*P2211K, Fall 2010 Quiz # 7 solutions:*
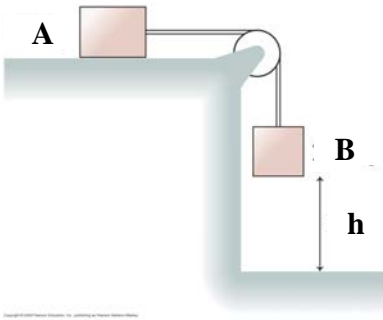
   a. Use work and energy to find the *speed of B* just before it hits the floor if it *begins from rest* and *the table is frictionless*.

   b. Use work and energy to find the *speed of B* just before it hits the floor if it *begins from rest* and the *coefficient of kinetic friction of A is $\mu_k$. (Ignore static friction*.)



Basic Idea :

$$\Delta K_T = W_T$$

$$\Delta K_A + \Delta K_B = W_g + W_f$$

$$\tfrac{1}{2}M_A v_f^2 + \tfrac{1}{2}M_B v_f^2 = M_B gh - (\mu_k M_A g)h$$

a., $W_f = 0$, so $v_f = \sqrt{\dfrac{2M_B gh}{(M_A + M_B)}}$

b., $W_f \neq 0$, so $v_f = \sqrt{\dfrac{2(M_B - \mu_k M_A)gh}{(M_A + M_B)}}$

*Comment:* It is possible to use a force analysis to find the tension (T) and the NET forces on A & B. There's no need to do that to find $v_f$, and doing so requires much more time for the calculation.

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*Version 1:* In the system below, *A = 2.0 kg, B = 3.0 kg, and h = 1.5m*.

     *a. ($\mu_k = 0$):*     *$v_f$ = 4.24 m/s*

     *b. ($\mu_k = 0.3$):*     *$v_f$ = 3.79 m/s*

*Version 2:* In the system below, *A = 3.0 kg, B = 2.0 kg, and h = 2.5m*.

     *a. ($\mu_k = 0$):*     *$v_f$ = 4.47 m/s*

     *b. ($\mu_k = 0.2$):*     *$v_f$ = 3.74 m/s*

*Version 3:* In the system below, *A = 4.0 kg, B = 6.0 kg, and h = 0.75m*.

     *a. ($\mu_k = 0$):*     *$v_f$ = 3.0 m/s*

     *b. ($\mu_k = 0.4$):*     *$v_f$ = 2.56 m/s*

In the system below, *A = 3.0 kg, B = 2.0 kg, and h = 2.5m*.

    a.  Use work and energy to find the ***speed of B*** just before it hits the floor if it ***begins from rest*** and ***the table is frictionless***.

    b.  Use work and energy to find the ***speed of B*** just before it hits the floor if it ***begins from rest*** and the ***coefficient of kinetic friction of A is 0.2***. *(**Ignore static friction**.)*

In the system below, *A = 2.0 kg, B = 3.0 kg, and h = 1.5m*.
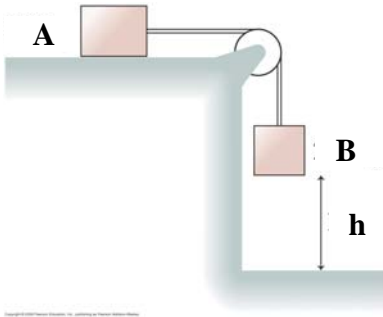
*Name:*_____

In the system below, *A = 4.0 kg, B = 6.0 kg, and h = 0.75m*.

    a.  Use work and energy to find the ***speed of B*** just before it hits the floor if it ***begins from rest*** and ***the table is frictionless***.

    b.  Use work and energy to find the ***speed of B*** just before it hits the floor if it ***begins from rest*** and the ***coefficient of kinetic friction of A is 0.4***. (***Ignore static friction***.)