NCERT Solutions for Class 10 Maths Chapter 13 Surface Area and Volume

EXERCISE 13.3:

Take $\pi = \frac{22}{7}$, unless stated otherwise

1. A metallic sphere of radius 4.2 cm is melted and recast into the shape of a cylinder ofradius 6 cm. Find the height of the cylinder

Solution:Radius (r1) of hemisphere = 4.2 cm

Radius (r2) of cylinder = 6 cm

Let the height of the cylinder be h.

The object formed by recasting the hemisphere will be the same in volume.

Volume of sphere = Volume of cylinder

$\frac{4}{3}\pi r1^3 = \pi r2^2 h$

$\frac{4}{3}\pi\ (4.2)^3 = \pi\ (6)^2 h$

$\frac{4}{3} * \frac{4.2*4.2*4.2}{36} = h$

$h = (1.4)^3$

$= 2.74$ cm

Hence, the height of the cylinder = 2.74 cm

2. Metallic spheres of radii 6 cm, 8 cm and 10 cm, respectively, are melted to form a singlesolid sphere. Find the radius of the resulting sphere

Solution:Radius (r1) of 1st sphere = 6 cm

Radius (r2) of 2nd sphere = 8 cm

Radius ($r3$) of 3rd sphere = 10 cm

Let the radius of the resulting sphere be *r*.

The object formed by recasting these spheres will be same in volume as the sum of the volumes of these spheres.

Volume of 3 spheres = Volume of resulting sphere

$\frac{4}{3}\pi\ [r1^3 + r2^3 + r3^3] = \frac{4}{3}\pi r^3$

$\frac{4}{3}\pi\ [6^3 + 8^3 + 10^3] = \frac{4}{3}\pi r^3$

$r^3 = 216 + 512 + 1000$

r = 1728

r = 12 cm

Hence, the radius of the resulting sphere, r = 12 cm

3. A 20 m deep well with diameter 7 m is dug and the earth from digging is evenly spread outto form a platform 22 m by 14 m. Find the height of the platform

Solution:As per the question,

The shape of the well will be cylindrical

Depth (*h*) of well = 20 m

Radius (*r*) of circular end of well $=\frac{7}{2}$

Area of platform = Length × Breadth = 22 × 14 m^2

Let height of the platform = *H*

Volume of soil dug from the well would be equal to the volume of soil that is scattered on the platform.

Volume of soil from well = Volume of soil used to make such platform

$\pi r^2 h$ = Area * Height

$\pi * (\frac{7}{2})^2 * 20 = 22 * 14 * H$

$H = \frac{22}{7} * \frac{49}{4} * \frac{20}{22*14}$

$= 2.5$ m

Hence, the height of the platform = 2.5m

4. A well of diameter 3 m is dug 14 m deep. The earth taken out of it has been spread evenlyall around it in the shape of a circular ring of width 4 m to form an embankment. Find the height of the embankment

Solution:The shape of the well will be cylindrical.

Depth ($h1$) of well = 14 m

Radius ($r1$) of the circular end of well $= \frac{3}{2}$ m

Width of embankment = 4 m

As per the question,

Our embankment will be in a cylindrical shape having outer radius ($r2$)as$\frac{11}{2}$ m and inner radius (r1) $= \frac{3}{2}$ m

Let the height of embankment be $h2$

Volume of soil dug from well = Volume of earth used to form embankment

$\pi r1^2 * h1 = \pi * (r2^2 - r1^2) * h2$

$\pi * (\frac{3}{2})^2 * 14 = \pi * [(\frac{11}{2})^2 - (\frac{3}{2})^2] * h$

$\frac{9}{4} * 14 = \frac{112}{4} * h$

$h = \frac{9}{8} = 1.125$ m

5. A container shaped like a right circular cylinder having diameter 12 cm and height 15 cmis full of ice cream. The ice cream is to be filled into cones of height 12 cm and diameter6 cm, having a hemispherical shape on the top. Find the number of such cones which can be filled with ice cream

Solution:Height (*h*1) of cylindrical container = 15 cm

Radius (*r*1) of circular end of container $=\frac{12}{2}$ = 6 cm

Radius (*r*2) of circular end of ice-cream cone $=\frac{6}{2}$ = 3 cm

Height (*h*2) of conical part of ice-cream cone = 12 cm

Let *n* cones be filled with ice-cream of the container

Volume of ice-cream in cylinder = *n* × (Volume of 1 ice-cream cone + Volume of hemispherical shape on the top)

$\pi * r1^2 * h1 = n\left(\frac{1}{3}\pi r2^2 h2 + \frac{2}{3}\pi r2^3\right)$

$n = \frac{6*6*15}{\frac{1}{3}*9*12+\frac{2}{3}*3*3*3}$

$n = \frac{36*15*3}{108+54}$

n = 10

6. How many silver coins, 1.75 cm in diameter and of thickness 2 mm, must be melted to forma cuboid of dimensions 5.5 cm × 10 cm × 3.5 cm?

Solution:Coins are cylindrical in shape.

Height (*h*1) of cylindrical coins = 2 mm = 0.2 cm

Radius (*r*) of circular end of coins $=\frac{1.75}{2}$ = 0.875 cm

Let *n* coins be melted to form the required cuboids

Volume of *n* coins = Volume of cuboids

$n * \pi * r^2 * h1 = l * b * h$

$n * \pi * (0.875)^2 * 0.2 = 5.5 * 10 * 3.5$

$n = \frac{5.5*10*3.5*7}{0.875*0.875*0.2*22}$

$= 400$

Hence,

The number of coins melted to form the given cuboid is 400

7. A cylindrical bucket, 32 cm high and with radius of base 18 cm, is filled with sand. Thisbucket is emptied on the ground and a conical heap of sand is formed. If the height of theconical heap is 24 cm, find the radius and slant height of the heap

Solution:Given:

Height ($h1$) of cylindrical bucket = 32 cm

Radius ($r1$) of circular end of bucket = 18 cm

Height ($h2$) of conical heap = 24 cm

Let the radius of the circular end of conical heap be $r2$

The volume of sand in the cylindrical bucket will be equal to the volume of sand in the conical heap

Volume of sand in the cylindrical bucket = Volume of sand in conical heap

$\pi \, r1^2 * h1 = \frac{1}{3} * \pi * r2^2 * h2$

$\pi * (18)^2 * 32 = \frac{1}{3} * \pi * r2^2 * 24$

$r2^2 = \frac{3*18*18*32}{24}$

$= 18 * 18 * 2 * 2$

r2 = 18 * 2

= 36 cm

Slant height (l) = $\sqrt{36*36+24*24}$

= $12\sqrt{13}$ cm

8. Water in a canal, 6 m wide and 1.5 m deep, is flowing with a speed of 10 km/h. How mucharea will it irrigate in 30 minutes, if 8 cm of standing water is needed?

Solution:Area of cross-section = 6 × 1.5

= 9 m^2

Speed of water = 10 km/h

=$\frac{10000}{60}$ meter/min

Volume of water that flows in 1 minute from canal =$\frac{10000}{60}$

=1500 m^3

Volume of water that flows in 30 minutes from canal = 30 × 1500

= 45000 m^3

Let the irrigated area be A.

Now, we know that,

Volume of water irrigating the required area will be equal to the volume of water thatflowed in 30 minutes from the canal

Vol. of water flowing in 30 minutes from canal = Vol. of water irrigating the reqd. area

45000 = $\frac{A*8}{100}$

A = 562500 m^2

9. A farmer connects a pipe of internal diameter 20 cm from a canal into a cylindrical tank inher field, which is 10 m in diameter and 2 m deep. If water flows through the pipe at therate of 3 km/h, in how much time will the tank be filled?

Solution:Radius ($r1$) of circular end of pipe $=\frac{20}{200}$

= 0.1 m

Area of cross-section $=\pi * r1^2$

$= \pi * (0.1)^2$

$= 0.01 \pi\ m^2$

Speed of water = 3 km/h

$=\frac{3000}{60}$

$=\frac{300}{6}$

= 50 meter/min

Volume of water that flows in 1 minute from pipe = $50 \times 0.01 \pi$

$= 0.5\pi\ m^3$

Volume of water that flows in t minutes from pipe = $t \times 0.5\pi\ m^3$

Radius ($r2$) of circular end of cylindrical tank $=\frac{10}{2}$

= 5 m

Depth ($h2$) of cylindrical tank = 2 m

Let the tank be filled completely in t minutes

Volume of water filled in tank in t minutes is equal to the volume of water flowed in t minutes from the pipe

Volume of water that flows in t minutes from pipe = Volume of water in tank

$t \times 0.5\pi = \pi \times (r2)^2 \times h2$

$t \times 0.5 = (5)^2 \times 2$

$t = 100$

Hence, the cylindrical tank will be filled in 100 minutes