Chapter 19: Surface Area and Volume of a Right Circular Cylinder

Exercise 19.1

1.) Curved surface area of a right circular cylinder is $4.4\ m^2$. If the radius of the base of the cylinder is 0.7 m. find its height.

→ Here, given that

The Curved surface area of a right circular cylinder $= 4.4\ m^2$

Radius of the base of the cylinder $= 0.7\ m$

Let us consider 'h' is the heigh of a right circular cylinder.

But we know that,

Curved surface area of a cylinder $= 2\pi rh$

$\Rightarrow 4.4 = 2 \times 3.14 \times 0.7 \times h$

$\boxed{h = 1\ m}$

Thus, the height of given right circular cylinder is found to be 1m.

2.) In a hot water heating system, there is a cylindrical pipe of length 28 m and diameter 5cm. Find the total radiating surface in the system.

→ Here, given that

Length of the cylindrical pipe = Height of the Cylinder $= h = 28\ m = 2800\ cm$

Diameter of the circular end of the cylindrical pipe $= 5\ cm$

Then, Radius of the circular end of the pipe $= \frac{5}{2} = 2.5$ cm

But, we have

Curved surface area of cylindrical pipe $= 2\pi rh$

$= 2 \times 3.14 \times \frac{5}{2} \times 2800$

$= 44000 \text{ cm}^2$

Thus, the area of the radiating surface is found to be 44000 cm^2.

3) A cylindrical pillar is 50cm in diameter & 3.5m in height. find the cost of painting the curved surface of the pillar at the rate of rs. 12.50 per m^2.

→ Here given that,

The diameter of cylindrical pillar = 50 cm

Then, Radius of cylindrical Pillar $= \frac{50}{2} = 25$ cm

Height of the cylindrical Pillar $= h = 3.5$m

The curved surface area of cylindrical pillar $= 2\pi rh$

$= 2 \times 3.14 \times 0.25 \times 3.5$

$= 5.5 \text{ m}^2$

Thus, the total curved surface area of cylindrical pillar is found to be 5.5 m^2.

The cost of painting curved surface of the pillar is Rs. 12.50 per m^2.

Then total cost required for painting the total curved surface area of 5.5 m^2 $= 5.5 \times 12.50$

$= 68.75$

Hence, the total cost of painting cylindrical pillar is Rs. 68.75

4.) It is required to make a closed cylindrical tank of height 1m & the base diameter of 140cm from a metal sheet. How many square meters of the sheet are required for the same?

→ Given that, The height of closed cylindrical tank $\} = h = 1m$

Base diameter of cylindrical tank = 140cm

Then, Radius of base of cylindrical tank $= \frac{140}{2} = 70cm$
$= 0.7m$

Now,
The area of sheet required to make the cylindrical tank is nothing but the total surface area of tank.

Total surface area of tank $= 2\pi r(h+r)$
$= 2 \times 3.14 \times 0.7 (1+0.7)$
$= 7.48\ m^2$

Thus, $7.48\ m^2$ metal sheet is needed to make the required cylindrical tank.

5.) A solid cylinder has a total surface area of $462\ cm^2$. Its curved surface area is one-third of its total surface area. Find the radius & height of the cylinder.

→ Here, given that
The total surface area of solid cylinder $= 462\ cm^2$
And given that,
Curved surface area of solid cylinder $\} = \frac{1}{3}$ (Total surface area of solid cylinder)

$\Rightarrow 2\pi rh = \frac{1}{3}(462)$

$2\pi rh = 154$

$\boxed{h = 49/2r}$

Again, Total surface area of Solid Cylinder $\} = 2\pi r(h+r)$

$$2\pi r(h+r) = 462$$

$$2\pi r\left(\frac{49}{2r} + r\right) = 462$$

$$49 + 2r^2 = 147$$

$$2r^2 = 98$$

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

$$\Rightarrow h = \frac{49}{2r} = \frac{49}{2(7)} = \frac{7}{2} = 3.5 \text{ cm}$$

Thus, the height of required solid cylinder = 3.5 cm
The radius of required solid cylinder = 7 cm

7) Find the ratio between the total surface area of a cylinder to its curved surface area, given that height & radius of the tank are 7.5 m & 3.5 m.

→ Given that,
Height of the cylinder = 7.5 m = (h)
Radius of the cylinder = 3.5 m = (r)

We know that,
Total surface area of cylinder = $2\pi r(h+r)$
Curved surface area of cylinder = $2\pi rh$

Then, $\frac{\text{TSA of cylinder}}{\text{CSA of cylinder}} = \frac{2\pi r(h+r)}{2\pi rh}$

$$= \frac{(h+r)}{h}$$

$$= 1 + \frac{r}{h}$$

$$= 1 + \frac{3.5}{7.5}$$

$$= \frac{22}{15}$$

$$\boxed{\text{TSA} : \text{CSA} = 22 : 15}$$

Thus, the ratio between total surface area of a cylinder to its curved surface area is found to be 22 : 15.

Exercise 19.2

1.) A soft drink is available in two packs.
i) a tin can with a rectangular base of length 5cm & width 4cm, having a height of 15 cm and
ii) a plastic cylinder with circular base of diameter 7cm and height 10 cm, which container has greater capacity & by how much?

→ (i) Given that,

Length of can (l) = 5cm
Breadth of can (b) = 4cm
Height of can (h) = 15cm

Then, Capacity of can = Volume of tin can = $l \times b \times h$

$= 5 \times 4 \times 15$

$\boxed{\text{Capacity of can} = 300\ cm^3}$ ——①

(ii) Given that,

Base diameter of cylinder = 7cm
⇒ Radius of base of cylinder = $r = 3.5$ cm
Height of cylinder (h) = 10 cm

Then, Capacity of cylinder = Volume of cylinder

$= \pi r^2 h$

$= \frac{22}{7}(3.5)^2 \times 10$

$\boxed{\text{Capacity of cylinder} = 385\ cm^3}$ ——②

Now, from ① & ② we can say that, the capacity of cylinder is greater than capacity of can.

Hence, the difference in capacity = $(385 - 300) = 85\ cm^3$

2) The pillars of a temple are cylindrically shaped. If each pillar has a circular base of radius 20cm and height 10m. How much concrete mixture would be required to build 14 such pillars?

→ Here, given that

The pillars of a temple are cylindrically shaped.

The base radius of circular base of a pillar } = $r = 20cm$

Height of pillar $(h) = 10m = 1000cm$

Then, the concrete mixture required to build such pillars is nothing but the volume of the cylindrical pillar.

⇒ Volume of pillar $= \pi r^2 h$

$= (22/7)(20)^2(1000)$

$$\boxed{\text{Volume of pillar} = 8.87\ m^3}$$

Thus, to make one pillar amount of concrete needed is $8.87\ m^3$.

Now, to make such 14 pillars, the amount of concrete needed is $= 14 \times 8.87$

$= 17.6\ m^3$

3) The inner diameter of a cylindrical wooden pipe is 24cm & its outer diameter is 28 cm. The length of the pipe is 35cm. Find the mass of the pipe, if $1cm^3$ of wood has mass of 0.6gm.

→ Let us consider R_1 is the inner radius of cylindrical wooden pipe & R_2 is the outer radius.

From given condition,

$R_1 = \frac{24}{2} = 12cm$ & $R_2 = \frac{28}{2} = 14cm$

Length of pipe $(l) = 35cm$

We know that, Voume $= \frac{\text{Mass}}{\text{density}}$

Then, mass of pipe = volume x density

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

$= \frac{22}{7}(14^2 - 12^2)35$

Mass of pipe = 5720 cm^3

Given that, mass of 1 cm^3 of wood = 0.6 gm

Then, total mass of pipe of 5720 cm^3 = 5720 X 0.6

= 3432 gm

= 3.432 kg.

4.) If the lateral surface of a cylinder is 94.2 cm^2 and its height is 5cm, find i) Radius of its base

ii) Volume of the cylinder

($\pi = 3.141$)

→ Here, given that

Lateral surface area of cylinder = 94.2 cm^2

Height of cylinder (h) = 5 cm

Let us consider, 'r' is the base radius of cylinder.

Then, (i) Lateral surface area of cylinder = $2\pi rh$

$94.2 = 2 \times 3.14 \times r \times 5$

r = 3cm

Radius of base of cylinder is found to be 3cm.

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

$= 3.14 \times 3^2 \times 5$

$= 141.3\ cm^3$

Thus, the volume of the cylinder is found to be 141.3 cm^3.

5.) The capacity of a closed cylindrical vessel of height 1m is 15.4 liters. How many square meters of the metal sheet would be needed to make it?

→

Here, given that

The capacity of cylinder = Volume of cylinder = 15.4 liters
= 0.0154 m

Height of cylinder (h) = 1m

Let 'r' be the radius of cylindrical vessle,

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

$0.0154 = 3.14 \times r^2 \times 1$

$\boxed{r = 0.07m}$

Again

Total surface area of vessel = $2\pi r(r+h)$

$= 2 \times 3.14 \times (0.07) \times (0.07+1)$

$= 0.470 m^2$

Thus, the metal sheet needed to make the cylinderical vessel is found to be $0.470 m^2$.

6.) A patient in a hospital is given soup daily in a cylindrical bowl of diameter 7cm. If the bowl is filled with soup to a height of 4cm, how much soup the hospital has to prepare daily to serve 250 patients?

→ Given that,

Diameter of cylindrical bowl = 7cm

Then, Radius of cylindrical bowl = $r = 3.5$ cm

Height of the soup filled in a bowl $\Big\}$ = $h = 4$cm

Then, Volume of bowl = $\pi r^2 h$

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

$= 154 cm^3$

Then, the volume of soup in 250 bowls = 250×154

$= 38500 cm^3$

$= 38.5$ liters

Thus, hospital has to prepare daily 38.5 liters of soup to serve 250 patients.

7) A hollow garden roller, 63cm wide with a girth of 440cm, is made of 4cm thick iron. find the volume of the iron.

→ Here, given that

Thickness of roller = 4cm

Height of roller (h) = 63cm

The circumference of outer part of roller = 440cm

Let us consider, R_1 is the outer radius and

R_2 is the inner radius of roller.

Then, Circumference $= 2\pi R_1$

$$440 = 2 \times \frac{22}{7} \times R_1$$

$$\boxed{R_1 = 70\,cm}$$

Inner Radius $(R_2) = R_1 - 4$

$$R_2 = 70 - 4$$

$$\boxed{R_2 = 66\,cm}$$

Then, Volume of the iron $= \pi (R_1^2 - R_2^2) h$

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

$$= 107712\,cm^3$$

Thus, the requred volume of the iron is $107712\,cm^3$.

9) The cost of painting the total outside surface of a closed cylindrical oil tank at 50 paise per square decimeters is Rs. 198. The height of the tank is 6 times the radius of the base of the tank. find the volume of the corrected to 2 decimal places.

→ Here, given that

Height of cylindrical tank = 6 (Radius of base tank)

$$\boxed{h = 6r}$$

Let 'r' be the radius of base of tank.

The cost of painting per square decimeter is Rs. 198.

Also,

$\Rightarrow 2\pi r(r+h) \times \frac{1}{2} = 198$

$2\left(\frac{22}{7}\right)(r)(r+(r) \times \frac{1}{2} = 198$

$\boxed{r = 3\,dm}$

$h = 6r = 6 \times 3 = 18\,dm$

Now, Volume of cylindrical tank $= \pi r^2 h$

$= \frac{22}{7}(9)(18)$

$= 509.14\,dm^3$.

Thus, the volume of the cylindrical tank is found to be $509.14\,dm^3$.

10.) 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 & the ratio of their curved surfaces.

→ Given that,

The radii of two cylinders are in the ratio 2:3.

The heights of two cylinders are in the ratio 5:3.

Then, $2x$ and $3x$ be radii of two cylinders respectively and $5x$ & $3x$ be the radii of two cylinders respectively.

Now, $\frac{(\text{Volume of cylinder 1})}{(\text{Volume of cylinder 2})} = \frac{\pi(2x)^2 5y}{\pi(3x)^2 3y} = \frac{20}{27}$

And $\frac{(\text{Surface area of cylinder 1})}{(\text{surface area of cylinder 2})} = \frac{2\pi(2x)5y}{2\pi(3x)3y} = \frac{10}{9}$

11.) The ratio between the curved surface area & the total surface area of right circular cylinder is 1:2. find the volume of the cylinder, if its total surface area is 616 cm^2.

→ Here, given that

Total surface area of RCC = 616 cm^2

Let 'h' be the height of cylinder and

'r' be the radius of cylinder.

From given condition,

$$\frac{\text{Curved Surface Area}}{\text{Total Surface Area}} = \frac{1}{2}$$

$$\Rightarrow \quad CSA = \tfrac{1}{2}(TSA)$$

$$CSA = \frac{1}{2}(616) = 308\ cm^2 \qquad \boxed{CSA = 308\ cm^2}$$

Now, Total Surface Area $= 2\pi rh + 2\pi r^2$

$$616 = CSA + 2\pi r^2$$

$$616 = 308 + 2\pi r^2$$

$$2\pi r^2 = 616 - 308$$

$$2\pi r^2 = 308$$

$$r^2 = 308/2\pi$$

$$r^2 = 49$$

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

Now, $CSA = 308\ cm^2$

$$2\pi rh = 308$$

$$2\left(\frac{22}{7}\right) \times 7 \times h = 308$$

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

Then, Volume of Cylinder $= \pi r^2 h$

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

$$= 1078\ cm^3$$

Thus, the volume of cylinder is found to be 1078 cm^3.

12.) The curved surface area of a cylinder is 1320 cm^3 and its base had diameter 21 cm. find the height & volume of the cylinder.

→ Here given that,

Curved surface area of a cylinder = 1320 cm^3

The base diameter of a cylinder = 21 cm

Then, base radius of a cylinder (r) = 10.5 cm

We have,

Curved surface area of a cylinder = $2\pi rh$

$$1320 = 2 \times \frac{22}{7} \times 10.5 \times h$$

$$\boxed{h = 20\,cm}$$

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

$$= \frac{22}{7} \times (10.5)^2 \times 20$$

$$= 6930$$

Thus, the volume of a cylinder is found to be 6930 cm^3.

13.) The ratio between the radius of the base & the height of a cylinder is 2:3. find the total surface area of the cylinder, if its volume is 1617 cm^3.

→ Let us first consider that

r - be the radius of base of cylinder and

h - be the height of a cylinder

Here, given that $r : h = 2 : 3$

If radius = $2x$ then height = $3x$

We know that, Volume of cylinder = $\pi r^2 h$

$$1617 = \frac{22}{7} (2x)^2 (3x)$$

$$1617 = \frac{22}{7} (12x^3)$$

$$x^3 = 343/8$$

$$x = 7/2$$

$$\boxed{x = 3.5\,cm}$$

Then, Radius of cylinder $(r) = 2x = 2(3.5) = 7cm$

Height of cylinder $(h) = 3x = 3(3.5) = 10.5cm$

But, The total surface area of a cylinder $= 2\pi r(h+r)$

$= 2\left(\frac{22}{7}\right)(7)(10.5+7)$

$= 770\ cm^2$

Thus, the total surface area of a cylinder is found to be $770\ cm^2$.

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

→ Here, given that

Length of rectangular sheet = 44cm (l)

Breadth of rectangular sheet = 20cm (b)

from given condition, we can write

$2\pi r = 44$

$r = 44/2\pi$

$\boxed{r = 7cm}$

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

$= \frac{22}{7}(7)^2(20)$

$= 3080\ cm^3$

Thus, the volume of a cylinder is found to be $3080\ cm^3$.

15) The curved surface area of cylindrical pillar is $264\ m^2$ and its volume is $924\ m^2$. find the diameter and the height of the pillar?

→

Let us consider 'r' is the radius of cylindrical pillar and 'h' is the height of cylindrical pillar.

Given that, Curved surface area of cylindrical pillar $= 264\ m^2$

Now, $2\pi rh = 264$

$\pi rh = 132$ —— (1)

But, Volume of the cylinder $= 924\ m^3$

$\pi r^2 h = 924$

$(\pi rh)\, r = 924$ by (1)

$(132)r = 924$

$r = 924/132$

$\boxed{r = 7m}$

Thus, $\pi rh = 132$

$\pi (7) h = 132$

$\boxed{h = 6m}$

Thus, diameter of the pillar $= 2r = 2(7) = 14m$

Height of the pillar $= 6m$

16.) Write the no. of surfaces of a right circular cylinder.

→ There are total 3 surfaces in a right circular cylinder

17.) Write the ratio of total surface area to the curved surface area of a cylinder of radius r & height h.

→ $\dfrac{\text{Total surface area of cylinder}}{\text{Curved surface area of cylinder}} = \dfrac{2\pi r(h+r)}{2\pi rh} = \dfrac{h+r}{h}$