Name; _____ Class; _____ Date; _____

Mechanical Advantage in a Hydraulic Jack

Learner Outcomes:

- Describe how hydraulic pressure can be used to create a mechanical advantage in a simple hydraulic jack (*e.g., describe the relationship among force, piston size and distance moved using different sized syringes linked by tubing*).
- Analyze mechanical devices to determine speed ratios and force ratios.

Key Terms:

Hydraulic system	Force	Pascal's law
Pressure	Fluid pressure	Piston

Background Information: A jack is any device used to lift objects. You will use syringes and flexible tubing to create a model of a hydraulic jack. The plungers in the syringes are pistons.

Research Question: How does fluid pressure create mechanical advantage in a hydraulic jack?

Hypothesis:

Materials:

2- 50 mL syringes with platforms	Small plastic tub	2 support stands
	Water	1 kg mass
10 mL syringe with platform	30cm rubber tubing	
	4 burette clamps	

This investigation / activity has been adapted from:
Mah K, Martha J, McClelland L, et al. *Science in Action 9.* Toronto, ON: Addison Wesley.

Procedure:

1. Measure and record the plunger diameter in the 50 mL and 10 mL syringes. Calculate and record the area of each plunger.
2. Connect the two 50 mL syringes with the latex tubing. Remove the plungers from both syringes and pour water into one until both are full.
3. Using the plastic tub to capture the overflow, insert the plunger into one syringe and push it all the way down. Insert the plunger into the second syringe and push it half way down. No air should be left in the syringes or tubing.
4. Mount each syringe on a support stand. Have your partner hold one stand and place the 1kg block on the platform. Hold the other stand steady as you push down on the platform until the mass on the other syringe moves.
5. Move the 1kg block to the other platform and push down on the empty platform until the mass moves. Note (qualitatively) how much force you used to move the mass.
6. Remove the mass and take both syringes off the support stands. Remove the latex tubing and drain the water.
7. Connect the 10 mL syringe to the50 mL syringe with the latex tubing. Fill the syringes with water, but this time insert the plunger in the 50 mL syringe only half way and then insert the plunger into the 10 mL syringe.
8. Repeat steps 4 and 5

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