

Exercise 13.6

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1. The circumference of the base of cylindrical vessel is 132cm and its height is 25cm. How many litres of water can it hold? ($1000 \text{ cm}^3 = 1\text{L}$) (Assume $\pi = 22/7$)

Solution:

Circumference of the base of cylindrical vessel = 132 cm

Height of vessel, $h = 25 \text{ cm}$

Let r be the radius of the cylindrical vessel.

Step 1: Find the radius of vessel

We know that, circumference of base = $2\pi r$, so

$$2\pi r = 132 \text{ (given)}$$

$$r = (132/(2\pi))$$

$$r = 66 \times 7/22 = 21$$

Radius is 21 cm

Step 2: Find the volume of vessel

Formula: Volume of cylindrical vessel = $\pi r^2 h$

$$= (22/7) \times 21^2 \times 25$$

$$= 34650$$

Therefore, volume is 34650 cm^3

Since, $1000 \text{ cm}^3 = 1\text{L}$

So, Volume = $34650/1000 \text{ L} = 34.65\text{L}$

Therefore, vessel can hold 34.65 litres of water.

2. The inner diameter of a cylindrical wooden pipe is 24cm and its outer diameter is 28 cm. The length of the pipe is 35cm. Find the mass of the pipe, if 1 cm^3 of wood has a mass of 0.6g. (Assume $\pi = 22/7$)

Solution:

Inner radius of cylindrical pipe, say $r_1 = \text{diameter}_1/2 = 24/2 \text{ cm} = 12\text{cm}$

Outer radius of cylindrical pipe, say $r_2 = \text{diameter}_2/2 = 28/2 \text{ cm} = 14 \text{ cm}$

Height of pipe, $h = \text{Length of pipe} = 35\text{cm}$

Now, the Volume of pipe = $\pi(r_2^2 - r_1^2)h \text{ cm}^3$

Substitute the values.

$$\text{Volume of pipe} = 110 \times 52 \text{ cm}^3 = 5720 \text{ cm}^3$$

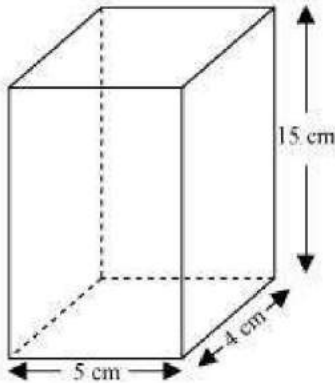
Since, **Mass of 1 cm^3 wood = 0.6 g**

Mass of 5720 cm^3 wood = $(5720 \times 0.6) \text{ g} = 3432 \text{ g}$ or 3.432 kg.

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

Solution:

(i) tin can will be cuboidal in shape



Dimensions of tin can are

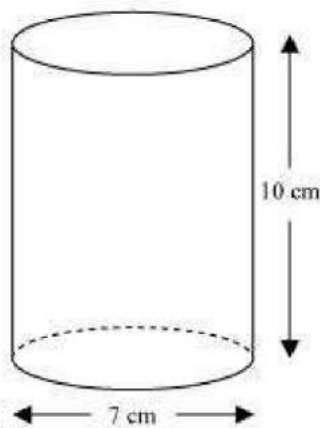
Length, $l = 5$ cm

Breadth, $b = 4$ cm

Height, $h = 15$ cm

Capacity of tin can $= l \times b \times h = (5 \times 4 \times 15) \text{ cm}^3 = 300 \text{ cm}^3$

(ii) Plastic cylinder will be cylindrical in shape.



Dimensions of plastic can are:

Radius of circular end of plastic cylinder, $r = 3.5\text{cm}$

Height, $H = 10\text{ cm}$

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

Capacity of plastic cylinder $= (22/7) \times (3.5)^2 \times 10 = 385$

Capacity of plastic cylinder is 385 cm^3

From results of (i) and (ii), plastic cylinder has more capacity.

Difference in capacity $= (385 - 300)\text{ cm}^3 = 85\text{ cm}^3$

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:

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

Height of cylinder, $h = 5\text{ cm}$

(i) Let radius of cylinder be r .

Using CSA of cylinder, we get

$$2\pi rh = 94.2$$

$$2 \times 3.14 \times r \times 5 = 94.2$$

$$r = 3$$

radius is 3 cm

(ii) Volume of cylinder

Formula for volume of cylinder $= \pi r^2 h$

Now, $\pi r^2 h = (3.14 \times (3)^2 \times 5)$ (using value of r from (i))

$$= 141.3$$

Volume is 141.3 cm^3

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

(i) inner curved surface area of the vessel

(ii) radius of the base

(iii) capacity of the vessel

(Assume $\pi = 22/7$)

Solution:

(i) Rs 20 is the cost of painting 1 m^2 area.

Rs 1 is the cost to paint $1/20\text{ m}^2$ area

$$\begin{aligned}\text{So, Rs 2200 is the cost of painting} &= (1/20 \times 2200)\text{ m}^2 \\ &= 110\text{ m}^2 \text{ area}\end{aligned}$$

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

(ii) Radius of the base of the vessel, let us say r .

Height (h) = 10 m and

Surface area formula = $2\pi rh$

Using result of (i)

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

$$2 \times \frac{22}{7} \times r \times 10 = 110$$

$$r = 1.75$$

Radius is 1.75 m.

(iii) Volume of vessel formula = $\pi r^2 h$

Here $r = 1.75$ and $h = 10$

$$\text{Volume} = \left(\frac{22}{7}\right) \times (1.75)^2 \times 10 = 96.25$$

Volume of vessel is 96.25 m^3

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

6. The capacity of a closed cylindrical vessel of height 1m is 15.4 liters. How many square meters of metal sheet would be needed to make it? (Assume $\pi = \frac{22}{7}$)

Solution:

Height of cylindrical vessel, $h = 1 \text{ m}$

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

Let r be the radius of the circular end.

Now,

$$\text{Capacity of cylindrical vessel} = \left(\frac{22}{7}\right) \times r^2 \times 1 = 0.0154$$

After simplifying, we get, $r = 0.07 \text{ m}$

Again, total surface area of vessel = $2\pi r(r+h)$

$$= \left(2 \times \frac{22}{7} \times 0.07(0.07+1)\right)$$

$$= 0.44 \times 1.07$$

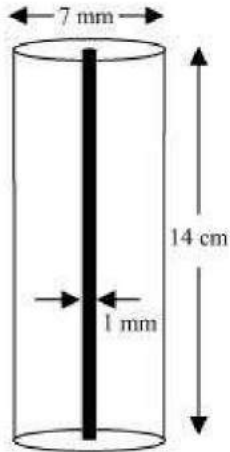
$$= 0.4708$$

Total surface area of vessel is 0.4708 m^2

Therefore, 0.4708 m^2 of the metal sheet would be required to make the cylindrical vessel.

7. 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. (Assume $\pi = \frac{22}{7}$)

Solution:



Radius of pencil, $r_1 = 7/2 \text{ mm} = 0.7/2 \text{ cm} = 0.35 \text{ cm}$

Radius of graphite, $r_2 = 1/2 \text{ mm} = 0.1/2 \text{ cm} = 0.05 \text{ cm}$

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

Formula to find, volume of wood in pencil = $\pi(r_1^2 - r_2^2)h$ cubic units

Substitute the values, we have

$$= [(22/7) \times (0.35^2 - 0.05^2) \times 14]$$

$$= 44 \times 0.12$$

$$= 5.28$$

This implies, volume of wood in pencil = 5.28 cm^3

Again,

Volume of graphite = $\pi r_2^2 h$ cubic units

Substitute the values, we have

$$= (22/7) \times 0.05^2 \times 14$$

$$= 44 \times 0.0025$$

$$= 0.11$$

So, the volume of graphite is 0.11 cm^3 .

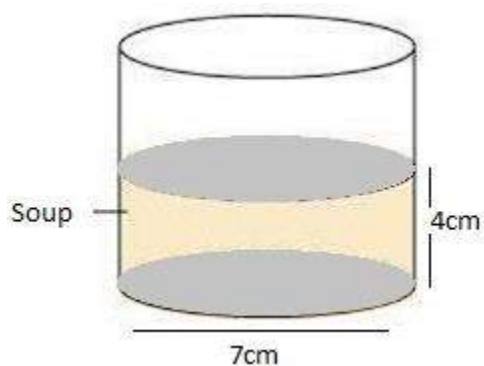
8. A patient in a hospital is given soup daily in a cylindrical bowl of diameter 7cm. If the bowl is filled with soup to a height of 4cm, how much soup the hospital has to prepare daily to serve 250 patients? (Assume $\pi = 22/7$)

Solution:

Diameter of cylindrical bowl = 7 cm

Radius of cylindrical bowl, $r = 7/2 \text{ cm} = 3.5 \text{ cm}$

Bowl is filled with soup to a height of 4cm, so $h = 4 \text{ cm}$



Volume of soup in one bowl = $\pi r^2 h$
 $(22/7) \times 3.5^2 \times 4 = 154$

Volume of soup in one bowl is 154 cm^3

Therefore,

Volume of soup given to 250 patients = $(250 \times 154) \text{ cm}^3 = 38500 \text{ cm}^3$
 $= 38.5 \text{ litres}$.