33010 Surface Board

Purpose: To study the effects of different types of friction on the force needed to move a stationary body over materials of different texture. This kit is designed for use in friction investigations.

Contents:
1 – Multi-surfaced Friction Board
2 – Wooden block with 2 hooks

Required Accessories:
1 – Spring scale or Force Measurer with thin blade
1 – 1 foot string with a loop at each end
1 – 100g mass
1 – 200g mass
1 – 500 g mass
1 - Ruler

Background: All surfaces, even those that appear smooth, are rough at the microscopic level. When two surfaces are in contact, the molecules temporarily bond with a weak attraction by transferring electrons. When you first attempt to move the two surfaces relative to each other, you must break these bonds. This is the essence of **static friction**. As the surfaces move past each other, the competing rates of bond forming and bond breaking reduces the attraction between the two surfaces and they experience a lower form of friction called **kinetic friction**.

Procedure (Part One):
1. Zero out your spring scale.
2. Convert your three masses to force using the formula F = m x a, (Force $_{Newtons}$) = Mass $_{kg}$ x Acceleration($_{9.8\ m/sec^2}$)
3. On the table, connect the spring scale to the wooden block (with one hook), using the string.
4. Place the Friction Board under the block so that the cork surface is under the block and place the 100g mass on the block.
5. Place a white sheet of paper (if needed) under the scale for easier reading.
6. The first lab partner will hold the scale in place while the second partner slowly pulls the Friction Board out from under the block of wood.
7. Read the force just before the block begins to move. Record this as Static Friction Force $F_{f(static)}$.
8. Read the force as the block is moving. Record this as Kinetic Friction Force $F_{f(kinetic)}$.
9. Calculate the coefficient of static friction produced (μ_S) for each mass by using the formula $F_N \times \mu_S = F_f$. (F_N = the force calculated in step 2 plus
0.1N, which is the force of gravity for the block of wood)
10. Calculate the coefficient of kinetic friction (μ_K) for each mass by using the formula $F_N \times \mu_K = F_f$, in the same way as you found μ_S.
11. Average the values for μ_S and μ_K for cork. Repeat procedure for rubber, sand paper and cardboard.
12. Repeat the experiment, but double the surface area being pulled across the board by hooking a second block to the first.

Procedure (Part Two):
1. Place the block of wood on the first surface. Using a ruler to measure the height, lift the Friction Board slowly, until the block of wood begins to slide.
2. Use the height and the length of the Friction board to determine the angle of inclination.
3. Use the tangent of this angle to determine the coefficient of static friction μ_S.
4. Repeat for all four surfaces and compare these answers with your results in part one.

Data Table:

	100g mass		200g mass		500g mass	
	$F_{f(static)}$	$F_{f(kinetic)}$	$F_{f(static)}$	$F_{f(kinetic)}$	$F_{f(static)}$	$F_{f(kinetic)}$
Cork Board						
Rubber						
Sand Paper						
Cardboard						

	100g mass		200g mass		500g mass	
	μ_S	μ_K	μ_S	μ_K	μ_S	μ_K
Cork Board						
Rubber						
Sand Paper						
Cardboard						

Time Allocation:

To prepare this product for an experimental trial should take less than two minutes. Actual experiments will vary with needs of students and the method of instruction, but are easily concluded within one class period.

Feedback:

If you have a question, a comment, or a suggestion that would improve this product, you may call our toll free number.