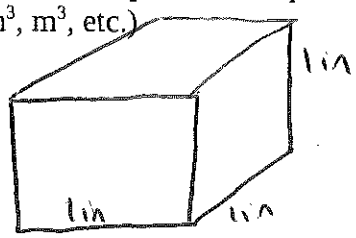
Chapter 5: Capacity, Volume, Mass & Temperature Name:

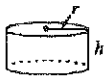
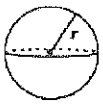
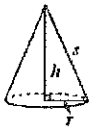
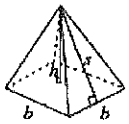
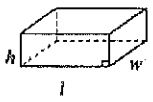
Volume (Imperial)

The volume of an object is the amount of space it occupies. There are specific formulas used to find the volume of different geometric solids. Just as area is expressed in square units, volume is ALWAYS expressed in **cubic units**; (cm^3, in^3, m^3, etc.) In equations, the symbol for volume is a capital V.

$1in^3 = 1in \times 1in \times 1in$



$V = lwh$
$= 1 \times 1 \times 1$
$= 1 in^3$

Geometric Solid	Surface Area	Volume
Cylinder 	$A_{top} = \pi r^2$ $A_{base} = \pi r^2$ $A_{side} = 2\pi rh$ $SA = 2\pi r^2 + 2\pi rh$	$V =$ (area of base) $\times h$
Sphere 	$SA = 4\pi r^2$ or $SA = \pi d^2$	$V = \frac{4}{3}\pi r^3$
Cone 	$A_{side} = \pi rs$ $A_{base} = \pi r^2$ $SA = \pi r^2 + \pi rs$	$V = \frac{1}{3} \times$ (area of base) $\times h$
Square-Based Pyramid 	$A_{triangle} = \frac{1}{2}bs$ (for each triangle) $A_{base} = b^2$ $b \cdot b = lw$ $SA = 2bs + b^2$	$V = \frac{1}{3} \times$ (area of base) $\times h$
Rectangular Prism 	$SA = wh + wh + lw + lw + lh + lh$ or $SA = 2(wh + lw + lh)$	$V =$ (area of base) $\times h$
General Right Prism	$SA =$ the sum of the areas of all the faces	$V =$ (area of base) $\times h$
General Right Pyramid	$SA =$ the sum of the areas of all the faces	$V = \frac{1}{3} \times$ (area of base) $\times h$

$V = \pi r^2 h$

$V = \frac{1}{3}\pi r^2 h$

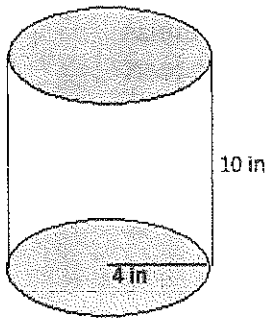
$V = \frac{\pi r^2 h}{3}$

$V = \frac{1}{3} lwh$

$V = \frac{lwh}{3}$

$V = lwh$

Practice: Calculate the Volume

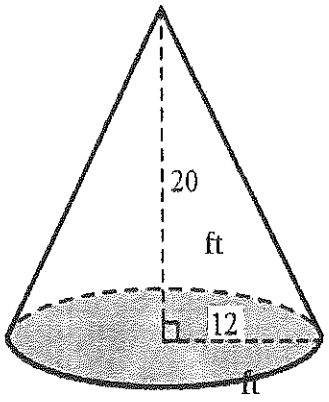


$V = \pi r^2 h$

$V = \pi 4^2 10 \Rightarrow \pi \cdot 4in \cdot 4in \cdot 10in$

$V = \pi \cdot 160$

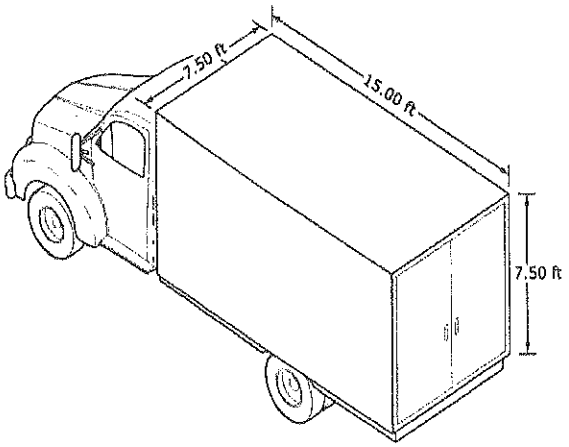
$V = 502.7\ in^3$



$V = \frac{\pi r^2 h}{3}$

$V = \frac{\pi\ 12^2 \cdot 20}{3}$

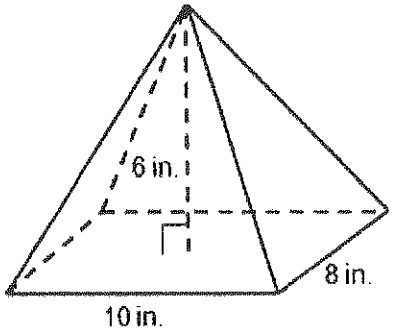
$V = \frac{\pi 2880}{3} = 3015.9\ ft^3$



$V = lwh$

$= 15 \cdot 7.5 \cdot 7.5$

$= 843.8\ ft^3$



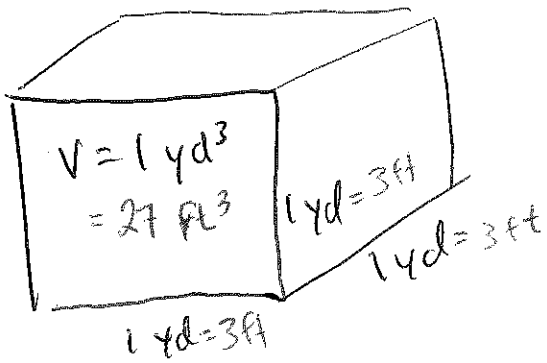
$V = \frac{lwh}{3}$

$V = \frac{10 \cdot 8 \cdot 6}{3}$

$V = 160\ in^3$

To convert between units of volume we must **cube** the conversion values for liner measures

	Common Imperial
Length	1 mile = 1760 yards
	1 mile = 5280 feet
	1 yard = 3 feet
	1 yard = 36 inches
	1 foot = 12 inches



$3^3 = 3 \cdot 3 \cdot 3$

Example:

Convert 108 ft^3 into cubic yards (yd^3)

Linear Conversion: $(3 \text{ ft})^3 = (1 \text{ yd})^3$

Cubed Volume Units: $27 \text{ ft}^3 = 1 \text{ yd}^3$

Set up a proportion with equivalent fractions.

$$\frac{27 \text{ ft}^3}{1 \text{ yd}^3} = \frac{108 \text{ ft}^3}{x \text{ yd}^3}$$

Match units in numerators and denominators

$1 \times 108 \div 27$

$108 \text{ ft}^3 = 4 \text{ yd}^3$

First Fraction: values from data **table/conversion**

Second Fraction: values from **question** (known/unknown)

Practice:

1. 3 mi^3 = 1.6×10^{10} yd^3

$(1 \text{ mi})^3 = (1760 \text{ yd})^3$

$1 \text{ mi}^3 = 1760^3 \text{ yd}^3$

$\frac{1 \text{ mi}^3}{1760^3 \text{ yd}^3} = \frac{3 \text{ mi}^3}{x \text{ yd}^3}$

2. 650 in^3 = 0.376 ft^3

$(1 \text{ ft})^3 = (12 \text{ in})^3$

$1 \text{ ft}^3 = 1728 \text{ in}^3$

$\frac{1 \text{ ft}^3}{1728 \text{ in}^3} = \frac{x \text{ ft}^3}{650 \text{ in}^3}$

3. 28 ft^3 = 48384 in^3

$\frac{1 \text{ ft}^3}{1728 \text{ in}^3} = \frac{28 \text{ ft}^3}{x \text{ in}}$

* 4. 0.25 mi^3 = 3.7×10^{10} ft^3

$(1 \text{ mi})^3 = (5280 \text{ ft})^3$

$\frac{1 \text{ mi}^3}{5280^3 \text{ ft}^3} = \frac{0.25 \text{ mi}^3}{x \text{ ft}^3}$