Mathematics

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(Chapter – 13)(Surface Areas and Volumes)
(Class – 9)

Exercise 13.6

Question 1:

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

Answer 1:

Circumference of base of cylindrical vessel C = 132 cm height h = 25 cm
Let, the radius of cylindrical vessel = r cm
Circumference of base of cylindrical vessel =$2\pi r$

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

$$\Rightarrow r = \frac{132 \times 7}{22 \times 2} \quad \Rightarrow r = 21 \text{ cm}$$

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

$$= \frac{22}{7} \times 21 \times 21 \times 25$$

$$= 34650 \text{ cm}^3$$

$$= \frac{34650}{1000} = 34.65 \text{ litres} \qquad [\because \ 1000\ cm^3 \ = \ 1 \text{ litres}]$$

Hence, the cylindrical vessel can hold 34.65 litres of water.

Question 2:

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 cm^3 of wood has a mass of 0.6 g.

Answer 2:

Inner radius of cylindrical pipe r = 24/2 = 12 cm, outer radius R = 28/2 = 14 cm and length h = 35 m
Volume of cylindrical wooden pipe = $\pi(R^2 - r^2)h$

$$= \frac{22}{7} \times (14^2 - 12^2) \times 35 \ = 22 \times (196 - 144) \times 5 \ = 22 \times 52 \times 5 = 5720\ cm^3$$

Mass of cylindrical wooden pipe = 5720 × 0.6 g = 3432 g = 3.432 kg [$\because$1 cm^3 of wood has a mass of 0.6 g]
Hence, the volume of cylindrical wooden pipe is 3.432 kg.

Question 3:

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

Answer 3:

Length of tin can l = 5 cm, breadth b = 4 cm and height h = 15 cm
Volume of tin can = $lbh = 5 \times 4 \times 15 = 300 \text{ cm}^3$
Radius of plastic cylinder r = 7/2 = 3.5 cm and height H = 10 cm
Volume of plastic cylinder = $\pi r^2 H$

$$= \frac{22}{7} \times 3.5 \times 3.5 \times 10 \ = 22 \times 0.5 \times 3.5 \times 10 \ = 385 \text{ cm}^3$$

Difference between capacities of two packs $= 385 - 300 = 85 \text{ cm}^3$

Hence, the capacity of plastic cylindrical pack is greater than tin can by 85 cm^3.

Question 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 π = 3.14)

Answer 4:

(i) Lateral surface area of cylinder C = 94.2 cm^2 and height h = 5 cm.
Let, the radius of cylinder = r cm
Lateral surface area of cylinder $C = 2\pi rh$
$\Rightarrow 94.2 = 2 \times 3.14 \times r \times 5 \quad \Rightarrow r = \frac{94.2}{3.14 \times 10} = 3$ cm
Hence, the radius of base is 3 cm.

(ii) Volume of cylinder = $\pi r^2 h = 3.14 \times 3 \times 3 \times 5 = 141.3$ cm^3
Hence, the volume of cylinder is 141.3 cm^3.

Question 5:

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.

Answer 5:

(i) Cost of painting the inner curved surface of cylindrical vessel = ₹ 2200 and height h = 10 m.
Let, the inner radius of cylindrical vessel = r m
The inner curved surface area of cylindrical vessel = $2\pi rh$
The cost of painting is at the rate of ₹ 20 per m^2 = ₹ $20 \times 2\pi rh$
According to question, ₹ $20 \times 2\pi rh$ = ₹ 2200
$\Rightarrow 2\pi rh = \frac{2200}{20} = 110$
Hence, the inner curved surface area is 110 m^2.

(ii) The inner curved surface area of cylindrical vessel = $2\pi rh$
$\Rightarrow 110 = 2 \times \frac{22}{7} \times r \times 10 \quad \Rightarrow r = \frac{110 \times 7}{22 \times 2 \times 10} = \frac{7}{4} = 1.75$ m
Hence, the radius of base of cylindrical vessel is 1.75 m.

(iii) Volume of cylindrical vessel = $\pi r^2 h$
$= \frac{22}{7} \times 1.75 \times 1.75 \times 10 \quad = 22 \times 0.25 \times 1.75 \times 10 \quad = 96.25$ m^3
Hence, the volume of cylindrical vessel is 96.25 m^3.

Question 6:

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?

Answer 6:

Capacity of cylindrical vessel V = 15.4 litres = 15.4/1000 m^3 = 0.0154 m^3 and height h = 1 m
Let, the radius of cylindrical vessel = r m
Volume of cylindrical vessel $V = \pi r^2 h$
$\Rightarrow 0.0154 = \frac{22}{7} \times r^2 \times 1$

$\Rightarrow r^2 = \frac{0.0154 \times 7}{22} = 0.0049$

$\Rightarrow r = \sqrt{0.0049} = 0.07$ m

Total surface area of cylindrical vessel = $2\pi r(r + h)$

$= 2 \times \frac{22}{7} \times 0.07 \times (0.07 + 1) \quad = 2 \times 22 \times 0.01 \times 1.07 \quad = 0.4708$ m^2

Hence, 0.4708 m^2 metal sheet is required to make this cylindrical vessel.

Question 7:

A lead pencil consists of a cylinder of wood with a 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.

Answer 7:

Inner radius of wood in pencil r = 1/2 = 0.5 mm = 0.05 cm,
Outer radius R = 7/2 = 3.5 mm = 0.35 cm and length h = 14 cm
Volume of wood used in pencil = $\pi(R^2 - r^2)h$

$= \frac{22}{7} \times [(0.35)^2 - (0.05)^2] \times 14$
$= 22 \times (0.1225 - 0.0025) \times 2$
$= 22 \times 0.12 \times 2$
$= 5.28$ cm^3

Radius of graphite inside the wood r = 1/2 = 0.5 mm = 0.05 cm and height h = 14 cm.
Volume of graphite in pencil = $\pi r^2 h$

$= \frac{22}{7} \times (0.05)^2 \times 14$

$= 22 \times 0.0025 \times 2$

$= 0.11$ cm^3

Hence, in pencil, the volume of wood is 5.28 cm^3 and that of graphite is 0.11 cm^3.

Question 8:

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?

Answer 8:

Radius of cylindrical bowl r = 7/2 = 3.5 and height of soup inside the cylindrical bowl h = 4 cm
Volume of cylindrical bowl = $\pi r^2 h$

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

$= 22 \times 0.5 \times 3.5 \times 4$

$= 154$ cm^3

Therefore, the volume of soup per day for 250 patient = $250 \times 154 = 38500$ cm^3
Hence, hospital has to prepare 38500 cm^3 soup daily to serve 250 patients.