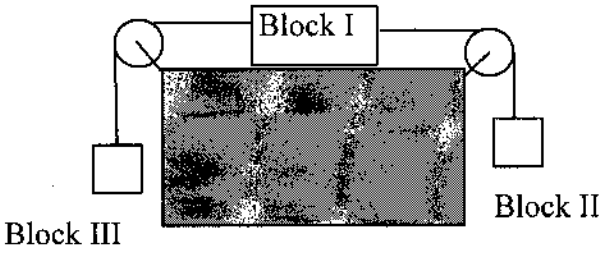
Name: KEY SP211

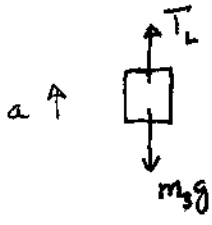
1. What is the acceleration of the system below? What is the tension in each cord? (they **are** different) The horizontal surface has no friction. The two pulleys have no mass or friction.

Block I: $m_1 = 20.\ kg$,
Block II: $m_2 = 5.0\ kg$,
Block III: $m_3 = 3.0\ kg$

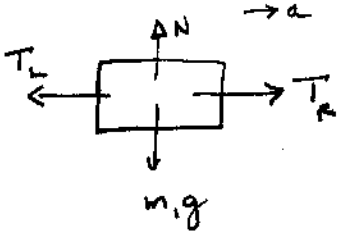


For full credit,
1. you must draw free body diagrams for each mass, drawing and labeling all forces on the free body diagrams 4
2. you must apply Newton's second law to each free body diagram. Put a box around the equation associated with each free body diagram. 4.5
3. use these equations to solve for the acceleration and tension. 1.5

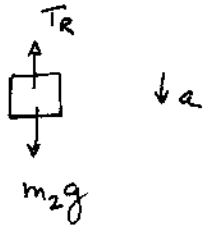
III



I



II



$\boxed{T_L - m_3 g = m_3 a}$ $\quad T_L - (3\,kg)(9.8\,m/s^2) = (3\,kg)a$

$\boxed{T_R - T_L = m_1 a}$ $\quad T_R - T_L = (20\,kg)a$

$\boxed{m_2 g - T_R = m_2 a}$ $\quad (5\,kg)(9.8\,m/s^2) - T_R = (5\,kg)a$

$T_L - m_3 g = m_3 a$

$T_R - T_L = m_1 a$

$m_2 g - T_R = m_2 a$

$m_2 g - m_3 g = (m_1 + m_2 + m_3)\,a$

$a = \dfrac{(m_2 - m_3)\,g}{m_1 + m_2 + m_3}$

$= \dfrac{2\,kg}{28\,kg}(9.8\,m/s^2) = \boxed{0.70\,m/s^2}$

$T_L = m_3 g + m_3 a = m_3(g + a)$

$= (3\,kg)(9.8\,m/s^2 + .7\,m/s^2) = 31.5\,N$

$= \boxed{32\,N}$

$T_R = m_2 g - m_2 a = m_2(g - a)$

$= 5\,kg\,(9.8\,m/s^2 - .7\,m/s^2) = 45.5\,N$

$= \boxed{46\,N}$