

EXERCISE 21.3**PAGE NO: 21.22****1. Find the surface area of a cuboid whose****(i) length = 10 cm, breadth = 12 cm, height = 14 cm****(ii) length = 6 dm, breadth = 8 dm, height = 10 dm****(iii) length = 2m, breadth = 4 m, height = 5 m****(iv) length = 3.2 m, breadth = 30 dm, height = 250 cm.****Solution:****(i)** Given details are,

Length of a cuboid = 10 cm

Breadth of a cuboid = 12 cm

Height of a cuboid = 14 cm

We know that,

$$\begin{aligned}\text{Surface area of cuboid} &= 2 (lb + bh + hl) \text{ cm}^2 \\ &= 2 (10 \times 12 + 12 \times 14 + 14 \times 10) \\ &= 2 (120 + 168 + 140) \\ &= 2 (428) \\ &= 856 \text{ cm}^2\end{aligned}$$

(ii) Given details are,

Length of a cuboid = 6 dm

Breadth of a cuboid = 8 dm

Height of a cuboid = 10 dm

We know that,

$$\begin{aligned}\text{Surface area of cuboid} &= 2 (lb + bh + hl) \text{ cm}^2 \\ &= 2 (6 \times 8 + 8 \times 10 + 10 \times 6) \\ &= 2 (48 + 80 + 60) \\ &= 2 (188) \\ &= 376 \text{ dm}^2\end{aligned}$$

(iii) Given details are,

Length of a cuboid = 2m

Breadth of a cuboid = 4m

Height of a cuboid = 5m

We know that,

$$\begin{aligned}\text{Surface area of cuboid} &= 2 (lb + bh + hl) \text{ cm}^2 \\ &= 2 (2 \times 4 + 4 \times 5 + 5 \times 2) \\ &= 2 (8 + 20 + 10) \\ &= 2 (38)\end{aligned}$$

$$= 76 \text{ m}^2$$

(iv) Given details are,

Length of a cuboid = 3.2 m = 32 dm

Breadth of a cuboid = 30 dm

Height of a cuboid = 250 cm = 25 dm

We know that,

$$\begin{aligned} \text{surface area of cuboid} &= 2 (lb + bh + hl) \text{ cm}^2 \\ &= 2 (32 \times 30 + 30 \times 25 + 25 \times 32) \\ &= 2 (960 + 750 + 800) \\ &= 2 (2510) \\ &= 5020 \text{ dm}^2 \end{aligned}$$

2. Find the surface area of a cube whose edge is

(i) 1.2 m

(ii) 27 cm

(iii) 3 cm

(iv) 6 m

(v) 2.1 m

Solution:

(i) Given,

Edge of cube = 1.2 m

We know that,

$$\begin{aligned} \text{Surface area of cube} &= 6 \times \text{side}^2 \\ &= 6 \times 1.2^2 \\ &= 6 \times 1.44 \\ &= 8.64 \text{ m}^2 \end{aligned}$$

(ii) Given,

Edge of cube = 27 cm

We know that,

$$\begin{aligned} \text{Surface area of cube} &= 6 \times \text{side}^2 \\ &= 6 \times 27^2 \\ &= 6 \times 729 \\ &= 4374 \text{ cm}^2 \end{aligned}$$

(iii) Given,

Edge of cube = 3 cm

We know that,

$$\begin{aligned}\text{Surface area of cube} &= 6 \times \text{side}^2 \\ &= 6 \times 3^2 \\ &= 6 \times 9 \\ &= 54 \text{ cm}^2\end{aligned}$$

(iv) Given,

Edge of cube = 6 m

We know that,

$$\begin{aligned}\text{Surface area of cube} &= 6 \times \text{side}^2 \\ &= 6 \times 6^2 \\ &= 6 \times 36 \\ &= 216 \text{ m}^2\end{aligned}$$

(v) Given,

Edge of cube = 2.1 m

We know that,

$$\begin{aligned}\text{Surface area of cube} &= 6 \times \text{side}^2 \\ &= 6 \times 2.1^2 \\ &= 6 \times 4.41 \\ &= 26.46 \text{ m}^2\end{aligned}$$

3. A cuboidal box is 5 cm by 5 cm by 4 cm. Find its surface area.

Solution:

Given details are,

Dimensions of cuboidal box = 5cm × 5cm × 4cm

We know that,

$$\begin{aligned}\text{Surface area of cuboid} &= 2 (lb + bh + hl) \text{ cm}^2 \\ &= 2 (5 \times 5 + 5 \times 4 + 4 \times 5) \\ &= 2 (25 + 20 + 20) \\ &= 2 (65) \\ &= 130 \text{ cm}^2\end{aligned}$$

4. Find the surface area of a cube whose volume is

(i) 343 m^3

(ii) 216 dm^3

Solution:

(i) Given details are,

Volume of cube = 343 m^3

Side of cube, $a = \sqrt[3]{(343)} = 7\text{m}$

We know that,

$$\begin{aligned}\text{Surface area of cube} &= 6 \times \text{side}^2 \\ &= 6 \times 7^2 \\ &= 6 \times 49 \\ &= 294 \text{ m}^2\end{aligned}$$

(ii) Given details are,

$$\text{Volume of cube} = 216 \text{ dm}^3$$

$$\text{Side of cube } a = \sqrt[3]{(216)} = 6 \text{ dm}$$

We know that,

$$\begin{aligned}\text{Surface area of cube} &= 6 \times \text{side}^2 \\ &= 6 \times 6^2 \\ &= 6 \times 36 \\ &= 216 \text{ dm}^2\end{aligned}$$

5. Find the volume of a cube whose surface area is

(i) 96 cm²

(ii) 150 m²

Solution:

(i) Given details are,

$$\text{Surface area of cube} = 96 \text{ cm}^2$$

$$6 \times \text{side}^2 = 96 \text{ cm}^2$$

$$\text{Side}^2 = 96/6$$

$$= 16$$

$$\text{Side} = \sqrt{16} = 4 \text{ cm}$$

$$\therefore \text{Volume of a cube} = 4^3 = 64 \text{ cm}^3$$

(ii) Given details are,

$$\text{Surface area of cube} = 150 \text{ m}^2$$

$$6 \times \text{side}^2 = 150 \text{ cm}^2$$

$$\text{Side}^2 = 150/6$$

$$= 25$$

$$\text{Side} = \sqrt{25} = 5 \text{ cm}$$

$$\therefore \text{Volume of a cube} = 5^3 = 125 \text{ m}^3$$

6. The dimensions of a cuboid are in the ratio 5: 3: 1 and its total surface area is 414 m². Find the dimensions.

Solution:

Given details are,

Ratio of dimensions of a cuboid = 5:3:1

Total surface area of cuboid = 414 m²

The dimensions are = 5x × 3x × x

Surface area of cuboid = 414 m²

We know that,

Surface area of cuboid = 2 (lb + bh + hl) cm²

2 (lb + bh + hl) cm² = 414

2 (15x² + 3x² + 5x²) = 414

2 (23x²) = 414

46x² = 414

x² = 414/46

= 9

x = √9

= 3

∴ Dimensions are,

5x = 5 (3) = 15m

3x = 3 (3) = 9m

x = 3m

7. Find the area of the cardboard required to make a closed box of length 25 cm, 0.5 m and height 15 cm.

Solution:

Given details are,

Dimensions of closed box = 25cm × 0.5m × 15cm = 25cm × 50cm × 15cm

We know that,

$$\begin{aligned}\text{Area of cardboard required} &= 2 (lb + bh + hl) \text{ cm}^2 \\ &= 2 (25 \times 50 + 50 \times 15 + 15 \times 25) \\ &= 2 (1250 + 750 + 375) \\ &= 2 (2375) \\ &= 4750 \text{ cm}^2\end{aligned}$$

8. Find the surface area of a wooden box whose shape is of a cube, and if the edge of the box is 12 cm.

Solution:

Given details are,

Edge of a cubic wooden box = 12 cm

We know that,

$$\begin{aligned}\text{Surface area of cubic wooden box} &= 6 \times \text{side}^2 \\ &= 6 \times 12^2\end{aligned}$$

$$\begin{aligned} &= 6 \times 144 \\ &= 864 \text{ cm}^2 \end{aligned}$$

9. The dimensions of an oil tin are 26 cm × 26 cm × 45 cm. Find the area of the tin sheet required for making 20 such tins. If 1 square metre of the tin sheet costs Rs. 10, find the cost of tin sheet used for these 20 tins.

Solution:

Given details are,

Dimensions of oil tin = 26cm × 26cm × 45cm

Then,

$$\begin{aligned} \text{Area of tin sheet required for making one oil tin} &= \text{total surface area of oil tin} \\ &= 2 (lb + bh + hl) \text{ cm}^2 \\ &= 2 (26 \times 26 + 26 \times 45 + 45 \times 26) \\ &= 2 (676 + 1170 + 1170) \\ &= 2 (3016) \\ &= 6032 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of tin sheet required for 20 oil tins} &= 20 \times 6032 \\ &= 120640 \text{ cm}^2 \\ &= 12.064 \text{ m}^2 \end{aligned}$$

Given, Cost of 1 m² tin sheet = Rs 10

$$\begin{aligned} \text{So, Cost of 12.064 m}^2 \text{ tin sheet} &= 10 \times 12.064 \\ &= \text{Rs } 120.60 \end{aligned}$$

10. A classroom is 11 m long, 8 m wide and 5 m high. Find the sum of the areas of its floor and the four walls (including doors, windows etc.)

Solution:

Given details are,

Dimensions of class room = 11m × 8m × 5m

Where, Length = 11m, Breadth = 8m, Height = 5m

We know,

$$\begin{aligned} \text{Area of floor} &= \text{length} \times \text{breadth} \\ &= 11 \times 8 \\ &= 88 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of four walls (including doors \& windows)} &= 2 (lh + bh) \text{ cm}^2 \\ &= 2 (11 \times 5 + 8 \times 5) \\ &= 2 (55 + 40) \\ &= 2 (95) \\ &= 190 \text{ m}^2 \end{aligned}$$

∴ Sum of areas of floor and four walls = area of floor + area of four walls

$$\begin{aligned} &= 88 + 190 \\ &= 278 \text{ m}^2 \end{aligned}$$

11. A swimming pool is 20 m long 15 m wide and 3 m deep. Find the cost of repairing the floor and wall at the rate of Rs. 25 per square metre.

Solution:

Given details are,

Dimensions of swimming pool are = $20\text{m} \times 15\text{m} \times 3\text{m}$

Where, Length = 20m , Breadth = 15m , Height = 3m

We know,

$$\begin{aligned} \text{Area of floor} &= \text{length} \times \text{breadth} \\ &= 20 \times 15 \\ &= 300 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of walls of swimming pool} &= 2 (lh + bh) \text{ cm}^2 \\ &= 2 (20 \times 3 + 15 \times 3) \\ &= 2 (60 + 45) \\ &= 2 (105) \\ &= 210\text{m}^2 \end{aligned}$$

$$\begin{aligned} \text{Sum of areas of floor and four walls} &= \text{area of floor} + \text{area of walls} \\ &= 300 + 210 \\ &= 510 \text{ m}^2 \end{aligned}$$

Given, Cost for repairing 1m^2 area = Rs 25

$$\begin{aligned} \therefore \text{Cost for repairing } 510 \text{ m}^2 &= 510 \times 25 \\ &= \text{Rs } 12750 \end{aligned}$$

12. The perimeter of a floor of a room is 30 m and its height is 3 m. Find the area of four walls of the room.

Solution:

Given details are,

Height of floor = 3m

Perimeter of floor = 30m

So, perimeter = 30

$$2(l+b) = 30$$

$$l+b = 30/2$$

$$l+b = 15\text{m}$$

$$\begin{aligned} \therefore \text{Area of four walls of room} &= 2 (lh + bh) \text{ m}^2 \\ &= 2h (l+b) \\ &= 2 (3) (15) \\ &= 90\text{m}^2 \end{aligned}$$

13. Show that the product of the areas of the floor and two adjacent walls of a cuboid is the square of its volume.

Solution:

Let us consider length of cuboid as = l cm

Let us consider breadth of cuboid as = b cm

Let us consider height of cuboid as = h cm

We know,

$$\text{Area of floor} = l \times b = lb \text{ cm}^2$$

Then,

$$\text{Product of areas of two adjacent walls} = (l \times h) \times (b \times h) = lbh^2 \text{ cm}^4$$

$$\begin{aligned} \text{Product of areas of floor and two adjacent walls} &= lb \times lbh^2 \text{ cm}^6 \\ &= l^2 \times b^2 \times h^2 \text{ cm}^6 \\ &= (lbh)^2 \text{ cm}^6 \end{aligned}$$

We know, volume of cuboid = lbh cm

Hence, areas of the floor and two adjacent walls of a cuboid is the square of its volume.

14. The walls and ceiling of a room are to be plastered. The length, breadth and height of the room are 4.5 m, 3 m and 350 cm, respectively. Find the cost of plastering at the rate of Rs. 8 per square metre.

Solution:

Given details are,

$$\text{Length of room} = 4.5\text{m}$$

$$\text{Breadth of wall} = 3\text{m}$$

$$\text{Height of wall} = 350\text{cm} = 350/100 = 3.5\text{m}$$

$$\begin{aligned} \text{Area of ceiling} &= l \times b \\ &= 4.5 \times 3 \\ &= 13.5 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of walls} &= 2(lh + bh) \text{ m}^2 \\ &= 2(4.5 \times 3.5 + 3 \times 3.5) \\ &= 2(15.75 + 10.5) \\ &= 52.5 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Sum of Area of ceiling + area of walls} &= 13.5\text{m}^2 + 52.5\text{m}^2 \\ &= 66\text{m}^2 \end{aligned}$$

Given, Cost for plastering 1m^2 area = Rs 8

$$\therefore \text{Cost for plastering } 66 \text{ m}^2 \text{ area} = 66 \times 8 = \text{Rs } 528$$

15. A cuboid has total surface area of 50 m^2 and lateral surface area is 30 m^2 . Find the area of its base.

Solution:

Given details are,

$$\text{Total surface area of cuboid} = 50 \text{ m}^2$$

$$\text{Lateral surface area of cuboid} = 30 \text{ m}^2$$

$$\text{Total Surface area} = 2 (\text{surface area of base}) + (\text{surface area of 4 walls})$$

$$50 = 2 (\text{surface area of base}) + (\text{lateral surface area})$$

$$50 = 2 (\text{surface area of base}) + 30$$

$$50 - 30 = 2 (\text{surface area of base})$$

$$20 = 2 (\text{surface area of base})$$

$$\begin{aligned} \text{Surface area of base} &= 20/2 \\ &= 10 \text{ m}^2 \end{aligned}$$

$$\therefore \text{Area of base is } 10 \text{ m}^2$$

16. A classroom is 7 m long, 6 m broad and 3.5 m high. Doors and windows occupy an area of 17 m^2 . What is the cost of white washing the walls at the rate of Rs 1.50 per m^2 ?

Solution:

Given details are,

$$\text{Dimensions of class room} = 7 \text{ m} \times 6 \text{ m} \times 3.5 \text{ m}$$

$$\text{Where, Length} = 7 \text{ m, Breadth} = 6 \text{ m, Height} = 3.5 \text{ m}$$

$$\begin{aligned} \text{Area of four walls (including doors \& windows)} &= 2 (lh + bh) \text{ m}^2 \\ &= 2 (7 \times 3.5 + 6 \times 3.5) \\ &= 91 \text{ m}^2 \end{aligned}$$

$$\text{Area of four walls (without doors \& windows)} =$$

$$\begin{aligned} \text{Area including doors \& windows} - \text{area occupied by doors \& windows} \\ &= 91 - 17 = 74 \text{ m}^2 \end{aligned}$$

Then,

$$\text{Cost for white washing } 1 \text{ m}^2 \text{ area of walls} = \text{Rs } 1.50$$

$$\therefore \text{Total cost for white washing the walls} = 74 \times 1.50 = \text{Rs } 111$$

17. The central hall of a school is 80 m long and 8 m high. It has 10 doors each of size $3 \text{ m} \times 1.5 \text{ m}$ and 10 windows each of size $1.5 \text{ m} \times 1 \text{ m}$. If the cost of white washing the walls of the hall at the rate of Rs 1.20 per m^2 is Rs 2385.60, find the breadth of the hall.

Solution:

Given details are,

Dimensions of central hall of a school = Length = 80 m , height = 8m

Let breadth of hall be 'b' m

So,

$$\text{Area of each door} = 3\text{m} \times 1.5\text{m} = 4.5\text{m}^2$$

$$\text{Area of 10 doors} = 10 \times 4.5 = 45\text{m}^2$$

$$\text{Area of each window} = 1.5\text{m} \times 1\text{m} = 1.5 \text{ m}^2$$

$$\text{Area of 10 windows} = 10 \times 1.5 = 15\text{m}^2$$

$$\text{Area occupied by doors and windows} = 45 + 15 = 60 \text{ m}^2$$

$$\begin{aligned} \text{Area of the walls of the hall including doors and windows} &= 2(lh + bh) \text{ m}^2 \\ &= 2(80 \times 8 + b \times 8) \\ &= 2(640 + 8b) \text{ m}^2 \end{aligned}$$

Then,

Area of only walls = area of walls including doors & windows – area occupied by doors & windows

$$\begin{aligned} &= 2(640 + 8b) - 60 \\ &= 1280 + 16b - 60 \\ &= (1220 + 16b) \text{ m}^2 \end{aligned}$$

Given, Total cost for white washing = Rs 2385.60

Rate of white washing = Rs 1.20 per m^2

So,

Total cost = Rate \times (areas of walls only)

$$2385.60 = 1.20 \times (1220 + 16b)$$

$$2385.60 / 1.20 = (1220 + 16b)$$

$$1988 = 1220 + 16b$$

$$16b = 1988 - 1220$$

$$= 768$$

$$b = 768 / 16$$

$$= 48$$

\therefore Breadth of hall is 48 m