Question: How does the angle of a wooden track affect the coefficient of friction between that wooden track and the hanging mass in a modified Atwood's machine?

Hypothesis: The angle of a wooden track will not affect the coefficient of friction between that wooden track and the hanging mass in a modified Atwood's machine.

Strategy:

- The hanging mass in a modified Atwood's machine was a block of wood that was pulled down a wooden track.
- The mass of the two objects, the cart (M_1) and the block of wood (M_2) were kept constant.
- The friction between the cart and its track was negligible because the cart's wheels were spinning freely on the track.
- The angle of the wooden track from the horizontal (floor) was changed for each value of theta. The angle was measured with a protractor.
- The acceleration was measured with a Vernier motion detector.
- The coefficient of friction was calculated for each angle using the angle of the board and the acceleration of the system

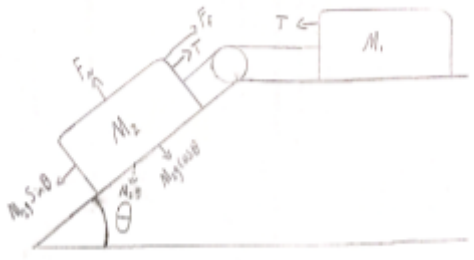


Fig 1: Free Body Diagram

Data:

Table 1: Data collected from the experiment

Theta(°)	Acceleration(m/s²)	Mu(μ)
28	0.4381	0.367
33	0.6668	0.385
40	1.030	0.393
47	1.365	0.408
50	1.516	0.409
55	1.712	0.437

Each acceleration value is the average of three trials

Dragged Mass (M_1): 0.2998 kg
Hanging Mass (M_2): 0.133 kg

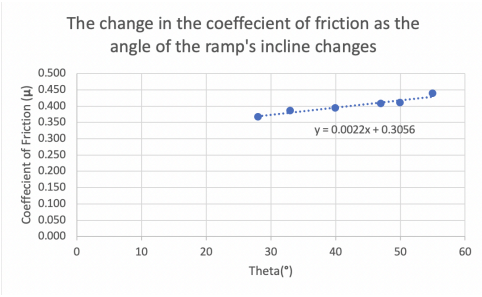
Analysis:

$$T = M_1 a \qquad \text{(eq. 1)}$$

$$M_2 g sin\theta - T - \mu M_2 cos\theta = M_2 a \qquad \text{(eq. 2)}$$

$$\mu = tan\theta - \frac{a}{g cos\theta}\left(1 + \frac{M_1}{M_2}\right) \qquad \text{(eq. 3)}$$

Using equations 1 and 2, equation 3 was derived by combining the two equations and isolating mu. Using equation 3, the coefficient of friction was calculated for each value of theta using the value of theta in degrees and acceleration in miles per second squared.



From Table 1 and the graph above, it's clear that the value of mu, which is the coefficient of friction, is relatively unchanged for all theta values. This shows that the coefficient of friction between the wooden track and the wooden block remained unaffected by the change in the angle of the wooden track's incline.

Averaging all the mu values from column three in Table 1, the average mu value is calculated to be 0.400. As a group, we are assured that our calculated coefficient of friction is correct, as the accepted coefficient of friction between two pieces of dry wood is between 0.3 and 0.5.

However, the slight increase in the value of the coefficient of friction indicates some source of error in the experiment. More specifically, the error indicates that the value of acceleration is not accurate, either too high or too low, for all of the trials. The most likely source for this discrepancy is friction in the wheels of the cart because any friction would reduce the acceleration.