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Student Reflection Sheet Answer Key

1. What did you learn about how forces are transferred through fluids in a hydraulic system?

   Forces are transferred evenly through the fluid, which allows the syringes to move the bridge. Liquids like water don't compress, so they work well for this purpose because they exert force evenly throughout everything.

2. How does Newton's First Law of Inertia explain what happens when the syringes push or pull fluid through the tubing?

   Newton's First Law says an object will stay at rest or in motion unless a force acts on it. The fluid stays still until the syringe applies a force. This causes the fluid to move to the other syringe, pushing it out, and therefore the bridge moves.

3. How did balanced and unbalanced forces affect the movement of your bridge?

   When the forces on both sides were balanced, the bridge stayed still. When one side pushed harder (unbalanced forces), the bridge started to lift or lower. If the forces from the fluid pushing outward are not balanced, the bridge will not move smoothly, or the tubing could pop off.

4. How did the viscosity of the fluid in your system affect the performance of your bridge?

   The thicker fluid (shampoo/honey/oil) moved more slowly and needed more force to push the syringe. The water moved quickly and was easier to control. The more viscous fluid also exerted (could exert) more force.

5. What challenges did you encounter while building your bridge, and how did you overcome them?

   One challenge was keeping the tubing from leaking. We secured it tightly with tape and tested it multiple times. Another was making the bridge move; the syringe need something to push against so that the force was applied in the correct direction.

6. Why is it important for engineers to design systems where forces are balanced during operation? How did you ensure balance in your bridge?

   Balanced forces make sure the system works smoothly and doesn't tip over. We placed the syringes equally on both sides of the bridge to make the lifting even.

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7. How does Pascal's Law apply to the movement of your bridge? Can you explain how it works in your system?

   Pascal's Law says that pressure in a fluid is distributed equally in all directions. When we pushed one syringe, the pressure moved through the tubing and lifted the bridge evenly.

8. How does this project relate to real-world hydraulic systems in cars, drawbridges, or heavy machinery?

   Drawbridges, car brakes, and hydraulic lifts all use similar principles. They rely on fluid systems to transfer force and make things move.

9. If you could redesign your bridge, what would you change, and why?

   I would make the bridge lighter by using fewer popsicle sticks. It would need less force to lift, so the system would work faster.

10. How did your bridge demonstrate Newton's First Law of Inertia during testing, especially when forces were applied or removed?

Commented [BM1]: Should there be an example answer for this?