RD SHARMA Solutions for Class 9 Maths Chapter 19 - Surface Areas and Volume of a Circular Cylinder

Chapter 19 - Surface Areas and Volume of a Circular Cylinder Exercise 19.28

Question 1

In a cylinder, if radius is doubled and height is halved, curved surface area will be
(a) halved
(b) doubled
(c) same
(d) four times

Solution 1

Curved surface Area of a cylinder of radius 'r' and height 'h' is given by

$A = 2\pi rh$

Now, if $r' = 2r$ and $h' = \frac{h}{2}$

then $A' = 2\pi \times (\cancel{2}r) \times \frac{h}{\cancel{2}} = 2\pi rh = A$

$\Rightarrow$ C.S.A. remains the same

Hence, correct option is (c).

Question 2

Two cylindrical jars have their diameters in the ratio 3 : 1, but height 1 : 3. Then the ratio of their volumes is
(a) 1 : 4
(b) 1 : 3
(c) 3 : 1
(d) 2 : 5

Solution 2

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

$r = \frac{d}{2}$

If $d_1 : d_2 = 3 : 1$ then, $r_1 : r_2 = 3 : 1$

$h_1 : h_2 = 1 : 3$

Now,

$$\frac{V_1}{V_2} = \frac{\pi(r_1)^2 h_1}{\pi(r_2)^2 h_2} = \left(\frac{r_1}{r_2}\right)^2 \frac{h_1}{h_2} = \left(\frac{3}{1}\right)^2\left(\frac{1}{3}\right) = \frac{3}{1} = 3 : 1$$

Hence, correct option is (c).

Question 3

The number of surfaces in right cylinder is
(a) 1
(b) 2
(c) 3
(d) 4

Solution 3

Number of Surfaces In a Right cylinder are 3.
Top surface, bottom surface and curved surface.
Hence, correct option is (c).

Question 4

Vertical cross-section of a right circular cylinder is always a
(a) square
(b) rectangle

(c) rhombus
(d) trapezium

Solution 4
Vertical cross-section of cylinder will always be a Rectangle of sides 'h', and 'r', where h is the height of a cylinder and r is the radius of a cylinder.
Hence, correct option is (b).

Question 5
If r is the radius and h is height of the cylinder the volume will be

(a) $\frac{1}{3}\pi r^2 h$

(b) $\pi r^2 h$

(c) $2\pi r(h+r)$

(d) $2\pi rh$

Solution 5
Volume of cylinder
= Area of Base × Height
= $(\prod r^2) \times h$
$V = \prod r^2 h$
Hence, correct option is (b).

Question 6
The number of surfaces of a hollow cylindrical object is
(a) 1
(b) 2
(c) 3
(d) 4

Solution 6
A Hollow cylinder has only 2 surfaces.
One is outer-curved surface and another is inner-curved surface.
Hence, correct option is (b).

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Question 7
If the radius of a cylinder is doubled and the height remains same, the volume will be
(a) doubled
(b) halved
(c) same
(d) four times

Solution 7
Volume of a cylinder = $V = \prod r^2 h$
If r' = 2r and h' = h, then
$V' = \prod (2r)^2 h = 4\prod r^2 h$
$V' = 4V$
Hence, correct option is (d).

Question 8
If the height of a cylinder is doubled and radius remains the same, then volume will be
(a) doubled
(b) halved
(c) same
(d) four times

Solution 8
Volume of cylinder $V = \prod r^2 h$
If h' = 2h and r' = r, then
$V' = \prod (r)^2 (2h) = 2\prod r^2 h = 2V$
Hence, correct option is (a).

Question 9
In a cylinder, if radius is halved and height is doubled, the volume will be

(a) same
(b) doubled
(c) halved
(d) four times

Solution 9

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

If $r' = \frac{r}{2}$ and $h' = 2h$

then $V' = \pi\left(\frac{r}{2}\right)^2 2h = \frac{\pi r^2}{\cancel{4}_2} \times \cancel{2}h = \frac{\pi r^2 h}{2} = \frac{V}{2}$

Hence, correct option is (c).

Question 10

If the diameter of the base of a closed right circular cylinder be equal to its height h, then its whole surface area is

(a) $2\pi h^2$

(b) $\frac{3}{2}\pi h^2$

(c) $\frac{4}{3}\pi h^2$

(d) πh^2

Solution 10

Diameter $= 2r = h$ (Given)

$\Rightarrow r = \frac{h}{2}$

Cylinder is closed.

$\Rightarrow$ Its surface area $= 2\pi r(h + r)$

$S = 2\pi r(h + r) = \cancel{2}\pi \frac{h}{\cancel{2}}\left(h + \frac{h}{2}\right) = \pi h\left(\frac{3}{2}h\right) = \frac{3}{2}\pi h^2$

Hence, correct option is (b).

Question 11

A right circular cylindrical tunnel of diameter 2 m and length 40 m is to be constructed from a sheet of iron. The area of the iron sheet required in m^2, is

(a) 40∏
(b) 80∏
(c) 160∏
(d) 200∏

Solution 11

Cylindrical tunnel will be hollow cylinder of radius $= 1$ m $\left\{r = \frac{d}{2} = \frac{2}{2} = 1 \text{ m}\right\}$

Length $= 40$ m

Area of iron sheet $=$ Curved Surface Area of cylinder

$= 2\pi rh$

$= 2\pi(1)40$

$= 80\pi$

Hence, correct option is (b).

Question 12

Two circular cylinders of equal volume have their heights in the ratio 1 : 2. Ratio of their radii is

(a) $1 : \sqrt{2}$

(b) $\sqrt{2} : 1$

(c) $1 : 2$

(d) $1 : 4$

Solution 12

Volume of cylinder 1, $v_1 = \pi r_1^2 h_1$

Volume of cylinder 2, $v_2 = \pi r_2^2 h_2$

$$\frac{v_1}{v_2} = \frac{r_1^2}{r_2^2}\ \frac{h_1}{h_2} \quad ....(1)$$

Now, $v_1 = v_2$ and $\frac{h_1}{h_2} = \frac{1}{2}$

Hence, equation (1) reduces to

$$1 = \frac{r_1^2}{r_2^2}\ \frac{1}{2}$$

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

$$\Rightarrow \frac{r_1^2}{r_2^2} = 2$$

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

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

Hence, correct option is (b).

Question 13

The radius of a wire is decreased to one-third. If volume remains the same, the length will become

(a) 3 times

(b) 6 times

(c) 9 times

(d) 27 times

Solution 13

Volume of wire $= \pi r^2$

If volume remains same, then

$$\pi r_1^2 l_1 = \pi r_2^2 l_2$$

If $r_2 = \frac{r_1}{3}$, then

$$\cancel{\pi} r_1^2 l_1 = \cancel{\pi}\left(\frac{r_1}{3}\right)^2 l_2$$

$$\Rightarrow l_2 = 9 l_1$$

Hence, correct option is (c).

Question 14

If the height of a cylinder is doubled, by what number must the radius of the base be multiplied so that the resulting cylinder has the same volume as the original cylinder?

(a) 4

(b) $\frac{1}{\sqrt{2}}$

(c) 2

(d) $\frac{1}{2}$

Solution 14

Volume of a cylinder $= V = \pi r^2 h$
Now, if $h' = 2h$ and new radius $= r'$, then
$V' = \pi r'^2 h' = \pi r'^2 (2h) = 2\pi r'^2 h$
Now if volume should remain same, then
$V' = V$
$\Rightarrow 2\cancel{\pi} r'^2 \cancel{h} = \cancel{\pi} r^2 \cancel{h}$
$\Rightarrow 2r'^2 = r^2$
$\Rightarrow r'^2 = \dfrac{r^2}{2}$
$\Rightarrow r' = \dfrac{r}{\sqrt{2}}$
Hence, correct option is (b).

Question 15

The volume of a cylinder of radius r is 1/4 of the volume of a rectangular box with a square base of side length x. If the cylinder and the box have equal heights, what is r in terms of x?

(a) $\dfrac{x^2}{2\pi}$
(b) $\dfrac{x}{2\sqrt{\pi}}$
(c) $\dfrac{\sqrt{2x}}{\pi}$
(d) $\dfrac{\pi}{2\sqrt{x}}$

Solution 15

Area of Base of cylinder $= \pi r^2$
Area of Base of Box (square) $= x^2$
Let the height of both objects $= h$
Then, $V_{cylinder} = \pi r^2 h$
$V_{box} = x^2 h$
Now, $V_{cylinder} = \dfrac{1}{4} V_{box}$
$\Rightarrow \pi r^2 \cancel{h} = \dfrac{1}{4} x^2 \cancel{h}$
$\Rightarrow r^2 = \dfrac{x^2}{4\pi}$
$\Rightarrow r = \dfrac{x}{2\sqrt{\pi}}$
hence, correct option is (b).

Question 16

The height h of a cylinder equals the circumference of the cylinder. In terms of h, what is the volume of the cylinder?

(a) $\dfrac{h^3}{4\pi}$
(b) $\dfrac{h^2}{2\pi}$
(c) $\dfrac{h^3}{2}$
(d) πh^3

Solution 16

Circumference of cylinder $= 2\pi r$
Height $= h$
If $h = 2\pi r$, then $r = \frac{h}{2\pi}$

$$\Rightarrow \text{Volume} = \pi r^2 h = \pi\left(\frac{h^2}{4\pi^2}\right)h = \frac{h^3}{4\pi}$$

Hence, correct option is (a).

Question 17
A cylinder with radius r and height h is closed on the top and bottom. Which of the following expressions represents the total surface area of this cylinder?
(a) $2\prod r\ (r + h)$
(b) $\prod r\ (r + 2h)$
(c) $\prod r\ (2r + h)$
(d) $2\prod r^2 + h$

Solution 17
Total surface Area = Area of Top + Area of bottom + Curved Surface Area
T.S.A. = $\prod r^2 + \prod r^2 + 2\prod rh = 2\prod r^2 + 2\prod rh = 2\prod r\ (r + h)$
Hence, correct option is (a).

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Question 18
The height of sand in a cylindrical-shaped can drops 3 inches when 1 cubic foot of sand is poured out. What is the diameter, in inches, of the cylinder?
(a) $\frac{24}{\sqrt{\pi}}$
(b) $\frac{48}{\sqrt{\pi}}$
(c) $\frac{32}{\sqrt{\pi}}$
(d) $\frac{48}{\pi}$

Solution 18

when sand is poured out, height dropped = 3 inches

Volume vacant $= \pi r^2 \times 3$ inches

Now, volume vacant = volume of sand poured out = 1 cubic foot

1 foot = 12 inches

$\Rightarrow$ 1 cubic foot $= 12 \times 12 \times 12$ inches = 1728 inches

Thus, we have

$3\pi r^2 = 1728$

$\Rightarrow \pi r^2 = 576$

$\Rightarrow r^2 = \dfrac{576}{\pi}$

$\Rightarrow r = \dfrac{24}{\sqrt{\pi}}$

$\Rightarrow \text{Diameter} = 2r = 2 \times \dfrac{24}{\sqrt{\pi}} = \dfrac{48}{\sqrt{\pi}}$

Hence, correct option is (b).

Question 19

Two steel sheets each of length a_1 and breadth a_2 are used to prepare the surfaces of two right circular cylinders - one having volume v_1 and height a_2 and other having volume v_2 and height a_1. Then,

(a) $v_1 = v_2$

(b) $a_1 v_1 = a_2 v_2$

(c) $a_2 v_1 = a_1 v_2$

(d) $\dfrac{v_1}{a_1} = \dfrac{v_2}{a_2}$

Solution 19

Surface Area of both cylinders is going to be same because same sheet is used.

$\Rightarrow$ S.A. $= a_1 a_2$

Surface area of cylinders is same

$S_1 = (2\pi r_1)a_2 = a_1 a_2$ ....(1)

$S_2 = (2\pi r_2)a_1 = a_1 a_2$ ....(2)

From equations (1) & (2)

$2\pi r_1 = a_1$ and $2\pi r_2 = a_2$

Volume of cylinder 1, $v_1 = (\pi r_1^2)\, a_2$ ....(3)

Volume of cylinder 2, $v_2 = (\pi r_2^2)\, a_1$ ....(4)

Dividing equation (3) by equation (4)

$$\frac{v_1}{v_2} = \frac{r_1^2}{r_2^2}\,\frac{a_2}{a_1} = \frac{\left(\frac{a_1}{\cancel{2\pi}}\right)^2}{\left(\frac{a_2}{\cancel{2\pi}}\right)^2}\,\frac{a_2}{a_1} = \frac{a_1^{\cancel{2}}}{a_2^{\cancel{2}}} \times \frac{\cancel{a_2^2}}{\cancel{a_1}} = \frac{a_1}{a_2}$$

$\Rightarrow a_2 v_1 = a_1 v_2$

Hence, correct option is (c).

Question 20

The altitude of a circular cylinder is increased six times and the base area is decreased one-ninth of its value. The factor by which the lateral surface of the cylinder increases, is

(a) $\frac{2}{3}$

(b) $\frac{1}{2}$

(c) $\frac{3}{2}$

(d) 2

Solution 20

If h is initial altitude, then $h' = 6h$

Initial Base Area $= \pi r^2 = B$

New Base Area $= B' = \pi r'^2$

Now, $B' = \frac{B}{9}$

$\Rightarrow \pi r'^2 = \frac{\pi r^2}{9}$

$\Rightarrow r'^2 = \frac{r^2}{9}$

$\Rightarrow r' = \frac{r}{3}$

Intial Lateral surface Area = $2\pi rh$

New Lateral Surface Area

$= 2\pi r'h'$

$= 2\pi\left(\frac{r}{3}\right)6h$

$= 2\,(2\pi rh)$

$= 2$(Initial Lateral Surface Area)

Hence, correct option is (d).

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Question 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.

Solution 1

Let the height of the cylinder be h.

Radius of the base of the cylinder = 0.7 m

CSA of cylinder = 4.4 m^2

$2\pi rh = 4.4 m^2$

$\left(2 \times \frac{22}{7} \times 0.7 \times h\right) m = 4.4\ m^2$

h = 1 m

Thus, the height of the cylinder is 1 m.

Question 2

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

Solution 2

Height (h) of cylindrical pipe = Length of cylindrical pipe = 28 m

Radius (r) of circular end of pipe = $\frac{5}{2}$ cm = 2.5 cm = 0.025 m

CSA of cylindrical pipe = $2\pi rh = \left(2\times\frac{22}{7}\times 0.025\times 28\right)m^2$ = 4.4 m^2

Thus, the area of radiating surface of the system is 4.4 m^2 or 44000 cm^2.

Question 3

A cylindrical pillar is 50 cm in diameter and 3.5 m in height. Find the cost of painting the curved surface of the pillar at the rate of Rs.12.50 per m^2.

Solution 3

Height of the pillar = 3.5 m

Radius of the circular end of the pillar = $\frac{50}{2}$ cm = 25 cm = 0.25 m

CSA of pillar = $2\pi rh$ = $\left(2\times\frac{22}{7}\times 0.25\times 3.5\right)m^2 = 5.5m^2$

Cost of painting 1 m^2 area = Rs 12.50

Cost of painting 5.5 m^2 area = Rs (5.5 $\times$ 12.50) = Rs 68.75

Thus, the cost of painting the CSA of pillar is Rs 68.75.

Question 4

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

Solution 4

Height (h) of cylindrical tank = 1 m.

Base radius (r) of cylindrical tank = $\left(\frac{140}{2}\right)$ cm = 70 cm = 0.7 m

Area of sheet required = total surface area of tank = $2\pi r\,(r + h)$

$$= \left[2\times\frac{22}{7}\times 0.7(0.7 + 1)\right]m^2$$

$$= (4.4 \times 1.7)m^2$$

$$= 7.48\ m^2$$

So, it will require 7.48 m^2 of metal sheet.

Question 5

The total surface area of a hollow cylinder which is open from both sides is 4620 sq. cm, area of base ring is 115.5 sq. cm and height 7 cm. Find the thickness of the cylinder.

Solution 5

Let the inner and outer radii of hollow cylinder be r cm and R cm respectively.

Then,

$$2\pi rh + 2\pi Rh + 2\pi R^2 - 2\pi r^2 = 4620 \qquad ---(1)$$

$$\text{And,} \quad \pi R^2 - \pi r^2 = 115.5 \qquad ---(2)$$

$$\Rightarrow 2\pi h\left(r+R\right) + 2\left(\pi R^2 - \pi r^2\right) = 4620 \text{ and, } \pi R^2 - \pi r^2 = 115.5$$

$$\Rightarrow 2\pi h\left(r+R\right) + 2 \times 115.5 = 4620 \text{ and } \pi(R^2 - r^2) = 115.5$$

$$\Rightarrow 2\pi h(R+r) + 231 = 4620 \text{ and } \pi(R^2 - r^2) = 115.5$$

$$\Rightarrow 2\pi \times 7\left(r+R\right) = 4389 \text{ and } \pi\left(R+r\right)\left(R-r\right) = 115.5$$

$$\Rightarrow \pi\left(R+r\right) = 313.5 \text{ and } \pi\left(R+r\right)\left(R-r\right) = 115.5$$

$$\Rightarrow \frac{\pi\left(R+r\right)\left(R-r\right)}{\pi\left(R+r\right)} = \frac{115.5}{313.5}$$

$$\Rightarrow R - r = \frac{7}{19} \text{ cm}$$

Question 6

Find the ratio between the total surface area of a cylinder to its curved surface area, given that its height and radius are 7.5 cm and 3.5 cm.

Solution 6

For cylinder,

Total surface area $= 2\pi r\left(h+r\right)$

Curved surface area $= 2\pi rh$

$$\therefore \frac{\text{Total surface area}}{\text{Curved surface area}} = \frac{2\pi r\left(h+r\right)}{2\pi rh} = \frac{h+r}{h}$$

$$\Rightarrow \frac{\text{Total surface area}}{\text{Curved surface area}} = \frac{7.5+3.5}{7.5} = \frac{11}{7.5}$$

$$= \frac{11 \times 10}{75} = \frac{22}{15} = 22:15$$

Question 7

A cylinderical vessel, without lid, has to be tin-coated on its both sides. If the radius of the base is 70 cm and its height is 1.4 m, calculate the cost of tin-coating at the rate of Rs 3.50 per 1000 cm^2

Solution 7

We have,

$r = 70$ cm, $h = 1.4$ m $= 140$ cm

$\therefore$ Area to be tin coated $= 2\left(2\pi rh + \pi r^2\right) = 2\pi r\left(2h + r\right)$

$$= 2 \times \frac{22}{7} \times 70\left(280 + 70\right) = 154000 \text{ cm}^2$$

Required cost $= \dfrac{154000 \times 3.50}{1000} = \text{Rs } 539$

Question 8
The inner diameter of a circular well is 3.5 m. It is 10 m deep. Find
(i) Its inner curved surface area,
(ii) The cost of plastering this curved surface at the rate of Rs 40 per m^2

Solution 8
Inner radius (r) of circular well = 1.75 m
Depth (h) of circular well = 10 m
(i) Inner curved surface area = $2\pi rh$

$$= \left(2 \times \frac{22}{7} \times 1.75 \times 10\right) m^2$$

= (44 x 0.25 x 10) m^2
= 110 m^2
(ii) Cost of plastering 1 m^2 area = Rs 40
Cost of plastering 110 m^2 area = Rs (110 x 40) = Rs 4400

Question 9
The students of a Vidyalaya were asked to participate in a competition for making and decorating penholders in the shape of a cylinder with a base, using cardboard. Each penholder was to be of radius 3 cm and height 10.5 cm. The Vidyalaya was to supply the competitors with cardboard. If there were 35 competitors, how much cardboard was required to be bought for the competition?

Solution 9
Radius of circular end of cylindrical penholder = 3 cm
Height of penholder = 10.5 cm
Surface area of 1 penholder = CSA of penholder + Area of base of
SA of 1 penholder = $2\pi rh$ + πr^2

$$= \left[2 \times \frac{22}{7} \times 3 \times 10.5 + \frac{22}{7}(3)^2\right] cm^2$$
$$= \left(132 \times 1.5 + \frac{198}{7}\right) cm^2$$
$$= \left(198 + \frac{198}{7}\right) cm^2$$
$$= \frac{1584}{7} cm^2$$

Area of cardboard sheet used by 1 competitor = $\frac{1584}{7} cm^2$

Area of cardboard sheet used by 35 competitors

$$= \left(\frac{1584}{7} \times 35\right) cm^2$$

= 7920 cm2

Thus, 7920 cm^2 of cardboard sheet will be required for the competition.

Question 10

The diameter of roller 1.5m long is 84 cm. If it takes 100 revolutions to level a playground, find the cost of levelling this ground at the rate of 50 paise per square meter.

Solution 10

Diameter of the roller = 84 cm = 0.84 m

Length of the roller = 1.5 m

Radius of the roller = $\frac{D}{2} = \frac{0.84}{2} = 0.42$ m

Area covered by the roller in one revolution= covered surface area of roller

C.S.A of roller = $2\pi rh = 2 \times \frac{22}{\cancel{7}} \times \cancel{0.42} \times 1.5$

$= 0.12 \times 22 \times 1.5 \ m^2$

Area of the playground= $100 \times$ Area covered by roller in one revolution

$= (100 \times 0.12 \times 22 \times 1.5) m^2$

$= 396 m^2$

Now,

Cost of levelling $1m^2 = 50p = \frac{50}{100}$, Re$= \frac{1}{2}$rs

cost of levelling $369m^2 = \frac{1}{2} \times 396 =$ Rs 198

Hence, Cost of levelling $396m^2$ is Rs 198

Question 11

Twenty cylindrical pillars of the Parliament House are to be cleaned. If the diameter of each pillar is 0.50 m and height is 4 m. What will be the cost of cleaning them at the rate of Rs 2.50 per square metre?

Solution 11

Diameter of each pillar = 0.50 m

Radius of each pillar = 0.25 m

Height of each pillar = 4 m

Curved surface area of each pillar = $2\pi rh$ =

$$\left(2 \times \frac{22}{7} \times 0.25 \times 4\right) \text{ m}^2 = \frac{44}{7} \text{ m}^2$$

Curved surface area of 20 pillars = $20 \times \frac{44}{7}$ m^2

Given, cost of cleaning = Rs 2.50 per square metre

$\therefore$ Cost of cleaning 20 pillars = Rs $2.50 \times 20 \times \frac{44}{7}$ = Rs 314.28

Question 12

A solid cylinder has total surface area of 462 cm^2. Its curved surface area is one-third of its total surface area. Find the radius and height of the cylinder.

Solution 12

We have,

Curved surface area = $\frac{1}{3} \times$ total surface area

$\Rightarrow 2\pi rh = \frac{1}{3} \times \left(2\pi rh + 2\pi r^2\right)$

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

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

$\Rightarrow 2h = r$

Now, total surface area = 462

$\Rightarrow$ Curved surface area = $\frac{1}{3} \times 462$

$\Rightarrow 2\pi rh = 154 \Rightarrow 2 \times \frac{22}{7} \times 2h^2 = 154$

$\Rightarrow h^2 = \frac{154 \times 7}{2 \times 22 \times 2} = \frac{49}{4}$

$\Rightarrow h = \frac{7}{2}$ cm

r = 2h

$\Rightarrow r = 2 \times \frac{7}{2}$ cm

$\Rightarrow r = 7$cm

Question 13
The total surface area of a hollow metal cylinder open at both ends of external radius 8 cm and height 10 cm is 338 π cm^2. Taking r to be inner radius, obtain an equation in r and use it to obtain the thickness of the metal in the cylinder.

Solution 13

We have,

$2\pi Rh + 2\pi rh + 2\pi R^2 - 2\pi r^2 = 338\pi$, Where $R = 8$ cm and $h = 10$ cm

$\Rightarrow h(R+r) + (R+r)(R-r) = 169$

$\Rightarrow 10(8+r) + (8+r)(8-r) = 169$

$\Rightarrow 80 + 10r + 64 - r^2 = 169$

$\Rightarrow r^2 - 10r + 25 = 0$

$\Rightarrow r = 5$

$\therefore R - r = (8-5)$ cm $= 3$ cm

Question 14
Find the lateral or curved surface area of a cylindrical petrol storage tank that is 4.2 m in diameter and 4.5 m high. How much steel was actually used, if $\frac{1}{12}$ of the steel actually used was wasted in making the closed tank?

Solution 14
Height (h) cylindrical tank = 4.5 m

Radius (r) of circular end of cylindrical tank = $\left(\frac{4.2}{2}\right)$ m = 2.1m

(i) Lateral or curved surface area of tank = $2\pi rh$

=
= 59.4 m2

(ii) Total surface area of tank = 2 πr (r + h)

= $\left[2\times\frac{22}{7}\times 2.1\times(2.1+4.5)\right] m^2$
= 87.12 m^2

Let A m^2 steel sheet be actually used in making the tank.

$\therefore A\left(1-\frac{1}{12}\right) = 87.12 \text{ m}^2$

$\Rightarrow A = \left(\frac{12}{11}\times 87.12\right) \text{ m}^2$

$\Rightarrow A = 95.04 \text{ m}^2$

Thus, 95.04 m^2 steel was used in actual while making the tank.

Chapter 19 - Surface Areas and Volume of a Circular Cylinder Exercise Ex. 19.2

Question 1

A soft drink is available in two packs -

(i) a tin can with a rectangular base of length 5 cm and width 4 cm, having a height of 15 cm and
(ii) a plastic cylinder with circular base of diameter 7 cm and height 10 cm. Which container has greater capacity and by how much?

Solution 1

The tin can will be cuboidal in shape.
Length (l) of tin can = 5 cm
Breadth (b) of tin can = 4 cm
Height (h) of tin can = 15 cm

Capacity of tin can = $l \times b \times h = (5 \times 4 \times 15)\ cm^3 = 300\ cm^3$

Radius (R) of circular end of plastic cylinder = $\left(\frac{7}{2}\right)\ cm = 3.5\ cm$

Height (H) of plastic cylinder = 10 cm

Capacity of plastic cylinder = $\pi R^2H = \left(\frac{22}{7} \times (3.5)^2 \times 10\right)\ cm^3 = 385\ cm^3$

Thus, the plastic cylinder has greater capacity.
Difference in capacity = $(385 - 300)\ cm^3 = 85\ cm^3$

Question 2

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

Solution 2

Since the concrete mixture that is to be used to build up the pillars is going to occupy the entire space of the pillar, what we need to find here is the volume of the cylinders.
Radius of base of cylinder = 20 cm
Height of the cylindrical pillar = 10 m = 1000 cm

So, volume of each cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 20 \times 20 \times 1000 cm^3$$

$$= \frac{8800000}{7}\ cm^3$$

$$= \frac{8.8}{7}\ m^2 \quad \left(\text{Since } 1000000\ cm^3 - 1m^3\right)$$

Therefore, volume of 14 pillars = Volume of each cylinder $\times$ 14

$$= \frac{8.8}{7} \times 14\ m^3$$

$$= 17.6\ m^3$$

Question 3

The inner diameter of a cylindrical wooden pipe is 24 cm and its outer diameter is 28 cm. The length of the pipe is 35 cm. find the mass of the pipe, if 1 cm^3 of wood has a mass of 0.6 g.

Solution 3

Inner radius (r1) of cylindrical pipe = $\left(\frac{24}{2}\right)$cm = 12 cm

Outer radius (r2) of cylindrical pipe = $\left(\frac{28}{2}\right)$cm = 14cm

Height (h) of pipe = Length of pipe = 35 cm
Mass of pipe = volume x density

Therefore, Volume of pipe = $\pi\left(r_2^2 - r_1^2\right)h = \left[\frac{22}{7} \times \left(14^2 - 12^2\right) \times 35\right]cm^3$ = 5720 cm^3

Mass of 1 cm^3 wood = 0.6 g
Hence, Mass of 5720 cm^3 wood = 5720 $\times$ 0.6 g = 3432 g = 3.432 kg

Question 4

If the lateral surface of a cylinder is 94.2 cm^2 and its height is 5 cm, then find

(i) radius of its base (ii) its volume. (Use π = 3.14)

Solution 4

(i) Height (h) of cylinder = 5 cm
Let radius of cylinder be r.
CSA of cylinder = 94.2 cm^2
$2\pi rh = 94.2\ cm^2$
$(2 \times 3.14 \times r \times 5)\ cm = 94.2\ cm^2$
r = 3 cm

(ii) Volume of cylinder = $\pi r^2h = (3.14 \times (3)^2 \times 5)\ cm^3 = 141.3\ cm^3$

Question 5

The capacity of a closed cylindrical vessel of height 1 m is 15.4 litres. How many square metres of metal sheet would be needed to make it?

Solution 5

Let radius of the circular ends of the cylinder be r.
Height (h) of the cylindrical vessel = 1 m
Volume of cylindrical vessel = 15.4 litres = 0.0154 m^3

$$\pi r^2 h = 0.0154\ m^3$$
$$\left(\frac{22}{77} \times r^2 \times 1\right)m = 0.0154\ m^3$$
$$\Rightarrow r = 0.07\ m$$

Total Surface area of vessel = $2\pi r(r+h)$
$$= \left[2 \times \frac{22}{7} \times 0.07(0.07+1)\right]m^2$$
$$= 0.44 \times 1.07\ m^2$$
$$= 0.4708\ m^2$$

Thus, 0.4708 m^2 of metal sheet would be needed to make the cylindrical vessel.

Question 6

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

Solution 6

Radius (r) of cylindrical bowl = $\left(\frac{7}{2}\right)$ cm = 3.5 cm

Height (h) up to which the bowl is filled with soup = 4 cm

Volume of soup in 1 bowl = $\pi r^2 h = \left(\frac{22}{7}\times(3.5)^2\times 4\right)\text{cm}^3 = 154\ \text{cm}^3$

Volume of soup in 250 bowls = $(250 \times 154)\ \text{cm}^3 = 38500\ \text{cm}^3$ = 38.5 litres

Thus, the hospital will have to prepare 38.5 litres of soup daily to serve 250 patients.

Question 7

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 7

Clearly, garden roller forms a cylinder of length h = 63 cm,

Circumference (girth) of one end = 440 cm.

Let the external radius of the roller be R cm.

Then,

$$2\pi R = 440$$

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

$$\Rightarrow R = 70\ \text{cm}$$

$\therefore$ Internal radius $(r) = (70-4)$ cm = 66 cm

Hence, Volume of the iron = $\pi\left(R^2 - r^2\right)h$

$$\Rightarrow \quad \text{Volume of the iron} = \frac{22}{7}\times\left(70^2 - 66^2\right)\times 63\ \text{cm}^3$$

$$\Rightarrow \text{Volume of the iron} = \frac{22}{7}\times(70+66)\times(70-66)\times 63\ \text{cm}^3$$

$$\Rightarrow \quad \text{Volume of the iron} = \frac{22}{7}\times 136\times 4\times 63\ \text{cm}^3$$

$$= 107712\ \text{cm}^3$$

Question 8

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

Solution 8

Let the radius of the tank be r dm.

Then, height $= 6r$ decimetre.

Now, cost of painting at the rate of 50 paise per dm^2 = Rs 198

$$\Rightarrow 2\pi r\left(r+h\right)\times\frac{50}{100} = 198$$
$$\Rightarrow 2\times\frac{22}{7}\times r\times 7r\times\frac{1}{2} = 198$$
$$\Rightarrow r^2 = \frac{198}{22}$$
$$\Rightarrow r^2 = 9$$
$$\Rightarrow r = 3 \text{ dm}$$

$$\therefore\ h = 18 \text{ dm}$$

Let V be the volume of the tank.

Then,

$$V = \pi r^2 h = \frac{22}{7}\times 9\times 18 \text{ dm}^3$$
$$= 509.14 \text{ dm}^3$$

Question 9

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

Solution 9

Let the radius of the cylinders be $2x, 3x$

and the height of the cylinders be` $5y, 3y$

$$\frac{\text{Volume of cylinder}_1}{\text{Volume of cylinder}_2} = \frac{\pi\left(2x\right)^2\times 5y}{\pi\left(3x\right)^2\times 3y} = \frac{20}{27}$$

$$\frac{\text{Surface area of cylinder}_1}{\text{Surface area of cylinder}_2} = \frac{2\pi\times 2x\times 5y}{2\pi\times 3x\times 3y} = \frac{10}{9}$$

Question 10

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.

Solution 10

We have,

$$\frac{2\pi rh}{2\pi rh + 2\pi r^2} = \frac{1}{2}$$

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

$$\Rightarrow h = r$$

Now,

$$2\pi r\left(h+r\right) = 616$$

$$\Rightarrow 2 \times \frac{22}{7} \times r \times 2r = 616 \qquad [\because h = r]$$

$$\Rightarrow r^2 = 49$$

$$r = 7$$

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

$$V = \pi r^2 h = \frac{22}{7} \times 49 \times 7 \text{ cm}^3$$

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

Question 11

The curved surface area of a cylinder is 1320 cm^2 and its base had diameter 21 cm. Find the height and the volume of the cylinder.

Solution 11

$$2\pi rh = 1320$$

$$\text{and } r = \frac{21}{2} \text{ cm}$$

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

$$\Rightarrow 66h = 1320$$

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

$$\therefore \ V = \pi r^2 h = \frac{22}{7} \times \left(\frac{21}{2}\right)^2 \times 20 \text{ cm}^3$$

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

Question 12

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, it its volume is 1617 cm^3

Solution 12

We have,

$r = 2x$

$h = 3x$

and $\pi r^2 h = 1617$

$\Rightarrow \frac{22}{7} \times 4x^2 \times 3x = 1617$

$\Rightarrow x^3 = \frac{1617 \times 7}{22 \times 12} = 42.875 = (3.5)^3$

$\Rightarrow x = 3.5$

$\therefore r = 7$ cm and $h = 10.5$ cm

Hence, $TSA = 2\pi r(h + r) = 2 \times \frac{22}{7} \times 7 \times 17.5 \text{ cm}^2$

$= 770 \text{ cm}^2$

Question 13

A rectangular sheet of paper, 44 cm $\times$20 cm, is rolled along its length of form a cylinder. Find the volume of the cylinder so formed.

Solution 13

We have,

$h = 20$ cm

and $2\pi r = 44$ cm

$\Rightarrow h = 20$ cm, $2 \times \frac{22}{7} \times r = 44$ cm

$\Rightarrow h = 20$ cm , $r = 7$ cm

$\therefore V = \pi r^2 h = \frac{22}{7} \times (7)^2 \times 20 \text{ cm}^3$

$= 3080 \text{ cm}^3$

Question 14

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

Solution 14

$2\pi rh = 264$

and $\pi r^2 h = 924$

$\Rightarrow \dfrac{\pi r^2 h}{2\pi rh} = \dfrac{924}{264}$

$\Rightarrow \quad \dfrac{r}{2} = 3.5$

$\Rightarrow \quad r = 7$ m

$\Rightarrow$ d = 14 m

Now, $\quad 2\pi rh = 264$

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

$\Rightarrow \quad h = 6$ m

Question 15

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

Solution 15

$V_1 = V_2$

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

$\Rightarrow \dfrac{r_1^2}{r_2^2} = \dfrac{h_2}{h_1}$

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

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

Question 16

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.

Solution 16

Here, $h = 10.5$ m

As per question

$$3\left(2\pi r^2\right) = 2 \times 2\pi rh$$

$$\Rightarrow 3r = 2h$$

$$\Rightarrow r = \frac{2h}{3}$$

$$\therefore \quad r = \frac{2 \times 10.5}{3} = 7\text{m}$$

$$\text{Volume} = \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 10.5\text{m}^3$$

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

Question 17

How many cubic metres of earth must be dugout to sink a well 21 m deep and 6 m diameter? Find the cost of plastering the inner surface of the well at Rs 9.50 per m^2.

Solution 17

We have,

h = 21 m

and r = 3 m

$$\therefore \text{ volume of earth } = \frac{22}{7} \times 3^2 \times 21\text{m}^3$$

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

$$\text{Cost of plastering } = \text{Rs } (594 \times 9.50)$$

$$= \text{Rs } 3762$$

Therefore, 594 m^3 of earth needs to be dugout and cost of plastering will be Rs 3762.

Question 18

The trunk of a tree is cylinderical 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 18

We have,

$$2\pi r = 176$$

and $h = 300$ cm

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

and $h = 300$ cm

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

and $h = 300$ cm

$$\text{Volume of timber} = \frac{22}{7} \times 28 \times 28 \times 300 \text{ cm}^3 = \frac{739200}{1000000} = 0.7392 \text{ m}^3$$

Question 19

A cylinderical 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.

Solution 19

Let the rise in the level of water be h cm.

Then,

Volume of the cylinder of height h and base radius 28 cm = Volume of iron solid

$$\Rightarrow \frac{22}{7} \times 28 \times 28 \times h = 32 \times 22 \times 14$$

$$\Rightarrow h = 4 \text{ cm}$$

Question 20

A cylinderical 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 every where. Calculate the volume of the metal.

Solution 20

Inner radius (r) = $\frac{10.4}{2}$ cm = 5.2 cm

Thickness = 8 mm = 0.8 cm

$\therefore$ Outer radius(R) = (5.2 + 0.8)cm = 6 cm

Volume of metal = Outer volume – Inner volume

$$= \pi R^2 h - \pi r^2 h$$
$$= \pi \left(R^2 - r^2\right) h$$
$$= \frac{22}{7} \times \left(6^2 - 5.2^2\right) \times 25 \text{ cm}^3$$

$$= 704 \text{ cm}^3$$

Question 21

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 deliverd by the pipe in one hour.

Solution 21

Clearly, volume of water delivered by the tube in one second is equal to the volume of a cylinder of length 7 m

$\therefore$ volume of water delivered in one second

$= \frac{22}{7} \times \left(0.75\right)^2 \times 700 \text{ cm}^3$

Hence, volume of water delivered in one hour

$= \frac{22}{7} \times \left(\frac{3}{4}\right)^2 \times 700 \times 60 \times 60 \text{ cm}^3$

$= \frac{22 \times 9 \times 700 \times 3600}{7 \times 16 \times 1000}$ litres

= 4455 litres

Question 22

A rectangular sheet of paper 30 cm $\times$ 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 volume of the two cylinders thus formed.

Solution 22

Let V_1 *and* V_2 be the volumes of two cylinders.

When the sheet is folded along its length, it forms a cylinder of height $h_1 = 18$ cm and perimeter of base equal to 30 cm.

Let r_1 be the radius of the base.

Then,

$2\pi r_1 = 30$

$\Rightarrow r_1 = \frac{15}{\pi}$

$$\therefore V_1 = \pi r_1^2 h_1 = \pi \times \frac{225}{\pi^2} \times 18 \text{ cm}^3$$

$$= \frac{225}{\pi} \times 18 \text{ cm}^3$$

When the sheet is folded along its breadth, it forms a cylinder of height $h_2 = 30$ cm and perimeter of base equal to 30 cm.

Let r_2 be the radius of the base when $h_2 = 30$ cm.

$\Rightarrow 2\pi r_2 = 18$

$\Rightarrow r_2 = \frac{9}{\pi}$

$$V_2 = \pi r_2^2 h_2 = \pi \times \left(\frac{9}{\pi}\right)^2 \times 30 \text{ cm}^3$$

$$= \frac{81 \times 30}{\pi} \text{ cm}^3$$

$$\therefore \frac{V_1}{V_2} = \frac{225 \times 18}{81 \times 30}$$

$$= \frac{5}{3}$$

Question 23

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

Solution 23

Speed of water = 30 cm/sec.

$\therefore$ Volume of water that flows out of the pipe in one second

= Area of cross-section $\times$ 30 cm^3

= (5×30) cm^3

= 150 cm^3

Hence, volume of water that flows out of the pipe in one minute

= 150×60 cm^3

= 9000 cm^3

= 9 litres

Question 24

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

Solution 24

Diameter of tubewell = 3 m

$\therefore$ Radius = $\frac{3}{2}$ m

$$\begin{aligned}\text{Cost of sinking} &= \text{Volume} \times \text{Rate} \\ &= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 280 \times 3.60 \\ &= 22 \times 3 \times 3 \times 10 \times 3.6 \\ &= 22 \times 9 \times 36 = \text{Rs } 7128\end{aligned}$$

$$\begin{aligned}\text{Cost of cementing} &= \text{Curved surface area} \times \text{Rate} \\ &= 2 \times \frac{22}{7} \times \frac{3}{2} \times 280 \times 2.50 \\ &= 2 \times 22 \times 3 \times 20 \times 2.50 \\ &= \text{Rs } 6600\end{aligned}$$

Question 25

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 25

Let the length of the wire be h metres.

Then,

Volume × 8.4 = 13.2 × 1000

$$\Rightarrow \frac{22}{7} \times \left(\frac{2}{10}\right)^2 \times h \times 8.4 = 13.2 \times 1000$$

$$\Rightarrow h = 12500 \text{ cm}$$
$$= 125 \text{ metres}$$

Question 26

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

Solution 26

We have,

$$TSA = 231\ cm^2,\ CSA = \frac{2}{3} \times TSA$$

$$\Rightarrow TSA = 231 \text{ cm}^2,\ CSA = 154 \text{ cm}^2$$
$$\Rightarrow 2\pi rh + 2\pi r^2 = 231 \text{ cm}^2, 2\pi rh = 154 \text{ cm}^2$$
$$\Rightarrow 2\pi r^2 + 154 = 231 \text{ cm}^2$$
$$\Rightarrow 2\pi r^2 = 77$$
$$\Rightarrow 2 \times \frac{22}{7} \times r^2 = 77$$
$$\Rightarrow r^2 = \frac{77 \times 7}{22 \times 2}$$
$$\Rightarrow r^2 = \frac{7^2}{2^2}$$
$$\Rightarrow r = \frac{7}{2} \text{ cm}$$

$$\text{Now, } 2 \times \frac{22}{7} \times r \times h = 154$$
$$\Rightarrow 2 \times \frac{22}{7} \times \frac{7}{2} \times h = 154$$
$$\Rightarrow h = 7 \text{ cm}$$

$$\therefore\ V = \pi r^2 h = \frac{22}{7} \times \frac{49}{4} \times 7 \text{ cm}^3 = 269.5 \text{ cm}^3$$

Question 27

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 around it to a width of 21 m to form an embankment. Find the height of the embankment.

Solution 27

We have,

$r = 7$ m

and $h = 8$ m

Let the height of the embankment be H *metre*.

and Radius of embankment + well = R = $(21 + r)$ m = 28 m

Then,

Volume of the earth in embankment = Volume of earth dugout

$$\frac{22}{7} \times \left(28^2 - 7^2\right) \times H = \frac{22}{7} \times 7^2 \times 8$$

$$\Rightarrow 35 \times 21 \times H = 7^2 \times 8$$

$$\Rightarrow H = \frac{7 \times 7 \times 8}{35 \times 21} \text{ m}$$

$$= \frac{8}{15} \text{ m}$$

$$= \frac{800}{15} \text{ cm}$$

$$= 53.3 \text{ cm}$$

Question 28

The difference between inside and outside surfaces of a cylinderical 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 28

We have,

$$2\pi R h - 2\pi r h = 88$$

$$\Rightarrow 2\pi\left(R - r\right)h = 88$$

$$\Rightarrow 2 \times \frac{22}{7} \times \left(R - r\right) \times 14 = 88$$

$$\Rightarrow R - r = 1$$

We have,

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

$$\Rightarrow \frac{22}{7}\left(R^2 - r^2\right) \times 14 = 176$$

$$\Rightarrow R^2 - r^2 = 4$$

$$\Rightarrow \left(R + r\right)\left(R - r\right) = 4$$

$$\Rightarrow R + r = 4$$

Hence, R = 2.5 cm and r = 1.5 cm

Question 29

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

Solution 29

The volume of the water that flows out through the circular pipe of radius 1 cm, at the rate of 6 metres per second, in one second is same as the volume of a cylinder of radius 1 cm and height = 6 metres.

$\therefore$ Volume of the water that flows out through the circular pipe in 1 second

$$= \frac{22}{7} \times \left(\frac{1}{100}\right)^2 \times 6 \text{ m}^3$$

$\Rightarrow$ Volume of the water that flows out through the circular pipe in 30 minutes

$$= \frac{22}{7} \times \frac{1}{10000} \times 6 \times 30 \times 60 \text{ m}^3$$

Let the water level rise to a height of h metres in 30 minutes in the cylinderical tank of base radius 60 cm.

Then,

Volume of the water collected in the tank in 30 minutes $= \frac{22}{7} \times \left(\frac{60}{100}\right)^2 \times h$

$$\therefore \frac{22}{7} \times \left(\frac{60}{100}\right)^2 \times h = \frac{22}{7} \times \frac{1}{10000} \times 6 \times 30 \times 60$$

$$\Rightarrow h = 3 \text{ m}$$

Question 30

A cylinderical 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 30

Suppose the tank is filled in x minutes.

Then,

Volume of the water that flows out through the pipe in x minutes = Volume of the tank

$$\Rightarrow \pi \times \left(\frac{3.5}{200}\right)^2 \times (2 \times 60x) = \pi \times (0.7)^2 \times 2.1$$

$$\Rightarrow \left(\frac{35}{2000}\right)^2 \times (120x) = \left(\frac{7}{10}\right)^2 \times \left(\frac{21}{10}\right)$$

$$\Rightarrow x = \frac{49 \times 21}{1000} \times \frac{2000 \times 2000}{35 \times 35 \times 120}$$

$$= 49 \times 21 \times \frac{2000 \times 2}{35 \times 35 \times 120}$$

$$= 28 \text{ minutes}$$

Question 31

The sum of the radius of the base and height of a solid cylinder is 37 m. If the total surface area of the solid cylinder is 1628 m^2. Find the volume of the cylinder.

Solution 31

We have,

$r + h = 37$

$2\pi r\left(h + r\right) = 1628$

$\Rightarrow 2 \times \frac{22}{7} \times r \times 37 = 1628$

$\Rightarrow r = 7$

$\therefore\ r = 7\text{m}$ and $h = 30\text{m}$

$$\text{Hence, volume } = \frac{22}{7} \times 7^2 \times 30\ \text{m}^3$$
$$= 4620\ \text{m}^3$$

Question 32

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 32

Outer radius = R = 5 + 7.5 = 12.5

Inner radius = r = 5

Let the height of the embankment = h m

$$\text{Area of embankment} = \pi\left(R^2 - r^2\right)$$
$$= \pi\left(12.5^2 - 5^2\right)$$
$$= \pi\left(12.5 + 5\right)\left(12.5 - 5\right)$$
$$= \pi \times 17.5 \times 7.5$$

Volume area of embankment = Volume of earth taken out

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

$$\pi \times 17.5 \times 7.5 \times h = \pi \times 5 \times 5 \times 8.4$$

$$h = \frac{\pi \times 5 \times 5 \times 8.4}{\pi \times 17.5 \times 7.5}$$
$$= 1.6\ \text{m}$$