An Approximate Graphical and Algebraic Analysis of the Volume of an Isolated, Spherical, Sodium Laureth Sulfate and Water Solution System Placed Within a Larger System with Increasing Pressure, both Filled with the Same Ideal, Diatomic Gas and Isolated from Outside Forces

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Contents

List of Tables

List of Figures

1 Gathered Data

Pressure [atm]	Pressure [Pa]	Diameter [m]	Volume [m^3]	Inverse Volume [m^{-3}]
.506	51270.45	.0285	$1.21\cdot10^{-5}$	82504.87
.411	41644.58	.0305	$1.49\cdot10^{-5}$	67315.44
.305	30904.13	.034	$2.06\cdot10^{-5}$	48593.42
.205	20771.63	.039	$3.11\cdot10^{-5}$	32197.37
.104	10537.8	.05	$6.54\cdot10^{-5}$	15279.33
.057	5775.53	0	0	0

Table 1: Gathered Data

2 Statement of Purpose

This laboratory experiment is intended to determine the relationship between pressure and volume in a controlled system by measuring and recording pressure and volume.

3 Materials Used

1. Sealed container
2. Bottle cap, dipped in soap
3. Phone, for pressure measuring purposes
4. Pressure pump

4 Procedure

1. Dip a bottle cap in soap
2. Place bottle cap in a sealed container
3. Change pressure (decrease in this case) in the sealed container
4. Record the corresponding diameter and pressure values
5. From the diameter, the volume needs to be determined using: $V = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3$
6. Finally, graphs will be produced, linearized and curved, with the vertical axis being inverse volume and volume, respectively, and the horizontal axis being pressure because it was the independent variable

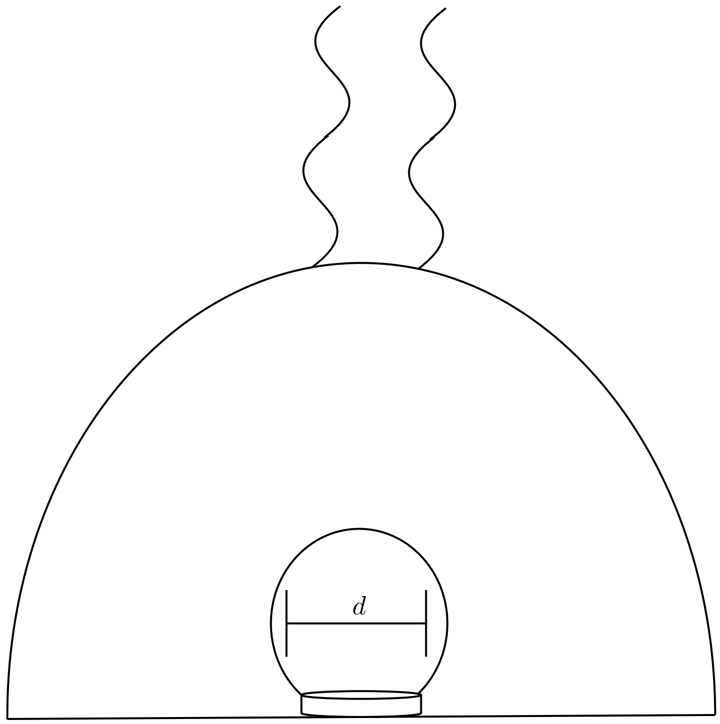

Figure 1: Set-up of the Laboratory Experiment, $V = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3$

5 Background Knowledge

$$PV = nRT \tag{1}$$

6 Graphical Analysis

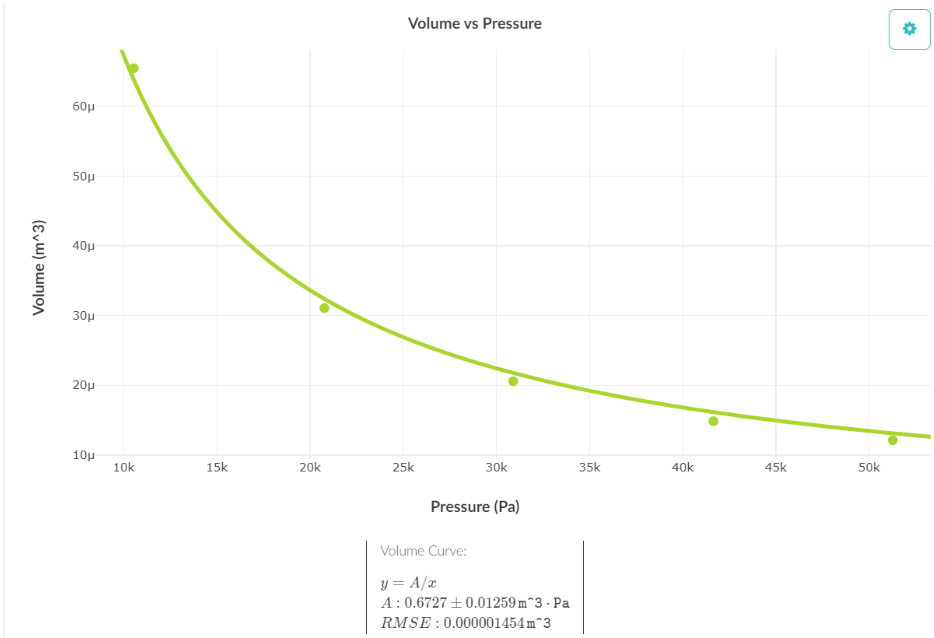

Figure 2: Curved Graph: $\frac{1}{V} = \frac{P}{nRT}$

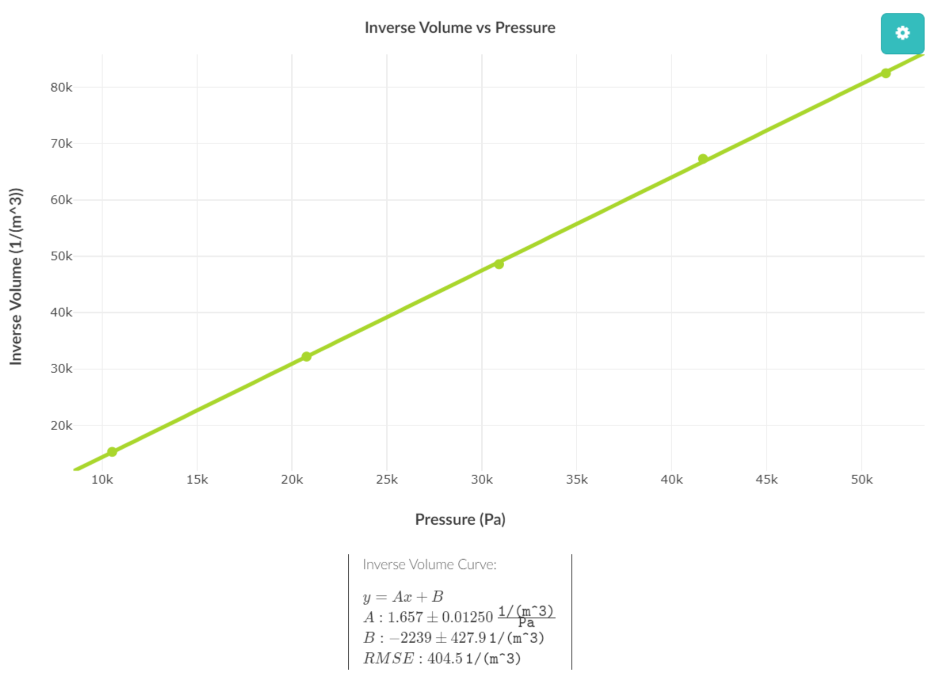

Figure 3: Linear Graph (where $I_V = V^{-}1$): $I_V = \frac{P}{nRT}$

1. The curved graph is of the form $y = \frac{A}{x}$
2. Because the graph represents an inverse correlation, the vertical column should be exponentiated to

the power of negative one

7 Post-Lab Questions and Conclusion

1. According to the results of the experiment, there is an inverse relationship between P and $V \to P \propto \frac{1}{V}$
2. The slope of the line given in graph fig:3 is 1.657[J^{-1}]
3. The equation of the line is $I_V = \frac{P}{nRT}$, where I_V represents the linearized function $\left(V^{-1}\right)^{-1}$. This means the slope may be represented as $\frac{1}{nRT} = 1.657$
4. The graph has a non-zero intercept because the volume of the bubble becomes too great and it bursts at pressure .057[atm].
5. The vertical axis intercept shows us the theoretical volume of the bubble at 0 pressure.
6. Following the laboratory experiment, it becomes clear that there is an inverse relationship between pressure and volume, that is, as one increases, the other decreases, which makes sense, as a gas expands, there is less pressure. A calculation of error can not be provided, as there was no actual calculation performed. One source of error is that air is not an ideal gas. This means that collisions between the particles are not perfectly elastic, and therefore, the ideal gas law (1) only serves as an approximation. One lab I think would be very interesting to see is a correlation between pressure and temperature, where the experiment is heating up and boiling water through an increase of pressure.