## **Mathematics**

(www.tiwariacademy.com) (Chapter – 13) (Surface Areas and Volumes)

(Class – IX)

## EXERCISE 13.9 (Optional)

**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 cm<sup>2</sup> and the rate of painting is 10 paise per cm<sup>2</sup>, find the total expenses required for polishing and painting the surface of the bookshelf.



Sol. Here, external dimensions of the bookshelf are : L = 110 cm, B = 85 cm, H = 25 cmwww.tiwariacademy.com Thickness of the plank = 5 cmInternal dimensions of the bookshelf are : l = (110 - 5 - 5) cm = 100 cm, b = (85 - 5 - 5) cm = 75 cm, h = (25 - 5) cm = 20 cmExternal surface area of the bookshelf = LB + 2 (BH + HL)  $= 110 \times 85 \text{ cm}^2 + 2(85 \times 25 + 25 \times 110) \text{ cm}^2$  $= (9350 + 9750) \text{ cm}^2 = 19100 \text{ cm}^2$ Surface are of the border  $= (4 \times 75 \times 5 + 110 \times 5 \times 2) \text{ cm}^2$  $= (1500 \times 1100) \text{ cm}^2 = 2600 \text{ cm}^2$  $\therefore$  Total surface area to be polished = (19100 + 2600) cm<sup>2</sup>  $= 21700 \text{ cm}^2$ :. Cost of polishing the outer surface = Rs  $\frac{21700 \times 20}{100}$  = Rs 4340 ... (i)

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Inner surface are of the bookshelf = lb + 2(bh + hl) $= 100 \times 75 \text{ cm}^2 + 2 (75 \times 20 + 100) \text{ cm}^2$  $= 7500 \text{ cm}^2 + 2 (1500 + 2000) \text{ cm}^2$  $= (7500 + 7000) \text{ cm}^2 = 14500 \text{ cm}^2$ Surface area of the two racks =  $4 \times 75 \times 20$  cm<sup>2</sup> = 6000 cm<sup>2</sup> Inner surface are covered by the racks =  $(75 \times 5 \times 2 + 20 \times 5 \times 4)$  cm<sup>2</sup>  $= (750 + 400) \text{ cm}^2 = 1150 \text{ cm}^2$  $\therefore$  Total surface are to be painted = (14500 + 6000 - 1150) cm<sup>2</sup>  $= 19350 \text{ cm}^2$ :. Cost of painting the inner surface = Rs  $\frac{19350 \times 10}{100}$  = Rs 1935 ... (ii) From (i), and (ii), we have,

Total expenses required for polishing and painting the surface of the bookshelf.

> www.tiwariacademy.com = Rs (4340 + 1935) = Rs 6275 Ans.

**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 the 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  $cm^2$ and black paint costs 5 paise per  $cm^2$ .

**Sol.** Radius of a sphere = 
$$\frac{21}{2}$$
 cm = 10.5 cm.

Surface area of a sphere =  $4\pi r^2$ 



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= 
$$4 \times \frac{22}{7} \times 10.5 \times 10.5 \text{ cm}^2$$
 = 1386 cm<sup>2</sup>

Area of the base of the cylinder (support) =  $\pi R^2$ 

$$= \pi \times (1.5)^2 = \frac{22}{7} \times 1.5 \times 1.5 \text{ cm}^2$$

 $= 7.07 \text{ cm}^2$ Area of a sphere to painted silver = (1386 - 7.07) cm<sup>2</sup>

$$= (1386 - 7.07) c$$
  
= 1378.93 cm<sup>2</sup>

Area of spheres to be painted silver =  $8 \times 1378.93$  cm<sup>2</sup>

 $\therefore$  cost of painting the spheres = Rs  $\frac{8 \times 1378.93 \times 25}{100}$ 

= Rs 2757.86

Curved surface area of a cylinder (support)

 $= 2 \times \frac{22}{7} \times 1.5 \times 7 \text{ cm}^2$ Curved surface area of 8 supports = 8 × 2 ×  $\frac{22}{7}$  × 1.5 × 7 cm<sup>2</sup>

Cost of painting the supports = Rs  $8 \times 2 \times \frac{22}{7} \times 1.5 \times 7 \times \frac{5}{100}$ = Rs 26.40

Total cost required of paint = Rs (2757.86 + 26.40) = Rs 2784.26 Ans.

**Q.3.** The diameter of a sphere is decreased by 25%. By what per cent does its curved surface area decrease?

**Sol.** Let originally the diameter of the sphere be 2r.

Then, radius of the sphere = r

Surface area of the sphere =  $4\pi r^2$  ... (i)

New diameter of the sphere 
$$= 2r - 2r \times \frac{25}{100} = \frac{3r}{2}$$

 $\therefore$  New radius of the sphere =  $\frac{3r}{4}$ 

Surface area of the new sphere =  $4\pi \left(\frac{3r}{4}\right)^2 = \frac{9\pi r^2}{4}$ 

Decrease in surface area =  $4\pi r^2 - \frac{9\pi r^2}{4} = \frac{7\pi r^2}{4}$ 

Per cent decrease =  $\frac{\frac{7\pi r^2}{4} \times 100}{4\pi r^2} = \frac{7}{16} \times 100 = \frac{175}{4} = 43.75$ 

Hence, the surface area decreases by 43.75% Ans.

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