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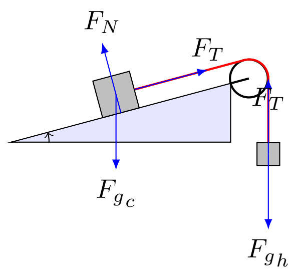
Worked with Cole TerBush and Daniel Aronov

1 • Free Body Diagram



2 • Derivations

Starting with:

$$\Delta x = v_0 t + \frac{1}{2}at^2$$

Since Δx is d and v_0 is 0, this can be simplified to:

$$d = \frac{1}{2}at^2$$

Solving for a, we obtain:

$$a = \frac{2d}{t^2}$$

2.1 Uphill

Replacing $F_{net} = ma$ with F_{net} and a, we obtain:

$$m_h g - m_c g \sin(\theta) = (m_h + m_c)\frac{2d}{t^2}$$

Solving for m_h, we obtain:

$$m_h = \frac{m_c g \sin(\theta) + \frac{2m_c d}{t^2}}{g - \frac{2d}{t^2}}$$

2.2 Downhill

Replacing $F_{net} = ma$ with F_{net} and a, we obtain:

$$m_c g \sin(\theta) - m_h g = (m_h + m_c)\frac{2d}{t^2}$$

Solving for m_h, we obtain:

$$m_h = \frac{m_c g \sin(\theta) - \frac{2m_c d}{t^2}}{g + \frac{2d}{t^2}}$$

3 • Data

Trial 1 was the uphill trial, and Trial 2 was the downhill trial.

Trial	Cart mass (kg)	Hanging mass (kg)	Time (s)	Percent Error
1	0.29	0.14	0.99	1
2	0.29	$3 \cdot 10^{-2}$	1.02	2