HW 11-5 Soln)

We saw that

$$f_{\text{o Physical Pendulum}} = \frac{1}{2\pi}\sqrt{\frac{Dgm}{I}} \ .$$

The moment of inertia of a rod about an axis through the Center perpendicular to its length is

$$I = \frac{1}{12}ML^2 \ .$$

Move the axis to the end and find the new moment with the parallel axis theorem:

$$I_{\text{Parallel}} = I_{CM} + Mh^2 = \frac{1}{12}ML^2 + M\left(\frac{L}{2}\right)^2 = \frac{1}{3}ML^2 \ .$$

D is the distance from the support point to the center of mass, *i.e.*, D = l/2. Then,

$$f_{\text{o Physical Pendulum}} = \frac{1}{2\pi}\sqrt{\frac{DgM}{I}} = \frac{1}{2\pi}\sqrt{\frac{\frac{L}{2}gM}{\frac{1}{3}ML^2}} = \frac{1}{2\pi}\sqrt{\frac{3g}{2L}} \ .$$