

Question: How does the hanging weight's mass affect the static and kinetic friction graph as it increases along with the sitting weight?

Hypothesis: We hypothesize that if the hanging weight's mass increases along with the sitting weight's mass, then the graph of static and kinetic friction would be linear.

Strategy:

- The hanging mass in a *modified* modified Atwood's machine was varied by hanging a cup filled with various numbers of washers from a string. The mass of m_2 is the mass of the cup and washers combined.
- The sitting mass was also varied by varying the weight carried by the wooden block being dragged by the string.
- The applied force (hanging weight) was graphed vs. the sitting weight to verify that the slope was equal to the coefficient of friction when the threshold of static and kinetic friction was broken.

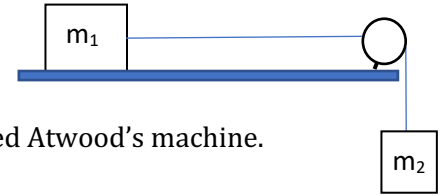


Fig 1: Modified Modified Atwood's machine.

Data:

Trial #	Hanging weight (g)(m_2)	Sitting weight (g) (m_1)
Trial 1	46.5	134.3
Trial 2	67.1	184.3
Trial 3	75.6	234.3
Trial 4	95.6	334.3
Trial 5	160.8	534.3
Trial 6	163.3	554.3
Trial 7	221.3	634.3
Trial 8	280.6	1134.3

Analysis:

The free-body diagrams in Figure 2 show the forces on the masses in the modified Atwood's machine.

defined as to the right for the cart, and down for the hanging mass.

$$m_2g - T = m_2a$$

$$T - \mu m_1g = m_1a$$

These equations can be combined to form the equation:

$$m_2(g - a) = m_1(\mu g + a)$$

This equation indicates that there is a linear relationship between the varying weights of the hanging and sitting masses. The slope of this line should be the coefficient of friction when the threshold is broken between static and kinetic friction. To determine if this is true, the equation was used for the values in the table to find the value of μ , and then they were compared to the result shown in the chart.

A graph of the hanging weight vs. sitting weight data for this experiment shows that it is indeed linear and that the slope equals 0.947 kg.

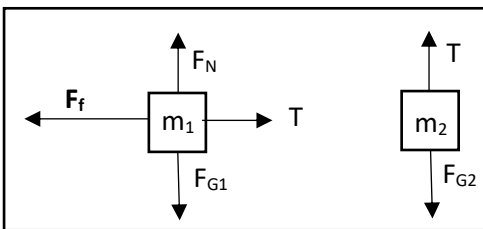


Figure 2: Free Body Diagrams

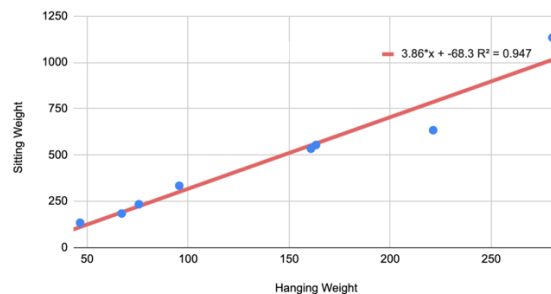


Figure 3: Hanging Weight vs. Sitting Weight Graph

Friction must be considered since the block is sliding on the desk without any wheels. The following equations are based on the free-body diagrams. Positive motion is