the cylindrical wire = 0.125 cm

Volume of the brass = 2.2 dm³ = 2200 cm³

Volume of the brass = Volume of the cylindrical wire

$$\text{Length of the wire} = \frac{2200 \text{ cm}^3}{\frac{22}{7} \times (0.125 \text{ cm})^2} = 44800 \text{ cm} = 488 \text{ m}$$

Q29. 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.

Soln:

r = Inner radii of the tube

R = Outer radii of the tube

h = length of the tube

$$2\pi h(R - r) = 88 \dots\dots\dots (1)$$

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

Substituting h = 14 cm in equation (1) and (2):

$$\pi(R - r) = \frac{88}{28} \dots\dots\dots (a)$$

$$\pi(R - r)(R + r) = \frac{176}{14} \dots\dots\dots (b)$$

Simplifying the second equation by substituting it with the first equation:

$$R + r = 4 \text{ cm or } R = (4 - r) \text{ cm}$$

Re- substituting $R = 4 - r$ into equation (1):

$$\frac{22}{7}(4 - r - r) = \frac{88}{28}$$
$$4 - 2r = 1$$

$$R = 4 - 1.5 = 2.5 \text{ cm}$$

Hence, the inner and outer radii of the tube are 1.5 and 2.5 cm, respectively

Q30. Water flows out through a circular pipe whose internal diameter is 2 cm, at the rate of 6 meters 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?

Soln:

Radius of the circular pipe = 0.01 m

Length of the water column in 1 sec = 6 m

$$\text{Volume of the water flowing in 1 s} = \pi r^2 h = \pi(0.01)^2(6)\text{m}^3$$

$$\text{Volume of the water flowing in 30 mins} = \pi(0.01)^2(6) \times 30 \times 60 \text{m}^3$$

Let h m be the rise in the level of water in the cylindrical tank.

$$\text{Volume of the cylindrical tank in which water is being flown} = \pi(0.6)^2 \times h$$

Volume of water flowing in 30 mins = Volume of the cylindrical tank in which water is being flown

$$\pi(0.01)^2(6) \times 30 \times 60 = \pi(0.6)^2 \times h \quad h = \frac{6(0.01)^2 \times 30 \times 60}{0.6 \times 0.6}$$
$$h = 3 \text{ m}$$

Q31. 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.

Soln:

Here, r = inner radius = 5.2 cm

R = outer radius

t = thickness = 0.8 cm

h = length = 25 cm

$$R = r + t = 5.2 \text{ cm} + 0.8 \text{ cm} = 6 \text{ cm}$$

$$\text{Volume of the metal} = \pi h(R^2 - r^2)$$

$$\frac{22}{7} \times (25) \times ((6)^2 - (5.2)^2) = 704 \text{ cm}^3$$

Thus, the volume of the metal is 704 cm³

Q32. From a tap of inner radius 0.75 cm, water flows at the rate of 7 m per second. Find the volume in liters of water delivered by the pipe in one hour.

Soln:

Radius of the water tap = 0.75 cm = 0.0075 m

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

$$\text{Volume of water flowing in 1s} = \pi(0.0075)^2 \times 700$$

$$\text{Volume of the water flowing in 1 hour} = \pi(0.0075)^2 \times 700 \times 60 \times 60$$

$$\text{Volume of the water flowing in 1 hour} = \frac{22}{7} \times (0.0075)^2 \times 7 \times 60 \times 60 = 4.455\text{m}^3 = 4455\text{l}$$

$$(1000\text{l} = 1\text{m}^3)$$

Q33. 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 meters per second. In how much time the tank will be filled?

Soln:

$$\text{Radius of the cylindrical tank} = 0.7\text{ m}$$

$$\text{Height of the cylindrical tank} = 2.1\text{ m}$$

$$\text{Volume of the cylindrical tank} = \pi(0.7)^2(2.1)\text{m}^3$$

$$\text{Length of the water column flown from the pipe in 1 s} = 2\text{ m}$$

Let the time taken to completely fill the water tank be x sec.

$$\text{Length of the water column flown from the pipe in } x \text{ sec} = 2x\text{ m}$$

$$\text{Radius of the pipe} = 1.75\text{cm} = 0.0175\text{ m}$$

$$\text{Volume of the water column flown from the pipe in } x \text{ sec} = \pi(0.0175)^2(2x)\text{m}^3$$

$$\text{Volume of the cylindrical tank} = \text{volume of the water column flown from the pipe } \pi(0.7)^2(2.1) = \pi(0.0175)^2(2x)$$

$$x = \frac{(0.7)^2(2.1)}{(0.0175)^2(2)} = 1680\text{sec} = 28\text{min}$$

Thus, the time required to fill the water tank is 28 min.

Q34. A rectangular sheet of paper 30 cm x 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.

Soln:

Let h cm be the length of the paper and r cm be the radius of the paper.

We know that the rectangular sheet of paper 30 cm x 18 cm can be transformed into two types of cylinder.

Type 1:

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

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

$$\text{Volume} = (\pi r^2 h) = (\pi(9\text{cm})^2(30\text{cm})) = 2430\pi\text{cm}^3$$

Type 2:

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

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

$$\text{Volume} = (\pi r^2 h) \text{ or } (\pi(15\text{cm})^2(18\text{cm})) = 4050\pi\text{cm}^3$$

Hence, the ratio of the volumes of the two cylinders formed is 3 : 5

Q35. How many liters of water flow out of a pipe having an area of the cross-section of 5 cm² in one minute, if the speed of water in the pipe is 30 cm/sec?

Soln:

We know:

$$\text{Area of cross section} = 5\text{ cm}^2$$

$$\text{Rate} = 30\text{ cm/s and}$$

$$\text{Time} = 1\text{ min}$$

So, the volume of water flow is:

$$\text{Volume} = \text{volumetric rate} \times \text{Time} = (30\text{ cm/s})(5\text{ cm}^2)(60\text{ s/min}) = 9000\text{ cm}^3 = 9\text{ litres}$$

Thus, 9 litres of water flows out of the pipe

Q36. A solid cylinder has a total surface area of 231 cm². Its curved surface area is 3/4 of the total surface area. Find the volume of the cylinder.

Soln:

We know that the total surface area of the cylinder is 231 cm² and the curved surface area of the cylinder is 3/4 of the total surface area.

So, the curved surface area is:

$$\frac{3}{4} \times (231 \text{ cm}^2) = 154 \text{ cm}^2$$

Then, the radius of the cylinder can be calculated in the following manner:

$$\text{Curved surface area} = 2\pi rh$$

$$154 \text{ cm}^2 = 2\pi rh \dots \dots \dots (1)$$

Here, r cm is the radius of the cylinder and h cm is the length of the cylinder

$$2\pi r^2 = (231 - 154) \text{ cm}^2 = 77 \text{ cm}^2$$

$$77 \text{ cm}^2 = 2\pi r^2$$

From here, the radius (r) can be calculated in the following manner:

$$r = \sqrt{\frac{77}{2 \times \frac{22}{7}}}$$

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

Substituting this result into equation (1)

$$154 \text{ cm}^2 = 2\pi(3.5 \text{ cm})h$$

$$h = h = \frac{154}{2 \times \frac{22}{7} \times (3.5 \text{ cm})}$$

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

$$\therefore V = \pi r^2 h = \frac{22}{7} \times (3.5 \text{ cm})^2 \times (7 \text{ cm}) = 269.5 \text{ cm}^3$$

Hence the volume of the cylinder is 269.5 cm³

Q37. Find the cost of sinking a tubewell 280 m deep, having diameter 3 m at the rate of Rs 3.60 per cubic meter. Find also the cost of cementing its inner curved surface at Rs 2.50 per square meter.

Soln:

Cost of sinking a tube well = volume of the tube well x cost of sinking a tube well per cubic metre

$$= \frac{22}{7} \times (1.5)^2 \times (280) \times \text{Rs}3.6/\text{m}^3 = \text{Rs } 7128$$

Cost of cementing = Inner surface area of the tube well x Cost of cementing per square meter

$$= 2 \times \frac{22}{7} \times 1.5 \times (280) \times \text{Rs}2.5/\text{m}^2 = \text{Rs } 6600$$

Q38. Find the length of 13.2 kg of copper wire of diameter 4 mm, when 1 cubic cm of copper weighs 8.4 gm.

Soln:

Since we know the weight and the volume of copper, we can calculate its density.

$$\text{Density of copper} = \frac{\text{weight}}{\text{volume}} = \frac{8.4 \text{ gram}}{1 \text{ cm}^3} = 8.4 \frac{\text{gram}}{\text{cm}^3}$$

If the weight of copper wire is 13.2 kg and the density of copper is 8.4 g/cm³, then:

$$\text{Volume} = \text{weight} / \text{density} = 13.2 \text{ kg and the density of copper is } 8.4 \text{ g/cm}^3 = 1571.43 \text{ cm}^3$$

The radius of copper wire is 2 mm or 0.2 cm. So, the length of the wire can be determined in the following way:

$$L = \frac{V}{\pi r^2} = \frac{1571.43 \text{ m}^3}{\pi(0.2 \text{ cm})^2} = 125050.01 \text{ cm} = 125 \text{ m}$$

Thus, the length of 13.2 kg of copper is 125 m.

Q39. 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.

Soln:

Let r cm be the radius of the wire and h cm be the height of the wire.

Volume of brass = Volume of the wire

We know that the volume of brass = $2.2 \text{ dm}^3 = 2200 \text{ cm}^3$

Volume of the wire = $\pi r^2 h = (0.125 \text{ cm})^2 (h)$

$$h = \frac{2200 \text{ cm}^3}{\pi (0.125 \text{ cm})^2} = 44800 \text{ cm} = 448 \text{ m}$$

Thus, length of the wire is 448 m.

Q40. 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.

Soln:

Let r be the radius and d be the depth of the well that is dug.

$$\text{Volume of the well} = \pi r^2 d = \pi (5 \text{ m})^2 (8.4 \text{ m}) = 660 \text{ m}^3$$

An embankment has the shape of hollow cylinder with thickness. Its inner radii is equal to the well's radii, i.e. $r = 5 \text{ m}$, and its outer radii is $R = (5 + 7.5) = 12.5 \text{ cm}$

$$\text{Then, the volume of the embankment} = \pi h (R^2 - r^2)$$

Volume of the well = volume of the embankment

$$659.73 \text{ m}^3 = \pi h [(12.5 \text{ m})^2 - (5 \text{ m})^2] h = \frac{660 \text{ cm}^3}{\frac{22}{7} \times [(12.5 \text{ m})^2 - (5 \text{ m})^2]} = 1.6 \text{ m}$$

Hence, the height of the embankment is 1.6 m

Q41. 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.

Soln:

Here, R = outer radius

r = inner radius

t = thickness = 4 cm

w = width = 63 cm

$$\text{Girth} = 440 \text{ cm} = 2\pi R$$

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

$$r = R - t = 70 \text{ cm} - 4 \text{ cm} = 66 \text{ cm}$$

$$\text{Volume of the iron} = \pi (R^2 - r^2) w = \frac{22}{7} (70^2 - 66^2) - (63) = 107712 \text{ cm}^3$$

Hence, volume of the iron is 107712 cm^3 .

Q42. 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?

Soln:

Here, r = Internal radius

R = External radius = 10 cm

h = Length of the cylinder

t = Thickness = 0.25 cm

$$\text{Volume of the hollow cylinder} = \pi h (R^2 - r^2) = \pi (16) (10^2 - (10 - 0.25)^2) = 79\pi \text{ cm}^3$$

Volume of the solid cylinder = Volume of the hollow cylinder

We know that the radius of the solid cylinder is 1 cm.

$$\therefore \pi (1^2) h = 79\pi$$

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

Hence, length of the solid cylinder that gives the same volume as the hollow cylinder is 79 cm.

Q43. In the middle of a rectangular field measuring 30m x 20m, a well of 7 m diameter and 10 m of depth is dug. The earth so removed is evenly spread over the remaining part the field. Find the height through which the level of the field is raised.

Soln:

Let r be the radius and h be the depth of the well that is dug.

$$\text{Volume of the well} = \pi r^2 h = \frac{22}{7} \times (3.5\text{m})^2 \times (10\text{m}) = 385\text{m}^3$$

$$\text{Area of the embankment field} = 30 \times 20 - \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{1123}{2}\text{m}^2$$

Volume of the well = Area of the spread out x height of the rectangular field

$$\text{Volume of the rectangular field} = 385 \text{ m}^3 = \frac{1123}{2} \times \text{height}$$

$$\text{Height} = \frac{385\text{m}^3 \times 2}{1123\text{m}^2} = 0.6856\text{m} = 68.56\text{cm}$$

Hence, the height through which the level of the field is raised is 68.56 cm.