SURFACE AREAS AND VOLUMES

SUBJECT : MATHEMATICS

CHAPTER NO: 13

CHAPTER NAME: SURFACE AREAS AND VOLUMES

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5. A container shaped like a right circular cylinder having diameter 12 cm and height 15 cm is full of ice cream. The ice cream is to be filled into cones of height 12 cm and diameter 6 cm having a hemispherical shape on the top. Find the number of such cones which can be filled with ice cream.

SOLUTION Let V_1 be the volume of ice-cream in the container shaped like a right circular cylinder having radius 6 cm and height 15 cm. Then,

$$V_1 = \pi \times 6^2 \times 15 \text{ cm}^3$$

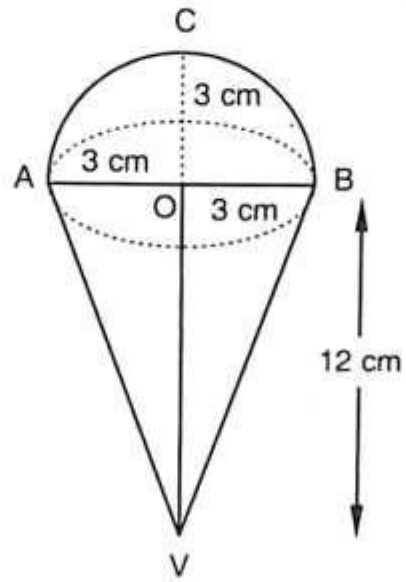


Fig. 14.49

Let V_2 be the volume of one ice-cream cone shown in Fig. 14.48. Then,

$$V_2 = \left\{\frac{2}{3}\pi \times 3^3 + \frac{1}{3}\pi \times 3^2 \times 12\right\} \text{cm}^3 = (18\pi + 36\pi) \text{ cm}^3 = 54\pi \text{ cm}^3$$

Let the total number of cones that can be filled with the ice-cream given in the container be n. Then,

Volume of ice-cream in n cones = Volume of ice-cream in the container

$\Rightarrow$ $n V_2 = V_1$

$\Rightarrow$ $54\pi \times n = \pi \times 36 \times 15 \Rightarrow n = \dfrac{\pi \times 36 \times 15}{54} = 10.$

9 A farmer connects a pipe of internal diameter 20 cm from a canal into a cylindrical tank in his field, which is 10 m in diameter and 2 m deep. If water flows through the pipe at the rate of 3 km/h, in how much time will the tank be filled? **2**

Sol. Given, speed of flow of water $= 3 \text{ km/h} = 3 \times 1000 \text{ m/h}$

$[\because 1 \text{ km} = 1000 \text{ m}]$

$\therefore$ Length of water in 1 h $= 3000$ m

Now, area of the pipe which is in the form of a circle

$= (10)^2 \ \pi \left[\because \text{area of circle} = \pi r^2 \text{ and } r = \frac{20}{2} \text{ cm} = 10 \text{ cm} \right]$

$= 100\pi \text{ cm}^2 = \frac{\pi}{100} \text{ m}^2 \quad \left[\because 1 \text{ cm} = \frac{1}{100} \text{ m}\right]$

For cylindrical tank,

Diameter $= 10$ m

$\therefore$ Radius $= \frac{10}{2}$ m and height $= 2$ m, then

Volume of cylindrical tank $= \pi \times \left(\frac{10}{2}\right)^2 \times 2 \quad [\because V = \pi r^2 h]$

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

$\therefore$ Required time $= \frac{\text{Volume of cylindrical tank}}{\text{Area of the pipe} \times \text{Length of water}}$

$= \frac{50\pi}{\frac{\pi}{100} \times 3000} \text{ h}$

$= \frac{50 \times 60 \times 100}{3000} \text{ min} = 100 \text{ min}$

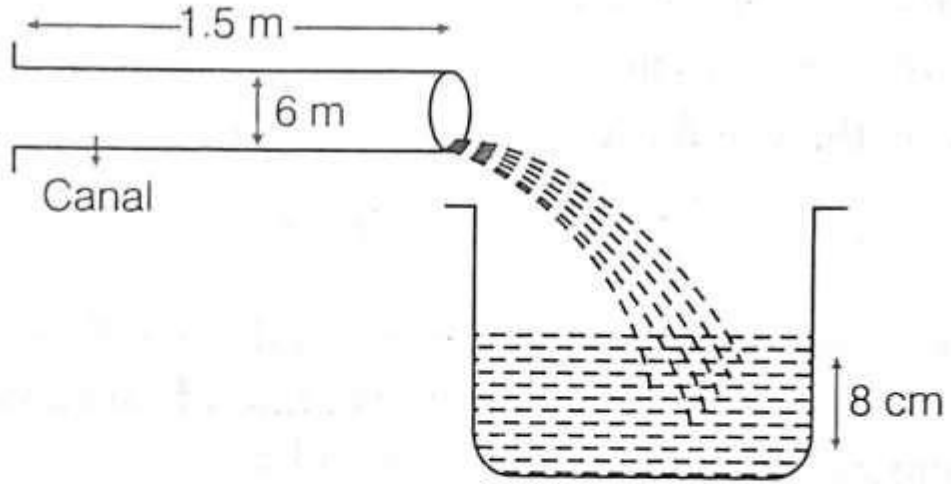
8 Water in a canal, 6 m wide and 1.5 m deep is flowing with a speed of 10 km/h. How much area will it irrigate in 30 min, if 8 cm of standing water is needed?

Sol. Given, speed of flow of water = 10 km/h

$$= 10 \times 1000 \text{ m/h} \quad [\because 1\text{km} = 1000\text{ m}]$$

$\Rightarrow$ Length of water in 1 h (l) = 10×1000 m

$\therefore$ Area of rectangular canal = $6 \times 1.5 = 9 \text{ m}^2$



Volume of water flowing in 1 h

= Area of canal $\times$ Length of water in 1 hour

$= 9 \times 10 \times 1000 \text{ m}^3$

$\therefore$ Volume of water flowing in 1/2 h

$$= \frac{10 \times 1000 \times 9}{2} = 45000 \text{ m}^3$$

Hence, the required area for covering 8 cm or $\frac{8}{100}$ m height of standing water $= \frac{45000}{8} \times 100 = 562500 \text{ m}^2$

$$= \frac{562500}{10000} \text{ hec}$$

$$= 56.25 \text{ hec} \qquad [\because 1 \text{ hec} = 10000 \text{ m}^2]$$

EXAMPLE 17 *A solid sphere of radius 3 cm is melted and then cast into small spherical balls each of diameter 0.6 cm. Find the number of balls thus obtained.*

SOLUTION Let the total number of balls be x.

$$\text{Volume of the solid sphere} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times 3^3 \text{ cm}^3 = 36\,\pi \text{ cm}^3$$

$$\text{Radius of spherical ball} = \frac{0.6}{2} \text{ cm} = 0.3 \text{ cm}$$

$$\text{Volume of a spherical ball} = \frac{4}{3}\pi \times (0.3)^3 \text{ cm}^3 = \frac{4}{3}\pi \times \frac{3}{10} \times \frac{3}{10} \times \frac{3}{10} \text{ cm}^3 = \frac{36\pi}{1000} \text{ cm}^3$$

$$\therefore \quad \text{Volume of } x \text{ spherical balls} = \frac{36\pi}{1000} x \text{ cm}^3$$

Clearly, Volume of the solid sphere = Volume of x spherical balls.

$$\Rightarrow \quad 36\pi = \frac{36\pi}{1000} x \Rightarrow x = 1000$$

Hence, 1000 spherical balls are obtained by melting the given solid sphere.

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