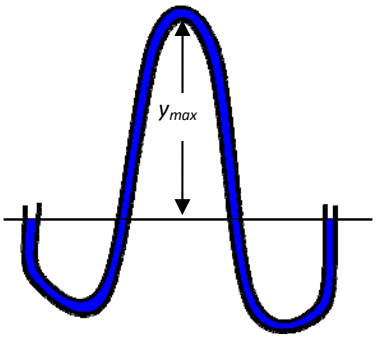
Experiment 1 – water filled tube

Figure 1: Two people holding each end of the clear plastic tubing

1. Fill the bucket with water and then fill the clear plastic tube with water. It is important not to have any air bubbles in the tubing. To remove air bubbles you must allow the air to rise out of the tube as you submerge it in the bucket. This requires some skill!
2. Have two people each hold one end of the tube about 4 inches from the end of the tube as shown in Figure 1.
3. Answer the following questions and write down the answers on a separate page (1 answer set per team)

Questions:

1. Holding the ends of the tube next to each other examine if the water levels are at the same height. Make a comment on this observation
2. What happens if one person holding the end of the tube slowly raises their hand while the other person's hand remains stationary? Give the results
3. What happens if a gas bubbles is in the line?
4. How high can you lift the middle of the tube while keeping the ends at the same height?
5. If the clear plastic tube had no length restrictions, calculate the maximum vertical height, y_{max}, before liquid would flow out of the tube.



Experiment 2: Paper lift

1. Take a strip of paper (about 1" by 8"). Blow over the top of the paper strip. Describe what happens and explain why.
2. Give a mathematical relationship that describes this effect. (start with specifying what variables are proportional to each other and then give an equation.

Experiment 3: Ping Pong Ball and air stream

1. Locate one of the stations with the orange pressure tubing connected to the air stream. Place a ping pong ball in the funnel. Turn the air stream on. Turn the funnel upside down. Describe what happens. Describe why it happens. Use a sketch to describe the air flow around the ball. Draw the air path using streamlines of the flow.
2. Remove the funnel from the tube and suspend the ping pong ball in an air jet. Describe what happens and give an explanation for this. What angle can you rotate this air jet and still suspend the ping pong ball?

Experiment 4: Siphon

1. Make sure that you have a bucket filled with water and either a sink or another bucket beneath this bucket in which any spills will flow into this (See Figure 3).
2. This is Using the buckets filled with water create submerse the tubing into the bucket and then with draw one end of the tube so that it looks like Figure 2. Describe the difference between the liquid level in the container and inside the clear plastic tube.
3. Could this device be used as a liquid level indicator? Describe why.
4. Next raise the height of the external tube about 1 inch. Describe what happens? Why does this happen?
5. Next you lower the height of the external tube and describe what happens.
6. Now perform an experiment in which you will measure the flowrate of liquid exiting the tube. To do this experiment you must first plan what measurements you need. You will need at least a volumetric flask, ruler and stopwatch.
7. Derive a mathematical model of this siphon and calculate the expected flowrate of liquid out of the siphon. You must show all steps of this derivation. Compare this prediction to your experiment. *If you are missing information you will be required to repeat this experiment before the next class.*

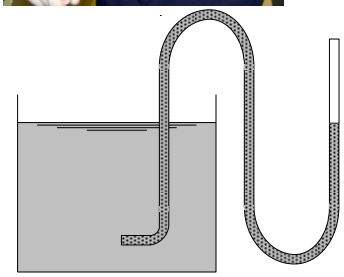


Figure 2: Bucket and external tube

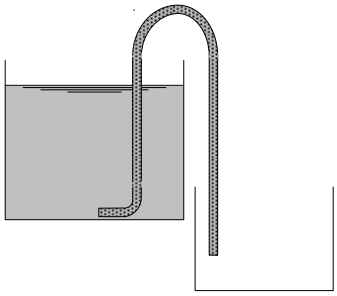


Figure 3: Siphon

Answers can be submitted using a combination of a word processor and green engineering paper (e.g. derivation of equations, if not derived in word using the equation editor) – For this assignment use the method that is the most efficient.