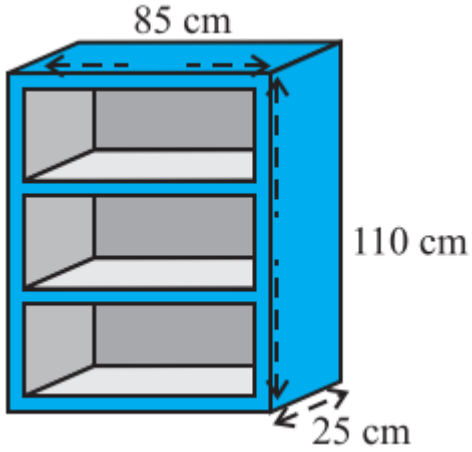
Surface Areas and Volumes: Exercise 13.9

Q.1 A wooden bookshelf has external dimensions as follows: Height = 110 cm, Depth = 25 cm, Breadth = 85 cm (see figure). The thickness of the plank is 5 cm everywhere. The external faces are to be polished and the inner faces are to be painted. If the rate of polishing is 20 paise per cm² and the rate of painting is 10 paise per cm², find the total expenses required for polishing and painting the surface of the bookshelf.



***Sol.* Given:** External dimension of bookshelf, Height = 110 cm, depth = 25cm, breadth =85 and thickness of plank = 5 cm and rate of polishing external faces = 20 paise per cm².

So, area to be polished = Area (Back side + Top & bottom + two side faces + four horizontal columns + two vertical columns)

Area to be polished = $(110 \times 85 + 2 \times 85 \times 25 + 2 \times 25 \times 110 + 4 \times 75 \times 5 + 2 \times 110 \times 5)$ cm²

$= (9350 + 4250 + 5500 + 1500 + 1100)$ cm²

$= 21700$ cm²

Since, cost of polishing of external faces is 20 paise per cm²

So, total cost = $(21700 \times \frac{20}{100}) = 4340$ Rs.

Now, area to be painted in one raw = $2(l + h)\, b + l\, h$

$= 2\,(75+30) \times 20 + 75 \times 30)$

$= 6452$ cm²

Area to be painted in three rows = 3×6450

$= 19350$ cm²

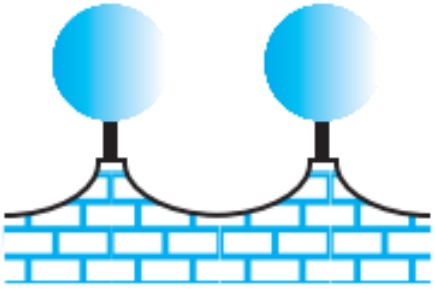
Since, cost of painting of three row is 10 paise per cm² = $(19350 \times \frac{10}{100})$

= Rs. 1935

Thus, total expenses = Rs. (4340 + 1935)

= Rs. 6275

Q.2 The front compound wall of a house is decorated by wooden spheres of diameter 21 cm, placed on small supports as shown in figure. Eight such spheres are used for this purpose, and are to be painted silver. Each support is a cylinder of radius 1.5 cm and height 7 cm and is to be painted black. Find the cost of paint required if silver paint costs 25 paise per cm² and black paint costs 5 paise per cm².



***Sol.* Given:** Dimension of spherical wooden, diameter = 21 cm, radius R = 21/2 cm and dimension of cylindrical support, radius r = 1.5 cm and height = 7 cm.
Since, we need to subtract the part of the sphere that is placing on the sphere while calculating the cost of silver paint.
Therefore, surface area to be silver painted = 8 x (Curved surface area of the sphere - area of circle on which sphere is resting on cylindrical support).

$= 8 \text{ x } (4\pi R^2 - \pi r^2) \text{ cm}^2$

$= 8\pi \text{ x } \left(4 \times \left(\frac{21}{2}\right)^2 - (1.5)^2\right) \text{ cm}^2$

$= 8\pi \text{ x } \left(4 \times \frac{441}{4} - 2.25\right) \text{ cm}^2$

$= 8\pi \text{ x } (441 - 2.25) \text{ cm}^2$

$= 8\pi \text{ x } (438.75) \text{ cm}^2$

Since, cost of silver paint is 25 paise per cm^2

So, total cost for silver painting of spherical wood = Rs. $\left(8 \times \frac{22}{7} \times 438.75 \times \frac{25}{100}\right)$

= Rs. 2757.86 (approx)

Now, surface area to be black painted = 8 × curved area of cylinder.

$= 8 \times 2\pi rh$

$= 8 \times 2 \times \frac{22}{7} \times 1.5 \times 7 \text{ cm}^2$

$= 528 \text{ cm}^2$

Since, cost of black paint is 5 paise per cm^2

So, total cost of black paint = Rs. $\left(528 \times \frac{5}{100}\right)$

= Rs. 26.40

Thus, total cost of painting = Rs. (2757.86 + 26.40)

= Rs. 2784.26

Q.3 The diameter of a sphere is decreased by 25%, by what percent does it's curved surface area decrease?

Sol. Suppose, d is the diameter of the sphere.

So, it's surface area = $4\pi \text{ x } \left(\frac{d}{2}\right)^2 = \pi d^2$

Now according to question, if we decrease its diameter by 25% , then new diameter, $d_1 = \frac{75}{100} \times d = \frac{3d}{4}$

Therefore, new surface area = $4\pi \left(\frac{d_1}{2}\right)^2$

$$= 4\pi \text{ x } \left(\frac{1}{2} \text{x} \frac{3d}{4}\right)^2$$

$$= 4\pi \frac{9d^2}{64}$$

$$= \pi d^2 \frac{9}{16}$$

So, decrement in surface area = $\pi d^2 - \pi d^2 \text{ x } \frac{9}{16}$

$$= \pi d^2 \left(1 - \frac{9}{16}\right)$$

$$= \pi d^2 \frac{7}{16}$$

Now, percentage decrease in surface area = $\frac{Decrease\ in\ surface\ area}{Initial\ surface\ area} \times 100$

$$= \frac{\frac{7}{16}\pi d^2}{\pi d^2} \times 100$$

$$= \frac{700}{16} \%$$

$$= 43.75 \%$$

Thus, percentage decrease in surface area is 43.75 %.