LAB 2
PRESSURE AND TEMPERATURE

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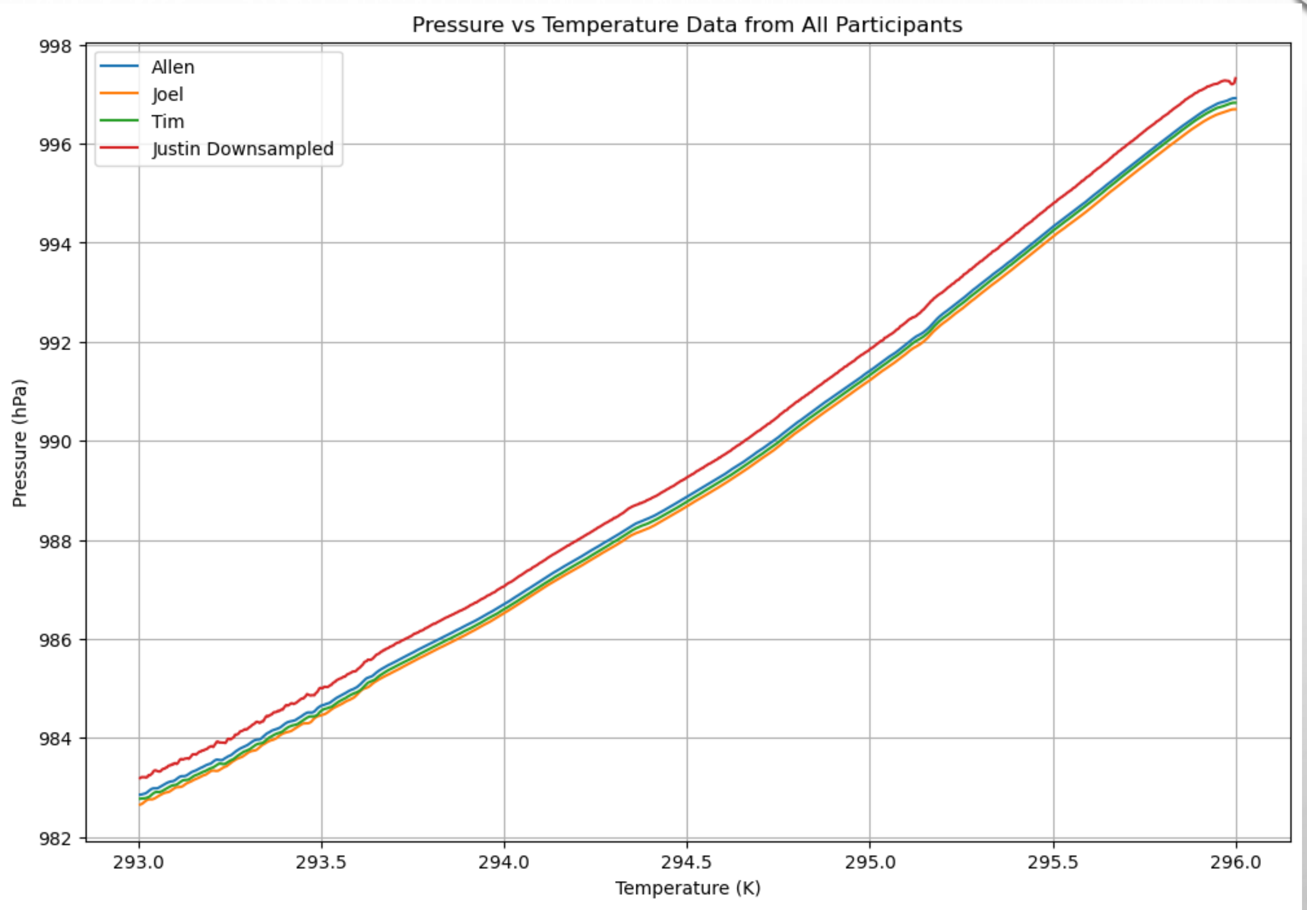
OBJECTIVE AND EXPERIMENT

- To determine the relationship between temperature and pressure of a gas
- Collecting pressure data with Phyphox by placing phones in a mason jar inside a fridge to cool down for 15 min.

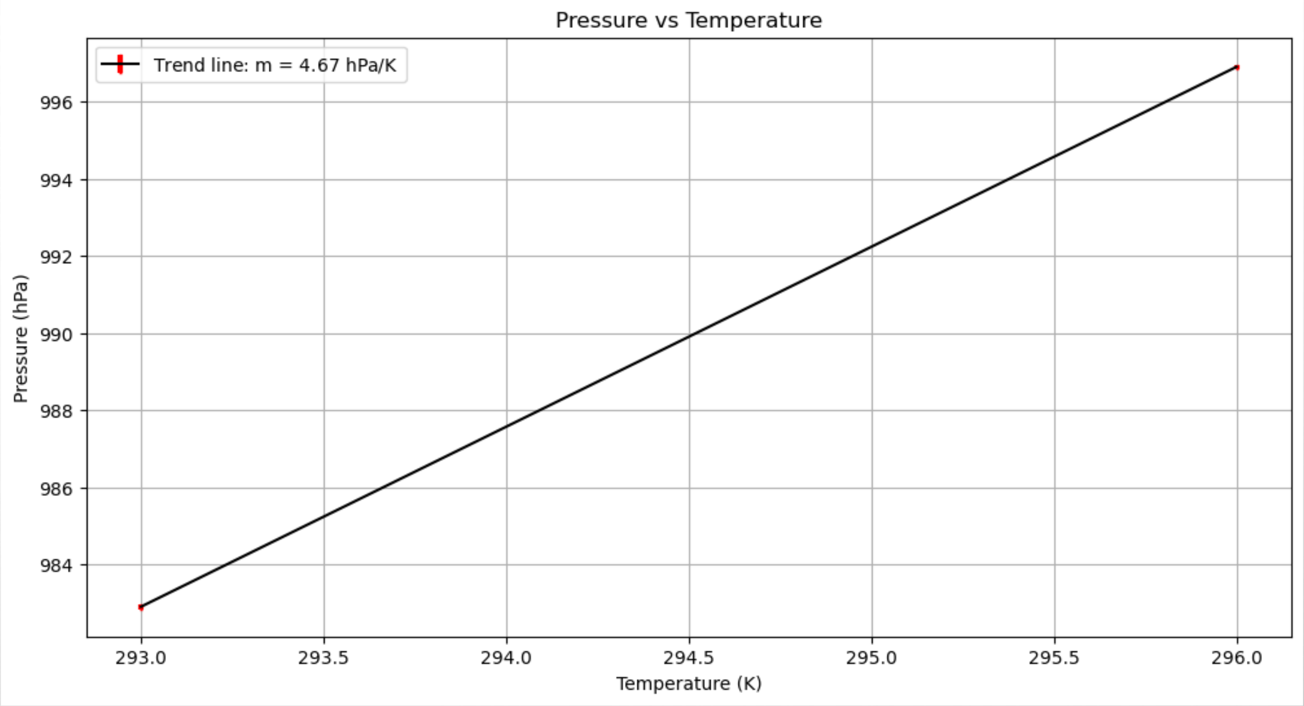
RAW DATA

- Justin's Android data was under sampled to match sample size of iPhone data for visualization and calculation purposes.
- The android barometer appears to be calibrated differently from the iPhone's (Allen, Joel, Tim)



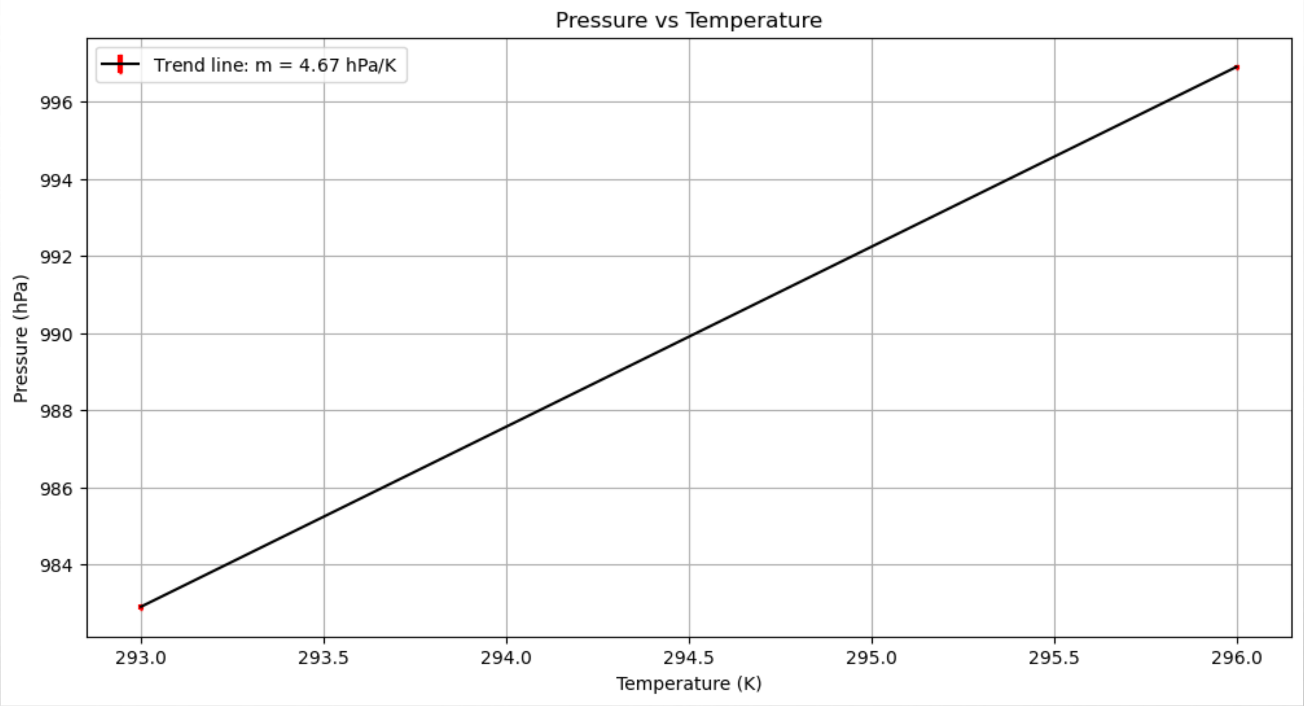
JAR VOLUME

- V is less than the volume of the jar (4200 mL). This is because 6 phones were occupying the jar.
- $V_{\mathrm{jar}} - V_{\mathrm{phones}} = 0.0042m^3 - 0.000626m^3 = 0.003572m^3$
- Where V_{phones} was found by using the dimensions of my iPhone 16 Pro Max and multiplying by 6.
- No uncertainty in measurements because dimensions were found online, and models of other phones are unknown



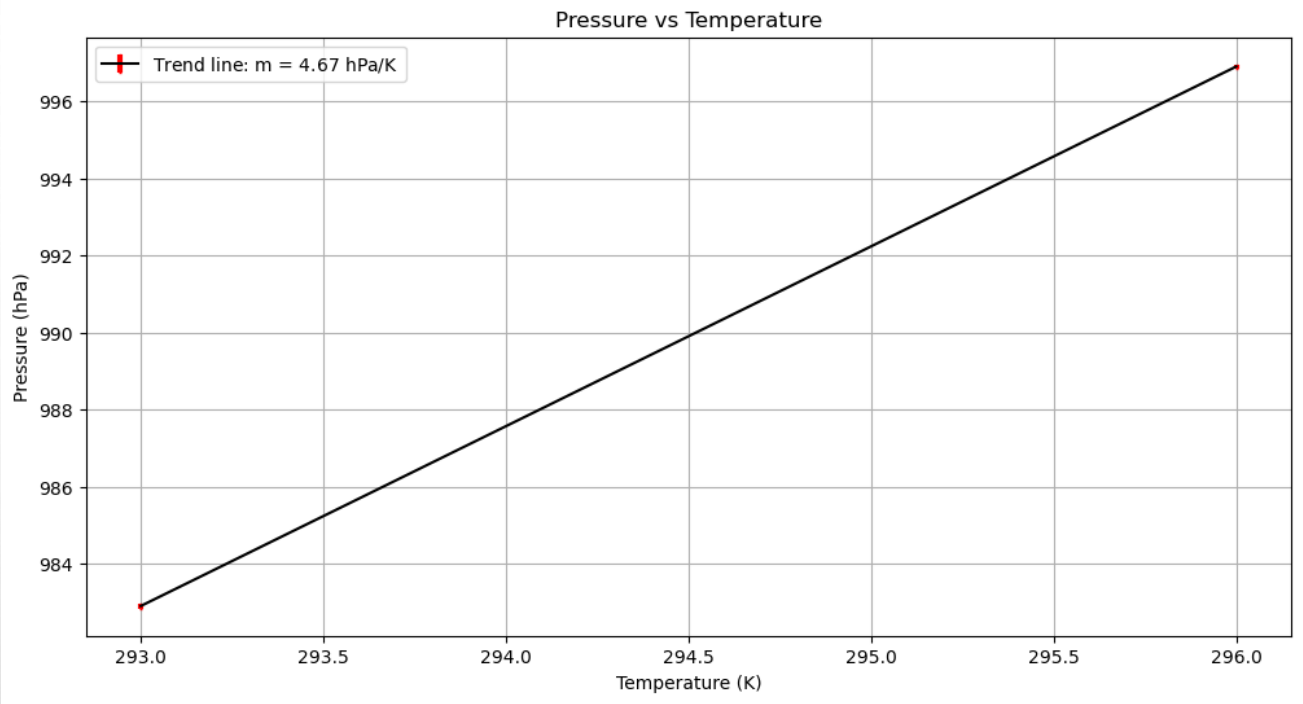
TREND LINE

- As temperature decreased in the fridge, the pressure dropped linearly
- Using $\frac{P_f - P_0}{T_f - T_0}$, the slope was found to be 4.67 hPa/K and y intercept of -385.4775
- This confirms a direct proportionality between pressure and temperature at a constant volume (Gay-Lussac's Law)
- Standard deviations of 0.06 hPa and 0.07 hPa
- The y intercept should be 0 as pressure is 0 when temperature is at absolute 0



ERROR ANALYSIS

- With finding V, we can find the number of moles using $n = \frac{m}{R}V$, where $V = 0.003572\ m^3$
- We get $n = 0.2005\ mol$
- The theoretical results were found by using ideal gas law
- $n_0 = \frac{P_0 V}{RT_0}$, $n_f = \frac{P_f V}{RT_f}$. Since n_0 and n_f should be the same. We can take the mean $n_t = 0.1445$
- That is a percent error of 38.88%
- This is likely due to the inaccurate measurements of the phone volume



CONCLUSION

- The experiment successfully demonstrated the Ideal Gas Law, the pressure temperature relationship remained linear as predicted
- Result: the calculated number of moles was 0.2005
- While there was a 38.9% error, the high correlation in the slope proves that a smartphone and a mason jar are effective tools for observing fundamental thermodynamic laws.