CBSE Class–10 Mathematics

NCERT solution

Chapter - 13

Surface Areas and Volumes - Exercise 13.1

Unless stated otherwise, take $\pi = \frac{22}{7}$.

1. 2 cubes each of volume 64 cm^3 are joined end to end. Find the surface area of the resulting cuboid.

Ans. Volume of cube = $(Side)^3$

According to question, $(Side)^3$ = 64

$\Rightarrow (Side)^3 = 4^3$

$\Rightarrow$ Side = 4 cm

For the resulting cuboid, length (l) = 4 + 4 = 8 cm, breadth (b) = 4 cm and height (h) = 4 cm

Surface area of resulting cuboid = $2(lb+bh+hl)$

= $2(8\times4+4\times4+4\times8)$

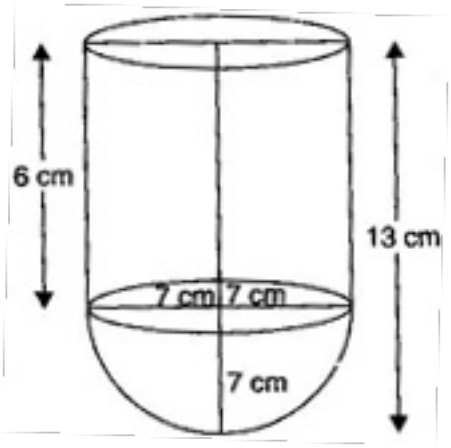
= 2 (32 + 16 + 32)

= $2\times80=160\ cm^2$

2. A vessel is 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 13 cm. Find the inner surface area of the vessel.

Ans. ∵ Diameter of the hollow hemisphere = 14 cm

∴ Radius of the hollow hemisphere = $\frac{14}{2}$ = 7 cm



Total height of the vessel = 13 cm

∴ Height of the hollow cylinder = 13 – 7 = 6 cm

∴ Inner surface area of the vessel

= Inner surface area of the hollow hemisphere + Inner surface area of the hollow cylinder

$= 2\pi(7)^2 + 2\pi(7)(6)$

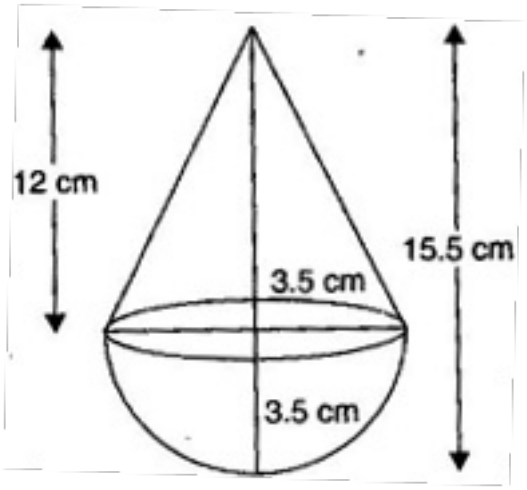
$= 98\pi + 84\pi = 182\pi$

$= 182 \times \frac{22}{7} = 26 \times 22 = 572\ cm^2$

3. 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.

Ans. Radius of the cone = 3.5 cm

∴ Radius of the hemisphere = 3.5 cm



Total height of the toy = 15.5 cm

∴ Height of the cone = 15.5 – 3.5 = 12 cm

Slant height of the cone = $\sqrt{(3.5)^2+(12)^2}$

= $\sqrt{12.25+144}$

= $\sqrt{156.25}$ = 12.5 cm

∴ TSA of the toy = CSA of hemisphere + CSA of cone

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

= $2\pi(3.5)^2+\pi(3.5)(12.5)$

= $24.5\pi+43.75\pi$ = 68.25π

= $68.25\times\frac{22}{7}$ = $214.5\ cm^2$

4. A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have? Find the surface area of the solid.

Ans. Greatest diameter of the hemisphere = Side of the cubical block = 7 cm

∴ TSA of the solid = External surface area of the cubical block + CSA of hemisphere

$= \left\{6(7)^2 - \pi\left(\frac{7}{2}\right)^2\right\} + 2\pi\left(\frac{7}{2}\right)^2$

$=> \left(294 - \frac{49}{4}\pi\right) + \frac{49}{2}\pi$

$= 294 + \frac{49}{4}\pi$

$= 294 + \frac{49}{4} \times \frac{22}{7}$

$= 294 + \frac{77}{2}$

= 294 + 38.5 = $332.5\ cm^2$

5. A hemispherical depression is cut out from one face of a cubical wooden block such that the diameter l of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.

Ans. ∵ Diameter of the hemisphere = l, therefore radius of the hemisphere = $\frac{l}{2}$

Also, length of the edge of the cube = l

∴ Surface area of the remaining solid = total surface area of cubical block + curved surface area of hemispherical - area of circular base

$= 2\pi\left(\frac{l}{2}\right)^2 + 6l^2 - \pi\left(\frac{l}{2}\right)^2$

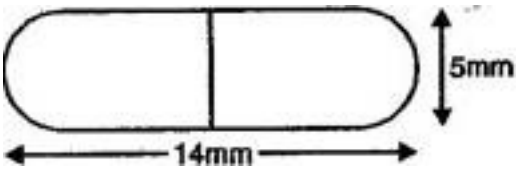
$= \pi\left(\frac{l}{2}\right)^2 + 6l^2$

$= \frac{\pi l^2}{4} + 6l^2$

$= \frac{1}{4}l^2(\pi + 24)$

6. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each

of its ends (see figure). The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm. Find its surface area.

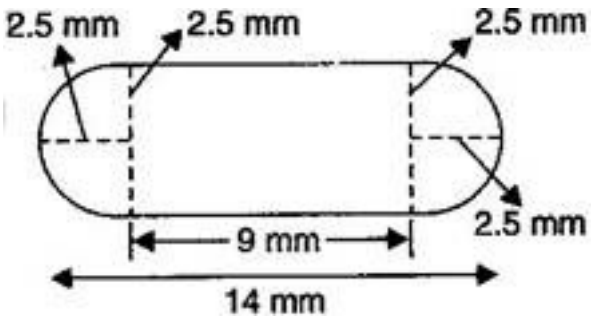


Ans. Radius of the hemisphere = $\frac{5}{2}$ mm

Let radius = r = 2.5 mm

Cylindrical height = Total height – Diameter of sphere = h = 14 – (2.5 + 2.5) = 9 mm

Surface area of the capsule = CSA of cylinder + curved Surface area of 2 hemispheres



$= 2\pi rh + 2\left(2\pi r^2\right)$

$= 2\pi\left(\frac{5}{2}\right)(9) + 2\left\{2\pi\left(\frac{5}{2}\right)^2\right\}$

$= 45\pi + 25\pi$

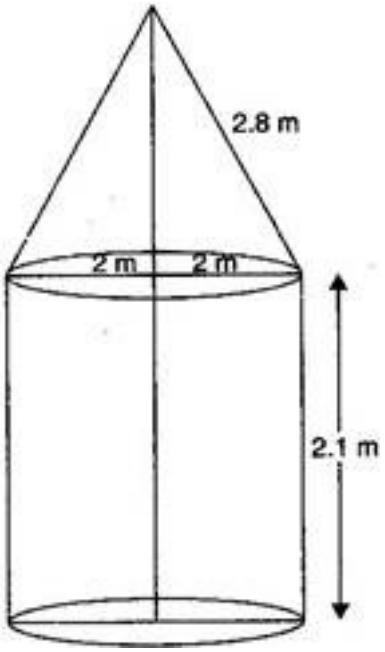
$= 70\pi = 70 \times \frac{22}{7} = 220\ mm^2$

7. A tent is in the shape of a cylinder surmounted buy a conical top. If the height and diameter of the cylindrical part are 2.1 m and 4 m respectively and the slant height of the top is 2.8 m, find the area of the canvas used for making the tent. Also, find the cost of the canvas of the tent at the rate of Rs. 500 per m^2. (Note that the base of the tent will not be covered with canvas.)

Ans. Diameter of the cylindrical part = 4 cm

∴ Radius of the cylindrical part = 2 cm

TSA of the tent = CSA of the cylindrical part + CSA of conical top



$= 2\pi(2)(2.1)+\pi(2)(2.8)$

$= 8.4\pi+5.6\pi$

$= 14\pi$

$= 14\times\frac{22}{7}$

$= 44\ m^2$

∴ Cost of the canvas of the tent of 1 m^2 = Rs. 500

cost of canvas of the tent of 44 m^2 =

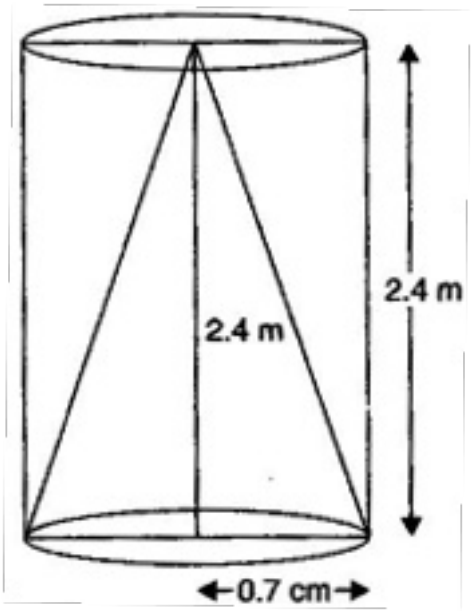
$= 44\times500$ = Rs. 22000

8. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid to the nearest cm^2.

Ans. Diameter of the solid cylinder = 1.4 cm

∴ Radius of the solid cylinder = 0.7 cm

∴ Radius of the base of the conical cavity = 0.7 cm



Height of the solid cylinder = 2.4 cm

∴ Height of the conical cavity = 2.4 cm

∴ Slant height of the conical cavity = $\sqrt{(0.7)^2+(2.4)^2}$

= $\sqrt{0.49+5.76}$

= $\sqrt{6.25}$ = 2.5 cm

∴ TSA of remaining solid = curved surface area of cylinder + area of upper circular part + curved surface area of conical part

= $2\pi(0.7)(2.4)+\pi(0.7)^2+\pi(0.7)(2.5)$

= $3.36\pi+0.49\pi+1.75\pi$

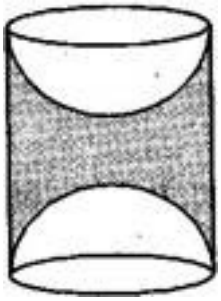
= 5.6π

= $5.6\times\frac{22}{7}$ = 17.6 $\mathbf{cm^2}$

= $18\ cm^2$ (to the nearest $\mathbf{cm^2}$)

9. A wooden article was made by scooping out a hemisphere from each end of a solid

cylinder as shown in figure. If the height of the cylinder is 10 cm and its base is of radius 3.5 cm, find the total surface area of the article.



Ans. TSA of the article = $2\pi rH + 2\left(2\pi r^2\right)$ = curved surface area of cylinder + curved surface area of 2 hemispheres

= $2\pi(3.5)(10) + 2\left[2\pi(3.5)^2\right]$

= $70\pi + 49\pi$

= 119π

= $119 \times \frac{22}{7}$

= $374\ cm^2$