**Introduction:** Friction is a force that exists in nature that opposes the motion of objects. It will always act in the opposite direction to the motion of an object. Take for example an automobile skidding to a halt, a baseball player sliding into home plate or a hockey puck sliding across the ice. In each case, there are two surfaces in motion relative to one another. In addition, the magnitude of the frictional force can be very different from one situation to the next. Consider a vehicle driving along a highway on a dry day vs. a wet day, vs. an icy day. How does friction change as you go from dry to wet to icy? In the case of kinetic friction, there is relative motion between the surfaces of the two objects. However, in static friction, there is no relative motion. If you push on a heavy crate and it doesn’t move, blame it on the static frictional force.

**Given the following equipment…**

|  |  |
| --- | --- |
| * Wooden block with attached string | * Various masses, slotted and without slots |
| * Vernier Equipment (LabPro, force gauge) | * Logger Pro 3.8 or higher. |

**You are challenged to…**

1. Come up with a procedure to determine a relationship involving the force of friction that can be used to make a prediction about the frictional force. You will measure the frictional force using a computer interfaced force gauge. What other forces or data to collect is up to you. Consider the materials you have.
2. Graphically represent your data is such a fashion that a well-defined pattern exists.
3. From your graph, try to determine a mathematical relationship that relates to your data.
4. Draw a free body diagram of all forces on the block as you pull it across the lab bench, including .

**Equipment Preparation and Procedure for Data Collection:**

1. Complete all connections to the LabPro interface and the computer. Connect the force gauge to a DIG/SONIC port on the LabPro. ***Set the force gauge to the 10N scale.***
2. Start Logger Pro 3.8.0 or higher and open up the file, “**Making Sense of Friction**” in the ***Student Assignments*** directory under ***Mr. Ropes/Physics***.
3. Connect the string from the block to the hook on the force gauge, and hold it in your hand such that the string is ***parallel*** to the surface on which it rests.
4. ***Press the collect button  on the screen and slowly increase the tensional force acting on the block until it begins to move***. ***Continue to pull on the block such that it moves at a relatively constant speed until the data collection times out***.
5. ***Determine the average kinetic frictional force by highlighting the region on the graph where the block was in motion. This should be pretty clear to you. Then click on the Statistics button,.***
6. ***To determine the static frictional force, Click the Examine button, , and move the mouse across any graph to find the maximum force required to get the block to begin to move***.

**Data:** (Note: The data table below may contain more columns and rows than you may need to use.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Free Body Diagram:** Draw all the forces acting on the block while you drag it across the lab bench.

**Sketch of Computer Screen:** Sketch a representative trial on the axes below.

Force (N)

Time (s)

**Results:** (graphical) – If you find a linear relationship, determine its slope. Does it have meaning?



**Sources of Error:**

**Summary of Results (Conclusion):**

* Describe any trends/correlations that you have found in your data.
* Can you write a representative equation based upon your results? *(Hint: Use your graph.)*

