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

EXERCISE 13.2:

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

1. A solid is in the shape of a cone standing on a hemisphere with both their radii beingequal to 1 cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π

Solution:Given:

Height (*h*) of conical part = Radius(*r*) of conical part = 1 cm

Radius(*r*) of hemispherical part = Radius of conical part (*r*) = 1 cm

Volume of solid = Volume of conical part + Volume of hemispherical part

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

$= \frac{1}{3}\pi(1)^2\,(1) + \frac{2\pi}{3}(1)^3$

$= \pi$ cm^3

Hence, Volume of the solid = π cm^3

2. Rachel, an engineering student, was asked to make a model shaped like a cylinder withtwo cones attached at its two ends by using a thin aluminum sheet. The diameter of themodel is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volumeof air contained in the model that Rachel made. (Assume the outer and inner dimensionsof the model to be nearly the same)

Solution:Height (*h1*) of each conical part = 2 cm

Height (*h2*) of cylindrical part = 12 - 2 × Height of conical part

= 12 - 2 ×2

= 8 cm

Radius (r) of cylindrical part = $\frac{3}{2}$ cm

Radius of conical part = $\frac{3}{2}$ cm

Volume of air present in the model = Volume of cylinder + 2 × Volume of cones

= $\pi r^2 h2 + 2 * \frac{1}{3}\pi r^2 h1$

= $\pi (\frac{3}{2})^2 (8)$ $2 * \frac{1}{3}\pi (\frac{3}{2})^2 (2)$

= $18\pi + 3\pi$

= 21π

= $66cm^2$

Hence, volumeof air contained in the model that Rachel made = $66cm^2$

3. A gulabjamun contains sugar syrup up to about30% of its volume. Find approximately how muchsyrup would be found in 45 gulabjamun each shaped like a cylinder with two hemispherical endswith length 5 cm and diameter 2.8 cm (see Fig. 13.15)

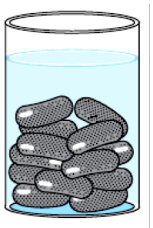

Fig. 13.15

Solution:Radius (r) of cylindrical part = $\frac{2.8}{2}$

Radius (r) of hemispherical part = $\frac{2.8}{2}$

= 1.4 cm

Length of each hemispherical part = 1.4 cm

Radius of hemispherical part = 1.4 cm

Length (*h*) of cylindrical part = 5 - 2 × Length of hemispherical part

= 5 - 2 × 1.4

= 2.2 cm

Volume of one gulabjamun = Vol. of cylindrical part + 2 × Vol. of hemispherical part

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

$= \pi r^2 h + \frac{4}{3}\pi r^3$

$= \pi * (1.4)^2 * 2.2 + \frac{4}{3}\pi (1.4)^3$

= 13.552 + 11.498

$= 25.05\ cm^3$

Volume of 45 gulabjamun = 45 * 25.05

$= 1{,}127.25\ cm^3$

Volume of sugar syrup = 30% of volume

$= \frac{30}{100} * 1127.25$

$= 338.17\ cm^3$

$= 338\ cm^3$

4. A pen stand made of wood is in the shape of acuboid with four conical depressions to hold pens.The dimensions of the cuboid are 15 cm by 10 cm by3.5 cm. The radius of each of the depressions is 0.5cm and the depth is 1.4 cm. Find the volume ofwood in the entire stand (see Fig. 13.16)

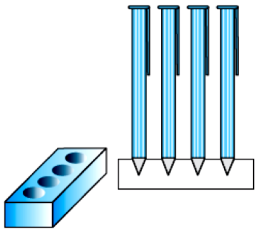

Fig. 13.16

Solution:Given:

Depth (*h*) of each conical depression = 1.4 cm

Radius (*r*) of each conical depression = 0.5 cm

Volume of wood = Volume of cuboid - 4 × Volume of cones

= lbh – 4 * $\frac{1}{3}\pi r^2 h$

= 15 * 10 * 3.5 – 4 * $\frac{1}{3}$ * $\frac{22}{7}$ * $(\frac{1}{2})^2$ * 1.4

= 525 – 1.47

= 523.53 cm^3

Hence,

The volume ofwood in the entire stand= 523.53 cm^3

5. A vessel is in the form of an inverted cone. Itsheight is 8 cm and the radius of its top, which isopen, is 5 cm. It is filled with water up to the brim.When lead shots, each of which is a sphere of radius0.5 cm are dropped into the vessel, one-fourth ofthe water flows out. Find the number of lead shotsdropped in the vessel

Solution:Height (*h*) of conical vessel = 8 cm

Radius (*r1*) of conical vessel = 5 cm

Radius (*r2*) of lead shots = 0.5 cm

Let *n* number of lead shots were dropped in the vessel

Volume of water spilled = Volume of dropped lead shots

$\frac{1}{4}$ * Volume of cone = n * $\frac{4}{3}\pi r2^3$

$\frac{1}{4} * \frac{1}{3}\pi r1^2h = n * \frac{4}{3}\pi r2^3$

$r1^2h = n * 16r2^3$

$5^2 * 8 = n * 16 * (0.5)^3$

$n = \frac{25*8}{16*\frac{1}{2}*\frac{1}{2}*\frac{1}{2}} = 100$

Hence, the number of lead shots dropped in the vessel is 100

6. A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, whichis surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of thepole, given that 1 cm3 of iron has approximately 8g mass. (Use π = 3.14)

Solution:Given:

Height ($h1$) of larger cylinder = 220 cm

Radius ($r1$) of larger cylinder =$\frac{24}{2}$ = 12 cm

Height ($h2$) of smaller cylinder = 60 cm

Radius ($r2$) of smaller cylinder = 8 cm

Total volume = Volume (Larger cylinder) + Volume (Smaller cylinder)

$= \pi r1^2h1 + \pi r2^2h2$

$= \pi (12)^2 * 220 + \pi (8)^2 * 60$

$= \pi [144 * 220 + 64 * 60]$

$= 35520 * 3.14$

$= 111532.8\ cm^3$

Mass of 1 cm^3 iron = 8 g

Mass of 111532.8 cm^3 iron = 111532.8 × 8

= 892262.4 g

= 892.262 kg

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

Solution:Radius (*r*) of hemispherical part = Radius (*r*) of conical part = 60 cm

Height (*h*2) of conical part of solid = 120 cm

Height (*h*1) of cylinder = 180 cm

Radius (*r*) of cylinder = 60 cm

Volume of water left = Volume of cylinder - Volume of solid

= Volume of cylinder – (Volume of cone + Volume of hemisphere)

$= \pi r^2 h1 - (\frac{1}{3}\pi r^2 h2 + \frac{2}{3}\pi r^3)$

$= \pi (60)^2 (180) - [\frac{1}{3}\pi (60)^2 * 120 + \frac{2}{3}\pi (60)^3]$

$= \pi (3{,}600) (100)$

$= 360000\pi$

= 1131428.57 cm^3

= 1.131 m^3

8. A spherical glass vessel has a cylindrical neck 8 cm long, 2 cm in diameter; the diameterof the spherical part is 8.5 cm. By measuring the amount of water

it holds, a child finds itsvolume to be 345 cm^3. Check whether she is correct, taking the above as the inside measurements, and π = 3.14

Solution: Given:

Height (*h*) of cylindrical part = 8 cm

Radius (*r2*) of cylindrical part =$\frac{2}{2}$ = 1 cm

Radius (*r1*) spherical part =$\frac{8.5}{2}$ = 4.25 cm

Volume of vessel = Volume of sphere + Volume of cylinder

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

= $\frac{4}{3}\pi\ (\frac{8.5}{2})^3 + \pi\ (1)^2\ (8)$

= $\frac{4}{3}$ * 3.14 * 76.765625 + 8 * 3.14

= 321.392 + 25.12

= 346.512

= 346.51 cm^3

Hence,

From the result we can conclude that she is wrong