Lab 5: Friction I (Horizontal Plane)

Name: **Your Name**
Class: **PHYS 2125 (15921)**
Date: **2025-02-14**

Objective

Determine the coefficient of friction between the wooden block and the track.

Equipment

- (1) 50cm "PASTrack" track with four legs
- (1) 110g friction block
- (1) set of masses
- (1) 5g hook
- (1) ~70cm length of string
- (1) pulley

Theory

$F_{net} = M_a for M_H : \downarrow M_H \cdot g - T = M_H \cdot a$

$F_{net} = M_a for M_b : \rightarrow T - f_k = M_b \cdot a$

$f_K = \mu \cdot n$

$n = M_b \cdot g$

$M_H g - \mu_k \cdot M_b g = M_H a + M_b a$

Setting $a = 0$

$M_H g - \mu_k \cdot M_b g = 0$

$\mu_k \cdot M_b = M_H$

where

M_b is the mass of the block

M_h is the mass of the hook ($5g$)

M_a is the hanging mass added with each trial

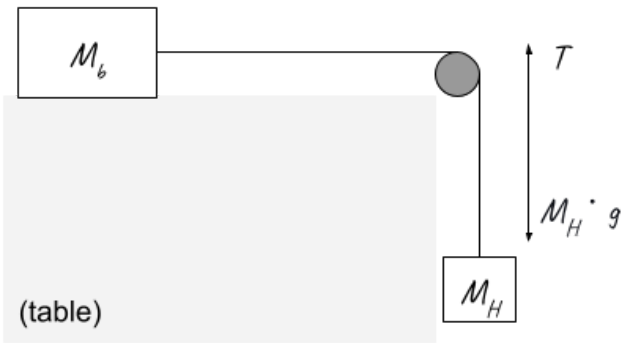
M_H is the total mass of hanging block including the hook and added weight ($M_H = M_h + M_a$)

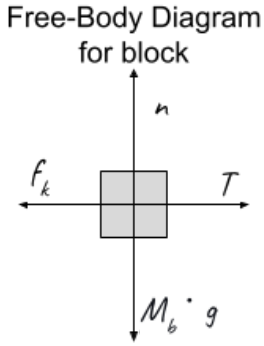
f_k is the friction force

n is the normal force

g_{earth} is the gravitatational constant ($9.8 \frac{m}{s^2}$ on Earth)

T is the tension





Procedure

Initial Setup

A track and pulley system were constructed.

1. A $50cm$ piece of PASTrack was placed on a table, ensuring the PASTrack end is near the table end to allow for the weight to hang over.
2. A pully was connected to the track, on the end near the end of the table.
3. A friction block was tied to a 5g hook using a length of string.
4. The friction block was placed on the track, furthest from the edge near the pulley.
5. The string was laid over the pulley and the hook was left hanging.

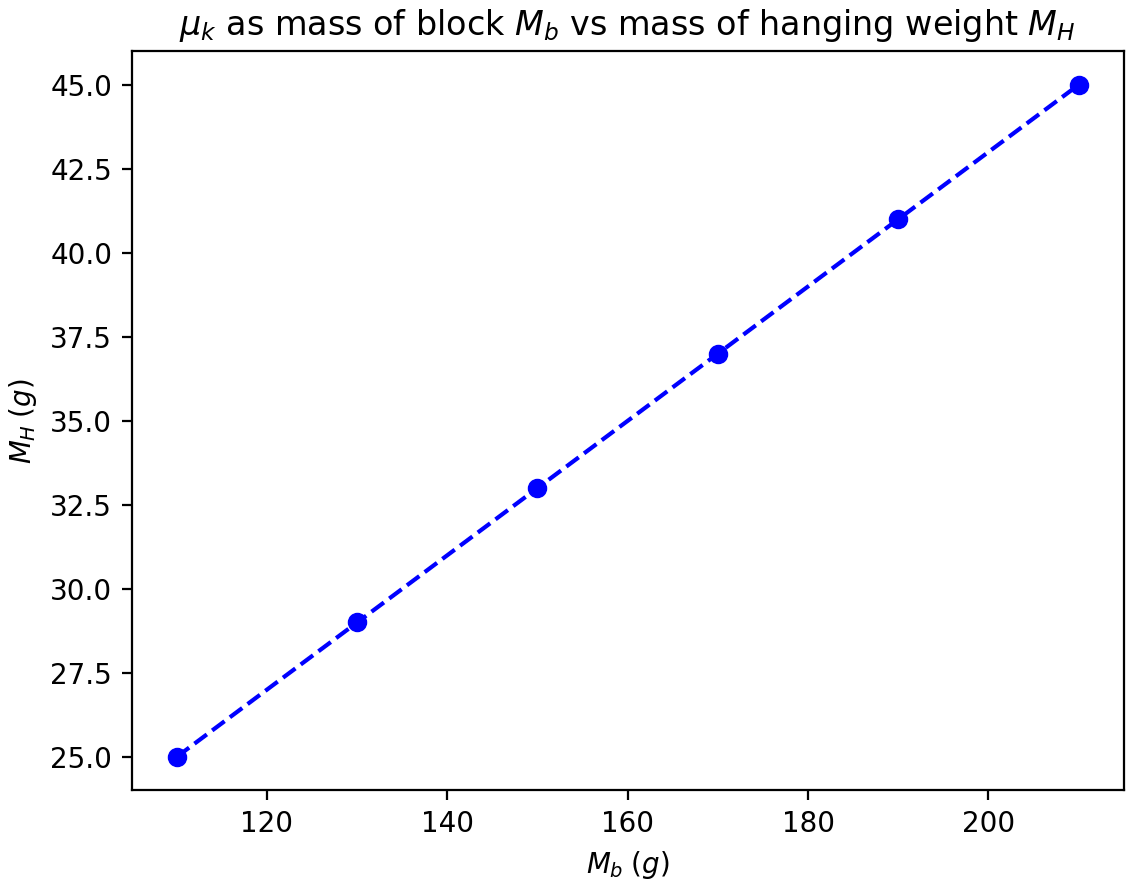
Trial (completed for each M_b)

1. As needed the weight of the block M_b was increased by placing a weight in the center.
2. The block was moved to the end of the track opposite the pulley.
3. Weight was slowly added to the hook M_a until the following occurred:
    A. The block was lightly tapped in the direction of the pulley to overcome the static friction.
    B. The block steadily advanced down the track until reaching the pulley.

Data

M_b (g)	M_a (g)	M_h (g)	M_H (g)	μ_k
110	20.0	5.0	25.0	0.227273
130	24.0	5.0	29.0	0.223077
150	28.0	5.0	33.0	0.22
170	32.0	5.0	37.0	0.217647
190	36.0	5.0	41.0	0.215789
210	40.0	5.0	45.0	0.214286
Average				0.219679
StdDev				0.004428

Calculations



Using the least squares method a trend line is fit to the data with *slope* 0.200 and y-*intercept* 3.000, resulting in the equation $y = 0.200x + 3.000$.

Results

The value of μ was determined using the mean, μ_t, and the least squares fit, μ_g.

$\mu_t = 0.220$ with σ of 0.004

$\mu_g = 0.200$

This equates to a 0.094% difference.

Discussion

Discussion

Questions

Why do you try to maintain the constant speed motion of the block?

Question 1 Answer

What is the most important part of the experiment?

Question 2 Answer