CHAPTER-11 SURFACE AREAS AND VOLUMES

Exercise **11.1**

Question 1: Diameter of the base of a cone is 10.5 cm and its slant height is 10 cm. Find its curved surface area. $\left[\textbf{Assume } \pi = \frac{22}{7}\right]$

Solution: Radius (r) of the base of cone = 10.5/2 = 5.25 cm

Slant height (l) of cone = 10 cm

CSA of cone = πrl

$$= \left(\frac{22}{7} \times 5.25 \times 10\right) \text{ cm}^2 = (22 \times 0.75 \times 10) \text{ cm}^2 = 165 \text{ cm}^2$$

Therefore, the curved surface area of the cone is 165 cm^2.

Question 2: Find the total surface area of a cone, if its slant height is 21 m and diameter of its base is 24 m. $\left[\textbf{Assume } \pi = \frac{22}{7}\right]$

Solution: Radius (r) of the base of cone = 24/2 = 12 m

Slant height (l) of cone = 21 m

Total surface area of cone = $\pi r(r + l)$

$$= \left[\frac{22}{7} \times 12 \times (12 + 21)\right] \text{ m}^2$$
$$= \left(\frac{22}{7} \times 12 \times 33\right) \text{ m}^2$$
$$= 1244.57 \text{ m}^2$$

Question 3: Curved surface area of a cone is 308 cm^2 and its slant height is 14 cm. Find

(i) radius of the base and (ii) total surface area of the cone. $\left[\textbf{Assume } \pi = \frac{22}{7}\right]$

Solution: (i) Slant height (l) of cone = 14 cm

Let the radius of the circular end of the cone be r.

We know, CSA of cone = πrl

$$(308)\ \text{cm}^2 = \left(\frac{22}{7} \times r \times 14\right)\ \text{cm}$$

$$\Rightarrow r = \left(\frac{308}{44}\right)\ \text{cm} = 7\ \text{cm}$$

Therefore, the radius of the circular end of the cone is 7 cm.

(ii) Total surface area of cone = CSA of cone + Area of base

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

$$= \left[308 + \frac{22}{7} \times (7)^2\right]\ \text{cm}^2$$
$$= (308 + 154)\ \text{cm}^2$$
$$= 462\ \text{cm}^2$$

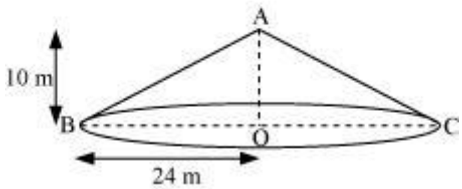
Therefore, the total surface area of the cone is 462 cm^2.

Question 4: A conical tent is 10 m high and the radius of its base is 24 m. Find

(i) slant height of the tent

(ii) cost of the canvas required to make the tent, if the cost of 1 m^2 canvas is Rs 70. $\left[\textbf{Assume } \pi = \frac{22}{7}\right]$

Solution:



(i) Let ABC be a conical tent.

Height (h) of conical tent = 10 m

Radius (r) of conical tent = 24 m

Let the slant height of the tent be l.

In ΔABO,

$AB^2 = AO^2 + BO^2$

$l^2 = h^2 + r^2$

$= (10 \text{ m})^2 + (24 \text{ m})^2$

$= 676 \text{ m}^2$

$\therefore l = 26$ m

Therefore, the slant height of the tent is 26 m.

(ii) CSA of tent = πrl

$$= \left(\frac{22}{7} \times 24 \times 26\right) \text{ m}^2$$

$$= \frac{13728}{7} \text{ m}^2$$

Cost of 1 m^2 canvas = Rs 70

Cost of 13728/7 m^2 canvas =

$$\text{Rs } \left(\frac{13728}{7} \times 70\right)$$

= Rs 137280

Therefore, the cost of the canvas required to make such a tent is

Rs 137280.

Question 5: What length of tarpaulin 3 m wide will be required to make conical tent of height 8 m and base radius 6 m? Assume that the extra length of material that will be required for stitching margins and wastage in cutting is approximately 20 cm. [Use π = 3.14]

Solution: Height (h) of conical tent = 8 m

Radius (r) of base of tent = 6 m

Slant height (l) of tent = $\sqrt{r^2 + h^2}$

$$= \left(\sqrt{6^2 + 8^2}\right) \text{ m} = \left(\sqrt{100}\right) \text{ m} = 10 \text{ m}$$

CSA of conical tent = πrl

$= (3.14 \times 6 \times 10) \text{ m}^2$

$= 188.4\ m^2$

Let the length of tarpaulin sheet required be l.

As 20 cm will be wasted, therefore, the effective length will be ($l - 0.2$ m).

Breadth of tarpaulin = 3 m

Area of sheet = CSA of tent

$[(l - 0.2\ m) \times 3]\ m = 188.4\ m^2$

$l - 0.2\ m = 62.8\ m$

$l = 63\ m$

Therefore, the length of the required tarpaulin sheet will be 63 m.

Question 6: The slant height and base diameter of a conical tomb are 25 m and 14 m respectively. Find the cost of white-washing its curved surface at the rate of Rs 210 per 100 m^2. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: Slant height (l) of conical tomb = 25 m

Base radius (r) of tomb = 14/2 =7 m

CSA of conical tomb = πrl

$$= \left(\frac{22}{7} \times 7 \times 25\right)\ m^2$$

$= 550\ m^2$

Cost of white-washing 100 m^2 area = Rs 210

Cost of white-washing 550 m^2 area =

$$Rs \left(\frac{210 \times 550}{100}\right)$$

= Rs 1155

Therefore, it will cost Rs 1155 while white-washing such a conical tomb.

Question 7: A joker's cap is in the form of right circular cone of base radius 7 cm and height 24 cm. Find the area of the sheet required to make 10 such caps. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: Radius (r) of conical cap = 7 cm

Height (h) of conical cap = 24 cm

Slant height (l) of conical cap = $\sqrt{r^2 + h^2}$

$$= \left[\sqrt{(7)^2 + (24)^2}\right] \text{ cm} = \left(\sqrt{625}\right) \text{ cm} = 25 \text{ cm}$$

CSA of 1 conical cap = πrl

$$= \left(\frac{22}{7} \times 7 \times 25\right) \text{ cm}^2 = 550 \text{ cm}^2$$

CSA of 10 such conical caps = (10 × 550) cm^2 = 5500 cm^2

Therefore, 5500 cm^2 sheet will be required.

Question 8: A bus stop is barricaded from the remaining part of the road, by using 50 hollow cones made of recycled cardboard. Each cone has a base diameter of 40 cm and height 1 m. If the outer side of each of the cones is to be painted and the cost of painting is Rs 12 per m^2, what will be the cost of painting all these cones? (Use π = 3.14 and take $\sqrt{1.04}$ = 1.02).

Solution: Radius (r) of cone = 40/2 = 20 cm = 0.2 m

Height (h) of cone = 1 m

Slant height (l) of cone =$\sqrt{r^2 + h^2}$

$$= \left[\sqrt{(1)^2 + (0.2)^2}\right] \text{ m} = \left(\sqrt{1.04}\right) \text{ m} = 1.02 \text{ m}$$

CSA of each cone = πrl

= (3.14 × 0.2 × 1.02) m^2 = 0.64056 m^2

CSA of 50 such cones = (50 × 0.64056) m^2

= 32.028 m^2

Cost of painting 1 m^2 area = Rs 12

Cost of painting 32.028 m^2 area = Rs (32.028 × 12)

= Rs 384.336

= Rs 384.34 (approximately)

Therefore, it will cost Rs 384.34 in painting 50 such hollow cones.

Exercise 11.2

Question 1: Find the surface area of a sphere of radius:

(i) 10.5 cm (ii) 5.6 cm (iii) 14 cm $\left[\textbf{Assume } \pi = \frac{22}{7}\right]$

Solution: (i) Radius (r) of sphere = 10.5 cm

Surface area of sphere = $4\pi r^2$

$$= \left[4 \times \frac{22}{7} \times (10.5)^2\right] \text{ cm}^2$$
$$= \left(4 \times \frac{22}{7} \times 10.5 \times 10.5\right) \text{ cm}^2$$
$$= (88 \times 1.5 \times 10.5) \text{ cm}^2$$
$$= 1386 \text{ cm}^2$$

Therefore, the surface area of a sphere having radius 10.5cm is 1386 cm^2.

(ii) Radius(r) of sphere = 5.6 cm

Surface area of sphere = $4\pi r^2$

$$= \left[4 \times \frac{22}{7} \times (5.6)^2\right] \text{ cm}^2$$
$$= (88 \times 0.8 \times 5.6) \text{ cm}^2$$
$$= 394.24 \text{ cm}^2$$

Therefore, the surface area of a sphere having radius 5.6 cm is 394.24 cm^2.

(iii) Radius (r) of sphere = 14 cm

Surface area of sphere = $4\pi r^2$

$$= \left[4 \times \frac{22}{7} \times (14)^2\right] \text{ cm}^2$$
$$= (4 \times 44 \times 14) \text{ cm}^2$$
$$= 2464 \text{ cm}^2$$

Therefore, the surface area of a sphere having radius 14 cm is 2464 cm^2.

Question 2: Find the surface area of a sphere of diameter:

(i) 14 cm (ii) 21 cm (iii) 3.5 m $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: (i) Radius (r) of sphere =

$$\frac{\text{Diameter}}{2} = \left(\frac{14}{2}\right) \text{ cm} = 7 \text{ cm}$$

Surface area of sphere = $4\pi r^2$

$$= \left(4 \times \frac{22}{7} \times (7)^2\right) \text{ cm}^2$$
$$= (88 \times 7) \text{cm}^2$$
$$= 616 \text{ cm}^2$$

Therefore, the surface area of a sphere having diameter 14 cm is 616 cm^2.

(ii) Radius (r) of sphere = 21/2 = 10.5 cm

Surface area of sphere = $4\pi r^2$

$$= \left[4 \times \frac{22}{7} \times (10.5)^2\right] \text{ cm}^2$$
$$= 1386 \text{ cm}^2$$

Therefore, the surface area of a sphere having diameter 21 cm is 1386 cm^2.

(iii) Radius (r) of sphere = 3.5/2 = 1.75 m

Surface area of sphere = $4\pi r^2$

$$= \left[4 \times \frac{22}{7} \times (1.75)^2\right] \text{ m}^2$$
$$= 38.5 \text{ m}^2$$

Therefore, the surface area of the sphere having diameter 3.5 m is 38.5 m^2.

Question 3: Find the total surface area of a hemisphere of radius 10 cm. [Use π = 3.14]

Solution: Radius (r) of hemisphere = 10 cm

Total surface area of hemisphere = CSA of hemisphere + Area of circular end of hemisphere

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

$= 3\pi r^2$

$= \left[3 \times 3.14 \times (10)^2\right] \text{ cm}^2$

$= 942 \text{ cm}^2$

Therefore, the total surface area of such a hemisphere is 942 cm^2.

Question 4: The radius of a spherical balloon increases from 7 cm to 14 cm as air is being pumped into it. Find the ratio of surface areas of the balloon in the two cases.

Solution: Radius (r_1) of spherical balloon = 7 cm

Radius (r_2) of spherical balloon, when air is pumped into it = 14 cm

$$\text{Required ratio} = \frac{\text{Initial surface area}}{\text{Surface area after pumping air into balloon}}$$

$$= \frac{4\pi r_1^2}{4\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2$$

$$= \left(\frac{7}{14}\right)^2 = \frac{1}{4}$$

Therefore, the ratio between the surface areas in these two cases is 1:4.

Question 5: A hemispherical bowl made of brass has inner diameter 10.5 cm. Find the cost of tin-plating it on the inside at the rate of Rs 16 per 100 cm^2. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: Inner radius (r) of hemispherical bowl

$= \left(\frac{10.5}{2}\right) \text{ cm} = 5.25 \text{ cm}$

Surface area of hemispherical bowl = $2\pi r^2$

$= \left[2 \times \frac{22}{7} \times (5.25)^2\right] \text{ cm}^2$

$= 173.25 \text{ cm}^2$

Cost of tin-plating 100 cm^2 area = Rs 16

Cost of tin-plating 173.25 cm^2 area

$= \text{Rs} \left(\frac{16 \times 173.25}{100}\right)$

= Rs 27.72

Therefore, the cost of tin-plating the inner side of the hemispherical bowl is Rs 27.72.

Question 6: Find the radius of a sphere whose surface area is 154 cm². $\left[\textbf{Assume } \boldsymbol{\pi = \frac{22}{7}}\right]$

Solution: Let the radius of the sphere be *r*.

Surface area of sphere = 154

$\therefore 4\pi r^2 = 154 \text{ cm}^2$

$$r^2 = \left(\frac{154 \times 7}{4 \times 22}\right) \text{cm}^2 = \left(\frac{7 \times 7}{2 \times 2}\right) \text{cm}^2$$

$$r = \left(\frac{7}{2}\right) \text{cm} = 3.5 \text{ cm}$$

Therefore, the radius of the sphere whose surface area is 154 cm^2 is 3.5 cm.

Question 7: The diameter of the moon is approximately one-fourth of the diameter of the earth. Find the ratio of their surface area.

Solution: Let the diameter of earth be *d*. Therefore, the diameter of moon will be d/4.

Radius of earth = d/2

Radius of moon = $\frac{1}{2} \times \frac{d}{4} = \frac{d}{8}$

Surface area of moon = $4\pi \left(\frac{d}{8}\right)^2$

Surface area of earth = $4\pi \left(\frac{d}{2}\right)^2$

Required ratio $= \frac{4\pi\left(\frac{d}{8}\right)^2}{4\pi\left(\frac{d}{2}\right)^2} = \frac{4}{64} = \frac{1}{16}$

Therefore, the ratio between their surface areas will be 1:16.

Question 8: A hemispherical bowl is made of steel, 0.25 cm thick. The inner radius of the bowl is 5 cm. Find the outer curved surface area of the bowl. $\left[\textbf{Assume } \boldsymbol{\pi = \frac{22}{7}}\right]$

Solution: Inner radius of hemispherical bowl = 5 cm

Thickness of the bowl = 0.25 cm

∴ Outer radius (r) of hemispherical bowl = (5 + 0.25) cm

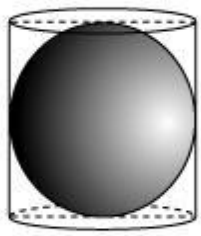
= 5.25 cm

Outer CSA of hemispherical bowl = $2\pi r^2$

$$= 2 \times \frac{22}{7} \times (5.25 \text{ cm})^2 = 173.25 \text{ cm}^2$$

Therefore, the outer curved surface area of the bowl is 173.25 cm^2.

Question 9: A right circular cylinder just encloses a sphere of radius *r* (see figure). Find

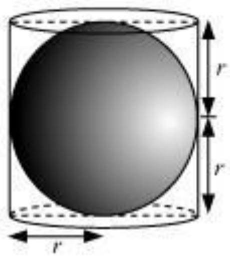


(i) surface area of the sphere,

(ii) curved surface area of the cylinder,

(iii) ratio of the areas obtained in (i) and (ii).

Solution:



(i) Surface area of sphere = $4\pi r^2$

(ii) Height of cylinder = $r + r = 2r$

Radius of cylinder = r

CSA of cylinder = $2\pi rh = 2\pi r\,(2r) = 4\pi r^2$

(i) Required ratio $= \frac{\text{Surface area of sphere}}{\text{CSA of cylinder}}$

$= \frac{4\pi r^2}{4\pi r^2}$

$= \frac{1}{1}$

Therefore, the ratio between these two surface areas is 1:1.

Exercise 11.3

Question 1: Find the volume of the right circular cone with

(i) radius 6 cm, height 7 cm

(ii) radius 3.5 cm, height 12 cm. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: (i) Radius (r) of cone = 6 cm

Height (h) of cone = 7 cm

Volume of cone $= \frac{1}{3}\pi r^2 h$

$= \left[\frac{1}{3} \times \frac{22}{7} \times (6)^2 \times 7\right] \text{ cm}^3$

$= (12 \times 22) \text{ cm}^3$

$= 264 \text{ cm}^3$

Therefore, the volume of the cone is 264 cm^3.

(ii) Radius (r) of cone = 3.5 cm

Height (h) of cone = 12 cm

Volume of cone $= \frac{1}{3}\pi r^2 h$

$= \left[\frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 12\right] \text{ cm}^3$

$= \left(\frac{1}{3} \times 22 \times \frac{1}{2} \times 3.5 \times 12\right) \text{ cm}^3$

$= 154 \text{ cm}^3$

Therefore, the volume of the cone is 154 cm^3.

Question 2: Find the capacity in litres of a conical vessel with

(i) radius 7 cm, slant height 25 cm

(ii) height 12 cm, slant height 12 cm. $\left[\textbf{Assume } \boldsymbol{\pi} = \frac{22}{7}\right]$

Solution: (i) Radius (r) of cone = 7 cm

Slant height (l) of cone = 25 cm

Height (h) of cone $= \sqrt{l^2 - r^2}$

$$= \left(\sqrt{25^2 - 7^2}\right) \text{ cm}$$
$$= 24 \text{ cm}$$

Volume of cone $= \frac{1}{3}\pi r^2 h$

$$= \left(\frac{1}{3} \times \frac{22}{7} \times (7)^2 \times 24\right) \text{ cm}^3$$
$$= (154 \times 8) \text{ cm}^3$$
$$= 1232 \text{ cm}^3$$

Therefore, capacity of the conical vessel

$= \left(\frac{1232}{1000}\right)$ litres $(1 \text{ litre } = 1000\text{cm}^3)$

= 1.232 litres

(ii) Height (h) of cone = 12 cm

Slant height (l) of cone = 13 cm

Radius (r) of cone $= \sqrt{l^2 - h^2}$

$$= \left(\sqrt{13^2 - 12^2}\right) \text{ cm}$$
$$= 5 \text{ cm}$$

Volume of cone $= \frac{1}{3}\pi r^2 h$

$$= \left[\frac{1}{3} \times \frac{22}{7} \times (5)^2 \times 12\right] \text{ cm}^3$$
$$= \left(4 \times \frac{22}{7} \times 25\right) \text{ cm}^3$$
$$= \left(\frac{2200}{7}\right) \text{ cm}^3$$

Therefore, capacity of the conical vessel

$= \left(\frac{2200}{7000}\right)$ litres (1 litre $= 1000\text{cm}^3$)

= 11/35 litres

Question 3: The height of a cone is 15 cm. If its volume is 1570 cm^3, find the diameter of its base. [Use π = 3.14]

Solution: Height (h) of cone = 15 cm

Let the radius of the cone be r.

Volume of cone = 1570 cm^3

$$\frac{1}{3}\pi r^2 h = 1570 \text{ cm}^3$$
$$\Rightarrow \left(\frac{1}{3}\times 3.14\times r^2\times 15\right) \text{ cm} = 1570 \text{ cm}^3$$
$$\Rightarrow r^2 = 100 \text{ cm}^2$$

$\Rightarrow r = 10$ cm

Therefore, the radius of the base of cone is 10 cm.

Question 4: If the volume of a right circular cone of height 9 cm is 48π cm^3, find the diameter of its base.

Solution: Height (h) of cone = 9 cm

Let the radius of the cone be r.

Volume of cone = 48π cm^3

$$\Rightarrow \frac{1}{3}\pi r^2 h = 48\pi \text{ cm}^3$$

$$\Rightarrow \left(\frac{1}{3}\pi r^2\times 9\right) \text{ cm} = 48\pi \text{ cm}^3$$
$$\Rightarrow r^2 = 16 \text{ cm}^2$$
$$\Rightarrow r = 4 \text{ cm}$$

Diameter of base = 2r = 8 cm

Question 5: A conical pit of top diameter 3.5 m is 12 m deep. What is its capacity in kilolitres? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: Radius (r) of pit $= \left(\frac{3.5}{2}\right)\text{m} = 1.75\text{m}$

Height (h) of pit = Depth of pit = 12 m

Volume of pit $= \frac{1}{3}\pi r^2 h$

$$= \left[\frac{1}{3}\times\frac{22}{7}\times(1.75)^2\times 12\right]\ \text{cm}^3$$

= 38.5 m^3

Thus, capacity of the pit = (38.5 × 1) kilolitres = 38.5 kilolitres

Question 6: The volume of a right circular cone is 9856 cm^3. If the diameter of the base is 28 cm, find

(i) height of the cone

(ii) slant height of the cone

(iii) curved surface area of the cone. $\left[\textbf{Assume } \boldsymbol{\pi} = \frac{22}{7}\right]$

Solution: (i) Radius of cone = $\left(\frac{28}{2}\right)\text{cm} = 14\text{cm}$

Let the height of the cone be h.

Volume of cone = 9856 cm^3

$$\Rightarrow \frac{1}{3}\pi r^2 h = 9856\ \text{cm}^3$$
$$\Rightarrow \left[\frac{1}{3}\times\frac{22}{7}\times(14)^2\times h\right]\ \text{cm}^2 = 9856\ \text{cm}^3$$

h = 48 cm

Therefore, the height of the cone is 48 cm.

(ii) Slant height (l) of cone $= \sqrt{r^2 + h^2}$

$$= \left[\sqrt{(14)^2 + (48)^2}\right]\ \text{cm}$$
$$= \left[\sqrt{196 + 2304}\right]\ \text{cm}$$
$$= 50\ \text{cm}$$

Therefore, the slant height of the cone is 50 cm.

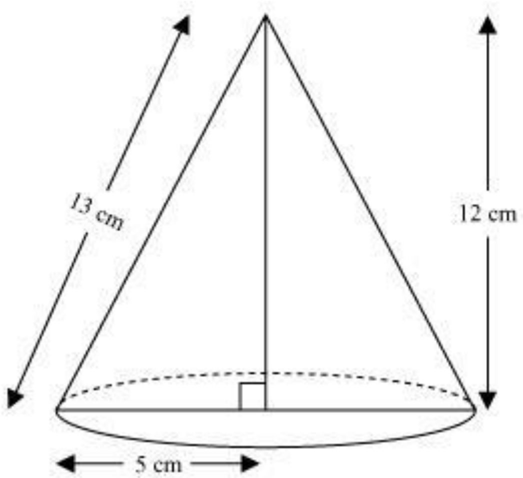
(iii) CSA of cone = $\pi r l$

$$= \left(\frac{22}{7} \times 14 \times 50\right) \text{ cm}^2$$

= 2200 cm^2

Therefore, the curved surface area of the cone is 2200 cm^2.

Question 7: A right triangle ABC with sides 5 cm, 12 cm and 13 cm is revolved about the side 12 cm. Find the volume of the solid so obtained.



Solution: When right-angled ΔABC is revolved about its side 12 cm, a cone with height (*h*) as 12 cm, radius (*r*) as 5 cm, and slant height (*l*) 13 cm will be formed.

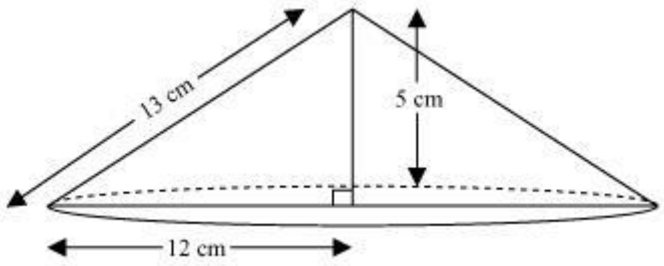
Volume of cone $= \frac{1}{3}\pi r^2 h$

$$= \left[\frac{1}{3} \times \pi \times (5)^2 \times 12\right] \text{ cm}^3$$

= 100π cm^3

Therefore, the volume of the cone so formed is 100π cm^3.

Question 8: If the triangle ABC in the Question 7 above is revolved about the side 5 cm, then find the volume of the solid so obtained. Find also the ratio of the volumes of the two solids obtained in Questions 7 and 8.



Solution: When right-angled ΔABC is revolved about its side 5 cm, a cone will be formed having radius (*r*) as 12 cm, height (*h*) as 5 cm, and slant height (*l*) as 13 cm.

Volume of cone $= \frac{1}{3}\pi r^2 h$

$$= \left[\frac{1}{3} \times \pi \times (12)^2 \times 5\right] \text{ cm}^3$$
$$= 240\pi \text{ cm}^3$$

Therefore, the volume of the cone so formed is 240π cm^3.

Required ratio

$$= \frac{100\pi}{240\pi}$$

$$= \frac{5}{12} = 5:12$$

Question 9: A heap of wheat is in the form of a cone whose diameter is 10.5 m and height is 3 m. Find its volume. The heap is to be covered by canvas to protect it from rain. Find the area of the canvas required. $\left[\textbf{Assume } \boldsymbol{\pi} = \frac{22}{7}\right]$

Solution: Radius (*r*) of heap $= \left(\frac{10.5}{2}\right) \text{m} = 5.25\text{m}$

Height (*h*) of heap = 3 m

Volume of heap $= \frac{1}{3}\pi r^2 h$

$$= \left(\frac{1}{3} \times \frac{22}{7} \times (5.25)^2 \times 3\right) \text{ m}^3$$
$$= 86.625 \text{ m}^3$$

Therefore, the volume of the heap of wheat is 86.625 m^3.

Area of canvas required = CSA of cone

$= \pi rl = \pi r\sqrt{r^2 + h^2}$

$= \left[\frac{22}{7} \times 5.25 \times \sqrt{(5.25)^2 + (3)^2}\right] \text{ m}^2$

$= \left(\frac{22}{7} \times 5.25 \times 6.05\right) \text{ m}^2$

$= 99.825 \text{ m}^2$

Therefore, 99.825 m^2 canvas will be required to protect the heap from rain.

Exercise 11.4

Question 1: Find the volume of a sphere whose radius is

(i) 7 cm (ii) 0.63 m $\left[\textbf{ Assume } \pi = \frac{22}{7}\right]$

Solution: (i) Radius of sphere = 7 cm

Volume of sphere $= \frac{4}{3}\pi r^3$

$= \left[\frac{4}{3} \times \frac{22}{7} \times (7)^3\right] \text{ cm}^3$

$= \left(\frac{4312}{3}\right) \text{ cm}^3$

$= 1437\frac{1}{3} \text{ cm}^3$

Therefore, the volume of the sphere is $1437\frac{1}{3}$ cm^3.

(ii) Radius of sphere = 0.63 m

Volume of sphere $= \frac{4}{3}\pi r^3$

$= \left[\frac{4}{3} \times \frac{22}{7} \times (0.63)^3\right] \text{ m}^3$

$= 1.0478 \text{ m}^3$

Therefore, the volume of the sphere is 1.05 m^3 (approximately).

Question 2: Find the amount of water displaced by a solid spherical ball of diameter

(i) 28 cm (ii) 0.21 m. $\left[\textbf{ Assume } \pi = \frac{22}{7}\right]$

Solution: (i) Radius (r) of ball $=\left(\frac{28}{2}\right)$ cm $= 14$cm

Volume of ball $=\frac{4}{3}\pi r^3$

$$= \left[\frac{4}{3} \times \frac{22}{7} \times (14)^3\right] \text{ cm}^3$$

$$= 11498\frac{2}{3} \text{ cm}^3$$

Therefore, the volume of the sphere is $11498\frac{2}{3}$ cm^3.

(ii)Radius (r) of ball = 0.21/2 = 0.105 m

Volume of ball $=\frac{4}{3}\pi r^3$

$$= \left[\frac{4}{3} \times \frac{22}{7} \times (0.105)^3\right] \text{ m}^3$$

$$= 0.004851 \text{ m}^3$$

Therefore, the volume of the sphere is 0.004851 m^3.

Question 3: The diameter of a metallic ball is 4.2 cm. What is the mass of the ball, if the density of the metal is 8.9 g per cm^3? $\left[\textbf{Assume } \pi = \frac{22}{7}\right]$

Solution: Radius (r) of metallic ball = $\left(\frac{4.2}{2}\right)$ cm $= 2.1$cm

Volume of metallic ball = $\frac{4}{3}\pi r^3$

$$= \left[\frac{4}{3} \times \frac{22}{7} \times (2.1)^3\right] \text{ cm}^3$$

$$= 38.808 \text{ cm}^3$$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Mass = Density × Volume

= (8.9 × 38.808) g

= 345.3912 g

Hence, the mass of the ball is 345.39 g (approximately).

Question 4: The diameter of the moon is approximately one-fourth of the diameter of the earth. What fraction of the volume of the earth is the volume of the moon?

Solution: Let the diameter of earth be *d*. Therefore, the radius of earth will be d/2 .

Diameter of moon will be d/4 and the radius of moon will be d/8 .

Volume of moon $=\frac{4}{3}\pi r^3 = \frac{4}{3}\pi\left(\frac{d}{8}\right)^3 = \frac{1}{512}\times\frac{4}{3}\pi d^3$

Volume of earth $= \frac{4}{3}\pi r^3 = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3 = \frac{1}{8}\times\frac{4}{3}\pi d^3$

$$\frac{\text{Volume of moon}}{\text{Volume of earth}} = \frac{\frac{1}{512}\times\frac{4}{3}\pi d^3}{\frac{1}{8}\times\frac{4}{3}\pi d^3}$$

$$= \frac{1}{64}$$

$$\Rightarrow \text{Volume of moon} = \frac{1}{64}\text{Volume of earth}$$

Therefore, the volume of moon is 1/64 of the volume of earth.

Question 5: How many litres of milk can a hemispherical bowl of diameter 10.5 cm hold? $\left[\textbf{Assume } \boldsymbol{\pi} = \frac{22}{7}\right]$

Solution: Radius (*r*) of hemispherical bowl **= 10.5/2** = 5.25 cm

Volume of hemispherical bowl $=\frac{2}{3}\pi r^3$

$$=\left[\frac{2}{3}\times\frac{22}{7}\times(5.25)^3\right]\text{ cm}^3$$

= 303.1875 cm^3

Capacity of the bowl =

$$\left(\frac{303.1875}{1000}\right)\text{ litre}$$

=0.3031875 litre=0.303 litre (approximately)

Therefore, the volume of the hemispherical bowl is 0.303 litre.

Question 6: A hemispherical tank is made up of an iron sheet 1 cm thick. If the inner radius is 1 m, then find the volume of the iron used to make the tank. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: Inner radius (r_1) of hemispherical tank = 1 m

Thickness of hemispherical tank = 1 cm = 0.01 m

Outer radius (r_2) of hemispherical tank = (1 + 0.01) m = 1.01 m

$$\text{Volume of iron used to make such a tank} = \frac{2}{3}\pi\left(r_2^3 - r_1^3\right)$$

$$= \left[\frac{2}{3} \times \frac{22}{7} \times \left\{(1.01)^3 - (1)^3\right\}\right] \text{ m}^3$$

$$= \left[\frac{44}{21} \times (1.030301 - 1)\right] \text{ m}^3$$

$$= 0.06348 \text{ m}^3 \quad (\text{approximately})$$

Question 7: Find the volume of a sphere whose surface area is 154 cm^2. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution: Let radius of sphere be r.

Surface area of sphere = 154 cm^2

$\Rightarrow 4\pi r^2 = 154 \text{ cm}^2$

$$\Rightarrow r^2 = \left(\frac{154 \times 7}{4 \times 22}\right) \text{ cm}^2$$

$$\Rightarrow r = \left(\frac{7}{2}\right) \text{ cm} = 3.5 \text{ cm}$$

Volume of sphere = $\frac{4}{3}\pi r^3$

$$= \left[\frac{4}{3} \times \frac{22}{7} \times (3.5)^3\right] \text{ cm}^3$$

$$= 179\frac{2}{3} \text{ cm}^3$$

Therefore, the volume of the sphere is $179\frac{2}{3}$ cm^3.

Question 8: A dome of a building is in the form of a hemisphere. From inside, it was white-washed at the cost of Rs 498.96. If the cost of white-washing is Rs 2.00 per square meter, find the

(i) inside surface area of the dome,

(ii) volume of the air inside the dome. $\left[\textbf{Assume } \pi = \frac{22}{7}\right]$

Solution: (i) Cost of white-washing the dome from inside = Rs 498.96

Cost of white-washing 1 m^2 area = Rs 2

Therefore, CSA of the inner side of dome =

$$\left(\frac{498.96}{2}\right) \text{ m}^2$$

= 249.48 m^2

(ii) Let the inner radius of the hemispherical dome be r.

CSA of inner side of dome = 249.48 m^2

$2\pi r^2$ = 249.48 m^2

$$\Rightarrow 2 \times \frac{22}{7} \times r^2 = 249.48 \text{ m}^2$$
$$\Rightarrow r^2 = \left(\frac{249.48 \times 7}{2 \times 22}\right) \text{ m}^2 = 39.69 \text{ m}^2$$

⇒ r = 6.3 m

Volume of air inside the dome = Volume of hemispherical dome

$$= \frac{2}{3}\pi r^3$$
$$= \left[\frac{2}{3} \times \frac{22}{7} \times (6.3)^3\right] \text{ m}^3$$

= 523.908 m^3

= 523.9 m^3 (approximately)

Therefore, the volume of air inside the dome is 523.9 m^3.

Question 9: Twenty seven solid iron spheres, each of radius *r* and surface area S are melted to form a sphere with surface area S'. Find the

(i) radius *r*' of the new sphere, (ii) ratio of S and S'.

Solution: (i)Radius of 1 solid iron sphere = r

Volume of 1 solid iron sphere $\frac{4}{3}\pi r^3$

Volume of 27 solid iron spheres

$$= 27 \times \frac{4}{3}\pi r^3$$

27 solid iron spheres are melted to form 1 iron sphere. Therefore, the volume of this iron sphere will be equal to the volume of 27 solid iron spheres. Let the radius of this new sphere be *r*'.

Volume of new solid iron sphere $= \frac{4}{3}\pi r^3$

$$\frac{4}{3}\pi r'^3 = 27 \times \frac{4}{3}\pi r^3$$
$$r'^3 = 27r^3$$
$$r' = 3r$$

(ii) Surface area of 1 solid iron sphere of radius $r = 4\pi r^2$

Surface area of iron sphere of radius $r' = 4\pi\,(r')^2$

$= 4\,\pi\,(3r)^2 = 36\,\pi r^2$

$$\frac{S}{S'} = \frac{4\pi r^2}{36\pi r^2} = \frac{1}{9} = 1:9$$

Question 10: A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in mm^3) is needed to fill this capsule? $\left[\textbf{Assume } \boldsymbol{\pi = \frac{22}{7}}\right]$

Solution: Radius (*r*) of capsule

$$= \left(\frac{3.5}{2}\right) \text{ mm} = 1.75 \text{ mm}$$

Volume of spherical capsule $\frac{4}{3}\pi r^3$

$$= \left[\frac{4}{3} \times \frac{22}{7} \times (1.75)^3\right] \text{ mm}^3$$

= 22.458 mm^3

= 22.46 mm^3 (approximately)

Therefore, the volume of the spherical capsule is 22.46 mm^3.