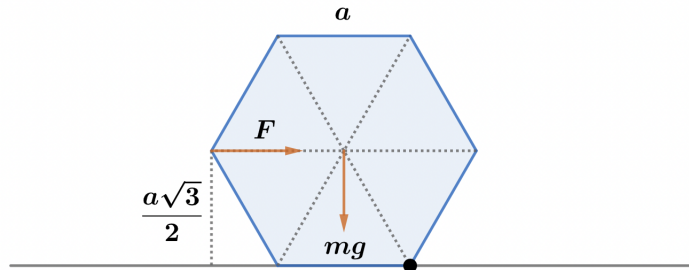


2022A F=ma Exam: Problem 16

Kevin S. Huang



Ignoring slipping, when the pencil is about to roll, the normal force acts at the right vertex touching the ground. Choosing that as the pivot point, we have

$$\tau_{\text{net}} = F \left(\frac{a\sqrt{3}}{2} \right) - mg \left(\frac{a}{2} \right) = 0$$

so the minimum force needed to roll the pencil is

$$F = \frac{mg}{\sqrt{3}}$$

To prevent slipping, friction must balance this:

$$f = F \leq \mu N$$

Since $N = mg$,

$$\frac{mg}{\sqrt{3}} \leq \mu mg$$

so the minimum coefficient of static friction is

$$\mu \geq \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

The answer is D.