22. Mensuration-III (Surface Area and Volume of a Right Circular Cylinder

Exercise 22.1

1. Question

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

Answer

Given,

Diameter of cylinder = 7 cm

Height of cylinder = 60 cm

So,

Radius of cylinder = $\frac{7}{2}\ cm$

Curved surface area of cylinder = 2πrh = $2\times\frac{22}{7}\times\frac{7}{2}\times60 = 1320\ cm^2$

Total surface area of cylinder = $2\pi r(h+r) = 2\times\frac{22}{7}\times\frac{7}{2}\left(60+\frac{7}{2}\right) = 1397\ cm^2$

2. Question

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

Answer

Given,

Curved surface area of cylindrical road =132 cm^2

Radius of road = 0.35 cm

Let length of road = h cm

So,

= $2\pi rh = 132$

=$2\times\frac{22}{7}\times0.35\times h = 132$

= $h = \frac{132}{44\times0.05} = 60\ cm$

Length of road = 60 cm

3. Question

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.

Answer

Given,

Area of base of right circular cylinder = 616 cm^2

Height of cylinder = 2.5 cm

Let the radius of cylinder = r cm

So,

= $\pi r^2 = 616$

$= r^2 = \frac{616 \times 7}{22} = 28 \times 7$

$= r = \sqrt{7 \times 7 \times 2 \times 2} = 14\ cm$

∴ Curved surface area of cylinder = $2 \times \frac{22}{7} \times 14 \times 2.5 = 220\ cm^2$

4. Question

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.

Answer

Given,

Circumference of base of cylinder = 88 cm

Height of cylinder = 15 cm

So,

$= 2\pi r = 88$ Given

$= r = \frac{88}{2\pi} = \frac{88 \times 7}{2 \times 22} = 14\ cm$

Radius of cylinder = 14 cm

∴ Curved surface area of cylinder = $2\pi rh = 2 \times \frac{22}{7} \times 14 \times 15 = 1320\ cm^2$

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

5. Question

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

Answer

Given,

Dimension of rectangular strip = 25 cm × 7cm

When this strip is rotated about its longer side :

So,

Height of cylinder thus form = 25 cm

Radius = 7 cm

∴ Total surface area of cylinder = $2\pi r(h + r) = 2 \times \frac{22}{7} \times 7 \times 32 = 1408\ cm^2$

6. Question

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.

Answer

Given,

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

When this sheet of paper is rolled along its length:

So,

Circumference of base thus form = 44 cm

$= 2\pi r = 44$

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

Radius = 7 cm

Height = 20 cm

∴ Total surface area of cylinder $= 2\pi r(h + r) = 2 \times \frac{22}{7} \times 7 \times 27 = 1188\ cm^2$

7. Question

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.

Answer

Given,

Ratio of radius of two cylinder = 2:3

Ratio of their heights = 5:3

$= \frac{r_1}{r_2} = \frac{2}{3}, \frac{h_1}{h_2} = \frac{5}{3}$

So,

$= \frac{curved\ surface\ area\ of\ cylinder\ 1}{curved\ surface\ area\ of\ cylinder\ 2} = \frac{2\pi r_1 h_1}{2\pi r_2 h_2} = \frac{2 \times \frac{22}{7} \times 2 \times 5}{2 \times \frac{22}{7} \times 3 \times 3} = \frac{10}{9}$

Hence,

Ratio of their curved surface area would be = 10 : 9

8. Question

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.

Answer

Given,

$= \frac{curved\ surface\ area\ of\ cylinder}{total\ surface\ area\ of\ cylinder} = \frac{1}{2}$

Let radius of cylinder = r

Let height of cylinder = h

So,

$= \frac{2\pi rh}{2\pi r(h+r)} = \frac{1}{2}$

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

$= 2h = h + r$

$= 2h - h = r$

$= h = r\ ,\ height = radius$

9. Question

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

Answer

Given,

Curved surface area of cylinder = 1320 cm^2

Diameter of base = 21 cm

Radius of cylinder = $\frac{21}{2}\ cm$

Let height of cylinder = h cm

So,

$= 2\pi rh = 1320$

$= h = \frac{1320}{2\pi r} = \frac{1320 \times 7 \times 2}{2 \times 22 \times 21} = 20\ cm$

Height of cylinder = 20 cm

10. Question

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.

Answer

Given,

Height of cylinder = 10.5 cm

Let radius of cylinder = r cm

So,

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

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

Now,

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

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

$= 3r = 2 \times 10.5$

$= r = \frac{2 \times 10.5}{3} = 7\ cm$

Radius of base of cylinder = 7 cm

11. Question

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 diamwter of its top is 6 m.

Answer

Given,

Height of cylinder = 21 m

Diameter of cylinder = 6 m

Radius of cylinder = $\frac{6}{2} = 3m$

So,

Curved surface area of cylinder = $2\pi rh = 2 \times \frac{22}{7} \times 3 \times 21 = 396\ m^2$

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

12. Question

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.

Answer

Given,

Diameter of base of cylinder = 20 cm

Radius of cylinder = $\frac{20}{2} = 10\ cm$

Height of cylinder = 14 cm

Total surface area of cylinder = $2\pi r(h+r) = 2\times\frac{22}{7}\times10\left(\frac{10}{2}+14\right) = \frac{8360}{7}\ cm^2$

∴ Cost of tin painting it inside at rate 50 paise per cm^2 = $\frac{8360}{7}\times\frac{50}{100} = Rs\ 5.97$

13. Question

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.

Answer

Given,

Inner diameter of circular well = 3.5 m

Radius of well = $\frac{3.5}{2}\ m$

Height of well = 10 m

So,

Curved surface area of well = $2\pi rh = 2\times\frac{22}{7}\times\frac{3.5}{2}\times10 = 110\ m^2$

∴ Cost of plastering its inner curved surface at rate Rs. 4 per m^2 = 110 ×4 = Rs. 440

14. Question

The diameter of a roller is 84 cm and its length is 120 cm. It takes 500 complete revolutions moving monce over to level a playground. What is the area of the playground?

Answer

Given,

Diameter of roller = 84 cm

Radius of roller = $\frac{84}{2} = 42\ cm$

Length of roller = 120 cm

So,

Curved surface area of roller = $2\pi rh = 2\times\frac{22}{7}\times42\times120 = 31680\ cm^2$

No. of revolution it takes to level $the\ ground = 500\ given$

Hence,

Area of play ground = 500 × 31680 = 15840000 cm^2 = 1584 m^2

15. Question

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 matre?

Answer

Given,

Number of pillars = 20

Diameter of pillar = 0.50 m

Radius of pillar = $\frac{0.50}{2} = 0.25\ m$

Height of pillar = 4 m

So,

Curved surface area of pillar = $2\pi rh = 2\times\frac{22}{7}\times0.25\times4 = \frac{44}{7}m^2$

Curved surface area of 20 pillars = $20\times\frac{44}{7} = \frac{880}{7}m^2$

∴ Cost of cleaning them at rate Rs.2.50 per m^2 = Rs. $\left(\frac{880}{7}\times2.50\right) = Rs.314.28$

16. Question

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.

Answer

Given,

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 = R cm , inner radius = r cm

So,

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

$\therefore \frac{surface\ area}{area\ of\ base} = \frac{4620}{115.5}$

$= \frac{[2\pi(R+r)(h+R-r)]}{[\pi(R+r)(R-r)]} = \frac{4620}{115.5}$

$= \frac{h+t}{t} = \frac{20}{1}$

$= h + t = 20t$

$= t = \frac{h}{19} = \frac{7}{19}$

Thickness of cylinder = $\frac{7}{19}cm$

17. Question

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.

Answer

Given,

Sum of base radius and height of cylinder = 37 m

Total surface area = 1628 m^2

So,

= r + h = 37

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

= $2\pi r = \frac{1628}{37} = 44$

= $2\pi r = 44m$

18. Question

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.

Answer

Given,

Radius of cylinder = 3.5 cm

Height of cylinder = 7.5 cm

So,

$= \frac{total\ surface\ area\ of\ cylinder}{curved\ surface\ area} = \frac{[2\pi r(h+r)]}{2\pi rh} = \frac{h+r}{h} = \frac{3.5+7.5}{7.5} = \frac{22}{15} = 22:15.$

19. Question

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.

Answer

Given,

Radius of base = 70 cm

Height of base = 1.4 m = 140 cm

So,

Area = $2\pi r\left(h+\frac{r}{2}\right) = 2\times\frac{22}{7}\times70\left(140+\frac{70}{2}\right) = 2\times22\times10(175)\ cm^2$

Tin coating must be done on both side so Area = $2(2\times22\times10(175)cm^2$

∴ Cost of tin coating at rate Rs.3.50 per 1000 cm^2 = $\frac{[2\times2\times22\times10\times175]}{1000} = \frac{5390}{10} = Rs.539$

Exercise 22.2

1. Question

Find the volume of a cylinder whose

(i) r = 3.5 cm, h = 40 cm

(ii) r = 2.8 m, h = 15 m

Answer

(i) Given,

r = 3.5 cm

h = 40 cm

Volume = $\pi r^2 h = \frac{22}{7}\times3.5\times3.5\times40 = 1540\ cm^3$

(ii) Given,

r = 2.8 m

h =15 m

volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 2.8 \times 2.8 \times 15 \ = 369.6\, m^3$

2. Question

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

Answer

(i) Given,

D =21cm

r = $\frac{d}{2} = \frac{21}{2} cm$

h = 10 cm

Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 10 = 3645\ cm^3$

(ii) Given,

d = 7 m

r = $\frac{7}{2} m$

h = 24 m

Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 24 = 924\, m^3$

3. Question

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.

Answer

Given,

Area of base = 616 cm^2

Height = 25 cm

∴ volume of cylinder = $area\ of\ base \times height = 616 \times 25 = 15900\ cm^3$

4. Question

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

Answer

Given,

Circumference of base = 88 cm

Height = 15 cm

So,

= $2\pi r = 88$

= $r = \frac{88}{2\pi} = \frac{88 \times 7}{44} = 14\ cm$

Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 14 \times 14 \times 15 = 9240\ cm^3$

5. Question

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.

Answer

Given,

Length of cylinder = 21 dm = 210 cm

Outer diameter = 10 cm

Outer radius = $R = \frac{10}{2} = 5\ cm$

Inner diameter = 6 cm

Inner radius = $r = \frac{6}{2} = 3\ cm$

∴ Area of base = $\pi(R^2 - r^2) = \pi(25 - 9) = 16\pi\ cm^2$

Volume of cylinder = $area\ of\ base \times height = 16\pi \times 210 = 16 \times \frac{22}{7} \times 210 = 10560\ cm^3$

6. Question

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.

Answer

Given,

Height of cylinder = 15 cm

Radius of base = 7 cm

i) Curved surface area = $2\pi rh = 2 \times \frac{22}{7} \times 7 \times 7 \times 15 = 660\ cm^2$

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

iii) Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 15 = 2310\ cm^3$

7. Question

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.

Answer

Given,

Diameter of base of cylinder = 42 cm

Radius of base = $\frac{42}{2} = 21\ cm$

Height = 10 cm

∴ volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 21 \times 21 \times 10 = 13860\ cm^3$

8. Question

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.

Answer

Given,

Diameter of base = 7 cm

Radius of base = $\frac{7}{2}\ cm$

Height of cylinder = 60 cm

∴ Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 60 = 2310\ cm^3$

Capacity of cylinder in litres = $\frac{2310}{1000} = 2.31\ litre$

9. Question

A rectangular strip 25 cm× 7 cm is rotated about the longer side. Find the volume of the solid, thus generated.

Answer

Given,

Dimensions of rectangular srip = 25 cm × 7 cm

When it rotated about longer side :

Radius of base = 7 cm

Height of cylinder = 25 cm

∴ Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 25 = 3850\ cm^3$

10. Question

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.

Answer

Given,

Dimensions of rectangular sheet = 44 cm×20 cm

When it rolled along its length :

Radius of base = $\frac{length}{2\pi} = \frac{44 \times 7}{2 \times 22} = 7cm$

Height of cylinder = 20 cm

∴ Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 20 = 3080\ cm^3$

11. Question

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.

Answer

Given,

Volume of cylinder = 1650 cm^3

Curved surface area = 660 cm^2

So,

$= \frac{volume\ of\ cylinder}{curved\ surface\ area} = \frac{1650}{660}$

$= \frac{\pi r^2 h}{2\pi r h} = \frac{5}{2}$

$= \frac{r}{2} = \frac{5}{2} = r = 5\ cm$

We have ,

Surface area = 660 cm^2

$= 2\pi rh = 660$

$= h = \frac{660}{2\pi r} = \frac{660 \times 7}{2 \times 22 \times 5} = 21\ cm$

Radius = 5 cm , height = 21 cm

12. Question

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.

Answer

Given,

Ratio of radii of two cylinder = 2 : 3

$= \frac{r_1}{r_2} = \frac{2}{3}$

Ratio of their heights = 5 : 3

$= \frac{h_1}{h_2} = \frac{5}{3}$

$\therefore \frac{volume\ of\ cylinder\ 1}{volume\ of\ cylinder\ 2} = \frac{\pi r_1^2 h_1}{\pi r_2^2 h_2} = \frac{4 \times 5}{9 \times 3} = \frac{20}{27}$

Ratio of volumes of two cylinder = 20 : 27

13. Question

The ratio between the curved surface area dna the total surface area of a right circular cylinder is 1 : 2. Find the volume of the cylinder, if its total surface area os 616 cm^2.

Answer

Given,

Total surface area of cylinder = 616 cm^2

Ratio between curved surface area and total surface area of cylinder = 1 : 2

$= \frac{2\pi rh}{2\pi r(h+r)} = \frac{1}{2}$

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

$= 2h = h + r$

$= h = r$

$= 2\pi r(h + r) = 616\ Given$

$= 2\pi r \times 2r = 616\ (putiing\ h = r)$

$= r^2 = \frac{616}{4\pi} = \frac{616 \times 7}{4 \times 22} = 49$

$= r = \sqrt{49} = 7$

Radius = 7 cm = height

$\therefore$ Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 7 = 1078\ cm^3$

14. Question

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

Answer

Given,

Curved surface area = 1320 cm^2

Diameter of base = 21 cm

Radius of base = $\frac{diameter}{2} = \frac{21}{2}\ cm$

So,

$= 2\pi rh = 1320$

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

$= h = \frac{1320\times14}{2\times22\times21} = 20\ cm$

∴ Volume of cylinder = $\pi r^2 h = \frac{22}{7}\times\frac{21}{2}\times\frac{21}{2}\times20 = 6930\ cm^3$

15. Question

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

Answer

Given,

Ratio between radius and height of a cylinder = 2:3

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

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

Volume of cylinder = 1617 cm^3

$= \pi r^2 h = 1617$

$= \frac{22}{7}\times r^2\times\frac{3}{2}r = 1617$

$= r^3 = \frac{1617\times14}{66} = 343$

$= r = \sqrt{343} = 7\ cm$

Radius = 7 cm

Height = $\frac{3}{2}\times7 = \frac{21}{2}cm = 10.5\ cm$

∴ total surface area of cylinder = $2\pi r(h+r) = 2\times\frac{22}{7}\times7(7+10.5) = 44\times17.5 = 770cm^2$

16. Question

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.

Answer

Given,

Curved surface area of cylinder = 264 m^2

Volume = 924 m^3

So,

$= \frac{volume}{curved\ surface\ area} = \frac{\pi r^2 h}{2\pi rh} = \frac{924}{264}$

$= r = 7\ m$

Radius = 7 m

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

Curved surface area = 264 m^2

$= 2\pi rh = 264$

$= 2\times\frac{22}{7}\times7\times h = 264$

$= h = \frac{264\times7}{2\times22\times7} = 6\ m$

Height of cylinder = 6 m

17. Question

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

Answer

Given,

Volume of cylinder 1 = volume of cylinder 2

Ratio of their height = 1 : 2

$= \frac{h_1}{h_2} = \frac{1}{2}$

We have,

$= V_1 = V_2$

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

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

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

18. Question

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.

Answer

Given,

Height of cylinder = 10.5 m

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

$= 3\times2A = 2\ (2\pi rh)$

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

$= r = \frac{2h}{3} = \frac{2\times10.5}{3} = 7m$

Volume of cylinder = $\pi r^2 h = \frac{22}{7}\times7\times7\times10.5 = 1617\ cm^3$

19. Question

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

Answer

Given,

Height of cylinder = 21 m

Diameter of well = 6 m

radius of well = $\frac{6}{2} = 3m$

so,

Amount of earth can be dug out from this well = $\pi r^2 h = \frac{22}{7} \times 3 \times 3 \times 21 = 594\, m^3$

20. Question

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.

Answer

Given,

Circumference of trunk of tree = 176 cm

Length of the trunk = 3m = 300 cm

so,

= $2\pi r = 176$

= $r = \frac{176}{2\pi} = \frac{176 \times 7}{44} = 28\, cm$

= $radius\ of\ trunk\ of\ tree = 28\, cm$

hence,

Volume of timber can be obtained from trunk of tree = $\pi r^2 h = \frac{22}{7} \times 28 \times 28 \times 300 = 7392\, cm^3 = 0.74 m^3$

21. Question

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?

Answer

Given,

Depth of well = 20m

Diameter of well = 7 m

Radius of well = $\frac{7}{2} m$

Dimension of rectangular field = 22m × 14m

so,

Amount of earth dug out from well = $\pi r^2 h = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 20 = 770\, m^3$

when this earth is spread on rectangular field:

Then height of platform formed on rectangular field = $\frac{volume\ of\ earth\ dug\ out}{area\ of\ rectangular\ field} = \frac{770}{22 \times 14} = 2.5\, m$

22. Question

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.

Answer

Given,

Diameter of well = 14 m

Radius of well = $\frac{14}{2} = 7\ m$

depth of well = 8 m

so,

Amount of earth dug out from well = $\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 8 = 1232\ m^3$

This earth is spread out on width of 21 m.

= Area ×h = 1232

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

= $\pi \times 735 \times h = 1232$

= $h = \frac{1232 \times 7}{735 \times 22} = \frac{56}{12} = 0.533\ m = 53.3\ cm$

Height of embankment = 53.3 cm

23. Question

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

Answer

Given,

Diameter of base of cylindrical vessel = 56 cm

Radius of base = $\frac{56}{2} = 28\ cm$

Dimensions of rectangular solid vessel = 32 cm ×22 cm×14 cm

let rise in water level in vessel = h cm

so,

Volume of vessel = $\pi r^2 h = \frac{22}{7} \times 28 \times 28 \times h\ cm^3$

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

= $h = \frac{32 \times 22 \times 14 \times 7}{22 \times 28 \times 28} = 4$ cm

24. Question

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.

Answer

Given,

Dimensions of rectangular sheet = 30 cm× 18 cm

Case (i)

when paper is rolled along its length :

= 2πr = 30

$= r = \frac{30}{2\pi}\ cm$

= height = 18 cm

Volume of cylinder thus formed = $\pi r^2 h = \pi \times \left(\frac{30}{2\pi}\right)^2 \times 18\ cm^3$

Case (ii)

When paper is rolled along its breadth :

= 2πr = 18

$= r = \frac{18}{2\pi}\ cm$

= Height = 30 cm

Volume of cylinder thus formed = $\pi r^2 h = \pi \left(\frac{18}{2\pi}\right)^2 \times 30$

Hence,

$= \frac{volume\ of\ cylinder\ 1}{volume\ of\ cylinder\ 2} = \frac{\left[\pi\left(\frac{30}{2\pi}\right)^2 \times 18\right]}{\left[\pi\left(\frac{18}{2\pi}\right)^2 \times 30\right]} = \frac{30}{18} = \frac{5}{3}$

25. Question

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?

Answer

Given,

Dimensions of roof = 18 m × 16.5 m

Diameter of cylindrical tank = 8 m

Radius of tank = $\frac{8}{2} = 4\ m$

it rains 10 cm a day

Let 'h' be the rise in level of tank

so,

$= \pi r^2 h = l \times b \times h$

$= \frac{22}{7} \times 4 \times 4 \times h = 18 \times 16.5 \times 0.1$

$= h = \frac{18 \times 16.5 \times 0.1 \times 7}{22 \times 4 \times 4} = 0.5906\ m = 59.06\ cm$

26. Question

A piece of ductile metal is in the form of a cylinder of diameter 1 cm and length 5 cm. It is drawnout into a wire of diameter 1 mm. What will be the length of the wire so formed?

Answer

Given,

Diameter of metallic cylinder = 1 cm

Radius of cylinder = $\frac{1}{2}\ cm$

Length of cylinder = 5 cm

Diameter of wire drawn from it = 1 mm = 0.1 cm

Let length of wire = h cm

so,

Length of wire drawn from metal = $\frac{volume\ of\ metal}{volume\ of\ wire} = \frac{\pi \times \frac{1}{4} \times 5}{\pi \times 0.1^2} = 500\ cm = 5\ m$

27. Question

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

Answer

Given,

weight of copper wire = 13.2 kg

Diameter of wire = 4 mm

Radius of wire = $\frac{4}{2} = 2mm = \frac{2}{10} = 0.2\ cm$

Let length of wire = h cm

so,

weight of 1 cubic cm wire = 8.4 gm

$= \pi r^2 h \times 8.4 = 13.2\ kg = 13200\ gm$

$= h = \frac{13200 \times 7}{22 \times 0.2 \times 0.2 \times 8.4} = 12500\ cm = 125\ m$

28. Question

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

Answer

Given,

Volume of brass wire = 2.2 dm^3 = 2200 cm^3

Diameter of cylindrical wire = 0.25 cm

Radius of wire = $\frac{0.25}{2} = 0.125\ cm$

Let length of wire = h cm

so,

$= \pi r^2 h = 2200$

$= h = \frac{(2200 \times 7)}{22 \times 0.125 \times 0.125} = 44800\ cm = 448\ m$

29. Question

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 cuboc cm, find the inner and outer radii of the tube.

Answer

Given,

length of cylindrical tube = 14 cm

Difference between inside and outside surface = 88 cm^2

volume of cylinder = 176 cm^3

let outer radius of tube = R cm

Let inner radius of tube = r cm

so,

$= 2\pi(R-r)h = 88 \ldots\ldots\ldots\ldots\ldots\ldots (i)$

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

dividing equation (i) by equation (ii)

$= \frac{[2\pi(R-r)h]}{[\pi(R+r)(R-r)h]} = \frac{88}{176} = \frac{1}{2}$

$= \frac{2}{R+r} = \frac{1}{2}$

= R+r = 4 .....(iii)

from equation (ii)

$= \pi(R+r)(R-r)h = 176$

$= \frac{22}{7} \times 4 \times (R-r) \times 14 = 176$

$= R-r = 1 \ldots\ldots\ldots (iv)$

from equation (iii) and (iv)

= 2R = 5

$= R = \frac{5}{2} = 2.5\ cm$

= r = 1.5 cm

30. Question

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?

Answer

Given,

internal diameter of pipe = 2 cm

internal radius of pipe = $\frac{2}{2} = 1cm$

rate of flow of water = 6 m/s = 600 cm/s

radius of base of cylindrical tank = 60 cm

so,

rise in height in cylindrical tank = $\frac{rate\ of\ flow\ of\ water \times total\ time \times volume\ of\ pipe}{volume\ of\ cylindrical\ tank}$

$= \frac{600 \times 30 \times 60 \times \pi \times 1 \times 1}{\pi \times 60 \times 60} = 300\ cm = 3\ m$

31. Question

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.

Answer

Given,

Internal diameter of cylindrical tube = 10.4 cm

internal radius of tube = $\frac{10.4}{2} = 5.2\ cm$

length of tube = 25 cm

thickness of metal = 8 mm = 0.8 cm

so,

Outer radius of tube = R = 5.2+0.8 = 6 cm

Volume of metal = $\pi(R^2 - r^2) \times l = \frac{22}{7}(6^2 - 5.2^2) \times 25 = 704\ cm^3$

32. Question

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.

Answer

Given,

inner radius of tap = 0.75 cm

Rate of water flow through it = 7 m/s = 700 cm/s

so,

volume of water per second derived from tap = $\pi r^2 l = \frac{22}{7} \times 0.75 \times 0.75 \times 700 = 1237.5\ cm^3$

Volume of water derived in 1 hour (3600 sec) = $\frac{1237.5 \times 3600}{1000}$ = 4455 litre

33. Question

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?

Answer

Given,

Diameter of cylindrical tank = 1.4 m

Radius of tank = $\frac{1.4}{2} = 0.7\ m$

Height of tank =2.1 m

Diameter of pipe flowing water in tank = 3.5 cm

Radius of pipe = $\frac{3.5}{2}$ cm

Rate of flow of water = 2 m/s

so,

Time taken to fill the tank = $\frac{volume\ of\ tank}{volume\ of\ pipe \times rate\ of\ flow} = \frac{\pi \times 0.7 \times 0.7 \times 2.1}{\pi \times \frac{3.5}{200} \times \frac{3.5}{200} \times 2} = 1680\ second = 28\ min.$

34. Question

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.

Answer

Given,

Dimensions of rectangular sheet = 30 cm ×.18 cm

Case (i)

When sheet is rolled along its length:

$= 2\pi r = 30$

$= r = \frac{30}{2\pi} = cm$

height of cylinder = 18 cm

Hence , Volume of cylinder thus formed = $V_1 \ \frac{22}{7} \times \left(\frac{30}{2\pi}\right)^2 \times 18 \ cm^3$

Case (ii)

When sheet is rolled along its breadth :

$= 2\pi r = 18$

$= r = \frac{18}{2\pi}$

Height of cylinder = 30 cm

Volume of cylinder = $V_2 = \frac{22}{7} \times \left(\frac{18}{2\pi}\right)^2 \times 30 \ cm^3$

Hence,

$$\frac{V_1}{V_2} = \frac{\left[\frac{22}{7} \times 900 \times 4\pi^2 \times 18\right]}{\left[\frac{22}{7} \times 324 \times 4\pi^2 \times 30\right]} = \frac{30}{18} = \frac{5}{3}$$

35. Question

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?

Answer

Given,

Cross section area of pipe = 5 cm^2

Speed of water = 30 cm/s

Time = 1 minute = 60 sec

so,

Volume of water flows through pipe = $Area\ of\ cross\ section \times speed\ of\ flow \times time$

$= 5 \times 30 \times 60 = 9000 \ cm^3 = \frac{9000}{1000} = 9 \ litre$

36. Question

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

Answer

Given,

Total surface area of cylinder = 231 cm^2

Curved surface area = $\frac{2}{3} \ total\ surface\ area = \frac{2}{3} \times 231 = 154 \ cm^2$

so,

= $2\pi rh = \frac{2}{3}\ 2\pi r(r+h)$

= 3 h = 2h + 2r

= h= 2r.....(i)

And,

= $2\pi r(r+h) =\ 231$

= $2\times\frac{22}{7}\times r\times 3r = 231\ (putting\ h = 2r)$

= $r^2 = \frac{231\times3\times7}{44} = \frac{49}{4}$

= $r = \sqrt{\frac{49}{4}} = \frac{7}{2} = 3.5\ cm$

= h = 2r = 2×3.5 = 7 cm

Volume of cylinder = $\pi r^2 h = \frac{22}{7}\times3.5\times3.5\times7\ = 269.5\ cm^3$

37. Question

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.

Answer

Given,

Depth of tube well = 280 m

Diameter of tube well = 3 m

Radius of well = $\frac{3}{2} = 1.5\ m$

so,

Volume = $\pi r^{2h} = \frac{22}{7}\times1.5\times1.5\times280 = 1980\ m^3$

Cost of sinking tubewell at rate Rs.3.60/m^3 = 1980×3.60 = Rs.7128

Curved surface area = $2\pi rh = 2\times\frac{22}{7}\times1.5\times280 = 2640\ m^2$

Cost of cementing its inner curved surface at rate Rs.2.50/m^2 = 2.50×2640 =Rs.6600

38. Question

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

Answer

Given,

weight of copper wire = 13.2 kg

Diameter of wire = 4 mm

Radius of wire = $\frac{4}{2} = 2mm = \frac{2}{10} = 0.2\ cm$

Let length of wire = h cm

so,

weight of 1 cubic cm wire = 8.4 gm

= $\pi r^2 h\times8.4 = 13.2\ kg = 13200\ gm$

$= h = \frac{13200 \times 7}{22 \times 0.2 \times 0.2 \times 8.4} = 12500\ cm = 125\ m$

39. Question

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.

Answer

Given,

Volume of brass wire = 2.2 dm^3 = 2200 cm^3

Diameter of cylindrical wire = 0.25 cm

Radius of wire = $\frac{0.25}{2} = 0.125\ cm$

Let length of wire = h cm

so,

$= \pi r^2 h = 2200$

$= h = \frac{(2200 \times 7)}{22 \times 0.125 \times 0.125} = 44800\ cm = 448\ m$

40. Question

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.

Answer

Given,

Inside diameter of well = 10 m

Inside radius = $\frac{10}{2} = 5\ m$

depth of well = 8.4 m

Volume of earth dug out = $\pi r^2 h = \frac{22}{7} \times 25 \times 8.4\ m^3$

Area of embankment formed = $\pi(R^2 - r^2) = \frac{22}{7}(17.5^2 - 10^2) = 206.25\ \pi\ m^2$

Height of embankment thus formed = $\frac{volume\ of\ well}{Area\ of\ embankment} = \frac{\pi \times 25 \times 8.4}{206.25\pi} = 1.6\ m$

41. Question

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.

Answer

Given,

Width of roller = 63 cm

Girth (perimeter) = 440 cm

$= 2\pi R = 440$

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

$= R = \frac{440 \times 7}{44} = 70\ cm$

thickness of roller = 4 cm

inner radius = R - thickness = 70 - 4 = 66 cm

Volume of cylindrical iron = $\pi(R^2 - r^2)l = \frac{22}{7}\times(70^2 - 66^2)63 = \frac{22}{7}\times594\times63 = 107712\ cm^3$

42. Question

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?

Answer

Given,

Length of solid cylinder = L

diameter o cylinder = 2 cm

radius of cylinder = $\frac{2}{2} = 1cm$

Volume of cylinder = $\pi r^2 L$.....(i)

Length of hollow cylinder = 16 cm

External diameter = 20 cm

External radius = $\frac{20}{2} = 10\ cm$

thickness = 2.5 mm = 0.25 cm

so,

inner radius = 10 - 0.25 = 9.75 cm

Volume = $\pi(R^2 - r^2)L = \pi(10^2 - 9.75^2)\times16 \ldots\ldots\ldots\ldots (ii)$

From (i) and (ii)

= $\pi\times1\times1\times L = \pi(10^2 - 9.75^2)\times16$

= L =79 cm

43. Question

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.

Answer

Given,

Diameter of well = 7 m

Radius of well = $\frac{7}{2} = 3.5\ m$

Depth of well = 10 m

Volume of well = $\pi r^2 h = \frac{22}{7}\times3.5\times3.5\times10\ m^3$

volume of well =Area of spread out × height of embankment

$=\frac{22}{7}\times3.5\times3.5\times10 = 30\times20 - \frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\times h$

$= \frac{22}{7}\times3.5\times3.5\times10 = \frac{1123}{2}\times h$

$= h = \frac{22\times35}{1123} = 68.56\ cm$

Height of embankment = 68.6 cm