Lab Report

Name: Partners: Department: Date:

Experiment 3: Determination of the Coefficient of Static and Kinetic Friction

Purpose

This experiment is performed to determine the coefficient of static and kinetic friction.

References

1. Physics Laboratory Experiments, Yuksel Sahan, Zambak Publications.
2. http://ffden-2.phys.uaf.edu/211_fall2002.web.dir/ben_townsend/staticandkineticfriction.htm
3. http://hyperphysics.phy-astr.gsu.edu/hbase/frict2.html
4. http://www.studyphysics.ca/newnotes/20/unit01_kinematicsdynamics/chp05_forces/lesson20.htm

did you know?

One of Wu-Li's relatives!

Some people think that my tarantula can climb the walls of her tank because of some sort of "stickiness" on her feet. Actually, she's using friction more than anything else. A tarantula's feet are covered with thousands of microscopic hairs. When she touches her feet to the glass, these hairs jam into the micro-cracks in the surface of the glass and hook on. This is why you'll often see her tap one of her feet against the glass a few times before it takes hold.

Equipments

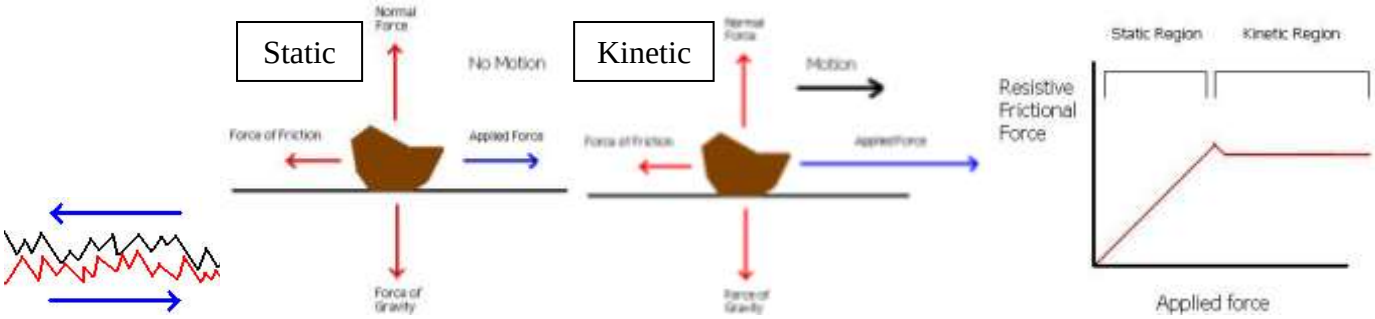
1. Wooden, glass and plexiglas slabs.
2. Wooden, glass and plexiglas path.
3. Dynamometer.
4. Weights.

Pre-Lab Questions

1. How does the coefficient of friction depend on the area of contact? Explain.
2. When you walk, what is the direction of friction force on your body?
3. If you push on a heavy box that is at rest, you must exert some force to start its motion. However, once the box is in motion you need a smaller force to maintain that motion. Why?

Introduction and Theory

The level of friction that different materials exhibit is measured by the coefficient of friction. The formula is μ = f / N, where μ is the coefficient of friction, f is the amount of force that resists motion, and N is the normal force. Normal force is the force at which one surface is being pushed into another. If a rock that weighs 50 newtons is lying on the ground, then the normal force is that 50 newtons of force. The higher μ is, the more force resists motion if two objects are sliding past each other.

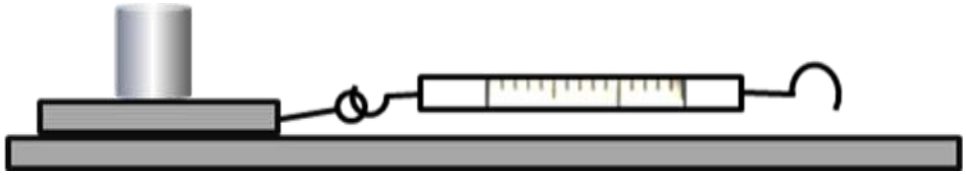


There are two forms of friction, kinetic and static. If you try to slide two objects past each other, a small amount of force will result in no motion. The force of friction is greater than the applied force. This is static friction. If you apply a little more force, the object "breaks free" and slides, although you still need to apply force to keep the object sliding. This is kinetic friction. **You do not need to apply quite as much force to keep the object sliding as you needed to originally break free of static friction.**

Notice! As a rule thumb, keep in your mind that, the static friction force is always maximum, it varies with the applied force.

Experimental Procedure

1. Set the equipments as shown in the figure below.
2. Calculate the normal force for each different mass combination with the equation N=mg ($g=9.81\ m/s^2$).
3. Apply horizontal force with and without mass for static friction (i.e. the maximum applied force without motion).
4. Record the maximum static friction force for the relative mass (which is equal to the applied force).
5. Apply horizontal force with and without mass for kinetic friction (i.e. apply constant force with constant motion).
6. Record the kinetic friction force for the relative mass (which is equal to the applied force).
7. Work out the coefficient of friction for all static and kinetic cases with the equation $\mu = f / N$.
8. Record the coefficients.
9. Plot the graphs of $f_{APPLIED}$ versus N and calculate the slope to find the average with graphical method.



Figure

Data Collection and Calculations

STATIC

	Surfaces	Weight (N)	Normal (N)	F_{STATIC} (N)	μ	μ AVERAGE
1						
2						
3						
4						
5						
6						

KINETIC

	Surfaces	Weight (N)	Normal (N)	$F_{KINETIC}$ (N)	μ	μ AVERAGE
1						
2						
3						
4						
5						
6						

Your Conclusion