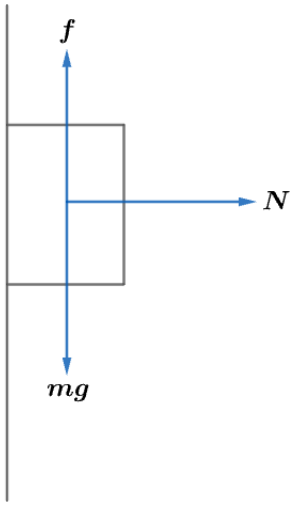
2008 F=ma Exam: Problem 8

Kevin S. Huang



The normal force provides the centripetal acceleration so we have

$$N = m\omega^2 R = \frac{m\omega^2 d}{2}$$

The friction force must balance gravity and is bounded by the threshold for static friction,

$$f = mg \leq \mu N$$

Substituting in the normal force,

$$mg \leq \frac{\mu m\omega^2 d}{2}$$

$$\mu \geq \frac{2g}{\omega^2 d} = \frac{2(10\,\mathrm{m/s^2})}{(45\,\frac{\mathrm{rev}}{\mathrm{min}} \cdot \frac{1}{60}\,\frac{\mathrm{min}}{\mathrm{s}} \cdot 2\pi\,\frac{\mathrm{rad}}{\mathrm{rev}})^2(8.0\,\mathrm{m})} = 0.11$$

so the answer is $\boxed{\mathrm{C}}$.