RD SHARMA

Solutions

Class 10 Maths

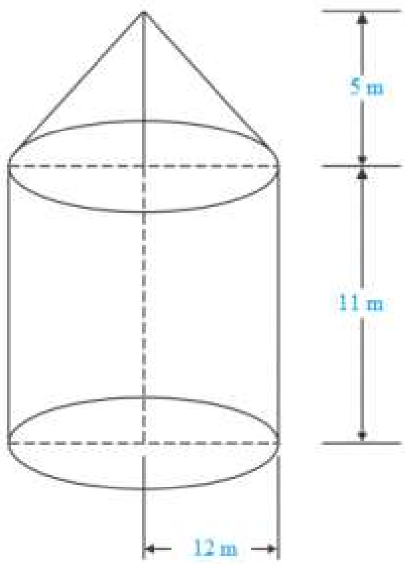
Chapter 16

16.2

Q.1 Consider a tent cylindrical in shape and surmounted by a conical top having height 16 m and radius as common for all the surfaces constituting the whole portion of the tent which is equal to 24 m. Height of the cylindrical portion of the tent is 11 m. Find the area of Canvas required for the tent.

Solution:

The diameter of the cylinder given in the question is 24m



Radius (R) = 122 $\frac{12}{2}$ = 12m

The height of the Cylindrical part (H_1) given in the question is 11m

So, Height of the cone part (H_2) = 5m

Now,

Vertex of the cone above the ground= 11 + 5= 16m

Curved Surface area of the Cone (say, S_1) = πRL = 227×6×L $\frac{22}{7} \times 6 \times L$

Where,

L=√R2+H2 $L = \sqrt{R^2 + H_2}$ L=√12^2+5^2 $L = \sqrt{12^2 + 5^2}$

L= 13m

So,

Curved Surface Area of Cone (S_1) = 227×12×13 $\frac{22}{7} \times 12 \times 13$ ……. E.1

Curved Surface Area of Cylinder (S_2) = 2πRH1

S_2= 2π(12)
(11)m^2 ………E.2

To find the area of Canvas required for tent

$S = S_1 + S_2$ = E.1 + E.2

S = 227 ×12×13+2× 227 ×12×11 $\frac{22}{7} \times 12 \times 13 + 2 \times \frac{22}{7} \times 12 \times 11$

S = 490 + 829.38

S = 1319.8 m^2

S = 1320 m^2

Hence, the total Canvas required for tent (s) = 1320 m^2

Q.2 Consider a Rocket. Suppose the rocket is in the form of a Circular Cylinder Closed at the lower end with a Cone of the same radius attached to its top. The Cylindrical portion of the rocket has radius say, 2.5m and the height of that cylindrical portion of the rocket is 21m. The Conical portion of the rocket has a slant height of 8m, then calculate the total surface area of the rocket and also find the volume of the rocket.

Solution:

Given radius of the cylindrical portion of the rocket (say, R) = 2.5m

Given height of the cylindrical portion of the rocket (say, H) = 21m

Given Slant Height of the Conical surface of the rocket (say, L) = 8m

Curved Surface Area of the Cone (say S_1) = RL

S_1 = m^2 ……. E.1

Curved Surface Area of the Cone (say, S_2) = 2RH + R^2

S_2 = (2 π 2.5 21) + (π $(2.5)^2$)

S_2 = (π 105) + (π 6.25) …….. E.2

So, The total curved surface area = E.1 + E.2

$S = S_1 + S_2$

S = (π 20) + (π 105) + (π 6.25)

S = 62.83 + 329.86 + 19.63

S = 412.3 m^2

Hence, the total Curved Surface Area of the Conical Surface = 412.3 m^2

Volume of the conical surface of the rocket = 13×227×R^2×h $\frac{1}{3} \times \frac{22}{7} \times R^2 \times h$

V_1 = 13×227×$(2.5)^2$×h $\frac{1}{3} \times \frac{22}{7} \times (2.5)^2 \times h$ ……. E.3

Let, h be the height of the conical portion in the rocket.

Now,

$L^2 = R^2 + h^2$

$h^2 = L^2 – R^2$

h = √L^2−R^2 $\sqrt{L^2 - R^2}$

h = √8^2−2.5^2 $\sqrt{8^2 - 2.5^2}$

h = 23.685 m

Putting the value of h in E.3, we will get

Volume of the conical portion (V_1) = 13×227×2.5^2×23.685 $\frac{1}{3} \times \frac{22}{7} \times 2.5^2 \times 23.685$ m^2 ……. E.4

Volume of the Cylindrical Portion (V_2) = $\pi R^2 h$

V_2 = 227×2.5^2×21 $\frac{22}{7} \times 2.5^2 \times 21$

So, the total volume of the rocket = $V_1 + V_2$

V = 461.84 m^2

Hence, the total volume of the Rocket (V) is 461.84 m^2

Q.3 Take a tent structure in vision being cylindrical in shape with height 77 dm and is being surmounted by a cone at the top having height 44 dm. The diameter of the cylinder is 36 m. Find the curved surface area of the tent.

Solution:

As per the question,

Height of the tent = 77 dm
Height of a surmounted cone = 44 dm

Height of the Cylindrical Portion = Height of the tent – Height of the surmounted Cone

= 77 – 44

= 33 dm = 3.3 m

Given diameter of the cylinder (d) = 36 m

So, Radius (r) of the cylinder = 362 $\frac{36}{2}$

R = 18 m

Consider L as the Slant height of the Cone.

$L^2 = r^2 + h^2$

$L^2 = 18^2 + 3.3^2$

$L^2 = 324 + 10.89$

$L^2 = 334.89$

L = 18.3 m

Hence, Slant height of the cone (L) = 18.3 m

The Curved Surface area of the Cylinder (S_1) = 2πRh

$S_1 = 2\ \pi\ 18\ \ 4.4\ m^2$ …………… E.1

The Curved Surface area of the cone (S^2) = πRh

$S_2 = \pi\ 18\ \ 18.3\ m^2$ ……………. E.2

So, the total curved surface of the tent = $S_1 + S_2$

$S = S_1 + S_2$

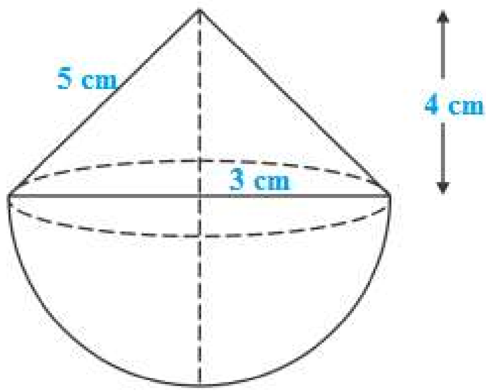
$S = (2\pi\ \ 18\ \ 4.4) + (\pi\ 18\ \ 18.3)$

$S = 1532.\ 46\ m^2$

Hence, the total Curved Surface Area (S) = 1532.46 m^2

Q.4: A toy is in the form of a cone surmounted on a hemisphere. The diameter of the base and the height of the cone are 6 cm and 4 cm, respectively. Determine the surface area of the toy.

Solution:



Given that,

The height of the cone (h) = 4cm

Diameter of the cone (d) = 6 cm

So, radius (r) = 3 [as we know that the radius is half of the diameter]

Let, 'l' be the slant height of cone. Then,

$l=\sqrt{r^2+h^2} l = \sqrt{r^2+h^2}$

$= \sqrt{3^2+4^2} \sqrt{3^2+4^2}$

l = 5cm

So, slant height of the cone (l) = 5 cm

Curved surface area of the cone (S_1) = $\prod rl \prod rl$

$S_1 = \prod(3)(5) \prod(3)(5)$

$S_1 = 47.1\ cm^2$

Curved surface area of the hemisphere (S_2) = $2\prod r^2 2\prod r^2$

$S_2 = 2\prod(3)^2 2\prod(3)^2$

$S_2 = 56.23\ cm^2$

So, the total surface area (S) = $S_1 + S_2$

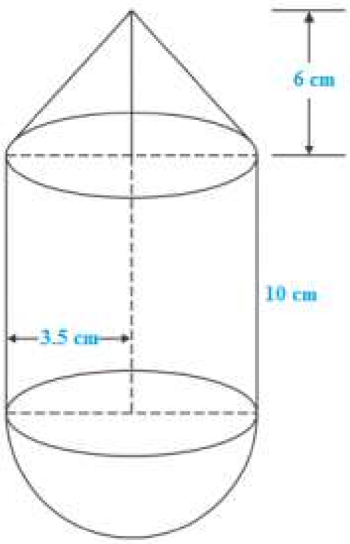
S = 47.1 + 56.23

$S = 103.62\ cm^2$

Therefore, the curved surface area of the toy = S = 103.62 cm^2

Q.5: A solid is in the form of a right circular cylinder, with a hemisphere at one end and a cone at the other end. The radius of the common base is 3.5 cm and the height of the cylindrical and conical portions are 10 cm and 6 cm, respectively. Find the total surface area of the solid. (Use $\pi = \frac{22}{7}$).

Solution:



Given that,

Radius of the common base (r) = 3.5 cm

Height of the cylindrical part (h) = 10 cm

Height of the conical part (H) = 6 cm

Let, 'l' be the slant height of the cone, then

$l = \sqrt{r^2 + H^2}$

$= \sqrt{3.5^2 + 6^2}$

l = 48.25 cm

Curved surface area of the cone (S_1) = πrl

$S_1 = \pi(3.5)(48.25)$

S_1 = 76.408 cm^2

Curved surface area of the hemisphere (S_2) = $2\pi rh$

$S_2 = 2\prod(3.5)(10)2\prod(3.5)(10)$

$S_2 = 220\ cm^2$

So, the total surface area (S) = $S_1 + S_2$

S = 76.408 + 220

S = 373.408 cm^2

Q.6: A toy is in the shape of a right circular cylinder with a hemisphere on one end and a cone on the other. The radius and height of the cylindrical parts are 5cm and 13 cm, respectively. The radii of the hemispherical and conical parts are the same as that of the cylindrical part. Find the surface area of the tor if the total height of the toy is 30 cm.

Solution:

As per the parameters given in the question, we have

Height of the Cylindrical portion = 13 cm

Radius of the Cylindrical portion = 5 cm

Height of the whole solid = 30 cm

Then,

The curved surface area of the Cylinder (say S_1) = 2πrh

$S_1 = 2\pi(5)(13)$

$S_1 = 408.2\ cm^2$

The curved surface area of the cone (say S_2) = πrL

$S_2 = \pi(6)L$

For conical part, we have

h = 30 – 13 – 5 = 12 cm

We know that,

$L = \sqrt{r^2+h_{22}}\sqrt{r^2+h_2^2}$

$L = \sqrt{5^2+12^2}\sqrt{5^2+12^2}$

$L = \sqrt{25+144}\sqrt{25+144}$

$L = \sqrt{169}\sqrt{169}$

L = 13 cm

So, The curved surface area of the cone (say S_2) = πrL

$S_2 = \pi$ (5) (13) cm^2

$S_2 = 204.1$ cm^2

The curved surface area of the hemisphere (say S_3) = 2 πr^2

$S_3 = 2\ \pi\ (5)^2$

$S_3 = 157$ cm^2

The total curved surface area (say S) = $S_1 + S_2 + S_3$

S = (408.2 + 204.1 + 157)

S = 769.3 cm^2

Therefore, the surface area of the toy (S) = 769.3 cm^2

Q- 7. Consider a cylindrical tub having radius as 5 cm and its length 9.8 cm. It is full of water. A solid in the form of a right circular cone mounted on a hemisphere is immersed in tub. If the radius of the hemisphere is 3.5 cm and the height of the cone outside the hemisphere is 5 cm. Find the volume of water left in the tub.

Solution:

As per the parameters given in the question, we have

The radius of the Cylindrical tub (r) = 5 cm

Height of the Cylindrical tub (say H) = 9.8 cm

Height of the cone outside the hemisphere (say h) = 5 cm

Radius of the hemisphere = 5 cm

Now,

The volume of the Cylindrical tub (say V_1) = πr^2 H

$V_1 = \pi(\ 5\ )^2\ 9.8$

$V_1 = 770$ cm^3

The volume of the Hemisphere (say V_2) = $23\times\prod\times r^3 \frac{2}{3}\times\prod\times r^3$

$V_2 = 23 \times 227 \times 3.5^3 \frac{2}{3} \times \frac{22}{7} \times 3.5^3$

$V_2 = 89.79\ cm^3$

The volume of the Hemisphere (say V_3) = $23 \times \prod \times r^2 h \frac{2}{3} \times \prod \times r^2 h$

$V_3 = 23 \times 227 \times 3.5^2 \times 5 \frac{2}{3} \times \frac{22}{7} \times 3.5^2 \times 5$

$V_3 = 64.14\ cm^3$

Therefore, The total volume = Volume of the cone + Volume of the hemisphere = $V_2 + V_3$

$V = 89.79 + 64.14\ cm^3 = 154\ cm^3$

Hence, the total volume of the solid = $154\ cm^3$

To find the volume of the water left in the tube, we have to subtract the volume of the hemisphere and the cone from the volume of the cylinder.

Hence, the volume of water left in the tube = $V = V_1 – V_2$

V = 770 – 154

V = 616 cm3

Therefore, the volume of water left in the tube is 616 cm^3.

Q-8. A circus tent has a cylindrical shape surmounted by a conical roof. The radius of the cylindrical base is 20 cm. The height of the cylindrical and conical portions is 4.2 cm and 2.1 cm. Find the volume of that circus tent.

Solution:

As per the parameters given in the question, we have

Radius of the cylindrical portion (say R) = 20 m

Height of the cylindrical portion (say h_1) = 4.2 m

Height of the conical portion (say h_2) = 2.1 m

Now,

Volume of the Cylindrical portion (say V_1) = $\pi r^2\ h_1$

$V_1 = \pi$

$(20)^2\ 4.2$

$V_1 = 5280\ m^3$

Volume of the conical part (say V_2) = 13×227×r^2×h_2 $\frac{1}{3} \times \frac{22}{7} \times r^2 \times h_2$

V_2 = 13×227×20^2×2.1 $\frac{1}{3} \times \frac{22}{7} \times 20^2 \times 2.1$

$V_2 = 880\ m^3$

Therefore, the total volume of the tent (say V) = volume of the conical portion + volume of the Cylindrical portion

$V = V_1 + V_2$

$V = 6160\ m^3$

Volume of the tent = V = $6160\ m^3$

Q-9. A petrol tank is a cylinder of base diameter 21 cm and length 18 cm fitted with the conical ends, each of axis 9 cm. Determine the capacity of the tank.

Solution:

As per the parameters given in the question, we have

Base diameter of the Cylinder = 21 cm

Radius (say r) = diameter2 $\frac{\text{diameter}}{2}$ = 252 $\frac{25}{2}$ = 11.5 cm

Height of the Cylindrical portion of the tank (say h_1) = 18 cm

Height of the Conical portion of the tank (say h_2) = 9 cm

Now,

The volume of the Cylindrical portion (say V_1) = $\pi r^2 h_1$

$V_1 = \pi\ (11.5)^2\ 18$

$V_1 = 7474.77\ cm^3$

The volume of the Conical portion (say V_2) = 13×227×r^2×h_2 $\frac{1}{3} \times \frac{22}{7} \times r^2 \times h_2$

V_2 = 13×227×11.5^2×9 $\frac{1}{3} \times \frac{22}{7} \times 11.5^2 \times 9$

$V_2 = 1245.795\ cm^3$

Therefore, the total volume of the tank (say V) = volume of the conical portion + volume of the Cylindrical portion

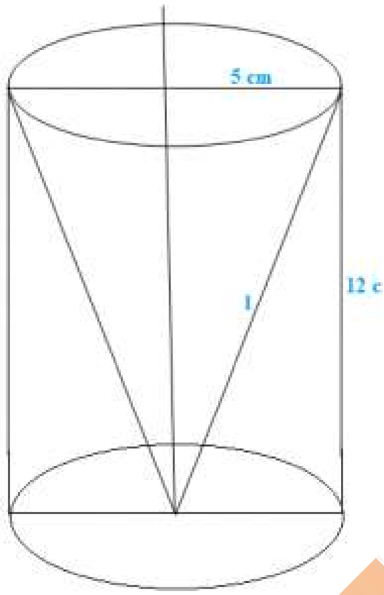
$V = V_1 + V_2$

$V = 8316 \text{ cm}^3$

So, the capacity of the tank = V = 8316 cm^3

Q-10: A conical hole is drilled in a circular cylinder of height 12 cm and base radius 5 cm. The height and base radius of the cone are also the same. Find the whole surface and volume of the remaining Cylinder.

Solution:



As per the parameters given in the question, we have

Height of the circular Cylinder (say h_1) = 12 cm

Base radius of the circular Cylinder (say r) = 5 cm

Height of the conical hole = Height of the circular cylinder, i.e., $h_1 = h_2$ = 12 cm

Base radius of the conical hole = Base radius of the circular Cylinder = 5 cm

Let us consider, L as the slant height of the conical hole.

$L = \sqrt{r^2+h^2}\sqrt{r^2+h^2}$

$L = \sqrt{5^2+12^2}\sqrt{5^2+12^2}$

$L = \sqrt{25+144}\sqrt{25+144}$

L = 13 cm

Now,

The total surface area of the reamining portion in the circular cylinder (say V_1) = $\pi r^2 + 2\pi rh + \pi rL$

$V_1 = \pi(5)^2 + 2\pi(5)(12) + \pi(5)(13)$

$V_1 = 210\ \pi\ cm^2$

Volume of the remaining portion of the circular cylinder = volume pof the cylinder – volume of the conical hole

$V = \pi r^2 h - 13 \times 227 \times r^2 \times h \frac{1}{3} \times \frac{22}{7} \times r^2 \times h$

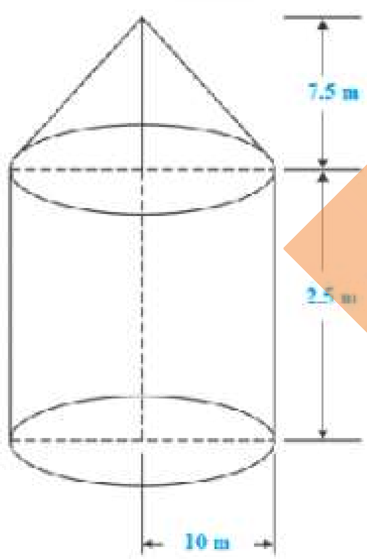
$V = \pi\ (5)^2(12) - 13 \times 227 \times 5^2 \times 12 \frac{1}{3} \times \frac{22}{7} \times 5^2 \times 12$

$V = 200\ \pi\ cm^2$

Therefore, the volume of the remaining portion of the cylindrical part = V = 200 π cm^2

Q-11. A tent is in the form of a cylinder of diameter 20m and height 2.5m surmounted by a cone of equal base and height 7.5m. Find the capacity of tent and the cost of canvas as well at a price of Rs.100 per square meter.

Solution:



As per the parameters given in the question, we have

Diameter of the cylinder = 20 m

Radius of the cylinder = 10 m

Height of the cylinder (say h_1) = 2.5 m

Radius of the cone = Radius of the cylinder (say r) = 15 m

Height of the Cone (say h_2) =7.5 m

Let us consider L as the slant height of the Cone, then

$L = \sqrt{r^2+h_{22}}\sqrt{r^2+h_2^2}$

$L = \sqrt{15^2+7.5^2}\sqrt{15^2+7.5^2}$

L = 12.5 m

Volume of the cylinder = $\pi r^2 h_1 = V_1$

$V_1 = \pi(10)^2\, 2.5$

$V_1 = 250\pi\ m^3$

Volume of the Cone = $13 \times 227 \times r^2 \times h_2 \frac{1}{3} \times \frac{22}{7} \times r^2 \times h_2 = V_2$

$V_2 = 13 \times 227 \times 10^2 \times 7.5 \frac{1}{3} \times \frac{22}{7} \times 10^2 \times 7.5$

$V_2 = 250\ \pi\ m^3$

Therefore, The total capacity of the tent = volume of the cylinder + volume of the cone = $V_1 + V_2$

$V = 250\ \pi + 250\ \pi$

$V = 500\ \pi\ m^3$

Hence, the total capacity of the tent = $V = 4478.5714\ m^3$

The total area of the canvas required for the tent is $S = 2\ \pi r h_1 + \pi r L$

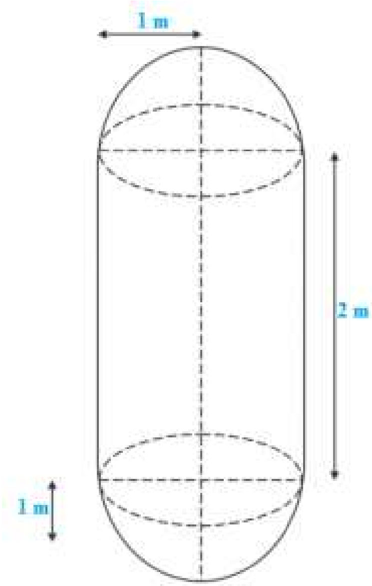
$S = 2(\pi)(10)(2.5) + \pi(10)(12.5)$

$S = 550\ m^2$

Therefore, the total cost of the canvas is (100) (550) = Rs. 55000

Q- 12. Consider a boiler which is in the form of a cylinder having length 2 m and there's a hemispherical ends each of having a diameter of 2m. Find the volume of the boiler.

Solution:



As per the parameters given in the question, we have

Diameter of the hemisphere = 2 m

Radius of the hemisphere (say r) = 1 m

Height of the cylinder (say h_1) = 2 m

The volume of the Cylinder = $\pi r^2 h_1 = V_1$

$V_1 = \pi (1)^2 2$

V_1 = 227 ×2=447 $\frac{22}{7} \times 2 = \frac{44}{7}$ m^3

Since, at each of the ends of the cylinder, hemispheres are attached.

So,

The volume of two hemispheres = 2×23×227×r³ $2 \times \frac{2}{3} \times \frac{22}{7} \times r^3$ = V_2

V_2 = 2×23×227×1³ $2 \times \frac{2}{3} \times \frac{22}{7} \times 1^3$

V_2 = 227×43=8821 $\frac{22}{7} \times \frac{4}{3} = \frac{88}{21}$ m^3

Therefore, the volume of the boiler = volume of the cylindrical portion + volume of the two hemispheres = V

$V = V_1 + V_2$

V = 447 $\frac{44}{7}$ + 8821 $\frac{88}{21}$

V = 22021 $\frac{220}{21}$ m^3

So, The volume of the boiler = V = 22021 $\frac{220}{21}$ m^3

Q-13. A vessel is a hollow cylinder fitted with a hemispherical bottom of the same base. The depth of the cylinder is 143 $\frac{14}{3}$ and the diameter of the hemisphere is 3.5m. Calculate the volume and the internal surface area of the solid.

Solution:

As per the parameters given in the question, we have

Diameter of the hemisphere = 3.5 m

Radius of the hemisphere (say r) = 1.75 m

Height of the cylinder (say h) = 143 $\frac{14}{3}$ m

The volume of the Cylinder = $\pi r^2 h_1 = V_1$

$V_1 = \pi (1.75)^2$ 143 $\frac{14}{3}$ m^3

The volume of two hemispheres = $2\times 23 \times 227 \times r^3 2 \times \frac{2}{3} \times \frac{22}{7} \times r^3 = V_2$

$V_2 = 2\times 23 \times 227 \times 1.75^3 2 \times \frac{2}{3} \times \frac{22}{7} \times 1.75^3$ m^3

Therefore, The total volume of the vessel = volume of the cylinder + volume of the two hemispheres = V

$V = V_1 + V_2$

$V = 56\ m^3$

Therefore, Volume of the vessel = V = 56 m^3

Internal surface area of solid (S) = $2\pi r h_1 + 2\pi r^2$

S = Surface area of the cylinder + Surface area of the hemisphere

$S = 2\pi (1.75)$ (143 $\frac{14}{3}$) $+ 2\pi (1.75)^2$

$S = 70.51\ m^3$

Hence, the internal surface area of the solid = S = 70.51 m^3

Q-14. Consider a solid which is composed of a cylinder with hemispherical ends. If the complete length of the solid is 104 cm and the radius of each of the hemispherical ends is 7 cm. Find the cost of polishing its surface at the rate of Rs. 10 per dm^2.

Solution:

As per the parameters given in the question, we have

Radius of the hemispherical end (say r) = 7 cm

Height of the solid = (h + 2r) = 104 cm

The curved surface area of the cylinder (say S) = 2 πr h

S = 2 π (7) h ……E.1

⇒h+2r=104⇒ $h+2r=104$ ⇒h=104−(2×7)⇒ $h=104-(2\times 7)$

h = 90 cm

Put the value of h in E.1, we will get

S = 2 π (7) (90)

S = 3948.40 cm^2

So, the curved surface area of the cylinder = S = 3948.40 cm^2

Curved surface area of the two hemisphere (say SA) = 2 (2 πr^2)

SA = 22π $(7)^2$

SA = 615.75 cm^2

Therefore, the total curved surface area of the solid = Curved surface area of the cylinder + Curved surface area of the two hemisphere = TSA

TSA = S + SA

TSA = 3948.40 + 615.75

TSA = 4571.8cm^2 = 45.718 dm^2

The cost of polishing the 1 dm^2 surface of the solid is Rs. 15

So, the cost of polishing the 45.718 dm^2 surface of the solid = 10 45.718 = Rs. 457.18

Hence,

The cost of polishing the whole surface of the solid is Rs. 457.18.

Q-15. A cylindrical vessel of diameter 14 cm and height 42 cm is fixed symmetrically inside a similar vessel of diameter 16cm and height of 42 cm. The total space between the two vessels is filled with Cork dust for heat insulation purposes. Find how many cubic cms of the Cork dust will be required?

Solution:

As per the parameters given in the question, we have

Depth of the cylindrical vessel = Height of the cylindrical vessel = h = 42 cm

Inner diameter of the cylindrical vessel = 14 cm

Inner radius of the cylindrical vessel = r_1 = 142 $\frac{14}{2}$ = 7 cm (as we know that the radius is half of the diameter)

Outer diameter of the cylindrical vessel = 16 cm

Outer radius of the cylindrical vessel = r_2 = 162 $\frac{16}{2}$ = 8 cm (as we know that the radius is half of the diameter)

Now,

The volume of the cylindrical vessel = ∏×(r_{22}−r_{21})×h$\prod \times (r_2^2 - r_1^2) \times h$ = V

V = ∏×(8^2–7^2)×42$\prod \times (8^2 - 7^2) \times 42$

V = 1980 cm^3

Therefore, Volume of the vessel = V = 1980 cm^3 = Amount of cork dust required.

Q-16. A cylindrical road roller made of iron is 1 m long. Its internal diameter is 54cm and the thickness of the iron sheet used in making roller is 9 cm. Find the mass of the road roller if 1 cm^3 of the iron has 7.8 gm mass.

Solution:

As per the parameters given in the question, we have]

Height of the cylindrical road roller = h = 1 m = 100 cm

Internal Diameter of the cylindrical road roller = 54 cm

Internal radius of the cylindrical road roller = 27 cm = r (as we know that the radius is half of the diameter)

Given the thickness of the road roller (T) = 9 cm

Let us assume that the outer radii of the cylindrical road roller be R.

T = R – r

9 = R – 27

R = 27 + 9

R = 36 cm

Now,

The volume of the iron sheet = ∏×(R^2−r^2)×h$\prod \times (R^2 - r^2) \times h$ = V

V = ∏×(36^2−27^2)×100$\prod \times (36^2 - 27^2) \times 100$

$V = 1780.38\ cm^3$

So, the volume of the iron sheet = $V = 1780.38\ cm^3$

Mass of 1 cm^3 of the iron sheet = 7.8 gm

So, the mass of 1780.38 cm^3 of the iron sheet = 1388696.4gm = 1388.7 kg

Hence, the mass of the road roller (m) = 1388.7 kg

Q-17. A vessel in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 13cm. Find the inner surface area of the vessel.

Solution:

As per the parameters given in the question itself, we have

Diameter of the hemisphere = 14 cm

Radius of the hemisphere = 7 cm (as we know that the radius is half of the diameter)

Total height of the vessel = 13 cm = h + r

Now,

Inner surface area of the vessel = 2r (h + r) = SA

SA = 2 (13) (7)

SA = 182 cm^2 = 572 cm^2

Therefore, the inner surface area of the vessel = SA = 572 cm^2

Q-18. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius. The total height of the toy is 15.5 cm. Find the total surface area of the toy.

Solution:

As per the parameters given in the question, we have

Radius of the conical portion of the toy = 3.5 cm = r

Total height of the toy = 15.5 cm = h

Length of the cone = L = 15.5 – 3.5 = 12 cm

Now,

The curved surface area of the cone = πrL = SA

SA = π (3.5) (12)

$SA = 131.94\ cm^2$

The curved surface area of the hemisphere = $2\pi r^2 = S$

$S = 2\pi\ (3.5)^2$

$S = 76.96\ cm^2$

Therefore, The total surface area of the toy = Curved surface area of the cone + curved surface area of the hemisphere = TSA

TSA = 131.94 + 76.96

TSA = 208.90 cm^2

Hence, the total surface area of the children's toy = TSA = 209 cm^2

Q-19. The difference between outside and inside surface areas of the cylindrical metallic pipe 14 cm long is 44 dm^2. If pipe is made of 99 cm^2 of metal. Find outer and inner radii of the pipe.

Solution:

Let, inner radius of the pipe be r_1.

Radius of outer cylinder be r_2.

Length of the cylinder (h) = 14 cm

Difference between the outer and the inner surface area is 44 dm^2.

So,

Surface area = 2∏h(r22–r21) $2\prod h(r_2^2 - r_1^2)$ = 44

2∏14(r22–r21) $2\prod 14(r_2^2 - r_1^2)$ = 44

(r2–r1) $(r_2 - r_1)$ = 12 $\frac{1}{2}$ ………… E.1

So,

Volume of the metal used is 99 cm^2,

∏h(r22–r21) $\prod h(r_2^2 - r_1^2)$ = 99

∏h(r2–r1)(r2+r1) $\prod h(r_2 - r_1)(r_2 + r_1)$ = 99

227 14(12)(r2+r1)=99 $\frac{22}{7} 14(\frac{1}{2})(r_2 + r_1) = 99$

Therefore,

(r_2+r_1)= 92 $(r_2+r_1)=\frac{9}{2}$ …………..E.2

Solve E.1 and E.2 to get,

r_2= 52 $r_2=\frac{5}{2}$ cm

r_1=2 $r_1=2$ cm

Q-20. A right circular cylinder having diameter 12 cm and height 15 cm is full ice-cream. The ice-cream is to be filled in cones of height 12 cm and diameter 6 cm having a hemispherical shape on the top. Find the number of such cones which can be filled with ice-cream.

Solution:

Given,

Radius of cylinder (r_1) = 6 cm

Radius of hemisphere (r_2) = 3 cm

Height of cylinder (h) = 15 cm

Height of the cones (l) = 12 cm

Volume of cylinder = ∏r_{21}h $\prod r_1^2 h$

= ∏$6^2$15 $\prod 6^2 15$ ……… E.1

Volume of each cone = Volume of cone + Volume of hemisphere

= 13∏r_{22}l+23∏r_{32} $\frac{1}{3}\prod r_2^2 l+\frac{2}{3}\prod r_2^3$

= 13∏$6^2$12+23∏3^3 $\frac{1}{3}\prod 6^2 12+\frac{2}{3}\prod 3^3$ ……. E.2

Let, number of cones be ‘n’

n(Volume of each cone) = Volume of cylinder

n(13∏$3^2$12+23∏3^3)=∏$(6)^2$15 $n(\frac{1}{3}\prod 3^2 12+\frac{2}{3}\prod 3^3)=\prod (6)^2 15$

n = 505=10 $\frac{50}{5}=10$

So, the number of cones being filled with the cylinder = n = 10

Q-21. Consider a solid iron pole having cylindrical portion 110 cm high and the base diameter of 12 cm is surmounted by a cone of 9 cm height. Find the mass of the pole. Assume that the mass of 1 cm^3 of iron pole is 8 gm.

Solution:

As per the data given in the question, we have

Base diameter of the cylinder = 12 cm

Radius of the cylinder = 6 cm = r (as we know that the radius os half of the diameter)

Height of the cylinder = 110 cm = h

Length of the cone = 9 cm = L

Now,

The volume of the cylinder = $\prod \times r^2 \times h \prod \times r^2 \times h$ = V_1

$V_1 = \prod \times 6^2 \times 110 \prod \times 6^2 \times 110$ cm^3 ……. E-1

The volume of the cone = $V_2 = 13 \times \prod r^2 L \frac{1}{3} \times \prod r^2 L$

$V_2 = 13 \times \prod 6^2 12 \frac{1}{3} \times \prod 6^2 12$

$V_2 = 108\pi\ cm^3$

Volume of the pole = volume of the cylinder + volume of the cone = $V_1 + V_2 = V$

$V = 108\pi + \pi\ (6)^2\ 110$

$V = 12785.14\ cm^3$

Given mass of 1 cm^3 of the iron pole = 8 gm

Then, mass of 12785.14 cm^3 of the iron pole = 8 12785.14 = 102281.12 gm = 102.2 kg

Therefore, the mass of the iron pole = 102.2 kg

Q-22. A solid toy is in the form of a hemisphere surmounted by a right circular cone. Height of the cone is 2 cm and the diameter of the base is 4 cm. If a right circular cylinder circumscribes the toy, find how much more space it will cover?

Solution:

Given that,

Radius of the cone, cylinder and hemisphere (r) = 2 cm

Height of the cone (l) = 2 cm

Height of the cylinder (h) = 4 cm

Volume of the cylinder = $\prod \times r^2 \times h \prod \times r^2 \times h$ = V_1

$V_1 = \prod \times 2^2 \times 4 \prod \times 2^2 \times 4$ cm^3 ……… E-1

Volume of the cone = $V_2 = 13 \times \prod r^2 L \frac{1}{3} \times \prod r^2 L$

$V_2 = 13 \times \prod 2^2 2 \frac{1}{3} \times \prod 2^2 2$

$V_2 = 13 \times \prod 4 \times 2 \frac{1}{3} \times \prod 4 \times 2$ cm^3 ………. E-2

Volume of the hemisphere $V_3 = 23 \prod r_{32} \frac{2}{3} \prod r_2^3$

$V_3 = 23 \prod 2^3 \frac{2}{3} \prod 2^3$ cm^3

$V_3 = 23 \prod \times 8 \frac{2}{3} \prod \times 8$ cm^3 ………. E-3

So, remaining volume of the cylinder when the toy is inserted to it = $V_1 - (V_2 + V_3)$

$V = 16\pi - 8\pi = 8\pi$ cm^3

Hence, remaining volume of the cylinder when toy is inserted into it = $V = 8\pi$ cm^3

Q-23. Consider a solid consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm, is placed upright in the right circular cylinder full of water such that it touches bottoms. Find the volume of the water left in the cylinder, if radius of the cylinder is 60 cm and its height is 180 cm.

Solution:

As per the data given in the question, we have

Radius of the circular cone = r = 60 cm

Height of the circular cone = L = 120 cm

Radius of the hemisphere = r = 60 cm

Radius of the cylinder = R = 60 cm

Height of the cylinder = H = 180 cm

Now,

Volume of the circular cone = $V_1 = 13 \times \prod r^2 L \frac{1}{3} \times \prod r^2 L$

$V_1 = 13 \times \prod 60^2 \times 120 \frac{1}{3} \times \prod 60^2 \times 120$

$V_1 = 452571.429$ cm^3

Volume of the hemisphere = $V_2 = 23 \times \prod r^3 \frac{2}{3} \times \prod r^3$

$V_2 = 23 \times \prod 60^3 \frac{2}{3} \times \prod 60^3$

$V_2 = 452571.429\ cm^3$

Volume of the cylinder = $\prod \times R^2 \times H \prod \times R^2 \times H$ = V_3

$V_3 = \prod \times 60^2 \times 180 \prod \times 60^2 \times 180$

$V_3 = 2036571.43\ cm^3$

Volume of water left in the cylinder = Volume of the cylinder – (volume of the circular cone + volume of the hemisphere) = V

$V = V_3 – (V_1 + V_2)$

V = 2036571.43 – (452571.429 + 452571.429)

V = 2036571.43 – 905142.858

$V = 1131428.57\ cm^3$

$V = 1.1314\ m^3$

Therefore, the volume of the water left in the cylinder = V = $1.1314\ m^3$

Q-24. Consider a cylindrical vessel with internal diameter 10 cm and height 10.5 cm is full of water. A solid cone of base diameter 8 cm and height 6 cm is completely immersed in water. Find the value of water when:

(i) Displaced out of the cylinder (ii) Left in the cylinder

Solution:

As per the parameters given in the question, we have

Internal diameter of the cylindrical vessel = 10 cm

Radius of the cylindrical vessel = r = 5 cm (as we know that the radius is half of the diameter)

Height of the cylindrical vessel = h = 10.5 cm

Base diameter of the solid cone = 7 cm

Radius of the solid cone = R = 3.5 cm (as we know that the radius is half of the diameter)

Height of the cone = L = 6 cm

(i) Volume of water displaced out from the cylinder = Volume of the cone = V_1

$V_1 = 13 \times \prod R^2 L \frac{1}{3} \times \prod R^2 L$

$V_1 = 13 \times \prod 3.5^2 \times 6 \frac{1}{3} \times \prod 3.5^2 \times 6$

$V_1 = 77\ cm^3$

Therefore, the volume of the water displaced after immersion of the solid cone in the cylinder = V_1 =77 cm^3

(ii) Volume of the cylindrical vessel = $\prod \times r^2 \times h \prod \times r^2 \times h$ = V_2

$V_2 = \prod \times 5^2 \times 10.5 \prod \times 5^2 \times 10.5$

$V_2 = 824.6\ cm^3 = 825\ cm^3$

Volume of the water left in the cylinder = Volume of the cylindrical vessel – Volume of the solid cone

$V = V_2 – V_1$

V = 825- 77

$V = 748\ cm^3$

Therefore, the volume of the water left in cylinder = V = 748 cm^3

Q-25. A hemispherical depression is cut from one face of a cubical wooden block of the edge 21 cm such that the diameter of the hemispherical surface is equal to the edge of the cubical surface. Determine the volume and the total surface area of the remaining block.

Solution:

As per the data given in the question itself, we have

Edge of the cubical wooden block = e = 21 cm

Diameter of the hemisphere = Edge of the cubical wooden block = 21 cm

Radius of the hemisphere = 10.5 cm = r (as we know that the radius is half of the diameter)

Now,

Volume of the remaining block = Volume of the cubical block – Volume of the hemisphere

$V = e^3 – (23 \prod r^3) e^3 – (\frac{2}{3} \prod r^3)$

$V = 21^3 – (23 \prod 10.5^3) 21^3 – (\frac{2}{3} \prod 10.5^3)$

$V = 6835.5\ cm^3$

Surface area of the block = $6(e^2) 6(e^2)$ = SA

SA = $6(21^2)6\,(21^2)$ ………………… E-1

Curved surface area of the hemisphere = CSA = $2\prod r^2 2\prod r^2$

CSA = $2\prod 10.5^2 2\prod 10.5^2$ …………………… E-2

Base area of the hemisphere = BA = $\prod r^2 \prod r^2$

BA = $\prod 10.5^2 \prod 10.5^2$ …………………… E-3

So, Remaining surface area of the box = SA – (CSA + BA)

= $6(21^2)6\,(21^2)$ – ($2\prod 10.5^2 2\prod 10.5^2$ + $\prod 10.5^2 \prod 10.5^2$)

= 2992.5 cm^2

Therefore, the remaining surface area of the block = 2992.5 cm^2

Volume of the remaining block = V = 6835.5 cm^3

Q-26. A boy is playing with a toy which is in the form of a hemisphere surmounted by a right circular cone of the same base radius as that of the hemisphere. If the radius of the base of the cone is 21 cm and its volume is 2/3 of the volume of the hemisphere. Calculate the height of the cone and surface area of the toy.

Solution:

As per the parameter given in the question itself, we have

Radius of the cone = 21 cm = R

Radius of the hemisphere = Radius of the cone = 21 cm

Volume of the cone = 2/3 of the hemisphere

We know that,

The volume of the cone = V_1 = 13 $\times \prod R^2 L \frac{1}{3} \times \prod R^2 L$

V_1 = 13 $\times \prod 21^2 L \frac{1}{3} \times \prod 21^2 L$

Also, we know that,

The volume of the hemisphere = V_2 = 23 $\times \prod R^3 \frac{2}{3} \times \prod R^3$

V_2 = 23 $\times \prod 21^3 \frac{2}{3} \times \prod 21^3$ cm^3

Now, as per the condition

$V_1 = \frac{2}{3} V_2$

$V_1 = \frac{2}{3} \times 169714.286$

$\frac{1}{3} \times \prod 21^2 L = \frac{2}{3} \times \prod 21^3$

L = 28 cm

Curved surface area of the Cone = $CSA_1 = \prod RL$

$CSA_1 = \prod \times 21 \times 28$ cm^2

Curved Surface area of the hemisphere = $CSA_2 = 2 \prod R^2$

$CSA_2 = 2 \prod (21^2)$ cm^2

Now, the total surface area = S = $CSA_1 + CSA_2$

$S = \prod \times 21 \times 28 + 2 \prod (21^2)$

S = 5082 cm^2

Therefore, the curved surface area of the toy = S = 5082 cm^2

Q-27. Consider a solid which is in the form of a cone surmounted on hemisphere. The radius of each of them is being 3.5 cm and the total height of the solid is 9.5 cm. Find the volume of the solid.

Solution:

As per the data given in the question, we have

Radius of the hemisphere = 3.5 cm = R

Radius of the cone = Radius of the hemisphere = 3.5 cm = R

Total height of the solid = 9.5 cm = H

Then,

Length of the cone = Total height – Radius of the cone

L = 9.5 – 3.5 = 6 cm

Now,

The volume of the cone = $V_1 = \frac{1}{3} \times \prod R^2 L$

$V_1 = \frac{1}{3} \times \prod 3.5^2 6$ cm^3 …….. E-1

The volume of the hemisphere = V_2 = $23\times\prod R^3 \frac{2}{3}\times\prod R^3$

V_2 = $23\times\prod 5^3 \frac{2}{3}\times\prod 5^3$ cm^3 ……… E-2

Total volume of the solid = Volume of the cone + Volume of the hemisphere = V

$V = V_1 + V_2$

V = $13\times\prod 3.5^2 6 \frac{1}{3}\times\prod 3.5^2 6$ + $23\times\prod 5^3 \frac{2}{3}\times\prod 5^3$

V = 166.75 cm^3

So, the volume of the solid = V = 166.75 cm^3

Q-28. A wooden toy is made by scooping out a hemisphere of same radius from each end of the solid cylinder. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the volume of the wood in the toy.

Solution:

Given that,

Radius of the cylinder = Radius of the hemisphere = 3.5 cm = r

Height of the hemisphere = 10 cm = h

Volume of the cylinder = $\prod\times r^2\times h\prod\times r^2\times h$ = V_1

V_1 = $\prod\times 3.5^2\times 10\prod\times 3.5^2\times 10$ ………… E-1

Volume of the hemisphere = V_2 = $23\times\prod r^3 \frac{2}{3}\times\prod r^3$

V_2 = $23\times\prod 3.5^3 \frac{2}{3}\times\prod 3.5^3$ cm^3 ……… E-2

So,

Volume of the wood in the toy = Volume of the cylinder – 2(Volume of the hemisphere)

$V = V_1 – V_2$

V = 205.33 cm^3

Q-29. The largest possible sphere is carved out of a wooden solid cube of side 7 cm. Find the volume of the wood left.

Solution:

Given that,

Diameter of the wooden solid = 7 cm

Radius of the wooden solid = 3.5 cm

Volume of the cube = e^3

$V_1 = 3.5^3$ ………… E-1.

Volume of sphere = $\frac{4}{3} \times \prod \times r^3$ = V_2

$V_2 = \frac{4}{3} \times \prod \times 3.5^3$ ………… E-2

Volume of the wood left = Volume of the cube – Volume of sphere

$V = 3.5^3 - \frac{4}{3} \times \prod \times 3.5^3$

$V = 163.33 \text{ cm}^3$

Q-30. From a solid cylinder of height 2.8 cm and diameter 4.2 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid.

Solution:

Given that,

Height of the cylinder = 2.8 cm = Height of the cone

Diameter of the cylinder = 4.2 cm

Radius of the cylinder = 2.1 cm = Radius of the cone

CSA of the cylindrical part = $CSA_1 = 2\pi RH$

$CSA_1 = 2\pi(2.8)(2.1) \text{ cm}^2$

Curved surface area of the Cone = $CSA_2 = \prod RL$

$CSA_2 = \prod \times 2.1 \times 2.8 \text{ cm}^2$

Area of the cylindrical base = $\pi r^2 = \pi(2.1)^2$

Total surface area of the remaining solid = CSA of the cylindrical part + Curved surface area of the Cone + Area of the cylindrical base

$TSA = 2\pi(2.8)(2.1) + \prod \times 2.1 \times 2.8 + \pi(2.1)^2$

TSA = 36.96 + 23.1 + 13.86

$TSA = 73.92 \text{ cm}^2$

Q-31. The largest cone is carved out from one face of the solid cube of side 21 cm. Find the volume of the remaining solid.

Solution:

Given that,

The radius of the largest possible cone is carved out of a solid cube is equal to the half of the side of the cube.

Diameter of the cone = 21 cm

Radius of the cone = 10.5 cm

The height of the cone is equal to the side of the cone.

Volume of the cube = $e^3 e^3$

V_1 = $10.5^3 10.5^3$ …………. E-1.

Volume of the cone = V_2 = $13 \times \prod r^2 L \frac{1}{3} \times \prod r^2 L$

V_2 = $13 \times \prod 10.5^2 21 \frac{1}{3} \times \prod 10.5^2 21$ cm^3 …….. E-2

Volume of the remaining solid = Volume of cube – Volume of cone

V = $10.5^3 10.5^3 - 13 \times \prod 10.5^2 21 \frac{1}{3} \times \prod 10.5^2 21$

V = 6835.5 cm^3

Q-32. A solid wooden toy is in the form of a hemisphere surmounted by a cone of the same radius. The radius of the hemisphere is 3.5 cm and the total wood used in the making of toy is $166\,56\,cm^3 166\frac{5}{6} cm^3$. Find the height of the toy. Also, find the cost of painting the hemispherical part of the toy at the rate of Rs. 10 per square cm.

Solution:

Given that,

Radius of the hemisphere = 3.5 cm

Volume of the solid wooden toy = $166\,56\,cm^3 166\frac{5}{6} cm^3$

As, Volume of the solid wooden toy = Volume of the cone + Volume of the hemisphere = $166\,56\,cm^3$ $166\frac{5}{6} cm^3$

$13 \times \prod r^2 L \frac{1}{3} \times \prod r^2 L + 23 \times \prod r^3 \frac{2}{3} \times \prod r^3$ = 10016

$13 \times \prod 3.5^2 L \frac{1}{3} \times \prod 3.5^2 L + 23 \times \prod 3.5^3 \frac{2}{3} \times \prod 3.5^3 = 10016$

L + 7 = 13

L = 6 cm

Height of the solid wooden toy = Height of the cone + Radius of the hemisphere

= 6 + 3.5

= 9.5 cm

Now, curved surface area of the hemisphere = $2\prod R^2 2 \prod R^2$

$CSA_2 = 2\prod(3.5^2) 2 \prod (3.5^2) = 77\ cm^2$

Cost of painting the hemispherical part of the toy = 10 77 = Rs. 770

Q-33. How many spherical bullets can be made out of a solid cube of lead whose edge measures 55 cm and each of the bullet being 4 cm in diameter?

Solution:

Let, the total number of bullets be a.

Diameter of the bullet = 4 cm

Radius of the spherical bullet = 2 cm (as we know that the radius is half of the diameter)

Now,

Volume of a spherical bullet = $43 \times \prod \times r^3 \frac{4}{3} \times \prod \times r^3 = V$

$V = 43 \times \prod \times 2^3 \frac{4}{3} \times \prod \times 2^3$

$V = 43 \times 227 \times 2^3 \frac{4}{3} \times \frac{22}{7} \times 2^3$

$V = 33.5238\ cm^3$

Volume of 'a' number of the spherical bullets = V a

$V_1 = (33.5238\ a)\ cm^{23}$

Volume of the solid cube = $(55)^3 = 166375\ cm^3$

Volume of 'a' number of the spherical bullets = Volume of the solid cube

33.5238 a = 166375

A = 4962.892

Hence, total number of the spherical bullets = 4963

Q-34. Consider a children's toy which is in the form of a cone at the top having a radius of 5 cm mounted on a hemisphere which is the base of the toy having the same radius. The total height of the toy is 20 cm. Find the total surface area of the toy.

Solution:

As per the parameters given in the question, we have

Radius of the conical portion of the toy = 5 cm = r

Total height of the toy = 20 cm = h

Length of the cone = L = 20 – 5 = 15 cm

Now,

The curved surface area of the cone = πrL = SA

SA = π (5) (15)

SA = 235.7142 cm^2

The curved surface area of the hemisphere = $2\pi r^2$ = S

S = 2π (5 $)^2$

S = 157.1428 cm^2

Therefore, The total surface area of the toy = Curved surface area of the cone + curved surface area of the hemisphere = TSA

TSA = 235.7142 + 157.1428

TSA = 392.857 cm^2

Hence, the total surface area of the children's toy = TSA = 392.857 cm^2

Q-35. A boy is playing with a toy conical in shape and is surmounted with hemispherical surface. Consider a cylinder in with the toy is inserted. The diameter of cone is the same as that of the radius of cylinder and hemispherical portion of the toy which is 8 cm. The height of the cylinder is 6 cm and the height of the conical portion of the toy is 3 cm. Assume a condition in which the boy's toy is inserted in the cylinder, then find the volume of the cylinder left vacant after insertion of the toy.

Solution:

As per the parameter given in the question, we have

Diameter of the cone = Diameter of the Cylinder = Diameter of the Hemisphere = 8 cm

Radius of the cone = Radius of the cylinder = Radius of the Hemisphere = 4 cm = r (as we know that the radius is half of the diameter)

Height of the conical portion = 3 cm = L

Height of the cylinder = 6 cm = H

Now,

Volume of the cylinder = $\prod \times r^2 \times H \prod \times r^2 \times H$ = V_1

$V_1 = \prod \times 4^2 \times 6 \prod \times 4^2 \times 6$

V_1 = 301.7142 cm^3

Volume of the Conical portion of the toy = V_2 = $13 \times \prod r^2 L \frac{1}{3} \times \prod r^2 L$

$V_2 = 13 \times \prod 4^2 \times 3 \frac{1}{3} \times \prod 4^2 \times 3$

V_2 = 50.2857 cm^3

Volume of the hemispherical portion of the toy = V_3 = $23 \times \prod r^3 \frac{2}{3} \times \prod r^3$

$V_3 = 23 \times \prod 4^3 \frac{2}{3} \times \prod 4^3$

V_3 = 134.0952 cm^3

So, the remaining volume of the cylinder when the toy (conical portion + hemispherical portion) is inserted in it = Volume of cylinder – (volume of the conical portion + volume of the hemispherical portion)

$V = V_1 - (V_2 + V_3)$

V = 301.7142 – (50.2857 + 134.0952)

V = 301.7142 – 184.3809

V = 117.3333 cm^3

Therefore, the remaining portion of the cylinder after insertion of the toy in it = V = 117.3333 cm^3

Q-36. Consider a solid consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm, is placed upright in the right circular cylinder full of water such that it touches bottoms. Find the volume of the water left in the cylinder, if radius of the cylinder is 60 cm and its height is 180 cm.

Solution:

As per the data given in the question, we have

Radius of the circular cone = r = 60 cm

Height of the circular cone = L = 120 cm

Radius of the hemisphere = r = 60 cm

Radius of the cylinder = R = 60 cm

Height of the cylinder = H = 180 cm

Now,

Volume of the circular cone = V_1 = $13\times\prod r^2 L \frac{1}{3} \times \prod r^2 L$

$V_1 = 13\times\prod 60^2\times 120 \frac{1}{3} \times \prod 60^2 \times 120$

V_1 = 452571.429 cm^3

Volume of the hemisphere = V_2 = $23\times\prod r^3 \frac{2}{3} \times \prod r^3$

$V_2 = 23\times\prod 60^3 \frac{2}{3} \times \prod 60^3$

V_2 = 452571.429 cm^3

Volume of the cylinder = $\prod\times R^2\times H \prod \times R^2 \times H$ = V_3

$V_3 = \prod\times 60^2\times 180 \prod \times 60^2 \times 180$

V_3 = 2036571.43 cm^3

Volume of water left in the cylinder = Volume of the cylinder – (volume of the circular cone + volume of the hemisphere) = V

$V = V_3 – (V_1 + V_2)$

V = 2036571.43 – (452571.429 + 452571.429)

V = 2036571.43 – 905142.858

V = 1131428.57 cm^3

V = 1.1314 m^3

Therefore, the volume of the water left in the cylinder = V = 1.1314 m^3

Q-37. Consider a cylindrical vessel with internal diameter 20 cm and height 12 cm is full of water. A solid cone of base diameter 8 cm and height 7 cm is completely immersed in water. Find the value of water when

(i) Displaced out of the cylinder

(ii) Left in the cylinder

Solution:

As per the parameters given in the question, we have

Internal diameter of the cylindrical vessel = 20 cm

Radius of the cylindrical vessel = r = 10 cm (as we know that the radius is half of the diameter)

Height of the cylindrical vessel = h = 12 cm

Base diameter of the solid cone = 8 cm

Radius of the solid cone = R = 4 cm (as we know that the radius is half of the diameter)

Height of the cone = L = 7 cm

(i) Volume of water displaced out from the cylinder = Volume of the cone = V_1

V_1 = 13×∏R^2L $\frac{1}{3} \times \prod R^2 L$

V_1 = 13×∏4^2×7 $\frac{1}{3} \times \prod 4^2 \times 7$

$V_1 = 117.3333\ cm^3$

Therefore, the volume of the water displaced after immersion of the solid cone in the cylinder = $V_1 = 117.3333\ cm^3$

(ii) Volume of the cylindrical vessel = ∏×r^2×h $\prod \times r^2 \times h$ = V_2

V_2 = ∏×10^2×12 $\prod \times 10^2 \times 12$

$V_2 = 3771.4286\ cm^3$

Volume of the water left in the cylinder = Volume of the cylindrical vessel – Volume of the solid cone

$V = V_2 - V_1$

V = 3771.4286 – 117.3333

$V = 3654.0953\ cm^3$

Therefore, the volume of the water left in cylinder = $V = 3654.0953\ cm^3$