Mathematics

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(Chapter – 13) (Surface Areas and Volumes)

(Class – IX)

EXERCISE 13.6

Q.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)

Sol. Here, h = 25 cm, $2\pi r$ = 132 cm.

$2\pi r = 132$

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

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

Volume of the cylinder = $\pi r^2 h = \frac{22}{7} \times 21 \times 21 \times 25$ cm^3

$= 34650$ cm^3

$= \frac{34650}{1000}$ litres **= 34.65 litres Ans.**

Q.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.*

Sol. Here, inner radius (r) = $\frac{24}{2}$ cm = 12 cm

Outer radius (R) = $\frac{28}{2}$ cm = 14 cm, h = 35 cm

Volume of the wood used in the pipe = $\pi(R^2 - r^2)\, h$

$= \frac{22}{7} [(14)^4 - (12)^2] \times 35$ cm^3

$= \frac{22}{7} \times 26 \times 2 \times 35$ $cm^3 = 5720$ cm^3

Mass of 1 cm^3 of wood = 0.6 g

$\therefore$ Mass of 5720 cm^3 of wood = 0.6 × 5720 g = 3432 g **= 3.432 kg Ans.**

Q.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?*

Sol. **For tin can with rectangular 6 base.**

l = 5 cm, b = 4 cm, h = 15 cm

Volume of the tin can = lbh = 5 × 4 × 15 cm^3 = 300 cm^3

For plastic cylinder with circular base.

$r = \frac{7}{2}$ cm = 3.5 cm, h = 10 cm

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

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

Difference in the capacities of the two containers

$= (385 - 300)$ $cm^3 = 85$ cm^3

Hence, the plastic cylinder with circular base has greater capacity by 85 cm^3 **Ans.**

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Q.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* $\pi = 3.14$*)*

Sol. Here, $h = 5$ cm, $2\pi rh = 94.2$ cm^2.

(i) $2\pi rh = 94.2$

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

$$\Rightarrow r = \frac{94.2}{2 \times 3.14 \times 5} = 3$$

Hence, base radius of the cylinder = 3 cm **Ans.**

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

$= 3.14 \times 3 \times 3 \times 5$ cm^3 = 141.3 cm^3 **Ans.**

Q.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.

Sol. Here, $h = 10$ m

(i) Inner curved surface area $= \dfrac{\text{Total cost}}{\text{Cost of painting per m}^2}$

$$= \frac{2200}{20} \text{ m}^2 = \mathbf{110\ m^2\ Ans.}$$

(ii) We have, $2\pi rh = 110$

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

$$\Rightarrow r = \frac{110 \times 7}{2 \times 22 \times 10} = \mathbf{1.75\ m\ Ans.}$$

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

$$= \frac{22}{7} \times 1.75 \times 1.75 \times 10 \text{ m}^3 = 96.25 \text{ m}^3$$

$$= \mathbf{96.25\ kl\ \ Ans.} \quad [1 \text{ m}^3 = 1 \text{ } kl]$$

Q.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?*

Sol. Here, $h = 1$ m, volume = 15.4 litres

$$= \frac{15.4}{1000} \text{ m}^3 = 0.0154 \text{ m}^3$$

Also, volume of the cylinderical vessel = $\pi r^2 h$

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

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

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$\Rightarrow r = 0.07$ m

$\therefore$ Total surface area of the cylinder $= 2\pi r\,(h + r)$

$= 2 \times \frac{22}{7} \times 0.07\,(1 + 0.07)$ m^2

$= 44 \times 0.01 \times 1.07$ m$^2 = 0.4708$ m^2

Hence, 0.4708 m^2 of metal sheet would be needed **Ans.**

Q.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 dimeter 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.*

Sol. Here, $h = 14$ cm.

Radius of the pencil (R) $= \frac{7}{2}$ mm $= 0.35$ cm.

Radius of the graphite (r) $= \frac{1}{2}$ mm $= 0.05$ cm.

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

$= \frac{22}{7} \times 0.05 \times 0.05 \times 14$ cm$^3 = 0.11$ cm^3

Volume of the the wood $= \pi\,(R^2 - r^2)h$

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

$= \frac{22}{7} \times 0.4 \times 0.3 \times 14$ cm$^3 = 5.28$ cm^3

Hence, volume of the wood **= 5.28 cm^3** and volume of the graphite **= 0.11 cm^3 Ans.**

Q.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?*

Sol. Here, $r = \frac{7}{2}$ cm $= 3.5$ cm, $h = 4$ cm

Capacity of 1 cylindrical bowl $= \pi r^2 h$

$= \frac{22}{7} \times 3.5 \times 3.5 \times 4$ cm$^3 = 154$ cm^3

Hence, soup consumed by 250 patients per day

$= 250 \times 154$ cm^3 **= 38500 cm^3 Ans.**