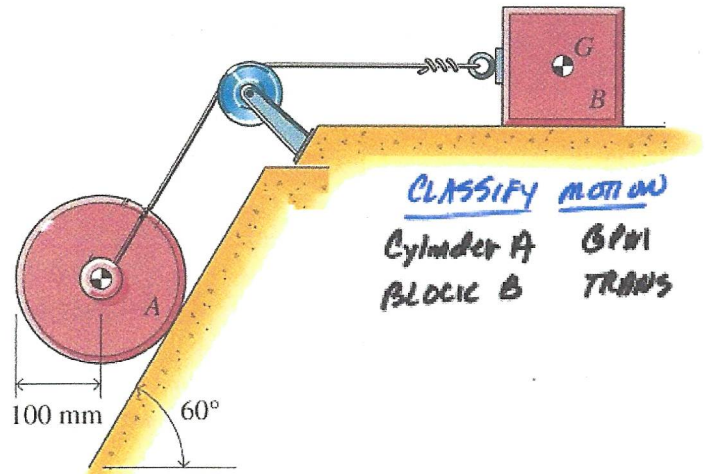


Problem 16. The 200-mm diameter cylinder A has a mass of 50 kg and a radius of gyration with respect to its center of mass of 70 mm. The cord is connected to a 100-kg block B which rests on a horizontal surface. The kinetic coefficient of friction between the horizontal surface and the block is 0.25. If the cylinder rolls without slipping, determine the acceleration, a_B , of the block, the angular acceleration, α_A , of the cylinder and the tension, T , in the cord. Classify the motion of each body. Ignore the mass of the pulley..



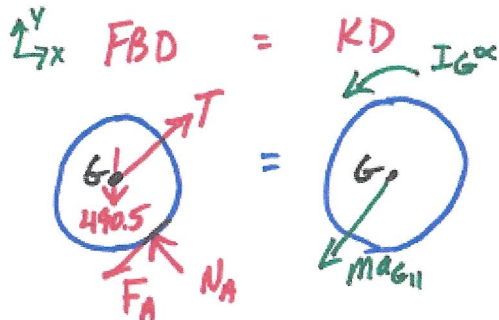
CLASSIFY MOTION
Cylinder A: GPM
Block B: TRANS

PROPERTIES

$$m_A = 50 \text{ kg} \quad W_A = 9.81(50) = 490.5 \text{ N}$$

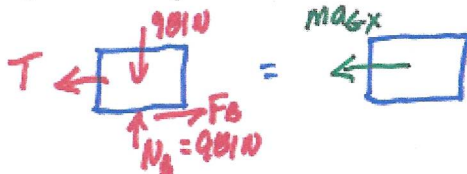
$$m_B = 100 \text{ kg} \quad W_B = 981 \text{ N}$$

$$I_G = mk^2 = 50(.07)^2 = 0.245$$



$$\sum \mathcal{M}_G: -0.1F = 0.245\alpha \quad (1)$$

$$\sum F_x: T - F - 490.5 \sin 60^\circ = -50 a_{Gx} \quad (2)$$



$$\sum F_x: F_B - T = -100 a_{Bx} \quad (3)$$

3 EQNS, 6 UNKS

$$a_{Gx} = a_{Bx} = \alpha r = 0.1\alpha = a_G$$

$$F_B = \mu_k N_B = 0.25(981) = 245 \text{ N}$$

$$(1) -0.1F - 245\alpha = 0$$

$$(2) T - F + 50 a_G = 425$$

$$(3) T - 100 a_G = 245$$

SOLVE

$$T = 340 \text{ N}$$

$$F = -25.3 \text{ N}$$

$$a_G = 1.03 \text{ m/s}^2$$

$$\alpha = \frac{a_G}{.1} = 10.3 \text{ rad/s}^2$$

ANSWER:

$$\alpha_A = 10.3 \text{ rad/s}^2 \quad a_B = 1.03 \text{ m/s}^2 \leftarrow T = 340 \text{ N}$$