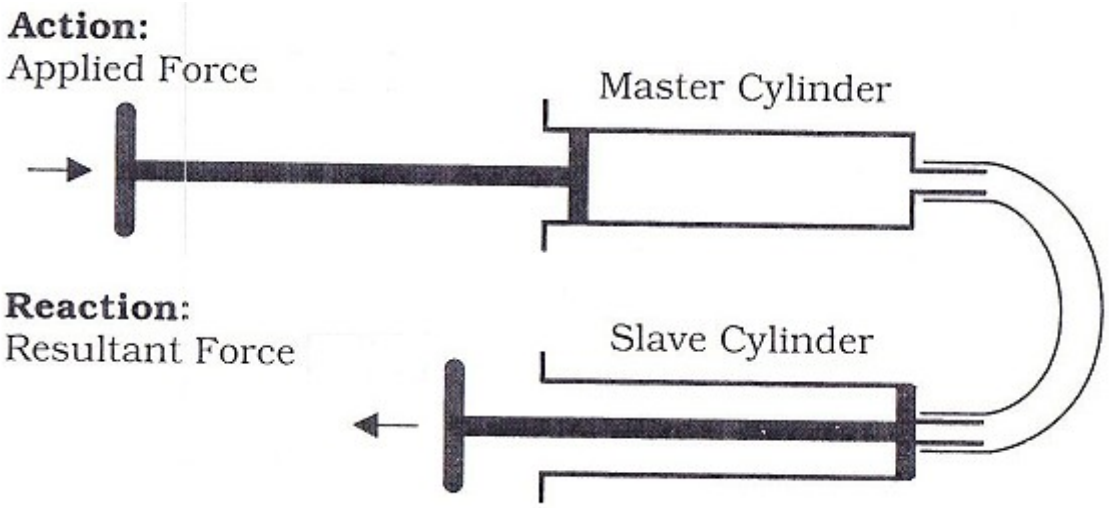
Name: _____

Pascal's Principle Lab Activity
SPH4C

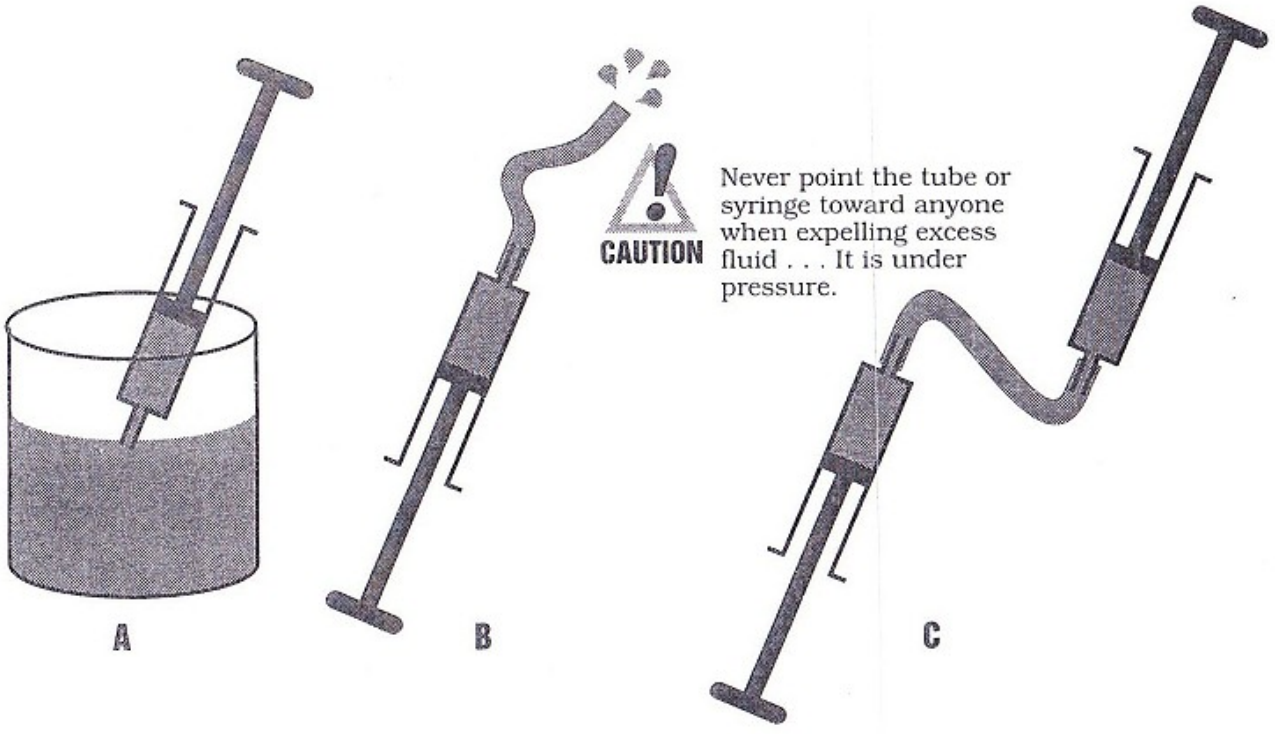
Materials: two 10 cc syringes, one 20 cc syringe, one 60 cc syringe, short piece of tubing, water, ruler

Part 1: The Hydraulic Press

Note: The syringe to which you are applying the force is referred to as the master cylinder. The syringe that moves in response is referred to as the slave cylinder.



Fill the system by first inserting the master cylinder tip into a filled beaker and drawing back the plunger (A). Next attach the piece of tubing and fill it with water by forcing the piston to expel water (B). Finally, attach the other syringe, the slave, to the other end of the tube (C). Make sure the piston is completely pushed in before connecting the tube!



What happens when you apply a force to the master cylinder plunger?

Complete the following table. (Measure the displacement with a ruler.)

Table 1: Volume and Displacement Comparisons for Two 10 cc Cylinders

Volume of water displaced in master cylinder (cc)	Volume of water displaced in slave cylinder (cc)	Displacement of master cylinder (cm)	Displacement of slave cylinder (cm)
2			
4			
6			
8			

Place your thumb gently on the plunger of the slave cylinder while applying force to the master cylinder. Do you notice any difference between the applied and resultant forces? Explain why this is what you would expect.

_____

_____

What would be your estimate for the ideal mechanical advantage (IMA) of the system? _____

Replace the slave cylinder with the 20 cc cylinder and repeat your measurements.

Table 2: Volume and Displacement Comparisons for 10 cc Master and 20 cc Slave Cylinders

Volume of water displaced in master cylinder (cc)	Volume of water displaced in slave cylinder (cc)	Displacement of master cylinder (cm)	Displacement of slave cylinder (cm)
2			
4			
6			
8			

Place your thumb gently on the plunger of the slave (20 cc) cylinder while applying force to the master (10 cc) cylinder. Do you notice any difference between the applied and resultant forces? Explain why this is what you would expect.

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_____

What would be your estimate for the ideal mechanical advantage (IMA) of the system? _____

(You may wish to compare the diameters of the two cylinders.)

Replace the slave cylinder with the 60 cc cylinder and repeat your measurements.

Table 3: Volume and Displacement Comparisons for 10 cc Master and 60 cc Slave Cylinders

Volume of water displaced in master cylinder (cc)	Volume of water displaced in slave cylinder (cc)	Displacement of master cylinder (cm)	Displacement of slave cylinder (cm)
2			
4			
6			
8			

Place your thumb gently on the plunger of the slave (60 cc) cylinder while applying force to the master (10 cc) cylinder. Do you notice any difference between the applied and resultant forces? Explain why this is what you would expect.

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What would be your estimate for the ideal mechanical advantage (IMA) of the system? _____

(You may wish to compare the diameters of the two cylinders.)

Discussion Questions:

Why does the system need to be filled with a liquid such as water?

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When you press on the plunger of the (smaller) master cylinder, where is the pressure in the system the greatest? Explain.

_____

_____

_____

When you press on the plunger of the (smaller) master cylinder, where is the force in the system the greatest? Explain.

_____

_____

_____

Part 2: Hydraulics vs. Pneumatics

Expel all the water from the system and repeat your measurements with two 10 cc syringes again but with air in the system instead of water. (Start with the plunger of the master cylinder pulled all the way back and the plunger of the slave cylinder pushed all the way in.)

Table 4: Volume and Displacement Comparisons for Two 10 cc Cylinders

Volume of air displaced in master cylinder (cc)	Volume of air displaced in slave cylinder (cc)	Displacement of master cylinder (cm)	Displacement of slave cylinder (cm)
2			
4			
6			
8			

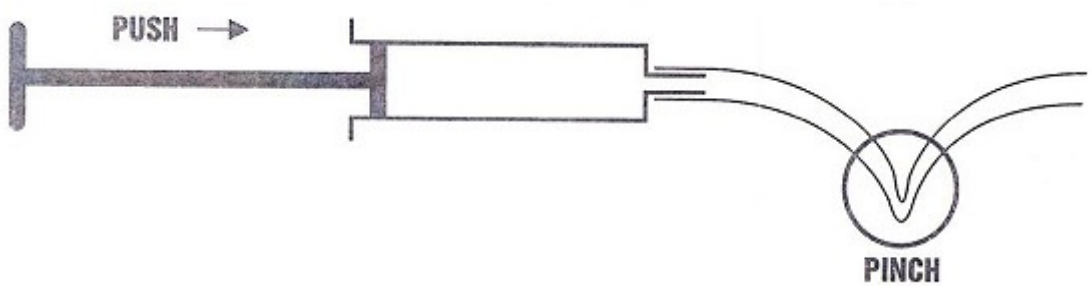
What do you notice? Explain why you think this occurred.

_____

_____

_____

For a demonstration of a very simple pneumatic system, take a single syringe with tubing attached. Pull the plunger back and pinch the tubing as shown.



Push the plunger in. What happens? Why?

_____

_____

Repeat the above demonstration, starting with the plunger all the way back. Pinch the tubing and push the plunger in. What happens? Why?

_____

_____