

The successful lab report will contain:

A title section or page, a summary of the experimental procedure, a graph or table of results that summarizes the data, sample calculations for each section of the experiment, and an analysis of the experiment-including percentage of error and possible explanations for these errors.

All reports must be printed, though any diagrams or sample equations may be written by hand. Graphs should be prepared using Excel or similar software.

The title should refer to the experimental design

Determination of Frictional Coefficients

The date the experiment was performed

March 15, 2005

List your name first and then those of your partners

Richard Feynman

Paul Gaugin

James Joyce

Emmanuel Kant

Summary: To investigate the magnitude of the coefficient of friction, two separate experiments were performed. To estimate the static coefficient, a known mass was placed on a board and the board was inclined until the mass began to slip. The slip angle was then recorded. To find the kinetic coefficient, the board was placed horizontally and attached to the tabletop. The mass was pulled across the board at a constant velocity. A spring scale was used to estimate the magnitude of the required force. The board was covered with three different materials and three trials were performed for each portion of the experiment. The results were compared to a table of commonly accepted values for frictional coefficients.

Data Summary

STATIC	Silk	Styrofoam	Sandpaper
Average Coefficient	0.16	0.70	1.15
% Error	1.1%	3.1%	10.2%
KINETIC	Silk	Styrofoam	Sandpaper
Average Coefficient	0.09	0.42	.69
% Error	3.4%	5.7%	15.8%

Sample Calculations:

From our experimental data we determined the average angle at which slipping occurred.

STATIC	Silk	Styrofoam	Sandpaper
Average Slip Angle	9°	35°	49°

Solving the equations of motion using Newton's Laws gives the relationship between the slip angle and the coefficient of friction:

$$\tan \theta = \mu$$

We estimated the force required to keep the mass moving with a constant velocity as it was dragged across the surface.

KINETIC	Silk	Styrofoam	Sandpaper
Average Slip Force	8N	13N	22N

Again, solving the equations of motion yields the relationship:

$$F - \mu N = 0, \text{ so } F = \mu N \text{ and } N = mg, \\ F/mg = \mu$$

Analysis:

When we compared the calculated coefficients to a table of accepted values, we calculated the percent error, and found it to be smaller than 10% in all cases except when using the sandpaper surface. As the other results were quite accurate we feel the discrepancy must come from another source. A possible explanation would be that the sandpaper used was substantially different from that used to construct the reference table.

The errors are all larger in the kinetic trial than in the static trial due to the uncertainty in estimating when the mass was moving with a constant velocity, but the largest error again occurs in the sandpaper trial.