Measuring Volume with Unit Cubes

Measuring Volume with Unit Cubes: Apply, Compare, and Design

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

Each unit cube takes up one cubic unit of space. Count a complete layer, then count how many layers have that size. Add separate layer counts if the layers differ. Include hidden cubes, not just faces you can see.

Worked example

A 4 by 2 by 4 cube model must be restacked in exactly two complete layers. Use all the cubes. Give a possible new base.

1. Originally there are $4 \times 2 \times 4 = 32$ cubes.

2. Two layers need $32 \div 2 = 16$ cubes each. A 4 by 4 layer has $4 \times 4 = 16$.

Answer: For example, a 4 by 4 cube base.

Practice Problems

Show your thinking.

1. Use 30 unit cubes. For a 3 by 2 base and a 4 by 2 base, find the full layers you can build and the cubes left over. Which uses all cubes?

2. A solid has three 4 by 3 layers. Move 6 cubes from its top layer into a separate row beside it. Find the remaining solid volume and the combined volume.

3. Two designs must use 24 unit cubes. A uses a 3 by 2 base and B uses a 2 by 2 base, with full layers. Which design can stay at or below 5 layers?

4. Design a two-layer block and a three-layer block, each using 30 unit cubes. All layers must be full and each base edge can be at most 5 cubes.

5. A box fits 4 layers of 2 rows of 5 unit cubes. It holds two full layers plus 6 cubes in the third. How many more finish the third layer? How many more fill the box from now?

6. A block is 3 cubes long, 2 deep, and 4 high. Turn it so it is 2 cubes high. Compare cubes per layer before and after and state whether the volume changes.

7. Solid A has two full 5 by 2 layers and one top row of 5 cubes. Solid B is a full 3 by 3 by 3 cube. Which uses fewer cubes and by how many?

8. Build two blocks with the same number of complete layers. One base is 2 by 2 cubes and the other is 2 by 4. Use 36 cubes in all. Find the common height in layers and how many cubes each block uses.

Answer Key

1. 3 by 2: 5 layers, 0 left; 4 by 2: 3 layers, 6 left. Use 3 by 2.
2. Remaining solid 30 cubic units; combined 36 cubic units.
3. Only A. A needs 4 layers; B needs 6.
4. For example, 3 by 5 with 2 layers and 2 by 5 with 3 layers.
5. 4 cubes to finish layer 3; 14 to fill the box.
6. 6 per layer before; 12 after. Both have volume 24 cubic units.
7. A; 2 fewer cubes.
8. 3 layers each; 12 cubes in the smaller block and 24 in the larger.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. A 3 by 2 layer takes 6 cubes. $30 \div 6 = 5$ layers use all of them.

2. A 4 by 2 layer takes 8. Three layers use 24; four need 32. Leftover: $30 - 24 = 6$.

Problem 2

1. One layer has $4 \times 3 = 12$ cubes. Three layers have $3 \times 12 = 36$.

2. The solid keeps $36 - 6 = 30$ cubes; with the moved cubes, $30 + 6 = 36$ cubic units.

Problem 3

1. A uses $3 \times 2 = 6$ per layer, so $24 \div 6 = 4$ layers.

2. B uses $2 \times 2 = 4$ per layer, so $24 \div 4 = 6$. Only 4 is at most 5.

Problem 4

1. Two layers need $30 \div 2 = 15$ cubes per layer; $3 \times 5 = 15$.

2. Three layers need $30 \div 3 = 10$ per layer; $2 \times 5 = 10$. Both bases meet the edge limit.

Problem 5

1. A full layer takes $2 \times 5 = 10$ cubes. Layer 3 needs $10 - 6 = 4$ more.

2. Layer 4 needs another 10. From now, $4 + 10 = 14$ cubes fill the box.

Problem 6

1. Before: $3 \times 2 = 6$ per layer, with $6 \times 4 = 24$ cubes.

2. After: $3 \times 4 = 12$ per layer, with $12 \times 2 = 24$ cubes. No cubes were added or removed.

Problem 7

1. A uses $2 \times (5 \times 2) + 5 = 25$ cubes.

2. B uses $3 \times 3 \times 3 = 27$ cubes, so A uses $27 - 25 = 2$ fewer.

Problem 8

1. One layer across both bases uses $2 \times 2 + 2 \times 4 = 12$ cubes.

2. $36 \div 12 = 3$ layers. The blocks use $3 \times 4 = 12$ and $3 \times 8 = 24$ cubes.

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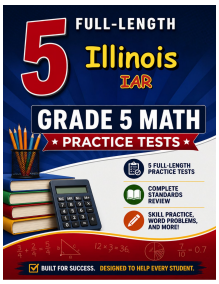

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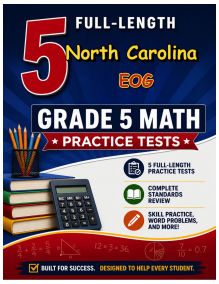

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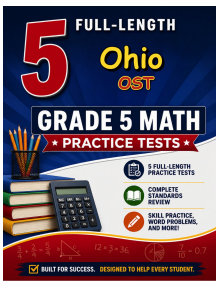

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