Exercise 21.1

Q 1. Find the volume of a cuboid whose:

i) Length = 12 cm, breadth = 8 cm and height = 6 cm

ii) length = 1.2 m, breadth = 30 cm ,height = 15 cm

iii) length = 1.5 dm, breadth = 2.5 dm, height = 8 cm

Soln:

i) In the given cuboid, we have:

Length = 12 cm, breadth = 8 cm and height = 6 cm

Therefore, Volume of the cuboid = length x breadth x height =12 x 8 x 6 = 576 cm^3

Therefore, Volume of the cuboid = 576 cm^3

ii) In the given cuboid, we have :

length = 1.2 m = 1.2 x 100 cm (1 m = 100 cm) = 120 cm

breadth = 30 cm

height=15 cm

Therefore, Volume of the cuboid = length x breadth x height = 120 x 30 x 15 = 54000 cm^3

Therefore, Volume of the cuboid = 54000 cm^3

iii) In the given cuboid, we have :

length = 1.5 dm = 1.5 x 10 (1 dm = 10 cm) = 15 cm

breadth = 2.5 dm =2.5 x 10 cm =25 cm

height = 8 cm

Therefore, Volume of cuboid = length x breadth x height = 15 x 25 x 8 = 3000 cm^3

Therefore, Volume of cuboid = 3000 cm^3

Q2. Find the volume of cube whose side is:

i) 4 cm

ii) 8 cm

iii) 1.5 dm

iv) 1.2 m

v) 25 mm

Soln:

i) The side of the given cube is 4 cm

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

Volume of the cube = 64 cm^3

ii) The side of the given cube is 8 cm

Therefore, Volume of the cube = $(\text{side})^3 = (8)^3 = 512\ cm^3$

Volume of the cube = 512 cm^3

iii) The side of the given cube is 1.5 dm = 1.5 dm x 10 cm = 15 cm

Therefore, Volume of the cube = $(\text{side})^3 = (15)^3 = 3375 \text{ cm}^3$

Volume of the cube = 3375 cm^3

iv) The side of the given cube is 1.2 m = 1.2 m x 100 = 120 cm

Therefore, Volume of the cube = $(\text{side})^3 = (120)^3 = 1728000 \text{ cm}^3$

Volume of the cube = 1728000 cm^3

v) The side of the given cube is 25 mm = 25 mm x 0.1 = 2.5 cm

Therefore, Volume of the cube = $(\text{side})^3 = (2.5)^3 = 15.625 \text{ cm}^3$

Volume of the cube = 15.625 cm^3

Q 3. Find the height of a cuboid of volume 100cm^3, whose length and breadth are 5 cm and 4 cm respectively.

Soln:

Let us suppose that the height of the cuboid is h cm.

Given :

Volume of the cuboid = 100 cm^3

Length = 5 cm

Breadth = 4 cm

Now, volume of the cuboid = length x breadth x height

$100 = 5 \times 4 \times h$

$h = \frac{100}{5x4} = \frac{100}{20} = 5$ cm

Therefore, h = 5 cm

Q 4. A cuboidal vessel is 10 cm long and 5 cm wide. How high must it be made to hold 300 cm^3 of a liquid?

Soln:

Let h cm be the height of the cuboidal vessel.

Given : Length = 10 cm

Breadth = 5 cm

Volume of the vessel = 300 cm^3

Now, volume of a cuboid = length x breadth x height

$300 = 10 \times 5 \times h$

$300 = 50 \times h$

Therefore, $h = \frac{300}{50} = 6$ cm

Therefore, h = 6 cm

Q 5. A milk container is 8 cm long and 50 cm wide. What should be its height so that it can hold 4 liters of milk?

Soln:

Length of the cuboidal milk container = 8 cm

Breadth = 50 cm

Let h cm be the height of the container.

It is given that the container can hold 4 L of milk.

i.e. , volume = 4 L = 4 x 1000 cm^3 = 4000 cm^3 (therefore, 1 L = 1000 cm^3)

Now, volume of the container = length x breadth x height

4000 = 8 x 50 x h

4000 = 400 x h

h = $\frac{4000}{400}$ = 10 cm

Therefore, the height of the milk container is 10 cm.

Q 6. A cuboidal wooden block contains 36 cm^3 wood. If it be 4 cm long and 3 cm wide, find its height.

Soln:

A cuboidal wooden block contains 36 cm^3 of wood

i.e. , volume = 36 cm^3

Length of the block = 4 cm

Breadth of block = 3 cm

Suppose that the height of the block is h cm

Now, volume of a cuboid = length x breadth x height

36 = 4 x 3 x h

36 = 12 x h

h = $\frac{36}{12}$ = 3 cm

Therefore, the height of the wooden block is 3 cm.

Q 7.What will happen to the volume of the cube , if its edge is :

i) Halved

ii) Trebled?

Soln:

(i) Suppose that the length of the edge of the cube is x.

Then, volume of the cube = (side)^3 = x^3

When the length of the side is halved, the length of the new edge becomes $\frac{x}{2}$

Now, volume of the new cube = (side)^3 = $(\frac{x}{2})^3$

= $\frac{x^3}{8}$

It means that if the edge of a cube is halved, its new volume will be $\frac{1}{8}$ times the initial volume.

(ii) Suppose that the length of the edge of the cube is x.

Then, volume of the cube = (side $)^3$ = x^3

When the length of the side is trebled, the length of the new edge becomes 3 x (x)

Now, volume of the new cube = (side $)^3$ = (3 x x $)^3$ = (3 $)^3$ = (x $)^3$= 27 x (x $)^3$

Thus, if the edge of a cube is trebled, its new volume will be 27 times the initial volume.

Q 8. What will happen to the volume of cuboid if its :

i) Length is doubled, height is same and breadth is halved?

ii) length is doubled, height is doubled and breadth is same?

Soln:

i) Suppose that the length, breadth, and height of the cuboid are l, b and h, respectively.

Then, volume = l x b x h

When its length is doubled, its length becomes 2 x l.

When its breadth is halved, its length becomes $\frac{b}{2}$

The height h remains the same.

Now, volume of the new cuboid = length x breadth x height

= 2 x l x h x $\frac{b}{2}$ = l x b x h .

Therefore, It can be observed that the new volume is the same as the initial volume.

So, there is no change in volume.

ii) Suppose that the length, breadth and height of the cuboid are l, b and h, respectively.

Then, volume = l x b x h

When its length is doubled, its length becomes 2 x l.

When its height is double, it becomes 2 x h.

The breadth b remains the same.

Now, volume of the new cuboid = length x breadth x-height

= 2 x l x b x 2 x h = 4 x l x b x h

Therefore, It can be observed that the volume of the new cuboid is four times the initial volume.

Q 9. Three cuboids of dimensions 5 cm x 6 cm x 7 cm , 4 cm x 7 cm x 8 cm and 2 cm x 3 cm x 13 cm are melted and a cube is made. Find the side of cube.

Soln:

The dimensions of the three cuboids are 5 cm x 6 cm x 7 cm, 4 cm x 7 cm x 8 cm and 2 cm x 3 cm x 13 cm

Now, a new cube is formed by melting the given cuboids.

Therefore, volume of the cube = sum of the volumes of the cuboids

= (5 cm x 6 cm x 7 cm) + (4 cm x 7 cm x 8 cm) + (2 cm x 3 cm x 13 cm)

= (210 cm^3) + (224 cm^3) + (78 cm^3) = 512 cm^3

Since Volume of a cube = (side $)^3$, we have :

512 cm^3 = (side $)^3$

(side) = $\sqrt[3]{512} = 8cm$

Therefore, the side of the new cube is 8 cm.

Q 10. Find the weight of a solid rectangular iron piece of size 50 cm x 40 cm x 10 cm, if 1 cm^3 of iron weighs 8 gm.

Soln :

The dimension of the rectangular piece of iron is 50 cm x 40 cm x 10 cm.

i.e. , volume = 50 cm x 40 cm x 10 cm = 20000 cm^3

It is given that the weight of 1 cm^3 of iron is 8 gm.

The weight of the given piece of iron = 20000 x 8 gm

= 160000 gm

= 160 x 1000 gm

= 160 kg (therefore, 1 kg = 1000 gm)

Q 11. How many wooden cubical blocks of side 25 cm can be cut from a log of wood of size 3 m by 75 cm by 50 cm, assuming that there is no wastage?

Soln :

The dimension of the log of wood is 3 m x 75 cm x 50 cm,

1. e. , 300 cm x 75 cm x 50 cm (therefore, 3 m = 100 cm)

therefore, Volume = 300 cm x 75 cm x 50 cm = 1125000 cm^3

It is given that the side of each cubical block of wood is of 25 cm.

Now, volume of one cubical block = (side)^3

= 25^3 = 15625 cm^3

Therefore, The required number of cubical blocks

$$= \frac{Volume of the wood log}{volume of one cubical block} = \frac{1125000 cm^3}{15625 cm^3} = 72$$

Q 12. A cuboidal block of silver is 9 cm long, 4 cm broad and 3.5 cm in height. From it, beads of volume 1.5 cm^3 each are to be made. Find the number of beads that can be made from the block.

Soln:

Length of the cuboidal block of silver = 9 cm

Breadth = 4 cm

Height = 3.5 cm

Now, volume of the cuboidal block = length x breadth x height = 9 x 4 x 3.5 = 126 cm^3

Therefore, The required number of beads of volume 1.5 cm^3 that can be made from the block

$$= \frac{Volume of the silver block}{volume of one beads} = \frac{126 cm^3}{1.5 cm^3} = 84$$

Q 13. Find the number of cuboidal boxes measuring 2 cm by 3 cm by 10 cm which can be stored in a carton whose dimensions are 40 cm, 36 cm, and 24 cm.

Soln :

Dimension of one cuboidal box = 2 cm x 3 cm x 10 cm

Volume = (2 x 3 x 10) cm^3 = 60 cm^3

It is given that the dimension of a carton is 40 cm x 36 cm x 24 cm, where the boxes can be stored. Therefore, Volume of the carton = (40 x 36 x 24) cm^3 = 34560 cm^3

Therefore, The required number of cuboidal boxes that can be stored in the carton

= $\frac{Volume of the carton}{volume of one cuboidal box} = \frac{34560cm^3}{60cm^3} = 576$

Q 14. A cuboidal block of solid iron has dimensions 50 cm, 45 cm and 34 cm. How many cuboids of size 5 cm by 3 cm by 2 cm can be obtained from this block? Assume cutting causes no wastage.

Soln :

Dimension of the cuboidal iron block = 50 cm x 45 cm x 34 cm

Volume of the iron block = length x breadth x height = (50 x 45 x 34) cm^3 = 76500 cm^3

It is given that the dimension of one small cuboids is 5 cm x 3 cm x 2 cm.

Volume of one small cuboid = length x breadth x height = (5 x 3 x 2) cm^3 = 30 cm^3

Therefore, The required number of small cuboids that can be obtained from the iron block

= $\frac{Volume of the iron block}{volume of one small cuboid} = \frac{76500cm^3}{30cm^3} = 2550$

Q 15. A cube A has side thrice as long as that of cube B. What is the ratio of the volume of cube A to that of cube B ?

Soln:

Suppose that the length of the side of cube B is l cm.

Then, the length of the side of cube A is 3 x l cm.

Now, ratio = $\frac{Volume of cube A}{volume of cube B}$

= $\frac{(3*l)cm^3}{(l)cm^3}$

= $\frac{27}{1}$

Therefore, the ratio of the volume of cube A to the volume of cube is 27 : 1

Q 16. An ice – cream brick measures 20 cm by 10 cm by 7 cm. How many such bricks can be stored in deep fridge whose inner dimensions are 100 cm by 50 cm by 42 cm ?

Soln:

Dimension of an ice cream brick = 20 cm x 10 cm x 7 cm

Its volume = length x breadth x height = (20 x 10 x 7) cm^3 = 1400 cm^3

Also, it is given that the inner dimension of the deep fridge is 100 cm x 50 cm x 42 cm.

Its volume = length x breadth x height = (100 x 50 x 42) cm^3 = 210000 cm^3

The number of ice cream bricks that can be stored in the fridge volume of the fridge 210000 cm^3

Now, ratio = $\frac{Volume of the fridge}{volume of an ice cream brick} = \frac{210000 cm^3}{(1400) cm^3} = \frac{150}{1}$

Q 17. Suppose that there are two cubes, having edges 2 cm and 4 cm, respectively. Find volumes V1 and V2 of the cubes and compare them.

Soln:

The edges of the two cubes are 2 cm and 4 cm.

Volume of the cube of side 2 cm, V1 = (side)^3 = (2)^3 = 8 cm^3

Volume of the cube of side 4 cm, V2 = (side)^3 = (4)^3 = 64 cm^3

We observe the following : V2 = 64 cm^3 = 8 x 8 cm^3 = 8 x V1

Therefore, V2 = 8V1

Q 18. A tea – packet measures 10 cm x 6 cm x 4 cm. how many such tea – packets can be placed in a cardboard box of dimensions 50 cm x 30 cm x 0.2 m?

Soln:

Dimension of a tea packet is 10 cm x 6 cm x 4 cm.

Volume of a tea packet = length x breadth x height = (10 x 6 x 4) cm^3 = 240 cm^3

Also, it is given that the dimension of the cardboard box is 50 cm x 30 cm x 0.2 m,

i.e., 50 cm x 30 cm x 20 cm (because 1 m = 100 cm)

Volume of the cardboard box = length x breadth x height = (50 x 30 x 20) cm^3 = 30000 cm^3

Therefore, The number of tea packets that can be placed inside the cardboard box

Now, ratio = $\frac{Volume of the box}{volume of a tea packet} = \frac{30000 cm^3}{(240) cm^3} = \frac{125}{1}$

Q 19. The weight of a metal block of size 5 cm by 4 cm by 3 cm is 1 kg. Find the weight of a block of the same metal of size 15 cm by 8 cm by 3 cm.

Soln:

The weight of the metal block of dimension 5 cm x 4 cm x 3 cm is 1 kg.

Its volume = length x breadth x height = (5 x 4 x 3) cm^3 = 60 cm^3

i.e. , the weight of 60 cm^3 of the metal is 1 kg

Again, the dimension of the other block which is of same metal is 15 cm x 8 cm x 3 cm.

Its volume = length x breadth x height = (15 x 8 x 3) cm^3 = 360 cm^3

Therefore, The weight of the required block = 360 cm^3 = 6 x 60 cm^3 (therefore, Weight of 60 cm^3 of the metal is 1 Kg) = 6 x 1 kg = 6 kg

Q 20. How many soap cakes can be placed in a box of size 56 cm x 0.4 cm x 0.25 m, if the size of a soap cake is 7 cm x 5 cm x 2.5 cm ?

Soln:

Dimension of a soap cake = 7cm x 5 cm x 2.5 cm

Its volume = length x breadth x height = (7 x 5 x 2.5) cm^3 = 87.5 cm^3

Also, the dimension of the box that contains the soap cakes is 56 cm x 0.4 m x 0.25 m,

i.e. , 56 cm x 40cm x 25 cm (because , 1 m = 100 cm).

Volume of the box = length x breadth x height = (56 x 40 x 25) cm = 56000 cm^3

Therefore, The number of soap cakes that can be placed inside the box

= $\frac{Volume of the box}{volume of a soap cake} = \frac{56000cm^3}{(87.5)cm^3} = \frac{640}{1}$

Q 21. The volume of a cuboidal box is 48 cm^3. If its height and length are 3 cm and 4 cm respectively, find its breadth.

Soln:

Suppose that the breadth of the box is b cm.

Volume of the cuboidal box = 48 cm^3

Height of the box = 3 cm

Length of the box = 4 cm

Now, volume of box = length x breadth x height

48 = 4 x b x 3

48 = 12 x b

b = $\frac{48}{12}$ = 4 cm

Therefore, the breadth of the cuboidal box is 4 cm.

Exercise 21.2

Q 1. Find the volume in cubic metre (cu .m) of each of the cuboids whose dimensions are :

i) Length = 12 m, Breadth = 10 m , height = 4.5 m

ii) Length = 4 m, Breadth = 2.5 m , height = 50 cm

iii) Length = 10 m, Breadth = 25 dm , height = 25 cm

Soln:

i) Length = 12 m

Breadth = 10 m

Height = 4. 5 m

Volume of the cuboid = length x breadth x height = 12 x 10 x 4.5 = 540 m^3

ii) Length = 4 m

Breadth = 2.5 m

Height = 50 cm

= $\frac{50}{100}$ m (therefore, 1 m = 100 cm)

Volume of the cuboid = length x breadth x height = 4 x 2.5 x 0.5 = 5 m^3

Q 2. Find the volume in cubic decimeter of each of the cubes whose side is :

i) 1.5 m

ii) 75 cm

iii) 2 dm 5 cm

Soln :

i) Side of the cube = 1.5 m

= 1.5 x 10 dm (Because 1 m = 10 dm)

= 15 dm

Therefore, Volume of the cube = $(\text{side})^3$ = $(15)^3$ = 3375 dm^3

ii) Side of the cube = 75 cm

= 75 x $\frac{1}{10}$ dm (because 1 dm = 10 cm)

= 7.5 dm

Therefore, Volume of the cube = $(\text{side})^3$ = $(7.5)^3$ = 421.875 dm^3

iii) Side of the cube = 2 dm 5 cm

= 2 dm + 5 x $\frac{1}{10}$ dm (Because 1 dm = 10 cm)

= 2 dm + 0.5 dm = 2.5 dm

Therefore, Volume of the cube = $(\text{side})^3$ = $(2.5)^3$ = 15.625 dm^3

Q3. How much clay is dug out in digging a well measuring 3 m by 2 m by 5 m ?

Soln:

The measure of well is 3 m x 2 m x 5 m

Therefore, volume of the clay dug out = (3 x 2 x 5) m^3 = 30 m^3

Q4. What will be the height of cuboid of volume 168 m^3 , if the area of its base is 28 m^2 ?

Soln:

Volume of the cuboid = 168 m^3

Area of its base = 28 m^2

Let h m be the height of the cuboid.

Now, we have the following :

Area of the rectangular base = length x breadth

Volume of the cuboid = length x breadth x height

Volume of the cuboid = (area of the base) x height

168 = 28 x h

h = $\frac{168}{28}$ = 6 cm

Therefore, the height of the cuboid is 6 m.

Q 5. A tank is 8 m long, 6 m broad and 2 m high. How much water can it contain ?

Soln:

Length of the tank = 8 m

Breadth = 6 m

Height = 2 m

Therefore, Its volume = length x breadth x height = (8 x 6 x 2) m^3 = 96 m^3

We know that 1m^3 = 1000 L

Now, 96 m^3 = 96 x 1000 L = 96000 L

Therefore, the tank can store 96000 L of water.

Q 6. The capacity of a certain cuboidal tank is 50000 litres of water. Find the breadth of the tank, if its height and length are 10 m and 2.5 m respectively.

Soln:

Capacity of the cuboidal tank = 50000 L

1000 L = 1 m^3

i.e. , 50000 L = 50 x 1000 litres = 50 m^3

Therefore, the volume of the tank is 50 m^3.

Also, it is given that the length of the tank is 10 m.

Height = 2.5 m

Suppose that the breadth of the tank is b m.

Now, volume of the cuboid = length x breadth x height

50 = 10 x b x 2.5

$50 = 25 \times b$

$b = \frac{50}{25} = 2$ cm

Therefore, the breadth of the tank is 2 m.

Q 7. A rectangular diesel tanker is 2 m long, 2 m wide and 40 cm deep. How many litres of diesel can it hold?

Soln:

Lenght of the rectangular diesel tanker = 2 m

Breadth = 2 m

Height = 40 cm

$= 40 \times \frac{1}{100}$ m (therefore, 1 m = 100 cm)

= 0.4 m

So, volume of the tanker = length x breadth x height

$= 2 \times 2 \times 0.4 = 1.6\ m^3$

We know that $1\ m^3 = 1000$ L

i.e., $1.6\ m^3 = 1.6 \times 1000$ L = 1600 L

Therefore, the tanker can hold 1600 L of diesel.

Q 8. The length, breadth, and height of a room are 5 m , 4.5 m and 3 m, respectively. Find the volume of the air it contains.

Soln:

Length of the room = 5 m

Breadth = 4.5 m

Height = 3 m

Now, volume = length x breadth x height

= 5 x 4. 5 x 3

= 67. 5 m^3

Therefore, the volume of air in the room is 67.5 m^3.

Q 9. A water tank is 3 m long, 2 m broad and 1 m deep. How many liters of water can it hold?

Soln:

Length of the water tank = 3 m

Breadth = 2 m

Height = 1 m

Volume of the water tank = 3 x 2 x 1= 6 m^3

We know that 1 m^3 = 1000 L

i.e. , 6 m^3 = 6 x 1000 L = 6000 L

Therefore, the water tank can hold 6000 L of water in it.

Q 10. How many planks each of which is 3 m long, 15 cm broad and 5 cm thick can be prepared from a wooden block 6 m long , 75 cm broad and 45 cm thick ?

Soln:

Length of the wooden block = 6 m

= 6 x 100 cm (Because 1 m = 100 cm)

= 600 cm

Breadth of the block = 75 cm

Height of the block = 45 cm

Volume of block = length x breadth x height = 600 x 75 x 45 = 2025000 cm^3

Again, it is given that the length of a plank = 3 m = 3 x 100 cm (because 1 m = 100 cm)

= 300 cm

Breadth = 15 cm

Height = 5 cm

Volume of the plank = length x breadth x height

= 300 x 15 x 5 = 22500 cm^3

Therefore, the number of such planks = $\frac{volume of the wooden block}{volume of a plank}$

= $\frac{2025000 cm^3}{22500 cm^3}$ = 90

Q 11. How many bricks will each of size 25 cm x 10 cm x 8 cm be required to build a wall 5 m long, 3 m high and 16 cm thick, assuming that the volume of sand and cement used in the construction is negligible?

Soln:

Dimension of a brick = 25 cm x 10 cm x 8 cm

Volume of a brick = 25 cm x 10 cm x 8 cm = 2000 cm^3

Also, it is given that the length of the wall is 5 m = 5 x 100 cm (Because 1 m = 100 cm) = 500 cm

Height of the wall = 3 m = 3 x 100 cm (because 1 m = 100 cm) = 300 cm

It is 16 cm thick, i.e. , breadth = 16 cm

Volume of the wall = length x breadth x height = 500 x 300 x 16 = 2400000 cm^3

Therefore, The number of bricks needed to build the wall = $\frac{volume of the wall}{volume of a brick}$

= $\frac{2400000 cm^3}{2000 cm^3}$ = 1200

Q 12. A village , having a population of 4000, requires 150 litres water per head per day. It has a tank which is 20 m long, 15 m broad and 6 m high. For how many days will the water of this tank last?

Soln:

A village has population of 4000 and every person needs 150 L of water a day.

So, the total requirement of water in a day = 4000 x 150 L = 600000 L

Also, it is given that the length of the water tank is 20 m.

Breadth = 15 m

Height = 6 m

Volume of the tank = length x breadth x height = 20 x 15 x 6 = 1800 m3

Now, 1 m3 = 1000 L

i.e. , 1800 m3 = 1800 x 1000 L = 1800000 L

The tank has 1800000 L of water in it and the whole village needs 600000 L per day.

Therefore, The water in the tank will last for $\frac{1800000cm^3}{600000cm^3}$ days, i.e., 3 days.

Q 13. A rectangular field is 70 m long and 60 m broad. A well of dimensions 14 m x 8 m x 6 m is dug outside the field and the earth dug – out from this well is spread evenly on the field. How much will the earth level rise ?

Soln:

Dimension of the well = 14 m x 8m x 6m

The volume of the dug – out earth = 14 x 8 x 6 = 672 m^3

Now, we will spread this dug – out earth on a field whose length, breadth and height are 70 m, 60 m and h m, respectively.

Volume of the dug – out earth = length x breadth x height = 70 x 60 x h

672 = 4200 x h

h = $\frac{672}{4200}$ = 0.16 m

We know that 1 m = 100 cm

Therefore, the earth level will rise by 0.16 m = 0.16 x 100 cm = 16 cm.

Q 14. A swimming pool is 250 m long and 130 m wide. 3250 cubic meters of water is pumped into it. Find the rise in the level of water.

Soln:

Length of the pool = 250 m

Breadth of the pool = 130 m

Also, it is given that 3250 m^3 of water is poured into it.

i.e. , volume of water in the pool = 3250 m^3

Suppose that the height of the water level is h m.

Then, volume of the water = length x breadth x height

3250 = 250 x 130 x h

3250 = 32500 x h

h = $\frac{3250}{32500}$ = 0.1 m

Therefore, the water level in the tank will rise by 0.1 m.

Q 15. A beam 5 m long and 40 cm wide contains 0.6 cubic meters of wood. How thick is the field on that day?

Soln:

Length of the beam = 5m

Breadth = 40 cm

= 40 x $\frac{1}{100}$ = 0.4 m (Because 100 cm = 1 m)

Suppose that the height of the beam is h m.

Also, it is given that the beam contains 0.6 cubic metre of wood.

i.e. , volume of the beam = 0.6 m^3

Now, volume of the cuboidal beam = length x breadth x height

6 = 5 x 0. 4 x h

0.6 = 2 x h

h = $\frac{0.6}{2}$ = 0.3 m

= 0.3 m

Therefore, the beam is 0.3 m thick.

Q 16. The rainfall on a certain day was 6 cm. How many liters of water fell on 3 hectares of the field on that day?

Soln:

The rainfall on a certain day = 6 cm

= $\frac{6}{100}$ = 0.06 m (Because 1 m = 100 cm) = 0.06 m

Area of the field = 3 hectares

We know that 1 hectare = 10000 m^2

i.e. , 3 hectares = 3 x 10000 m^2 = 30000 m^2

Thus, volume of rain water that fell in the field = (area of the field) x (height of rainfall)

= 30000 x 0.06 = 1800 m^3

Since 1 m^3 = 1000 L,

We have : 1800 m^3 = 1800 x 1000 L = 1800000 L = 18 x 100000 L = 18 x 10^5 L

Therefore, on that day, 18 x 10^5 L of rain water fell on the field.

Q 17. An 8 m long cuboidal beam of wood when sliced produces four thousand 1 cm cubes and there are no wastages of wood in this process. If one edge of the beam is 0.5 m, find the third edge.

Soln:

Length of the wooden beam = 8 m

Width = 0.5 m

Suppose that the height of the beam is h m

Then, its volume = length x width x height = 8 x 0.5 x h = 4 x h m^3

Also, it produces 4000 cubes, each of edge 1 cm = 1 x 1 m = 0.01 m (100 cm = 1 m)

Volume of a cube = $(side)^3 = (0.01)^3 = 0.000001\ m^3$

Volume of 4000 cubes = 4000 x 0.000001 = 0.004 m^3

Since there is no wastage of wood in preparing cubes, the volume of the 4000 cubes will be equal to the volume of the cuboidal beam.

i.e. , Volume of the cuboidal beam = volume of 4000 cubes

4 x h = 0.004

h = $\frac{0.004}{4}$ = 0.001 m

Therefore, the third edge of the cuboidal wooden beam is 0.001 m.

Q 18. The dimensions of a metal block are 2.25 m by 1.5 m by 27 cm. it is melted and recast into cubes, each of the side 45 cm. How many cubes are formed?

Soln:

Dimension of the metal block is 2.25 m x 1.5 m x 27 cm,

i.e. , 225 cm x 150 cm x 27 cm (1 m = 100 cm).

Volume of the metal block = 225 x 150 x 27 = 911250 cm^3

This metal block is melted and recast into cubes each of side 45 cm.

Volume of a cube = $(side)^3 = 45^3 = 91125\ cm^3$

The number of such cubes formed from the metal block

$= \frac{Volume of the metal block}{Volume of a metal cube}$

$= \frac{911250 cm^3}{91125 cm^3}$

= 10

Q 19. A solid rectangular piece of iron measures 6 cm by 6 cm by 2 cm. Find the weight of this piece, if 1 cm^3 of iron weighs 8 gm.

Soln:

The dimensions of the an iron piece is 6 m x 6 cm x 2 cm,

i.e. , 600 cm x 6 cm x 2 cm (therefore, 1 m = 100 cm).

Its volume = 600 x 6 x 2 = 7200 cm^3

Now, 1 cm^3 = 8 gm

i.e., 7200 cm^3 = 7200 x 8 gm = 57600 gm

Therefore, Weight of the iron piece = 57600 gm = 57600 x $\frac{1}{1000}$ kg (Because 1 Kg = 1000 gm) = 57.6 kg

Q 20. Fill in the blanks in each of the following so as to make the statement true :

i) 1 m3 = _______ cm^3

ii) 1 litre = _______ cubic decimeter

iii) 1 kl = _______ m^3

iv) the volume of a cube of side 8 cm is _______

v) the volume of a wooden cuboid of length 10 cm and breadth 8 cm is 4000 cm^3. The height of the cuboid is _____ cm

vi) 1 cu. dm = _______ cu. mm

vii) 1 cu . km = ______ cu . m

viii) 1 litre = _______ cu. cm

ix) 1 ml = ______ cu . cm

x) 1 kl = _______ cu. Dm = _____ cu. cm

Soln:

i) 1 m^3 = 1m x 1m x 1 m

= 100 cm x 100 cm x 100 cm (because 1 m = 100 cm)

= 1000000 cm^3 = 10^6 cm^3

ii) 1 L = $\frac{1}{1000}$ m^3

$= \frac{1}{1000} \times 1\text{ m} \times 1\text{ m} \times 1\text{ m}$

$= \frac{1}{1000} \times 10\text{ dm} \times 10\text{ dm} \times 10\text{ dm} = 1\text{ dm}^3$

iii) 1 kL = 1000 L

= 1 m^3 (1000 L = 1 m^3)

iv) Volume of a cube of side 8 cm = $\text{side}^3 = 8^3 = 512\text{ cm}^3$

v) Length of the wooden cuboid = 10 cm

Breadth = 8 cm

Its volume = 4000 cm^3

Suppose that the height of the cuboid is h cm

Then, Volume of the cuboid = length x breadth x height

4000 = 10 x 8 x h

4000 = 80 x h

$h = \frac{4000}{80} = 50\text{ cm}$

vi) 1 cu dm = 1 dm x 1 dm x 1 dm

= 100 mm x 100 mm x 100 mm

= 1000000 mm^3 = 10^6 cu mm

vii) 1 cu km = 1 km x 1 km x 1 km

= 1000 m x 1000 m x 1000 m (because 1 km = 1000 m) = 10^9 m^3

Exercise 21.3

1)

We have

i) length = 10 cm, breadth = 12 cm, height = 14 cm.

Surface area of cuboid $= 2(l\times b + b\times h \times h \times l)$

$= 2(10\times 12 + 12\times 14 \times 14\times 10)\ cm^2$

$= 2(120 + 168 + 140)\ cm^2$

$= 2(428)\ cm^2$

$= 856\ cm^2$.

ii) length = 6 dm, breadth = 8 dm, height = 10 dm.

Surface area $= 2(l\times b + b\times h + h\times l) = 2\times(6\times 8 + 8\times 10 + 10\times 6)\ dm^2$

$= 2(48 + 80 + 60) = 2(188)\ dm^2$

$= \underline{376\ dm^2}$

iii) length = 2 m, breadth = 4 m, height = 5 m.

Surface area $= 2(l\times b + b\times h + h\times l) = 2(2\times 4 + 4\times 5 + 5\times 2)\ m^2$

$= 2(8 + 20 + 10)\ m^2 = 2(38)\ m^2$

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

iv) length $= \underline{3.2\ m}$, breadth $= 30\,dm$, height $= 250\,cm$.

$\Rightarrow$ breadth $= \frac{30}{10}\ m = 3\ m$, height $= \frac{250}{100}\ m = \underline{2.5\ m}$

surface area $= 2(l\times b + b\times h + h\times l) = 2(3.2\times 3 + 3\times 2.5 + 2.5\times 3.2)$

$= 2(9.6 + 7.5 + 8)\ m^2 = 2(25.1)\ m^2$

$= 50.2\ m^2 = \underline{5020\ dm^2}$ $[\because 1m = 10dm]$

2)

We have,

i) side of cube $(l) = 1.2\,m$.

surface area of cube $= 6l^2 = 6(1.2)^2 = 6\times 1.44\ m^2$

$= \underline{8.64\ m^2}$

ii) Edge of cube $(l) = 27\,cm$.

surface area $= 6l^2 = 6\times(27)^2 = 6\times 729\ cm^2 = \underline{4374\ cm^2}$

iii) Edge of cube $(l) = 3\,cm$.

Surface area $= 6l^2 = 6\times(3)^2 = 6\times 9\ cm^2 = \underline{54\ cm^2}$

iv) Edge of cube $(l) = 6\,m$.

Surface area $= 6l^2 = 6\times(6)^2 = 6\times 36\ m^2 = \underline{216\ m^2}$

v) Edge of cube $(l) = 2.1\,m$.

surface area $= 6l^2 = 6\times(2.1)^2 = 6\times 4.41\ m^2 = \underline{26.46\ m^2}$

3)

We have,

cuboidal box of 5cm by 5cm by 4cm.

surface area of cuboid $= 2(l\times b + b\times h + h\times l)$

$= 2(5\times5 + 5\times4 + 4\times5)\ cm^2$

$= 2(25+20+20)\ cm^2$

$= 2(65)\ cm^2 = \underline{\underline{130\ cm^2}}$

4)

We have

i) volume of cube $= l^3 = 343\ m^3$

$\Rightarrow l^3 = 7^3\ m^3 \Rightarrow l = 7m$

$\therefore$ surface area of cube $= 6l^2 = 6(7)^2$

$= 6\times(49)\ m^2 = \underline{294\ m^2}$

ii) We have,

volume of cube $= l^3 = 216\ dm^3$

$\Rightarrow l^3 = 6^3\ dm^3 \Rightarrow l = 6dm.$

$\therefore$ Surface area $= 6l^2 = 6\times(6)^2 = 6\times36\ dm^2 = \underline{216\ dm^2}$

5)

We have

i) surface area of cube $= 96\ cm^2$

$\Rightarrow 6l^2 = 96\ cm^2 \Rightarrow l^2 = \frac{96}{6} = 16\ cm^2$

$\Rightarrow l = 4$ cm.

$\therefore$ Volume of cube $= l^3 = (4)^3\,cm^3 = \underline{64\,cm^3}$.

ii) Surface area of cube $= 150\,m^2$

$\Rightarrow 6l^2 = 150\,m^2 \Rightarrow l^2 = \frac{150}{6} = 25\,m^2$

$\Rightarrow l = 5\,m$.

$\therefore$ Volume of cube $= l^3 = (5)^3\,m^3 = \underline{125\,m^3}$

6)

We have,

Ratio of dimensions $= l : b : h = 5 : 3 : 1$

$\Rightarrow \frac{b}{h} = \frac{3}{1}$ and $\frac{l}{h} = \frac{5}{1}$

$\Rightarrow b = 3h$ and $l = 5h$.

Total surface area $= 2(l\times b + b\times h + h\times l) = 414\,m^2$

$\Rightarrow 2(5h\times 3h + 3h\times h + h\times 5h) = 414\,m^2$

$\Rightarrow 2(15h^2 + 3h^2 + 5h^2) = 414\,m^2$

$\Rightarrow 2(23h^2) = 414\,m^2 \Rightarrow 46h^2 = 414\,m^2$

$\Rightarrow h^2 = \frac{414}{46}\,m^2 \Rightarrow h^2 = 9\,m^2$

$\Rightarrow$ $h = 3m$.

$\therefore$ length $(l) = 5h = 5 \times 3 = 15m$.

Breadth $(b) = 3h = 3 \times 3 = 9m$

height $(h) = h = 3m$ are dimensions of cuboid.

7)

We have,

length $= 25cm$, breadth $= 0.5m = 0.5 \times 100$ cm $= 50cm$.

height $= 15cm$ of the box (closed).

Then,

Area of card board required = Total surface area of closed box

$\Rightarrow$ Area of card board required $= 2(l \times b + b \times h \times h \times l)$

$= 2(25 \times 50 + 50 \times 15 + 15 \times 25)$

$= 2(1250 + 750 + 375) \, cm^2$

$= 2(2375)$

Area of card board $= 4750 \, cm^2$.

8)

We have,

Edge of a cubic wooden box $= 12$ cm.

Surface area of cubic wooden box $= 6l^2 = 6 \times (12)^2 \, cm^2$

$= 6(144) \, cm^2$

$= 864 \, cm^2$

Exercise 21.4

Q 1. Find the length of the longest rod that can be placed in a room 12 m long, 9 m broad and 8 m high.

Soln:

Length of the room = 12 m

Breadth = 9 m

Height = 8 m

Since the room is cuboidal in shape, the length of the longest rod that can be placed in the room will be equal to the length of the diagonal between opposite vertices.

Length of the diagonal of the floor using the Pythagorus theorem

= $\sqrt{(l^2 + b^2)}$

= $\sqrt{(12^2 + 9^2)}$

= $\sqrt{(144 + 81)}$

= $\sqrt{(225)}$ = 15 m

i.e. , the length of the longest rod would be equal to the length of the diagonal of the right angle triangle of base 15 m and altitude 8 m.

Similarly, using the Pythagorus theorem, length of the diagonal

= $\sqrt{(15^2 + 8^2)}$

= $\sqrt{(225 + 64)}$ = 17 m

Therefore, the length of the longest rod that can be placed in the room is 17 m.

Q 2. If V is the volume of a cuboid of dimension a, b , c and S is its surface area, then prove that :

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

Soln:

It is given that V is the volume of a cuboid of length = a, breadth = b and height = c.

Also, S is the surface area of a cuboid.

Then, V = a x b x c

Surface area of the cuboid = 2 x (length x breadth + breadth x height + length x height)

= S = 2 x (a x b + b x c + a x c)

Let us take the right – hand side of the equation to be proven.

$\frac{2}{S}\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$

= $\frac{2}{2x(axb+bxc+axc)}x\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$

= $\frac{2}{2x(axb+bxc+axc)}x\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$

= $\frac{1}{(axb+bxc+axc)}x\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$

Now, multiplying the numerator and the denominator with a x b x c, we get :

= $\frac{1}{(axb+bxc+axc)}x\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$ X $\frac{axbxc}{axbxc}$

= $\frac{1}{(axb+bxc+axc)}x\left(\frac{axbxc}{a}+\frac{axbxc}{b}+\frac{axbxc}{c}\right)$ X $\frac{1}{axbxc}$

$= \frac{1}{(axb+bxc+axc)} x(bxc + axc + axb)x\frac{1}{axbxc}$

$= \frac{1}{(axb+bxc+axc)} x(axb + bxc + axc)x\frac{1}{axbxc}$

$= \frac{1}{axbxc} = \frac{1}{V}$

Therefore, $\frac{1}{V}$

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

Q 3. The area of three adjacent faces of a cuboid are x, y and z. If the volume is V, Prove that V^2 = x y z.

Soln:

The areas of three adjacent faces of a cuboid are x, y and z.

Volume of the cuboid = V

Observe, that x = length x breadth

y = breadth x height,

z = length x height

Since volume of cuboid V = length x breadth x height, we have :

V^2 = V x V

= (length x breadth x height) x (length x breadth x height) = (length x breadth) x (breadth x height) x (length x height)

= (x) x (y) x (z)

= x y z

Therefore, V^2 = x y z

Q 4. A rectangular water reservoir contains 105 m^3 of water. Find the depth of the water in the reservoir if its base measures 12 m by 3.5 m.

Soln:

Length of the rectangular water reservoir = 12 m

Breadth = 3.5 m

Suppose that the height of the reservoir = h m

Also, it contains 105 m^3 of water,

i.e. , its volume = 105 m^3

Volume of the cuboidal water reservoir = length x breadth x-height

105 = 12 x 3.5 x h

105 = 42 x h

h = $\frac{105}{42}$ = 2.5 m

Therefore, the depth of the water in the reservoir is 2.5 m.

Q 5. Cubes A, B, C, having edges 18 cm, 24 cm, and 30 cm respectively are melted and molded into a new cube D. Find the edge and bigger cube D.

Soln:

We have the following :

Length of the edge of cube A = 18 cm

Length of the edge of cube B = 24 cm

Length of the edge of cube C = 30 cm

The given cubes are melted and molded into a new cube D.

Hence, volume of cube D = volume of cube A + volume of cube B + volume of cube C

= (side of cube A) ^{3} + (side of cube B) ^{3} + (side of cube C) ^{3}

= $18^3 + 24^3 + 30^3$

= 5832 + 13824 + 27000

= 46656 cm^3

Suppose that the edge of the new cube D = x

$x^3 = 46656$

x = 36 cm

Therefore, the edge of the bigger cube D is 36 cm.

Q 6. 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 dimension.

Soln:

Suppose that the breadth of the room = x dm

Since breadth is twice the height, breadth = 2 x height

So, height of the room = breadth / 2 ;

Also, it is given that the breadth is half the length.

So, breadth = a x length

i.e , length = 2 x breadth = 2 x x

Since volume of the room = 512 cu dm, we have :

Volume of a cuboid = length x breadth x height

$512 = 2 \times (x) \times (x) \times \frac{x}{2}$

$x^3 = 512$

x = 8 dm

$512 = x^3$

x = 8 dm

Hence, length of the room = 2 x x = 2 x 8 = 16 dm

Breadth of the room = x = 8 dm

Height of the room = $\frac{x}{2} = \frac{8}{2}$ = 4 dm

Q 7. A closed iron tank 12 m long, 9m wide and 4 m deep is to be made. Determine the cost of an iron sheet used at the rate of Rs. 5 per meter sheet, the sheet being 2 m wide.

Soln:

A closed iron tank of dimensions 12 m long, 9 m wide and 4 m deep is to be made.

Surface area of the cuboidal tank = 2 x (length x breadth + breadth x height + length x height)

= 2 x (12 x 9 + 9 x 4 + 12 x 4)

= 2 x (108 + 36 + 48)

= 384 m^2

Also, the cost of an iron sheet is Rs 5 per metre and the sheet is 2 metres wide.

i.e. , area of a sheet = 1 m x 2 m = 2 m^2

So, the cost of 2 m^2 of iron sheet = Rs 5

i.e. , the cost of 1 m^2 of iron sheet = Rs $\frac{5}{2}$

Therefore, Cost of 384 m^2 of iron sheet = 384 x $\frac{5}{2}$

= Rs 960

Q 8. A tank open at the top is made of an iron sheet 4 m wide. If the dimensions of the tank are 12 m x 8 m x 6 m, find the cost of an iron sheet at Rs. 17.50 per meter.

Soln:

An open iron tank of dimensions 12 m x 8 m x 6 m is to be made.

Surface area of the open tank = (area of the base) + (total area of the 4 walls)

$= (12 \times 8) + 2 \times (8 \times 6 + 12 \times 6) = (96) + 2 \times (48 + 72) = 336\ m^2$

Also, it is given that the cost of the iron sheet that is 4 m wide is Rs 17.50 per metre.

i.e. , the area of the iron sheet = 1 m x 4 m = 4 m^2

So, the cost of 4 m^2 of iron sheet = Rs 17.50

The cost of iron sheet required to an iron tank of surface area 336 m^2 = $336 \times \frac{17.50}{4}$ = Rs. 1470.

Q 9. Three equal cubes are placed adjacently in a row. Find the ratio of the total surface area of the new cuboid to that of the sum of the surface areas of the three cubes.

Soln:

Suppose that the side of the cube = x cm

Surface area of the cube = 6 x $(side)^2 = 6 \times x^2 = 6x^2\ cm^2$

i.e. , the sum of the surface areas of three such cubes = $6x^2 + 6x^2 + 6x^2 = 18x^2\ cm^2$

Now, these three cubes area placed together to form a cuboid.

Then the length of the new cuboid will be 3 times the edge of the cube = 3 x x = 3 x cm

Breadth of the cuboid = x cm

Height of the cuboid = x cm

Therefore, Total surface area of the cuboid = 2 x (length x breadth + breadth x height + length x height)

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

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

$= 2 \times (7x^2)$

$= 14x^2$ cm

i.e., the ratio of the total surface area cuboid to the sum of the surface areas of the three cubes

$= 14x^2 \text{ cm}^2 : 18x^2 \text{ cm}^2 = 7 : 9$

Hence, the ratio is 7 : 9.

Q 10. The dimensions of a room are 12.5 m by 9 m by 7 m. there are 2 doors and 4 windows in the room; each door measures 2.5 m by 1.2 m and each window 1.5 m by 1 m. Find the cost of painting the walls at Rs. 3.50 per square meter.

Soln :

The dimensions of the room are 12.5 m x 9 m x 7 m.

Hence, the surface area of walls = 2 x (length x height + breadth x height)

$= 2 \times (12.5 \times 7 + 9 \times 7) = 301 \text{ m}^2$

Also, there are 2 doors and 4 windows in the room.

The dimensions of door are 2.5 m x 1.2 m.

2. e. , area of a door = 2.5 x 1.2 = 3 m^2

Therefore, Total area of 2 doors = 2 x 3 = 6 m^2

The dimensions of a window are 1.5 m x 1 m.

1. e. , area of a window = 1.5 x 1 = 1.5 m^2

Total area of 4 windows = 4 x 1.5 = 6 m^2

Hence, the total area to be painted = 301 − (6 + 6) = 289 m^2

The rate of painting 1 m^2 of wall = Rs 3.50

Therefore, the total cost of painting 289 m^2 of wall

= Rs 289 x 3.50 = Rs 1011.50

Q 11. A field is 150 m long and 100 m wide. A plot (outside the field) 50 m long and 30 m wide is dug to a depth of 8 m and the earth taken out from the plot is spread evenly in the field. By how much is the level of field raised?

Soln:

The dimensions of the plot dug outside the field are 50 m x 30 m x 8 m.

Hence, volume of the earth dug − out from the plot = 50 x 30 x 8 = 12000 m^3

Suppose that the level of the earth rises by hm.

When we spread this dug − out earth on the field of length 150 m, breadth 100 m and height h m, we have :

Volume of earth dug − out = 150 x 100 x h

12000 = 15000 x h

h = $\frac{12000}{15000}$ = 0.8 m

h = 80 cm (Because 1 m = 100 cm)

Therefore, the level of the field will rise by 80 cm.

Q 12. Two cubes, each of volume 512 cm^3 are joined end to end. Find the surface area of the resulting cuboid.

Soln:

Two cubes each of volume 512 cm^3 are joined end to end.

Now, volume of a cube = $(\text{side})^3$

$512 = (\text{side})^3$

Side of the cube = 8 cm

If the cubes are joined side by side, then the length of the resulting cuboid is

2 x 8 cm = 16 cm.

Breadth = 8 cm

Height = 8 cm

Surface area of the cuboid = 2 x (length x breadth + breadth x height + length x height)

$= 2 \times (16 \times 8 + 8 \times 8 + 16 \times 8) = 2 \times (128 + 64 + 128) = 640\ cm^2$

Q 13. Three cubes, each whose edges measure 3 cm, 4 cm and 5 cm respectively are melted to form a new cube. Find the surface area of the new cube formed.

Soln:

Three cubes of edges 3 cm, 4 cm and 5 cm are melted and molded to form a new cube.

i.e. , volume of the new cube = sum of the volumes of the three cubes

$= (3)^3 + (4)^3 + (5)^3$

$= 27 + 64 + 125$

$= 216 \text{ cm}^3$

We know that volume of a cube = $(\text{side})^3$

$216 = (\text{side})^3$

Side of the new cube = 6 cm

Therefore, Surface area of the new cube = $6 \times (\text{side})^2 = 6 \times (6)^2 = 216 \text{ cm}^2$

Q 14. The cost of preparing the walls of a room 12 m long at the rate of Rs. 1.35 per square meter is Rs. 304.20 and the cost of matting the floor at 85 paise per square meter is Rs. 91.80. Find the height of the room.

Soln:

The cost of preparing 4 walls of a room whose length is 12 m is Rs. 340.20 at a rate of Rs. 1.35 / m^2.

Area of the four walls of the room = $\frac{totalcost}{rate} = \frac{Rs.340.20}{Rs.1.35} = 252 \text{ m}^2$

Also, the cost of matting the floor at 85 paise /m^2 is Rs 91.80.

Therefore, Area of the floor = $\frac{totalcost}{rate} = \frac{Rs.91.80}{Rs.0.85} = 108 \text{ m}^2$

Hence, breadth of the room = $\frac{areaofthefloor}{length} = \frac{108}{12} = 9 \text{ m}^2$

Suppose that the height of the room is h m.

Then, we have :

Area of four walls = $2 \times (\text{length} \times \text{height} + \text{breadth} \times \text{height})$

$252 = 2 \times (12 \times h + 9 \times h)$

$252 = 2 \times (21 h)$

$21\ h = \frac{252}{21} = 126$

$h = \frac{126}{21} = 6$ m

Therefore, the height of the room is 6 m.

Q 15. The length of a hall is 18 m and the width 12 m. the sum of the area of the floor and the flat roof is equal to the sum of the area of the four walls. Find the height of the wall.

Soln:

Length of the hall = 18 m

Its width = 12 m

Suppose that the height of the wall is hm.

Also, sum of the areas of the floor and the flat roof

= sum of the areas of the four walls

= 2 x (length x breadth)

= 2 x (length + breadth) x height

= 2 x (18 x 12) = 2 x (18 + 12) x h

432 = 60 x h

$h = \frac{432}{60} = 7.\ 2$ m

Therefore, the height of wall is 7.2 m

Q 16. A metal cube 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.

Soln:

Let the edge of the third cube be x cm.

Three small cubes are formed by melting the cube of edge 12 cm.

Edges of two small cubes are 6 cm and 8 cm.

Now, volume of a cube = $(\text{ side })^3$

Volume of the big cube = sum of the volumes of the three small cubes

$(12)^3 = (6)^3 + (8)^3 + (x)^3$

$1728 = 216 + 512 + x^3$

$x^3 = 1728 - 728 = 1000$

x = 10 cm

Therefore, the edge of the third cube is 10 cm.

Q 17. The dimensions of a cinema hall are 100 m, 50 m and 18 m. How many people can sit in the hall, if each person requires 150 m^3 of air?

Soln:

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

i.e. , volume of air in the cinema hall = 100 x 50 x 18 = 90000 m^3

It is given that each person requires 150 m^3 of air.

Therefore, The number of persons that can sit in the cinema hall

$$= \frac{volume of air in hall}{Volume of air required by 1 person}$$

$= \frac{9000}{150} = 600$

Therefore, the number of persons that can sit in the cinema hall is 600

Q 18. The external dimensions of a closed wooden box are 48 cm, 36 cm, 30 cm. the box is made of 1.5 cm thick wood. How many bricks of size 6 cm x 3 cm x 0.75 cm can be put in this box?

Soln:

The outer dimensions of the closed wooden box are 48 cm x 36 cm x 30 cm.

Also, the box is made of a 1.5 cm thick wood, so the inner dimensions of the box will be (2 x 1.5 = 3) cm less.

i.e. , the inner dimensions of the box are 45 cm x 33 cm x 27 cm

Therefore, Volume of the box = 45 x 33 x 27 = 40095 cm^3

Also, the dimensions of a brick are 6 cm x 3 cm x 0.75 cm.

Volume of a brick = 6 x 3 x 0.75 = 13.5 cm^3

Therefore, The number of bricks that can be put in the box $= \frac{40095}{13.5} = 2970$

Q 19. The dimensions of a rectangular box are in the ratio of 2 : 3 : 4 and the difference between the cost of covering it with the 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.

Soln:

Suppose that the dimensions be x multiple of each other.

The dimensions are in the ratio 2 : 3 : 4.

Hence, length = 2x m

Breadth = 3x m

Height = 4x m

So, total surface area of the rectangular box = 2 x (length x breadth + breadth x height + length x height)

$= 2 \times (2x \times 3x + 3x \times 4x + 2x \times 4x)$

$= 2 \times (6x^2 + 12x^2 + 8x^2)$

$= 2 \times (26x^2)$

$= 52x^2 \ m^2$

Also, the cost of covering the box with paper at the rate Rs 8 /m^2 and Rs 9.50 / m^2 is Rs. 1248.

Here, the total cost of covering the box at a rate of its 8 /m^2 = $8 \times 52x^2$ = Rs. $416x^2$

And the total cost of covering the box at a rate of Rs 9.50 /m^2 = $9.50 \times 52x^2$ = Rs. $494x^2$

Now, total cost of covering the box at the rate Rs. 9.50 /m^2 – total cost of covering the box at the rate Rs 8/m^2 = 1248

$494x^2 - 416x^2 = 1248$

$78x^2 = 1248$

$x^2 = \frac{1248}{78} = 16$

x = 4 m

hence, length of the rectangular box = 2 x x = 2 x 4 = 8 m

Breadth = 3 x x = 3 x 4 = 12 m

height = 4 x x = 4 x 4 = 16 m