

Step 6. The pressure vs height should (at least roughly) obey this formula:

$$P_{\text{meas}} = -\rho gh + P_{\text{ground}}$$

where P_{meas} and P_{ground} are in Pa units, $g = 9.8 \text{ m/s}^2$, ρ is the density of air in kg/m^3 units and h is the height above the ground in meters. Use your measurements to create a pressure vs. height scatter plot in Excel or Google Sheets. Does your data produce a trend similar to what you would expect considering the formula above?

Step 7. Using this scatter plot and the formula above, we can estimate other interesting quantities, like the density of air and the height of the edge of the atmosphere. To do this, you first need to perform a *linear regression* on the plot of your data. A linear regression will model the relationship between height and pressure measurements with a linear equation (which should be a good fit for your roughly linear data). A simple way to do this is by fitting a linear trendline to your data. See the **Linear Regression Instructions** document if you are unsure how to do this.

Record the equation of the linear trendline here: $y = \underline{\hspace{2cm}} x + \underline{\hspace{2cm}}$

Step 8. Notice that both the trendline equation and the formula from Step 6 are in slope-intercept form ($y = mx + b$). In the formula from Step 6, what are the x and y variables? What are the slope and y-intercept? Estimate air density, ρ , using this information.

Formula from Step 6:
 $P_{\text{meas}} = -\rho gh + P_{\text{ground}}$

Linear trendline equation:
 $y = \underline{\hspace{2cm}} x + \underline{\hspace{2cm}}$

$$\rho =$$

Step 9. Hypothetically, what kind of experiment could you do to measure the density of air that wouldn't involve a barometer? (Hint: it may require a parachute!)

Step 10. It is hard to say exactly where the earth's atmosphere ends and space begins, but a reasonable way of doing it is to estimate the height above the ground where the atmospheric pressure would be zero ($P_{meas} = 0$). Use the formula from Step 6 and your value for air density (ρ) found in Step 8 to estimate the height of the edge of the atmosphere, h_{space} .

$$P_{meas} = -\rho g h_{space} + P_{ground} = 0$$

$$\rightarrow h_{space} =$$

Step 11. Explain why our estimations of the edge of the earth's atmosphere is a low estimate at best. What crucial assumptions are we making here? Which one is to blame? (Hint: can you explain why it's not gravity's fault?)

Step 12. In a sentence or two, how would you improve your estimate for the edge of space?