Name: _____ Date: _____ _____/ 60

The Frictional Force Laboratory *Conceptual Physics*

Introduction

1. Write out in your own words the definitions for the following:

Inertia -

Static friction -

Kinetic friction -

2. Do you think an object with a larger mass will experience less friction than one with a smaller mass on the same surface? Why or why not?

3. Do you think the application of soap over a surface will cause an object to slide more effortlessly across it? Why or why not?

Materials

- Safety goggles
- Spring scale with measurements in Newtons
- A plastic tub
- Rubber band
- Paper Clip
- Aluminum foil
- Dish detergent
- Washcloth
- Sand or kitty litter
- A board or other homogenous surface that is at least a meter long and at least twice the width of the plastic tub

Methods

Part I. How increased inertia impacts static and kinetic friction.

1. Lay the board down on a flat surface, it should not be inclined at all.

2. Place the rubber band around the base of the empty tub.

3. Attach the paper-clip to the rubber band.

4. Weigh the plastic tub with the rubber band and paper clip attached; record the mass.

5. Calibrate your spring scale.

6. Place the plastic tub on the flat surface and attach the spring scale to the paper clip.

7. Very slowly, pull the spring scale, taking careful note of the time at which the tub begins to move and the amount of force you are applying. At the very instant the tub begins to move, note the amount of force applied in newtons. Record this in the Data Table I. Repeat this two more times. You are measuring *static friction*.

8. Slowly pull the spring scale again, but this time, keep pulling the spring scale even after the tub started moving, and move the tub at a constant velocity. Note the amount of force needed according to the scale to do this. Repeat two more times and record in Data Table I. You are measuring *kinetic friction*.

9. Fill the tub half-way with sand, and record the mass in Data Table I.

10. Repeat step 7, noting static friction. Perform three trials, and record in Data Table I.

11. Repeat step 8, noting kinetic friction. Perform three trials, and record in Data Table I.

12. Fill the tub nearly completely with sand, and record the mass in your Data Table I.

13. Repeat step 7, noting static friction. Perform three trials and record in Data Table I.

14. Repeat step 8, noting kinetic friction. Perform three trials and record in Data Table I.

Part II. How different surfaces impacts static and kinetic friction.

1. Record the data from steps 13 and 14 in Data Table II, under the Plain Board Condition

2. Spread about 2 feet of aluminum foil over the tabletop and smooth it out.

3. Slowly pull the tub from step one over the surface of the aluminum foil, note the point on the scale at which the tub started moving (static friction), and the reading of the scale when the tub is moved at a constant velocity (kinetic friction). Record the results in Data Table II under the condition of foil-covered surface and repeat two more times.

4. Remove the foil and spread dishwashing detergent over your surface. Use a towel to make the surface as homogenous as possible.

5. Repeat step 3 and record both static and kinetic friction. Perform a total of three trials and record in Data Table II under the soap-covered surface condition.

6. Average all results and discuss.

Data Collection and Results

Data Table I. Comparison of Forces Needed to Overcome Static vs. Kinetic Friction								
Condition	Amount of Force Applied in Newtons							
	Trial 1		Trial 2		Trial 3		Average	
	Static	Kinetic	Static	Kinetic	Static	Kinetic	Static	Kinetic
Tub only _____g								
Tub ½ full _____g								
Tub full _____ g								

Data Table II. Comparison of Forces Needed to Overcome Friction over Various Surfaces								
Condition	Amount of Force Applied in Newtons							
	Trial 1		Trial 2		Trial 3		Average	
	Static	Kinetic	Static	Kinetic	Static	Kinetic	Static	Kinetic
Over Plain Board								
Over Foil-covered Surface								
Over Soap-covered Surface								

Discussion

In your discussion, use the actual numbers from your data to back up your explanations.

1. Do any of these results surprise you? Why or why not?

2. For any given condition, which required more force? Getting the tub to move initially or moving it at a constant velocity? Use the actual data in your explanation.

3. In Part I, when the mass of the tub was increased, how did that impact both static and kinetic friction?

4. How can you apply Newtons First Law of Motion to this conclusion?

5. How can you apply Newton's Second Law of Motion to this conclusion?

6. In Part II, compare the results between the plain board and the foil-covered surface. Which surface required more applied force to overcome both static and kinetic friction? Why do you think this happened?

7. Compare the results between the plain board and the soap-covered surface. Which surface required more applied force to overcome both static and kinetic friction? Are you surprised at these results? Why or why not?

8. Write out in your own words why there is a difference between the amount of force required to overcome static versus kinetic friction.