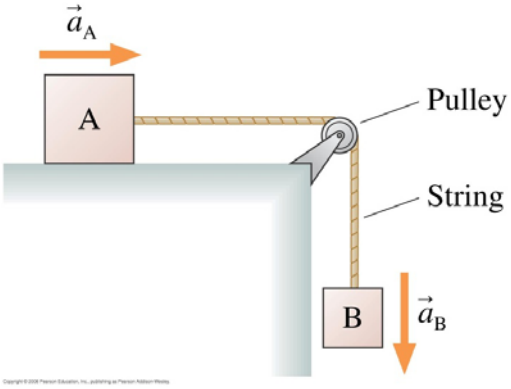
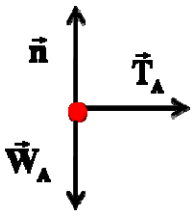
Physics 2211K

Quiz # 5, Solutions

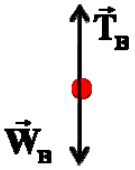
In the system sketched below, block A slides on a ***frictionless surface*** and the string connecting the two blocks is ***massless***.



a. Sketch the ***free-body diagram for A*** showing all the forces acting on it.



Block A :



Block B :

b. Calculate the ***tension*** in the string.

From the free - body diagrams : (note that $a_A = a_B = a$ ***&*** $T_A = T_B = T$***)***

$$m_A a = T \Rightarrow a = \frac{T}{m_A} \quad \& \quad m_B a = W_B - T \Rightarrow m_B\left(\frac{T}{m_A}\right) = m_B g - T$$

$$T = \frac{m_B g}{\left(m_B/m_A + 1\right)} = \frac{m_A m_B g}{\left(m_B + m_A\right)}$$

c. Calculate the ***acceleration of Block A***.

$$a = \frac{T}{m_A} = \frac{m_B g}{\left(m_B + m_A\right)}$$

d. If it begins from ***rest***, ***how far*** does ***Block B move in t = 3 seconds***?

$$d = \tfrac{1}{2} a t^2$$

- For the case where ***block A*** has mass ***6 kg*** and ***block B*** has mass ***10 kg***:

  $T = 37.5\ N \quad \& \quad a = 6.25\ m/s^2 \quad \& \ d = 28.13\ m$

- For the case where ***block A*** has mass ***10 kg*** and ***block B*** has mass ***4 kg***:

  $T = 28.6\ N \quad \& \quad a = 2.86\ m/s^2 \quad \& \ d = 12.86\ m$

- For the case where ***block A*** has mass ***6 kg*** and block B has mass ***2 kg***:

  $T = 15\ N \quad \& \quad a = 2.5\ m/s^2 \quad \& \ d = 11.25\ m$