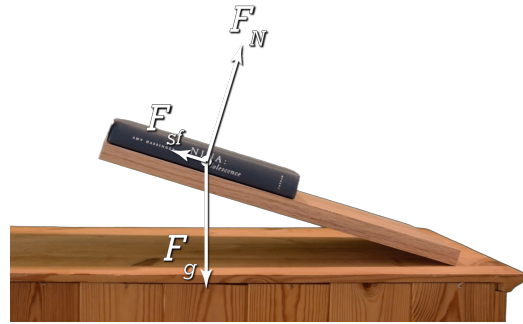Flipping Physics Lecture Notes:

An Introductory Static Friction on an Incline Problem

Example: A book is resting on a board. One end of the board is slowly raised. The book starts to slide when the incline angle is 15°. What is the coefficient of static friction between the book and the incline?
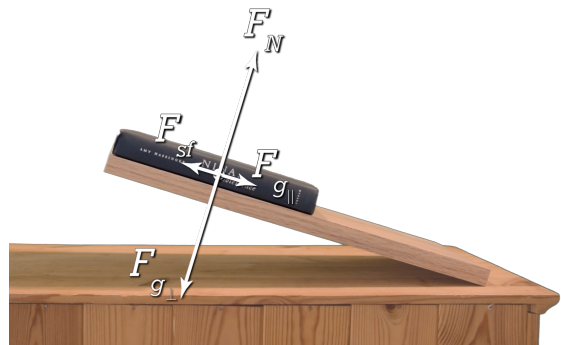
Knowns: $\theta = 15°; \mu_s = ?$

Draw the Free Body Diagram.

Break the Force of Gravity into its components.

Redraw the Free Body Diagram.

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

Note: The acceleration in the parallel direction is zero because this is *static* friction. In other words, the book is not sliding relative to the incline yet.

We need the Force Normal.

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

& $mg\sin\theta = \mu_s F_N \Rightarrow mg\sin\theta = \mu_s mg\cos\theta \Rightarrow \sin\theta = \mu_s\cos\theta \Rightarrow \mu_s = \dfrac{\sin\theta}{\cos\theta} = \tan\theta$

$\mu_s = \tan(15) = 0.267949 \approx \boxed{0.27}$