Fluid Energy Lab (Bernoulli Principle)

Learning objective -

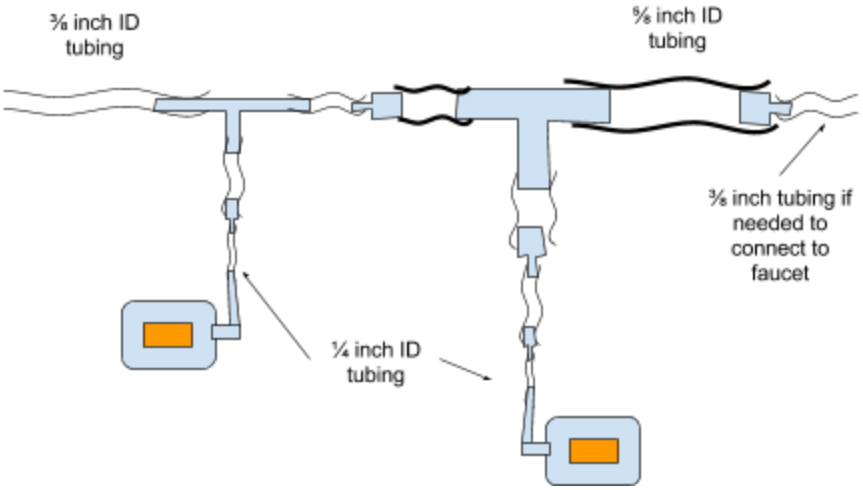
To relate velocity, pressure, diameter, and flow rate for flowing fluid.

Materials -

- Tubing - ⅝ inch inner diameter (ID)
- Tubing - ¼ inch ID
- Tubing - other sizes
- Connectors and fittings
- Wash bottles
- PocketLab detectors
- Towels

Procedure -

1. Determine the inner diameter of the two T junctions. That is where your pressure measurement lines will tap off.
2. Prepare pressure measurement wash bottles by
    - Pair each PocketLab detector to an iPad.
    - Seal each PocketLab in a ziplock bag along with a paper towel.
    - Place the bagged PocketLab into its wash bottle and tighten the cap.
3. Assemble your tubing so that there is flow from narrow (¼ inch ID) to wide (⅝ inch ID) tubing.
4. Attach pressure taps (lines branching off of T junctions, connected to wash bottles).



5. Connect one end of the tubing apparatus to the faucet. **Hold** the other end so that water discharges to a sink.
6. Turn on the water so that it is flowing at a steady rate. Flush all bubbles out of the main line. DO NOT flush air out of the pressure taps or the wash bottles.
7. Measure and record:
    - Pressure at each T junction
    - Whatever data that allows you to calculate fluid flow rate
8. Change the fluid flow setting significantly (higher or lower). Repeat the measurements and record.
9. Reverse the flow direction and repeat the measurements (also at two different flow rates).

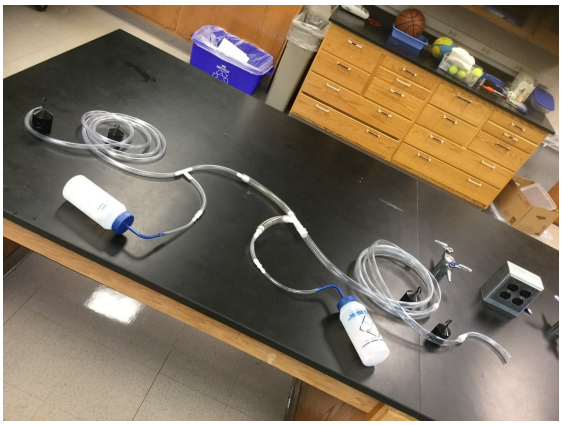
Lab report, to include:

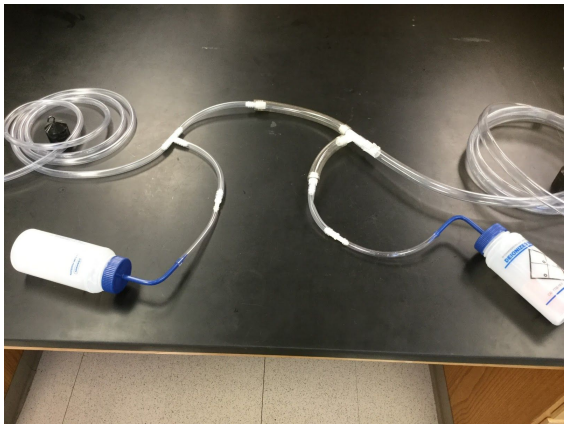
- Lab objective
- Recorded data (what you measured; this does not include calculated values).
- Calculations and calculated results. Be sure to show your work.
- Analysis - Given the T junction diameters and the flow rate, what should the pressure difference be for each condition? How do your results compare to the predicted values?
- Conclusion in Claim/Evidence/Reasoning format

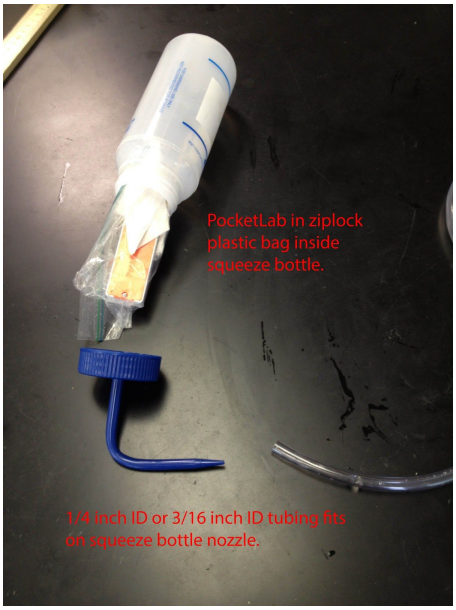
    Answer the question:

        Does the Bernoulli principle correctly predict fluid pressure differences as a function of tubing diameter?

NOTE: LAB REPORT CONCLUSIONS MUST ALWAYS BE YOUR OWN WORDS.







Example Data -

Data from this lab does not prove Bernoulli principle, due to viscous losses in the tubing. When fluid flow is from small to large tubing, the pressure drop due to head loss is more significant than the expected increase in pressure due to change in Fluid velocity.