# Chapter-Surface area and volume

Q1.

.Water is flowing at the rate of 2.52 km/h through a cylindrical pipe into a cylindrical tank, the radius of whose base is 40 cm. If the increase in the level of the water in the tank, in half an hour is 3.15 m, find the internal diameter of the pipe.

Q2.

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

Q3.

.A right angled triangle whose sides are 3 cm, 4 cm and 5 cm is revolved about the longest side. Find the surface area of figure obtained. Use $\pi = \frac{22}{7}$

Q4.

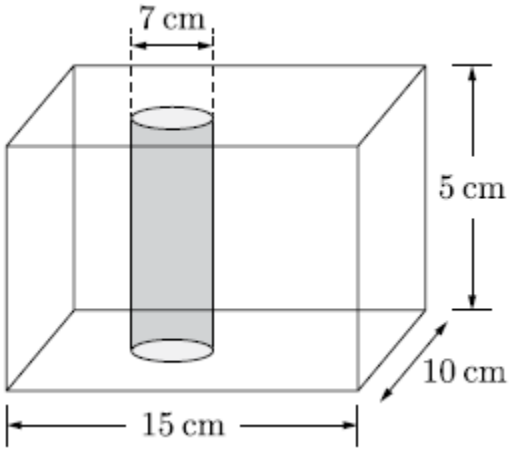
.A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm and the diameter of the base is 4 cm. Determine the volume of the toy. If a right circular cylinder circumscribes the toy, find the difference of the volume of the cylinder and toy. (Use $\pi = 3.14$)

Q5.

A vessel full of water is in the form of an inverted cone of height 8 cm and the radius of its top, which is open, is 5 cm. 100 spherical lead balls are dropped into the vessel. One-fourth of the water flows out of the vessel. Find the radius of a spherical ball.

Q6.

In fig., from a cuboidal solid metallic block of dimensions 15 cm $\times$ 10 cm $\times$ 5 cm, a cylindrical hole of diameter 7 cm is drilled out. Find the surface area of the remaining block. Use $\pi = \frac{22}{7}$




Q7.

**A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface areas of the hemispherical part and the conical part are equal, then find the ratio of the radius and the height of the conical part.**

Q8.

A well diameter 3 m is dug 14 m deep. The soil taken out of it is spread evenly around it to a width of 5 m. to form a embankment. Find the height of the embankment.

Q9.

Water is flowing at the rate of 5 km/hour through a pipe of diameter 14 cm into a rectangular tank of dimensions 50 m $\times$ 44 m. Find the time in which the level of water in the tank will rise by 7 cm.

Q10.

.A milk tanker cylindrical in shape having diameter 2 m and length 4.2 m supplies milk to the two booths in the ratio of 3 : 2. One of the milk booths has cuboidal vessel having base area 3.96 sq. m. and the other has a cylindrical vessel having radius 1 m. Find the level of milk in each of the vessels. Use $\pi = \frac{22}{7}$

# Solutions

Q1.

Let $r$ be the internal radius of the pipe, then cross section area of pipe is $\pi r^2$.

Speed of water flowing through the pipe

$$= 2.52 \text{ km/hr} = 2520 \text{ m/hr}$$

In an hour length of water $= 2520$ m

Volume of water flowing from pipe in 1 hr,

$$\pi r^2 h = \pi r^2 2520 \text{ m}^3$$

In 30 minute or in 0.5 hour,

Volume of water flown= Volume of water in tank

$$\pi r^2 2520 \times 0.5 = \pi \times (0.4)^2 \times 3.15$$

$$1260 r^2 = 0.4 \times 0.4 \times 3.15$$

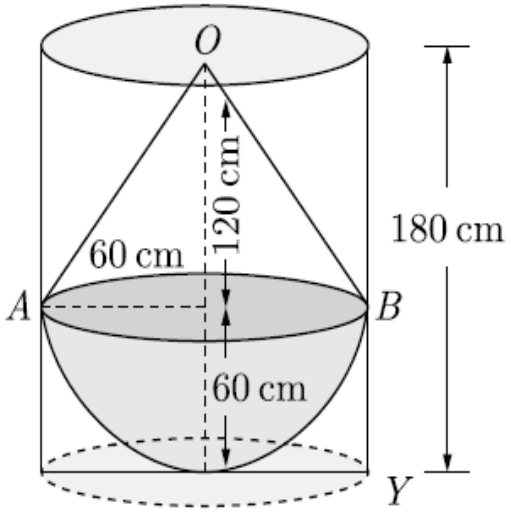
$$400 r^2 = 0.4 \times 0.4$$

$$20r = 0.4 \Rightarrow r = \frac{0.4}{20} = 0.02 \text{ m}$$

Internal radius is 2 cm and diameter of pipe is 4 cm.

Q2.

As per question the figure is shown below.




Height of cone, $h = 120$ cm,

Radius of cone, $r = 60$ cm

Radius of hemisphere, $r = 60$ cm.

Height of cylinder, $H = 180$ cm,

Radius of cylinder, $R = 60$ cm

Radius of cone, hemisphere and cylinder is equal to $r = 60$ cm

Volume of solid,

$$V_{\text{solid}} = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$

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

$$= \frac{\pi r^2}{3} \times 240 = 80\pi r^2$$

$$= \frac{\pi r^2}{3} \times 240 = 80\pi r^2$$

Volume of water in the cylinder is equal to the volume of cylinder.

$$V_{\text{cylinder}} = \pi r^2 h$$

$$= \pi \times r^2 \times 180 = 180\pi r^2$$

Water left in the cylinder is equal to the difference of the volume of water in cylinder and volume of solid.

Water left in the cylinder,

$$= V_{\text{cylinder}} - V_{\text{solid}}$$

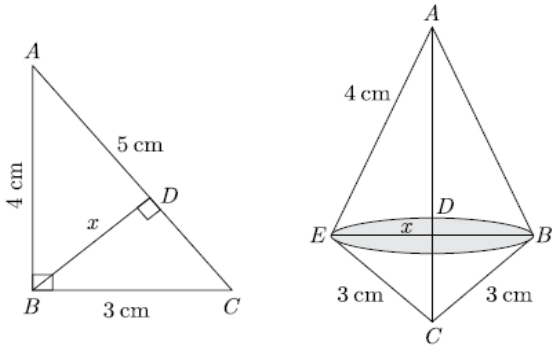
$$= 180\pi r^2 - 80\pi r^2$$

$$= 100\pi r^2$$

$$= 100 \times \frac{22}{7} \times (60)^2$$

Q3.

As per question the figure is shown below.




By revolving right triangle about longest side double cone is generated. Let $x$ be radius of double cone.

$$\text{area}(\Delta ABC) = \text{area}(\Delta ABC)$$

$$\frac{1}{2} \times 5 \times x = \frac{1}{2} \times 3 \times 4$$

$$x = \frac{12}{5} = 2.4 \text{ cm}$$

Surface area of double cone,

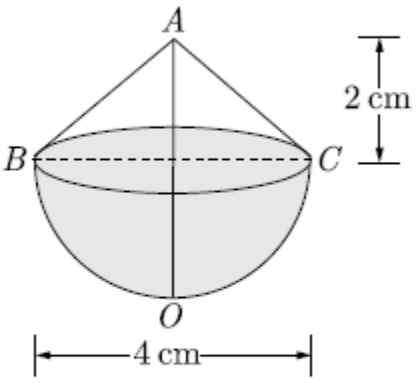
$$\pi r l_1 + \pi r l_2 = \pi x (l_1 + l_2)$$

$$= \frac{22}{7} \times 2.4 \times (3 + 4)$$

$$= 22 \times 2.4 = 52.8 \text{ cm}^2.$$

Q4.

Let $BOC$ is a hemisphere and $ABC$ is a cone. As per question the figure is shown below.




Radius of hemisphere is equal to the radius of cone which is $\frac{4}{2} = 2$ cm.

Height of cone, $h = 2$ cm

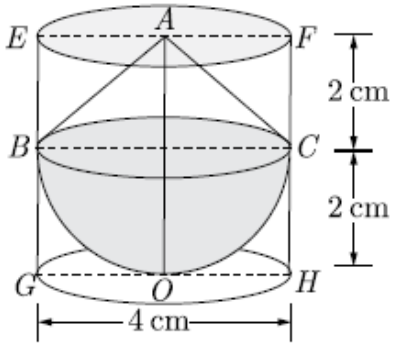
$$\text{Volume of toy} = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$$

$$\frac{1}{3}\pi r^2(2r+h) = \frac{1}{3} \times 3.14 \times 2 \times 2(2 \times 2 + 2)$$

$$= \frac{1}{3} \times 3.14 \times 4 \times 6$$

$$= 25.12 \text{ cm}^3$$

Let right circular cylinder $EFGH$ circumscribe the given solid toy.




Radius of cylinder $= 2$ cm

Height of cylinder $= 4$ cm

Volume of right circular cylinder

$$\pi r^2 h = 3.14 \times (2)^2 \times 4 \text{ cm}^3$$

$$= 50.24 \text{ cm}^3$$

Difference of two volume

$$= \text{Volume of cylinder} - \text{Volume of toy}$$

$$= 50.24 - 25.12 = 25.12 \text{ cm}^3.$$

Q5.

Volume of water in cone

$$\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times (5)^3 \times 8 = \frac{200}{3}\pi \text{ cm}^3$$

Volume of water flows out

$$= \frac{1}{4} \times \frac{200}{3}\pi = \frac{50}{3}\pi \text{ cm}^3$$

Let $r$ be the radius of one spherical ball.

Volume of 100 spherical ball,

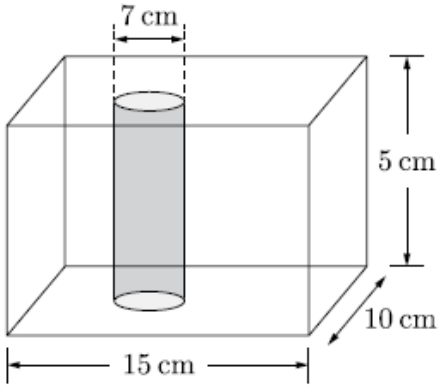
$$\frac{4}{3}\pi r^3 \times 100 = \frac{50}{3}\pi$$

$$r^3 = \frac{50}{4 \times 100} = \frac{1}{8}$$

$$r = \frac{1}{2} = 0.5 \text{ cm}$$

Q6.

As per question the figure is shown below.




We have $l = 15$ cm, $b = 10$ cm, $h = 5$cm, $r = \frac{7}{2}$ cm

Total Surface area $= 2(lb + bh + hl) + 2\pi rh - 2\pi r^2$

TSA of cuboidal block

$$= 2(15 \times 10 + 10 \times 5 + 5 \times 15)$$

$$= 550 \text{ cm}^2.$$

Area of curved surface cylinder,

$$2\pi rh = 2 \times \frac{22}{7} \times \frac{7}{2} \times 5 = 110 \text{ cm}^2$$

$$\text{Area of two circular bases} = 2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$$

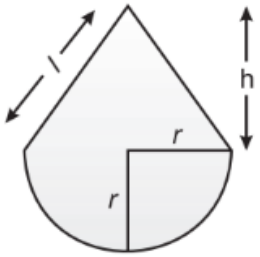
$$= 77 \text{ cm}^2$$

$$\text{Required area} = 550 + 110 - 77 = 583 \text{ cm}^3.$$

Q7.

Let the radii of conical part and the hemispherical part be $r$, slant height of conical part be $l$ and the height of conical part be $h$.

Now, according to the question,




C.S.A of hemispherical part = C.S.A. of conical part

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

Squaring both sides,

$$\Rightarrow \quad 4r^2 = l^2$$

$$\Rightarrow \quad 4r^2 = r^2 + h^2 \quad [\because l^2 = r^2 + h^2]$$

$$\Rightarrow \quad 3r^2 = h^2$$

$$\Rightarrow \quad \frac{r^2}{h^2} = \frac{1}{3}$$

$$\Rightarrow \quad \frac{r}{h} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad r : h = 1 : \sqrt{3} \qquad \textbf{Ans.}$$

Q8.

The volume of soil taken out from the well,

$$\pi^2 rh = \pi \times \left(\frac{3}{2}\right)^2 \times 14 \text{ m}^3$$

The radius of embankment with well

$$= \frac{3}{5} + 5 = \frac{13}{2} \text{ m}$$

Let the $y$ be height of embankment. Then the volume of soil used in embankment,

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

$$\pi\left[\left(\frac{13}{2}\right)^2 - \left(\frac{3}{2}\right)^2\right]y = \pi \times \left(\frac{3}{2}\right)^2 \times 14$$

$$\frac{160}{4}y = \frac{3}{2} \times \frac{3}{2} \times 14$$

$$y = \frac{3 \times 3 \times 14}{160} = 0.7875 \text{ m}$$

Hence the height of embankment is 78.75 cm.

Q9.

Radius of pipe, $r = \frac{14}{2} = 7$ cm

Cross section area of pipe,

$$\pi r^2 = \frac{22}{7} \times \left(\frac{7}{100}\right)^2$$

Speed of water flowing through the pipe

$$= 5 \text{ km/hr} = 15000 \text{ m/hr}$$

In an hour length of water $= 5000$ m

Volume of water flowing from pipe in 1 hr,

$$\pi r^2 h = \frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 5000 \text{ m}^3$$

Let $t$ be time taken to fill the tank. Now total volume of water flowing in time $t$,

$$\pi r^2 ht = \frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 5000t$$

Volume of water flown= Volume of water in tank

$$\pi r^2 ht = l \times b \times y$$

$$\frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 500t = 50 \times 44 \times \frac{7}{100}$$

$$\frac{22}{7} \times \frac{7}{100} \times \frac{7}{100} \times 5000t = 50 \times 44 \times \frac{7}{100}$$

$$22 \times 50t = 50 \times 44$$

$$t = \frac{50 \times 44}{22 \times 50} = 2$$

Hence, Time taken to fill the tank is 2 hours.

Q10.

Radius of milk tanker $R = \frac{2}{2} = 1$ m

Length of mil tanker $L$ 4.2 m

Volume of milk tanker,

$$\pi R^2 L = \frac{22}{7} \times 1 \times 4.2 = 13.2 \text{ m}^3$$

Supply of milk to booth I,

$$= 13.2 \times \frac{3}{5} = 2.64 \times 3 = 7.92 \text{ m}^3$$

Supply of milk to booth II,

$$= 13.2 \times \frac{2}{5} = 2.64 \times 2 = 5.28 \text{ m}^3$$

Height in $1^{st}$ vessel $= \frac{7.92}{3.96} = 2$ m

Height in $2^{nd}$ vessel $= \frac{5.28}{\frac{22}{7} \times 1} = \frac{5.28 \times 7}{22} = 1.68$ m