

VOLUME

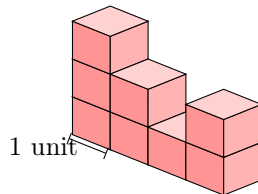
A DEFINITION

Definition Volume

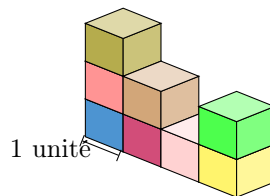
The **volume** of a shape is the amount of space it takes up in three dimensions. We measure it in cubic units, like cubic centimeters or cubic meters.

To find the volume, imagine filling the shape with small cubes, like building blocks. Count how many cubes fit inside the shape.

Ex: Find the volume:



Answer:



Volume = 8 cube units

B UNITS OF VOLUME

Definition Units of Volume

- Cubic Millimeter (mm^3): A very small unit of volume, about the size of a tiny grain of sand.

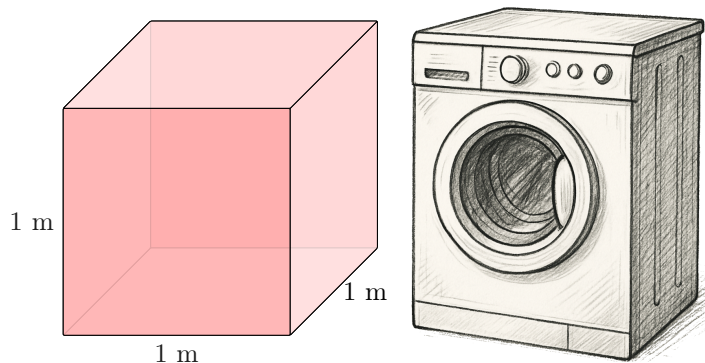
$$1 \text{ mm}^3 = 1 \text{ mm} \times 1 \text{ mm} \times 1 \text{ mm} \quad 1 \text{ mm} \times 1 \text{ mm} \times 1 \text{ mm} \quad \text{grain of sand}$$

- Cubic Centimeter (cm^3): A small unit of volume, about the size of a small ice cube.

$$1 \text{ cm}^3 = 1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm} \quad 1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm} \quad \text{ice cube}$$

- Cubic Meter (m^3): A larger unit of volume, about the space it takes for a washing machine.

$$1 \text{ m}^3 = 1 \text{ m} \times 1 \text{ m} \times 1 \text{ m}$$



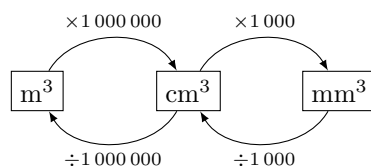
C CONVERSION OF VOLUME UNITS

Proposition Conversion of Volume Units

- $1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3$
- $1 \text{ cm}^3 = 1\,000 \text{ mm}^3$

Method Converting Using Multiplication or Division

- Use **multiplication** to go from a larger unit to a smaller one (like cubic meters to cubic centimeters).
- Use **division** to go from a smaller unit to a larger one (like cubic centimeters to cubic meters).



Method Converting Using a Table

To convert between units of volume, we can use a conversion table. For example, to convert 10.5 cubic meters to cubic centimeters:

1. Write the units in the table: m^3 , cm^3 , mm^3 .

m^3						cm^3			mm^3		

2. Place the number in the column of the unit you start with.

m^3						cm^3			mm^3		
	1	0.	5								

3. Fill in zeros in the columns to the right until you reach the unit you want to convert to.

m^3						cm^3			mm^3		
	1	0.	5	0	0	0	0	0			

4. Read the number in the column of the target unit.

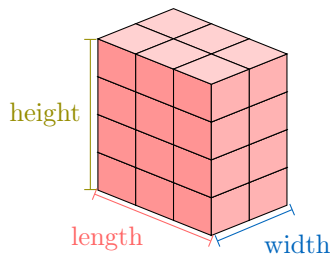
So, $10.5 \text{ m}^3 = 10\,500\,000 \text{ cm}^3$.

D VOLUME OF A RECTANGULAR CUBOID

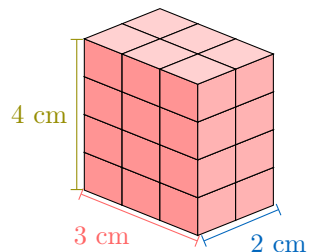
Proposition Volume of a Rectangular Cuboid

The volume of a rectangular prism is multiplying its length, width, and height:

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$



Ex: Find the volume:



Answer:

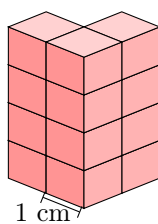
$$\begin{aligned}\text{Volume} &= \text{length} \times \text{width} \times \text{height} \\ &= 3 \times 2 \times 4 \\ &= 24 \text{ cm}^3\end{aligned}$$

E VOLUMES OF SOLIDS WITH UNIFORM CROSS-SECTION

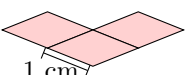
Proposition **Volume of Solid of Uniform Cross-Section**

$$\text{Volume} = \text{area of end} \times \text{height}$$

Ex: Find the volume of the figure



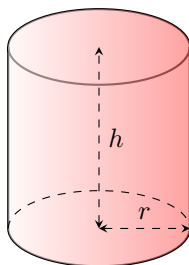
Answer:

- Area of  = 3 cm²
- height = 4 cm
-

$$\begin{aligned}V &= \text{area of end} \times \text{height} \\ &= 3 \text{ cm}^2 \times 4 \text{ cm} \\ &= 12 \text{ cm}^3\end{aligned}$$

Proposition **Volume of a Cylinder**

$$\text{Volume of a cylinder} = \pi r^2 h$$



F CAPACITY

We often need to measure liquids like water, milk, or juice. Instead of using cubic centimeters, there's an **easier way** to talk about these amounts: we use a unit called a **liter**. For example, instead of saying "1000 cubic centimeters," we can simply say "**1 liter**". This makes it much easier to understand how much liquid we have!

Definition Liter

A **liter** is a unit we use to measure the volume of liquids.

- 1 liter is the volume of a cube that measures 10 cm on each side.

$$1 \text{ L} = 1000 \text{ cm}^3 \text{ and } 1000 \text{ L} = 1 \text{ m}^3$$

- We write it with the symbol **L** (a capital "L").
- A smaller unit, the **centiliter** (cL), is often used for smaller volumes:

$$1 \text{ L} = 100 \text{ cL}$$

- An even smaller unit, the **milliliter** (mL), is used for very small volumes:

$$1 \text{ L} = 1000 \text{ mL} \text{ and } 1 \text{ cL} = 10 \text{ mL}$$

Ex:



- A big water bottle holds about 1 liter of water, which is 100 centiliters:



- A small soda can holds about 0.33 liters of soda, which is 33 centiliters: