

## Pressure Lab

### Purpose:

To determine the area of the face of the piston based on the relationship between force and pressure.

### Theory:

$$\text{Pressure} = \text{Force} / \text{Area}$$

Hypothesis: The surface area is approximately 0.02 m in diameter so the area would be  $1.26 \times 10^{-3} \text{ m}^2$ .

### Material:

- Pressure Sensor
- Force Sensor
- Computer
- 60 mL Syringe

### Procedure:

1. Start the Pasco software and connect the pressure sensor and the force sensor to the computer.
2. Open the 60mL syringe to 60mL and the connect it to the pressure sensor.
3. Create a 4 block Display (Digits Pressure, Digits Force, Data Table of Pressure and Force, Graph of P vs Force)
4. Collect 10 Data Points of Pressure, Volume, and Force using the force sensor to compress the syringe. Make sure to record them in Pascals, Liters, and Newtons.
5. Create a column of calculated data show Pressure times Volume
  - a. Take note of how these values compare to each other.
6. Create a Pressure vs Volume Graph
  - a. Include the polynomial equation of the line and the coefficient of determination.
7. Create a Force vs Pressure Graph
  - a. Include the polynomial equation of the line and the coefficient of determination.
8. Using the slope function in excel [ =slope(y1:y10,x1:110) ] calculate the area of the face of piston. Y is Force and X is Pressure
9. Calculate the radius by using the equation  $r = \sqrt{\text{Area}_{\text{circl}} / \pi}$
10. Calculate the diameter by using the equation  $d = 2r$
11. Measure the actual diameter of the base of the piston using your Vernier calipers. Record your answer in meters.
12. Calculate the percent error

### Conclusion:

- Record the relationship you have discovered between Pressure and Volume
- Record the relationship you have discovered between Pressure and Force
- Discuss your observations and reaction to the calculation of the area of the face of the piston using pressure and force and not length.