Name:_____ Date: _____ Period:_____

Calculating Coefficient of Friction Lab

Introduction:

Friction can waste energy, wear down parts and cause things to heat up. But we also depend on friction to keep our shoes/feet from sliding out from under us and to keep our cars on the road (from friction between road and our car's tires).

Two types of friction:

Static friction - resists an object to start moving or sliding

Kinetic friction - resists an object that is already moving or sliding and always acts in a direction opposite of the motion (the reason that anything sliding freely will eventually come to a stop)

Note: static friction is always stronger than kinetic friction – more force is needed to start to move an object than to keep it sliding.

Static and kinetic friction between an object and the ground can be calculated using the following equation:

$$F_F = \mu \times F_N$$

F_f is the frictional force

μ is the coefficient of friction

F_N is the normal force

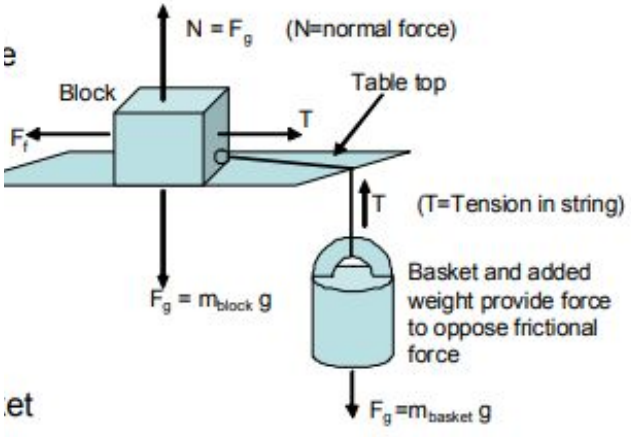
μ_s - coefficient of static friction, used when an object is not sliding

μ^k – coefficient of kinetic friction, used when object is sliding

The values for μ are usually found experimentally.

Materials:

- Fishing line
- Cup
- Block
- Marbles
- Sand paper
- Wax paper
- Rubber
- Paper



Procedure:

1. Gently add marbles to the cup .
2. Continue to gradually add weight until the block starts to slide.
3. Record the total amount of marbles in the cup that finally caused the block to begin sliding.
4. Repeat steps 1-3 with the same system for three trials
5. Turn the wooden block so a different surface material is in contact with the table and Repeat steps 1-4 for each material.
6. Calculate the average coefficient of static friction for each trial.

Data and Discussion Questions:
Equations:
Total mass of marbles = mass of marble X number of marbles
Total mass of cup = mass of marbles + mass of cup
Normal force of blocks = Mass of block X 9.8 m/s^2
Gravitational Force of Cup = total mass of cup X 9.8 m/s^2

Static Friction Data:

Mass of block: _____kg

Mass of empty cup: _____kg

Mass of marbles added: _____kg

Material 1: _____

Trial #	**# of marbles**	**Total mass of marbles in cup (kg)**	**Total Mass of cup (kg)**	**Total Mass of block**	**Gravitational force of cup F_g= mg**	**Normal Force of blocks F_N= mg**	**μ_s** **$\mu_s = F_g/F_N$**
1							
2							
3							
						Average μ_s	

Material 2: _____

Trial #	# of marbles	Total mass of marbles in cup (kg)	Total Mass of cup (kg)	Total Mass of block	Gravitational force of cup $F_g = mg$	Normal Force of blocks $F_N = mg$	μ_s $\mu_s = F_g/F_N$
1							
2							
3							
						Average μ_s	

Material 3: _____

Trial #	# of marbles	Total mass of marbles in cup (kg)	Total Mass of cup (kg)	Total Mass of block	Gravitational force of cup $F_g = mg$	Normal Force of blocks $F_N = mg$	μ_s $\mu_s = F_g/F_N$
1							
2							
3							
						Average μ_s	

Material 4: _____

Trial #	# of marbles	Total mass of marbles in cup (kg)	Total Mass of cup (kg)	Total Mass of block	Gravitational force of cup $F_g = mg$	Normal Force of blocks $F_N = mg$	μ_s $\mu_s = F_g/F_N$
1							
2							
3							
						Average μ_s	

Discussion Questions:

1. What are the two factors that affect friction?

2. How does μs vary with mass of the blocks? With the surface material? Are these results consistent with what you expected based on theory and your knowledge of friction? Explain.

3. What are some possible experimental errors?

4. What is one way that you can improve this experiment?