Grade 5 · Unit 1 · Assessment Guide

Finding Volume

For the Parent or Teacher — What to look for

Unit 1 introduces volume. The diagnostic is whether the student understands volume as the COUNT of unit cubes that fill a solid (and equivalently, the product of three perpendicular side lengths) — not just a formula to memorize. Watch especially for whether they see the layered structure of a prism and the additive nature of volume.

Problem 1 — Layered prism (12 cubes per face, 4 layers)

- Volume = 48 cubic units.
- Expression should be something like 12 x 4 or (3 x 4) x 4 — both reveal that they see the structure: one layer's count times number of layers.
- Strong: writes 3 x 4 x 4 and explains that each layer is 12 cubes.
- Weak: gives 48 with no expression, or writes 12 + 4 (adding rather than multiplying).

Problem 2 — Same 18 cubes, different shapes

- Yes, same volume (18). The shapes are different — different orientations and surface areas.
- ★ This is the key diagnostic that volume is preserved under rearrangement.
- Weak: says no because 'they look different.' Reveals confusion of volume with shape.

Problem 3 — 6 x 4 x 5 two ways

- Answer: 120 cubic cm both ways (e.g., 6 x 4 x 5 = 24 x 5 = 120; 4 x 5 x 6 = 20 x 6 = 120).
- ★ Strong explanation: associative/commutative property — multiplication does not depend on order.
- Weak: gets one answer right and the other wrong, suggesting they do not trust the commutative property.

Problem 4 — Base x height

- Volume = 24 x 7 = 168 cu cm.
- ★ Strong explanation: 'Base times height works because the base tells you how many cubes per layer, and the height tells you how many layers.'
- Possible base sides: 1x24, 2x12, 3x8, 4x6 — accept any factor pair.
- Weak: just multiplies 24 + 7, or does not understand why base x height equals total.

Problem 5 — Three expressions for 2 x 3 x 10

- All should equal 60. Accept any ordering: 2 x 3 x 10, 3 x 10 x 2, 10 x 2 x 3, etc.
- For the third (grouped): (2 x 3) x 10 = 6 x 10 = 60, or (3 x 10) x 2 = 30 x 2 = 60.
- ★ The property is associative (grouping) and commutative (order).

Problem 6 — Two prisms additive

- Prism A = 24; Prism B = 30; Total = 54.
- ★ Strong: explains volume is additive — the cubes in A plus the cubes in B equal the total.
- Weak: tries to multiply the volumes, or adds dimensions instead.

Problem 7 — L-shape (subtraction OR addition)

- Whole box: 8 x 4 x 3 = 96. Missing piece: 3 x 2 x 3 = 18. Final: 96 - 18 = 78.

- OR split into 8 x 4 x 3 minus the corner — same answer.
- ★ Strong: shows BOTH methods and they agree. Reveals flexible structural thinking.
- Weak: only one method, OR cannot make the subtraction work because they cannot visualize the missing piece.

Problem 8 — Mai's adding-sides error

- Volumes: 2x3x4 = 24; 1x4x6 = 24. Both equal 24 — they DO happen to be equal, but Mai's reasoning is wrong.
- ★ This is the trickiest problem: the conclusion happens to be right (volumes equal), but the rule is wrong.
- Strong: 'Mai is right that they're equal, but for the wrong reason — you MULTIPLY side lengths, you don't add them.'
- Weak: agrees with Mai's reasoning without checking, OR rejects the conclusion without verifying.

Problem 9 — Volume from one face + height

- Yes! V = 15 x 4 = 60 cubic inches. Base x height works regardless of what the base is.
- ★ Strong: 'Yes, because the face he sees IS the base. The other side length does not matter once you know base area.'
- Weak: says no because 'you need three side lengths.' Reveals they only know V = l x w x h, not V = B x h.

Problem 10 — Write your own volume story

- Strong: coherent context ('A fish tank is 60 cubic feet…'), and a reasonable side length triplet (e.g., 3 x 4 x 5 = 60, or 2 x 5 x 6 = 60, or 1 x 6 x 10 = 60).
- Weak: nonsense story; or side lengths don't multiply to 60.

Problem 11 — Pat's doubling claim

- All three operations should double the volume: 4x3x4 = 48; 2x6x4 = 48; 2x3x8 = 48. (Original is 2x3x4 = 24.)
- ★ Pat is RIGHT — doubling any one side doubles the volume. The diagnostic is whether the student tests it carefully and articulates why.
- Strong: 'Pat is right. Doubling one side doubles the cubes in the layer-stack, no matter which side.'
- Weak: tries one case and stops, or claims Pat is wrong without testing.

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