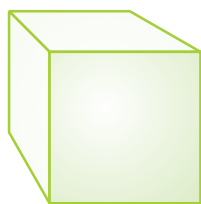




## Volume

To understand the concept of volume, you should know the difference between two-dimensional and three-dimensional figures or objects. Two-dimensional figures contain only length and breadth while three-dimensional figures or objects contain length, breadth and height.

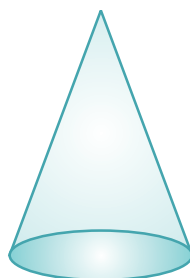
The amount of space occupied by a solid is known as the **volume** of the solid. Two solids with same shape and same size have the same volume, but two solids with same volume may not have the same shape or the same size. A cube, a cuboid, a cylinder, a cone and a sphere are examples of five various types of solids.



Cube



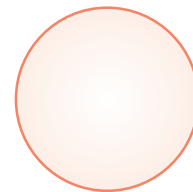
Cuboid



Cone



Cylinder



Sphere

A cube is a solid whose length, breadth and height are equal. Therefore, a cube is taken as the unit of solid to measure the amount of space that a solid occupies.

1 cubic millimeter is the volume of a cube of edge 1 mm and written as 1 cu. mm or  $1 \text{ mm}^3$ .

1 cubic centimetre is the volume of a cube of edge 1 cm and written as 1 cu. cm or  $1 \text{ cm}^3$ .

1 cubic metre is the volume of a cube of edge 1 m and written as 1 cu. m or  $1 \text{ m}^3$ .

The cubes of edges 1 mm, 1 cm and 1 m are taken as the standard units of measuring the volume.

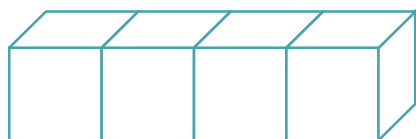




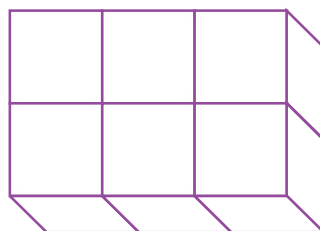
## To Find Volume by Counting Cubes

To find the volume of a rectangular solid (cuboids and cubes), we find the number of unit cubes which together make the given solid or fill up the entire space occupied by the solid.

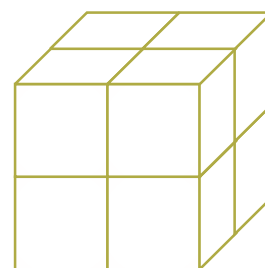
**For Example :** Determine the volume of the cuboid and cube given below :



**A**



**B**



**C**

Cuboid 'A' consists of four 1 cm cubes. So, the volume of the cuboid 'A' is 4 cu. cm.

Cuboid 'B' consists of six 1 cm cubes. So, the volume of the cuboid 'B' is 6 cu. cm.

Cube 'C' consists of eight 1 cm cubes. So, the volume of the cuboid 'C' is 8 cu. cm.



## Indirect Method of Determining Volume

Look at the given cube. Here, 1 cm cubes are placed in such a way that each edge of the cube so formed = 3 cm.

The number of 1 cm cubes in the given cube

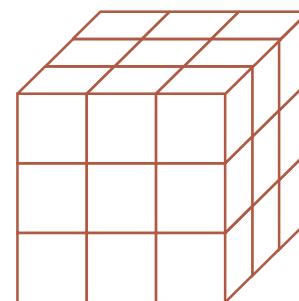
$$= 27 \text{ cu. cm or } 27 \text{ cm}^3$$

But,  $27 \text{ cu. cm} = 3 \text{ cm} \times 3 \text{ cm} \times 3 \text{ cm}$

$$= (\text{length of an edge}) \times (\text{length of an edge}) \times (\text{length of an edge})$$

Therefore, Volume of a cube

$$= (\text{length of an edge}) \times (\text{length of an edge}) \times (\text{length of an edge})$$



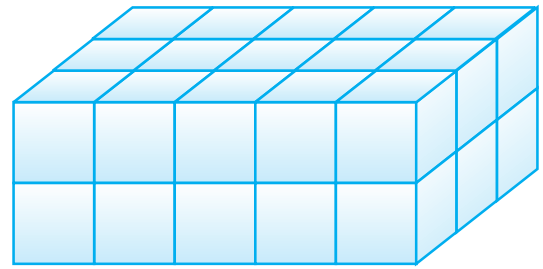


Look at the given cuboid.

The length of the cuboid = 5 cm

The breadth of the cuboid = 3 cm

The height of cuboid (thickness) = 2 cm



The number of 1 cm cubes in the given cuboid = 30 cubes =  $5 \times 3 \times 2$

We find that volume of the given cuboid with length 5 cm, breadth 3 cm and height 2 cm is 30 cu cm.

Therefore, Volume of a cuboid = length  $\times$  breadth  $\times$  height.

**Example I** : Find the volume of a cuboid whose length is 6 cm, breadth 5 cm and height 4 cm.

**Solution** : Volume of a cuboid = 6 cm  $\times$  5 cm  $\times$  4 cm = 120 cu. cm

**Example II** : Find the volume of a cube whose each edge is 6 cm long.

**Solution** : Volume of a cube = 6 cm  $\times$  6 cm  $\times$  6 cm  
 $= 6 \times 6 \times 6$  cu. cm = 216 m<sup>3</sup>

**Example III** : A pond is 25 m long, 22 m broad and  $3\frac{1}{11}$  m deep. Find the volume of the pond.

**Solution** : Volume of the pond =  $25 \text{ m} \times 22 \text{ m} \times \frac{34}{11} \text{ m}$   
 $= (25 \times 22 \times \frac{34}{11}) \text{ cu. m}$   
 $= 1700 \text{ m}^3$

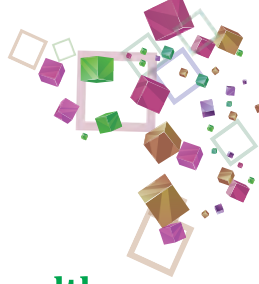
### Relationship Between Different Units of Volume

1 cm = 10 mm	1 cu. cm = 10 mm $\times$ 10 mm $\times$ 10 mm	
	= (10 $\times$ 10 $\times$ 10) cu. mm	= 1000 cu. mm
1 dm = 10 cm	1 cu. dm = (10 $\times$ 10 $\times$ 10) cu. cm	= 1000 cu. cm
1 m = 10 dm	1 cu. m = (10 $\times$ 10 $\times$ 10) cu. dm	= 1000 cu. dm
1 m = 100 cm	1 cu. m = (100 $\times$ 100 $\times$ 100) cu. cm	= 1000000 cu. cm





## Exercise 11.1



1. Find the volumes of rectangular solids whose dimensions (length, breadth and height) are given below.

- a. length = 12 cm, breadth = 3 cm, height = 2 cm
- b. length = 15 cm, breadth = 8 cm, height = 6 cm
- c. length = 16 cm, breadth = 14 cm, height = 6 cm
- d. length = 20 cm, breadth = 5 cm, height = 3 cm

2. A shoe box is 24 cm in length, 10 cm in breadth (width) and 5 cm in thickness (height). Find the volume of the shoe box.

3. A pond is 50 m long, 30 m wide and 2 m deep. Find the capacity of the pond in cubic metre.

4. A cuboid is 7 cm long, 4 cm broad and 3 cm high. A cube has an edge of 7 cm. Which one has a greater volume?

5. A room is 8 m long, 6 m broad and 4 m high. Find the volume of the room.

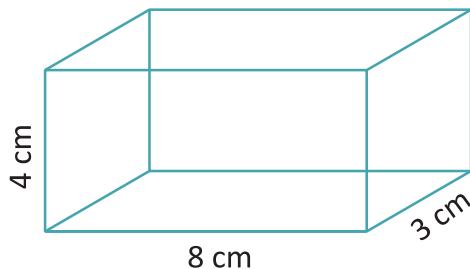
6. A wooden block is of length 12 cm, breadth 12 cm and height 12 cm. Find its volume.

7. Fill in the blanks.

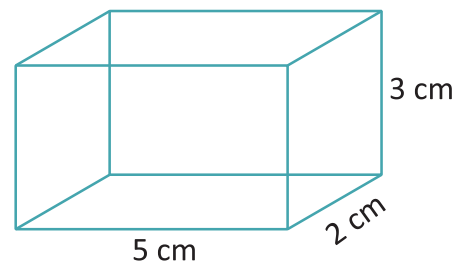
- a. The volume of a rectangular box (or cuboid) = .....  $\times$  .....  $\times$  .....
- b. The volume of a cube = .....  $\times$  .....  $\times$  .....
- c. The volume of a 1 cm cube is .....

8. Find the volume of the following rectangular solids.

a.



b.





# Nets

Let us see the shapes given below :



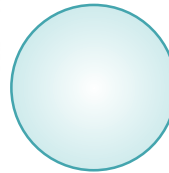
These shapes have only length and breadth, that is, 2-dimensions. These are 2-dimensional shapes.



Triangle



Square



Circle



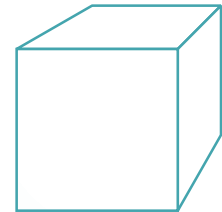
Rectangle



These shapes have length, breadth and height, that is, 3-dimensions. These are 3-dimensional shapes.



Cuboid



Cube

## Converting a 3-D Shape into a 2-D Shape

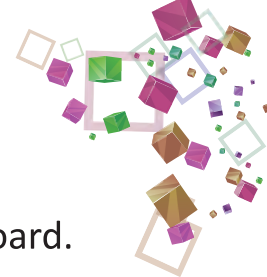
Take an empty pencil box and open it.



How many faces does it have? ..... How many faces does it have? .....

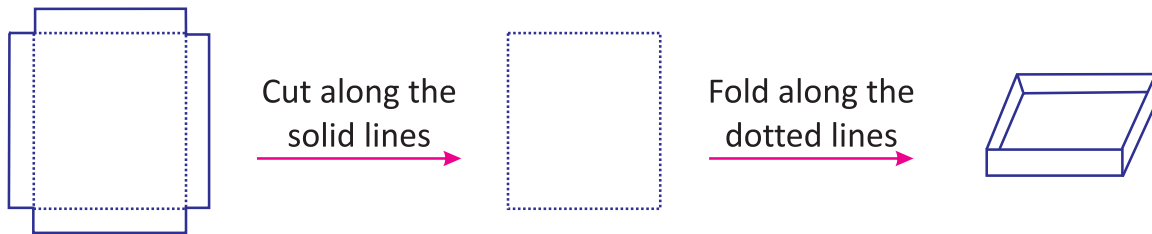
Does an open box have the same number of faces as the closed box? Yes / No





## Converting a 2-D Shape into a 3-D Shape

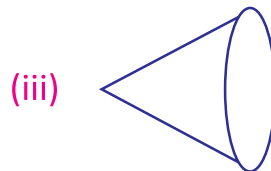
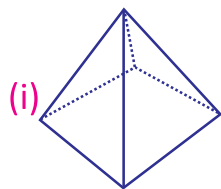
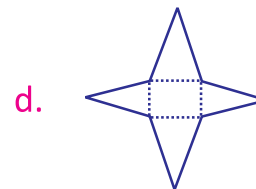
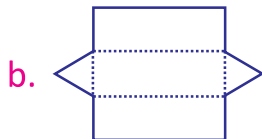
Take an A4 sheet of paper. Draw the shape (as shown) on it. Paste it on a cardboard.



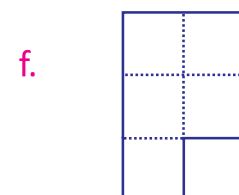
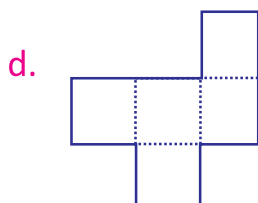
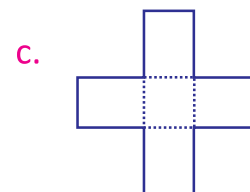
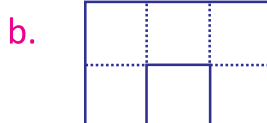
You have changed a ..... dimensional shape to a ..... dimensional shape.  
 A plane 2-dimensional shape used to make a 3-dimensional shape is called a **net**.  
 Nets are used to make layout plans of houses, buildings, bridges and so on.

### Exercise 11.2

#### 1. Match the following.



#### 2. Which of the following can be folded to make an open cubical box?

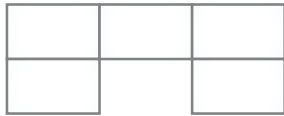
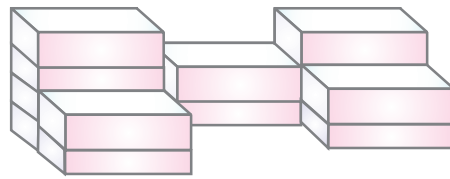






## Looking at the Shapes

Sometimes, when we look at a shape from different directions, we get different views. Ruby, John and Rohan made a model using matchboxes. Given are the views of model as looked from various directions.



View from the top



View from the front

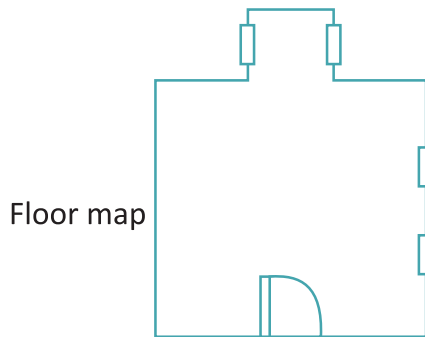


View from the side

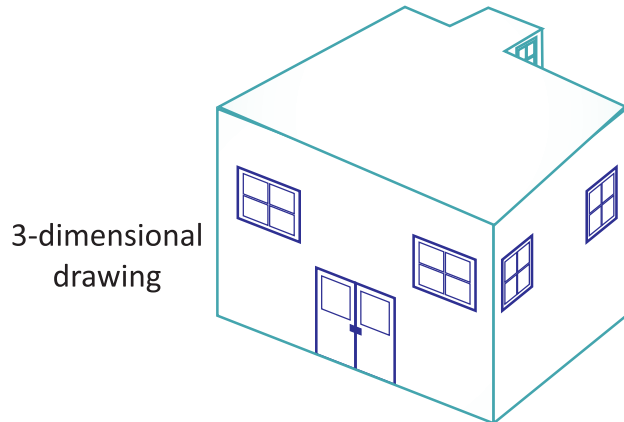
## Floor Map

Before building a house, an architect makes a floor map. A floor map is a 2-dimensional shape which gives an idea of where the doors and windows of the house will lie.

Look at the floor map and the 3-dimensional drawing of a house carefully. Write D for door and W for Windows on the floor map.



Floor map

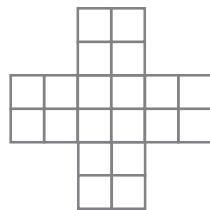
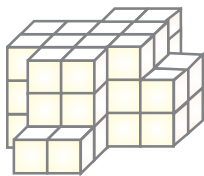


3-dimensional drawing

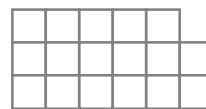


## Exercise 11.3

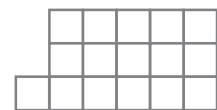
### 1. Colour the views to match the figures.



Top view



Front view

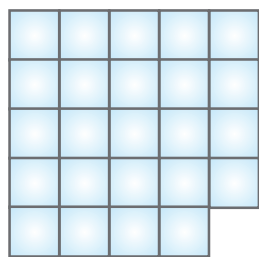


Side view

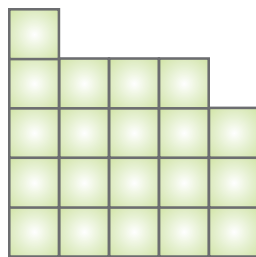




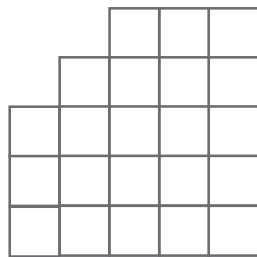
**2. Different views of a block diagram are given below. Colour the figure to match the views.**



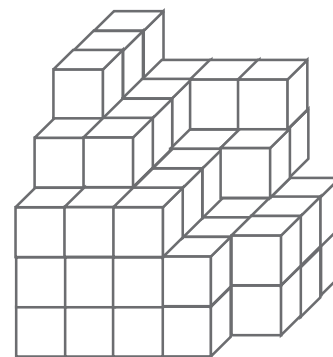
Top view



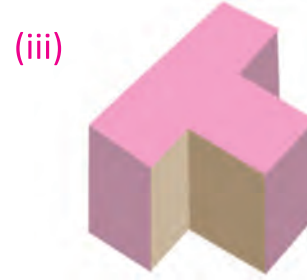
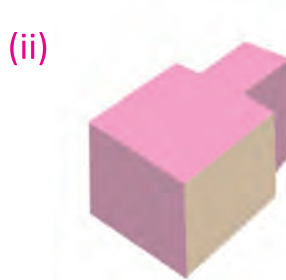
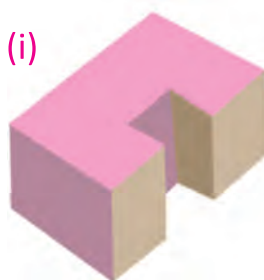
Front view



Side view



**3. Match the floor maps with their 3-dimensional drawings.**

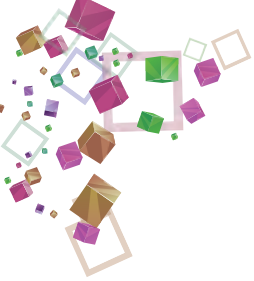


**Points to Remember**

- ❖ The amount of space occupied by a solid is called its volume.
- ❖ The different units of volume are cu. mm, cu. cm and cu. m.
- ❖ Volume of a cuboid = length × breadth × height
- ❖ 2-dimensional shapes have only two dimensions, length and breadth.
- ❖ 3-dimensional shapes have three dimensions, length, breadth and height.
- ❖ 1 m = 100 cm, 1 sq m = 10,000 sq cm, 1 cm = 10 mm, 1 sq cm = 100 sq mm







# EXERCISE

## 1. Multiple Choice Questions (MCQs)

Tick (✓) the correct option:

- a. A square has ..... dimension.
- (i) one  (ii) two  (iii) three  (iv) four
- b. A cuboid has ..... dimensions.
- (i) one  (ii) two  (iii) three  (iv) four
- c. The unit of volume is .....
- (i) cu. m  (ii) cu. mm  (iii) cu. cm  (iv) all of these
- d. Length × breadth × height is formula to calculate the volume of the .....
- (i) cube  (ii) cuboid  (iii) square  (iv) rectangle
- e. Nets are used to convert .....
- (i) 1-D to 2-D  (ii) 2-D to 3-D
- (iii) 3-D to 4-D  (iv) 3-D to 2-D

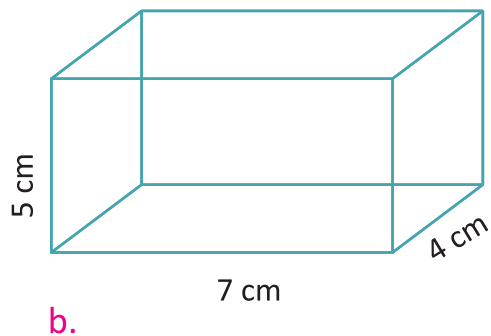
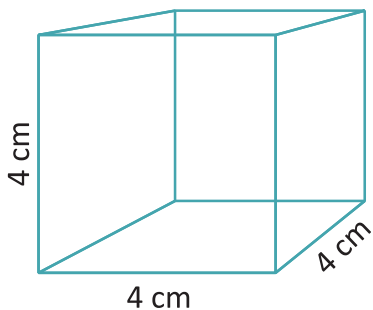
## 2. Find the no. of bricks to be laid in a square path of side 18 cm, if the side of each brick is 3 cm. Number of bricks would be :

- a. 28 cm                      b. 17 cm                      c. 63 cm                      d. 36 cm

## 3. Find the volume of the cuboid whose length, breadth and height are given as follows :

- a.  $l = 10 \text{ cm}, b = 8 \text{ cm}, h = 4 \text{ cm}$                       b.  $l = 8 \text{ cm}, b = 6 \text{ cm}, h = 2 \text{ cm}$
- c.  $l = 12 \text{ cm}, b = 10 \text{ cm}, h = 5 \text{ cm}$                       d.  $l = 6 \text{ cm}, b = 5 \text{ cm}, h = 3 \text{ cm}$

## 4. Find the volume of the following figures.



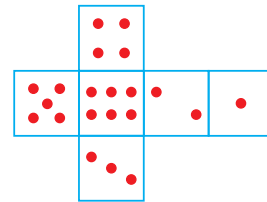


- Find the cost of painting a wall of length 80 m and breadth 15 m at the rate of Rs per sq m.
- A rectangular pond has 10,000 cubic m water. If its length is 50 m and breadth is 40 m then what is the depth of water in the pond?



HOTSPOTS

This cut-out can be folded to make a cube. Given below are some options. Circle the correct cubes.



### Lab Activity

**Objective**

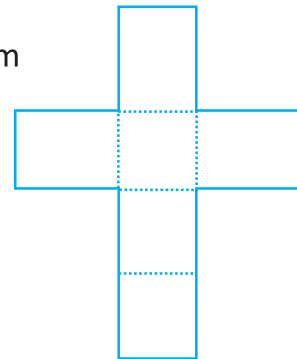
: Working with volume.

**Materials Required**

: Sheet of drawing paper, scale, pencil, a pair of scissors and tape to hold the folds together

#### Activities :

- Draw the figure alongside having 6 equal square surfaces of side 5 cm on a thick sheet of paper.
- Cut along the bold lines and fold on the dotted lines to make a cube.
- Use tape to hold the cube.
- Now, make an observation.



Volume of the cube = .....

The cube can be coloured and numbered to make it look like a dice to play.

### MENTAL MATHS



What is the shape of each object? Write Cube or Cuboid.

1.



2.



3.



4.



.....

.....

.....

.....

