MD5-26 Stacking Blocks

1. How many blocks are in the shaded row?
   a) 
   _____ blocks
   b) 
   _____ blocks
   c) 
   _____ blocks

2. How many blocks are in the shaded row?
   a) 
   _____ blocks
   b) 
   _____ blocks
   c) 
   _____ blocks

3. Write the number of shaded blocks. Then write an addition equation and a multiplication equation for all the blocks.
   a) 
   _____ blocks shaded
   _____ + _____ + _____
   = _____ blocks
   _____ \times 3 = _____ blocks
   b) 
   _____ blocks shaded
   _____ + _____ + _____
   = _____ blocks
   _____ \times _____ = _____ blocks
   c) 
   _____ blocks shaded
   _____ + _____ + _____ + _____
   = _____ blocks
   _____ \times _____ = _____ blocks

4. a) Write a multiplication equation for the number of blocks in one layer.
   _____ \times _____ = _____ blocks

   b) Calculate the number of blocks in the shaded layer. Then calculate the total number of blocks in the stack.
   i) 
   blocks in each layer
   number of layers
   _____ \times _____ \times _____
   = _____ blocks
   ii) 
   _____ \times _____ \times _____
   = _____ blocks
   iii) 
   _____ \times _____ \times _____
   = _____ blocks
5. Write a multiplication statement for the number of blocks in the stack.

a) \[ \quad \times \quad \times \quad = \text{blocks} \]
b) \[ \quad \times \quad \times \quad = \text{blocks} \]
c) \[ \quad \times \quad \times \quad = \text{blocks} \]

6. a) Number of blocks in a vertical layer
   \[ = \text{height} \times \text{width} \]
   \[ = 3 \times 2 = 6 \text{ blocks} \]
   Total number of blocks
   \[ = \text{height} \times \text{width} \times \text{length} \]
   \[ = \quad \times \quad \times \quad = \text{blocks} \]

b) Number of blocks in a vertical layer
   \[ = \text{height} \times \text{width} \]
   \[ = \quad \times \quad = \text{blocks} \]
   Total number of blocks
   \[ = \text{height} \times \text{width} \times \text{length} \]
   \[ = \quad \times \quad \times \quad = \text{blocks} \]

c) Number of blocks in a vertical layer
   \[ = \text{height} \times \text{width} \]
   \[ = \quad \times \quad = \text{blocks} \]
   Total number of blocks
   \[ = \text{height} \times \text{width} \times \text{length} \]
   \[ = \quad \times \quad \times \quad = \text{blocks} \]

d) Number of blocks in a vertical layer
   \[ = \text{height} \times \text{width} \]
   \[ = \quad \times \quad = \text{blocks} \]
   Total number of blocks
   \[ = \text{height} \times \text{width} \times \text{length} \]
   \[ = \quad \times \quad \times \quad = \text{blocks} \]

7. Two stacks in Question 6 have the same number of blocks. Use the height, width, length, and the properties of multiplication to explain why this happens.
Volume is the amount of space taken up by a three-dimensional (or 3-D) object. These objects have a volume of 4 cubes.

1. Count the number of cubes to find the volume of the object.

   a)  

   Volume = _____ cubes  

   b)  

   Volume = _____ cubes  

   c)  

   Volume = _____ cubes  

We measure volume in cubic units or unit cubes. Note: The cubes below are not drawn to scale.

\[
\begin{align*}
1 \text{ cm}^3 &= 1 \text{ cubic centimeter} \\
1 \text{ m}^3 &= 1 \text{ cubic meter} \\
1 \text{ in}^3 &= 1 \text{ cubic inch}
\end{align*}
\]

2. Find the volume of the object made from unit cubes. Include units in your answer.

   a)  

   Volume = ____________  

   b)  

   Volume = ____________  

   c)  

   Volume = ____________  

   d)  

   Volume = ____________  

   e)  

   Volume = ____________  

   f)  

   Volume = ____________  

   g)  

   Volume = ____________  

   h)  

   Volume = ____________  

   i)  

   Volume = ____________
Mathematicians call rectangular boxes **rectangular prisms**.

3. Use two ways to find the volume of the rectangular prism made from unit cubes.
   a) Find the number of unit cubes. Include units in the answer.
      
      ![Image of unit cubes]
      
      Volume = ____________  Volume = ____________  Volume = ____________

   b) Find the length, width, and height of the prisms in part a). Multiply length × width × height to find the volume. Include the units!
      
      ![Image of rectangular prism]
      
      i) Length = ______________  ii) Length = ______________  iii) Length = ______________  
      Width = ______________  Width = ______________  Width = ______________  
      Height = ______________  Height = ______________  Height = ______________  
      Volume = ______________  Volume = ______________  Volume = ______________  

   c) Compare your answers for volume in parts a) and b). Did you get the same answer both ways?

   For a rectangular prism, volume = length × width × height  OR  \( V = l \times w \times h \)

4. Kim has a box that is 15 cm long, 10 cm wide, and 8 cm tall. She packs the box with 1 cm cubes.
   a) How many cubes fit along each side of the box?
      
      Length = _____ cubes  
      Width = _____ cubes  
      Height = _____ cubes  

   b) How many cubes does Kim need to fill the box? ______________

   c) What is the volume of the box? _____ cubes = ____ cm³

   d) Use the formula volume = length × width × height to find the volume of the box.
      
      Volume = _____ cm × _____ cm × _____ cm = _____ cm³

   e) Did you get the same answer in parts c) and d)? If not, find your mistake.
5. Find the volume of the prism.
   a) Length = \(3\) m
      
      Width = \(2\) m
      
      Height = \(2\) m
      
      Volume = \(3\) m \(\times\) \(2\) m \(\times\) \(2\) m = \(12\) m\(^3\)
      
   b) Length = \(\quad\) m
      
      Width = \(\quad\) m
      
      Height = \(\quad\) m
      
      Volume = \(\quad\) m\(^3\)
      
      c) Length = \(\quad\) ft
      
      Width = \(\quad\) ft
      
      Height = \(\quad\) ft
      
      Volume = \(\quad\) ft\(^3\)
      
   d) Length = \(\quad\) cm
      
      Width = \(\quad\) cm
      
      Height = \(\quad\) cm
      
      Volume = \(\quad\) cm\(^3\)
      
   e) \(\ell = \quad\) mm
      
      \(w = \quad\) mm
      
      \(h = \quad\) mm
      
      \(V = \quad\) mm\(^3\)
      
   f) \(\ell = \quad\) in
      
      \(w = \quad\) in
      
      \(h = \quad\) in
      
      \(V = \quad\) in\(^3\)

6. Find the volume of the rectangular prism.
   a) Length 25 m, width 6 m, height 6 m
      
      Volume = \(\quad\) m\(^3\)
      
   b) Length 15 ft, width 30 ft, height 45 ft
      
      Volume = \(\quad\) ft\(^3\)
      
   c) Length 90 cm, width 15 cm, height 8 cm
      
      Volume = \(\quad\) cm\(^3\)
      
   d) Length 115 in, width 20 in, height 30 in
      
      Volume = \(\quad\) in\(^3\)

7. Estimate the answer. Then use a calculator to find the actual value.
   a) The tower of the Aon Center in Chicago, IL, is a rectangular prism that is 194 ft wide, 194 ft long, and 1,123 ft tall. What is the volume of the tower?
   b) The Cheung Kong Center Tower in Hong Kong, China, is a rectangular prism 154 ft wide, 154 ft long, and 928 ft tall. What is the volume of the tower?
   c) Which tower has a greater volume, the Aon Center or the Cheung Kong Center Tower? What is the difference between them?

8. Use this prism to explain why \(2 \times 3 \times 4 = 3 \times 2 \times 4\).
Flat surfaces on a three-dimensional (or 3-D) shape are called **faces**. Faces meet at **edges**. Edges meet at **vertices**. You can show hidden edges with dashed lines.

1. Draw dashed lines to show the hidden edges. The dot marks a hidden vertex.

2. Imagine the skeleton covered in paper and placed on a table. Shade the edges that would be hidden.

3. Shade the face or faces named below.
   a) front face
      i)  
      ii)  
      iii)  
      iv)  
   b) back face
      i)  
      ii)  
      iii)  
      iv)  
   c) side faces
      i)  
      ii)  
      iii)  
      iv)  
   d) top and bottom faces
      i)  
      ii)  
      iii)  
      iv)  

Edges and vertices of a shape make its **skeleton**. This is the skeleton of a cube.
**A net** of a three-dimensional (or 3-D) shape is a pattern that you can fold to make the shape.

4. Draw a net of the prism on the grid below. Label each face. Each square on the grid represents 1 cm.

   **a)**
   - Front: 3 cm
   - Top: 1 cm
   - Right side: 2 cm

   **b)**
   - Front: 2 cm
   - Top: 1 cm
   - Right side: 4 cm

5. On the net, mark the prism that matches.

6. Draw a net for the prism on 1 cm grid paper.

   **a)**
   - 3 cm
   - 2 cm
   - 3 cm

   **b)**
   - 3 cm
   - 2 cm
   - 3 cm

   **c)**
   - 4 cm
   - 5 cm
   - 2 cm

   **d)**
   - 4 cm
   - 4 cm
   - 3 cm
MD5-29 Volume and Area of One Face

1. The top face and the bottom face are the horizontal faces. Shade the horizontal faces on the prism.

   a)  b)  c)  d)

2. The bottom face of the rectangular prism has an area of 12 cm\(^2\).
   What is the area of the shaded face? __________

3. These prisms are made from 1 cm cubes. Fill in the table.

<table>
<thead>
<tr>
<th>Area of a horizontal face</th>
<th>6 cm(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of shaded layer</td>
<td>6 cm(^3)</td>
</tr>
<tr>
<td>Height of prism</td>
<td>4 cm</td>
</tr>
<tr>
<td>Number of horizontal layers</td>
<td>4</td>
</tr>
<tr>
<td>Volume of prism</td>
<td>24 cm(^3)</td>
</tr>
</tbody>
</table>

   a) What do you notice about the number part of the area of the horizontal face and number part of the volume of the shaded layer?

   __________________________

   b) How can you get the volume of a prism from the volume of one layer and the number of layers?

   Volume = __________________________

   c) How can you get the volume of a prism from the area of a horizontal face and the height of the prism?

   Volume = __________________________

4. Circle the part of the formula for the volume of a prism that shows the area of a horizontal face.

   Volume = length \times width \times height
For rectangular prisms,
\[ \text{volume} = \text{length} \times \text{width} \times \text{height} \quad \text{OR} \quad \text{volume} = \text{area of horizontal face} \times \text{height}. \]

5. Find the volume. Remember to include the units in your answer.

a) \[ \text{Volume} = \frac{64 \text{ in}^2}{3 \text{ in}} \]
\[ = \frac{64}{3} \text{ in}^3 \]

b) \[ \text{Volume} = \frac{84 \text{ ft}^2}{5 \text{ ft}} \]
\[ = \frac{84}{5} \text{ ft}^3 \]

c) \[ \text{Volume} = \frac{1,600 \text{ m}^2}{22 \text{ m}} \]
\[ = \frac{1,600}{22} \text{ m}^3 \]

d) Area of top face = 25 m²
Height = 10 m
\[ \text{Volume} = \frac{25 \text{ m}^2}{10 \text{ m}} \]
\[ = \frac{25}{10} \text{ m}^3 \]

e) Area of top face = 200 mm²
Height = 45 mm
\[ \text{Volume} = \frac{200 \text{ mm}^2}{45 \text{ mm}} \]
\[ = \frac{200}{45} \text{ mm}^3 \]

f) Area of top face = 15 m²
Height = 32 m
\[ \text{Volume} = \frac{15 \text{ m}^2}{32 \text{ m}} \]
\[ = \frac{15}{32} \text{ m}^3 \]

6. a) Circle the part of the formula for the volume of a prism that shows the area of the shaded face. \[ \text{Volume} = \text{length} \times \text{width} \times \text{height} \]

b) Find the volume.

i) \[ \text{Volume} = \frac{12 \text{ cm}^2}{5 \text{ cm}} \]
\[ = \frac{12}{5} \text{ cm}^3 \]

ii) \[ \text{Volume} = \frac{80 \text{ ft}^2}{5 \text{ ft}} \]
\[ = \frac{80}{5} \text{ ft}^3 \]

BONUS

\[ \text{Volume} = \frac{15 \text{ m}^2}{3 \text{ m}} \]
\[ = \frac{15}{3} \text{ m}^3 \]

7. a) Tom thinks he can find the volume of a rectangular prism using the formula \[ \text{volume} = \text{width} \times \text{length} \times \text{height} \]. Is he correct? Explain.

b) Tom thinks the volume of this prism is 30 in² \( \times \) 6 in = 180 in³. Is he correct? Explain.

c) Find the volume.

i) \[ \text{Volume} = \frac{24 \text{ cm}^2}{5 \text{ cm}} \]
\[ = \frac{24}{5} \text{ cm}^3 \]

ii) \[ \text{Volume} = \frac{80 \text{ ft}^2}{6 \text{ ft}} \]
\[ = \frac{80}{6} \text{ ft}^3 \]

iii) \[ \text{Volume} = \frac{16 \text{ mm} \times 35 \text{ mm}^2}{35 \text{ mm}^2} \]
\[ = \frac{16}{35} \text{ mm}^3 \]
1. Find the missing measurement.
   a) \[ \text{Area} = 15 \text{ m}^2 \quad 3 \text{ m} \]
   b) \[ \text{Area} = 24 \text{ in}^2 \quad \_\_\_ \text{ in} \]
   c) \[ \text{Area} = 32 \text{ cm}^2 \quad 4 \text{ cm} \]

2. Shade all the edges that have the same measurement as the edge marked.
   Example: 2 cm
   a) 
   b) 
   c) 

3. Write the length of the thick edge beside it. Then find the missing measurement.
   a) 
   b) 
   c) 

REMINDER For rectangular prisms, 
\[ \text{volume} = \text{length} \times \text{width} \times \text{height} \quad \text{OR} \quad \text{volume} = \text{area of horizontal face} \times \text{height}. \]

4. Find the volume of the prisms in Question 3.
   a) Volume = 
   b) Volume = 
   c) Volume = 

5. Find the area of the shaded face.
   a) \[ \text{Volume} = 250 \text{ cm}^3 \]
   b) \[ \text{Volume} = 70 \text{ m}^3 \]
   c) \[ \text{Volume} = 48 \text{ in}^3 \]
6. Find the missing measurement.
   a) Volume = 36 km$^3$
   b) Volume = 63 ft$^3$
   c) Volume = 30 yd$^3$
   d) Volume = 36 m$^3$
   e) Volume = 1,200 mm$^3$
   f) Volume = 378 in$^3$

REMINDER ▶ Area of a horizontal face = length \times width.

7. The bottom face is labeled on the net. Label and record the length, width, and height of the prism. Then find the volume of the prism.

<table>
<thead>
<tr>
<th>a)</th>
<th>b)</th>
<th>c)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Net A" /></td>
<td><img src="image" alt="Net B" /></td>
<td><img src="image" alt="Net C" /></td>
</tr>
<tr>
<td>Length = ___ units</td>
<td>Length = ___ units</td>
<td>Length = ___ units</td>
</tr>
<tr>
<td>Width = ___ units</td>
<td>Width = ___ units</td>
<td>Width = ___ units</td>
</tr>
<tr>
<td>Height = ___ units</td>
<td>Height = ___ units</td>
<td>Height = ___ units</td>
</tr>
<tr>
<td>Volume = ___ units$^3$</td>
<td>Volume = ___ units$^3$</td>
<td>Volume = ___ units$^3$</td>
</tr>
</tbody>
</table>

Volume = ___ \times ___ \times ___

= ___ units$^3$