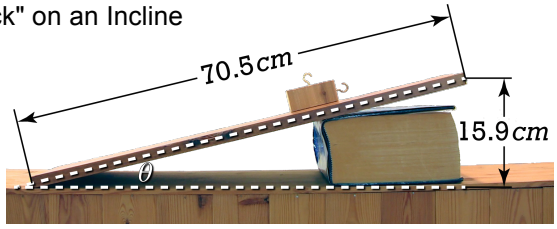
Flipping Physics Lecture Notes:

Physics "Magic Trick" on an Incline

First we need the incline angle:

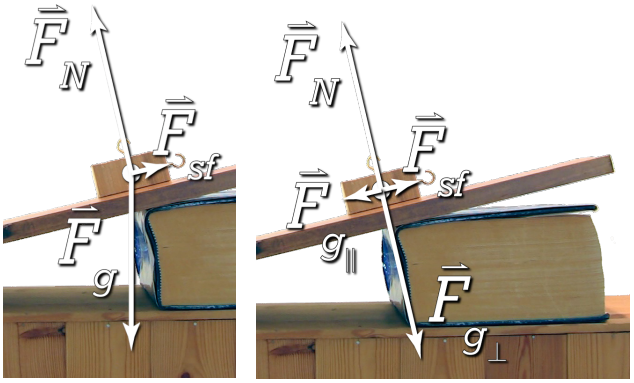
$$\sin\theta = \frac{O}{H} = \frac{15.9\,cm}{70.5\,cm} \Rightarrow \theta = \sin^{-1}\left(\frac{15.9}{70.5}\right) = 13.0342^\circ$$



The mass of the block:

$$m_{block} = 121g \times \frac{1kg}{1000g} = 0.121kg$$

- Draw The Free Body Diagram.
- Break the Force of Gravity into its parallel and perpendicular components.
- Redraw the Free Body Diagram.



Newton's Second Law in both directions:

$$\sum F_{\parallel} = F_{sf} - F_{g_{\parallel}} = ma_{\parallel} = m(0) = 0 \Rightarrow F_{sf} = F_{g_{\parallel}} = mg\sin\theta$$

$$\Rightarrow F_{sf} = F_{g_{\parallel}} = (0.121)(9.81)\sin(13.0342) = 0.267709 \approx 0.268N$$

$$\sum F_y = F_N - F_{g_\perp} = ma_\perp = m(0) = 0 \Rightarrow F_N = F_{g_\perp} = mg\cos\theta$$

$$\Rightarrow F_N = F_{g_\perp} = (0.121)(9.81)\cos(13.0342) = 1.15643 \approx 1.16N$$

The "Magic Trick" math:

$$m_{\parallel} = m\sin\theta = (121)\sin(13.0342) = 27.2894 \approx 27.3g$$

$$m_\perp = m\cos\theta = (121)\cos(13.0342) = 117.883 \approx 118g$$

The "Floating Block" replaces the Force Normal with Force of Tension 1 and the Force of Static Friction with Force of Tension 2.