Physics 2211K

Quiz # 8 (*Take home*)

October 26, 2010

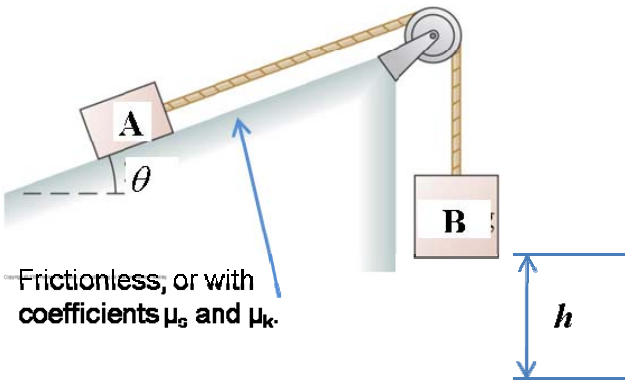
Name:_____

In the system below, ***A = 4.0 kg, B = 10.0 kg, θ = 30°, and h = 1.5m***.

a. How far does ***block A*** move ***along the incline*** when ***block B falls by h***? (***Express your result in algebraic form.***)

b. How high (***vertically***) does ***block A*** rise when ***block B falls by h***? (***Express your result in algebraic form.***)

c. Use work and energy to find the ***speed of B*** when it has fallen the ***distance h*** if it ***begins from rest*** and the ***coefficient of kinetic friction for A is $\mu_k = 0.2$***. ***(Ignore static friction***.)



a. Because blocks A and B are tied together, as B falls the distance h_B, A moves the same distance along the incline. Thus $d_A = h_B$.

b. As B falls the vertical distance h_B, A rises by the amount $h_A = d_A \sin\theta$. Thus $h_A = h_B \sin\theta$.

c. ***Principle :*** $\Delta K = W_T$

$$\Delta K = \Delta K_A + \Delta K_B = \tfrac{1}{2} M_A v^2 + \tfrac{1}{2} M_B v^2 = \tfrac{1}{2}\left(M_A + M_B\right) v^2$$

$$W_T = W_{g,B} + W_{g,A} + W_{f,A}$$

$$W_{g,B} = M_B g h_B = M_B g h$$

$$W_{g,A} = -M_A g h_A = -M_A g\left(h\sin\theta\right) \quad \textit{(Force \& d are opposite} \Rightarrow \textit{- sign)}$$

$$W_{f,A} = -\mu_k n_A d_A = -\mu_k \left(M_A g\cos\theta\right) h \quad \textit{(Force \& d are opposite} \Rightarrow \textit{- sign)}$$

$$\tfrac{1}{2}\left(M_A + M_B\right) v^2 = M_B g h - M_A g\left(h\sin\theta\right) - \mu_k \left(M_A g\cos\theta\right) h$$

$$v^2 = \frac{M_B g h - M_A g\left(h\sin\theta\right) - \mu_k \left(M_A g\cos\theta\right) h}{\tfrac{1}{2}\left(M_A + M_B\right)}$$

$$v^2 = \frac{2gh\left[M_B - M_A\left(\sin\theta + \mu_k\cos\theta\right)\right]}{\left(M_A + M_B\right)}$$

$$v = \sqrt{\frac{2gh\left[M_B - M_A\left(\sin\theta + \mu_k\cos\theta\right)\right]}{\left(M_A + M_B\right)}} = 3.96 \text{ m/s}$$