

Volume: counting unit cubes (a first look)

CURRICULUM ALIGNMENT

MEA.MSR.3a

compare, estimate and measure length, weight, capacity, area and volume using appropriate instruments and record and communicate appropriately.

INTERACTIVES [Volume Builder · challenge, display, explore](#)

WHAT THIS LESSON TEACHES

Volume is how much space a solid fills. We find it by counting the equal unit cubes that fit inside, including any cubes hidden underneath or behind.

→ A box packed with 8 unit cubes has a volume of 8 cubes.

→ A two-layer stack still counts the bottom layer even when the top hides it.

MODEL THIS ON THE BOARD

COUNT THE CUBES IN A SMALL TOWER

- 1 Look at the tower built from unit cubes. The bottom layer has 2 cubes side by side.
- 2 A second layer sits on top with another 2 cubes.
- 3 Add the layers: $2 + 2 = 4$. The volume is 4 unit cubes.

DISCUSSION STARTER

REFLECT How is counting cubes for volume like counting squares for area?

LESSON ARC

Open with a small tower of building cubes on screen plus one loose cube as the unit — take three estimates for how many cubes hide inside. On the volume interactive, count a row of 3, then a $2 \times 2 \times 2$ box, holding out for the hidden bottom layer. Pupils drive the steppers at the board to build 4, 8 and 6 cubes, then build a 6-cube solid from real cubes and sketch it in their copy. Class Challenge matches targets up to 18.

TEACHING MOVES

1. **Getting Started.** Hold up a real stack and one loose cube. 'If this one cube is our unit, how many are hiding inside?' Take three hands-up estimates, not open call-outs — and don't reveal the count, the guess is the point.
2. **Watch and Notice.** Count the row of 3 by pointing to each cube in unison. On the $2 \times 2 \times 2$ box, stop before the total settles: 'four on the bottom, four on top — how many in all?' Let the class predict the hidden layer before the running count lands on 8.
3. **Try It Together.** Move one stepper at a time yourself first so pupils see width, height and depth each add cubes and change the live count. Then call a target, a pupil sets the steppers, the class reads the count to check. Before any two-layer total settles ask 'how many, counting the hidden layer?' Rotate three pupils across the three builds.
4. **Build and sketch in your copy.** Pupils build a solid from 6 real cubes, sketch it, and write the count underneath. Walk the room glancing for anyone who leaves a hidden cube out of their own count — this is practice, not marking.

5. **Class Challenge.** Brisk turn-taking at the board — pupils build to each target and press Check, class confirms before moving on. On the 18-cube box read it layer by layer: 'nine in one layer, nine behind — how many altogether?' Ask for the dimensions chosen before checking so pupils own the reasoning.
6. **What Did We Notice?.** Ask why we count cubes we can't see. Listen for 'they're really there and take up space.' Revoice a strong answer: 'the box would look full but we'd say it held fewer cubes than it really does.' Head off the idea that volume is only the outside layer.

COMMON MISCONCEPTIONS

⚠ Pupils count only the cubes they can see and skip the bottom or back layer — a $2 \times 2 \times 2$ box gets called '4' or '5' instead of 8.

Pause and pull the box apart on the interactive, or lift the top layer off a real stack, so the hidden layer is exposed. 'These cubes are really there — they take up space, so they count.' Rebuild and count layer by layer.

⚠ Pupils think each target has only one right shape — that '6 cubes' must be a single row.

On the 6-cube target, build a flat row, then an L, then a 3×2 slab side by side and count each to 6. 'Different shapes, same number of cubes, same volume.'

DIFFERENTIATION

EMERGING

- Keep these pupils on single-layer solids (a row, an L, a flat slab) so every cube is visible while the class moves to two-layer boxes.
- For the copybook build, hand them 6 real cubes already snapped into a flat 3×2 — they sketch and count rather than invent a stack.

DEVELOPING

- After the 8-cube box, ask them to predict the count of a $2 \times 2 \times 3$ box before building it, then check on the interactive.
- Give a missing-dimension puzzle: 'a box is 12 cubes and 2 wide, 2 high — how deep?'

PROFICIENT

- During Class Challenge, narrate a harder target for the fast finishers — 'build me a box of exactly 24 cubes, then tell me a different pair of dimensions that also make 24.' Have them justify why both work.
- Ask them to find every different box (not just any solid) that reaches 12 cubes and explain how they know they've found them all.

➤ **Cross-curricular:** Link to Geography — packing a shipping crate on a lorry: which cubes fill the hidden bottom layer we can't see from the door?

ANSWER KEY

a) 12 cubes

Q1: 3

Q2: 4

Q3: 4

Q4: 8

a) **Always** : That is the definition of volume for this lesson.

b) **Always** : Every cube that fills space counts, seen or unseen.

c) **Never** : Hidden cubes behind or under must be counted too.

d) **Sometimes** : True for two different shapes of 6 cubes each; false for shapes of 6 cubes and 8 cubes.

EXTENSION SHEET · STRETCH ANSWERS

S1: 75 cm^3

S3: 75 cm^3

S2: 60 cm^3