SURFACE AREAS AND VOLUMES

SUBJECT : MATHEMATICS

CHAPTER NO: 13

CHAPTER NAME: SURFACE AREAS AND VOLUMES

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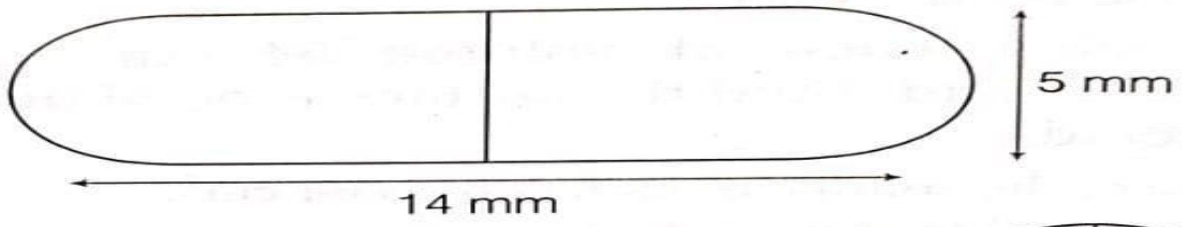
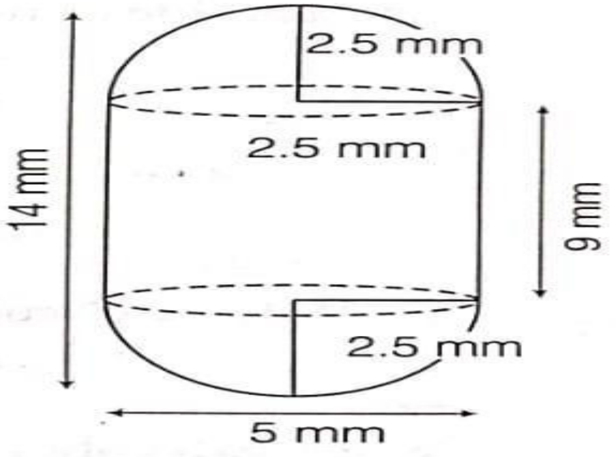
6 A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends (see below figure). The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm. Find its surface area.



Sol. Given that, medicine capsule is a combination of two hemispheres and one cylinder.



Also, given diameter of the capsule $= 5$ mm

$\therefore$ Radius $= \frac{5}{2} = 2.5$ mm

and length of the capsule $= 14$ mm

$\therefore$ Length of the cylindrical portion

$= 14 - (2.5 + 2.5) = 9$ mm

Now, CSA of one hemispherical portion

$$= 2\pi r^2 = 2 \times \frac{22}{7} \times 2.5 \times 2.5 = \frac{275}{7} \text{ mm}^2$$

and CSA of the cylindrical portion

$$= 2\pi rh = 2 \times \frac{22}{7} \times 2.5 \times 9 = \frac{22}{7} \times 45 = \frac{990}{7} \text{ mm}^2$$

Now, required surface area of medicine capsule

$= 2 \times$ CSA of one hemispherical portion

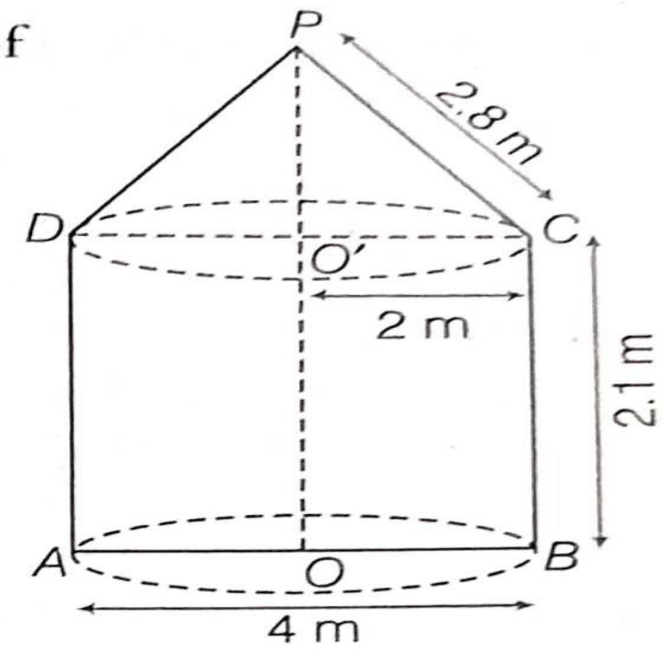
$+$ CSA of the cylindrical portion

$$= 2 \times \frac{275}{7} + \frac{990}{7} = \frac{550}{7} + \frac{990}{7} = \frac{1540}{7} = 220 \text{ mm}^2$$

7 A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are 2.1 m and 4 m, respectively and the slant height of the top is 2.8 m, then find the area of the canvas used for making the tent. Also, find the cost of the canvas of the tent at the rate of ₹500 per m.

[**Note** The base of the tent will not be covered with canvas.] **CBSE 2016**

Sol. Given that, tent is a combination of a cylinder and a cone.



For conical portion,

Slant height, $l = 2.8$ m

Radius, r = Radius of cylinder

$$= \frac{\text{Diameter}}{2} = \frac{4}{2} = 2 \text{ m}$$

For cylindrical portion,

Radius, $r = \frac{4}{2} = 2$ cm

Height, $h = 2.1$ m

$\therefore$ Required surface area of the tent = CSA of cone + CSA of cylinder

$$= \pi r l + 2\pi r h = \pi r (l + 2h)$$

$$= \frac{22}{7} \times 2 \times (2.8 + 2 \times 2.1)$$

$$= \frac{44}{7} (2.8 + 4.2)$$

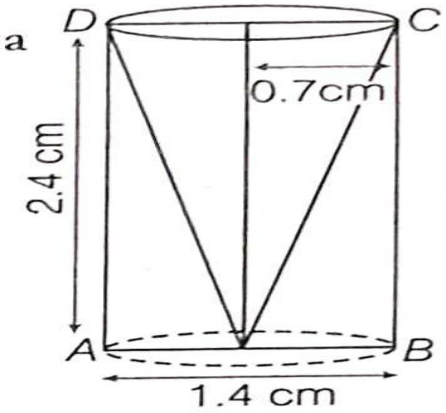
$$= \frac{44}{7} \times 7 = 44 \text{ m}^2$$

$\because$ Cost of the canvas of the tent at the rate of ₹ 500 per m^2

= Surface area × Cost per m^2 = 44 × 500 = ₹ 22000

8 From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid to the nearest cm^2.

Sol. Here, a cylinder is hollowed out in a conical cavity.



Given diameter of cylinder

$= $ Diameter of conical cavity $= 1.4$ cm

$\therefore$ Radius of cylinder

$= $ Radius of conical cavity

$= \frac{\text{Diameter}}{2} = \frac{1.4}{2} = 0.7$ cm

Height of the cylinder

$= $ Height of the conical cavity $= 2.4$ cm

$\therefore$ Slant height of the conical cavity,

$l = \sqrt{h^2 + r^2} = \sqrt{(2.4)^2 + (0.7)^2}$

$= \sqrt{5.76 + 0.49}$

$= \sqrt{6.25} = 2.5$ cm

Hence, TSA of remaining solid

$= $ CSA of conical cavity $+$ CSA of cylinder $+$ Area of the base of the cylinder

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

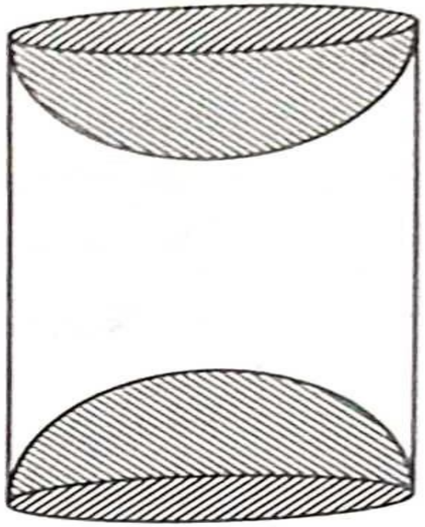
$= \pi r(l + 2h + r)$

$= \frac{22}{7} \times 0.7 \times (2.5 + 2 \times 2.4 + 0.7)$

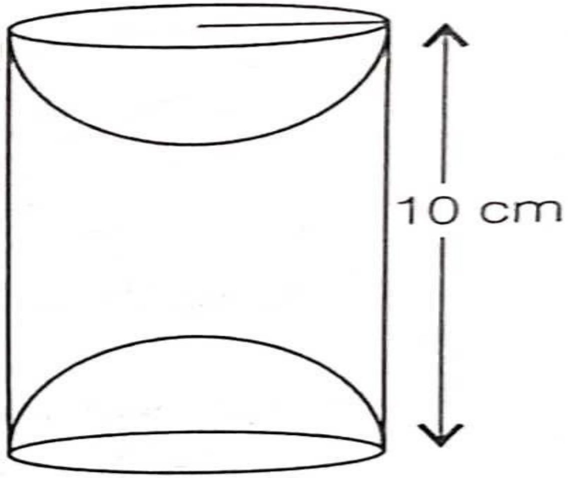
$= 22 \times 0.1 \times (2.5 + 4.8 + 0.7)$

$= 2.2 \times 8$

9 A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in adjacent figure. If the height of the cylinder is 10 cm and its base is of radius 3.5 cm, then find the total surface area of the article.



Sol. Given, wooden article is a combination of a cylinder and two hemispheres.



Here, height of the cylinder, $h = 10$ cm

$\because$ Radius of base of the cylinder

$=$ Radius of hemisphere, $r = 3.5$ cm

Now, required TSA of the wooden article

$= 2 \times$ CSA of one hemisphere + CSA of cylinder

$= 2 \times (2\pi r^2) + 2\pi r h$

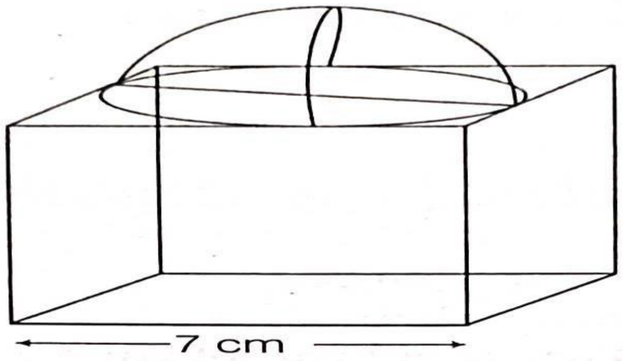
$= 2\pi r(2r + h)$

$= 2 \times \frac{22}{7} \times 3.5 \times (2 \times 3.5 + 10)$

$= \frac{22}{7} \times 7 \times (7 + 10) = 22 \times 17 = 374 \text{ cm}^2$

4 A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter of the hemisphere can have? Find the surface area of the solid.

Sol. Given, a cubical block is surmounted by a hemisphere. Therefore, diameter of hemisphere must be equal to the side of cubical block and it is the greatest diameter of hemisphere.



For cubical portion,

$$\text{Edge} = 7 \text{ cm}$$

For hemispherical portion,

$$\text{Diameter} = 7 \text{ cm}$$

$$\therefore \quad \text{Radius, } r = \frac{7}{2} \text{ cm}$$

Now, required surface area of solid

= TSA of the cube + CSA of hemisphere − Area of circular base of hemisphere.

$$= 6 \times (\text{Edge})^2 + 2\pi r^2 - \pi r^2$$

$$= 6 \times (7)^2 + 2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} - \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$$

$$= 294 + 11 \times 7 - \frac{11 \times 7}{2}$$

$$= 294 + 77 - \frac{77}{2}$$

$$= 371 - 38.5 = 332.5 \text{ cm}^2$$

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