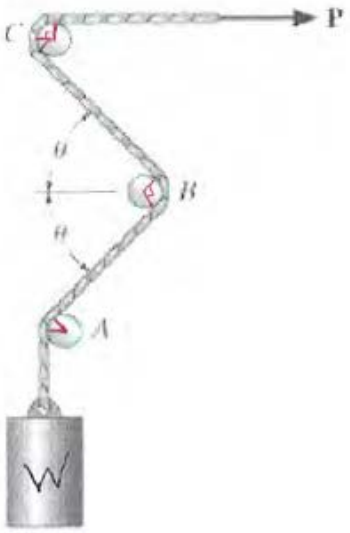
Friction III – Problem 2

The cord supporting the cylinder of mass M = 6 kg passes around three pegs, *A*, *B*, *C*, where the coefficient of friction is $\mu_s = 0.2$. Determine the range of values for the magnitude of the horizontal force **P** for which the cylinder will not move up or down. $\theta = 45°$



Given:

$\mu_s = 0.2$ $\quad \theta = 45°$

$M = 6\,kg$

Calculate:

$W = Mg = (6)(9.81) = 58.9\,N$

$\beta = (135° + 90° + 45°) = 270°$ (@C @B @A)

$270\left(\frac{\pi}{180}\right) = 1.5\pi$ rad

Smallest → W↓

$T_2 = T_1 e^{\mu\beta}$

$T_2 = 58.9\,N$

$T_1 = P$

$\mu = 0.2$

$\beta = 1.5\pi$

$P = \frac{58.9}{e^{[.2(1.5\pi)]}}$

$P_{min} = 22.9\,N$

Greatest → W↑

$T_2 = T_1 e^{\mu\beta}$

$T_2 = P$

$T_1 = 58.9\,N$

$\mu = 0.2$

$\beta = 1.5\pi$

$P = (58.9)e^{[(.2)(1.5\pi)]}$

$P_{max} = 151.1\,N$

$22.9\,N \leq P \leq 151.1\,N$