

Lab: Boyle's Law—Datasheet

Data and Calculations:

- Pressure is defined as force per unit area:  $P = \text{Force} / \text{Area}$
- When a book rests on top of the plunger, the pressure it exerts equals the weight of the book divided by the area of the bottom of the plunger.

1. Diameter of syringe = \_\_\_\_\_ cm = \_\_\_\_\_ m

Show your work here.

2. Weight (force) of 1 book = \_\_\_\_\_ N

Show your work here.

3. Calculate the area of the circle in  $\text{m}^2$  using the formula  $\pi r^2$ :

4. Using the fact that pressure is defined as force  $\div$  area, what is the pressure exerted by 1 book in  $\text{N}/\text{m}^2$ ?

5. If  $1 \text{ N}/\text{m}^2 = 1 \text{ Pascal (Pa)}$ , what is the pressure exerted by 1 book in Pa? \_\_\_\_\_  
Using conversion facts, convert Pa to kPa. Show your work here.

Exerting Pressure	Pressure (kPa)	Volume of gas ( $\text{cm}^3$ )	P/V ( $\text{kPa}/\text{cm}^3$ )	P X V ( $\text{kPa} \times \text{cm}^3$ )
atmosphere				
atmosphere + 1 book				
atmosphere + 2 books				
atmosphere + 3 books				
atmosphere + 4 books				
atmosphere + 5 books				

Use graphical analysis to make a graph of "pressure vs. volume". Use proper technique for scientific graphing and be sure to draw a best-fit line. When your graph is complete in Graphical Analysis, right click your graph, click Copy, then Paste your graph below:

Conclusions:

As the pressure exerted on the air inside the syringe increased, the volume (increased,

decreased). Volume and pressure are (directly, inversely) proportional. Look at the last two columns of your data table. Within bounds of experimental error, the relationship between pressure and volume of a gas is ( $P/V = k$  ,  $P \cdot V = k$ ).

This relationship is known as \_\_\_\_\_ . (Look at the title of this lab!)

Rubric:

Each calculation question is worth 10 points, for a total of 50 points.

10 points: The response indicates that the student has a complete understanding of the concept. The response is accurate and complete. All work is shown and steps are easy to follow.

5 points: The response indicates that the student has a partial understanding of the concept. The response is text-based, but is incomplete. Some work may be missing or is not easy to follow.

0-4 points: No response, or the response indicates that the student does not demonstrate an understanding of the concept. The response is inaccurate or has insufficient information to determine if understanding took place.

Data table is worth 25 points.

25 points: The responses indicate that the student has a complete understanding of the concept. The responses are accurate and complete.

15 points: The responses indicate that the student has a partial understanding of the concept. The responses are text-based, but are incomplete.

0-14 points: No response, or the response indicates that the student does not demonstrate an understanding of the concept. The responses are inaccurate or have insufficient information to determine if understanding took place.

Graph is worth 20 points.

	5 points	3 points	2 points	0 points
<b>Title</b>	Title is creative and clearly relates to the topic. It is printed at the top of the graph.	Title clearly relates to the topic being graphed and is printed at the top of the graph.	A title is present at the top of the graph.	A title is not present.
<b>Units and Axes Labeled</b>	All units are described (in a key or with labels) and are appropriately sized for the data set.	Most units are described (in a key or with labels) and are appropriately sized for the data set.	All units are described (in a key or with labels) but are not appropriately sized for the data set.	Units are neither described NOR appropriately sized for the data set.
<b>Representation of Data</b>	Exceptionally well designed, neat, and attractive. Colors that go well together are used to make the graph more readable. Scale is appropriate	Neat and relatively attractive. Colors are distinguishable.	Neat, but the graph appears quite plain. Colors may be distinguishable. Software procedure may or may not be followed. Scale is not appropriate.	Appears messy and "thrown together" in a hurry.
<b>Spelling, mechanics, punctuation, capitalization</b>	No spelling, mechanics, punctuation, or capitalization errors	1-3 errors	4-6 errors	More than 6 errors

Conclusion questions are worth 1 point each, for a total of 5 points.

Each correctly answered question results in 1 point.

An incorrectly answered question results in 0 points.