# Friction Forces Evaluation

## 1 Assignment

At your lab station, you have an inclined plane and a block with two different surface materials: bare wood and rubber. In this lab, your team is tasked with *experimentally* determining the effect of contact area on the coefficients of static friction, $\mu_s$, and kinetic friction, $\mu_k$. To achieve this, we can perform experiments to determine $\mu_s$ and $\mu_k$ while changing one variable: the area in contact.

Your team should select one material (rubber or wood) to investigate. For this material, you are tasked with:

1. determining the coefficient of static friction, $\mu_s$, between the chosen material and the inclined plane for the block's larger area side. In order to compute a reasonable uncertainty, you should perform *at least* 9 trials.
2. determining the coefficient of kinetic friction, $\mu_k$, between the chosen material and the inclined plane for the block's larger area side. You should perform *at least* 9 trials.
3. evaluating the dependence that $\mu_s$ and $\mu_k$ have on contact area by repeating assignments 1 and 2 for the block's smaller area side.

## 2 Deliverables

For your lab report, 10% of the grade will be for following the guidelines in the lab report template. Another 10% will be allocated for the Abstract and Introduction of your report. The remaining percentage will be based on your inclusion of:

1. *[16%]* a description of the process your team developed to perform the measurements of static friction in assignments 1 and 3.
2. *[14%]* a table showing the values you determined for the coefficient of static friction $\mu_s$ for assignments 1 and 3. Make sure the last row of the table includes the average value of $\mu_s$ and its uncertainty. An example table is shown in Section 3.
3. *[16%]* a description of the process your team developed to perform the measurement of kinetic friction in assignments 2 and 3.
4. *[14%]* a table showing the values you determined for the coefficient of kinetic friction $\mu_k$ for assignments 2 and 3. Make sure the last row of the table includes the average value of $\mu_k$ and its uncertainty. An example table is shown in Section 3.
5. *[20%]* your conclusion of how the coefficients of friction depend on the surface area in contact. This conclusion should be supported with data and should discuss whether or not two measurements agree with each-other within uncertainty.

# 3 Results Reporting

Below are example tables that can be put in the lab report as detailed in the assignment above. Make sure you populate the tables with the coefficient obtained from every trial and compute the average and uncertainties in the bottom row.

| **Coefficient of Static Friction** | | |
|---|---|---|
| **Trial** | **Large Area** | **Small Area** |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| **Avg** | **a±b** | **c±d** |

The value **a±b** refers to the combination of all trials for the Large Area column. In the same way, the values **c±d** refer to the combination of all trials in the Small Area column.

| **Coefficient of Kinetic Friction** | | |
|---|---|---|
| **Trial** | **Large Area** | **Small Area** |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| **Avg** | **e±f** | **g±h** |

The value **e±f** refers to the combination of all trials for the Large Area column. In the same way, the values **g±h** refer to the combination of all trials in the Small Area column..