

CBSE NCERT Solutions for Class 9 Mathematics Chapter 13

Back of Chapter Questions

Exercise: 13.1

1. A plastic box 1.5 m long, 1.25 m wide and 65 cm deep, is to be made. It is opened at the top. Ignoring the thickness of the plastic sheet, determine:

- (i) The area of the sheet required for making the box.
 (ii) The cost of sheet for it, if a sheet measuring 1m^2 costs ₹20.

Solution:

Given, the dimension of the box is:

$$\text{Length} = 1.5 \text{ m}$$

$$\text{Breadth} = 1.25\text{m}$$

$$\text{Height} = 65\text{cm} = 0.65\text{m}$$

- (i) Area of the sheet (cuboid) = $lb + 2lh + 2bh$ (since top is opened)

$$\text{Area} = (1.5 \times 1.25) + 2(1.5 \times 0.65) + 2(1.25 \times 0.65)$$

$$= 1.95 + 1.875 + 1.625$$

$$= 5.45 \text{ m}^2$$

Hence, the area of the sheet required for making the box is 5.45 m^2 .

- (ii) Cost of sheet:

$$1\text{m}^2 = ₹ 20$$

$$5.45\text{m}^2 = 5.45 \times 20$$

$$= ₹109$$

Hence, the cost of sheet is ₹109.

2. The length, breadth and height of a room are 5 m, 4 m and 3 m respectively. Find the cost of white washing the walls of the room and the ceiling at the rate of ₹ 7.50 per m^2 .

Solution:

Given, Length = 5m, Breadth = 4m, Height = 3m

Area to be whitewashed = Area of the walls + Area of ceiling of rooms

$$\text{Area of the walls} = 2lh + 2bh$$

$$= 2(5 \times 3) + 2(4 \times 3)$$

$$= 30 + 24$$

$$= 54 \text{ m}^2$$

Area of ceiling of rooms = lb

$$= 5 \times 4$$

$$= 20 \text{ m}^2$$

Area to be whitewashed = 54 + 20

$$= 74 \text{ m}^2$$

Cost of whitewashing $1 \text{ m}^2 = ₹ 7.50$

Hence, Cost of whitewashing $74 \text{ m}^2 = 74 \times 7.5$

$$= ₹ 555$$

3. The floor of a rectangular hall has a perimeter 250 m. If the cost of painting the four walls at the rate of ₹10 per m^2 is ₹15000, find the height of the hall.

Solution:

Let length, breadth and height of the hall to be l, b, h respectively

Perimeter of the rectangular hall = $2(l + b)$

$$= 250 \text{ m}$$

Area of the four walls = $2(l + b) \times h$

$$= 250 \text{ hm}^2$$

Cost of painting the four walls is ₹10 per m^2

$$15000 = 250 \times h \times 10$$

$$\text{Hence, } h = \frac{15000}{2500}$$

$$= 6 \text{ m}$$

Hence, the height of the hall is 6 m.

4. The paint in a certain container is sufficient to paint an area equal to 9.375 m^2 . How many bricks of dimensions $22.5 \text{ cm} \times 10 \text{ cm} \times 7.5 \text{ cm}$ can be painted out of this container?

Solution:

Given, dimension of brick is $22.5 \text{ cm} \times 10 \text{ cm} \times 7.5 \text{ cm}$

Total surface area of the bricks = $2lb + 2lh + 2bh$

$$\begin{aligned}
 &= 2(22.5 \times 10) + 2(22.5 \times 7.5) + 2(10 \times 7.5) \\
 &= 450 + 337.5 + 150 \\
 &= 937.5 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Total area that can be painted} &= 9.375 \text{ m}^2 \\
 &= 93750 \text{ cm}^2
 \end{aligned}$$

Hence,

$$\begin{aligned}
 \text{Number of bricks that can be painted} &= \frac{93750}{937.5} \\
 &= 100
 \end{aligned}$$

Hence, 100 bricks can be painted out of the container.

5. A cubical box has each edge 10 cm and another cuboidal box is 12.5 cm long, 10 cm wide and 8 cm high.
- Which box has the greater lateral surface area and by how much?
 - Which box has the smaller total surface area and by how much?

Solution:

- (i) Given, the edge of the cubical box = 10 cm

$$\begin{aligned}
 \text{Lateral surface area of cubical box} &= 4a^2 \\
 &= 4(10)^2 \\
 &= 400 \text{ cm}^2
 \end{aligned}$$

Dimension of the cuboidal box is $l = 12.5 \text{ cm}$, $b = 10 \text{ cm}$, $h = 8 \text{ cm}$

$$\begin{aligned}
 \text{Lateral surface area of cuboidal box} &= 2(l + b)h \\
 &= 2(12.5 + 10) \times 8 \\
 &= 360 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{The difference in lateral surface area} &= 400 - 360 \\
 &= 40 \text{ cm}^2
 \end{aligned}$$

Hence the lateral surface area of the cubical box is greater than the lateral surface area of the cuboidal box by 40 cm^2

- (ii) Total surface area of the cubical box = $6a^2$
- $$\begin{aligned}
 &= 6(10)^2 \\
 &= 600 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned} \text{Total surface area of the cuboidal box} &= 2lb + 2lh + 2bh \\ &= 2(12.5 \times 10) + 2(12.5 \times 8) + 2(10 \times 8) \\ &= 250 + 200 + 160 \\ &= 610 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{The difference in Total surface area} &= 610 - 600 \\ &= 10 \text{ cm}^2 \end{aligned}$$

Hence the total surface area of the cubical box is smaller than the total surface area of the cuboidal box by 10 cm^2

6. A small indoor greenhouse (herbarium) is made entirely of glass panes (including base) held together with tape. It is 30 cm long, 25 cm wide and 25 cm high.
- What is the area of the glass?
 - How much of tape is needed for all the 12 edges?

Solution:

Given, dimension of the green house: $l = 30 \text{ cm}$, $b = 25 \text{ cm}$, $h = 25 \text{ cm}$

- Total surface area of the green house $= 2(lb + lh + bh)$
 $= 2(30 \times 25 + 30 \times 25 + 25 \times 25) \text{ cm}^2$
 $= 2(750 + 750 + 625) \text{ cm}^2$
 $= 2(2125) \text{ cm}^2$
 $= 4250 \text{ cm}^2$

Hence, the area of the glass is 4250 cm^2

- Length of the tape needed $= 4(l + b + h)$
 $= 4(30 + 25 + 25) \text{ cm}$
 $= 320 \text{ cm}$

Hence, 320 cm tape is needed for all the 12 edges

7. Shanti Sweets Stall was placing an order for making cardboard boxes for packing their sweets. Two sizes of boxes were required. The bigger of dimensions $25 \text{ cm} \times 20 \text{ cm} \times 5 \text{ cm}$ and the smaller of dimensions $15 \text{ cm} \times 12 \text{ cm} \times 5 \text{ cm}$. For all the overlaps, 5% of the total surface area is required extra. If the cost of the cardboard is ₹4 for 1000 cm^2 , find the cost of cardboard required for supplying 250 boxes of each kind.

Solution:

Dimensions of the bigger box: $l = 25 \text{ cm}$, $b = 20 \text{ cm}$, $h = 5 \text{ cm}$

Total surface area of the bigger box = $2(lb + lh + bh)$

$$= 2(25 \times 20 + 25 \times 5 + 20 \times 5) \text{ cm}^2$$

$$= 2(500 + 125 + 100) \text{ cm}^2$$

$$= 2(725) \text{ cm}^2$$

$$= 1450 \text{ cm}^2$$

Dimension of the smaller box: $l = 15 \text{ cm}, b = 12 \text{ cm}, h = 5 \text{ cm}$

Total surface area of the bigger box = $2(lb + lh + bh)$

$$= 2(15 \times 12 + 15 \times 5 + 12 \times 5) \text{ cm}^2$$

$$= 2(180 + 75 + 60) \text{ cm}^2$$

$$= 2(215) \text{ cm}^2$$

$$= 630 \text{ cm}^2$$

Total surface area of 250 boxes of each type = $(250 \times 1450) + (250 \times 630)$

$$= 362500 + 157500$$

$$= 520000 \text{ cm}^2$$

Extra area required by both types for overlapping = $1450 \times \frac{5}{100} + 630 \times \frac{5}{100}$

$$= 72.5 + 31.5$$

$$= 104$$

For 250 boxes = 104×250

$$= 26000 \text{ cm}^2$$

Hence, total cardboard required = $520000 + 26000$

$$= 546000 \text{ cm}^2$$

Cost of 1000 cm^2 cardboard sheet = ₹ 4

Hence, cost of 546000 cm^2 cardboard sheet required for 250 boxes:

$$= \frac{546000}{1000} \times 4$$

$$= ₹ 2184$$

8. Parveen wanted to make a temporary shelter for her car, by making a box-like structure with tarpaulin that covers all the four sides and the top of the car (with the front face as a flap which can be rolled up). Assuming that the stitching margins are very small, and therefore negligible, how much tarpaulin would be required to make the shelter of height 2.5 m, with base dimensions $4 \text{ m} \times 3 \text{ m}$?

Solution:

Dimension of the box like car cover: $l = 4 \text{ m}$, $b = 3 \text{ m}$, $h = 2.5 \text{ m}$

Tarpaulin is required only for the four sides and top of the shelter

Hence, area of tarpaulin required $= 2(l + b) \times h + lb$

$$= 2(4 + 3) \times 2.5 + (4 \times 3)$$

$$= 2(7 \times 2.5) + 12$$

$$= 35 + 12$$

$$= 47 \text{ m}^2$$

Exercise: 13.2

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

The curved surface area of a right circular cylinder of height 14 cm is 88 cm^2 .

Find the diameter of the base of the cylinder.

Solution:

Given, Height (h) of cylinder = 14 cm

Curved surface area of cylinder = 88 cm^2

Let us consider the diameter of the cylinder be d.

$$\Rightarrow 2\pi rh = 88 \text{ cm}^2 \text{ (r is the radius of the base of the cylinder)}$$

$$\Rightarrow \pi dh = 88 \text{ cm}^2 \text{ (d = 2r)}$$

$$\Rightarrow \frac{22}{7} \times d \times 14 \text{ cm} = 88 \text{ cm}^2$$

$$\Rightarrow d = 2 \text{ cm}$$

Hence, the diameter of the base of the cylinder is 2 cm.

2. Assume $\pi = \frac{22}{7}$, unless stated otherwise. It is required to make a closed cylindrical tank of height 1 m and base diameter 140 cm from a metal sheet. How many square meters of the sheet are required for the same?

Solution:

Given, Height (h) of cylindrical tank = 1 m

Base radius (r) of cylindrical tank = $\frac{140}{2} \text{ cm} = 70 \text{ cm} = 0.7 \text{ m}$

Area of the sheet required = Total surface area of tank = $2\pi r(r + h)$

$$\begin{aligned} &\Rightarrow \left[2 \times \frac{22}{7} \times 0.7(0.7 + 1) \right] \text{ m}^2 \\ &= (4.4 \times 1.7) \text{ m}^2 \\ &= 7.48 \text{ m}^2 \end{aligned}$$

Hence, it will require 7.48 m² sheet.

3. A metal pipe is 77 cm long. The inner diameter of a cross section is 4 cm, the outer diameter being 4.4 cm (see Fig.). Find its

- (i) Inner curved surface area,
- (ii) Outer curved surface area,
- (iii) Total surface area.



Solution:

Given, inner radius = $r_1 = \frac{4}{2} = 2$ cm

outer radius = $r_2 = \frac{4.4}{2} = 2.2$ cm

Length of the cylindrical pipe = 77 cm

CSA of inner surface of pipe = $2\pi r_1 h$

$$= \left[2 \times \frac{22}{7} \times 2 \times 77 \right] \text{ cm}^2$$

$$= 968 \text{ cm}^2$$

CSA of outer surface of pipe = $2\pi r_2 h$

$$= \left[2 \times \frac{22}{7} \times 2.2 \times 77 \right] \text{ cm}^2$$

$$= 1064.8 \text{ cm}^2$$

Total surface area of pipe = CSA of inner surface + CSA of outer surface + Area of both circular ends of pipe

$$\begin{aligned}
 &= 968 + 1064.8 + 2\pi(r_2^2 - r_1^2) \text{ cm}^2 \\
 &= 968 + 1064.8 + 2\pi\{2.2^2 - 2^2\} \text{ cm}^2 \\
 &= (2032.8 + 5.28) \text{ cm}^2 \\
 &= 2038.08 \text{ cm}^2
 \end{aligned}$$

4. Assume $\pi = \frac{22}{7}$, unless stated otherwise. The diameter of a roller is 84 cm and its length is 120 cm. It takes 500 complete revolutions to move once over to level a playground. Find the area of the playground in m^2 ?

Solution:

It is clear that a roller is cylindrical.

Given, Height (h) of cylindrical roller = Length of roller = 120 cm

Radius (r) of the circular end of roller = $\frac{84}{2} = 42$ cm

CSA of roller = $2\pi rh$

$$= \left[2 \times \frac{22}{7} \times 42 \times 120 \right] \text{ cm}^2$$

$$= 31680 \text{ cm}^2$$

Area of field = 500 × CSA of roller

$$= (500 \times 31680) \text{ cm}^2$$

$$= 15840000 \text{ cm}^2$$

$$= 1584 \text{ m}^2$$

5. Assume $\pi = \frac{22}{7}$, unless stated otherwise. A cylindrical pillar is 50 cm in diameter and 3.5 m in height. Find the cost of painting the curved surface of the pillar at the rate of ₹12.50 per m^2 .

Solution:

Given, Height (h) of cylindrical pillar = 3.5 m

Radius (r) of the circular end of pillar = $\frac{50}{2} = 25$ cm = 0.25 m

CSA of pillar = $2\pi rh$

$$= \left[2 \times \frac{22}{7} \times 0.25 \times 3.5 \right] \text{ m}^2$$

$$= (44 \times 0.125) \text{ m}^2$$

$$= 5.5 \text{ m}^2$$

Cost of painting 1 m² area = ₹ 12.50

Cost of painting 5.5 m² area = ₹ (5.5 × 12.50)
= ₹ 68.75

Hence, the cost of painting the CSA of the pillar is ₹ 68.75

6. Assume $\pi = \frac{22}{7}$, unless stated otherwise. Curved surface area of a right circular cylinder is 4.4 m². If the radius of the base of the cylinder is 0.7 m, find its height.

Solution:

Given, the height of the circular cylinder to be h.

Radius (r) of the base of cylinder = 0.7 m

CSA of cylinder = 4.4 m²

$$2\pi rh = 4.4 \text{ m}^2$$

$$= \left[2 \times \frac{22}{7} \times 0.7 \times h \right] = 4.4 \text{ m}^2$$

$$h = 1 \text{ m}$$

Hence, the height of the cylinder is 1 m.

7. Assume $\pi = \frac{22}{7}$, unless stated otherwise. The inner diameter of a circular well is 3.5 m. It is 10 m deep. Find

- (i) Its inner curved surface area,
(ii) The cost of plastering this curved surface at the rate of ₹ 40 per m²

Solution:

- (i) Given, inner radius (r) of circular well = $\frac{3.5}{2} = 1.75 \text{ m}$

depth (h) of circular well = 10 m

Inner curved surface area = $2\pi rh$

$$= \left[2 \times \frac{22}{7} \times 1.75 \times 10 \right] \text{ m}^2$$

$$= (44 \times 0.25 \times 10) \text{ m}^2$$

$$= 110 \text{ m}^2$$

- (ii) Cost of plastering 1 m² area = ₹ 40

Cost of plastering 110 m² area = ₹ (110 × 40)

$$= ₹ 4400$$

Hence, the cost of plastering the CSA of this well is ₹ 4400.

8. Assume $\pi = \frac{22}{7}$, unless stated otherwise. In a hot water heating system, there is a cylindrical pipe of length 28 m and diameter 5 cm. Find the total radiating surface in the system.

Solution:

Since, height (h) of cylindrical pipe = Length of cylindrical pipe = 28 m

Given, radius (r) of circular end of pipe = $\frac{5}{2} = 2.5 \text{ cm} = 0.025 \text{ m}$

CSA of cylindrical pipe = $2\pi rh$

$$= \left[2 \times \frac{22}{7} \times 0.025 \times 28 \right] \text{m}^2$$

$$= 4.4 \text{ m}^2$$

Hence, the area of the radiating surface of the system is 4.4 m^2 .

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

Find

- (i) The lateral or curved surface area of a closed cylindrical petrol storage tank that is 4.2 m in diameter and 4.5 m high.
- (ii) How much steel was actually used, if $\frac{1}{12}$ of the steel actually used was wasted in making the tank.

Solution:

- (i) Given, Height (h) of cylindrical tank = 4.5 m

Radius (r) of the circular end of cylindrical tank = $\frac{4.2}{2} = 2.1 \text{ m}$

Lateral or curved surface area of tank = $2\pi rh$

$$= \left[2 \times \frac{22}{7} \times 2.1 \times 4.5 \right] \text{m}^2$$

$$= (44 \times 0.3 \times 4.5) \text{m}^2$$

$$= 59.4 \text{ m}^2$$

Hence, CSA of tank is 59.4 m^2 .

- (ii) Total surface area of tank = $2\pi r(r + h)$

$$= \left[2 \times \frac{22}{7} \times 2.1 \times (2.1 + 4.5) \right] \text{m}^2$$

$$= (44 \times 0.3 \times 6.6) \text{m}^2$$

$$= 87.12 \text{ m}^2$$

Let $A \text{ m}^2$ steel sheet be actually used in making the tank.

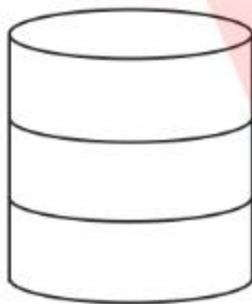
$$\therefore A \left[1 - \frac{1}{12} \right] = 87.12 \text{ m}^2$$

$$\Rightarrow A = \left[\frac{12}{11} \times 87.12 \right] \text{m}^2$$

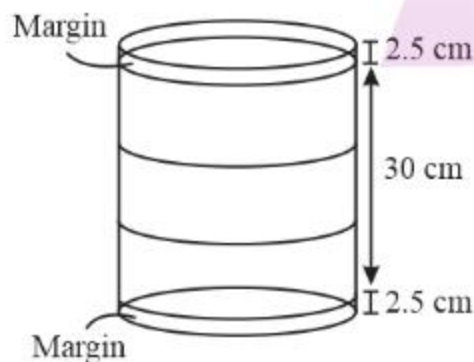
$$\Rightarrow A = 95.04 \text{ m}^2$$

Hence, 95.04 m^2 of steel was actually used in making the tank.

10. Assume $\pi = \frac{22}{7}$, unless stated otherwise. In the given figure, you see the frame of a lampshade. It is to be covered with a decorative cloth. The frame has a base diameter of 20 cm and a height of 30 cm. A margin of 2.5 cm is to be given for folding it over the top and bottom of the frame. Find how much cloth is required for covering the lampshade.



Solution:



Given, Height (h) of the frame of lampshade = $(2.5 + 30 + 2.5) \text{cm} = 35 \text{ cm}$

Radius (r) of the circular end of the frame of lampshade = $\frac{20}{2} = 10 \text{ cm}$

$$\begin{aligned} \text{Cloth required for covering the lampshade} &= 2\pi rh \\ &= \left[2 \times \frac{22}{7} \times 10 \times 35 \right] \text{cm}^2 \\ &= 2200 \text{ cm}^2 \end{aligned}$$

Hence, for covering the lampshade, 2200 cm² cloth will be required.

11. Assume $\pi = \frac{22}{7}$, unless stated otherwise. The students of a Vidyalaya were asked to participate in a competition for making and decorating penholders in the shape of a cylinder with a base, using cardboard. Each penholder was to be of radius 3 cm and height 10.5 cm. The Vidyalaya was to supply the competitors with cardboard. If there were 35 competitors, how much cardboard was required to be bought for the competition?

Solution:

Given, Radius (r) of the circular end of cylindrical penholder = 3 cm

Height (h) of penholder = 10.5 cm

Surface area of 1 penholder = CSA of penholder + Area of base of penholder

$$\begin{aligned} &= 2\pi rh + \pi r^2 \\ &= \left[2 \times \frac{22}{7} \times 3 \times 10.5 + \frac{22}{7} \times 3 \times 3 \right] \text{cm}^2 \\ &= \left[132 \times 1.5 + \frac{198}{7} \right] \text{cm}^2 \\ &= \frac{1584}{7} \text{ cm}^2 \end{aligned}$$

Area of cardboard sheet used by 1 competitor = $\frac{1584}{7}$ cm²

Area of cardboard sheet used by 35 competitors

$$\begin{aligned} &= \left[\frac{1584}{7} \times 35 \right] \text{cm}^2 \\ &= 7920 \text{ cm}^2 \end{aligned}$$

Hence, 7920 cm² cardboard sheet will be bought.

Exercise: 13.3

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

Diameter of the base of the cone is 10.5 cm and its slant height is 10 cm. Find its curved surface area.

Solution:

Given, diameter of the cone = 10.5 cm

Hence, radius of the cone, $r = \frac{10.5}{2} = 5.25$ cm

Slant height of the cone, $l = 10$ cm

Hence, curved surface area of the cone = $\pi r l$

$$= \frac{22}{7} \times 5.25 \times 10$$

$$= 165 \text{ cm}^2$$

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

Find the total surface area of a cone, if its slant height is 21 m and diameter of its base is 24 m.

Solution:

Given, diameter of the cone = 24 cm

Hence, radius of the cone, $r = \frac{24}{2} = 12$ m

Slant height of the cone, $l = 21$ m

Total surface area of the cone = $\pi r l + \pi r^2$

$$= \frac{22}{7} \times 12 \times (12 + 21)$$

$$= \frac{22}{7} \times 12 \times 33$$

$$= 1244.57 \text{ m}^2$$

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

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.

Solution:

- (i) Given, CSA of the cone = 308 cm^2 ,

Slant height of the cone, $l = 14$ cm

Curved surface area of the cone = $\pi r l$

$$308 = \frac{22}{7} \times 14 \times r$$

$$\Rightarrow r = \frac{308}{44}$$

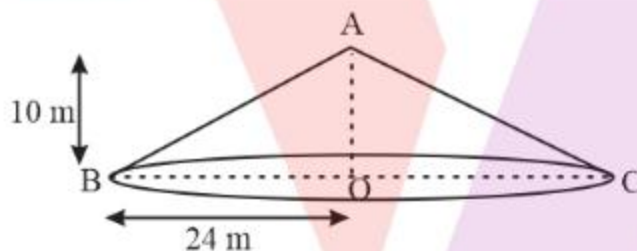
Hence, radius of the base = 7cm

$$\begin{aligned} \text{(ii) Total surface area of the cone} &= \pi r l + \pi r^2 \\ &= \left[308 + \frac{22}{7} \times 7^2 \right] \\ &= 308 + 154 \\ &= 462 \text{ cm}^2 \end{aligned}$$

Hence, total surface area of the cone is 462 cm².

4. Assume $\pi = \frac{22}{7}$, unless stated otherwise. A conical tent is 10 m high and the radius of its base is 24 m. Find
- Slant height of the tent
 - Cost of the canvas required to make the tent, if the cost of 1 m² canvas is ₹70.

Solution:



- Given, height of the cone, $h = 10$ m
 Radius of the cone, $r = 24$ m
 Hence, slant height of the cone, $l = \sqrt{r^2 + h^2}$
 $= \sqrt{24^2 + 10^2}$
 $= 26$ m
- Curved surface area of the cone = $\pi r l$
 $= \frac{22}{7} \times 24 \times 26$
 $= \frac{13728}{7} \text{ m}^2$
 Cost of 1 canvas is = ₹ 70

$$\begin{aligned} \text{Hence, cost of canvas required to make the tent} &= \frac{13728}{7} \times 70 \\ &= ₹ 137280 \end{aligned}$$

Hence, the cost of the canvas required to make such a tent is ₹ 137280.

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 $\pi = 3.14$).

Solution:

Given, height of the conical tent, $h = 8$ m

Radius of the conical tent, $r = 6$ m

Slant height of the conical tent, $l = \sqrt{r^2 + h^2}$

$$= \sqrt{6^2 + 8^2}$$

$$= 10 \text{ m}$$

Curved surface area of the cone = πrl

$$= 3.14 \times 6 \times 10$$

$$= 188.4 \text{ m}^2$$

Area of the tent = Area of the tarpaulin sheet

$$\text{Length} \times \text{Breadth} = 188.4$$

$$\text{Length} \times 3 = 188.4$$

$$\text{Length} = \frac{188.4}{3}$$

$$= 62.8 \text{ m}$$

Now, given that wastage of margin is 20 cm = 0.2 m

Hence, actual length of tarpaulin sheet required = $62.8 + 0.2$

$$= 63 \text{ m}$$

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

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

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 ₹ 210 per 100 m².

Solution:

Given, radius of the conical tomb $r = \frac{14}{2} = 7$ m

slant height of the conical tomb $l = 25$ m

Curved surface area of the tomb $= \pi rl$

$$= \frac{22}{7} \times 7 \times 25$$

$$= 550 \text{ m}^2$$

Cost of white washing per $100 \text{ m}^2 = ₹ 210$

$$\text{Hence, cost for } 550 \text{ m}^2 = \frac{210 \times 550}{100}$$

$$= ₹ 1155$$

Hence, it will cost ₹ 1155 while white-washing such a conical tomb.

7. Assume $\pi = \frac{22}{7}$, unless stated otherwise. A joker's cap is in the form of a right circular cone of base radius 7 cm and height 24 cm. Find the area of the sheet required to make 10 such caps.

Solution:

Given, height of the cone, $h = 24$ cm

Radius of the cone, $r = 7$ cm

Hence, slant height of the cone, $l = \sqrt{r^2 + h^2}$

$$= \sqrt{7^2 + 24^2}$$

$$= 25 \text{ cm}$$

Curved surface area of the cone $= \pi rl$

$$= \frac{22}{7} \times 7 \times 25$$

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

Hence, area of the sheet required to make 10 caps $= 550 \times 10$

$$= 5500 \text{ cm}^2$$

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 ₹ 12 per m^2 , what will be the cost of painting all these cones? (Use $\pi = 3.14$ and take $\sqrt{1.04} = 1.02$).

Solution:

Given, height of the cone, $h = 1$ m

radius of the cone, $r = \frac{40}{2} = 20$ cm = 0.2 m

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

$$= \sqrt{0.2^2 + 1^2}$$

$$= \sqrt{1.04}$$

$$= 1.02$$
 m

Curved surface area of the cone = πrl

$$= 3.14 \times 0.2 \times 1.02$$

$$= 0.64056 \text{ m}^2$$

Curved surface area of 50 cones = 0.64056×50

$$= 32.028 \text{ m}^2$$

The cost of painting $1 \text{ m}^2 = ₹ 12$

Hence, the cost of painting 50 cones of $32.028 \text{ m}^2 = 12 \times 32.028$

$$= ₹ 384.336$$

Exercise: 13.4

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

Find the surface area of a sphere of radius:

(i) 10.5 cm

(ii) 5.6 cm

(iii) 14 cm

Solution:

- (i) Given, radius of the sphere, $r = 10.5$ cm

Hence, surface area of the sphere = $4\pi r^2$

$$= 4 \times \frac{22}{7} \times 10.5 \times 10.5$$

$$= 1386 \text{ cm}^2$$

- (ii) Given, radius of the sphere, $r = 5.6$ cm

Hence, surface area of the sphere = $4\pi r^2$

$$= 4 \times \frac{22}{7} \times 5.6 \times 5.6$$

$$= 394.24 \text{ cm}^2$$

- (iii) Given, radius of the sphere, $r = 14 \text{ cm}$

Hence, surface area of the sphere $= 4\pi r^2$

$$= 4 \times \frac{22}{7} \times 14 \times 14$$

$$= 2464 \text{ cm}^2$$

2. Assume $\pi = \frac{22}{7}$, unless stated otherwise. Find the surface area of a sphere of diameter:

- (i) 14 cm

- (ii) 21 cm

- (iii) 3.5 m

Solution:

- (i) Given, diameter of the sphere $= 14 \text{ cm}$

Hence, radius of the sphere, $r = \frac{14}{2} = 7 \text{ cm}$

Hence, surface area of the sphere $= 4\pi r^2$

$$= 4 \times \frac{22}{7} \times 7 \times 7$$

$$= 616 \text{ cm}^2$$

- (ii) Given, diameter of the sphere $= 21 \text{ cm}$

Hence, radius of the sphere, $r = \frac{21}{2} = 10.5 \text{ cm}$

Hence, surface area of the sphere $= 4\pi r^2$

$$= 4 \times \frac{22}{7} \times 10.5^2$$

$$= 1386 \text{ cm}^2$$

- (iii) Given, diameter of the sphere $= 3.5 \text{ m}$

Hence, radius of the sphere, $r = \frac{3.5}{2} = 1.75 \text{ m}$

Hence, surface area of the sphere $= 4\pi r^2$

$$= 4 \times \frac{22}{7} \times 1.752$$

$$= 38.5 \text{ m}^2$$

3. Find the total surface area of a hemisphere of radius 10 cm. (Use $\pi = 3.14$)

Solution:

Given, radius of the hemisphere, $r = 10$ cm

Hence, total surface area of the hemisphere = $3\pi r^2$

$$= 3 \times 3.14 \times 10 \times 10$$

$$= 942 \text{ cm}^2$$

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

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:

Given, radius (r_1) of spherical balloon = 7 cm, and radius (r_2) of spherical balloon, when air is pumped into it = 14 cm

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

$$= \frac{4\pi r_1^2}{4\pi r_2^2} = \frac{r_1^2}{r_2^2}$$

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

Hence, the required ratio is 1:4

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

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 ₹16 per 100 cm²

Solution:

According to the question,

$$\text{Inner radius (r) of hemispherical bowl} = \frac{10.5}{2} = 5.25 \text{ cm}$$

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

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

$$= 173.25 \text{ cm}^2$$

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

Cost of tin-plating 173.25 cm^2 area = ₹ $\frac{16 \times 173.25}{100} = ₹ 27.72$

Hence, the cost of tin-plating the inner side of the hemispherical bowl is ₹ 27.72.

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

Find the radius of a sphere whose surface area is 154 cm^2

Solution:

Let the radius of the sphere be r .

Surface area of sphere = 154 cm^2

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

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

$$\Rightarrow r = \frac{7}{2} = 3.5 \text{ cm}$$

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

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

The diameter of the moon is approximately one fourth of the diameter of the earth. Find the ratio of their surface areas.

Solution:

Let the diameter of the earth be d

Hence, the diameter of the moon will be $\frac{d}{4}$

Radius of the earth is $\frac{d}{2}$

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

$$\text{Required ratio} = \frac{\text{Surface area of the moon}}{\text{Surface area of the earth}} = \frac{4\pi\left(\frac{d}{8}\right)^2}{4\pi\left(\frac{d}{2}\right)^2} = \frac{4}{64} = \frac{1}{16}$$

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

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

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.

Solution:

Given, 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

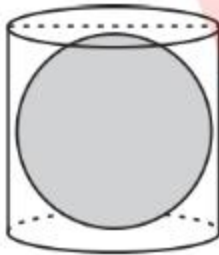
Outer CSA of hemispherical bowl = $2\pi r^2$
= $2 \times \frac{22}{7} \times (5.25)^2 = 173.25 \text{ cm}^2$.

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

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

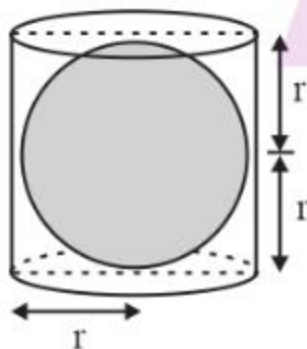
A right circular cylinder just encloses a sphere of radius r (see Fig.). Find

- (i) Surface area of the sphere,
- (ii) Curved surface area of the cylinder,
- (iii) Ratio of the areas obtained in (i) and (ii).



Solution:

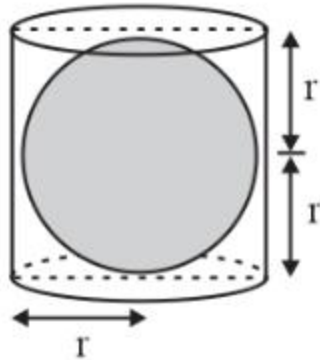
- (i)



Given, radius of the sphere = r

Hence, surface area of the sphere = $4\pi r^2$

(ii)



As per the question,

Radius of the cylinder = r

Height of the cylinder is twice the radius

Hence, $h = 2r$

Curved surface area of the cylinder = $2\pi rh$

$$= 2\pi r(2r)$$

$$= 4\pi r^2$$

(iii) Ratio = $\frac{\text{Surface area of the sphere}}{\text{Curved surface area of the cylinder}}$

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

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

Hence the required ratio is 1:1

Exercise: 13.5

1. A matchbox measures $4 \text{ cm} \times 2.5 \text{ cm} \times 1.5 \text{ cm}$. What will be the volume of a packet containing 12 such boxes?

Solution:

As per the question, $l = 4 \text{ cm}$, $b = 2.5 \text{ cm}$, $h = 1.5 \text{ cm}$

Hence, volume of the matchbox = $l \times b \times h$

$$= 4 \times 2.5 \times 1.5$$

$$= 15 \text{ cm}^3$$

Hence, volume of 12 such boxes in a packet = 15×12

$$= 180 \text{ cm}^3$$

2. A cuboidal water tank is 6 m long, 5 m wide and 4.5 m deep. How, many litres of water can it hold? ($1\text{m}^3 = 1000$ litres)

Solution:

As per the question, $l = 6\text{m}$, $b = 5\text{m}$, $h = 4.5\text{m}$

Volume of the tank $= l \times b \times h$

$$= 6 \times 5 \times 4.5$$

$$= 135 \text{ m}^3$$

$$1 \text{ m}^3 = 1000 \text{ litres}$$

$$135 \text{ m}^3 = 135 \times 1000$$

$$= 135000 \text{ litres}$$

Hence, the tank can hold 135000 litres of water

3. A cuboidal vessel is 10 m long and 8 m wide. How high must it be made to hold 380 cubic meters of a liquid?

Solution:

As per the question, $l = 10 \text{ m}$, $b = 8 \text{ m}$, volume of the vessel $= 380 \text{ m}^3$

Volume of the vessel $= l \times b \times h$

$$380 \text{ m}^3 = 10 \times 8 \times h$$

$$h = \frac{380}{80}$$

$$= 4.75 \text{ m}$$

Hence the vessel must be 4.75 m high to hold 380 cubic metres of liquid

4. Find the cost of digging a cuboidal pit 8 m long, 6 m broad and 3 m deep at the rate of ₹ 30 per m^3

Solution:

As per the question, $l = 8 \text{ m}$, $b = 6 \text{ m}$, $h = 3 \text{ m}$

Hence, volume of the pit $= l \times b \times h$

$$= 8 \times 6 \times 3$$

$$= 144 \text{ m}^3$$

Given, cost of digging the pit per $\text{m}^3 = ₹ 30$

Hence, the cost of digging $144\text{m}^3 = 144 \times 30$
 $= ₹ 4320$

5. The capacity of a cuboidal tank is 50000 litres of water. Find the breadth of the tank, if its length and depth are respectively 2.5 m and 10 m.

Solution:

Let the breadth of the tank be b , length l and height h

Given, volume of a cuboidal tank = 50000 litres

We know, $1\text{m}^3 = 1000$ litres

$$\text{So, } 50000 \text{ litres} = \frac{50000}{1000}$$

$$= 50 \text{ m}^3$$

Dimension of the cuboidal tank, $l = 2.5\text{m}$, $b = ?$, $h = 10 \text{ m}$

Volume of the tank = $l \times b \times h$

$$50 \text{ m}^3 = 2.5 \times b \times 10$$

$$b = \frac{50}{25}$$

$$= 2 \text{ m}$$

Hence, the breadth of the tank is 2 m

6. A village, having a population of 4000, requires 150 litres of water per head per day. It has a tank measuring $20 \text{ m} \times 15 \text{ m} \times 6 \text{ m}$. For how many days will the water of this tank last?

Solution:

Dimension of the tank is: length, $l = 20 \text{ m}$, breadth, $b = 15$, height, $h = 6\text{m}$

Hence, volume of the tank = $l \times b \times h$

$$= 20 \times 15 \times 6$$

$$= 1800 \text{ m}^3$$

Water required per head per day = 150 litres

Water required by 4000 people per day = 150×4000

$$= 600000 \text{ litres}$$

We know, $1 \text{ m}^3 = 1000$ litre

Water required by 4000 people per day = 600 m^3

Volume of the tank = 1800 m^3

Hence, the number of days the water of the tank will last is:

$$\frac{\text{volume of the tank}}{\text{water required by the people of the village for 1 day}} = \frac{1800}{600} = 3$$

Hence, the water of tank will last for 3 days.

7. A godown measures $40 \text{ m} \times 25 \text{ m} \times 15 \text{ m}$. Find the maximum number of wooden crates each measuring $1.5 \text{ m} \times 1.25 \text{ m} \times 0.5 \text{ m}$ that can be stored in the godown.

Solution:

Dimension of the godown is: length, $L = 40 \text{ m}$, breadth, $B = 25 \text{ m}$, height, $H = 10 \text{ m}$

Volume of the godown = $L \times B \times H$

$$= 40 \times 25 \times 15$$

$$= 15000 \text{ m}^3$$

Dimension of the crate is: length, $l = 1.5 \text{ m}$, breadth, $b = 1.25 \text{ m}$, height, $h = 0.5 \text{ m}$

Volume of the crate = $l \times b \times h$

$$= 1.5 \times 1.25 \times 0.5$$

$$= 0.9375 \text{ m}^3$$

Maximum number of wooden crates that can be stored in the godown

$$= \frac{\text{Volume of the godown}}{\text{volume of the crates}}$$

$$= \frac{15000}{0.9375}$$

$$= 16000 \text{ crates}$$

8. A solid cube of side 12 cm is cut into eight cubes of equal volume. What will be the side of the new cube? Also, find the ratio between their surface areas.

Solution:

Given, side of the large cube, $a_1 = 12 \text{ cm}$

Let side of the smaller cube is a_2

Hence, volume of the larger cube = a_1^3

$$= 12^3$$

$$= 1728 \text{ cm}^3$$

The cube is cut into 8 equal cubes of equal volume

$$\Rightarrow \text{volume of each of the smaller cubes} = \frac{1728}{8}$$

$$a_2^3 = 216 \text{ cm}^3$$

Hence side of each of the small cubes $a_2 = 6 \text{ cm}$

Ratio of their surface areas = Surface area of the larger cube/surface area of the smaller cube

$$= \frac{6 a_1^2}{6 a_2^2}$$

$$= \frac{12^2}{6^2}$$

$$= 4:1$$

Hence, the required ratio = 4:1

9. A river 3 m deep and 40 m wide is flowing at the rate of 2 km per hour. How much water will fall into the sea in a minute?

Solution:

Given,

Depth of the river $h = 3 \text{ m}$

Breadth of the river $b = 40 \text{ m}$

Rate of flow, $l = 2 \text{ km/hour} = \frac{2000\text{m}}{60 \text{ minutes}} = \frac{100}{3} \text{ m/minute}$

Hence, volume of water flowed in one minute = $l \times b \times h$

$$= \frac{100}{3} \times 40 \times 3$$

$$= 4000 \text{ m}^3$$

Exercise: 13.6

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

The circumference of the base of cylindrical vessel is 132 cm and its height is 25 cm. How many litres of water can it hold? ($1000 \text{ cm}^3 = 1\text{l}$)

Solution:

Let the radius of the cylinder be r

Height of the cylinder, $h = 25$ cm

Circumference of the cylinder $= 2\pi r$

Hence, $2\pi r = 132$ cm

$$r = \frac{132 \times 7}{2 \times 22}$$

$= 21$ cm

Volume of the cylinder $= \pi r^2 h$

$$= \left[\frac{22}{7} \times (21)^2 \times 25 \right]$$

$= 34650$ cm³

$= 34.65$ litres (1000 cm³ = 1l)

Hence, the cylindrical vessel can hold 34.65 litres of water

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

The inner diameter of a cylindrical wooden pipe is 24 cm and its outer diameter is 28 cm. The length of the pipe is 35 cm. find the mass of the pipe, if 1 cm³ of wood has a mass of 0.6 g.

Solution:

Inner radius (r_1) of cylindrical pipe $= \frac{24}{2} = 12$ cm

Outer radius (r_2) of cylindrical pipe $= \frac{28}{2} = 14$ cm

Height (h) of pipe = Length of pipe = 35 cm

Volume of pipe $= \pi(r_2^2 - r_1^2)h$

$$= \left[\frac{22}{7} \times (14^2 - 12^2) \times 35 \right] \text{ cm}^3$$

$= 110 \times 52$ cm³

$= 5720$ cm³

Mass of 1 cm³ wood = 0.6 g

Mass of 5720 cm³ wood $= (5720 \times 0.6)$ g

$= 3432$ g

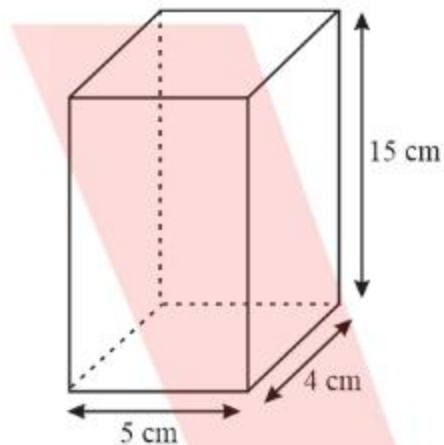
$= 3.432$ kg

Hence, the mass of the pipe is 3.432 kg

3. Assume $\pi = \frac{22}{7}$, unless stated otherwise. A soft drink is available in two packs
- a tin can with a rectangular base of length 5 cm and width 4 cm, having a height of 15 cm and
 - a plastic cylinder with circular base of diameter 7 cm and height 10 cm.
- Which container has greater capacity and by how much?

Solution:

(i)



Given, length (l) of tin can = 5 cm

Breadth (b) of tin can = 4 cm

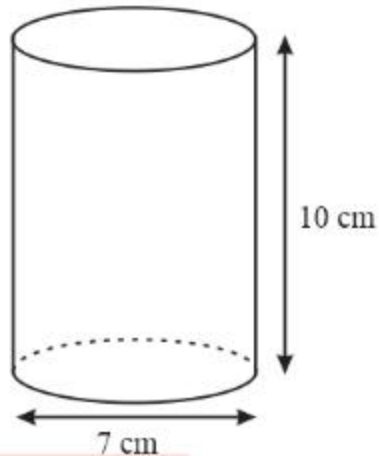
Height (h) of tin can = 15 cm

Capacity of tin can = $l \times b \times h$

$$= (5 \times 4 \times 15) \text{cm}^3$$

$$= 300 \text{ cm}^3$$

(ii)



Radius (r) of circular end of plastic cylinder = $\frac{7}{2} = 3.5$ cm

Height (H) of plastic cylinder = 10 cm

Capacity of plastic cylinder = $\pi r^2 H$

$$= \left[\frac{22}{7} \times (3.5)^2 \times 10 \right]$$

$$= 11 \times 35 \text{ cm}^3$$

$$= 385 \text{ cm}^3$$

Capacity of the cylinder - Capacity of the can

$$= 385 - 300$$

$$= 85 \text{ cm}^3$$

Hence, the cylinder has greater capacity by 85 cm^3

4. If the lateral surface of a cylinder is 94.2 cm^2 and its height is 5 cm, then find

- (i) radius of its base
- (ii) its volume. (Use $\pi = 3.14$)

Solution:

(i) Given, height (h) of cylinder = 5 cm

Let radius of cylinder be r .

CSA of cylinder = 94.2 cm^2

Hence, $2\pi rh = 94.2 \text{ cm}^2$

$$\Rightarrow (2 \times 3.14 \times r \times 5) \text{ cm} = 94.2 \text{ cm}^2$$

$$\Rightarrow r = 3 \text{ cm}$$

Hence, the radius of the base of the cylinder = 3 cm

- (ii) Given, height (h) of cylinder = 5 cm

Let radius of cylinder be r.

$$\text{CSA of cylinder} = 94.2 \text{ cm}^2$$

$$\Rightarrow 2\pi rh = 94.2 \text{ cm}^2$$

$$\Rightarrow (2 \times 3.14 \times r \times 5) \text{ cm} = 94.2 \text{ cm}^2$$

$$\Rightarrow r = 3 \text{ cm}$$

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

$$= (3.14 \times (3)^2 \times 5) \text{ cm}^3$$

$$= 141.3 \text{ cm}^3$$

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

It costs ₹ 2200 to paint the inner curved surface of a cylindrical vessel 10 m deep. If the cost of painting is at the rate of ₹ 20 per m^2 , find

- (i) inner curved surface area of the vessel
- (ii) radius of the base
- (iii) capacity of the vessel

Solution:

- (i) ₹ 20 is the cost of painting 1 m^2 area. ₹ 2200 is the cost for painting $\left[\frac{1}{20} \times 2200\right] \text{m}^2$ area.
= 110 m^2 area

Hence, the inner surface area of the vessel is 110 m^2 .

- (ii) Let the radius of the base of the vessel be r.

$$\text{Height (h) of vessel} = 10 \text{ m}$$

$$\text{Surface area} = 2\pi rh = 110 \text{ m}^2$$

$$\Rightarrow 110 \text{ m}^2 = \left[\frac{22}{7} \times 2 \times r \times 10\right] \text{ m}^2$$

$$\Rightarrow r = \frac{7}{4} = 1.75 \text{ m}$$

- (iii) Capacity of the vessel = $\pi r^2 h$

$$= \left[\frac{22}{7} \times (1.75)^2 \times 10\right] \text{ m}^3$$

$$= 96.25 \text{ m}^3$$

Hence, the capacity of the vessel is 96.25 m^3 or 96250 litres.

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

The capacity of a closed cylindrical vessel of height 1 m is 15.4 litres. How many square metres of metal sheet would be needed to make it?

Solution:

Let the radius of the circular end be r .

Height (h) of cylindrical vessel = 1 m

Volume of cylindrical vessel = 15.4 litres = 0.0154 m^3

Hence, $\pi r^2 h = 0.0154 \text{ m}^3$

$$\Rightarrow \frac{22}{7} \times r^2 \times 1 = 0.0154 \text{ m}^3$$

$$\Rightarrow r = 0.07 \text{ m}$$

Total Surface Area of the vessel = $2\pi r(r + h)$

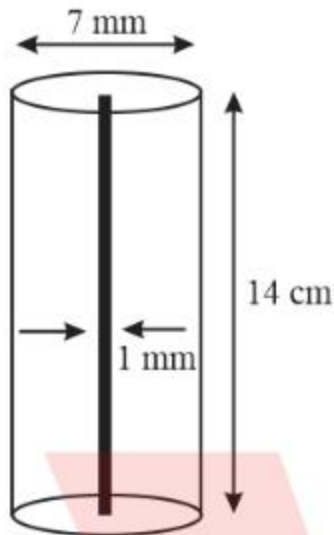
$$= \left[2 \times \frac{22}{7} \times 0.07(0.07 + 1) \right] \text{ m}^2$$

$$= 0.44 \times 1.07 \text{ m}^2$$

$$= 0.4708 \text{ m}^2$$

7. Assume $\pi = \frac{22}{7}$, unless stated otherwise. A lead pencil consists of a cylinder of wood with solid cylinder of graphite filled in the interior. The diameter of the pencil is 7 mm and the diameter of the graphite is 1 mm. If the length of the pencil is 14 cm, find the volume of the wood and that of the graphite.

Solution:



$$\text{Radius } (r_1) \text{ of pencil} = \frac{7}{2} \text{ mm} = 0.35 \text{ cm}$$

$$\text{Radius } (r_2) \text{ of graphite} = \frac{1}{2} \text{ mm} = 0.05 \text{ cm}$$

$$\text{Height } (h) \text{ of pencil} = 14 \text{ cm}$$

$$\text{Volume of wood in pencil} = \pi(r_2^2 - r_1^2)h$$

$$= \left[\frac{22}{7} \{ (0.35)^2 - (0.05)^2 \} \times 14 \right]$$

$$= \left[\frac{22}{7} \{ (0.1225) - (0.0025) \} \times 14 \right]$$

$$= (44 \times 0.12)$$

$$= 5.28 \text{ cm}^3$$

$$\text{Volume of graphite} = \pi r_2^2 h = \left[\frac{22}{7} (0.05)^2 \times 14 \right]$$

$$= (44 \times 0.0025)$$

$$= 0.11 \text{ cm}^3$$

8. Assume $\pi = \frac{22}{7}$, unless stated otherwise. A patient in a hospital is given soup daily in a cylindrical bowl of diameter 7 cm. If the bowl is filled with soup to a height of 4 cm, how much soup the hospital has to prepare daily to serve 250 patients?

Solution:

Given, diameter of the cylindrical bowl = 7 cm

Hence, radius of the cylindrical bowl = $\frac{7}{2} = 3.5$ cm

Height of the cylindrical bowl = 4cm

Volume of the cylindrical bowl = $\pi r^2 h$

$$= \frac{22}{7} \times (3.5)^2 \times 4$$

$$= (11 \times 3.5 \times 4) \text{cm}^3$$

$$= 154 \text{ cm}^3$$

The amount of soup the hospital has to prepare daily for 1 patient = 154 cm^3

Hence, the amount of soup to be prepared for 250 patients = 154×250

$$= 38500 \text{ cm}^3$$

$$= 38.5 \text{ litres (1 cm}^3 = 0.001 \text{ litres)}$$

Exercise: 13.7

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

Find the volume of a right circular cone with

- (i) radius 6 cm, height 7 cm
- (ii) radius 3.5 cm, height 12 cm

Solution:

- (i) Given, radius, $r = 6 \text{ cm}$
height, $h = 7 \text{ cm}$

Hence, volume of a right circular cone = $\frac{1}{3} \pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times (6)^2 \times 7 \text{ cm}^3.$$

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

$$= 264 \text{ cm}^3$$

- (ii) Given, radius, $r = 3.5 \text{ cm}$
height, $h = 12 \text{ cm}$

Hence, volume of a right circular cone = $\frac{1}{3} \pi r^2 h$

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

$$= 154 \text{ cm}^3$$

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

Find the capacity in litres of a conical vessel with

- (i) radius 7 cm, slant height 25 cm
- (ii) height 12 cm, slant height 13 cm

Solution:

- (i) Given, radius (r) of cone = 7 cm

slant height (l) of cone = 25 cm

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

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

$$= 24 \text{ cm}$$

Hence, volume of cone = $\frac{1}{3} \pi r^2 h$

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

$$= (154 \times 8) \text{ cm}^3.$$

$$= 1232 \text{ cm}^3.$$

Hence, capacity of the conical vessel

$$= \frac{1232}{1000} \text{ liters.}$$

$$= 1.232 \text{ litres}$$

- (ii) Given, height (h) of cone = 12 cm

slant height (l) of cone = 13 cm

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

$$= \sqrt{(13^2 - 12^2)}$$

$$= 5 \text{ cm.}$$

Hence, volume of cone = $\frac{1}{3} \pi r^2 h$

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

$$= \left[4 \times \frac{22}{7} \times 25 \right] \text{ cm}^3$$

$$= \frac{2200}{7} \text{ cm}^3$$

Hence, capacity of the conical vessel

$$= \frac{2200}{7000} \text{ liters (1 liter = 1000 cm}^3\text{)}$$

$$= \frac{11}{35} \text{ liters}$$

3. The height of a cone is 15 cm. If its volume is 1570 cm^3 , find the diameter of its base. (Use $\pi = 3.14$)

Solution:

Given, height (h) of cone = 15 cm

Let the radius of the cone be r.

Volume of cone = 1570 cm^3

$$\Rightarrow \frac{1}{3} \pi r^2 h = 1570 \text{ cm}^3$$

$$\Rightarrow \left[\frac{1}{3} \times 3.14 \times r^2 \times 15 \right] \text{ cm} = 1570 \text{ cm}^3$$

$$\Rightarrow r^2 = 100 \text{ cm}^2$$

$$\Rightarrow r = 10 \text{ cm}$$

Hence, the diameter of the base of cone is $10 \times 2 = 20 \text{ cm}$.

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

If the volume of a right circular cone of height 9 cm is $48 \pi \text{ cm}^3$, find the diameter of its base.

Solution:

Given, height (h) of cone = 9 cm

Let the radius of the cone be r.

Volume of cone = $48\pi \text{ cm}^3$

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

$$\Rightarrow \frac{1}{3} \pi r^2 (9) = 48\pi \text{ cm}^3$$

$$\Rightarrow r^2 = 16$$

$$\Rightarrow r = 4 \text{ cm}$$

Diameter of base = $2r = 8 \text{ cm}$

5. Assume $\pi = \frac{22}{7}$, unless stated otherwise. A conical pit of top diameter 3.5 m is 12 m deep. What is its capacity in kilolitres?

Solution:

Given, diameter of pit = 3.5 m

Hence, radius (r) of pit = $\frac{3.5}{2} = 1.75$ m

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

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

$$= \left[\frac{1}{3} \times 3.14 \times 1.75^2 \times 12 \right] \text{m}^3$$

$$= 38.5 \text{ m}^3$$

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

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

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

Solution:

- (i) Given, diameter of base of cone = 28 m

Hence, radius of base of cone = $\frac{28}{2} = 14$ cm

Let the height of the cone be h.

Volume of cone = 9856 cm^3

$$\Rightarrow \frac{1}{3}\pi r^2 h = 9856 \text{ cm}^3$$

$$\Rightarrow \frac{1}{3}\pi(14)^2 h = 9856 \text{ cm}^3$$

$$h = 48 \text{ cm}$$

Hence, the height of the cone is 48 cm

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

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

$$= \sqrt{(196 + 2304)} \text{ cm}$$

$$= 50 \text{ cm}$$

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

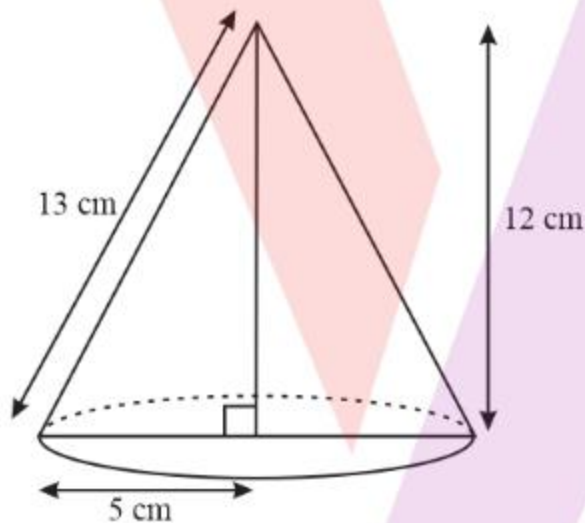
$$= \frac{22}{7} \times 14 \times 50 \text{ cm}$$

$$= 2200 \text{ cm}^2$$

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

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

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

$$= \frac{1}{3} \times \pi \times 5^2 \times 12 \text{ cm}^3$$

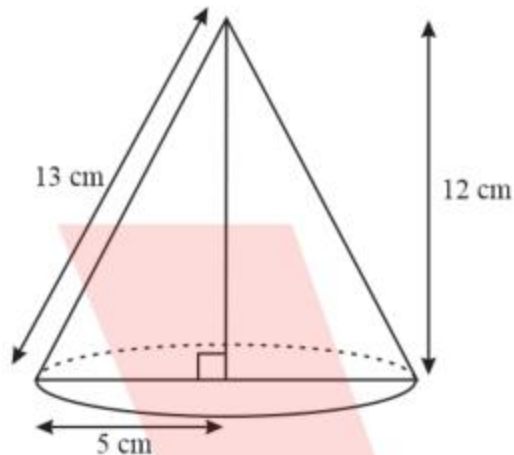
$$= 100\pi \text{ cm}^3$$

Hence, the volume of the cone so formed is $100\pi \text{ cm}^3$.

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

A right triangle ABC with sides 5 cm, 12 cm and 13 cm 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 when we revolve the triangle about side 12 cm and side 5 cm.

Solution:



ABC is a right-angled triangle with $AB = 5$ cm, $BC = 12$ cm, $AC = 13$ cm. When the triangle is revolved about the side 12 cm, a right circular cone is formed with Radius of the cone, $r = 5$ cm

Height of the cone, $h = 12$ cm

Slant height of the cone = 13 cm

Hence, the volume of the cone so obtained $V_1 = \frac{1}{3}\pi r^2 h$

$$= \frac{1}{3} \times \pi \times 5^2 \times 12 \text{ cm}^3$$

$$= 100\pi \text{ cm}^3$$

When the triangle is revolved about the side 5 cm, a right circular cone is formed with:

Radius of the cone, $r = 12$ cm

Height of the cone, $h = 5$ cm

Slant height of the cone = 13 cm

Hence, the volume of the cone so obtained $V_2 = \frac{1}{3}\pi r^2 h$

$$= \frac{1}{3} \times \pi \times 12^2 \times 5 \text{ cm}^3$$

$$= 240\pi \text{ cm}^3$$

Hence, volume of the solid obtained when revolved about side 5 cm is $240\pi\text{cm}^3$.

$$\text{Ratio of the volumes of the two solids} = \frac{V_1}{V_2}$$

$$= \frac{100\pi\text{cm}^3}{240\pi\text{cm}^3}$$

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

Hence, ratio of the volumes of the two solids is 5: 12

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

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.

Solution:

Given, diameter of the heap = 10.5 m

$$\text{Radius (r) of heap} = \frac{10.5}{2} = 5.25 \text{ m}$$

Height (h) of heap = 3 m

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

$$= \frac{1}{3} \times \frac{22}{7} \times 5.25^2 \times 3 \text{ m}^3$$

$$= 86.625 \text{ m}^3$$

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

Area of canvas required = CSA of cone

$$\Rightarrow \pi r l = \pi r \sqrt{(r^2 + h^2)}$$

$$= \frac{22}{7} \times 5.25 \times \sqrt{((5.25)^2 + (3)^2)}$$

$$= \frac{22}{7} \times 5.25 \times 6.05$$

$$= 99.825 \text{ m}^2.$$

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

Exercise: 13.8

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

Find the volume of a sphere whose radius is

- (i) 7 cm
- (ii) 0.63 m

Solution:

- (i) Given, radius, $r = 7$ cm

$$\text{Hence, volume of the sphere} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \pi \times 7^3$$

$$= 1437.33 \text{ cm}^3$$

Hence, the volume of the sphere is 1437.33 cm^3 .

- (ii) Given, radius, $r = 0.63$ m

$$\text{Hence, volume of the sphere} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \pi \times 0.63^3$$

$$= 1.05 \text{ m}^3$$

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

2. Assume $\pi = \frac{22}{7}$, unless stated otherwise. Find the amount of water displaced by a solid spherical ball of diameter

- (i) 28 cm
- (ii) 0.21 m

Solution:

- (i) Given, diameter of the spherical ball = 28 cm

$$\text{Hence, radius of the spherical ball, } r = \frac{28}{2} = 14 \text{ cm}$$

$$\text{Hence, volume of the sphere} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \pi \times 14^3$$

$$= 11498.667 \text{ cm}^3$$

Hence, 11498.667 cm^3 of water gets displaced by the spherical ball

- (ii) Given, diameter of the spherical ball = 0.21 m

Hence, radius of the spherical ball, $r = \frac{0.21}{2} = 0.105 \text{ m}$

Hence, volume of the sphere $= \frac{4}{3} \pi r^3$

$$= \frac{4}{3} \times \pi \times 0.105^3$$

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

Hence, 0.004851 m^3 of water gets displaced by the spherical ball.

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

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 ?

Solution:

Given, diameter of the metallic ball = 4.2 cm

Hence, radius of the metallic ball, $r = \frac{2.1}{2} = 1.05 \text{ cm}$

Hence, volume of the ball $= \frac{4}{3} \pi r^3$

$$= \frac{4}{3} \times \pi \times 1.05^3$$

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

Now,

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{Hence, } 8.9 \text{ g per cm}^3 = \frac{\text{mass}}{38.808}$$

$$\Rightarrow \text{Mass} = 8.9 \times 38.808$$

$$= 345.3912 \text{ g}$$

Hence, the mass of the ball is approximately 345.39 g

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

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 diameter of earth = x , \Rightarrow radius $R = \frac{x}{2}$

So, diameter of moon = $\frac{x}{4}$, \Rightarrow radius $r = \frac{\frac{x}{4}}{2} = \frac{x}{8}$

$$\begin{aligned} \text{Hence, } \frac{\text{volume of the moon}}{\text{volume of the earth}} &= \frac{\frac{4}{3}\pi\left[\frac{x}{8}\right]^3}{\frac{4}{3}\pi\left[\frac{x}{2}\right]^3} \\ &= \frac{8}{512} \\ &= \frac{1}{64} \end{aligned}$$

Hence, the volume of the moon is $\frac{1}{64}$ of the volume of the earth.

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

How many litres of milk can a hemispherical bowl of diameter 10.5 cm hold?

Solution:

Given, diameter of the bowl = 10.5 cm

Hence, radius of the bowl = $\frac{10.5}{2} = 5.25$ cm

Hence, volume of the bowl = $\frac{2}{3}\pi r^3$

$$= \frac{2}{3} \times \frac{22}{7} \times (5.25)^3$$

$$= 303.1875 \text{ cm}^3$$

$$= 303.1875 \times \frac{1}{1000} \text{ litres (1000 cm}^3 = 1 \text{ litre)}$$

$$= 0.303 \text{ litres}$$

Hence, the hemispherical bowl can hold 0.303 litres of milk

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

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.

Solution:

Given, thickness of the iron sheet = 1 cm = 0.01 m

Inner radius of the tank, $r = 1$ m

Outer radius of the tank, $R = 1 + 0.01 = 1.01$ m

Volume of the iron used = Volume of the outer hemisphere - volume of the inner hemisphere

$$= \frac{2}{3}\pi R^3 - \frac{2}{3}\pi r^3$$

$$\begin{aligned}
 &= \frac{2}{3}\pi(R^3 - r^3) \\
 &= \frac{2}{3}\pi(1.01^3 - 1^3) \\
 &= \frac{44}{21} \times (1.030301 - 1) \\
 &= 0.06348 \text{ m}^3
 \end{aligned}$$

Hence, 0.06348 m³ of iron is used to make the tank.

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

Find the volume of a sphere whose surface area is 154 cm².

Solution:

Let the radius of the sphere be r

$$\text{Surface area of the sphere} = 4\pi r^2$$

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

$$\Rightarrow 4 \times \frac{22}{7} \times r^2 = 154$$

$$\Rightarrow r^2 = 154 \times \frac{7}{88}$$

$$\Rightarrow r = 3.5 \text{ cm}$$

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

$$= \frac{4}{3} \times \frac{22}{7} \times 3.5^3$$

$$= 179.67 \text{ cm}^3$$

Hence, the volume of the sphere is 179.67 cm³

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

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

- (i) inside surface area of the dome,
- (ii) volume of the air inside the dome.

Solution:

- (i) Cost of white washing the hemispherical dome = ₹ 498.96

$$\text{Cost per } m^2 = ₹ 2$$

$$\text{Hence, inside surface area of the dome} = \frac{498.96}{2}$$

$$= 249.48 \text{ m}^2$$

- (ii) Surface area of the dome = 249.48 m²

$$\text{Hence, } 2\pi r^2 = 249.48 \times \frac{7}{44}$$

$$\Rightarrow r^2 = 39.69$$

$$\Rightarrow r = 6.3 \text{ m}$$

$$\text{Hence, the volume of the air inside the dome} = \frac{2}{3}\pi r^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times 6.3^3$$

$$= 523.908 \text{ m}^3$$

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

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) Given, r be the radius of the solid iron spheres and r' be the radius of the new sphere

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

$$\text{Hence, volume of 27 old spheres} = \frac{4}{3}\pi r^3 \times 27$$

$$= 36\pi r^3$$

$$\text{Volume of the new sphere} = \frac{4}{3}\pi r'^3$$

27 iron spheres are melted to form a new sphere. Hence

$$\text{Volume of 27 old sphere} = \text{volume of the new sphere}$$

$$\Rightarrow 36\pi r^3 = \frac{4}{3}\pi r'^3$$

$$\Rightarrow r'^3 = 27r^3$$

$$\Rightarrow r' = 3r$$

Hence radius r' of the new sphere = $3r$

(ii) Surface area of old iron sphere, $S = 4\pi r^2$

Surface area of new iron sphere, $S' = 4\pi r'^2$

$$S' = 4\pi r'^2$$

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

$$= 36\pi r^2$$

Hence, the required ratio = $4\pi r^2 : 36\pi r^2$

$$= 1:9$$

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

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?

Solution:

Given, diameter of the spherical capsule = 3.5 mm

Hence, radius of the spherical capsule = $\frac{3.5}{2} = 1.75$ mm

Hence, volume of the spherical capsule = $\frac{4}{3}\pi r^3$

$$= \frac{4}{3} \times \frac{22}{7} \times 1.75^3$$

$$= 22.458 \text{ mm}^3$$

Hence, 22.458 mm^3 medicine is required to fill the capsule.