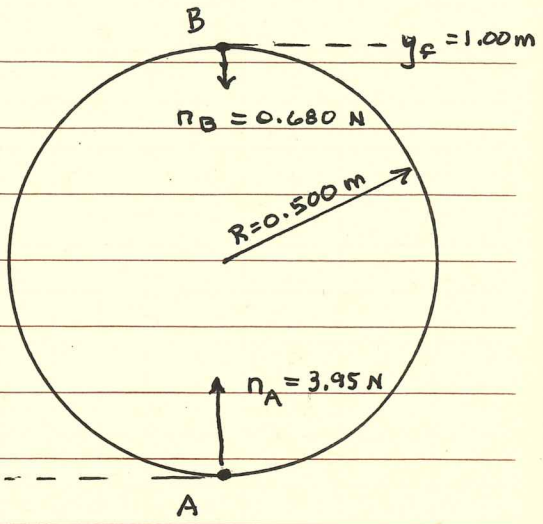
DATE

TOPIC

Problem 70

7.70 A small block ($m = 0.0400\ kg$) slides in a vertical circle, ...



$m = 0.0400\ kg$

$n_A = 3.95\ N$

$n_B = 0.680\ N$

$R = 0.500$ meters

$$W_{tot} = \Delta K$$

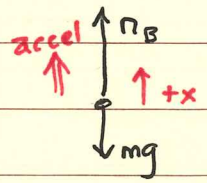
$$\Rightarrow \quad W_{fr} + W_{gr} = K_f - K_i$$

$$\Rightarrow \quad W_{fr} = K_f - K_i - W_{gr} = K_f - K_i - \left(-mg(y_f - y_i)\right)$$

$$= \frac{1}{2} m \left(V_B^2 - V_A^2\right) + mg\left(y_B - y_A\right)$$

Need to find V_B^2 and V_A^2 from Newton's 2nd Law

A:

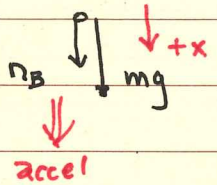


$$\Sigma F_x = \frac{mV_A^2}{R}$$

$$n_B - mg = \frac{mV_A^2}{R}$$

$$\boxed{mV_A^2 = R\left(n_A - mg\right)}$$

B:



$$\Sigma F_x = \frac{mV_B^2}{R}$$

$$n_B + mg = \frac{mV_B^2}{R}$$

$$\boxed{mV_B^2 = R\left(n_B + mg\right)}$$

$$W_{fr} = \frac{1}{2}\left(mV_B^2 - mV_A^2\right) + mg\left(y_B - y_A\right)$$

($y_A = 0.00\ m$)

$$W_{fr} = \frac{R}{2}\left(n_B + mg - \left(n_A - mg\right)\right) + mgy_B = \frac{R}{2}\left(n_B - n_A + 2mg\right) + mgy_B$$

$$W_{fr} = \frac{1}{4} m \left(0.680 - 3.95 + 2(0.0400)(9.8)\right) + (0.0400)(9.8)(1.0) = -0.23\ J$$

$$\boxed{W_{fr} = -0.23\ J}$$