05-03 Pascal's Principle Lab *Name: _____*

Objective

- Observe how Pascal's Principle and hydraulics are related.

Materials

- 3 Syringes of the same size (3mL) (with Luer-lock tip)
- 1 Syringe of very different size (20mL) (with Luer-lock tip)
- Connectors to connect 2 syringes using the Luer-lock tip
- Water
- Ruler

Procedure

Pascal's Principle states that any change in pressure in a closed system is transmitted equally to all parts of the system. That also means that in a closed system, the pressure is the same everywhere.

1. Connect 2 of the 3mL syringes together. Fill them with water so that no air is inside.
2. Carefully press a plunger so that the other plunger is fully extended to the 3mL mark.
3. Press the extended plunger until the other plunger is at the 3mL mark.
4. How much water was pushed out of the 1st syringe? _____
5. How much water was pushed into the 2nd syringe? _____
6. Do these volumes make sense? Explain. _____
7. Which plunger moved farther? _____
8. Push both plungers at the same time with the same force. What happens? _____
9. Connect the other 3mL syringe to the 20mL syringe so that there is no air inside.
10. Carefully press the 20mL plunger so that the other plunger is at the 3mL mark.
11. Note the locations of both plungers. Press the 3mL plunger all the way.
12. How much water was pushed out of the 3mL syringe? _____
13. How much water was pushed into the 20mL syringe? _____
14. Do these volumes make sense? Explain. _____
15. Which plunger moved farther? _____
16. How do you find the volume of a cylinder or prism? _____
17. If the area of the base gets smaller, what happens to the height to have the same volume? _____
18. Using this concept, explain your answer to number 15? _____
    _____
19. Push both plungers at the same time with the same force. What happens? _____
20. Which plunger is easier to push? _____

Pressure is

$$P = \frac{F}{A}$$

Solve this for force.

$$F = PA$$

Therefore, force is directly proportional to area when the pressure is constant. Therefore, a bigger plunger area means a _____ force.

Take the pressure equation and write it for each syringe noting that the pressure is the same

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

For this equation to be true, when the area is larger, the force needs to be larger. That is the basis of hydraulics. To move something with a lot of force, give it a big plunger. This can be moved by applying a small force on a small plunger.

21. Which plunger was easier to push, the one that moved farther or less? _____
22. If you wanted to lift a car with hydraulics, would you want the car to be on the big plunger or small one? _____
    Which plunger would you want to push? _____ Which one will move farther? _____