Volume of Prisms and Pyramids

Learning Goals

- I know the volume of an object is the amount of space occupied by the object
- I know that volume is measured in cubic units
- I know how to find the volume of a prism
- I know how to find the volume of a pyramid

Vocabulary

**Prism:**
- a solid with base and top faces that are congruent, parallel polygons
- all other faces are parallelograms

**Pyramid:**
- a solid with a polygon base
- all other faces are triangles

**Volume:**
- the amount of space occupied by an object
- measured in cubic units
<table>
<thead>
<tr>
<th>Geometric Figure</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder</td>
<td>$A_{\text{base}} = \pi r^2$</td>
<td>$V = (A_{\text{base}})h$</td>
</tr>
<tr>
<td></td>
<td>$A_{\text{lateral}} = 2\pi rh$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$A_{\text{total}} = 2A_{\text{base}} + A_{\text{lateral}}$</td>
<td>$V = \pi r^2h$</td>
</tr>
<tr>
<td>Sphere</td>
<td>$A = 4\pi r^2$</td>
<td>$V = \frac{4}{3} \pi r^3$ or $V = \frac{d^3}{3}$</td>
</tr>
<tr>
<td>Cone</td>
<td>$A_{\text{lateral}} = \pi r\ell$</td>
<td>$V = \frac{(A_{\text{base}})h}{3}$</td>
</tr>
<tr>
<td></td>
<td>$A_{\text{base}} = \pi r^2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$A_{\text{total}} = A_{\text{lateral}} + A_{\text{base}}$</td>
<td>$V = \frac{1}{3} \pi r^2h$ or $V = \frac{2}{3} \pi h^3$</td>
</tr>
<tr>
<td>Square-based pyramid</td>
<td>$A_{\text{base}} = \frac{1}{2} bh$</td>
<td>$V = \frac{(A_{\text{base}})h}{3}$</td>
</tr>
<tr>
<td></td>
<td>$A_{\text{lateral}} = b^2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$A_{\text{total}} = aA_{\text{base}} + A_{\text{lateral}}$</td>
<td>$V = \frac{1}{3} bh^3$ or $V = \frac{b^2 h}{3}$</td>
</tr>
<tr>
<td>Rectangular prism</td>
<td>$A = 2lw + lh + wh$</td>
<td>$V = (A_{\text{base}})h$</td>
</tr>
<tr>
<td>Triangular prism</td>
<td>$A_{\text{base}} = \frac{1}{2} hl$</td>
<td>$V = (A_{\text{base}})h$</td>
</tr>
<tr>
<td></td>
<td>$A_{\text{lateral}} = ah + bh + ch$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$A_{\text{total}} = A_{\text{lateral}} + 2A_{\text{base}}$</td>
<td>$V = \frac{1}{3} lwh$ or $V = \frac{bh}{2}$</td>
</tr>
</tbody>
</table>

**Volume of a Square Prism**

A candle is in the form of a square-based prism. How much wax is needed to make the candle?
Find the Volume of Air in a Greenhouse
Mohammed is planning to build a greenhouse in the shape of a rectangular pyramid. The dimensions of the floor are 12 ft by 18 ft and the height is 16 ft. The volume of air in the greenhouse will determine what type of ventilation system he should install. Find the volume of air in the greenhouse.

Find the Volume of Space in a Tent
A tent is in the shape of an equilateral triangular prism. How much space is there inside the tent?
Questions

1. Find the volume of each prism.
   a)  
   ![Prism A](image1)
   b)  
   ![Prism B](image2)
   c)  
   ![Prism C](image3)

2. Find the volume of each prism.
   a)  
   ![Prism A](image4)
   b)  
   ![Prism B](image5)

3. Find the volume of each pyramid.
   a)  
   ![Pyramid A](image6)
   b)  
   ![Pyramid B](image7)
   c)  
   ![Pyramid C](image8)

4. Find the volume of each triangular prism.
   a)  
   ![Triangular Prism A](image9)
   b)  
   ![Triangular Prism B](image10)

5. Which has the greater volume, a rectangular prism with length 3", width 4" and height 5", or a cube with edges 4" long?

10. A polymer resin is to be mixed in a rectangular container with length 100 cm, width 25 cm, and depth 20 cm. The resin will be poured into a rectangle-based pyramid mould with dimensions 15 cm by 20 cm at the base and height 300 cm.

   ![Rectangular Container](image11)
   ![Mould](image12)

   a) Find the volume of the rectangular container.
   b) Find the volume of the mould.
   c) Is the rectangular container large enough to mix the resin for the mould? Explain.