Worksheet: Pressure

Name: _____ Group name: _____

In this lab you will study pressure.

1. Force some air out of your squeeze bulb and seal the end with your finger.

   - How does the pressure inside the bulb compare with the pressure in the room? What causes the squeeze bulb to remain compressed even after you are no longer squeezing it with your hand?

   - Now draw some water up into the squeeze bulb. Similarly, put the straw in water and seal the end. Lift the straw clear of the water. What happens in each case? What is the upward force? Remember, pressure only pushes; it does not pull.

2. Set up "dueling syringes". With one syringe disconnected from the flexible tube, set the position of both syringes about halfway in the cylinders. Connect them both by the tube. Have one person push on the small side and one person push on the large side.

   - Which synringe “wins”? _____

   - Explain why this works. In your explanation, you should use the fact that the cross-sectional areas of the two syringes are not the same.

   - If we were to move the small syringe by 1 cm. what would be the corresponding motion in the second syringe. What is the ratio of forces applied to the small and large syringes?

- Repeat the "dueling syringes" using water instead of air. Are their differences between air and water filled syringes in this experiment?

- A fluid is **compressible** if its density changes with pressure, and **incompressible** otherwise. Based on your observations, describe air and water in terms of compressibility.

3. Build a **Cartesian Diver**. Fill a soda bottle full of water. Insert the air-filled eyedropper into the bottle pointed-tip down. Close tightly. What happens when you squeeze the bottle? Explain the effect using the concepts of pressure, compressibility, density, buoyancy.

4. Hold a sheet of paper, keeping the short end horizontal, and (forcefully) blow over the top of it.
   - What happens?

   - Explain the observed effect using velocity, pressure and Bernoulli's principle.

5. Set up the water tank with ruler and stopper and the plastic tub to catch the water. Place the aluminum ruler in the bottom of the plastic tub so that the water stream from the tank lands on or near the ruler.

   - With the water tank nearly full, uncover the hole and observe the stream of water. Draw the shape of the water stream you observe. Compare the shape to the motion of penny that you shoot off the edge of a table.

   - Measure with the aluminum ruler the distance the stream travels horizontally and how it changes as the level of the water in the tank decreases. Make a plot of your data.

   - What is the relationship between the tank's filling (height h of the water column over the hole) and horizontal distance d covered?

   - You can assume that it takes the water the same time to fall regardless of the filling level of the tank. This implies that $d = kv$, where *k* is some constant. With that additional information, what is the relationship between *h* and *v* ? Can you explain this using Bernoulli's principle?

6. Levitate the table tennis ball vertically with the hair dryer. Now tilt the hair dryer toward the horizontal and see how close to horizontal you can rotate the stream of air and still trap the ball. Explain how the ball is trapped in the flowing air using Bernoulli's principle.

7. Start water flowing from the tank through the long siphon tube into the plastic tub, using your squeeze bulb to draw water down the tube and start the flow.

    - The water in the pickup end of the siphon tube is actually flowing uphill. What pushes the water up the tube?

    - Consider the following 4 heights: the maximum height of the tube; the height of the entrance to the tube; the height of the tube exit' the height of the water. On which of these heights does the exit speed depend? How might you explain this?