Coefficient of Friction

Purpose:

1. to determine and compare the coefficient of static friction of different materials
2. to determine and compare the coefficient of kinetic friction of different materials
3. to compare the coefficients of static and kinetic friction

Procedure:

Materials: block, board, protractor, ruler - choose several different materials to slide down a ramp - wood, wood covered with sandpaper, pad of paper (like post-its); list the items you used - **you need to use at least 3**; the ramp can be wood, metal, plastic, etc - make note of that as well (Do not use items that will roll - that is a different concept!) Be creative in your choice of materials!

A. Static Friction

Note: Horizontal distance = distance along the base of the triangle that is formed when the ramp meets the table or floor.

Vertical distance = distance from the floor or table to the top of the ramp, straight up - start measuring where the triangle makes a 90^{o} angle.

1. Place the 1st block on the board and slowly tilt the board until the block just starts to slide from rest.
2. Measure the horizontal distance (x) and the vertical distance (y) of the board at this inclination. Also, measure the angle that the board makes with the surface (Φ). The calculated complement of this angle is θ. Record both angles.
3. Calculate the coefficient of static friction using the equation: $\mu_s = (y/x)$ in the Calculations section.

4. Place the block at the same point on the board and repeat the procedure to get three values for μ_s. Average the results.
5. Repeat Steps 1-4 for your other materials.

B. Kinetic Friction

1. Repeat Step #1 of the procedure for static friction. However, this time give the block a slight push to get it in motion. Tilt the board so the block neither speeds up nor slows down but moves down the incline at a constant velocity. (acceleration = 0). (Since the viewer's eye is judging the uniform velocity and since the surface board is not uniform, the value obtained for this height will not be completely accurate.)
2. Repeat Steps #2 - #4 above but determine the coefficient of kinetic friction by the equation $\mu_k = (y/x)$ in the Calculations section.
3. Compare μ_s with μ_k.
4. Repeat Steps 1-3 for your other materials.

Data/Calculations:

Construct tables as below for each material, one for static and one for kinetic coefficient of friction. Using a **minimum** of three materials means a **minimum** of six data/calculation tables. You can copy/paste this table into your Word document.

Ramp material: _____ Block material: _____ kinetic or static friction data?			
Trial	Length (x) (cm)	Height (y) (cm)	$\mu_s = y/x$
1			
2			
3			

Average			

Questions:

1. Which combination of materials had the highest coefficient of friction? the lowest?
2. Which type of friction is always greatest - kinetic or static? Why?
3. What effect does surface area have on the coefficient of friction? You may need to research this if you do not know the answer.
4. Research one of your combinations on-line to see how close you came to a published coefficient of friction. Here is one site you can use: **Engineers Handbook**

Graded Assignment:

Submit your completed lab to the dropbox titled: **Lab-Coefficient of Friction.** Use the Lab report format and rubric found in the Introductory Unit to guide you in writing your lab report.