



Box Builder

Mission: The toy factory ships building blocks in boxes. Fill boxes with unit cubes (one at a time, a row at a time, or a layer at a time) and discover a shortcut for finding volume without counting every cube.

Big question: Why does $V = \text{length} \times \text{width} \times \text{height}$ (or $\text{base} \times \text{height}$) find volume?

★ Warm-up: Estimation station

Estimate, then explain your thinking.

About how many sugar cubes would fill a tissue box? ✓ **Accept reasoned estimates (hundreds).**

A floor is 4 tiles by 3 tiles. How many tiles? ✓ **12.**

Key vocabulary

Volume	How many cubic units fill a solid.
Unit cube	A cube that is 1 unit long on each side (1 cubic unit).
Base (B)	The area of the bottom layer: $\text{length} \times \text{width}$.
Layer	One level of cubes in a box.

1 Box 1

Count smarter

How many cubes are in ONE layer of the $4 \times 3 \times 2$ box?

☐ 12 ☐ 4 ☐ 24 ☐ 7

✓ **12**

2 Box 2

Layer by layer

In the simulator: Use **+1 layer** to fill a $5 \times 2 \times 4$ box.

What is the volume?

Answer: _____ cubic units ✓ **40**

Show your thinking:

3 Box 3

Find the pattern

Build each box and record.

Box ($l \times w \times h$)	Cubes in 1 layer (B)	Layers (h)	Volume
$3 \times 3 \times 4$	9	4	36
$6 \times 2 \times 3$	12	3	36
$5 \times 4 \times 5$	20	5	100

4 Box 4

Write the rule

Which rule works for every box in your table?

- ☐ Volume = (cubes in one layer) $\times$ (number of layers) ☐ Volume = length + width + height
☐ Volume = length $\times$ width only ☐ Volume = 2 $\times$ height

✓ **Volume = (cubes in one layer) $\times$ (number of layers)**

5 Box 5

No cubes allowed

A toy box is 8 in. long, 5 in. wide, and 6 in. tall. What is its volume?

Answer: _____ cubic inches ✓ **240**

Show your thinking:

Order doesn't matter

Maya says $(8 \times 5) \times 6$ and $8 \times (5 \times 6)$ give different volumes. Is she right?

- ☐ No: both are 240. You can multiply in any order ☐ Yes ☐ Only if the box is a cube

✓ **No: both are 240. You can multiply in any order**

6 Box 6

Legend: missing height Legend only

A box has volume 120 cubic cm and a base of 6 cm by 4 cm. How tall is it?

Answer: _____ cm ✓ **5**

Show your thinking:

7 Box 7

Explain the formula

Explain why $V = B \times h$ works. Use the word "layer".

Look for: Uses layers; Connects to the base; Connects to height



Exit ticket: answer the big question in your own words

Why does $V = \text{length} \times \text{width} \times \text{height}$ (or $\text{base} \times \text{height}$) find volume?

Look for: Volume is the number of unit cubes that fill a solid. The bottom layer has length $\times$ width cubes (the base, B). Each layer is the same, so multiply the base by the number of layers (height): $V = l \times w \times h = B \times h$.



Completion codes

Students see a code like **ABC-I3** when they finish. The first part must match below. The letter is the level (E = Explorer, I = Investigator, L = Legend), and the number at the end is how many stars they earned.

Level	Code starts with
 Explorer	1RV-E
 Investigator	H3O-I
 Legend	1KF-L

 Watch for these misconceptions

- "Volume and area are the same." Area is 2-D square units; volume is 3-D cubic units.
- "Add the dimensions." Volume multiplies them.
- "Composite figures: multiply all the numbers you see." Split into separate prisms first.