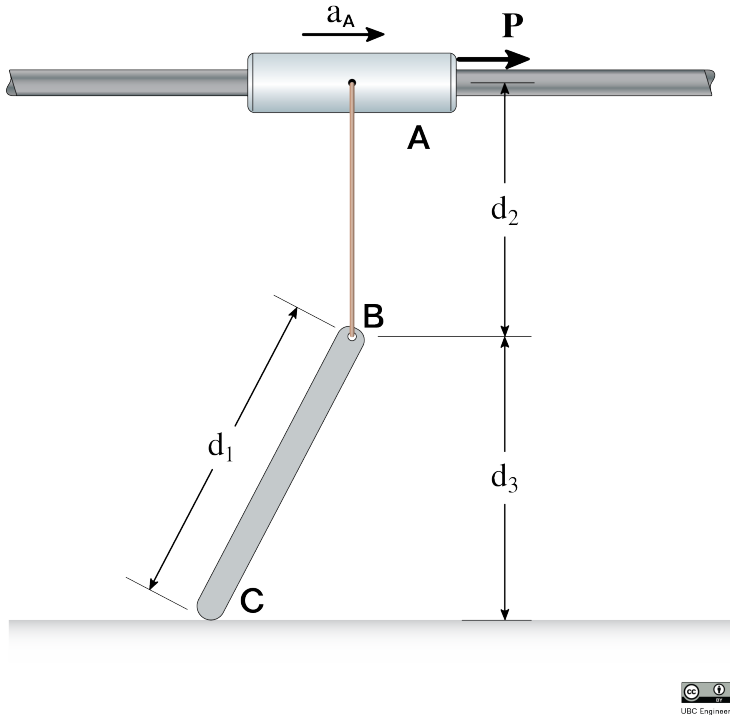


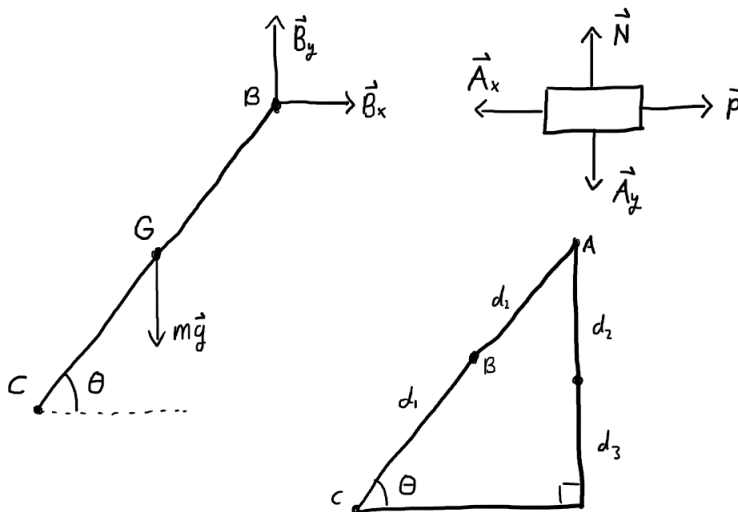
## 22-R-KIN-TW-11



A rod of mass 16 kg with uniform density is connected to a collar by a rope of negligible mass, as shown. If a constant force  $P$  is applied to the collar, for what value  $P$  will the rod begin to leave the ground when the system is in rotational equilibrium?

Take  $d_1 = 3$  m,  $d_2 = 2$  m,  $d_3 = 2$  m, and use  $g = 9.81$  m/s<sup>2</sup>.

**Solution:**



$$F_y : mg = B_y$$

$$M_G : \frac{d_1}{2} B_y \cos \theta = \frac{d_1}{2} B_x \sin \theta$$

$$B_x = \frac{B_y}{\tan \theta}$$

$$B_x = -A_x = P$$

$$P = \frac{mg}{\tan \theta}$$

$$\tan \theta = \frac{d_2 + d_3}{\sqrt{(d_1 + d_2)^2 - (d_2 + d_3)^2}} = \frac{4}{3}$$

$$P = \frac{3}{4}(16)(9.81) = 117.72 \text{ N}$$