

RD Sharma Solutions for Class 9 Chapter 19 Surface Area and Volume of A Right Circular Cylinder

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:

Radius of the base of the cylinder = $r = 0.7 \text{ m}$ (Given)

Curved surface area of cylinder = C.S.A = 4.4 m^2 (Given)

Let 'h' be the height of the cylinder.

We know, curved surface area of a cylinder = $2\pi rh$

Therefore,

$$2\pi rh = 4.4$$

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

[using $\pi=3.14$]

or $h = 1$

Therefore 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:

Height of cylinder (h) = Length of cylindrical pipe = 28 m or 2800 cm (Given)

[$1 \text{ m} = 100 \text{ cm}$]

Diameter of circular end of pipe = 5 cm (given)

Let 'r' be the radius of circular end, then $r = \text{diameter}/2 = 5/2 \text{ cm}$

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

$$= 2 \times 3.14 \times 5/2 \times 2800$$

[using $\pi = 3.14$]

$$= 44000$$

Therefore, the area of radiating surface is 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:

Height of cylindrical pillar (h) = 3.5 m

Radius of circular end of pillar (r) = $50/2 \text{ cm} = 25 \text{ cm} = 0.25 \text{ m}$

[As radius = half of the diameter] and [$1 \text{ m} = 100 \text{ cm}$]

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

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

$$= 5.5$$

Curved surface area of cylindrical pillar is 5.5 m.

Find the cost:

Cost of whitewashing 1m^2 is Rs 12.50 (Given)

Cost of whitewashing 5.5m^2 area = Rs. 12.50×5.5 = Rs. 68.75

Thus the cost of whitewashing the pillar is Rs 68.75.

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

Solution:

Height of cylindrical tank (h) = 1 m

Base radius of cylindrical tank (r) = diameter/2 = $140/2\text{ cm} = 70\text{ cm} = 0.7\text{ m}$

[1 m = 100 cm]

Now,

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

$$= 2 \times 3.14 \times 0.7(1 + 0.7)$$

$$= 7.48$$

Therefore, 7.48 m^2 metal sheet is required to make required closed cylindrical tank.

Question 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 and height of the cylinder.

Solution:

Total surface area of a cylinder = 462 cm^2 (Given)

As per given statement:

Curved or lateral surface area = $1/3$ (Total surface area)

$$\Rightarrow 2\pi rh = 1/3(462)$$

$$\Rightarrow 2\pi rh = 154$$

$$\Rightarrow h = 49/2r \dots (1)$$

[Using $\pi = 22/7$]

Again,

Total surface area = 462 cm^2

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

$$2\pi r(49/2r + r) = 462$$

$$\text{or } 49 + 2r^2 = 147$$

$$\text{or } 2r^2 = 98$$

or $r = 7$

Substitute the value of r in equation (1), and find the value of h .

$$h = 49/2(7) = 49/14 = 7/2$$

$$\text{Height (h)} = 7/2 \text{ cm}$$

Answer: Radius = 7 cm and height = 7/2 cm of the cylinder

Question 6: The total surface area of a hollow cylinder which is open on both the sides is 4620 sq.cm and the area of the base ring is 115.5 sq.cm and height is 7 cm. Find the thickness of the cylinder.

Solution:

Given:

Total surface area of hollow cylinder = 4620 cm²

Height of cylinder (h) = 7 cm

Area of base ring = 115.5 cm²

To find: Thickness of the cylinder

Let ' r_1 ' and ' r_2 ' are the inner and outer radii of the hollow cylinder respectively.

$$\text{Then, } \pi r_2^2 - \pi r_1^2 = 115.5 \dots\dots(1)$$

And,

$$2\pi r_1 h + 2\pi r_2 h + 2(\pi r_2^2 - \pi r_1^2) = 4620$$

$$\text{Or } 2\pi h (r_1 + r_2) + 2 \times 115.5 = 4620$$

(Using equation (1) and $h = 7$ cm)

$$\text{or } 2\pi 7 (r_1 + r_2) = 4389$$

$$\text{or } \pi (r_1 + r_2) = 313.5 \dots\dots(2)$$

Again, from equation (1),

$$\pi r_2^2 - \pi r_1^2 = 115.5$$

$$\text{or } \pi(r_2 + r_1)(r_2 - r_1) = 115.5$$

[using identity: $a^2 - b^2 = (a - b)(a + b)$]

Using result of equation (2),

$$313.5 (r_2 - r_1) = 115.5$$

$$\text{or } r_2 - r_1 = 7/19 = 0.3684$$

Therefore, thickness of the cylinder is 7/19 cm or 0.3684 cm.

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

Solution:

Height of cylinder (h) = 7.5 m

Radius of cylinder (r) = 3.5 m

We know, Total Surface Area of cylinder (T.S.A) = $2\pi r(r+h)$

And, Curved surface area of a cylinder(C.S.A) = $2\pi rh$

Now, Ratio between the total surface area of a cylinder to its curved surface area is

$$T.S.A/C.S.A = 2\pi r(r+h)/2\pi rh$$

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

$$= (3.5 + 7.5)/7.5$$

$$= 11/7.5$$

$$= 22/15 \text{ or } 22:15$$

Therefore the required ratio is 22:15.

Exercise 19.2 Page No: 19.20

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:

(i) Dimensions of a cubical tin can:

Length (L) = 5 cm

Breadth (B) = 4 cm

Height (H) = 15 cm

Capacity of the tin can = Volume of Tin Can = $l \times b \times h$ cubic units = $(5 \times 4 \times 15) \text{ cm}^3 = 300 \text{ cm}^3$

(ii) Radius of the circular end of the plastic cylinder (R) = $\text{diameter}/2 = 7/2 \text{ cm} = 3.5 \text{ cm}$

Height of plastic cylinder (H) = 10 cm

Capacity of plastic cylinder = Volume of cylindrical container = $\pi R^2 H = 22/7 \times (3.5)^2 \times 10 \text{ cm}^3 = 385 \text{ cm}^3$

From (i) and (ii) results, the plastic cylinder has greater capacity.

Difference in capacity = $(385 - 300) \text{ cm}^3 = 85 \text{ cm}^3$

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

Solution:

In this case, we have to find the volume of the cylinders.

Given:

Radius of the base of a cylinder = 20 cm

Height of cylinder = 10 m = 1000 cm

[1m = 100 cm]

Volume of the cylindrical pillar = $\pi R^2 H$

$$= (22/7 \times 20^2 \times 1000) \text{ cm}^3$$

$$= 8800000/7 \text{ cm}^3 \text{ or } 8.87 \text{ m}^3$$

Therefore, volume of 14 pillars = $14 \times 8.87 \text{ m}^3 = 17.6 \text{ m}^3$

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 cm³ of wood has a mass of 0.6 gm.

Solution:

Let r and R be the inner and outer radii of cylindrical pipe.

Inner radius of a cylindrical pipe (r) = $24/2 = 12 \text{ cm}$

Outer radius of a cylindrical pipe (R) = $28/2 = 14 \text{ cm}$

Height of pipe (h) = length of pipe = 35 cm

Mass of pipe = volume $\times$ density = $\pi(R^2 - r^2)h$

$$= 22/7(14^2 - 12^2)35$$

$$= 5720$$

Mass of pipe is 5720 cm³

Mass of 1 cm³ wood = 0.6 gm (Given)

Therefore, mass of 5720 cm³ wood = $5720 \times 0.6 = 3432 \text{ gm} = 3.432 \text{ kg}$

Question 4: If the lateral surface of a cylinder is 94.2 cm² and its height is 5 cm, find:

i) radius of its base (ii) volume of the cylinder

[Use $\pi = 3.141$]

Solution:

Lateral surface of the cylinder = 94.2 cm²

Height of the cylinder = 5 cm

Let ' r ' be the radius.

(i) Lateral surface of the cylinder = 94.2 cm²

$$2 \pi r h = 94.2$$

$$\text{or } 2 \times 3.14 \times r \times 5 = 94.2$$

$$\text{or } r = 3 \text{ cm}$$

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

$$= (3.14 \times 3^2 \times 5) \text{ cm}^3$$

$$= 141.3 \text{ cm}^3$$

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

Solution:

Given, The capacity of a closed cylindrical vessel of height 1 m is 15.4 liters.

Height of the cylindrical vessel = 15.4 litres = 0.0154 m^3

[$1 \text{ m}^3 = 1000 \text{ litres}$]

Let 'r' be the radius of the circular ends of the cylinders, then

$$\pi r^2 h = 0.0154 \text{ m}^3$$

$$3.14 \times r^2 \times 1 = 0.0154 \text{ m}^3$$

$$\text{or } r = 0.07 \text{ m}$$

Again,

$$\text{Total surface area of a vessel} = 2\pi r(r+h)$$

$$= 2(3.14)(0.07)(0.07+1) \text{ m}^2$$

$$= 0.470 \text{ m}^2$$

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:

$$\text{Radius of cylindrical bowl (R)} = \text{diameter}/2 = 7/2 \text{ cm} = 3.5 \text{ cm}$$

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

Now,

$$\text{Volume of soup in 1 bowl} = \pi r^2 h$$

$$= 22/7 \times 3.5^2 \times 4 \text{ cm}^3$$

$$= 154 \text{ cm}^3$$

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

$$= 38500 \text{ cm}^3$$

$$= 38.5 \text{ liters}$$

Thus, hospital has to prepare 38.5 liters of soup daily in order 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:

$$\text{The outer circumference of the roller} = 440 \text{ cm}$$

$$\text{Thickness of the roller} = 4 \text{ cm and}$$

$$\text{Its height (h)} = 63 \text{ cm}$$

Let 'R' be the external radius and 'r' be the inner radius of the roller.

$$\text{Circumference of roller} = 2\pi R = 440$$

$$\text{Or } 2\pi R = 440$$

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

$$\text{or } R = 70$$

And, inner radius 'r' is given as

$$\Rightarrow r = R - 4$$

$$\Rightarrow r = 70 - 4$$

$$\Rightarrow r = 66$$

Inner radius is 66 cm

Now, volume of the iron is given as

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

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

$$V = 107712$$

Therefore, required volume is 107712 cm³.

Question 8: A solid cylinder has a total surface area of 231 cm². Its curved surface area is $\frac{2}{3}$ of the total surface area. Find the volume of the cylinder.

Solution:

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

$$\text{As per given statement: Curved surface area} = \frac{2}{3}(\text{Total surface area})$$

$$\text{Curved surface area} = \frac{2}{3} \times 231 = 154$$

$$\text{So, Curved surface area} = 154 \text{ cm}^2 \dots(1)$$

$$\text{We know, Curved surface area of cylinder} = 2\pi rh + 2\pi r^2$$

$$\text{Or } 2\pi rh + 2\pi r^2 = 231 \dots(2)$$

Here $2\pi rh$ is the curved surface area, so using (1), we have

$$\Rightarrow 154 + 2\pi r^2 = 231$$

$$\Rightarrow 2\pi r^2 = 231 - 154$$

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

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

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

Find the value of h:

$$\text{CSA} = 154 \text{ cm}^2$$

$$\Rightarrow 2\pi rh = 154$$

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

$$\Rightarrow h = 154/22$$

$$\Rightarrow h = 7$$

Now,

Find Volume of the cylinder:

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

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

$$= 269.5$$

The volume of the cylinder is 269.5 cm³

Question 9: The cost of painting the total outside surface of a closed cylindrical 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 2 decimal places.

Solution:

Let 'r' be the radius of the tank.

As per given statement: Height (h) = 6(Radius) = 6r dm

Cost of painting for 50 paise or Rs 1/2 per dm² = Rs 198 (Given)

$$\Rightarrow 2\pi r(r+h) \times 1/2 = 198$$

$$\Rightarrow 2 \times 22/7 \times r(r+6r) \times 1/2 = 198$$

$$\Rightarrow r = 3 \text{ dm}$$

And, h = (6 x 3) dm = 18 dm

Now,

$$\text{Volume of the tank} = \pi r^2 h = 22/7 \times 9 \times 18 = 509.14 \text{ dm}^3$$

Question 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 and the ratio of their curved surfaces.

Solution:

Let the radius of the cylinders be 2x and 3x and the height of the cylinders be 5y and 3y.

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

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

Question 11: 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.

Solution:

Total surface area (T.S.A) = 616 cm² (given)

Let r be the radius of cylinder and h be the radius of cylinder.

As per given statement:

$$(\text{curved surface area} / (\text{total surface area})) = 1/2$$

$$\text{or } \text{CSA} = 1/2 \text{ TSA}$$

$$\text{CSA} = 1/2 \times 616 = 308$$

$$\Rightarrow \text{CSA} = 308 \text{ cm}^2$$

Now,

$$\text{TSA} = 2\pi rh + 2\pi r^2$$

$$\Rightarrow 616 = \text{CSA} + 2\pi r^2$$

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

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

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

$$\Rightarrow r^2 = 49$$

$$\text{or } r = 7 \text{ cm} \dots (1)$$

$$\text{As, } \text{CSA} = 308 \text{ cm}^2$$

$$2\pi rh = 308$$

$$\Rightarrow 2 \times 22/7 \times 7 \times h = 308$$

$$(\text{using } (1))$$

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

Now,

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

$$= 22/7 \times 7 \times 7 \times 7$$

$$= 1078$$

Therefore, Volume of cylinder is 1078 cm^3 .

Question 12: The curved surface area of a cylinder is 1320 cm^2 and its base had diameter 21 cm. Find the height and volume of the cylinder.

Solution:

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

Let, r be the radius of the cylinder and h be the height of the cylinder.

$$\Rightarrow r = \text{diameter}/2 = 21/2 \text{ cm} = 10.5 \text{ cm}$$

$$\text{We know, Curved surface area(CSA)} = 2\pi rh$$

$$\text{So, } 2\pi rh = 1320$$

$$\Rightarrow 2 \times 22/7 \times 10.5 \times h = 1320$$

or $h = 20$ cm

Now,

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

$$= \frac{22}{7} \times 10.5 \times 10.5 \times 20$$

$$= 6930$$

Thus, Volume of cylinder is 6930 cm³.

Question 13: 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 1617cm³.

Solution:

Let, r be the radius of the cylinder and h be the height of the cylinder.

As per statement: $r:h = 2:3$

Then, radius = $2x$ cm and height = $3x$ cm

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

And Volume of cylinder = 1617 cm³ (given)

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

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

$$x^3 = \frac{343}{8}$$

$$\text{or } x = \frac{7}{2}$$

$$\text{or } x = 3.5 \text{ cm}$$

Now, radius, $r = 2 \times 3.5 = 7$ cm and

Height = $3x = 3 \times 3.5 = 10.5$ cm

Now,

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

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

$$= 770$$

Thus, Total surface area of cylinder is 770 cm².

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

Solution:

Length of a rectangular sheet = 44 cm

Height of a rectangular sheet = 20 cm

$$\text{Now, } 2\pi r = 44$$

$$r = \frac{44}{2\pi}$$

$$r = 44 \times \frac{1}{2} \times \frac{7}{22}$$

or $r = 7$ cm

Now,

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

$$= \frac{22}{7} \times 7 \times 7 \times 20$$

$$= 3080$$

So, Volume of cylinder is 3080 cm^3 .

Question 15: The curved surface area of cylindrical pillar is 264 m^2 and its volume is 924 m^3 . Find the diameter and the height of the pillar.

Solution:

Let, r be the radius of the cylindrical pillar and h be the height of the cylindrical pillar

Curved surface area of cylindrical pillar = CSA = 264 m^2 (Given)

$$\text{So, } 2\pi rh = 264$$

$$\text{or } \pi rh = 132 \dots (1)$$

Again,

Volume of the cylinder = 924 m^3 (given)

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

$$\text{or } \pi rh(r) = 924$$

Using equation (1)

$$132 r = 924$$

$$\text{or } r = 924/132$$

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

Substitute value of r value in equation (1)

$$\frac{22}{7} \times 7 \times h = 132$$

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

Therefore, diameter = $2r = 2(7) = 14 \text{ m}$ and height = 6 m