RD Sharma Solutions for Class 8 Maths Chapter 22 – Mensuration – III (Surface Area and Volume of a Right Circular Cylinder)

EXERCISE 22.1 PAGE NO: 22.10

1. Find the curved surface area and total surface area of a cylinder, the diameter of whose base is 7 cm and height is 60 cm.

Solution:

We have,

Diameter of cylinder = 7 cm

So, Radius of cylinder = 7/2 cm

Height of cylinder = 60 cm

By using the formula,

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

$= 2 \times 22/7 \times 7/2 \times 60$

$= 1320\ cm^2$

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

$= 2 \times 22/7 \times 7/2\ (60 + 7/2)$

$= 22\ (127/2)$

$= 1397\ cm^2$

2. The curved surface area of a cylindrical road is 132 cm^2. Find its length if the radius is 0.35 cm.

Solution:

We have,

Curved surface area of cylindrical road =132 cm^2

Radius of road = 0.35 cm

Let length of road be 'h' cm

By using the formula,

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

So, $2\pi rh = 132$

$2 \times 22/7 \times 0.35 \times h = 132$

$h = 132 \times 7 / 2 \times 22 \times 0.35$

$= 924 / 15.4$

$= 60cm$

∴ Length of road is 60 cm.

3. The area of the base of a right circular cylinder is 616 cm^2 and its height is 2.5 cm. Find the curved surface area of the cylinder.

Solution:

We have,

Area of base of right circular cylinder = 616 cm^2
Height of cylinder = 2.5 cm
Let the radius of cylinder be 'r' cm
By using the formula,
Area of base of right circular cylinder = πr^2
So, $\pi r^2 = 616$
$22/7\ r^2 = 616$
$r^2 = 616 \times 7 / 22$
$= 196$
$r = \sqrt{196}$
$= 14cm$
∴ Curved surface area of cylinder = $2\pi rh$
$= 2 \times 22/7 \times 14 \times 2.5$
$= 1540/7$
$= 220\ cm^2$

4. The circumference of the base of a cylinder is 88 cm and its height is 15 cm. Find its curved surface area and total surface area.
Solution:
We have,
Circumference of base of cylinder = 88 cm
Height of cylinder = 15 cm
By using the formula,
Circumference of base of cylinder = $2\pi r$
So,
$2\pi r = 88$
$2 \times 22/7 \times r = 88$
$r = 88 \times 7 / 44$
$= 616/44$
$= 14cm$
Radius of cylinder = 14 cm
∴ Curved surface area of cylinder = $2\pi rh$
$= 2 \times 22/7 \times 14 \times 15$
$= 1320\ cm^2$

∴ Total surface area area of cylinder = $2\pi r\ (h+r)$
$= 2 \times 22/7 \times 14\ (15 + 14)$
$= 2 \times 22/7 \times 14 \times 29$
$= 2552\ cm^2$

5. A rectangular strip 25 cm × 7 cm is rotated about the longer side. Find the total surface area of the solid thus generated.

Solution:

We have,

Dimension of rectangular strip = 25 cm × 7cm

When this strip is rotated about its longer side,

Height of cylinder becomes = 25 cm

Radius = 7 cm

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

$= 2 \times 22/7 \times 7 (25 + 7)$

$= 2 \times 22/7 \times 7 \times 32$

$= 1408 \text{ cm}^2$

6. A rectangular sheet of paper, 44 cm× 20 cm, is rolled along its length to form a cylinder. Find the total surface area of the cylinder thus generated.

Solution:

We have,

Dimensions of rectangular sheet of paper = 44cm × 20cm

When this sheet of paper is rolled along its length,

Circumference of base becomes = 44 cm

By using the formula,

Circumference of base = $2\pi r$

So, $2\pi r = 44$

$2 \times 22/7 \times r = 44$

$r = 44 \times 7 / 44$

$= 7\text{cm}$

Radius = 7cm

Height = 20cm

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

$= 2 \times 22/7 \times 7 (20 + 7)$

$= 2 \times 22/7 \times 7 \times 27$

$= 1188 \text{ cm}^2$

7. 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 curved surface areas.

Solution:

We have,

Ratio of radius of two cylinder, $r_1 : r_2 = 2:3$

Ratio of their heights, $h_1:h_2 = 5:3$
$r_1/r_2 = 2/3$
$h_1/h_2 = 5/3$
so,
Curved surface area of cylinder1 / curved surface area of cylinder2 $= 2\pi r_1h_1 / 2\pi r_2h_2$
$= (2 \times 22/7 \times 2 \times 5) / (2 \times 22/7 \times 3 \times 3)$
$= 10/9$
∴ Ratio of their curved surface area is 10:9

8. The ratio between the curved surface area and the total surface area of a right circular cylinder is 1:2. Prove that its height and radius are equal.
Solution:
We have,
Let radius of cylinder be 'r'
Let height of cylinder be 'h'
Curved surface area of cylinder / total surface area of cylinder = 1/2
$2\pi rh / 2\pi r (h+r) = 1/2$
$h/(h+r) = 1/2$
$2h = h+r$
$2h - h = r$
$h = r$
Height = Radius
Hence proved.

9. The curved surface area of a cylinder is 1320 cm^2 and its base has diameter 21 cm. Find the height of the cylinder.
Solution:
We have,
Diameter of base = 21 cm
Radius of cylinder = 21/2 cm
Let height of cylinder be 'h' cm
Curved surface area of cylinder = 1320 cm^2
By using the formula,
Curved surface area of cylinder = $2\pi rh$
So,
$2\pi rh = 1320$
$2 \times 22/7 \times 21/2 \times h = 1320$
$66h = 1320$
$h = 1320/66 = 20cm$

∴ Height of cylinder is 20cm.

10. The height of a right circular cylinder is 10.5 cm. If three times the sum of the areas of its two circular faces is twice the area of the curved surface area. Find the radius of its base.

Solution:

We have,

Height of cylinder = 10.5 cm

Let radius of cylinder be 'r' cm

So,

Area of two bases of cylinder = $2\pi r^2$

Area of curved surface of cylinder = $2\pi rh$

Now,

$3(2\pi r^2) = 2(2\pi rh)$

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

$\pi r^2 / \pi r = 4/6\ h$

$r = 2/3\ h$

$= 2 \times 10.5 / 3$

$= 7cm$

∴ Radius of base of cylinder is 7cm.

11. Find the cost of plastering the inner surface of a well at Rs 9.50 per m^2, if it is 21 m deep and diameter of its top is 6 m.

Solution:

We have,

Height of cylinder = 21m

Diameter of cylinder = 6m

Radius of cylinder = 6/2 = 3m

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

$= 2 \times 22/7 \times 3 \times 21$

$= 396\ m^2$

∴ Cost of plastering the inner surface at the rate of Rs 9.50 per m^2 = 396×9.50 = Rs 3762

12. A cylindrical vessel open at the top has diameter 20 cm and height 14 cm. Find the cost of tin-plating it on the inside at the rate of 50 paise per hundred square centimetre.

Solution:

We have,

Diameter of base of cylinder = 20 cm
Radius of cylinder = 20/2 = 10cm
Height of cylinder = 14 cm
Total surface area of cylinder = $2\pi rh + \pi r^2$
$= (2 \times 22/7 \times 10 \times 14) + (22/7 \times 10^2)$
$= 880 + 2200/7$
$= (6160+2200)/7$
$= 8360/7\ cm^2$
We know that cost per $100cm^2$ = 50paise
So, cost per $1cm^2$ = Rs 0.005
∴ Cost of tin painting the area inside the vessel = $8360/7 \times 0.005$
= Rs 5.97

13. The inner diameter of a circular well is 3.5 m. It is 10 m deep. Find the cost of plastering its inner curved surface at Rs. 4 per square metre.
Solution:
We have,
Inner diameter of circular well = 3.5 m
Radius of well = 3.5/2 m
Height of well = 10 m
So,
Curved surface area of well = $2\pi rh$
$= 2 \times 22/7 \times 3.5/2 \times 10$
$= 110\ m^2$
We know, Cost of plastering $1m^2$ = Rs 4
∴ Cost of plastering its inner curved surface of area $110m^2 = 110 \times 4$ = Rs 440

14. The diameter of a roller is 84 cm and its length is 120 cm. It takes 500 complete revolutions moving once over to level a playground. What is the area of the playground?
Solution:
We have,
Diameter of roller = 84 cm
Radius of roller = 84/2 = 42cm
Length of roller = 120 cm
Curved surface area of roller = $2\pi rh$
$= 2 \times 22/7 \times 42 \times 120$
$= 31680\ cm^2$
It takes 500 complete revolutions to level the playground.

∴ Area of playground = 500 × 31680
= 15840000 cm^2
= 1584 m^2

15. Twenty one 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:

We have,
Number of pillars = 21
Diameter of pillar = 0.50 m
Radius of pillar = 0.50/2 = 0.25m
Height of pillar = 4 m
Rate of cleaning = Rs 2.5 per m^2
Curved surface area of pillar = $2\pi rh$
= 2 × 22/7 × 0.25 × 4
= 44/7 m^2
Curved surface area of 21 pillars = 21 × 44/7 = 132m^2
∴ Cost of cleaning the pillars at the rate of R 2.50 per m^2 = 2.50 × 132 = Rs 330

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

Solution:

We have,
Total surface area of hollow cylinder = 4620 cm^2
Area of base ring = 115.5 cm^2
Height of cylinder = 7 cm
Let outer radius be 'R' cm , inner radius be 'r' cm

Area of hollow cylinder = $2\pi(R^2 - r^2) + 2\pi Rh + 2\pi rh$
$= 2\pi(R+r)(R-r) + 2\pi h(R+r)$
$= 2\pi(R+r)(h+R-r)$

Area of base = $\pi R^2 - \pi r^2$
$= \pi (R^2 - r^2)$
$= \pi (R+r)(R-r)$

Surface area / area of base = 4620/115.5

$\{2\pi(R+r)(h+R-r)\} / \{\pi(R+r)(R-r)\} = 4620/115.5$
$2(h+R-r) / (R-r) = 4620/115.5$
Let us consider $(R-r) = t$
$2(h+t)/t = 40$
$2h + 2t = 40t$
$2h = 38t$
$2(7) = 38t$
$14 = 38t$
$t = 14/38$
$= 7/19$ cm
∴ Thickness of cylinder is 7/19cm

17. 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 circumference of its base.
Solution:
We have,
Sum of base radius and height of cylinder = 37m
$(r + h) = 37$m
Total surface area = 1628 m^2
By using the formula,
Total surface area = $2\pi r(h+r)$
So,
$2\pi r(h+r) = 1628$
$2 \times 22/7 \times r\,(37) = 1628$
$r = 1628 \times 7 / 2 \times 22 \times 37$
$= 11396 / 1628$
$= 7$m
∴ Circumference of its base = $2\pi r$
$= 2 \times 22/7 \times 7$
$= 44$m

18. 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:
We have,
Radius of cylinder = 3.5 cm
Height of cylinder = 7.5 cm
By using the formulas,
Total surface area = $2\pi r\,(h+r)$

Curved surface area = $2\pi rh$
So, from the question,
Total surface area / Curved surface area = $2\pi r (h+r) / 2\pi rh$
$= (h+r)/h$
$= (3.5+7.5)/7.5$
$= 11/7.5$
$= 110/75$
$= 22/15$
∴ Ratio between the two areas is 22:15

19. A cylindrical 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:
We have,
Radius of base = 70 cm
Height of base = 1.4 m = 140 cm
Rate of tin plating = Rs 3.50 per cm^2
So,
Total surface area of vessel = Area of outer side of base + Area of inner and outer curved surface
$= 2 (\pi r^2 + 2 \pi rh)$
$= 2\pi r (r + 2h)$
$= 2 \times 22/7 \times 70 (70 + 2(140))$
$= 2 \times 22/7 \times 70 (350)$
$= 154000\ cm^2$
∴ Cost of tin coating at the rate of Rs 3.50 per 1000 cm^2 = $3.50/1000 \times 154000$
= Rs 539

EXERCISE 22.2 PAGE NO: 22.25

Use π = 22/7, unless otherwise indicated

1. Find the volume of a cylinder whose
(i) r = 3.5 cm, h = 40 cm
(ii) r = 2.8 m, h = 15 m
Solution:
(i) Given,
r = 3.5 cm
h = 40 cm
By using the formula,
Volume of a cylinder = $\pi r^2 h$
$= 22/7 \times 3.5 \times 3.5 \times 40$
$= 1540\ cm^3$

(ii) Given,
r = 2.8 m
h =15 m
By using the formula,
Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 2.8 \times 2.8 \times 15$
$= 369.6\ m^3$

2. 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
Solution:
(i) Given,
d = 21cm
r = d/2 = 21/2cm
h = 10 cm.
By using the formula,
Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 21/2 \times 21/2 \times 10$
$= 3465\ cm^3$

(ii) Given,

d = 7 m
r = d/2 = 7/2m
h = 24 m
By using the formula,
Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 7/2 \times 7/2 \times 24$
$= 924\ m^3$

3. The area of the base of a right circular cylinder is 616 cm^2 and its height is 25 cm. Find the volume of the cylinder.
Solution:
We have,
Area of base of right circular cylinder = 616 cm^2
Height of cylinder = 2.5 cm
Let the radius of cylinder be 'r' cm
By using the formula,
Area of base of right circular cylinder = πr^2
So,
$\pi r^2 = 616$
$22/7 \times r^2 = 616$
$r^2 = 616 \times 7/22$
$= 196$
$r = \sqrt{196}$
$= 14cm$
∴ Curved surface area of cylinder = $2\pi rh$
$= 2 \times 22/7 \times 14 \times 2.5$
$= 220\ cm^2$

4. The circumference of the base of a cylinder is 88 cm and its height is 15 cm. Find the volume of the cylinder.
Solution:
We have,
Circumference of base of cylinder = 88 cm
Height of cylinder = 15 cm
Let 'r' be the radius of the cylinder.
By using the formula,
Circumference of base of cylinder = $2\pi r$
So,

$2\pi r = 88$
$2 \times 22/7 \times r = 88$
$r = 88 \times 7 / 2 \times 22$
$= 616/44$
$= 14cm$
Radius of cylinder = 14 cm
∴ Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 14 \times 14 \times 15$
$= 9240\ cm^3$

5. A hollow cylindrical pipe is 21 dm long. Its outré and inner diameters are 10 cm and 6 cm respectively. Find the volume of the copper used in making the pipe.
Solution:
We have,
Length of cylinder = 21 dm = 210 cm
Outer diameter = 10 cm
Outer radius, R = 10/2 = 5cm
Inner diameter = 6 cm
Inner radius, r = 6/2 = 3cm
∴ Volume of copper used in making the pipe = $\pi (R^2 - r^2)h$
$= 22/7 (5^2 - 3^2) 210$
$= 22/7 (25-9) 210$
$= 10560\ cm^3$

6. 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.
Solution:
We have,
Height of cylinder = 15 cm
Radius of base = 7 cm
(i) Curved surface area = $2\pi rh$
$= 2 \times 22/7 \times 7 \times 15$
$= 660\ cm^2$

(ii) Total surface area = $2\pi r(h+r)$
$= 2 \times 22/7 \times 7\ (15+7)$
$= 968\ cm^2$

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

$= 22/7 \times 7 \times 7 \times 15$
$= 2310\ cm^3$

7. 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.
Solution:
We have,
Diameter of base of cylinder = 42 cm
Radius of base = d/2 = 42/2 = 21cm
Height = 10 cm
∴ Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 21 \times 21 \times 10$
$= 13860\ cm^3$

8. Find the volume of cylinder, the diameter of whose base is 7 cm and height being 60 cm. Also, find the capacity of the cylinder in litres.
Solution:
We have,
Diameter of base = 7 cm
Radius of base = d/2 = 7/2 cm
Height of cylinder = 60 cm
Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 7/2 \times 7/2 \times 60$
$= 2310\ cm^3$
Capacity of cylinder in litres = 2310 / 1000 = 2.31 litres.

9. A rectangular strip 25 cm× 7 cm is rotated about the longer side. Find the volume of the solid, thus generated.
Solution:
Given,
Dimensions of rectangular strip = 25 cm × 7 cm
When it rotated about longer side it becomes,
Radius of base = 7 cm
Height of cylinder = 25 cm
Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 7 \times 7 \times 25$
$= 3850\ cm^3$

10. A rectangular sheet of paper, 44 cm × 20 cm, is rolled along its length to form a

cylinder. Find the volume of the cylinder so formed.
Solution:
We have,
Dimensions of rectangular sheet = 44cm × 20cm
When it rolled along its length it becomes,
Radius of base = length/2π
= 44×7 / 2×22
= 7cm
Height of cylinder = 20 cm
∴ Volume of cylinder = $\pi r^2 h$
= 22/7 × 7 × 7 × 20
= 3080 cm^3

11. The volume and the curved surface area of cylinder are 1650 cm^3 and 660 cm^2 respectively. Find the radius and height of the cylinder.
Solution:
We have,
Volume of cylinder = 1650 cm^3
Curved surface area = 660 cm^2
Volume of cylinder/curved surface area = 1650/660
$\pi r^2 h / 2\pi rh$ = 1650/660
r/ 2 = 5/2
r = 5cm

Surface area = 660 cm^2
$2\pi rh$ = 660
2 × 22/7 × 5 × h = 660
h = 660×7 / 2×22×5
= 4620/220
= 21cm
∴ Radius = 5cm and height = 21cm

12. The radii of two cylinders are in the ratio 2:3 and their heights are in the ratio 5:3. Calculate the ratio of their volumes.
Solution:
We have,
Ratio of radii of two cylinder = 2:3
Radius of cylinder 1 = r_1
Radius of cylinder 2 = r_2

$r_1/r_2 = 2/3$

Ratio of their heights = 5:3
Height of cylinder 1 = h_1
Height of cylinder 2 = h_2
$h_1/h_2 = 5/3$

Volume of cylinder 1 = v_1
Volume of cylinder 2 = v_2

$v_1 / v_2 = \pi r_1^2 h_1 / \pi r_2^2 h_2$
$= 2^2 \times 5 / 3^2 \times 3$
$= 4 \times 5 / 9 \times 3$
$= 20/27$
∴ Ratio of volumes of two cylinder is 20:27

13. The ratio between the curved surface area and the total surface area of a right circular cylinder is 1:2. Find the volume of the cylinder, if its total surface area is 616 cm^2.
Solution:
We have,
Total surface area of cylinder = 616 cm^2
Ratio between curved surface area and total surface area of cylinder = 1:2
$2\pi rh / 2\pi r (h+r) = 1/2$
$h / (h+r) = 1/2$
$2h = h+r$
$h = r$
We know, $2\pi r (h+r) = 616$
$2\pi r (r+r) = 616$
$2\pi r (2r) = 616$
$4\pi r^2 = 616$
$r^2 = 616/4\pi$
$= 616 \times 7 / 4 \times 22$
$= 4312 / 88$
$= 49$
$r = \sqrt{49}$
$= 7$
Radius = 7cm
Height = 7cm

∴ Volume of cylinder = $\pi r^2 h$
= 22/7 × 7 × 7 × 7
= 1078 cm^3

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

Solution:

We have,
Diameter of base = 21 cm
Radius of base = d/2 = 21/2 cm
Curved surface area = 1320 cm^2
$2\pi rh = 1320$
$2 \times 22/7 \times 21/2 \times h = 1320$
$h = 1320 \times 7 \times 2 / 2 \times 22 \times 21$
= 18480/924
= 20cm
∴ Volume of cylinder = $\pi r^2 h$
= 22/7 × 21/2 × 21/2 × 20
= 6930 cm^3

15. The ratio between the radius of the base and the height of a cylinder is 2:3. Find the total surface area of the cylinder, if its volume is 1617 cm^3.

Solution:

We have,
Ratio between radius and height of a cylinder = 2:3
r/h = 2/3
h = 3/2 r
Volume of cylinder = 1617 cm^3
$\pi r^2 h = 1617$
$22/7 \times r^2 \times 3/2r = 1617$
$r^3 = 1617 \times 7 \times 2 / 22 \times 3$
= 343
$r = \sqrt[3]{343}$
= 7cm
Radius = 7 cm
Height = 3/2r = 3/2 × 7 = 21/2 = 10.5cm
∴ Total surface area of cylinder = $2\pi r (h+r)$
= 2 × 22/7 × 7 (10.5+7)
= 770 cm^2

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

Solution:

We have,

Curved surface area of cylinder = 264 m^2

Volume = 924 m^3

Volume / Curved surface area of cylinder

$\pi r^2h / 2\pi rh = 924 / 264$

$r / 2 = 924 / 264$

$r = 924 \times 2 / 264$

$= 7m$

Radius = 7 m

Diameter of cylinder = 2 × radius = 2×7 = 14m

Curved surface area = 264 m^2

$2\pi rh = 264$

$2 \times 22/7 \times 7 \times h = 264$

$h = 264 \times 7 / 2 \times 22 \times 7$

$= 6m$

∴Height of cylinder is 6m

Diameter of cylinder is 14m

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

Solution:

We have,

Ratio of their height = 1:2

Height of cylinder 1 = h_1

Height of cylinder 2 = h_2

$h_1 / h_2 = 1/2$

Volume of cylinder 1, V_1 = volume of cylinder 2, V_2

$V_1 = V_2$

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

$r_1^2 / r_2^2 = 2/1$

$r_1 / r_2 = \sqrt{(2/1)}$

$= \sqrt{2} / 1$

∴ Ratio of their radii is $\sqrt{2}$:1

18. 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:

We have,

Height of cylinder = 10.5 m

$3(A+A) = 2$ curved surface area (where, A= circular area of box)

$3 \times 2A = 2(2\pi rh)$

$6A = 4\pi rh$

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

$r^2/r = 4\pi h/6\pi$

$r = 2/3\ h$

$= 2 \times 10.5 / 3$

$= 7m$

∴ Volume of cylinder $= \pi r^2 h$

$= 22/7 \times 7 \times 7 \times 10.5$

$= 1617\ m^3$

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

Solution:

We have,

Height of cylinder = 21m

Diameter of well = 6m

Radius of well = d/2 = 6/2 = 3m

Then,

∴ Volume of earth that must be dug out from this well $= \pi r^2 h$

$= 22/7 \times 3 \times 3 \times 21$

$= 594\ m^3$

20. The trunk of a tree is cylindrical and its circumference is 176 cm. If the length of the trunk is 3 m, find the volume of the timber that can be obtained from the trunk.

Solution:

We have,

Length of the trunk = 3m = 300 cm

Circumference of trunk of tree = 176 cm

$2\pi r = 176$

$2 \times 22/7 \times r = 176$

$r = 176 \times 7 / 2 \times 22$

= 28cm
Radius = 28cm
∴ Volume of timber can be obtained from trunk of tree = $\pi r^2 h$
= 22/7 × 28 × 28 × 300
= 7392 cm^3
= 0.74 m^3

21. A well is dug 20 m deep and it has a diameter of 7 m. The earth which is so dug out is spread out on a rectangular plot 22 m long and 14 m broad. What is the height of the platform so formed?
Solution:
We have,
Depth of well = 20m
Diameter of well = 7 m
Radius of well = d/2 = 7/2 m
Dimension of rectangular field = 22m × 14m
Volume of earth dug out from well = $\pi r^2 h$
= 22/7 × 7/2 × 7/2 × 20
= 770 m^3
When this earth is spread on rectangular field,
Then,
∴ Height of platform formed on rectangular field = volume of earth dug out / area of field
= 770/ (22×14)
= 2.5m

22. 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.
Solution:
We have,
Diameter of well = 14 m
Radius of well = d/2 = 14/2 = 7m
Depth of well = 8 m
Volume of earth dug out from well = $\pi r^2 h$
= 22/7 × 7 × 7 × 8
= 1232 m^3

This earth is spread out on width of 21 m.
Area × h = 1232

$\pi(R^2 - r^2)\, h = 1232$
$\pi(28^2 - 7^2)\, h = 1232$
$22/7\ (735)\, h = 1232$
$h = 1232 \times 7 / 22 \times 735$
$= 8624/16170$
$= 0.533$ m
$= 53.3$ cm
∴ Height of embankment is 53.3 cm

23. A cylindrical container with diameter of base 56 cm contains sufficient water to submerge a rectangular solid of iron with dimensions 32 cm×22 cm×14 cm. Find the rise in the level of the water when the solid is completely submerged.
Solution:
We have,
Diameter of base of cylindrical vessel = 56 cm
Radius of base = d/2 = 56/2 = 28cm
Dimensions of rectangular solid vessel = 32cm × 22cm × 14cm
Volume of rectangular solid vessel = $32 \times 22 \times 14 = 9856\ cm^3$
Let the rise of water level be 'h' cm
Volume of cylindrical container = Volume of rectangular solid vessel
$\pi r^2 h = 9856$
$22/7 \times 28 \times 28 \times h = 9856$
$h = 9856 \times 7 / 22 \times 28 \times 28$
$= 68992 / 17248$
$= 4$cm
∴ Rise in water level is 4cm.

24. A rectangular sheet of paper 30 cm × 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.
Solution:
We have,
Dimensions of rectangular sheet = 30 cm × 18 cm
Case (i)
When paper is rolled along its length
$2\pi r = 30$
$r = 30 / 2\pi$ cm
Height = 18 cm

Volume of cylinder, $V_1 = \pi r^2 h$
$= \pi \times (30/2\pi)^2 \times 18\ cm^3$

Case (ii)
When paper is rolled along its breadth
$2\pi r = 18$
$r = 18/2\pi$ cm
Height = 30 cm
Volume of cylinder, $V_2 = \pi r^2 h$
$= \pi \times (18/2\pi)^2 \times 30\ cm^3$

Hence,
Volume of cylinder, V_1 / Volume of cylinder, $V_2 = \{\pi \times (30/2\pi)^2 \times 18\}/\{\pi \times (18/2\pi)^2 \times 30\}$
$= \{\pi \times (30/2\pi)^2 \times 18\} \times 1/\{\pi \times (2\pi/18)^2 \times 30\}$
$= 30^2 \times 18 / 18^2 \times 30$
$= 30/18$
$= 5/3$

∴ The ratio of two volumes is 5:3

25. The rain which falls on a roof 18 m long and 16.5 m wide is allowed to be stored in a cylindrical tank 8 m in diameter. If it rains 10 cm on a day, what is the rise of water level in the tank due to it?
Solution:
We have,
Dimensions of roof = 18 m × 16.5 m
Diameter of cylindrical tank = 8 m
Radius of tank = d/2 = 8/2 = 4m
Given that, it rains 10 cm a day or 0.1m a day
Let the rise in level of tank be 'h'
Volume of tank = volume of roof
$\pi r^2 h = lbh$
$22/7 \times 4 \times 4 \times h = 18 \times 16.5 \times 0.1$
$h = (18 \times 16.5 \times 0.1 \times 7) / 22 \times 4 \times 4$
$= 207.9/352$
$= 0.5906m = 59.06cm$
∴ Rise in water level is 59.06cm

26. A piece of ductile metal is in the form of a cylinder of diameter 1 cm and length 5 cm. It is drawn-out into a wire of diameter 1 mm. What will be the length of the

wire so formed?
Solution:
We have,
Diameter of metallic cylinder = 1 cm
Radius of metallic cylinder = d/2 = 1/2 = 0.5 cm
Length of cylinder = 5 cm

Diameter of wire drawn from it = 1 mm = 0.1 cm
Radius of wire = 0.5mm = 0.05cm
Let length of wire be 'h' cm
Length of wire drawn from metal = volume of metal/ volume of wire
$= \pi r^2h / \pi r^2$
$= (½)^2 \times 5 / (0.05)^2$
$= (5/4) / 0.0025$
$= 1.25/0.0025$
$= 500$ cm
$= 5$m
∴ Length of the wire is 5m.

27. 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:
We have,
Weight of copper wire = 13.2 kg = 13200 gm
Diameter of wire = 4 mm
Radius of wire = d/2 = 4/2 = 2mm = 0.2cm
Let length of wire be 'h' cm
So,
Weight (Density) of 1 cubic cm wire = 8.4 gm
We know, volume = weight/density
Volume × density = weight
$\pi r^2h \times 8.4 = 13200$
$22/7 \times 0.2 \times 0.2 \times h \times 8.4 = 13200$
$h = 13200 \times 7 / 22 \times 0.2 \times 0.2 \times 8.4$
$= 92400/7.392$
$= 12500$ cm $= 125$m
∴ Length of 13.2kg of copper wire is 125 m.

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

Find the length of the wire.
Solution:
We have,
Diameter of cylindrical wire = 0.25 cm
Radius of wire = d/2 = 0.25/2 = 0.125cm
Let length of wire be 'h' cm
Volume of brass wire = 2.2 dm^3 = 2200 cm^3
$\pi r^2 h = 2200$
$22/7 \times 0.125 \times 0.125 \times h = 2200$
$h = 2200 \times 7 / 22 \times 0.125 \times 0.125$
$= 15400 / 0.34375$
$= 44800$ cm
$= 448$m
∴ Length of the wire is 448m.

29. 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.
Solution:
We have,
Length of cylindrical tube = 14 cm
Let outer radius of tube = R cm
Let inner radius of tube = r cm

Difference between inside and outside surface = 88 cm^2
$2\pi (R-r) h = 88$ ….. (i)

Volume of cylinder = 176 cm^3
$\pi (R^2 - r^2) h = 176$ ….. (ii)

Dividing equation (i) by equation (ii)
$2\pi (R-r) h / \pi (R^2 - r^2) h = 88/176$
$2 / R + r = 1/2$
$R+r = 4$ ……. (iii)

From equation (ii)
$\pi (R^2 - r^2) h = 176$
$\pi (R+r) (R-r) h = 176$
$22/7 \times 4 \times (R-r) \times 14 = 176$

R-r = 176×7 / 22×4×14
= 1232/1232
R-r = 1 .....(iv)

By adding equation (iii) and (iv)
R+r = 4
R-r = 1
2R = 5
R = 5/2 = 2.5cm

R-r = 1
r = 2.5 – 1
= 1.5cm
∴ Inner and outer radii are 2.5cm and 1.5cm

30. Water flows out through a circular pipe whose internal diameter is 2 cm, at the rate of 6 metres per second into a cylindrical tank, the radius of whose base is 60 cm. Find the rise in the level of water in 30 minutes?
Solution:
We have,
Internal diameter of pipe = 2 cm
Internal radius of pipe = d/2 = 2/2 = 1cm

Rate of flow of water = 6 m/s = 600 cm/s
Radius of base of cylindrical tank = 60 cm
Rise in height in cylindrical tank = rate of flow of water × total time × volume of pipe / volume of cylindrical tank
= (600 × 30 × 60 × π × 1 × 1) / (π × 60 × 60)
= 1080000/3600
= 300 cm
= 3m
∴ Rise in water level is 3m.

31. A cylindrical tube, open at both ends, is made of metal. The internal diameter of the tube is 10.4 cm and its length is 25 cm. The thickness of the metal is 8 mm everywhere. Calculate the volume of the metal.
Solution:
We have,
Internal diameter of cylindrical tube = 10.4 cm

Internal radius of tube = d/2 = 10.4/2 = 5.2cm
Length of tube = 25 cm
Thickness of metal = 8 mm = 0.8 cm

Outer radius of tube = R = 5.2+0.8 = 6 cm
∴ Volume of metal = $\pi (R^2 - r^2) \times l$
$= 22/7 \times (6^2 - 5.2^2) \times 25$
$= 22/7 \times (36 - 27.04) \times 25$
$= 704\ cm^3$

32. From a tap of inner radius 0.75 cm, water flows at the rate of 7 m per second. Find the volume in litres of water delivered by the pipe in one hour.
Solution:
We have,
Inner radius of tap = 0.75 cm
Length of water flowing in 1s = 7m = 700 cm
Volume of water per second derived from tap = $\pi r^2 l$
$= 22/7 \times 0.75 \times 0.75 \times 700$
$= 1237.5\ cm^3$
∴ Volume of water derived in 1 hour (3600 sec) = $(1237.5 \times 3600)/1000$
= 4455 litres

33. A cylindrical water tank of diameter 1.4 m and height 2.1 m is being fed by a pipe of diameter 3.5 cm through which water flows at the rate of 2 metre per second. In how much time the tank will be filled?
Solution:
We have,
Diameter of cylindrical tank = 1.4 m
Radius of tank = d/2 = 1.4/2 = 0.7m
Height of tank = 2.1 m

Diameter of pipe flowing water in tank = 3.5 cm
Radius of pipe = d/2 = 3.5/2 cm
Rate of flow of water = 2 m/s
Time taken to fill the tank = volume of tank / volume of pipe × rate of flow
$= \pi r^2 h / (\pi r^2 \times 2)$
$= (\pi \times 0.7 \times 0.7 \times 2.1) / (\pi \times 3.5/2 \times 3.5/2 \times 2)$
$= 1.029 / 6.125$
$= 0.168$

= 1680 seconds
= 128 minutes.

∴ Time taken to fill the tank is 128minutes.

34. A rectangular sheet of paper 30 cm × 18 cm 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.

Solution:

We have,

Dimensions of rectangular sheet = 30 cm × 18 cm

Case (i)

When paper is rolled along its length

$2\pi r = 30$

$r = 30 / 2\pi$ cm

Height = 18 cm

Volume of cylinder, $V_1 = \pi r^2 h$

$= \pi \times (30/2\pi)^2 \times 18$ cm^3

Case (ii)

When paper is rolled along its breadth

$2\pi r = 18$

$r = 18/2\pi$ cm

Height = 30 cm

Volume of cylinder, $V_2 = \pi r^2 h$

$= \pi \times (18/2\pi)^2 \times 30$ cm^3

Hence,

Volume of cylinder, V_1 / Volume of cylinder, $V_2 = \{\pi \times (30/2\pi)^2 \times 18\}/\{\pi \times (18/2\pi)^2 \times 30\}$

$= \{\pi \times (30/2\pi)^2 \times 18\} \times 1/\{\pi \times (2\pi/18)^2 \times 30\}$

$= 30^2 \times 18 / 18^2 \times 30$

$= 30/18$

$= 5/3$

∴ The ratio of two volumes is 5:3

35. How many litres of water flows 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:

We have,

Cross section area of pipe = 5 cm^2
Speed of water = 30 cm/s
Time = 1 minute = 60 sec
Volume of water flows through pipe = Area of cross section × speed of flow × time
= 5 × 30 × 60
= 9000 cm^3
= 9000/1000 = 9 litres
∴ 9 litres of water flows out of pipe.

36. A solid cylinder has a total surface area of 231 cm^2. It curved surface area is 2/3 of the total surface area. Find the volume of the cylinder.
Solution:
We have,
Total surface area of cylinder = 231 cm^2
Curved surface area = 2/3 total surface area = 2/3 × 231 = 154 cm^2
$2\pi rh = 2/3\ 2\pi r(h + r)$
$3h = 2(h+r)$
$3h = 2h + 2r$
$h = 2r$ ..... (i)
And,
$2\pi r(h + r) = 231$
$2 \times 22/7 \times r \times (2r+r) = 231$
$2 \times 22/7 \times r \times 3r = 231$
$3r^2 = 231 \times 7 / 2 \times 22$
$= 1617 / 44$
$= 36.75$
$r^2 = 36.75 / 3$
$= 12.25$
$r = \sqrt{12.25}$
$= 3.5$ cm

Since, $h = 2r = 2 \times 3.5 = 7$cm
∴ Volume of cylinder = $\pi r^2 h$
$= 22/7 \times 3.5 \times 3.5 \times 7$
= 269.5 cm^3

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

Solution:
We have,
Depth of tube well = 280 m
Diameter of tube well = 3 m
Radius of well = d/2 = 3/2 = 1.5 m
Volume = $\pi r^2 h$
$= 22/7 \times 1.5 \times 1.5 \times 280$
$= 1980\ m^3$

∴ Cost of sinking tube well at rate Rs 3.60/m^3 = 1980 × 3.60 = Rs 7128
Curved surface area = $2\pi rh$
$= 2 \times 22/7 \times 1.5 \times 280$
$= 2640\ m^2$
∴ Cost of cementing its inner curved surface at rate Rs 2.50/m^2 = 2.50 × 2640 = Rs 6600

38. Find the length of 13.2 kg of copper wire of diameter 4 mm, when 1 cubic cm of copper weighs 8.4 gm.
Solution:
We have,
Weight of copper wire = 13.2 kg = 13200 gm
Diameter of wire = 4 mm
Radius of wire = d/2 = 4/2 = 2mm = 0.2cm
Let length of wire be 'h' cm
So,
Weight (Density) of 1 cubic cm wire = 8.4 gm
We know, volume = weight/density
Volume × density = weight
$\pi r^2 h \times 8.4 = 13200$
$22/7 \times 0.2 \times 0.2 \times h \times 8.4 = 13200$
$h = 13200 \times 7 / 22 \times 0.2 \times 0.2 \times 8.4$
$= 92400/7.392$
$= 12500$ cm = 125m
∴ Length of 13.2kg of copper wire is 125 m.

39. 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.
Solution:
We have,
Diameter of cylindrical wire = 0.25 cm

Radius of wire = d/2 = 0.25/2 = 0.125cm
Let length of wire be 'h' cm
Volume of brass wire = 2.2 dm^3 = 2200 cm^3
$\pi r^2 h = 2200$
$22/7 \times 0.125 \times 0.125 \times h = 2200$
$h = 2200 \times 7 / 22 \times 0.125 \times 0.125$
$= 15400 / 0.34375$
$= 44800$ cm
$= 448$m
∴ Length of the wire is 448m.

40. A well with 10 m inside diameter is dug 8.4 m deep. Earth taken out of it is spread all around it to a width of 7.5 m to form an embankment. Find the height of the embankment.
Solution:
We have,
Diameter of well = 10 m
Radius of well = d/2 = 10/2 = 5m
Depth of well = 8.4 m
Volume of earth dug out from well = $\pi r^2 h$
$= 22/7 \times 5 \times 5 \times 8.4$
$= 660\ m^3$

This earth is spread out on width of 7.5 m.
inner radii, r = 5m and outer radii, R = (5+7.5) = 12.5cm
Area × h = 660
$\pi(R^2 - r^2) h = 660$
$\pi(12.5^2 - 5^2) h = 660$
$22/7\ (131.25)\ h = 660$
$h = 660 \times 7 / 22 \times 131.25$
$= 4620/2887.5$
$= 1.6$ m
∴ Height of embankment is 1.6m.

41. 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:
We have,
Width of roller = 63 cm

Thickness of roller = 4 cm
Girth (perimeter) = 440 cm
$2\pi R = 440$
$2 \times 22/7 \times R = 440$
$R = 440 \times 7 / 2 \times 22$
$= 70$cm
Inner radius = R - thickness = 70 - 4 = 66 cm
Volume of cylindrical iron = $\pi(R^2 - r^2)\,l$
$= 22/7 \times (70^2 - 66^2) \times 63$
$= 22/7 \times 594 \times 63$
$= 107712\ cm^3$
∴ The volume of iron is $107712 cm^3$

42. 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?
Solution:
We have,
Length of solid cylinder = L
Diameter o cylinder = 2 cm
Radius of cylinder = d/2 = 2/2 = 1cm
Volume of cylinder = $\pi r^2 L$ ..... (i)

Length of hollow cylinder = 16 cm
External diameter = 20 cm
External radius = 20/2 = 10cm
Thickness = 2.5 mm = 0.25 cm

Inner radius = 10 - 0.25 = 9.75 cm
Volume = $\pi (R^2 - r^2)\,l$ .....(ii)

From (i) and (ii)
$\pi r^2 L = \pi (R^2 - r^2)\,l$
$\pi \times 1 \times 1 \times L = \pi \times (10^2 - 9.75^2) \times 16$
L = 79cm
∴ The length of the solid cylinder should be 79cm.

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

raised.

Solution:

We have,

Diameter of well = 7 m

Radius of well = d/2 = 7/2 = 3.5m

Depth of well = 10 m

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

$= 22/7 \times 3.5 \times 3.5 \times 10$

$= 385\ m^3$

Area of embankment field = $30 \times 20 - 22/7 \times 7/2 \times 7/2$

$= 600 - 38.5 = 561.5\ m^2$

Volume of well =Area of embankment field × height of embankment

$385 = 561.5 \times h$

$h = 385/561.5$

$= 0.6856m$

$= 68.56\ cm$

∴ Height of embankment is 68.56 cm