

65. For simplicity, we denote the 70° angle as θ and the magnitude of the push (80 N) as P . The vertical forces on the block are the downward normal force exerted on it by the ceiling, the downward pull of gravity (of magnitude mg) and the vertical component of \vec{P} (which is upward with magnitude $P \sin \theta$). Since there is no acceleration in the vertical direction, we must have

$$N = P \sin \theta - mg$$

in which case the leftward-pointed kinetic friction has magnitude

$$f_k = \mu_k (P \sin \theta - mg) \ .$$

Choosing $+x$ rightward, Newton's second law leads to

$$P \cos \theta - f_k = ma \implies a = \frac{P \cos \theta - \mu_k (P \sin \theta - mg)}{m}$$

which yields $a = 3.4 \text{ m/s}^2$ when $\mu_k = 0.40$ and $m = 5.0 \text{ kg}$.