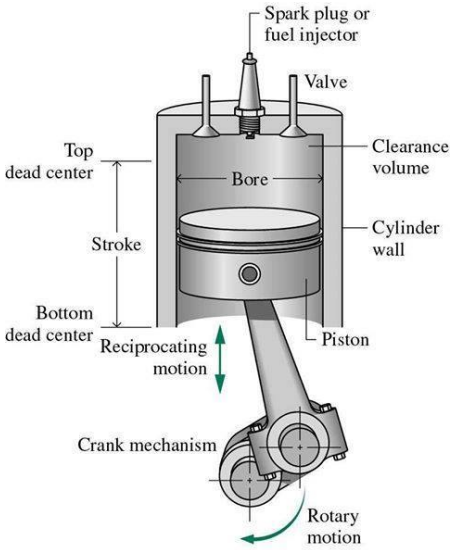
**A Simple (reciprocating) Internal Combustion Engine Example**

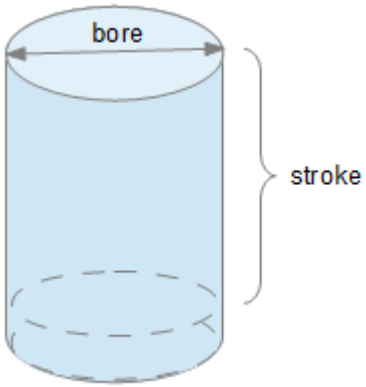
*From: [http://mechanicstips.blogspot.com/2018/02/internal-combustion-engine-diagram.html](http://mechanicstips.blogspot.com/2018/02/internal-combustion-engine-diagram.html)*

*"The principle behind any **reciprocating internal combustion engine**: If you put a tiny amount of high-energy fuel (like gasoline) in a small, enclosed space and ignite it, an incredible amount of energy is released in the form of expanding gas. You can use that energy to propel a potato 500 feet.*

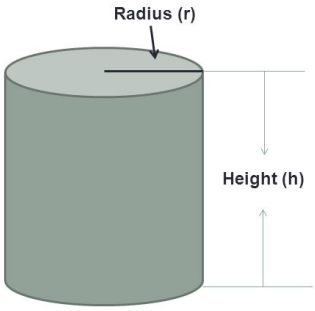
*In this case, the energy is translated into potato motion. You can also use it for more interesting purposes. For example, if you can create a cycle that allows you to set off explosions like this hundreds of times per minute, and if you can harness that energy in a useful way, what you have is the core of a car engine!"*




$V = \pi * (b/2)^2 * s$




## Part I : Finding the Volume of a Cylinder




$$V = \pi r^2 h$$

**V = volume**

$\pi = pi\ or\ 3.14$

**$r^2$ = radius x radius**

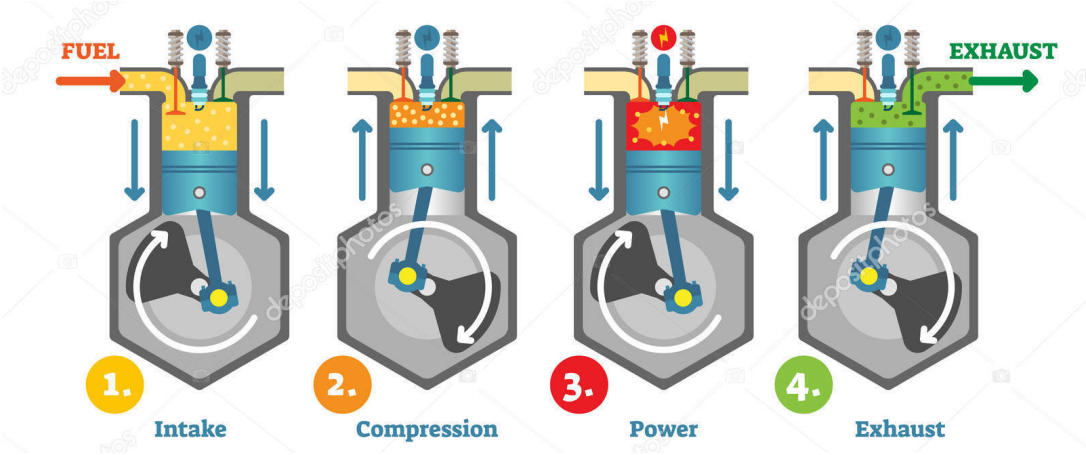
**h = height**

For a 3.35" bore and a 3.07" stroke, calculate the "active" cylinder volume in cubic inches and then liters?

*Given: 1" = 2.54 cm* *(show work below)*

There is a term called "***displacement***" which is simply the cylinder volume x number of cylinders...for the above example the displacement is... (show calc below for a 6-cylinder engine):

Below is a diagram showing the 4 stages a cylinder undergoes during operation:




1) During the intake stage, an air-fuel mixture (not just fuel, as shown) fills the cylinder.

2) During the compression stage, the air-fuel mixture is compressed

3) During the "Power stroke," the air-fuel mixture is ignited (expansion).

4) During the exhaust stage, combustion gases are expelled.

Considering that the reaction stoichiometry for gasoline (octane) combustion below, balance this reaction:

$$\_\_\_\_ C_8H_{18} + \_\_\_\_ O_2 \rightarrow \_\_\_\_ CO_2 + \_\_\_\_\_ H_2O$$

What is the mass ratio of the air-fuel mixture (mass air/mass fuel), when considering that ~0.1 grams of gasoline is added during each cycle? *(Note: $O_2$ is 21% air; 1 mol air/0.21 mol $O_2$; 28.8 g/mol air)?*