19. Surface Area and Volume of a Right Circular Cylinder

Exercise 19.1

1. Question

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.

Answer

Given,

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

Radius of base of cylinder = 0.7 m

=2πrh = 4.4

= h = $\frac{4.4\times7}{2\times22\times0.7} = 1m.$

∴ Height of cylinder = 1m.

2. Question

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.

Answer

Given,

Length of cylindrical pipe = 28 m =2800 cm

Diameter of pipe = 5cm

So, radius of pipe = $\frac{5}{2}\ cm$

Total radiating surface area = 2πrh

= $2\times\frac{22}{7}\times\frac{5}{2}\times2800 = 44039.28\ cm^2$

3. Question

A cylindrical pillars 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 12.50 per m^2.

Answer

Given,

Diameter of cylindrical pillar = 50 cm

So, radius of pillar = $\frac{50}{2} = 25\ cm = 2.5m$

Height of pillar = 3.5 m

So, curved surface area of pillar = 2πrh = $2\times\frac{22}{7}\times.25\times3.5 = 55m^2$

Cost of painting 1 m^2 area = 12.50 rs.

∴ cost of painting 55 m^2 = $55\times12.50 = 68.75\ rs.$

4. Question

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 metres of the sheet are required for the same?

Answer

Given,

Base diameter of cylindrical tank = 140 cm

So, radius of tank = $\frac{140}{2} = 70\ cm$ = .70m

Height of tank = 1m

So, area of sheet required for making the tank = $TSA = 2\pi r(h+r)$

= $2\times\frac{22}{7}\times.70\times1.7 = 7.48m^2$

5. Question

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.

Answer

Given,

Total surface area of cylinder = 462 cm^2

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

= $\frac{1}{3}\times462 = 154\ cm^2$

= 2πrh = 154

= h = $\frac{154\times7}{2\times22\times r} = \frac{49}{2r}$

And,

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

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

$= 49 + 2r^2 = \frac{462\times7}{22} = 147$

$= 2r^2 = 98$

$= r = 7$

So, radius of cylinder = 7 cm

∴ height =

2πrh = 154

$= h = \frac{154\times7}{2\times22\times7} = \frac{7}{2}\ cm$

6. Question

The total surface area of ahollow 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.

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 of hollow cylinder = R cm

Let inner radius be = r cm

$= \pi R^2 - \pi r^2 = 115.5$ ……. (i)

And,

$2\pi rh + 2\pi rh + 2(\pi R^2 - \pi r^2) = 4620$ ……(ii)

(putting value of $(\pi R^2 - \pi r^2)$ from (i) to (ii))

$=2\pi h(R+r) = 4620 - 231 = 4389$

$= \pi(R+r) = \frac{4389}{14} = 313.5$……..(iii)

From equation (i)

$=\pi(R^2 - r^2) = 115.5$

$= \pi[(R+r)(R-r)] = 115.5$

(putting value of π(R+r) from equation (iii))

$= R - r = \frac{115.5}{313.5} = \frac{7}{19}\ cm$

7. 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,

Height of cylinder = 7.5 cm

Radius of cylinder = 3.5 cm

So, curved surface area of cylinder = 2πrh $= 2\times\frac{22}{7}\times7.5\times3.5 = 165$ cm^2

Total surface area = 2πr(h+r) = $2\times\frac{22}{7}\times3.5\times11 = 242$ cm^2

So, $\frac{total\ surface\ area}{curved\ surface\ area} = \frac{242}{165} = \frac{22}{15}$

8. Question

The total surface area of a hollow metal cylinder, open at both ends of external radius 8 cm and height 10 cm is 338 p 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.

Answer

Given,

Total surface area of hollow cylinder = 338π cm^2

Height = 10 cm

External radius R = 8 cm

Let internal radius = r cm

∴ 2πRh+2πrh+2π(R^2-r^2) = 338π

$=Rh + rh + (R + r)(R - r) = \frac{338\pi}{2\pi} = 169$

=80+10r+(8+r)(8-r) =169

= 10r+64-8r+8r-r^2 = 89

=r^2-10r+25 = 0

= r(r-5) -5(r-5) =0

= r = 5 cm

∴ Thickness of hollow cylinder = (R-r) = 8-5 = 3 cm

9. 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 Rs. 3.50 per 1000 cm^2.

Answer

Given,

Radius of base = 70 cm

Height = 1.4 m = 140 cm

Because tin is coated on both side of vessel so surface area of side should be calculated,

= 2(2πrh) = $2\times\frac{22}{7}\times70\times140 = 61600 cm^2$

Area of circular bases = $2\pi r^2$ = $2\times\frac{22}{7}\times70\times70 = 30800 cm^2$

So, total area to paint = 61600+30800 = 154000 cm^2

Cost of coating 1000 cm^2 area = Rs. 3.50

∴cost of coating 154000 cm^2 = $\frac{154000\times3.50}{1000} = Rs.539.$

10. Question

The inner diameter of a circular well is 3.5 m. It is 10 m deep Find:

(i) inner curved surface area.

(ii) the cost of plastering this curved surface at the rate of Rs. 40 per m^2.

Answer

Given,

Inner diameter of circular well = 3.5 m

Inner radius = $\frac{3.5}{2}\ m$

Depth of well = 10 m

i) Inner curved surface area of well = 2πrh = $2\times\frac{22}{7}\times\frac{3.5}{2}\times10 = 110 m^2$

ii) Cost of plastering 1m^2 area = Rs.40

Cost of plastering 110 m^2 = 40×110 = 4400 rs.

11. Question

Find the lateral curved surface area of a cylindrical petrol storage tank that is 4.3 m in diameter and 4.5 m high. How much steel was actually used, if $\frac{1}{12}$ of steel actually used was wasted in making the closed tank?

Answer

Given,

Diameter of cylindrical tank = 4.3 m

Radius of tank = $\frac{4.3}{2}m$

Height of tank = 4.5 m

Lateral curved surface area of tank = 2πrh = $2\times\frac{22}{7}\times\frac{4.3}{2}\times4.5 = 59.4\,m^2$

Let total steel used in making of tank = X m^2

Wasted steel = $\frac{X}{12}$ m^2

Actual steel used = X-$\frac{X}{12} = \frac{11X}{12}\ m^2$

$\therefore \frac{11X}{12} = total\ surface\ area\ of\ tank$

$=\frac{11X}{12} = 2\pi r(h+r) = \ 2\times\frac{22}{7}\times\frac{4.3}{2}\left(\frac{4.3}{2}+4.5\right)$

= x = $2\times\frac{22}{7}\times\frac{4.3}{2}\times\frac{13.3}{2}\times\frac{12}{11} = 95.04\ m^2$

12. Question

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

Answer

Given,

Radius of each cylindrical pen holder = 3cm

Height = 10.5 cm

So, area of one cardboard = 2πrh+πr^2

= πr(2h+r) =$\frac{22}{7}\times3\times24 = 226.28\ cm^2$

Number of competitors = 35

∴ total area of cardboard needed = 35×226.28 = 7920 cm^2

13. Question

The diameter of roller 1.5 m 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 metre.

Answer

Given,

Diameter of roller = 84 cm

So radius of roller = $\frac{84}{2} = 42\ cm = .42\ m$

Length of roller = 1.5 m

Area covered by roller in one revolution = 2πrh = $2\times\frac{22}{7}\times.42\times1.5 = 3.96m^2$

Area covered by it in 100 revolution = 100×3.96 = 396 m^2

Cost of levelling 1m^2 area = Rs. .50

∴cost of levelling 396m^2 = .50×396 = Rs. 198

14. Question

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?

Answer

Given,

Diameter of one pillar = .50m

Radius of pillar = $.\frac{50}{2} = .25\ m$

Height of each pillar = 4m

Curved surface area of one pillar = 2πrh = $2\times\frac{22}{7}\times.25\times4 = 6.28\ m^2$

Area of 20 pillars = 20×6.28 = 125.60 m^2

Cost of cleaning 1 m^2 area = Rs. 2.50

∴cost of cleaning 125.60 m^2 = 125.60×2.50 = Rs 314.28.

Exercise 19.2

1. Question

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?

Answer

Given,

i) Length of rectangular can = 5cm

Breadth = 4cm

Height = 15 cm

So, volume of rectangular can = length×breadth×height

= 5×4×15 = 300cm^3

ii) Diameter of plastic cylindrical box = 7 cm

So radius = $\frac{7}{2}cm$

Height = 10 cm

Volume of cylindrical box = πr^{2}h = $\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\times10 = 385\ cm^3$

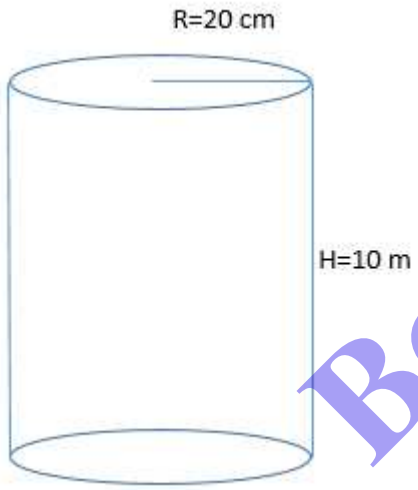
So,

V_2-V_1 = 85 cm . (plastic cylinder has more capacity).

2. Question

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 built 14 such pillars?

Answer



Given,

Radius of base of cylindrical pillar = 20 cm = .20 m

Height = 10 m

So, concrete require to make a pillar = πr^{2}h = $\frac{22}{7}\times0.20\times0.20\times0.1$

= $\frac{0.00088}{7}$

Concrete required for 14 such pillars = $\frac{0.00088}{7} \times 14$

= 0.00176 m^3

= 1.76 litres

3. Question

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 gm.

Answer

Given,

Inner diameter of cylindrical pipe = 24 cm

So, inner radius = $\frac{24}{2} = 12\ cm$

Outer diameter of that pipe = 28 cm

So, outer radius =$\frac{28}{2} = 14\ cm$

Length of pipe = 35 cm

Volume of pipe = π(R^2 – r^2) = $\frac{22}{7}(14^2 - 12^2) \times 35$

= 22×26×2×5 = 5720 m^3

1 cm^3 wwod has mass = 0.6 gm

∴ 5720 cm^3 wood has mass = 5720 ×0.6 = 3432 gm = 3.432 kg.

4. Question

If the lateral surface of a cylinder is 9.42 cm2 and its height is 5 cm, find :

(i) radius of its base

(ii) volume of the cylinder [Use π = 3.14]

Answer

Given,

Lateral surface area of cylinder = 9.42 cm^2

Height of cylinder = 5 cm

i) Radius of cylinder =

2πrh = 9.42

R = $\frac{9.42 \times 7}{2 \times 22 \times 5} = 3cm$

ii) Volume of cylinder = πr^{2}h = $\frac{22}{7} \times 9 \times 5 = 141.3\ cm^3$

5. Question

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?

Answer

Given,

Volume of cylindrical vessel = 15.4 litre = 15400 cm^3

Height of vessel = 1 m = 100 cm

= πr^{2}h = 15400

= r^2 = $\frac{15400 \times 7}{22 \times 100} = 49$

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

Area of metal sheet required = 2πr(h+r)

= $2 \times \frac{22}{7} \times 7 \times 107 = 4708\ cm^2 = .4708 m^2$

6. Question

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?

Answer

Given,

Diameter of cylindrical bowl = 7 cm

So radius of bowl = $\frac{7}{2}\ cm$

Height of soup in bowl = 4 cm

Volume of soup in 1 bowl = πr^{2}h = $\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 4 = 154\ cm^3$

For 250 patients volume of soup prepared = 250 ×154 = 38500 cm^3

= $\frac{38500}{1000} = 38.5\ litre$

7. 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 hollow cylinder = 63 cm

Girth (perimeter) = 440 cm

Let external radius of cylinder = R cm

So, 2πr = 440

= R = $\frac{440\times7}{2\times22} = 70\ cm$

= inner radius = outer radius – thickness = 70 – 4 = 66 cm

∴ volume of iron = π(R^2-r^2)h = $\frac{22}{7}\times(70^2-66^2)\times63 = \frac{22}{7}\times136\times4\times63 = 107712\ cm^3$

8. Question

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.

Answer

Given,

Total surface area of cylinder = 231 cm^2

Curved surface area = $\frac{2}{3}\times231 = 154\ cm^2$

= 2πrh + 2πr^2 = 231

= 154 +2πr^2 = 231

= 2πr^2 = 77 = r^2 = $\frac{77\times7}{2\times22} = \frac{49}{4}$

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

And , 2πrh = 154

(put value of r)

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

= height = h = 7 cm

So, volume of cylinder = πr^2h = $\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\times7 = 269.5\ cm^3$

9. Question

The cost of painting the total outside surface of a closed cylindrical oil tank as 50 paise per square decimatre is Rs. 198. The height of the tank is 6 times the radius of the base of the tank. Find the volume corredcted to 2 decimal places.

Answer

Given,

Height of tank = 6 × radius of tank

Let radius of tank = r decimeter

So, height of tank = 6r dm

Total surface area of tank = $\frac{198\times100}{50}\ dm^2$

= 2πr(h+r) = 198×2

= 2πr(7r) = 396

= $r^2 = \frac{396\times7}{14\times22} = 9$

= r = 3 dm

Height = 6r = 6×3 = 18 dm

So, volume of tank = $\pi r^2h = \frac{22}{7}\times9\times18 = 509.14\ dm^3$

10. Question

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

Answer

Given,

Ratio of radii of cylinders = $r_1:r_2 = \frac{2}{3}$

Ratio oh heights of cylinders = $h_1:h_2 = \frac{5}{3}$

So, ratio of their volumes = $\pi r_1^2h_1 : \pi r_2^2h_2 = \frac{4\times5}{9\times3} = \frac{20}{27}$

Ratio of their curved surface areas = $2\pi r_1h_1 : 2\pi r_2h_2 = \frac{10}{9}$

11. Question

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.

Answer

Given,

= $\frac{2\pi rh}{[2\pi r(r+h)]} = \frac{1}{2}$ and, total surface area of cylinder = 616 cm^2

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

So, 2πr(h+r) = 616

= 2πr(2r) = 616

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

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

Hence, volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 49 \times 7 = 1078\ cm^3$

12. Question

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.

[Use π = 22/7]

Answer

Given,

Curved surface area of cylinder = 1320 cm^2

Diameter of base = 21 cm

So, radius of base = $\frac{21}{2} cm$

= 2πrh = 1320

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

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

Hence volume of cylinder = $\pi r^2 h = \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 20 = 6930\ cm^3$

13. Question

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.

Answer

Given,

= $\frac{radius\ of\ base\ of\ cylinder}{height\ of\ cylinder} = \frac{2}{3}$

Volume of cylinder = 1617 cm^3

Let radius = 2x cm and height = 3x cm

So, volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 2x \times 2x \times 3x = 1617$

= $\frac{22}{7} \times 12x^2 = 1617 = x^2 = \frac{1617 \times 7}{22 \times 12} = 42.875$

= x = $\sqrt{42.875} = 3.5$

Radius of cylinder = 2x = 2×3.5 = 7 cm

Height of cylinder = 3x = 3×3.5 = 10.5 cm

Hence , total surface area of cylinder = 2πr(h+r) = $2\times\frac{22}{7}\times7\times17.5 = 770\ cm^2$

14. Question

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

Answer

Given,

Dimension of rectangular sheet = 44cm×20cm

(sheet is rolled along length so length become perimeter and breadth become its height)

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

Height = 20 cm

So, volume of cylinder = $\pi r^2 h = \frac{22}{7}\times49\times20 = 3080\ cm^3$

15. 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 of cylinder = 924 m^3

= 2πrh = 264

= h = $\frac{264}{2\pi r} = \frac{132}{\pi r} \ldots\ldots\ldots (i)$

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

(putting value of h from equation (I)

= $\pi r^2 \times \frac{132}{\pi r} = 924$

= $r = \frac{924}{132} = 7\ m$

So, diameter of cylinder = 2r = 2×7 = 14 m

From equation (i)

$=h = \frac{132}{\pi r} = \frac{132\times7}{22\times7} = 6\ m$

16. 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

$= \frac{height\ of\ cylinder\ 1}{height\ of\ cylinder\ 2} = \frac{1}{2}$

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

$= r_1^2 / r_2^2 = h_2/h_1 = \frac{2}{1}$

= ratio of their radii = $r_1 : r_2 = \sqrt{\frac{2}{1}} = \frac{\sqrt{2}}{1}$.

17. 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 right circular cylinder = 10.5 m

And 3(area of both circular ends) = 2(curved surface area of cylinder)

$= 3\times\pi r^2 = 2\times2\pi rh$

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

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

So, volume of cylinder = $\pi r^2 h = \frac{22}{7}\times49\times10.5 = 1617\ m^3$

18. Question

How many cubic metres of earth msut 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.

Answer

Given,

Depth of well = 21m

Diameter of well = 6m

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

Volume of earth that can be dug out = $\pi r^2 h = \frac{22}{7} \times 9 \times 21 = 594\ m^3$

Inner curved surface area of cylindrical well = $2\pi rh = 2 \times \frac{22}{7} \times 3 \times 21 = 396\ m^2$

Cost of plastering 1 m^2 area = Rs. 9.50

∴cost of plastering 396 m^2 area = 396×9.50 = Rs. 3762

19. Question

The trunk of a tree os 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 cylindrical tank = 176 cm

Length of tank = 3m = 300 cm

$= 2\pi r = 176 = r = \frac{176 \times 7}{22 \times 2} = 28\ cm$

∴ volume of timber = $\pi r^2 h = \frac{22}{7} \times 28 \times 28 \times 300 = 739200\ cm^3$

$= \frac{739200}{1000000} = 0.74\ m^3$

20. 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

So, radius of well = $\frac{14}{2} = 7\ m$

Depth of well = 8 m

Width of embankment = 21 m

So outer radius R = 21+7 = 28 m

Let height of embankment = H m

So, volume of earth in embankment = volume of earth dug out

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

= π $(28^2 - 7^2)$ ×H = π ×49×8

= H = $\frac{49\times8}{35\times21} = \frac{8}{15}\ m = \frac{800}{15} cm = 53.3\ cm$

21. 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 cubic cm, find the inner and outer radii of the tube.

Answer

Given,

Difference between inner and outer surface area of cylindrical tube = 88 cm^2

Length of tube = 14 cm

Volume of tube = 176 cm^3

= 2πRh – 2πrh = 88

= 2πh(R-r) = 88

= R-r = $\frac{88\times7}{44\times14} = 1\ cm$ .....(i)

And, 2π(R^2-r^2)h = 176

= (R+r) (R-r) = $\frac{176\times7}{44\times14} = 4$

= R+r = 4 cm .....(ii)

From equation (i) and (ii)

= 2R = 5 = R = 2.5cm

= r = 4-2.5 = 1.5 cm

22. 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 circular pipe = 2 cm

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

Rate of flow of water through pipe = 6 m/s

Radius of base of cylindrical tank = 60 cm

So, volume of water flows through pipe in 1 second = $\pi r^2 h = \frac{22}{7} \times \left(\frac{1}{100}\right)^2 \times 6\ m^3$

Volume of flows in 30 minute (30×60) second = $\frac{22}{7} \times \left(\frac{1}{100}\right)^2 \times 6 \times 30 \times 60\ m^3$

Let rise of water level in cylindrical tank = h m

So, volume of water collected in tank in 30 minute =

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

$= h = \frac{6 \times 30 \times 60 \times 10000}{60 \times 60 \times 10000} = 3\ m$

23. Question

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.

Answer

Given,

Diameter of base of cylindrical tank = 56 cm

So, radius of tank = $\frac{56}{2} = 28\ cm$

Dimension of rectangular solid = 32cm×22cm×14 cm

Let height of cylinder = h cm

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

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

24. 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 tube = 10.4 cm

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

Length of tube = 25 cm

Thickness of metal of tube = 8 mm = $\frac{8}{10} = .8\ cm$

Hence , external radius of tube = 5.2+.8 = 6 cm

So, volume of metal = π(R^2 – r^2)h = $\frac{22}{7}(6^2-5.2^2)\times25=704\ cm^3$

25. Question

From a tap of inner radius 0.75 cm, water flows atr 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 flow of water through tap = 7 m/s = 700cm/s

Volume of water delivered in 1 second = πr^2h = $\frac{22}{7}\times(0.75)^2\times700\ cm^3$

Volume of water delivered in 1 hour (60×60 sec) = $\frac{22}{7}\times(0.75)^2\times70\times60\times60$

= $\frac{22}{7}\times\frac{9}{36}\times700\times3600=4455000\ cm^3$

= $\frac{4455000}{1000}=4455\ litre$

26. Question

A culindrical 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

So, radius of tank = $\frac{1.4}{2}=0.7\ m$

Height of tank = 2.1 m

Diameter of pipe = 3.5 cm

So radius of pipe =$\frac{3.5}{2}cm=\frac{3.5}{200}m$

Rate of flow of water through pipe = 2 m/s

Suppose the tank is filled in = x minute

So, volume of water flows through pipe in x minute= volume of tank

= $\pi\times\left(\frac{3.5}{200}\right)^2\times2\times60x=\pi\times(0.7)^2\times2.1$

= $\left(\frac{35}{2000}\right)^2\times120x=\left(\frac{7}{10}\right)^2\times\frac{21}{10}$

$= x = \frac{49\times21\times2000\times2000}{35\times35\times120} = 28\ minute$

27. 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,

Dimension of rectangular sheet of paper = 30cm×18cm

Case (i)

When paper is rolled along its length ,

Then, 2πr = 30 = r = $\frac{30}{2\pi} = \frac{15}{\pi} cm$

= h = 18 cm

So, volume of cylinder V_1 = $\pi r^2 h = \pi\times\left(\frac{15}{\pi}\right)^2\times18 = \frac{225}{\pi}\times18\ cm^3$

Case (ii)

When paper is rolled along its width,

Then 2πr = 18 = r= $\frac{18}{2\pi} = \frac{9}{\pi}\ cm$

= h = 30 cm

So, volume of cylinder thus form = $\frac{22}{7}\times\left(\frac{9}{\pi}\right)^2\times30 = \frac{81}{\pi}\times30\ cm^3$

Rato of volumes $V_1 : V_2 = \frac{225\times18}{81\times30} = \frac{5}{3}$

28. Question

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?

Answer

Given,

Area of cross section of pipe = 5 cm^2

Speed of water flows through pipe = 30 cm/s

So, volume of water flows through pipe in 1 second = area of cross section × rate of flow

= 5×30 = 150 cm^3

Hence , volume of water flows through pipe in 1 minute(60second) =

= 60×150 = 9000 cm^3 = $\frac{9000}{1000} = 9\ litre$

29. 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 cm^2. Find the volume of the cylinder.

Answer

Given,

Sum of base radius and height of cylinder = 37 m

Total surface area of cylinder = 1628 m^2

= 2πr(h+r) = 1628

= 2πr ×37 = 1628 = r = $\frac{1628\times7}{37\times44} = 7\ m$

∵ h+r = 37

∴ h = 37- 7 = 30 m

Hence, volume of cylinder = $\pi r^2h = \frac{22}{7}\times49\times30 = 4620\ m^3$

30. Question

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 also the cost of cementing its inner curved surface at Rs. 2.50 per square metre.

Answer

Given,

Depth of tubewell = 280 m

Diameter of tubewell = 3 m

So radius = $\frac{3}{2}\ m$

Volume of tubewell = $\pi r^2h = \frac{22}{7}\times\frac{9}{4}\times280 = 1980\ m^3$

Curved surface area of tubewell = $2\pi rh = 2\times\frac{22}{7}\times\frac{3}{2}\times280 = 2640\ m^2$

∴ cost of sinking at rate Rs 3.60/m^3 = 3.60 ×1980 = Rs. 7128.

∴ cost of cementing at rate Rs. 2.50/m^2 = 2.50×2640 = Rs. 6600.

31. Question

Find the length of 13.2 kg 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 = (13.2×1000) gm

Diameter of wire = 4mm

So, radius of wire = $\frac{4}{2} = 2mm = \frac{2}{10}cm$

Weight of 1 cm^3 wire = 8.4 gm

Let length of wire = h cm

So, volume ×8.4 = 13.2×1000

= $\pi r^2 h \times 8.4 = 13.2 \times 1000$

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

= h = $\frac{13.2 \times 1000 \times 100 \times 7}{22 \times 4 \times 8.4} = 12500\ cm = \frac{12500}{1000} = 125\ meter$

32. 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 ambankment. Find the height of the embankment.

Answer

Given,

Inside diameter of well = 10 m

So, inside radius of well = $\frac{10}{2} = 5\ m$

Depth of well = 8.4 m

Earth spread out at height up to = 7.5m

So, outer radius R = 7.5+5= 12.5 m

Let height of embankment = H meter

So ,

volume of earth in embankment = volume of earth dug out

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

= $\pi(12.5^2 - 5^2) \times H = \pi \times 5^2 \times 8.4$

= $17.5 \times 7.5 \times H = 25 \times 8.4$

= $H = \frac{25 \times 8.4}{17.5 \times 7.5} = 1.6\ m$

CCE - Formative Assessment

1. Question

Write the number of surfaces of a right curcular cylinder.

Answer

There are 3 surfaces in a cylinder. (top, bottom, side)

2. Question

Write the ratio of total surface area to the curved surface area of a cylinder of radius *r* and height *h.*

Answer

$= \frac{total\ surface\ area\ of\ a\ cylinder}{curved\ surface\ area\ of\ cylinder} = \frac{[2\pi r(h+r)]}{2\pi r^2} = \frac{h+r}{r}$

3. Question

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

Answer

Given,

Volume of cylinder = 1617 cm^3

Let radius of cylinder = 2x cm

Let height of cylinder = 3x cm

= $\pi r^2 h$ = 1617

$= \frac{22}{7} \times 4x2 \times 3x = 1617$

$= x^3 = \frac{1617 \times 7}{22 \times 12} = 42.875$

= x = 3.5 cm

So radius = 2x = 2 ×3.5 = 7 cm

Height = 3x = 3×3.5 = 10.5 cm

∴ total surface area of cylinder = 2πr(h+r)

$= 2 \times \frac{22}{7} \times 7 \times 17.5 = 770\ cm^2$

4. Question

If the radii of two cylinders are in the ratio 2 : 3 and their heights are in the ratio 5 : 3, then find the ratio of their volumes.

Answer

Given,

Ratio of radii = $r_1 : r_2$ = 2:3

Ratio of heights = $h_1:h_2 = 5:3$

Ratio of volumes of cylinders = $(\pi r_1^2 h_1) : (\pi r_2^2 h_2) = \frac{4\times5}{9\times3} = \frac{20}{27}$

1. Question

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

Answer

Let Radius of cylinder = r

Let height of cylinder = h

So, curved surface area of cylinder = $2\pi rh$

Now radius become = 2r

Height becomes = $\frac{h}{2}$

So curved surface area = $2\times\pi\times2r\times\frac{h}{2} = 2\pi rh$

Hence curved surface area is SAME.

2. Question

Two cylindrical jars have their diameters in the ratio 3 : 1, but height 1 : 3. Then the ratio of their volume is

A. 4 : 1

B. 1 : 3

C. 3 : 1

D. 2 : 5

Answer

Given,

Ratio of diameters of cylinders = 3:1

So, ratio of their radii = $r_1:r_2 = 3:1$

Ratio of their heights = $h_1:h_2 = 1:3$

So, ratio of their volumes = $\pi(r_1)^2h_1 : \pi(r_2)^2h_2 = \frac{9\times1}{1\times3} = \frac{3}{1}$

3. Question

The number of surfaces in right cylinder is

A. 1

B. 2

C. 3

D. 4

Answer

The number of surfaces in a right cylinder = 3 (top, bottom, side)

4. Question

Vertical cross-section of a right circular cylinder is always a

A. square

B. rectangle

C. rhombus

D. trapezium

Answer

Vertical cross section of a cylinder is a RECTANGLE

5. Question

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. $2\pi rh$

Answer

Radius of cylinder = r

Height of cylinder = h

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

6. Question

The number of surfaces of a hollow cylindrical object is

A. 1

B. 2

C. 3

D. 4

Answer

Number of surfaces in a hollow cylinder = 4

7. Question

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

Answer

Let radius of cylinder = r

Let height of cylinder = h

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

Now radius becomes = 2r

And radius = h

So ,

volume = $\pi \times 4r^2 \times h = 4\pi r^2 h$

It becomes FOUR times.

8. Question

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

Answer

Let radius of cylinder = r

Let height of cylinder = h

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

New radius = r

New height = 2h

So,

volume becomes = $\pi r^2 \times 2h = 2\pi r^2 h$

It becomes DOUBLED.

9. Question

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

A. same

B. doubled

C. halved

D. four times

Answer

Let radius of cylinder = r

Let height of cylinder = h

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

Now radius become = $\frac{r}{2}$

Now height becomes = 2h

So, volume = $\pi \times \frac{r^2}{4} \times 2h = \frac{\pi r^2 h}{2}$

It become HALF .

10. Question

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 volumes as the original cylinder?

A. 4

B. $\frac{1}{\sqrt{2}}$

C. 2

D. $\frac{1}{2}$

Answer

Let radius of cylinder = r

Let height of cylinder = h

So, volume = $\pi r^2 h$

Now height is doubled = 2h

So , volume = $\pi r^2 \times 2h = 2\pi r^2 h$.

To gain a volume same as original volume we have to multiply r by $\frac{1}{\sqrt{2}}$

New r = $\frac{r}{\sqrt{2}}$

Height = 2h

Volume = $\pi r^2 h = \pi \times \frac{r^2}{2} \times 2h = \pi r^2 h$

11. Question

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. $\frac{x^2}{2\pi}$

B. $\frac{x}{2\sqrt{\pi}}$

C. $\frac{\sqrt{2x}}{\pi}$

D. $\frac{\pi}{2\sqrt{x}}$

Answer

Given

Radius of cylinder = r

Side length of square base =x

Height of rectangular box = height of cylinder

$= \pi r^2 h = \frac{1}{4} x^2 h$

$= r^2 = \frac{1}{\pi} \times \frac{1}{4} \times x^2$

$= r = \frac{1}{2} x \sqrt{\frac{1}{\pi}}$

$= r = \frac{x}{2\sqrt{\pi}}$

12. Question

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

A. $\frac{h^3}{4\pi}$

B. $\frac{h^2}{2\pi}$

C. $\frac{h^3}{2}$

D. πh^3

Answer

Given,

Height of cylinder = h

= h = 2πr

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

Volume of cylinder = $\pi r^2 h = \pi \times \frac{h^2}{4\pi^2} \times h = \frac{h^3}{4\pi}$

13. Question

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

B. $\pi r(r+2h)$

C. $\pi r(2r+h)$

D. $2\pi r^2+h$

Answer

Given,

Radius of cylinder = r

Height of cylinder = h

Total surface area = area of curved surface + area of circular bases

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

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

14. Question

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. $\frac{48}{\pi}$

Answer

Given,

1 cubic feet =12×12×12 = 1728 inch^3

Culinder of volume decrease = πr^2×3 inch

= πr^2×3 inches^3 = 1728 inches^3

= πr^2 = $\frac{1728}{13} = 576$

= $r^2 = \frac{576}{\pi}$ = $r = \sqrt{\frac{576}{\pi}} = \frac{24}{\sqrt{\pi}}$

Diameter of cylinder = 2r = 2×$\frac{24}{\sqrt{\pi}} = \frac{48}{\sqrt{\pi}}$.

15. Question

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. 2π*rh*^{2}

B. $\frac{3}{2}$π*h*^{2}

C. $\frac{4}{3}$π*h*^{2}

D. π*h*^{2}

Answer

Given,

Diameter of cylinder = height of cylinder

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

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

= hπ (h+$\frac{h}{2}$) = $\frac{3}{2}\pi h^2$

16. Question

A right curcular 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. 40π

B. 80π

C. 160π

D. 200π

Answer

Given,

Diameter of cylindrical tunnel = 2 m

So radius = $\frac{2}{2} = 1\ m$

Length of tunnel = 40 m

Area of iron sheet required = 2πrh

= 2π×1×40 = 80π m^2

17. Question

Two steel sheets each of length a_1 and breadth a_2 are used to prepare the surfaces of two right circular cylinder —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. $a_2v_1=a_1v_2$

C. $a_1v_1=a_1v_2$

D. $\frac{V_1}{a_1} = \frac{V_2}{a_2}$

Answer

In case (i)

$2\pi r = a_1$

$= r = a_1/2\pi$

$= h_1 = a_2$

So, $v_1 = \pi r^2 h = \pi\times(a_1/2\pi)^2 h = a_1^2 a_2/4\pi$.....(1)

In case (ii)

$2\pi r = a_2$

$= r = a_2/2\pi$ and $h = a_1$

So, $v_2 = \pi r^2 h = \pi \times (a_2/4\pi)^2 a_1 = a_2^2 a_1/4\pi$.....(2)

From equations 1 and 2 …

$= a_2 v_1 = a_1 v_2$

$= v_1/a_1 = v_2/a_2$ (so both options (B) and (D) are correct.)

18. Question

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

Answer

Given,

Ratio of heights of cylinder = $h_1:h_2 = 1:2$

$V_1=V_2$

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

$= \frac{r_1^2}{r_2^2} = \frac{h_1}{h_2}$

$= \frac{r^1}{r^2} = \frac{\sqrt{2}}{1}$

19. Question

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

Answer

Given,

$R_2 = \frac{1}{3} R_1$

$V_1=V_2$

$= \pi R_1^2 h_1 = \pi R_2^2 h_2$

$= R_1^2h_1 = \frac{1}{9} R_1^2h_2$

$= h_2 = 9h_1$

20. Question

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

Answer

Given,

Let Initial height of cylinder = h

Initial curved surface area = 2πrh

Now altitude become = 6h

And base area = $\frac{1}{9}\pi r^2$

In first case radius = r

In second case it become = $\frac{1}{3}r$

So , area = $2\pi \times 6h \times \frac{1}{3}r = 4\pi rh.$

Factor by which lateral surface of cylinder increase = $\frac{4\pi rh}{2\pi rh} = 2$