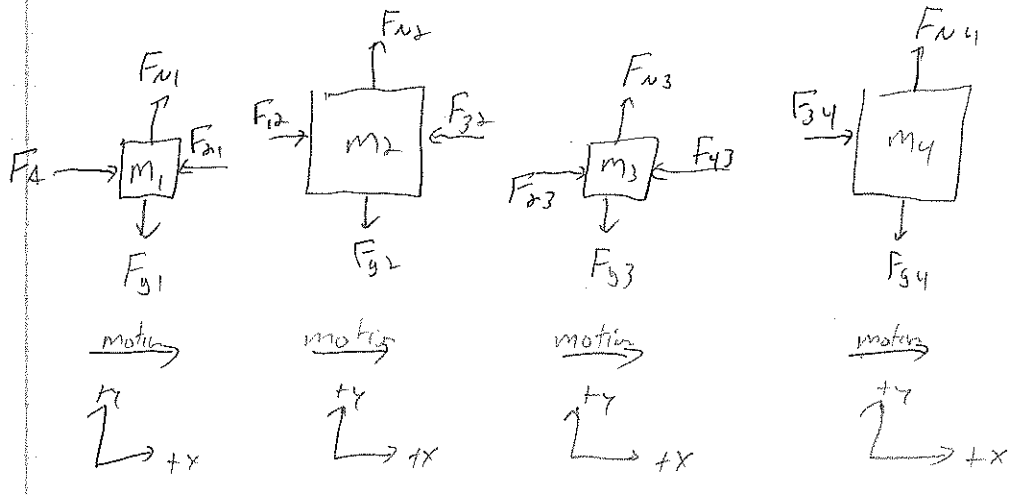
Connected Systems: More practice



$m_1 = 1.0\ kg$
$m_2 = 3.0\ kg$
$m_3 = 1.0\ kg$
$m_4 = 5.0\ kg$
$m_{sys} = m_1 + m_2 + m_3 + m_4$
$= 10.0\ kg$
$\vec{a}_{sys} = 2.0\ m/s^2\ [E]$
$\vec{g} = 9.8\ m/s^2\ [down]$
$\vec{a}_y = 0\ m/s^2$

$$F_{net,sys} = F_A - F_{21} + F_{12} - F_{32} + F_{23} - F_{43} + F_{34} = m_{sys}\, a_{sys}$$

$$F_A = m_{sys}\, a_{sys} = (10.0\ kg)(2.0\ m/s^2) = 20.0\ N$$

$$= \boxed{20.\ N}$$

$F_{net,1} = m_1 a_1 = (1.0\ kg)(2.0\ m/s^2) = \boxed{2.0\ N}$

$F_{net,2} = m_2 a_2 = (3.0\ kg)(2.0\ m/s^2) = \boxed{6.0\ N}$

$F_{net,3} = m_3 a_3 = (1.0\ kg)(2.0\ m/s^2) = \boxed{2.0\ N}$

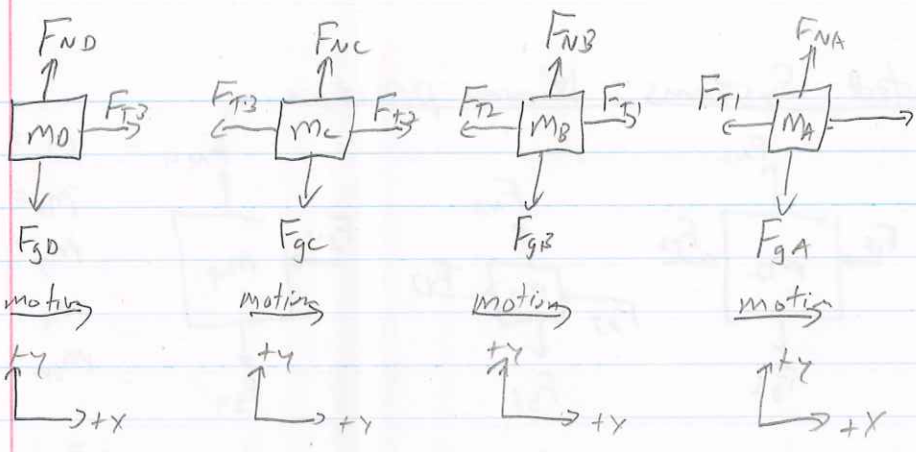
$F_{net,4} = m_4 a_4 = (5.0\ kg)(2.0\ m/s^2) = \boxed{10.\ N}$

$F_{net,1} = F_A - F_{21} \rightarrow F_{21} = F_A - F_{net,1} = 20N - 2.0N = \boxed{18\ N}$

$F_{net,2} = F_{12} - F_{32} \rightarrow F_{32} = F_{12} - F_{net,2} = 18N - 6.0N = \boxed{12\ N}$

$F_{net,3} = F_{23} - F_{43} \rightarrow F_{43} = F_{23} - F_{net,3} = 12N - 2.0N = \boxed{10\ N}$

$F_{12} = F_{21}$, $F_{23} = F_{32}$, $F_{34} = F_{43}$



$m_A = 1.0\ kg$
$m_B = 0.20\ kg$
$m_C = 0.80\ kg$
$m_D = 0.50\ kg$
$m_{sys} = m_A + m_B + m_C + m_D$
$= 2.5\ kg$
$\vec{F}_P = 4.0\ N\ [E]$
$\vec{a}_y = 0\ m/s^2$
$\vec{g} = 9.81\ m/s^2\ [down]$

$F_{Net,sys} = F_P - F_{T1} + F_{T1} - F_{T2} + F_{T2} - F_{T3} + F_{T3} = m_{sys} a_{sys}$

$F_P = m_{sys} a_{sys} \rightarrow F_{Net,sys} = \boxed{4.0\ N}$

$F_{A\ on\ P} = F_P = \boxed{4.0\ N}$

$a_{sys} = \frac{F_P}{m_{sys}} = \frac{4.0\ N}{2.5\ kg} = \boxed{1.6\ m/s^2}$

$F_{Net,A} = m_A a_A = (1.0\ kg)(1.6\ m/s^2) = \boxed{1.6\ N}$

$F_{Net,B} = m_B a_B = (0.20\ kg)(1.6\ m/s^2) = \boxed{0.32\ N}$

$F_{Net,C} = m_C a_C = (0.80\ kg)(1.6\ m/s^2) = 1.28\ N = \boxed{1.3\ N}$

$F_{Net,D} = m_D a_D = (0.50\ kg)(1.6\ m/s^2) = \boxed{0.80\ N}$

$F_{Net,D} = F_{T3} = \boxed{0.80\ N} = F_{3\ on\ D} = F_{D\ on\ 3}$

$F_{Net,C} = F_{T2} - F_{T3} \rightarrow F_{T2} = F_{Net\ C} + F_{T3} = 1.28\ N + 0.80\ N$
$= 2.08\ N$

$F_{T2} = F_{2\ on\ C} = F_{C\ on\ 2} = \boxed{2.1\ N}$

$F_{Net,B} = F_{T1} - F_{T2} \rightarrow F_{T1} = F_{Net\ B} + F_{T2} = 0.32\ N + 2.08\ N$
$= 2.40\ N$

$F_{T1} = F_{1\ on\ 13} = F_{B\ on\ 1} = \boxed{2.4\ N}$