RD SHARMA Solutions for Class 9 Maths Chapter 18 - Surface Areas and Volume of a Cuboid and Cube

Chapter 18 - Surface Areas and Volume of a Cuboid and Cube Exercise 18.35

Question 1

The length of the longest rod that can be fitted in a cubical vessel of edge 10 cm long, is

(a) 10 cm

(b) $10\sqrt{2}$ cm

(c) $10\sqrt{3}$ cm

(d) 20 cm

Solution 1

The longest rod that can be fitted in a cube is diagonal of a cube.

Now, if a is side of a cube, then diagonal $= \sqrt{a^2+a^2+a^2} = \sqrt{3}a$

$\Rightarrow$ Diagonal of a cube of edge 10 cm $= 10\sqrt{3}$ cm

Hence, correct option is (c).

Question 2

Three equal cubes are placed adjacently in a row. The ratio of the total surface area of the resulting cuboid to that of the sum of the surface areas of three cubes, is

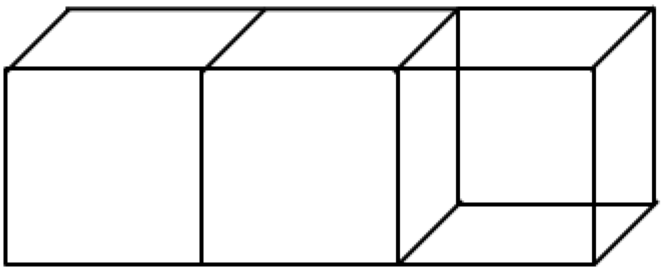
(a) 7 : 9

(b) 49 : 81

(c) 9 : 7

(d) 27 : 23

Solution 2



Surface of one cube $= 6(\text{edge})^2 = 6a^2$

$\Rightarrow$ Surface area of three cubes $= 3 \times 16a^2 = 18a^2$

Surface Area of cuboid formed

$= 2(lb + bh + hl)$

$= 2(3a \times a + a \times a + a \times 3a)$

$= 2(3a^2 + a^2 + 3a^2)$

$= 2 \times 7a^2$

$= 14a^2$

$\Rightarrow$ Required Ratio $= \dfrac{\text{Surface area of resulting cuboid}}{\text{Surface area of three cubes}} = \dfrac{14a^2}{18a^2} = \dfrac{7}{9} = 7 : 9$

Hence, correct option is (a).

Question 3

If the length of a diagonal of a cube is $8\sqrt{3}$ cm, then its surface area is
(a) 512 cm^2
(b) 384 cm^2
(c) 192 cm^2
(d) 768 cm^2

Solution 3

Length of diagonal of a cube of side a $= 8\sqrt{3}$ cm
$\Rightarrow \sqrt{3}a = 8\sqrt{3}$
$\Rightarrow a = 8$ cm
So, Surface Area of a Cube $= 6a^2 = 6 \times 8 \times 8 = 384\ cm^2$
Hence, correct option is (b).

Question 4

If the volumes of two cubes are in the ratio 8 : 1, then the ratio of their edges is
(a) 8 : 1
(b) $2\sqrt{2}$: 1
(c) 2 : 1
(d) none of these

Solution 4

If side of 1^{st} cube = a and side of 2^{nd} cube = b, then

$$\frac{\text{Volume of } 1^{st} \text{ cube}}{\text{Volume of } 2^{nd} \text{ cube}} = \frac{a^3}{b^3} = \frac{8}{1}$$

$$\Rightarrow \frac{a}{b} = \frac{2}{1}$$

Hence, correct option is (c).

Question 5

The volume of a cube whose surface area is 96 cm^2, is
(a) $16\sqrt{2}$ cm^3
(b) 32 cm^2
(c) 64 cm^3
(d) 216 cm^3

Solution 5

Surface Area of Cube $= 6a^2 = 96\ cm^2$
$\Rightarrow a^2 = 16\ cm^2$
$\Rightarrow a = 4$ cm
$\Rightarrow$ Volume $= a^3 = 4^3 = 64\ cm^3$
Hence, correct option is (c).

Question 6

The length, width and height of a rectangular solid are in the ratio of 3 : 2 : 1. If the volume of the box is 48 cm^3, the total surface area of the box is
(a) 27 cm^2
(b) 32 cm^2
(c) 44 cm^2
(d) 88 cm^2

Solution 6

Let,
Length = 3x,

Width = 2x

Height = x

Volume = 48 cm^3

$L \times W \times H = 48\ cm^3$

$3x \times 2x \times x = 48\ cm^3$

$6x^3 = 48\ cm^3$

$x^3 = 8\ cm^3$

x = 2 cm

Total Surface area

$= 2(3x \times 2x + 2x \times x + 3x \times x)$

$= 2(6x^2 + 2x^2 + 3x^2)$

$= 2(11x^2)$

$= 22x^2$

$= 22(4)$

$= 88\ cm^2$

Hence, correct option is (d).

Question 7

If the areas of the adjacent faces of a rectangular block are in the ratio 2 : 3 : 4 and the volume is 9000 cm^3, then the length of the shortest edge is

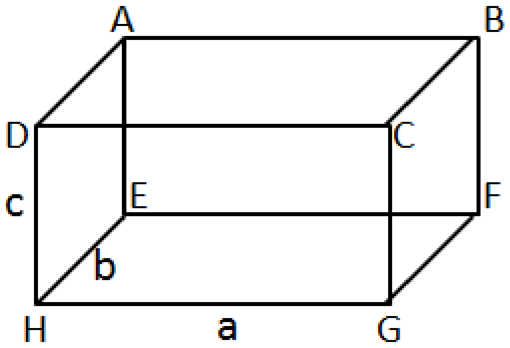
(a) 30 cm

(b) 20 cm

(c) 15 cm

(d) 10 cm

Solution 7



Three adjacent Faces are AEHD, DCGH, EHGF

Ratio of areas,

bc : ac : ab = 2 : 3 : 4 .....(1)

Volume, abc = 9000 cm^3

From eq. (1), let bc = 2x, ac = 3x, ab = 4x

$\Rightarrow (2x \times 3x \times 4x) = (bc)(ac)(ab)$

$\Rightarrow 24x^3 = (abc)^2$

$\Rightarrow 24x^3 = (9000)^2 = 81000000$

$x^3 = \frac{81 \times 10^6}{24} = \frac{27 \times 10^6}{8}$

$\Rightarrow x = \frac{3 \times 10^2}{2} \Rightarrow x = 150 \text{ cm}$

$\Rightarrow bc = 300 \text{ cm}^2, \quad ac = 450 \text{ cm}^2, \quad ab = 600 \text{ cm}^2$

Thus, we have

$a = \frac{abc}{bc} = \frac{9000}{300} = 30 \text{ cm}, \; b = \frac{abc}{ac} = \frac{9000}{450} = 20 \text{ cm}, \; c = \frac{abc}{ab} = \frac{9000}{600} = 15 \text{ cm}$

$\Rightarrow$ The length of the Shortest edge = 15 cm.

Hence, correct option is (c).

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Question 8

If each edge of a cube, of volume V, is doubled, then the volume of the new cube is

(a) 2 V

(b) 4 V

(c) 6 V

(d) 8 V

Solution 8

Let edge = a

Volume, V = a^3

If a' = 2a, then

$V' = (a')^3 = (2a)^3 = 8a^3$

V' = 8 V

Hence, correct option is (d).

Question 9

If each edge of a cuboid of surface area S is doubled, then surface area of the new cuboid is

(a) 2 S

(b) 4 S
(c) 6 S
(d) 8 S

Solution 9

Let the edges of Cuboid be a, b, c

S = Surface Area $= 2(ab + bc + ca)$

If $a' = 2a,\ b' = 2b,\ \ c' = 2c$, then

$S' = 2(a'b' + b'c' + c'a')$

$\Rightarrow S' = 2[(2a)(2b) + (2b)(2c) + (2c)(2a)]$

$\Rightarrow S' = 2[4ab + 4bc + 4ca]$

$\Rightarrow S' = 4 \times 2(ab + bc + ca)$

$\Rightarrow S' = 4\ S$

Hence, correct option is (b).

Question 10

The area of the floor of a room is 15 m^2. If its height is 4 m, then the volume of the air contained in the room is
(a) 60 dm^3
(b) 600 dm^3
(c) 6000 dm^3
(d) 60000 dm^3

Solution 10

$$\begin{aligned}\text{Volume of room} &= \text{Area of floor} \times \text{Height of room} \\ &= 15\ m^2 \times 4\ m \\ &= 1500\ dm^2 \times 40\ dm \\ &= 60000\ dm^3\end{aligned}$$

Hence, correct option is (d).

Question 11

The cost of constructing a wall 8 m long, 4 m high and 20 cm thick at the rate of Rs. 25 per m^3 is
(a) Rs. 16
(b) Rs. 80
(c) Rs. 160
(d) Rs. 320

Solution 11

$$\text{Volume of wall} = 8\ m \times 4\ m \times 20\ cm = 8\ m \times 4\ m \times \frac{1}{5} m = \frac{32}{5} m^3$$

$$\Rightarrow \text{Cost of constructing wall} = \text{Rs.}\left(25 \times \frac{32}{5}\right) = \text{Rs. } 160$$

Hence, correct option is (c).

Question 12

10 cubic metres clay is uniformly spread on a land of area 10 ares. The rise in the level of the ground is
(a) 1 cm
(b) 10 cm
(c) 100 cm
(d) 1000 cm

Solution 12

$$\text{Area of land} = 10 \text{ ares} = 10 \times 100 \text{ m}^2 = 1000 \text{ m}^2$$

$$\text{Volume of clay} = 10 \text{ m}^3$$

$$\Rightarrow \text{Area of land} \times \text{Rise in level} = 10 \text{ m}^3$$

$$\Rightarrow 1000 \text{ m}^2 \times \text{Rise in level} = 10 \text{ m}^3$$

$$\Rightarrow \text{Rise in level} = \frac{10 \text{ m}^3}{1000 \text{ m}^2} = \frac{1}{100} \text{m} = 1 \text{ cm}$$

Hence, correct option is (a).

Question 13

Volume of a cuboid is 12 cm^3. The volume (in cm^3) of a cuboid whose sides are double of the above cuboid is
(a) 24
(b) 48
(c) 72
(d) 96

Solution 13

Let the dimensions of Cuboid be a, b, c respectively.
Volume, V = abc = 12 cm^3
If a' = 2a,   b' = 2b,   c' = 2c, then
V' = a'b'c' = 8abc = 8 × 12 = 96 cm^3
Hence, correct option is (d).

Question 14

If the sum of all the edges of a cube is 36 cm, then the volume (in cm^3) of that cube is
(a) 9
(b) 27
(c) 219
(d) 729

Solution 14

Let the edge of cube = a
Total no. of edge = 12
Sum of all edges = 12a
12a = 36cm
i.e. a = 3 cm
Volume = $a^3 = 3^3 = 27$ cm^3
Hence, correct option is (b).

Question 15

The number of cubes of sides 3 cm that can be cut from a cuboid of dimensions 10 cm × 9 cm × 6 cm, is
(a) 9
(b) 10
(c) 18
(d) 20

Solution 15

$$\text{Volume of cuboid} = 10 \text{ cm} \times 9 \text{ cm} \times 6 \text{ cm} = 540 \text{ cm}^2$$

$$\text{Volume of Cube} = (3 \times 3 \times 3) \text{ cm}^3 = 27 \text{ cm}^3$$

$$\text{No. of cubes that can be cut from a cuboid} = \frac{540}{27} = 20$$

Hence, correct option is (d).

Question 16

On a particular day, the rain fall recorded in a terrace 6 m long and 5 m broad is 15 cm. The quantity of water collected in the terrace is
(a) 300 litres
(b) 450 litres
(c) 3000 litres
(d) 4500 litres

Solution 16

Volume of water collected

$= 6 \text{ m} \times 5 \text{ m} \times \frac{15}{100} \text{m}$

$= \frac{450}{100} \text{m}^3$

$= 4.5 \text{ m}$

$= 4.5 \times 1000$ litres

$= 4500$ litres

Hence, correct option is (d).

Question 17

If A_1, A_2 and A_3 denote the areas of three adjacent faces of a cuboid, then its volume is

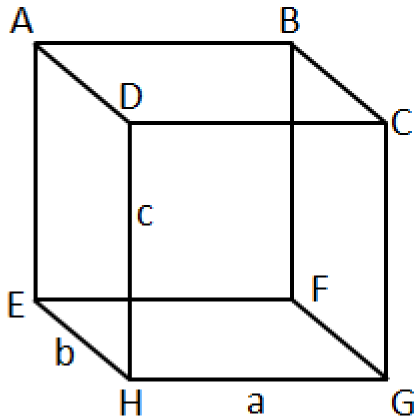
(a) $A_1 A_2 A_3$

(b) $2A_1 A_2 A_3$

(c) $\sqrt{A_1 A_2 A_3}$

(d) $\sqrt[3]{A_1 A_2 A_3}$

Solution 17



Let three adjacent faces be ADHE, DCGH, EHGF.

$A_1 = \text{ar(ADHE)} = bc$

$A_2 = \text{ar(DCGH)} = ca$

$A_3 = \text{ar(EHGH)} = ab$

Volume of cuboid $= abc$

Now, $A_1A_2A_3 = bc \times ca \times ab = a^2b^2c^2$

Also, we can write

$abc = \text{Volume of Cuboid} = \sqrt{a^2b^2c^2} = \sqrt{A_1A_2A_3}$

Hence, correct option is (c).

Question 18

If l is the length of a diagonal of a cube of volume V, then

(a) $3V = l^3$

(b) $\sqrt{3}V = l^3$

(c) $3\sqrt{3}V = 2l^3$

(d) $3\sqrt{3}V = l^3$

Solution 18

Length of diagonal of cube of side a $= \sqrt{3}a$

Volume, $V = a^3$

$\Rightarrow (V)^{1/3} = a$

Now, length of diagonal , $l = \sqrt{3}\,(V)^{1/3}$

$\Rightarrow l^3 = 3\sqrt{3}\,V$

Hence, correct option is (d).

Question 19

If V is the volume of a cuboid of dimensions x, y, z and A is its surface area, then $\frac{A}{V} =$

(a) $x^2y^2z^2$

(b) $\frac{1}{2}\left(\frac{1}{xy} + \frac{1}{yz} + \frac{1}{zx}\right)$

(c) $\frac{1}{2}\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)$

(d) $\frac{1}{xyz}$

Solution 19

Sides of a cuboid are x, y, z

Volume $= xyz = V$

Surface Area $= 2(xy + yz + zx) = A$

$$\frac{A}{V} = \frac{2(xy + yz + zx)}{xyz} = 2\left(\frac{1}{z} + \frac{1}{x} + \frac{1}{y}\right) = 2\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)$$

Hence, correct option is (c).

Question 20

The sum of the length, breadth and depth of a cuboid is 19 cm and its diagonal is $5\sqrt{5}$ cm. Its surface area is

(a) 361 cm^2

(b) 125 cm^2

(c) 236 cm^2

(d) 486 cm^2

Solution 20

If a, b, c are the sides of a cuboid, then

$a + b + c = 19$ cm

Length of diagonal $= 5\sqrt{5}$

$\Rightarrow \sqrt{a^2 + b^2 + c^2} = 5\sqrt{5}$

$\Rightarrow a^2 + b^2 + c^2 = (5\sqrt{5})^2 = 25 \times 5 = 125$ cm

Now, $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$

$\Rightarrow (19)^2 = 125 +$ Surface Area of Cuboid

$\Rightarrow$ Surface Area of a Cuboid $= 361 - 125 = 236\ cm^2$

Hence, correct option is (c).

Question 21

If each edge of a cube is increased by 50%, the percentage increase in its surface area is

(a) 50%

(b) 75%

(c) 100%

(d) 125%

Solution 21

Surface Area of a Cube of side a $= 6a^2$

If a is incresed by 50%,

$a'(\text{new side}) = a + \frac{a}{2} = \frac{3a}{2}$

So new Surface Area $= S' = 6a'^2 = 6\left(\frac{3a}{2}\right)^2 = \frac{6 \times 9 \times a^2}{4} = 13.5\ a^2$

Increase in area $= 13.5a^2 - 6a^2 = 7.5a^2$

% Increase $= \frac{7.5\cancel{a^2}}{6\cancel{a^2}} \times 100\% = 125\%$

Hence, correct option is (d).

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Question 22

A cube whose volume is 1/8 cubic centimeter is placed on top of a cube whose volume is 1 cm^3. The two cubes are then placed on top of a third cube whose volume is 8 cm^3. The height of the stacked cubes is

(a) 3.5 cm

(b) 3 cm

(c) 7 cm

(d) none of these

Solution 22

Side of cube whose volume is $\frac{1}{8} cm^3 = \left(\frac{1}{8}\right)^{1/3} = \frac{1}{2}$ cm $\{V = (a)^3\}$

Side of Second cube whose volume is 1 $cm^3 = (1)^{1/3} = 1$ cm

Side of Third cube whose volume is 8 $cm^3 = (8)^{1/3} = 2$ cm

1st Cube is placed on second and second on third,

then height of stacked cubes

= Sum of sides of all cubes

$= \left(\frac{1}{2} + 1 + 2\right)$ cm

$= 3.5$ cm

Hence, correct option is (a).

Chapter 18 - Surface Areas and Volume of a Cuboid and Cube Exercise Ex. 18.1

Question 1

Find the lateral surface area and total surface area of a cuboid of length 80 cm, breadth 40 cm and height 20 cm.

Solution 1

Here given,
Length = 80 cm
Breadth = 40 cm
Height = 20 cm

$$\begin{aligned}\text{Total surface area} &= 2\left(lb + bh + hl\right)\\ &= 2\left[80 \times 40 + 40 \times 20 + 80 \times 20\right]\\ &= 2\left[3200 + 800 + 1600\right]\\ &= 2\left[5600\right]\\ &= 11200\ \text{cm}^2\end{aligned}$$

$$\begin{aligned}\text{Lateral surface area} &= 2\left[l + b\right]h\\ &= 2\left[80 + 40\right] \times 20\\ &= 2 \times 120 \times 20\\ &= 4800\ \text{cm}^2\end{aligned}$$

Question 2
Find the lateral surface area and total surface area of a cube of edge 10 cm.

Solution 2
Given, edge 'a' of cube = 10 cm.

$$\begin{aligned}\text{Lateral surface area} &= 4a^2\\ &= 4 \times 100\\ &= 400\ \text{cm}^2\end{aligned}$$

$$\begin{aligned}\text{Total surface area} &= 6a^2\\ &= 6 \times 100\\ &= 600\ \text{cm}^2\end{aligned}$$

Question 3
Find the ratio of the total surface area and lateral surface area of a cube.

Solution 3
Total surface area = $TSA = 6a^2$.
Where, a = edge of cube.

And, lateral surface area = $LSA = 4a^2$
Where, a = edge of cube.

$\therefore$ Ratio of TSA and LSA is $\frac{6a^2}{4a^2}$ is $\frac{3}{2}$ is $3 : 2$

Question 4
Mary wants to decorate her Christmas tree. She wants to place the tree on a wooden block covered with coloured paper with picture of Santa Claus on it. She must know the exact quantity of paper to buy for this purpose. If the box has length, breadth and height as 80 cm, 40 cm and 20 cm respectively. How many square sheets of paper of side 40 cm would she require?

Solution 4

Since mary wants to paste the paper on the outer surface of the box; the quantity of paper required would be equal to the surface area of the box which is of the shape of a cuboid . The dimensions of the box are:

Length = 80cm, Breadth = 40 cm, Height = 20 cm.

The surface area of the box = 2(lb + bh + hl)

$$= 2[(80 \times 40) + (40 \times 20) + (20 \times 80)]\text{cm}^2$$

$$= 2[3200 + 800 + 1600]\ \text{cm}^2$$

$$= 2 \times 5600\ \text{cm}^2 = 11200\ \text{cm}^2$$

The area of each sheet of the paper = $40 \times 40\ \text{cm}^2$

$$= 1600\ \text{cm}^2$$

Therefore, number of sheets required = $\dfrac{\text{surface area of box}}{\text{area of one sheet of paper}}$

$$= \frac{11200}{1600} = 7$$

Question 5

The length, breadth and height of a room are 5m, 4m and 3m respectively.Find the cost of white washing the walls of the room and ceiling at the rate of Rs7.50m^2.

Solution 5

Total area to be white washed = $lb + 2(l + b)h$

Where, l = 5 m

b = 4 m

h = 3 m

$\therefore$ Total area to be white washed = $(5 \times 4) + 2(5 + 4) \times 3 = 20 + 54 = 74\,\text{m}^2$

Now,

Cost of white washing 1 m^2 is Rs 7.50

$\therefore$ Cost of white washing 74 m^2 is Rs (74×7.50) = Rs 555.

Question 6

Three equal cubes are placed adjacently in a row. Find the ratio of total surface area of the new cuboid to that of the sum of the surface areas of the three cubes.

Solution 6

Length of new cuboid = $3a$
Breadth of new cuboid = a
Height of new cuboid = a

Total surface area of new cuboid

$\Rightarrow (TSA)_1 = 2[lb + bh + hl]$

$\Rightarrow (TSA)_1 = 2[3a \times a + a \times a + 3a \times a]$

$\Rightarrow (TSA)_2 = 14a^2$

Total surface of three cubes

$\Rightarrow (TSA)_2 = 3 \times 6a^2$

$\Rightarrow (TSA)_2 = 18a^2$

$\therefore \dfrac{(TSA)_1}{(TSA)_2} = \dfrac{14a^2}{18a^2} = \dfrac{7}{9}$

$\therefore$ Ratio is 7 : 9.

Question 7

A 4 cm cube is cut into 1 cm cubes. Calculate the total surface area of all the small cubes.

Solution 7

Volume of 4 cm cube = $(4\text{ cm})^3$
$= 64\text{ cm}^3$

Volume of 1 cm cube = $(1\text{ cm})^3$
$= 1\text{cm}^3$

$\therefore$ Total number of small cubes = $\dfrac{64\text{ cm}^3}{1\text{ cm}^3} = 64$

$\therefore$ Total surface area of 64 small cubes

$= 64 \times 6 \times (1\text{ cm})^2$

$= 384\text{ cm}^2$

Question 8

The length of a hall is 18 m and the width is 12 m. The sum of the areas of the floor and the flat roof is equal to the sum of the areas of the four walls. Find the height of the hall.

Solution 8

Length of hall = 18 m
Width of hall = 12 m

Now given,
Areas of the floor and the flat roof = Sum of the areas of the four walls.

$\Rightarrow 2lb = 2lh + 2bh$

$\Rightarrow \quad lb = lh + bh$

$$\Rightarrow \quad h = \frac{lb}{l+b} = \frac{18 \times 12}{18+12} = \frac{216}{30}$$
$$= 7.2 \text{ m}$$

Question 9
Hameed has built a cubical water tank with lid for his house, with each outer edge 1.5 m long. He gets the outer surface of the tank excluding the base, covered with square tiles of side 25 cm. Find how much he would spend for the titles, if the cost of tiles is Rs. 360 per dozen.

Solution 9
Since Hameed is getting the five outer faces of the tank covered with titles, he would need to know the surface area of the tank, to decide on the number of tiles required.

Edge of the cubick tank = 1.5m = 150 cm (= a)

So, surface area of the tank = $5 \times 150 \times 150$ cm^2

$$\text{Area of each square title} = \frac{\text{surface area of the tank}}{\text{area of each title}}$$

$$= \frac{5 \times 150 \times 150}{25 \times 25} = 180$$

Cost of 1 dozen titles, i.e., cost of 12 tiles = Rs 360

Therefore, cost of one title = Rs $\frac{360}{12}$ = Rs 30

So the cost of 180 tiles = 180 $\times$ Rs 30= Rs 5400

Question 10
Each edge of a cube is increased by 50%. Find the percentage increase in the surface area of the cube.

Solution 10

Let 'a' be the edge of the cube.

$\therefore$ Surface area of the cube $= 6 \times a^2$

i.e., $s_1 = 6a^2$

According to question when edge is increased by 50% then new edge becomes

$= a + \frac{50}{100} \times a$

$= \frac{3}{2} a$

New surface area becomes $= 6 \times \left(\frac{3}{2} a\right)^2$

i.e., $s_2 = 6 \times \frac{9}{4} a^2$

$s_2 = \frac{27}{2} a^2$

$\therefore$ Increase in surface area $= \frac{27}{2} a^2 - 6a^2$

$= \frac{15}{2} a^2$

$\therefore$ % increase in surface area $= \frac{\frac{15}{2} a^2}{6a^2} \times 100$

$= \frac{15}{12} \times 100$

$= 125\%$

Question 11

A closed iron tank 12 m long, 9 m wide and 4 m deep is to be made. Determine the cost of iron sheet used at the rate of Rs 5 per metre sheet, sheet being 2 m wide.

Solution 11

Length = 12 m
Breadth = 9 m
Height = 4 m

$\therefore$ Total surface area of tank

$= 2(lb + bh + hl)$

$= 2[12 \times 9 + 9 \times 4 + 12 \times 4]$

$= 2[108 + 36 + 48]$

$= 384 \text{ m}^2$

$$\text{Now length of iron sheet} = \frac{384}{\text{width of iron sheet}}$$
$$= \frac{384}{2} = 192 \text{ m}$$

$$\text{Cost of iron sheet} = (\text{length of sheet}) \times (\text{cost rate})$$
$$= 192 \times 5$$
$$= \text{Rs } 960$$

Question 12
Ravish wanted to make a temporary shelter for his 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 x 3m?

Solution 12
Length of shelter = 4 m
Breadth of shelter = 3 m
Height of shelter = 2.5 m

The tarpaulin will be required for top and four sides of the shelter.
Area of Tarpaulin required = 2(lh + bh) + lb
= $[2(4 \times 2.5 + 3 \times 2.5) + 4 \times 3]$ m^2
= $[2(10 + 7.5) + 12]$ m^2
= 47 m^2

Question 13
An open box is made of wood 3 cm thick. Its external length, breadth and height are 1.48m, 1.16 m and 8.3 dm. Find the cost of painting the inner surface at Rs 50 per sq meter.

Solution 13

Given:

Outer dimensions:

length = 1.48m = 148 cm

breadth = 1.16m = 116 cm

height = 8.3 dm = 83 cm

Thickness of wood = 3 cm

Therefore, Inner dimensions:

length = $(148 - 2 \times 3)$ cm = 142 cm

breadth = $(116 - 2 \times 3)$ cm = 110 cm

height = $(83 - 3)$ cm = 80 cm

Inner surface area: = $2(l+b)h + lb$

$= 2(142 + 110) \times 80 + 142 \times 110 \text{ cm}^2$
$= 55940 \text{ cm}^2$
$= 5.5940 \text{ m}^2$

Hence, cost of painting inner surface area:

= $5.5940 \times$ Rs 50

= Rs 279.70

Question 14

The dimensions of a room are 12.5 m by 9 m by 7 m. There are two doors and 4 windows in the room; each door measure 2.5 m by 1.2 m and each windows 1.5 m by 1 m. Find the cost of painting the walls at Rs 3.50 per square metre.

Solution 14

Length of room = 12.5 m
Breadth of room = 9 m
Height of room = 7 m

$\therefore$ Total surface area of 4 walls
$= 2(l + b)h$
$= 2(12.5 + 9) \times 7$
$= 301 \text{ m}^2$

Area of 2 doors $= 2[2.5 \times 1.2]$
$= 6 \text{ m}^2$

Area of 4 windows $= 4[1.5 \times 1]$
$= 6 \text{ m}^2$

Area to be painted on 4 walls
$= 301 - (6+6)$
$= 301 - 12 = 289 \text{ m}^2$

$\therefore$ Cost of painting $= 289 \times 3.50$
$= \text{Rs } 1011.5$

Question 15
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 cm × 10 cm × 7.5 cm can be painted out of this container?

Solution 15
Total surface area of one brick = 2(lb + bh + lh)
= [2(22.5 × 10 + 10 × 7.5 + 22.5 × 7.5)]cm^2
cm^2
= 2(225 + 75 + 168.75)
= (2 × 468.75) cm^2
= 937.5 cm^2
Let n number of bricks be painted by the container.
Area of n bricks = 937.5n cm^2
Area that can be painted by the container = 9.375 m^2 = 93750 cm^2
$\therefore$
93750 = 937.5n
n = 100
Thus, 100 bricks can be painted out by the container.

Question 16
The dimensions of a rectangular box are in the ratio of 2 : 3 : 4 and the difference between the cost of covering it with sheet of paper at the rates of Rs 8 and Rs 9.50 per m^2 is Rs 1248. Find the dimensions of the box.

Solution 16

Let the ratio be x

$\therefore$ Length $= 2x$
Breadth $= 3x$
Height $= 4x$

$$\therefore \text{ Total surface area} = 2(lb + bh + hl)$$
$$= 2\left[6x^2 + 12x^2 + 8x^2\right]$$
$$= 52x^2 \text{ m}^2$$

When cost is at Rs 8 per m^2

$$\therefore \text{ Total cost of } 52x^2\, m^2 = \text{Rs } 8 \times 52x^2$$
$$= \text{Rs } 416x^2$$

And when cost is at Rs 9.50 per m^2

$$\therefore \text{ Total cost of } 52x^2\, m^2 = \text{Rs } 9.50 \times 52x^2$$
$$= \text{Rs } 494x^2$$

$$\therefore \text{Difference in cost} = \text{Rs } 494x^2 - \text{Rs } 416x^2$$
$$\Rightarrow \quad 1248 = 494x^2 - 416x^2$$
$$\Rightarrow \quad 78x^2 = 1248$$
$$\Rightarrow \quad x^2 = 16$$
$$\Rightarrow \quad x = 4$$

$\therefore$ Length $= 2x = 2 \times 4 = 8$ m
Breadth $= 3x = 3 \times 4 = 12$ m
And height $= 4x = 4 \times 4 = 16$ m

Question 17

The cost of preparing the walls of a room 12 m long at the rate of Rs 1.35 per square meter is Rs 340.20 and the cost of matting the floor at 85 paise per square meter is Rs 91.80. Find the height of the room.

Solution 17

Length of room = 12m

Let height of room be 'h' m.

Area of 4 walls = $2(l+b) \times h$

According to question

$\Rightarrow 2(l+b) \times h \times 1.35 = 340.20$

$\Rightarrow 2(12+b) \times h \times 1.35 = 340.20$

$\Rightarrow (12+b) \times h = \dfrac{170.10}{1.35} = 126 \qquad ---(1)$

Also area of floor = $l \times b$

$\therefore\ l \times b \times 0.85 = 91.80$

$\Rightarrow 12 \times b \times 0.85 = 91.80$

$\Rightarrow \qquad b = 9\text{m} \qquad ---(2)$

Substituting b=9m in equation 1

$\Rightarrow \qquad (12+9) \times h = 126$

$\Rightarrow \qquad h = 6\text{ m}$

Question 18

The length and breadth of a hall are in the ratio 4 : 3 and its height is 5.5 metres. The cost of decorating its walls (including doors and windows) at Rs 6.60 per square metre is Rs 5082. Find the length and breadth of the room.

Solution 18

Let the length be 4x and breadth be 3x

Height = 5.5 m [given]

Now it is given that cost of decorating 4 walls at the rate of Rs 6.60 $/m^2$ is Rs 5082.

$\Rightarrow$ Area of four walls × rate = total cost of painting

$\Rightarrow 2[l+b] \times h \times 6.60 = 5082$

$\Rightarrow 2[4x+3x] \times 5.5 \times 6.6 = 5082$

$\Rightarrow 7x = \dfrac{5082}{5.5 \times 6.6 \times 2}$

$\Rightarrow 7x = 10$

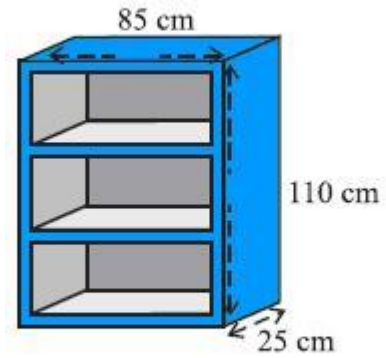
$\Rightarrow x = 10$

$\therefore$ Length = $4x = 4 \times 10 = 40\text{ m}$

Breadth = $3x = 3 \times 10 = 30\text{ m}$

Question 19

A wooden bookshelf has external dimensions as follows: Height = 110 cm, Depth = 25 cm, Breadth = 85 cm. 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^2 and the rate of painting is 10 paise per cm^2, find the total expenses required for polishing and painting the surface of the bookshelf.



Solution 19

External length (l) of bookshelf = 85 cm
External breadth (b) of bookshelf = 25 cm
External height (h) of bookshelf = 110 cm
External surface area of shelf while leaving front face of shelf
= lh + 2 (lb + bh)
= [85 $\times$ 110 + 2 (85 $\times$ 25 + 25 $\times$ 110)] cm^2
= 19100 cm^2
Area of front face = [85 $\times$ 110 - 75 $\times$ 100 + 2 (75 $\times$ 5)] cm^2
= 1850 + 750 cm^2
= 2600 cm^2
Area to be polished = (19100 + 2600) cm^2 = 21700 cm^2
Cost of polishing 1 cm^2 area = Rs 0.20
Cost of polishing 21700 cm^2 area = Rs (21700 $\times$ 0.20) = Rs 4340

Now, length (l), breadth (b) height (h) of each row of bookshelf is 75 cm, 20 cm, and 30cm $\left(=\frac{110-20}{3}\right)$ respectively.
Area to be painted in 1 row = 2 (l + h) b + lh
= [2 (75 + 30) $\times$ 20 + 75 $\times$ 30] cm^2
= (4200 + 2250) cm^2
= 6450 cm^2
Area to be painted in 3 rows = (3 $\times$ 6450) cm^2 = 19350 cm^2
Cost of painting 1 cm^2 area = Rs 0.10
Cost of painting 19350 cm^2 area = Rs (19350 $\times$ 0.10) = Rs 1935
Total expense required for polishing and painting the surface of the bookshelf
= Rs(4340 + 1935) = Rs 6275

Chapter 18 - Surface Areas and Volume of a Cuboid and Cube Exercise Ex. 18.2

Question 1

A cuboidal water tank is 6 m long, 5 m wide and 4.5 m deep. How, many litres of water can it holds?

Solution 1

Volume of tank = l $\times$ b $\times$ h = (6 $\times$ 5 $\times$ 4.5) m^3 = 135 m^3
It is given that:
1 m^3 = 1000 litres
$\therefore 135\ m^3 = (135 \times 1000)$ litres = 135000 litres

Thus, the tank can hold 135000 litres of water.

Question 2

A cuboidal vessel is 10 m long and 8 m wide. How high must it be made to hold 380 cubic metres of a liquid?

Solution 2

Let height of cuboidal vessel be h.
Length (l) of vessel = 10 m
Width (b) of vessel = 8 m

Volume of vessel = 380 m^3

$\therefore$ l $\times$ b $\times$ h = 380

10 $\times$ 8 $\times$ h = 380
h = 4.75

Thus, the height of the vessel should be 4.75 m.

Question 3
Find the cost of digging a cuboidal pit 8 m long, 6 m broad and 3 m deep at the rate of Rs 30 per m^3.

Solution 3
Length (l) of the cuboidal pit = 8 m
Width (b) of the cuboidal pit = 6 m
Depth (h) of the cuboidal pit = 3 m

Volume of the cuboidal pit = l $\times$ b $\times$ h = (8 $\times$ 6 $\times$ 3) m^3 = 144 m^3
Cost of digging 1 m^3 = Rs 30
Cost of digging 144 m^3 = Rs (144 $\times$ 30) = Rs 4320

Question 4
If the areas of three adjacent faces of a cuboid are 8 cm^2, 18 cm^3 and 25 cm^3.
Find the volume of the cuboid.

Solution 4
We know that if x, y, z denote the areas of three adjacent faces of a cuboid.
$\Rightarrow x = l \times b,\ y = b \times h,\ z = l \times h$

Volume V is given by
$V = l \times b \times h$

Now, $xyz = l \times b \times b \times h \times l \times h = V^2$

Here, $x = 8$
$y = 18$
And $z = 25$

$\therefore V^2 = 8 \times 18 \times 25 = 3600$

$\Rightarrow V = 60\ cm^3$

Question 5
The breadth of a room is twice its height, one half of its length
and the volume of the room is 512 cu.dm. Find its dimensions.

Solution 5

We have,

$b = 2h$ and $b = \dfrac{l}{2}$

$\Rightarrow \dfrac{l}{2} = 2h$

$\Rightarrow l = 4h$

$\Rightarrow l = 4h, b = 2h$

Now,

Volume = $512\,\text{dm}^3$

$\Rightarrow 4h \times 2h \times h = 512$

$\Rightarrow \quad h^3 = 64$

$\Rightarrow \quad h = 4$

So, $l = 4 \times h = 16\,\text{dm}$,

$b = 2 \times h = 8\,\text{dm}$

And $h = 4\,\text{dm}$

Question 6

Three metal cube cubes with edges 6 cm, 8 cm and 10 cm respectively are melted together and formed into a single cube. Find the volume, surface area and diagonal of the new cube.

Solution 6

Let the length of each edge of the new cube be a cm.

Then,

$a^3 = \left(6^3 + 8^3 + 10^3\right)\,\text{cm}^3$

$\Rightarrow a^3 = 1728$

$\Rightarrow a = 12$

$\therefore$ Volume of the new cube = $a^3 = 1728\,\text{cm}^3$

Surface area of the new cube = $6a^2 = 6 \times 12^2\,\text{cm}^2 = 864\,\text{cm}^2$

Diagonal of the new cube = $\sqrt{3}a = 12\sqrt{3}$ cm

Question 7

Two cubes, each of volume $512\,\text{cm}^3$ are joined end to end. Find the surface area of the resulting cuboid.

Solution 7

We have,

Volume of cube = 512

$\Rightarrow \quad side^3 = 512$

$\Rightarrow \quad side^3 = 8^3$

$\Rightarrow \quad side = 8 cm$

Dimensions of the new cuboid formed

$l = 8 + 8 = 16 cm$

$b = 8 cm$

$h = 8 cm$

$$\begin{aligned} \text{Surface area} &= 2(lb + bh + lh) \\ &= 2(16 \times 8 + 8 \times 8 + 8 \times 16) \\ &= 2(128 + 64 + 128) \\ &= 2(320) \\ &= 640 \text{ cm}^2 \end{aligned}$$

Hence, surface area = 640 cm^2

Question 8

A metal cube of edge 12 cm is melted and formed into three smaller cubes. If the edges of the two smaller cubes are 6 cm and 8 cm, Find the edge of the third smaller cube.

Solution 8

Volume of large cube = $V_1 + V_2 + V_3$

Let the edge of the third cube be x cm

$12^3 = 6^3 + 8^3 + x^3 \qquad [\because \text{volume of cube} = \text{side}^3]$

$1728 = 216 + 512 + x^3$

$1728 - 728 = x^3$

$\Rightarrow x^3 = 1000$

$\Rightarrow x = \sqrt[3]{1000} = 10 \text{ cm}$

$\therefore$ Side of third cube = 10 cm

Question 9

The dimensions of a cinema hall are 100 m, 50 m and 18 m.

How many person can sit in the hall, if each person requires 150 m^3 of air?

Solution 9

$$\text{Number of person who can sit in the hall} = \frac{\text{Volume of cinema hall}}{\text{Volume of air required by each person}}$$

$$= \frac{100 \times 50 \times 18 \text{ m}^3}{150 \text{ m}^3} = 600 \qquad [\because V = l \times b \times h]$$

$\therefore$ Number of person who can sit in the hall = 600

Question 10

Given that 1cubic cm of marble weighs 0.25kg, the weight of marble block 28 cm in width and 5cm thick is 112kg. Find the length of the block.

Solution 10

Let the length of the block be l cm.

Then,

$\text{Volume} = l \times 28 \times 5 \text{ cm}^3$

$\therefore \text{Weight} = 140 l \times 0.25 \text{kg}$

According to question

$\Rightarrow 112 = 140 l \times 0.25$

$\Rightarrow l = \dfrac{112}{140 \times 0.25} = 3.2 \text{ cm}$

Question 11

A box with lid is made of 2 cm thick wood. Its external length, breadth and height are 25 cm, 18 cm and 15 cm respectively. How much cubic cm of a liquid can be placed in it? Also, find the volume of the wood used in it.

Solution 11

External dimensions of the cuboid

$l = 25, b = 18, h = 15$

$\therefore \text{External volume} = 25 \times 18 \times 15 \qquad [\because V = l \times b \times h]$

$= 6750 \text{ cm}^3$

Internal dimension of the cuboid

$l = 25 - 2 \times \text{thickness} = 25 - 4 = 21 \text{ cm}$

$b = 18 - 4 = 14 \text{ cm}$

$h = 15 - 4 = 11 \text{ cm}$

$\therefore \text{Internal volume} = 21 \times 14 \times 11 \text{ cm}^3$

$= 3234 \text{ cm}^3$

$\therefore$ Volume of liquid that can be placed $= 3234 \text{ cm}^3$

Now, volume of wood = External volume – Internal volume

$= 6750 - 3234$

$= 3516 \text{ cm}^3$

Question 12

The external dimensions of a closed wooden box are 48cm, 36cm, 30cm. The box is made of 1.5cm thick wood. How many bricks of size $6 \text{ cm} \times 3 \text{ cm} \times 0.75 \text{ cm}$ can be put in this box?

Solution 12

Internal dimensions

$l = 48 - 2 \times \text{thickness} = 48 - 3 = 45 \text{ cm}$

$b = 36 - 3 = 33 \text{ cm}$

$h = 30 - 3 = 27 \text{ cm}$

$\therefore$ Internal volume $= 45 \times 33 \times 27 \text{ cm}^3$

Volume of brick $= 6 \times 3 \times 0.75 \text{ cm}^3$

$$\text{Hence, number of bricks} = \frac{\text{Internal volume}}{\text{Volume of 1brick}}$$
$$= \frac{45 \times 33 \times 27}{6 \times 3 \times 0.75}$$
$$= \frac{38880}{13.5}$$
$$= 2970$$

$\therefore$ 2970 bricks can be kept inside the box.

Question 13

A cube of 9 cm edge is immersed completely in a rectangular vessel containing water. If the dimensions of the base are 15 cm and 12 cm, find the rise in water level in the vessel.

Solution 13

Volume of cube $= s^3 = 9^3 = 729 \text{cm}^3$

Area of base $= l \times b = 15 \times 12 = 180 \text{cm}^2$

$$\text{Rise in water level} = \frac{\text{Volume of cube}}{\text{Area of base of the rectangular vessel}}$$
$$= \frac{729}{180} = 4.05 \text{ cm}$$

Question 14

A field is 200 m long and 150 m broad. There is a plot, 50 m long and 40 m broad, near the field. The plot is dug 7 m deep and the earth taken out is spread evenly on the field. By how many metres is the level of the field raised? Give the answer to the second place of decimal.

Solution 14

$$\text{Volume of earth dug out} = 50 \times 40 \times 7 \text{ m}^3$$
$$= 14000 \text{ m}^3$$

Let the height of the field rises by h metres

$\therefore$ Volume of field (cuboidal) = Volume of earth dugout

$$\Rightarrow 200 \times 150 \times h = 14000$$
$$\Rightarrow h = \frac{14000}{200 \times 150} = 0.47 \text{ m}$$

Question 15

A field is in the form of a rectangle of length 18 m and width 15 m. A pit, 7.5 m long, 6 m broad and 0.8 m deep, is dug in a corner of the field and the earth out is spread over the remaining area of the field. Find out the extent to which the level of the field has been raised.

Solution 15

Let the level of the field be risen by h metres.

Volume of the earth taken out from the pit = $7.5 \times 6 \times 0.8 \text{ m}^3$

Area of the field on which the earth taken out is to be spread
$= 18 \times 15 - 7.5 \times 6 = 225 \text{ m}^2$

Now, Area of the field $\times h$ = Volume of the earth taken out from the pit
$$\Rightarrow 225 \times h = 7.5 \times 6 \times 0.8$$
$$\Rightarrow h = \frac{36}{225} = 0.16 \text{ m} = 16 \text{ cm}$$

Question 16

A village, having a population of 4000, requires 150 litres of water per head per day. It has a tank measuring 20 m × 15 m × 6 m. For how many days will the water of this tank last?

Solution 16

Length (l) of the cuboidal tank = 20 m
Breadth (b) of the cuboidal tank = 15 m
Height (h) of the cuboidal tank = 6 m

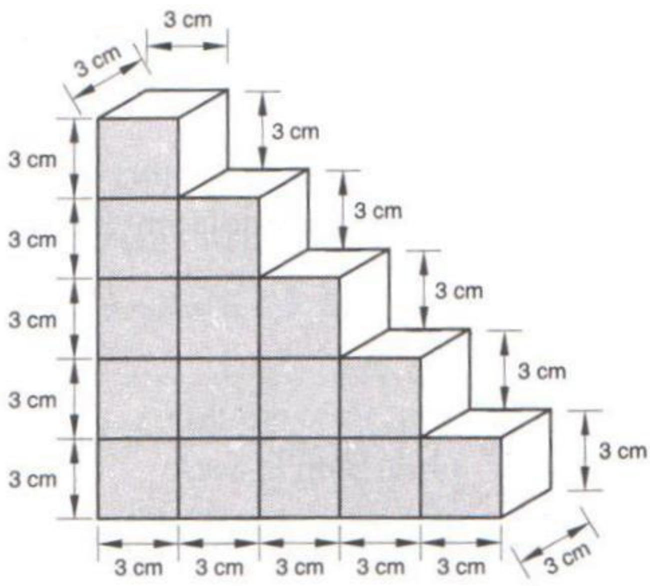
Capacity of tank = l × b × h = (20 × 15 × 6) m^3 = 1800 m^3 = 1800000 litres

Water consumed by people of village in 1 day = 4000 × 150 litres = 600000 litres

Let water of this tank lasts for n days.
Water consumed by all people of village in n days = capacity of tank
n × 600000 = 1800000
n = 3
Thus, the water of tank will last for 3 days.

Question 17

A child playing with building blocks, which are of the shape of the cubes, has built a structure as shown in fig. If the edge of each cube is 3 cm, find the volume of the structure built by the child



Solution 17

Volume of each cube = edge × edge × edge

$= 3 \times 3 \times 3 cm^3 = 27\ cm^3$

Number of cubes in the structure = 15

Therefore, volume of the structure = $27 \times 15\ cm^3$

$= 405\ cm^3$

Question 18

A godown measures 40 m $\times$ 25 m $\times$ 10 m. Find the maximum number of wooden crates each measuring 1.5 m $\times$ 1.25 m $\times$ 0.5 m that can be stored in the godown.

Solution 18

Length (l_1) of the godown = 40 m

Breadth (b_1) of the godown = 25 m

Height (h_1) of the godown = 10 m

Volume of godown = $l_1 \times b_1 \times h_1$ = (40 $\times$ 25 $\times$ 10) m^3 = 10000 m^3

Length (l_2) of a wooden crate = 1.5 m

Breadth (b_2) of a wooden crate = 1.25 m

Height (h_2) of a wooden crate = 0.5 m

Volume of a wooden crate = $l_2 \times b_2 \times h_2$ = (1.5 $\times$ 1.25 $\times$ 0.5) m3 = 0.9375 m^3

Let n wooden crates be stored in the godown.

Volume of n wooden crates = volume of godown

$0.9375 \times n = 10000$

$$n = \frac{10000}{0.9375} = 10666.66$$

Thus, 10666 wooden crates can be stored in godown.

Question 19

A wall of length 10 m was to be built across an open ground. The height of the wall is 4 m and thickness of the wall is 24 cm. If this wall is to be built up with bricks whose dimensions are 24 cm x 12 cm x 8 cm, how many bricks would be required?

Solution 19

Since the wall with all its bricks makes up the space occupied by it, we need to find the volume of the wall, which is nothing but a cuboid.

Here, Length = 10 m = 1000 cm

Thickness = 24 cm

Height = 4 m = 400 cm

Therefore, Volume of the wall = length $\times$ thickness $\times$ height

$= 1000 \times 24 \times 400 \text{ cm}^3$

Now, each brick is a cuboid with length = 24 cm, breadth = 12 cm and height = 8 cm

So, volume of each brick = length $\times$ breadth $\times$ height

$= 24 \times 12 \times 8 \text{ cm}^3$

So, number of bricks required = $\dfrac{\text{volume of the wall}}{\text{volume of each brick}}$

$$= \frac{1000 \times 24 \times 400}{24 \times 12 \times 8}$$

$= 4166.6$

So, the wall requires 4167 bricks.

Question 20

If v is the volume of a cuboid of dimensions a, b, c and s is its surface area, then prove that

$$\frac{1}{v} = \frac{2}{s}\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)$$

Solution 20

Here,
length = a,
Breadth = b,
Height = c

Volume = $l \times b \times h$
$= a \times b \times c$
$= abc$

surface area = $2(lb + bh + lh)$
$= 2(ab + bc + ac)$

Now, $\frac{2}{s}\left[\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right] = \frac{2}{2(ab+bc+ac)}\left[\frac{(bc+ac+ab)}{abc}\right] = \frac{1}{abc} = \frac{1}{v}$

Question 21

The areas of three adjacent faces of a cuboid are x, y and z.
If the volume is V, prove that
$V^2 = xyz$.

Solution 21

Let a, b, c be the length, breadth and height of the cuboid.

Then,
$x = ab$,
$y = bc$,
$z = ca$ and
$V = abc$ [volume=l×b×h]

$\Rightarrow xyz = ab \times bc \times ca = (abc)^2$
and $V = abc$

$\Rightarrow V^2 = xyz$

Question 22

A river 3 m deep and 40 m wide is flowing at the rate of 2 km per hour. How much water will fall into the sea in a minute?

Solution 22

$$= \left(\frac{2000}{60}\right) \text{m / min} = \left(\frac{100}{3}\right) \text{m / min}$$

Rate of water flow = 2 km per hour
Depth (h) of river = 3 m
Width (b) of river = 40 m

$$= \left(\frac{100}{3} \times 40 \times 3\right) \text{m}^3 = 4000 \text{m}^3$$

Volume of water flowed in 1 min

Thus, in 1 minute 4000 m^3 = 4000000 litres of water will fall into the sea.

Question 23

Water in a canal 30 dm wide and 12 dm deep, is flowing with a velocity of 100 km per hour. How much area will it irrigate in 30 minutes if 8 cm of standing water is desired?

Solution 23

Water in the canal forms a cuboid of width 30 dm = 3 m, height 12 dm = 1.2 m

Length of the cuboid is equal to the distance travelled in 30 minutes with the speed of 100 km per hour.

$\therefore$ Length of the cuboid $= 100 \times \frac{30}{60}$ km = 50000 metres.

So, volume of the water to be used for irrigation $= 50000 \times 3 \times 1.2\ m^3$

Water accumulated in the field forms a cuboid of base area equal to the area of the field and height equal to $\frac{8}{100}$ metre.

$\therefore$ Area of the field $\times \frac{8}{100} = 50000 \times 3 \times 1.2$

$\Rightarrow$ Area of the field $= \frac{50000 \times 3 \times 1.2 \times 100}{8} = 2250000$ metres

Question 24

Half cubic metre of gold-sheet is extended by hammering so as to cover an area of 1 hectare. Find the thickness of the gold-sheet.

Solution 24

$$\begin{aligned}\text{Thickness of gold-sheet} &= \frac{\text{Volume of gold}}{\text{Area of gold-sheet}}\\ &= \frac{0.5\,m^3}{1\text{Hectare}}\\ &= \frac{0.5\,m^3}{10000\,m^2} \qquad \left[\because 1\text{Hectare} = 10{,}000\,m^2\right]\\ &= \frac{5}{10000 \times 10}\ m\\ &= \frac{1}{20000} \times 100\ cm\end{aligned}$$

Thickness of gold-sheet $= \frac{1}{200}$ cm

Question 25

How many cubic centimetres of iron are there in an open box whose external dimensions are 36 cm, 25 cm and 16.5 cm, the iron being 1.5 cm thick throughout? If 1 cubic cm of iron weighs 15 g, find the weight of the empty box in kg.

Solution 25

Outer dimensions :
$l = 36$ cm
$b = 25$ cm
$h = 16.5$ cm

Inner dimensions:
$l = 36 - (2 \times 1.5) = 33$ cm
$b = 25 - 3 = 22$ cm
$h = 16.5 - 1.5 = 15$ cm

Volume of iron = outer volume – Inner volume

$$= (36 \times 25 \times 16.5 - 33 \times 22 \times 15)\ cm^3$$
$$= (14850 - 10890)\ cm^3$$
$$= 3960\ cm^3$$

Weight of iron = 3960×1.5 gm = 59400 gm = 59.4 kg

Question 26

A rectangular container, whose base is a square of side 5 cm, stands on a horizontal table, and holds water upto 1 cm from the top. When a cube is placed in the water it is completely submerged, the water rises to the top and 2 cubic cm of water overflows. Calculate the volume of the cube and also the length of its edge.

Solution 26

Let the length of each edge of the cube be x cm

Then,

Volume of the cube = volume of water inside the tank + volume of water that over flowed

$$x^3 = (5 \times 5 \times 1) + (2) = 25 + 2$$
$$x^3 = 27$$
$$x = 3\ cm$$

Hence, volume of cube = $27\ cm^3$

And edge of cube = 3 cm

Question 27

A rectangular tank is 80 m long and 25 m broad. Water flows into it through a pipe whose cross-section is 25 cm^2, at the rate of 16 km per hour. How much the level of the water rises in the tank in 45 minutes.

Solution 27

Let the level of water be risen by h cm.

Then,

Volume of water in the tank = $8000 \times 2500 \times h\ \text{cm}^2$

Area of cross-section of the pipe = $25\ \text{cm}^2$

Water coming out of the pipe forms a cuboid of base area $25\ \text{cm}^2$ and length equal to the distance travelled in 45 minutes with the speed of 16 km/hour.

i.e., Length = $16000 \times 100 \times \frac{45}{60}$ cm

$\therefore$ Volume of water coming out of the pipe in 45 minutes

$= 25 \times 16000 \times 100 \frac{45}{60}$

Now, Volume of water in the tank= Volume of water coming out of the pipe in 45 minutes

$\Rightarrow 8000 \times 2500 \times h = 16000 \times 100 \times \frac{45}{60} \times 25$

$\Rightarrow h = \frac{16000 \times 100 \times 45 \times 25}{8000 \times 2500 \times 60}$ cm = 1.5 cm

Question 28

Water in a rectangular reservoir having base 80 m by 60 m is 6.5 m deep. In what time can the water be emptied by a pipe of which the cross-section is a square of side 20 cm, if the water runs through the pipe at the rate of 15 km/hr.

Solution 28

Flow of water = 15 km/hr = 15000 m/hr

Volume of water coming out of the pipe in 1hr = $\frac{20}{100} \times \frac{20}{100} \times 15000 = 600\ \text{m}^3$

Volume of tank = $80 \times 60 \times 6.5 = 31200\ \text{m}^3$

$\therefore$ Time taken to empty the tank = $\frac{\text{Volume of tank}}{\text{Volume of water coming out of the pipe in 1hr}}$

$= \frac{31200}{600} = 52\text{hours}$