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

EXERCISE 13.4:

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

1. A drinking glass is in the shape of a frustum of acone of height 14 cm. The diameters of its twocircular ends are 4 cm and 2 cm. Find the capacity of the glass

Solution: Given:

Radius ($r1$) [Upper base] = $\frac{4}{2}$

= 2 cm

Radius ($r2$) [Lower base] = $\frac{2}{2}$ = 1 cm

Capacity of glass = Volume of frustum of cone

= $\frac{1}{3}\pi h\ (r1^2 + r2^2 + r1r2)$

= $\frac{1}{3}\pi h\ [(2)^2 + (1)^2 + (2)\ (1)]$

= $\frac{1}{3} * \frac{22}{7} * 14\ [4 + 1 + 2]$

= $\frac{308}{3}$

= $102\ \frac{2}{3}\ cm^3$

Hence, the capacity of the glass = $102\ \frac{2}{3}\ cm^3$

2. The slant height of a frustum of a cone is 4 cm andthe perimeters (circumference) of its circular endsare 18 cm and 6 cm. Find the curved surface area of the frustum

Solution: According to the question,

Perimeter of upper circular end of frustum = 18 cm

[$2\pi r1 = 18$]

$r1 = \frac{9}{\pi}$

Perimeter of lower end of frustum = 6 cm

$2\pi r2 = 6$

$r2 = \frac{3}{\pi}$

Slant height (l) of frustum = 4 cm

CSA of frustum = $\pi (r1 + r2)\, l$

$= \pi (\frac{9}{\pi} + \frac{3}{\pi}) * 4$

$= 12 * 4$

$= 48\ cm^2$

3. A fez, the cap used by the Turks, is shaped like thefrustum of a cone (see Fig. 13.24). If its radius on theopen side is 10 cm, radius at the upper base is 4 cmand its slant height is 15 cm, find the area of material used for making it

Fig. 13.24

Solution: Given:

Radius ($r2$) at upper circular end = 4 cm

Radius ($r1$) at lower circular end = 10 cm

Slant height (*l*) of frustum = 15 cm

Area of material used for making the fez = CSA of frustum + Area of upper circular end

= π (r1 + r2) l + πr2^2

= π (10 + 4) * 15 + π (4)^2

= π (14) * 15 + 16π

= 210π + 16π

= $\frac{226*22}{7}$

= 710 $\frac{2}{7}$ cm^2

Hence, the area of material used= 710 $\frac{2}{7}$ cm^2

4. A container, opened from the top and made up of a metal sheet, is in the form of afrustum of a cone of height 16 cm with radii of its lower and upper ends as 8 cm and 20cm, respectively. Find the cost of the milk which can completely fill the container, at therate of Rs 20 per litre. Also find the cost of metal sheet used to make the container, if itcosts Rs 8 per 100 cm^2 (Take π = 3.14)

Solution: Radius (*r*1) of upper end of container = 20 cm

Radius (*r*2) of lower end of container = 8 cm

Height (*h*) of container = 16 cm

Slant height (*l*) of frustum

=$\sqrt{(r1-r2)(r1-r2)+\ h*h}$

= $\sqrt{12*12+16*16}$

= $\sqrt{144+256}$

= 20 cm

Capacity of container = Volume of frustum

= $\frac{1}{3}\pi$ h ($r1^2 + r2^2 + r1r2$)

= $\frac{1}{3}$ * 3.14 * 16 * [$(20)^2 + (8)^2 + (20)(8)$]

= $\frac{1}{3}$ * 3.14 * 16 (400 + 64 + 160)

= $\frac{1}{3}$ * 3.14 * 16 * 624

= 10449.92 cm^3

= 10.45 litres

Cost of 1 litre milk = Rs 20

Cost of 10.45 litres milk = 10.45 × 20

= Rs 209

Area of metal sheet used to make the container

= π (r1 + r2) * l + $\pi r2^2$

= π (20 + 8) * 20 + π $(8)^2$

= 560 π + 64 π

= 624 π cm^2

Cost of 100 cm^2 metal sheet = Rs 8

Cost of 624 π cm^2 metal sheet = $\frac{624*3.14*8}{100}$

= 156.75

5. A metallic right circular cone 20 cm high and whose vertical angle is 60° is cut into twoparts at the middle of its height by a plane parallel to its base. If

the frustum so obtainedbe drawn into a wire of diameter $\frac{1}{16}$ cm, find the length of the wire

Solution: In ΔAEG,

$\frac{EG}{AG}$ = Tan 30°

EG = $\frac{10}{\sqrt{3}}$ cm

= $\frac{10\sqrt{3}}{3}$

In ΔABD,

$\frac{BD}{AD}$ = Tan 30°

BD = $\frac{20}{\sqrt{3}}$

= $\frac{20\sqrt{3}}{3}$

Radius ($r1$) = $\frac{10\sqrt{3}}{3}$ cm

Radius ($r2$) = $\frac{20\sqrt{3}}{3}$ cm

Height (h) = 10 cm

Volume of frustum = $\frac{1}{3}$πh ($r1^2 + r2^2 + r1r2$)

= $\frac{1}{3} * \pi * 10 [(\frac{10\sqrt{3}}{3})^2 + (\frac{20\sqrt{3}}{3})^2 + \frac{10\sqrt{3} * 20\sqrt{3}}{3*3}]$

= $\frac{10}{3}\pi [\frac{100}{3} + \frac{400}{3} + \frac{200}{3}]$

= $\frac{10}{3} * \frac{22}{7} * \frac{700}{3}$

= $\frac{22000}{9}$ cm^3

Radius (r) of wire = $\frac{1}{16} * \frac{1}{2} = \frac{1}{32}$ cm

Let the length of wire be *l*.

Volume of wire = Area of cross-section × Length

= (πr^2) (l)

= $\pi * (\frac{1}{32})^2 * l$

Volume of frustum = Volume of wire

$\frac{22000}{9} = \frac{22}{7} * (\frac{1}{32})^2 * l$

$\frac{7000}{9} * 1024 = l$

l = 796444.44 cm

= 7964.44 meters