Slip me Some Skin

Part A

Purpose: to measure μ_s and μ_k for a variety of surface combinations.

Set-up

You will need to obtain a set of friction blocks, then attach a motion detector and force sensor to your GLX interface. Configure DataStudio so that you display *v* vs. *t* and *F* vs. *t* graphs. Make sure your table is clear of debris; it may be necessary to wipe it off with a damp cloth to ensure a clean surface (make sure it is dry before collecting data).

Make sure that you have 1250g of total mass that you can put inside the friction blocks. You may need to obtain a spare mass from the "extras" bin. If any of your blocks are not labeled with their mass, use the triple-beam balance to measure this mass and label them with a piece of masking tape.

Cut a piece of string and attach it to one of the friction blocks (it is probably best to start with either the cork or felt blocks). Make sure to find the mass of the block using the triple beam balance before you start your experiment. Use a knot that is easy to untie, for example the larks head knot:

Data Collection

Determine the maximum force that you can apply to the block before it starts sliding. Once it starts moving, determine the force required to keep it moving with a constant speed. The purpose of the motion sensor is to allow the person pulling the box to maintain as constant a speed as possible. This may require some practice.

Record these two force values (in a data table using Excel) for five values of mass inside: 1250g, 1000g, 750g, 500g & 250g (make sure you know the actual mass you use). It is suggested that you start with the largest mass and work your way down.

In Excel, plot a graph of $F_{max\ (before\ movement)}$ vs. Normal Force (use total mass!) and a graph of $F_{while\ sliding}$ vs. Normal Force. Add a trend line to both graphs and find the slope and its error from the fit. You can plot both forces (dependent variables) on the same graph.

What does the slope of each of these graphs represent?

Repeat this process for the remaining surfaces. (You will likely be unable to collect quality data for 500g and 250g for the plastic surface because the small forces involved may be below the resolution of the force sensors.) Print from Excel one copy of your data tables and three sets of graphs per group. For your report, each group should print one copy of the best *v* vs. *t* and *F* vs. *t* graph set from DataStudio for each surface type.

Part B

Purpose: To examine the relationship between surface area and frictional forces.

For this part of the activity you will need to trade friction blocks with a neighboring group so that one group has two cork blocks and the other group has two felt blocks.

Data Collection

Put 1250g into one block. Place the other similar block on top of the loaded block. Collect the same "Force" data as in Part A, and record these values in a new table.

Now hook the two blocks (with same surface type) together and distribute the 1250g as evenly as possible between them. Collect the force data for this new situation on the same graph as the single block. Record this data in your data table.

Repeat this process for 1000g and 500g.

What is the relationship between surface area and frictional forces, given the same normal force (mass)? Support your claims by providing evidence. Include your best one/two block graph.

Additional questions for report:

(1) **What variables influence frictional forces?**

(2) **How does the normal force of the single-block system compare to the normal force for the two-block system? Support your claim mathematically.**