Surface Areas and Volumes: Exercise 13.1

Q.1 A plastic box 1.5 m long, 1.25 m wide and 65 cm deep is to be made. It is to be open at the top. Ignoring the thickness of the plastic sheet, determine :
(i) The area of the sheet required for making the box.
(ii) The cost of sheet for it, if a sheet measuring 1 m² costs Rs 20.

Sol. Given: Dimension of a plastic box, length l = 1.5 m, Breadth b = 1.25 m and depth or Height. h = 65 cm = 0.65 m

(i) Since, the plastic box is in cuboid shape and open at the top.
So, Plastic sheet required for making such a box.

$= [2(\ell+b) \times h + \ell b]\ m^2$
$= [2(1.5+1.25) \times 0.65 + 1.5 \times 1.25]\ m^2$
$= (3.575 + 1.875)\ m^2$
$= 5.45\ m^2$

(ii) Since, cost of 1m² of sheet = Rs. 20
So, total cost of 5.45 m² of sheet = Rs (5.45 × 20)
= Rs.109

Q.2 The length, breadth and height of a room are 5 m, 4 m and 3 m respectively. Find the cost of white washing the walls of the room and the ceiling at the rate of Rs. 7.50 per m².

Sol. **Given:** Dimension of room, length l = 5m, breadth b = 4 m and height h = 3m
Therefore, Area of four walls including ceiling = $[2(\ell+b) \times h + \ell b]\ m^2$

$= [2(5+4) \times 3 + 5 \times 4]\ m^2$
$= [2 \times 9 \times 3 + 20]\ m^2$
$= 74\ m^2$

The cost of white washing = Rs 7.50 per m².
So, cost of white washing = Rs (74 × 7.50) = Rs 555

Q.3 The floor of a rectangular hall has a perimeter 250 m. If the cost of painting the four walls at the rate of Rs. 10 per m² is Rs. 15000, find the height of the hall.

Sol. **Given:** Cost of painting the four walls = Rs 15000
Rate of painting = Rs. 10 per m²
So, Area of four walls = (15000/10) m² = 1500 m²
⇒ 2(ℓ+b) x h =1500
Since, Perimeter = 2(ℓ+b)
⇒ Perimeter × Height = 1500
⇒ 250 × Height = 1500
⇒ Height = 1500/250 = 6
Thus, the height of the hall = 6 m

Q.4 The paint in a certain container is sufficient to paint an area equal to 9.375 m². How many bricks of dimensions 22.5 cm ×10 cm × 7.5 cm can be painted out of this container?

Sol. **Given:** Dimensions of one bricks, let length l = 22.5 cm , Breadth b = 10 cm and Height h = 7.5 cm. The area for which the paint is just sufficient is 9.375 m².
So, surface area of one brick = 2(ℓb + bh + hℓ)

$$= 2\left(\frac{22.5}{100} \times \frac{10}{100} + \frac{10}{100} \times \frac{7.5}{100} + \frac{7.5}{100} \times \frac{22.5}{100}\right)\ m^2$$

$$= \frac{1}{5000} \times (225 + 75 + 168.75)\ m^2$$

$$= \frac{1}{5000} \times 468.75\ m^2 \quad = 0.09375\ m^2$$

Area for which the paint is just sufficient = 9.375 m^2
So, number of bricks can be painted with the available paint = 9.375/0.09375
= 100 bricks.

Q.5 A cubical box has each edge 10 cm and another cuboidal box is 12.5 cm long, 10 cm wide and 8 cm high.
(i) Which box has the greater lateral surface area and by how much?
(ii) Which box has the smaller total surface area and by how much?
***Sol.* Given:** Edge of cubical box = 10 cm and dimension of cuboidal box, let length l = 12.5 cm, Breadth b = 10 cm and Height h = 8 cm

(i) So, lateral surface area of cubical box = 4×10^2 cm^2 = 400 cm^2
Now, lateral surface area of cuboid box = $2(\ell+b) \times h$
$= 2 \times (12.5+10) \times 8$ cm^2
$= 2 \times 22.5 \times 8$ cm^2
$= 360$ cm^2
So from the calculation, lateral surface area of the cubical box is greater than cuboidal and it is more by (400 – 360) cm^2 = 40 cm^2

(ii) Now, total surface area of cubical box = 6×10^2 cm^2 = 600 cm^2
And total surface area of cuboidal box = $2(\ell b + bh + h\ell)$
$= 2(12.5\times10 + 10\times8 + 8\times12.5)$ cm^2
$= 2(125 + 80 + 100)$ cm^2
$= (2\times305)$ cm^2 = 610 cm^2
So, from the calculation, total surface area of cubical box is smaller by (610-600) cm^2 = 10cm^2

Q.6 A small indoor greenhouse (herbarium) is made entirely of glass panes (including base) held together with tape. It is 30 cm long, 25 cm wide and 25 cm high.
(i) What is the area of the glass?
(ii) How much of tape is needed for all the 12 edges?
***Sol.* Given:** Dimension of glass panes, let length l = 30 cm, breadth b = 25 cm and height h = 25 cm.
(i) So, area of the glass will be equal to total surface area = $2(\ell b + bh + h\ell)$
$= 2\ (30\times25 + 25\times25 + 25\times30)$ cm^2
$= 2(750 + 625 + 750)$ cm^2
$= (2\times2125)$ cm^2 = 4250 cm^2
(ii) Now, tape required for the 12 edges = the sum of all the edges
$= 4\ (\ell + b + h)$
$= 4\ (30 + 25 + 25)$ cm
$= 4 \times 80$cm
= 320 cm

Q.7 Shanti Sweets Stall was placing an order for making cardboard boxes for packing their sweets. Two sizes of boxes were required. The bigger of dimensions 25 cm × 20 cm × 5 cm and the smaller of dimensions 15 cm × 12 cm × 5 cm . For all the overlaps, 5 % of the total surface area is required extra. If the cost of the cardboard is Rs. 4 for 1000 cm^2, find the cost of cardboard required for supplying 250 boxes of each kind.
***Sol.* Given:** The dimension of bigger box = 25 cm × 20 cm × 5 cm and Dimension of smaller box = 15 cm × 12 cm × 5 cm.

For bigger box :
let length l = 25 cm, breadth b = 20 cm and height h = 5 cm
So, total surface area = $2(\ell b + bh + h\ell)$
$= 2\ (25\times20 + 20\times5 + 5\times25)$ cm^2
$= 2\ (500 + 100 + 125)$ cm^2
$= (2\times725)$ cm^2

$= 1450\ cm^2$

For smaller box :

Let, length, $l = 15$ cm , breadth b = 12 cm and height h = 5 cm

So, total surface area = $2(\ell b + bh + h\ell)$

$= 2(15\times12 + 12\times5 + 5\times15)\ cm^2$

$= 2(180 + 60 + 75)\ cm^2$

$= (2\times315)\ cm^2 = 630\ cm^2$

Then, total surface area of 250 boxes of each kind = 250 x $(1450 + 630)\ cm^2$

$= (250 \times 2080)\ cm^2$

$= 520000\ cm^2$

Since, cardboard required 5% extra for overlaps = $(520000 \times \frac{105}{100})\ cm^2$

= 546000cm2

Given that cost of 1000 cm^2 of cardboard is Rs 4

So, total cost of cardboard = Rs $(\frac{4}{1000}$ X 546000)

= Rs2184

Q.8 Parveen wanted to make a temporary shelter for her car, by making a box- like structure with tarpaulin that covers all the four sides and the top of the car (with the front face as a flap which can be rolled up). Assuming that the stitching margins are very small, and therefore negligible, how much tarpaulin would be required to make the shelter of height 2.5 m, with base dimensions 4 m × 3 m?

***Sol.* Given:** Dimensions of the box- like structure, let length $l = 4$m, breadth b = 3m and height h = 2.5 m.

Since, there is no tarpaulin for the floor.

So, tarpaulin needed = $[2(\ell+b) \times h + \ell b]\ m^2$

$= [2(4+3) \times 2.5 + 4\times3]\ m^2$

$= [2 \times 7 \times 2.5 + 12]\ m^2$

$= [35 \times 12]\ m^2$

$= 47\ m^2$