Dynamics Lab - Palak Yadav

Question: How can the relationship between the angle of an incline and a hanging weight be developed to keep a system constant?
Hypothesis: If the angle increases, the mass of the hanging weight must also increase to keep both sides at rest.
Strategy

Design a frictionless inclined plane system with a hanging weight and one stationary cart

Independent variable: The angle of the ramp

- manually altered and measured using a mobile application

Constant: The mass of the cart on the incline remains constant in mass (m_2)

Dependent variable: Mass of the hanging weight (m_1)

- Washers are manually added to the hanging weight (m_1) until the stationary cart (m_2) begins to slide up. The mass right before the system begins to accelerate is recorded.

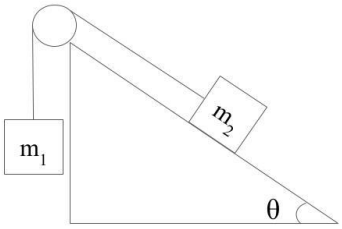


Fig 1: Incline Experiment Set-Up

The equation indicates that there is a linear relationship between m_1 and $sin\,\Theta$. Friction between the track and cart is negligible. Positive motion is defined as the downward motion of the hanging mass.

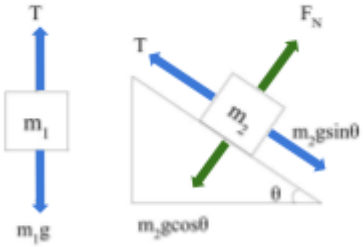


Fig 2: Incline Experiment FBD

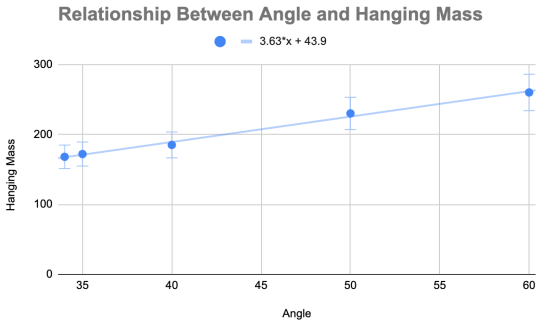
$$\sum F_{system} = m_1 g - m_2 g sin\Theta$$

$$m_1 g = m_2 g sin\Theta$$

$$m_1 = 300 sin\Theta$$

Mass of m_1 vs θ needed to keep both sides at rest

Θ Degrees	Measured Mass of m_1 (g)	Expected Mass of m_1 (g)
34	168	167.8
35	172	172.1
40	185	192.8
50	230	229.8
60	260	259.8



Analysis

Based on the FBD, as the degree of the incline increases, the calculated mass m_1 is expected to increase if m_2 on the incline is kept constant. The experimental setup supports this relationship, as the data shows that an increase in the incline angle results in a proportional increase in the hanging mass required to keep the system at rest. The slope of the graph also indicates that the ratio between m_1 and Θ is linear and is equivalent to the value of m_2.The slight difference in the measured and expected mass is likely due to the margin of error in the devices used, the minimal role of friction which can be challenging to eliminate, and the limitation of the washer weights available.

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