Name: Date: Class:

Fluid Forces Student Worksheet

Goal:
Explore how different fluids can exert different forces and observe how fluid properties impact the movement of objects in a hydraulic system.

Materials Needed:
- 3 sets of connected syringes and tubing:
  - Set 1: Air (empty syringes)
  - Set 2: Water
  - Set 3: Viscous substance (e.g., honey or bubble bath)
- Small objects to move: marker, board eraser, small book

Procedure:
1. Initial Observations
   a. Test each set of syringes by pressing one syringe and observing the movement of the connected syringe.
   b. Use the syringes to try and move small objects (e.g., a marker, eraser, or book).
   c. Observe and compare the force required to push the syringe with different fluids.

2. Record Observations
   Instructions: For each fluid, answer the following using a scale of 1-5 (1 = easiest, 5 = most difficult).

	How much effort is needed to push the syringe?	How quickly does the connected syringe respond?	How effectively does the system move the object?
Air			
Water			
Viscous Fluid			

Name: **Date:** **Class:**

Analysis Questions:

Instructions: Answer the following questions based on your observations.

1. How did the force transfer differ between the air-filled, water-filled, and viscous-fluid-filled syringes?

2. Which fluid allowed for the easiest and fastest movement of the object? Why?

3. What challenges would engineers face when using a viscous fluid in a hydraulic system?

4. How do your observations demonstrate Newton's First Law of Inertia?

5. What role do balanced and unbalanced forces play in the motion of the objects?

Name: **Date:** **Class:**

Illustrations of Observations

Instructions: Use the space below to sketch your free body diagrams for each fluid system. Be sure to:

- Label the syringes and tubing.
- Use arrows to represent the forces and show any differences in the size or direction of the forces between the systems.

Free Body Diagram for Air System: *(Draw here)*

Free Body Diagram for Water System: *(Draw here)*

Free Body Diagram for Viscous Fluid System: *(Draw here)*

Name: **Date:** **Class:**

Vocabulary Development

Instructions: Research and define each term in your own words.

- Force:
- Balanced Forces:
- Unbalanced Forces:
- Fluids:
- Viscosity:
- Hydraulic:
- Inertia:
- Pressure:
- Pascal's Law:

Name: **Date:** **Class:**

Research: Hydraulic Bridges Around the World

Instructions: Research hydraulic bridges around the world. Record your bridge inspirations, the name, and a brief summary of how the bridge works. Include at least 2 different bridges from around the world.

Name: **Date:** **Class:**

Planning and Building Instructions

Sketch MUST INCLUDE:

- Plans for a base
- Bridge size: 8” in length, 5” in height & width
- Location of syringes
- Direction of potential movement
- Labels

Materials:

- Minimum of 2 syringes
- 12” plastic tube (⅛” diameter)
- 1/2" wood cubes with holes
- ¾” wood cubes
- Skewers
- Popsicle sticks
- Hot glue

Name: **Date:** **Class:**

Test and Improve

Instructions: Test your bridge.

1. Test your bridge with air. Record your observations here.

2. Test your bridge with water. Record your observations here.

3. Test your bridge with a thicker fluid (e.g., honey or body wash). Record your observations here.

Name: **Date:** **Class:**

Instructions: Improve your bridge.

4. List what worked with your bridge.

5. List what didn't work with your bridge.

6. List what you will do to improve your bridge.