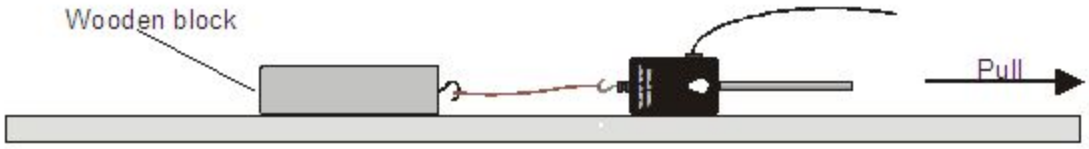
Static and Kinetic Friction Lab (GROUPS)

EQUIPMENT:

- Wooden block with hook and various weights
- Rough wooden plank to drag block across
- Digital balance that can handle up to 5 kg
- Vernier dual range force sensor + interface
- Laptop with LoggerPro and Googlesheet
- Steady hand

PROCEDURE for STATIC FRICTION:

1. In your groups, you will using this equipment to figure out what force is needed to JUST get the wooden block to move when you pull on it with the force sensor (see diagram below).



2. An easy way to do this with logger pro is to click the green arrow to collect data and GENTLY pull the sensor horizontally 4 or 5 times so that the graph produces 4 or 5 similar force peaks on the graph. Once the run is done, you can use the EXAMINE function to figure out the maximum force for each peak which = the static friction force that needed to be overcome to move the block. Don't forget to zero the sensor before starting.

3. You will be changing the Normal Force (FN) of the wooden block by stacking weights. Remember, the Normal Force on a horizontal surface is the same as the WEIGHT. You will be weighing the blocks on the digital balances provided. Please treat them with respect. You need FIVE different normal forces with 4 similar trials each. Enter this RAW data into a spreadsheet. Everyone in the group SHOULD do their own graphing. Include measurement uncertainties for the force sensor (± .05 N). Create a column in your spreadsheet that calculates average Force of Static Friction for the trials and another column that shows the uncertainty between all the trials for the same Normal Force. Note: We did this for the ball on ramp data.

4. Knowing the equation for the force of static friction, you should graph the data in such a way that you can use the slope to estimate the coefficient of static friction between the wooden block and the wooden board. You will need a best fit line, a max and a min that are labeled and different colors and a final calculation for μs including the propagated uncertainty obtained from the range of values provided by your max and min lines.

PROCEDURE for KINETIC FRICTION:

1. You can also use this same equipment to calculate KINETIC friction. In this case you will use the same set up, but instead of seeing what force you need to JUST get a block to start moving, you will see what force is needed to KEEP the block sliding at a slow but constant velocity. When you click on the green arrow on logger pro, you will start dragging the block slowly and steadily over the same part of the wooden board for each trial. You want the line on the graph to be as close to horizontal has possible. This is NOT EASY to do. You can highlight a particularly smooth part and put a best fit line on it to read the force or use the “statistics feature” which will show you the min and max values for that section. Or you can use the “examine” feature.

2. Again, do 5 different combinations of masses on the wooden block with four consistent trials each. Should you reweigh them? Should you re-zero the sensor?

3. Again, create a raw data table for Kinetic Friction on Googlesheets. You will need use the spreadsheet to average your trials and calculate the uncertainty for each Normal Force. Create a second graph similar to the first with ALL of the SAME FEATURES so you can use the graph to estimate the coefficient of sliding/kinetic friction for the wood block on the wooden board.