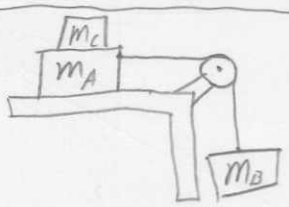
Force Homework, #4



$m_A = 44\,N$ $\quad \mu_s = 0.20$

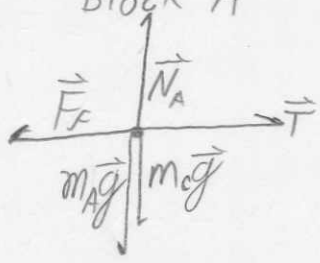
$m_B = 22\,N$

$m_C = ?$

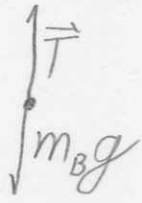
a) Free body diagram for each mass.

Block C

Block A



Block B



Newton's 2nd law:

A: $F_{xA} = T - F_f = 0$ ← Want to <u>just</u> overcome Friction

$T - \mu_s N_A = 0$

$F_{yA} = N_A - m_A g - m_c g = 0$ ← No accel. in y

B: $F_{yB} = T - m_B g = 0$ ← Want block B stationary

$\boxed{T = m_B g}$

C: $F_{yC} = N_c - m_c g = 0$

From F_{yA}: $\underline{N_A = (m_A + m_c)g}$

Plug into F_{xA}: $T - \mu_s(m_A + m_c)g$

continued ↓

Force Homework #4, Continued

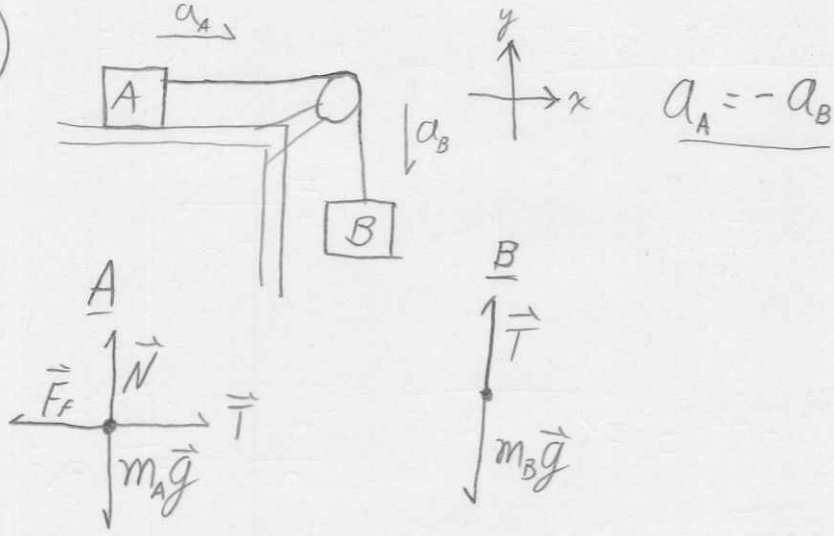
T from F_{yB} is equal to T from F_{xA}

$$m_B g - \mu_s (m_A + m_C) g = 0$$

$$\boxed{m_C = \frac{m_B}{\mu_s} - m_A}$$

$$m_C = \frac{22N}{0.20} - 44N = \boxed{66N}$$

b)



$a_A = -a_B$

$F_{yA} = N_A - m_A g = 0 \Rightarrow N_A = m_A g$

$F_{xA} = T - F_f = m_A a_A$

$\Rightarrow m_B(g - a_A) - \mu_K m_A g = m_A a_A$

$(m_A + m_B) a_A = (m_B - \mu_K m_A) g$

$$\boxed{a_A = g \frac{(m_B - \mu_K m_A)}{(m_A + m_B)}} = (9.8)\frac{22 - (0.15)(44)}{22 + 44} = \boxed{2.3\ m/s}$$

$F_{yB} = T - m_B g = m_B a_B$

$\Rightarrow T = m_B(g + a_B)$

$T = m_B(g - a_A)$