Dynamics Lab Report

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Question: How does the weight of m1 change as the mass of m2 increases with an acceleration of 0?

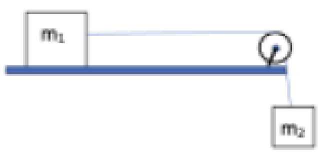
Hypothesis: As the weight of m2 increases, the weight required for m1 to move with an acceleration of zero will also increase. This relationship will form a linear graph, with the slope indicating the coefficient of friction between m1 and the track .

Methodology:

· The hanging mass in a modified Atwood's machine was varied by hanging differing m2 values . This was accomplished by adding weights to the string (m2)

· The mass of m1 was adjusted in response to the change in m2 until the m1 moved forwards briefly at a constant velocity (acceleration is 0).

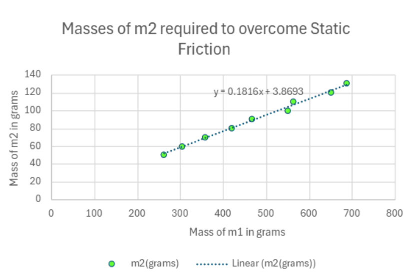
· The weights recorded in a table and graphed in a scatterplot of the mass of m1 vs. the mass of m2 with a line of best fit.



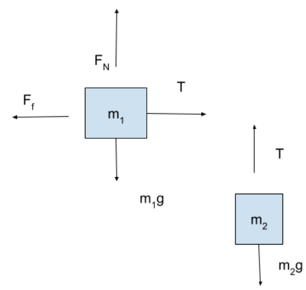
Data:

This is the data and graph of the data of the m1 weights required to move m2 with an acceleration of 0

m1(grams)	m2(grams)
262.4	50
305.9	60
358.6	70
420.2	80
466.9	90
550.6	100
564.2	110
650.7	120
689	130



Analysis:



The free body diagram in Figure 2 shows the forces acting on the masses in the modified Atwood's machine. This free body diagram allowed us to derive the equations found below. We decided that positive motion is to the right for the cart, and down for the hanging mass.

Based on this diagram we made the equation F-Ff=m*a. We decided to make acceleration zero leaving us with F-Ff=0. Ff = μ*m1*g, so we can input that in the equation. F-μ*m1*g=0. F is equal to the tension between the two blocks, which based on our free body diagrams is equal to m2g. m2g-μ*m1*g=0. Simplifying this equation we get m2=μ*m1.

This equation shows that there is a linear relationship between the mass of m_2 and the mass of m_1 required to match the static friction. Since we graphed m1 vs m2 of our graph values, we can find the slope and based on the equation the slope would be the μ value.

We ended up with a linear regression of y=0.1816x + 3.8693 for the graphed data. We can identify that the mu value between the metal and the felt is 0.1816. The y intercept value represents possible error in our experiment, as the equation states that the b value in y=mx+b will be equal to 0. .

This proves our hypothesis because we were able to identify a mu value that seems realistic relative to the movement of the cart. Also it is proven because the data graphed out in a linear relationship with a r^2 value of 0.9935, which shows positive linear relationship. Possible sources of error was the assumption that the cart used was frictionless. It was assumed that the cart's friction would be non-existant or small enough to be negligible, and therefore the cart weight wasn't taken into account as it didn't affect the force of friction. If it wasn't negligible, this would have resulted in a different weight and therefore a different slope / mu value. Another source of error could have been the weights picked themselves. Since there were only whole number increments for weights, the m1 and m2 values weren't as precise as possible.