

EXERCISE 13.1

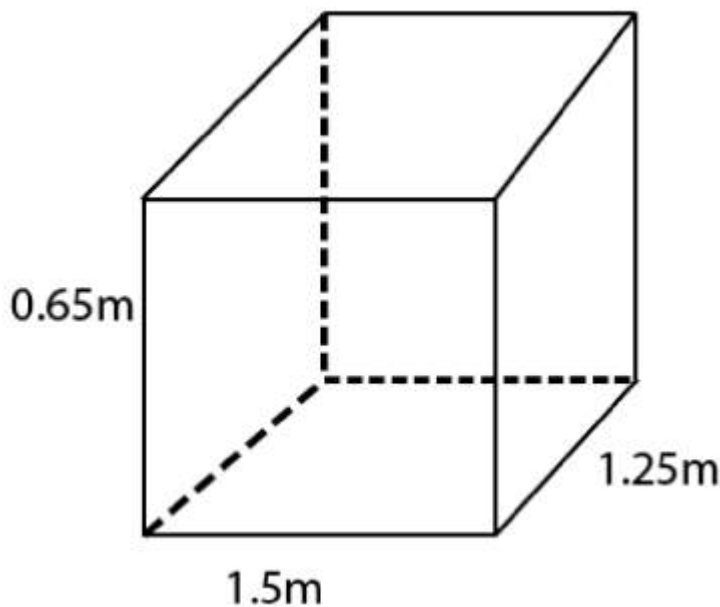
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1. A plastic box 1.5 m long, 1.25 m wide and 65 cm deep is to be made. It is to be open at the top. Ignoring the thickness of the plastic sheet, determine

(I) The area of the sheet required for making the box.

(ii) The cost of the sheet for it, if a sheet measuring 1m^2 costs Rs. 20.

Solution:



Given: length (l) of box = 1.5m

Breadth (b) of box = 1.25 m

Depth (h) of box = 0.65m

(i) Box is to be open at the top.

Area of sheet required.

$$= 2lh + 2bh + lb$$

$$= [2 \times 1.5 \times 0.65 + 2 \times 1.25 \times 0.65 + 1.5 \times 1.25] \text{m}^2$$

$$= (1.95 + 1.625 + 1.875) \text{m}^2 = 5.45 \text{m}^2$$

(ii) Cost of sheet per m^2 area = Rs.20

Cost of sheet of 5.45m^2 area = Rs (5.45×20)

= Rs.109.

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

Solution:

Length (l) of room = 5m

Breadth (b) of room = 4m

Height (h) of room = 3m

It can be observed that four walls and the ceiling of the room are to be whitewashed.

Total area to be whitewashed = Area of walls + Area of the ceiling of the room

$$= 2lh + 2bh + lb$$

$$= [2 \times 5 \times 3 + 2 \times 4 \times 3 + 5 \times 4]$$

$$= (30 + 24 + 20)$$

$$= 74$$

$$\text{Area} = 74 \text{ m}^2$$

Also,

$$\text{Cost of whitewash per m}^2 \text{ area} = \text{Rs. } 7.50 \text{ (Given)}$$

$$\text{Cost of whitewashing } 74 \text{ m}^2 \text{ area} = \text{Rs. } (74 \times 7.50)$$

$$= \text{Rs. } 555$$

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.15,000, find the height of the hall.

[Hint: Area of the four walls = Lateral surface area.]

Solution:

Let the length, breadth, and height of the rectangular hall be l, b, and h, respectively.

$$\text{Area of four walls} = 2lh + 2bh$$

$$= 2(l+b)h$$

$$\text{Perimeter of the floor of hall} = 2(l+b)$$

$$= 250 \text{ m}$$

$$\text{Area of four walls} = 2(l+b)h = 250h \text{ m}^2$$

Cost of painting per square metre area = Rs.10

Cost of painting $250h$ square metre area = Rs $(250h \times 10)$ = Rs.2500h

However, it is given that the cost of painting the walls is Rs. 15,000.

$$15000 = 2500h$$

$$\text{Or } h = 6$$

Therefore, the height of the hall is 6 m.

4. The paint in a certain container is sufficient to paint an area equal to 9.375 m^2 . How many bricks of dimensions $22.5 \text{ cm} \times 10 \text{ cm} \times 7.5 \text{ cm}$ can be painted out of this container?

Solution:

Total surface area of one brick = $2(lb + bh + lb)$

$$= [2(22.5 \times 10 + 10 \times 7.5 + 22.5 \times 7.5)] \text{ cm}^2$$

$$= 2(225 + 75 + 168.75) \text{ cm}^2$$

$$= (2 \times 468.75) \text{ cm}^2$$

$$= 937.5 \text{ cm}^2$$

Let n bricks can be painted out by the paint of the container.

$$\text{Area of } n \text{ bricks} = (n \times 937.5) \text{ cm}^2 = 937.5n \text{ cm}^2$$

As per the given instructions, the area that can be painted by the paint of the container = $9.375 \text{ m}^2 = 93750 \text{ cm}^2$

$$\text{So, we have } 93750 = 937.5n$$

$$n = 100$$

Therefore, 100 bricks can be painted out by the paint of the container.

5. A cubical box has each edge 10 cm, and another cuboidal box is 12.5cm 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?

Solution:

From the question statement, we have

Edge of a cube = 10cm

Length, $l = 12.5 \text{ cm}$

Breadth, $b = 10\text{cm}$

Height, $h = 8\text{ cm}$

(i) Find the lateral surface area for both figures.

Lateral surface area of cubical box $= 4 (\text{edge})^2$

$$= 4(10)^2$$

$$= 400\text{ cm}^2 \dots(1)$$

Lateral surface area of cuboidal box $= 2[lh+bh]$

$$= [2(12.5 \times 8 + 10 \times 8)]$$

$$= (2 \times 180) = 360$$

Therefore, the lateral surface area of the cuboidal box is 360 cm^2 . $\dots(2)$

From (1) and (2), the lateral surface area of the cubical box is more than the lateral surface area of the cuboidal box. The difference between both lateral surfaces is 40 cm^2 .

$$(\text{Lateral surface area of the cubical box} - \text{Lateral surface area of cuboidal box}) = 400\text{cm}^2 - 360\text{cm}^2 = 40\text{ cm}^2$$

(ii) Find the total surface area for both figures.

The total surface area of the cubical box $= 6(\text{edge})^2 = 6(10\text{ cm})^2 = 600\text{ cm}^2 \dots(3)$

The total surface area of the cuboidal box

$$= 2[lh+bh+lb]$$

$$= [2(12.5 \times 8 + 10 \times 8 + 12.5 \times 100)]$$

$$= 610$$

This implies that the total surface area of the cuboidal box is 610 cm^2 . $\dots(4)$

From (3) and (4), the total surface area of the cubical box is smaller than that of the cuboidal box. And their difference is 10cm^2 .

Therefore, the total surface area of the cubical box is smaller than that of the cuboidal box by 10 cm^2

6. A small indoor greenhouse (herbarium) is made entirely of glass panes (including the base) held together with tape. It is 30cm long, 25 cm wide, and 25 cm high.

(i) What is the area of the glass?

(ii) How much tape is needed for all 12 edges?

Solution:

Length of the greenhouse, say $l = 30\text{cm}$

Breadth of the greenhouse, say $b = 25\text{ cm}$

Height of greenhouse, say $h = 25\text{ cm}$

(i) Total surface area of greenhouse = Area of the glass = $2[lb+lh+bh]$

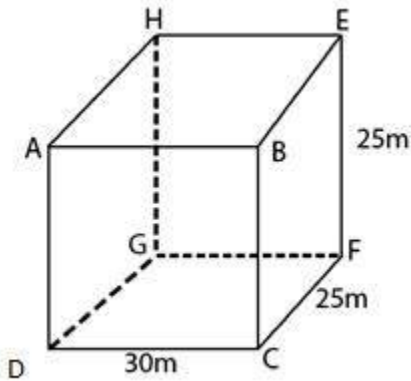
$$= [2(30 \times 25 + 30 \times 25 + 25 \times 25)]$$

$$= [2(750 + 750 + 625)]$$

$$= (2 \times 2125) = 4250$$

The total surface area of the glass is 4250 cm^2

(ii)



From the figure, the tape is required along sides AB, BC, CD, DA, EF, FG, GH, HE, AH, BE, DG, and CF.

Total length of tape = $4(l+b+h)$

$$= [4(30+25+25)] \text{ (after substituting the values)}$$

$$= 320$$

Therefore, 320 cm tape is required for all 12 edges.

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 $25\text{ cm} \times 20\text{ cm} \times 5\text{ cm}$, and the smaller of dimension $15\text{ cm} \times 12\text{ cm} \times 5\text{ cm}$. 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.

Solution:

Let l , b and h be the length, breadth and height of the box.

Bigger Box

$$l = 25\text{cm}$$

$$b = 20\text{ cm}$$

$$h = 5\text{ cm}$$

$$\text{Total surface area of bigger box} = 2(lb+lh+bh)$$

$$= [2(25 \times 20 + 25 \times 5 + 20 \times 5)]$$

$$= [2(500 + 125 + 100)]$$

$$= 1450\text{ cm}^2$$

$$\text{Extra area required for overlapping } 1450 \times 5/100\text{ cm}^2$$

$$= 72.5\text{ cm}^2$$

While considering all overlaps, the total surface area of the bigger box.

$$= (1450 + 72.5)\text{ cm}^2 = 1522.5\text{ cm}^2$$

Area of cardboard sheet required for 250 such bigger boxes

$$= (1522.5 \times 250)\text{ cm}^2 = 380625\text{ cm}^2$$

Smaller Box

$$\text{Similarly, total surface area of the smaller box} = [2(15 \times 12 + 15 \times 5 + 12 \times 5)]\text{ cm}^2$$

$$= [2(180 + 75 + 60)]\text{ cm}^2$$

$$= (2 \times 315)\text{ cm}^2$$

$$= 630\text{ cm}^2$$

$$\text{Therefore, the extra area required for overlapping } 630 \times 5/100\text{ cm}^2 = 31.5\text{ cm}^2$$

The total surface area of 1 smaller box while considering all overlaps

$$= (630 + 31.5)\text{ cm}^2 = 661.5\text{ cm}^2$$

$$\text{Area of cardboard sheet required for 250 smaller boxes} = (250 \times 661.5)\text{ cm}^2 = 165375\text{ cm}^2$$

In Short

Box	Dimensions (in cm)	Total surface area (in cm ²)	Extra area required for overlapping (in cm ²)	Total surface area for all overlaps (in cm ²)	Area for 250 such boxes (in cm ²)

Bigger Box	$l = 25$ $b = 20$ $c = 5$	1450	$1450 \times 5 / 100 = 72.5$	$(1450 + 72.5) = 1522.5$	$(1522.5 \times 250) = 380625$
Smaller Box	$l = 15$ $b = 12$ $h = 5$	630	$630 \times 5 / 100 = 31.5$	$(630 + 31.5) = 661.5$	$(250 \times 661.5) = 165375$

Now, total cardboard sheet required = $(380625 + 165375) \text{ cm}^2$

$$= 546000 \text{ cm}^2$$

Given, cost of 1000 cm^2 cardboard sheet = Rs. 4

Therefore, the cost of 546000 cm^2 cardboard sheet = Rs. $(546000 \times 4) / 1000 = \text{Rs. } 2184$

Therefore, the cost of cardboard required for supplying 250 boxes of each kind will be Rs. 2,184.

8. Praveen wanted to make a temporary shelter for her car by making a box-like structure with a tarpaulin that covers all 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 many tarpaulins would be required to make the shelter of height 2.5m, with base dimensions $4\text{m} \times 3\text{m}$?

Solution:

Let l , b and h be the length, breadth and height of the shelter.

Given:

$$l = 4\text{m}$$

$$b = 3\text{m}$$

$$h = 2.5\text{m}$$

Tarpaulins will be required for the top and four wall sides of the shelter.

Using formula, area of tarpaulin required = $2(lh + bh) + lb$

On putting the values of l , b and h , we get

$$= [2(4 \times 2.5 + 3 \times 2.5) + 4 \times 3] \text{ m}^2$$

$$= [2(10 + 7.5) + 12] \text{ m}^2$$

$$= 47 \text{ m}^2$$

Therefore, 47 m^2 of tarpaulin will be required.