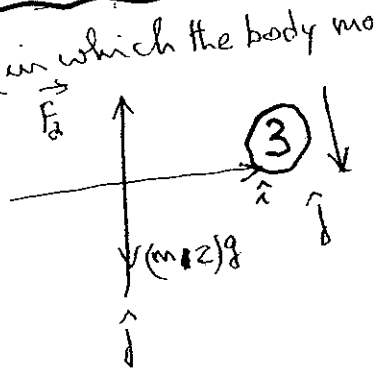
P-151/002 Random Graded HWK

Total Pts = 40

4-17 (a) Take downward direction (in which the body moves) as positive. We have,



10

$$\sum F_y = m_{12}a_y \quad (2)$$

$$\Rightarrow \left(m_{12}g - \frac{1}{4}m_{12}g\right) = m_{12}a_y$$

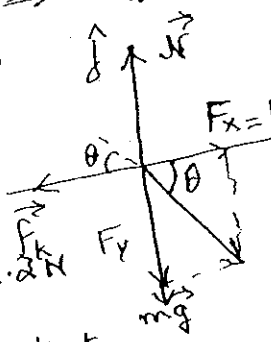
$$\Rightarrow a_y = \frac{3}{4}g = \frac{3}{4}\left(9.8\,\frac{m}{s^2}\right)$$

$$\hookrightarrow = 7.3\,\frac{m}{s^2} \quad (3)$$

(b) when the parachute opens, the divers descend at constant speed $\Rightarrow F_d = m_{12}g \Rightarrow F_d = 120\,kg\left(9.8\,\frac{m}{s^2}\right) = 1176\,N$ (2)

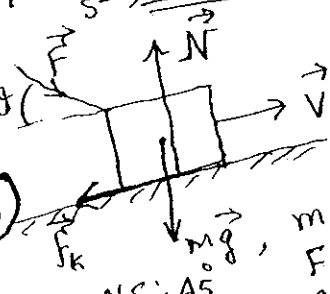
4-26 The force and free body diagrams are shown.

20 (a) For equilibrium in $\hat{j}$ direction: $N = mg + F_Y$



(c) $\Rightarrow N = 14.5\,kg\left(9.8\,\frac{m}{s^2}\right) + 62.2\,N$

$\hookrightarrow = 204.3\,N$ (5)



$m = 14.5\,kg$, $F = 88\,N$, $\theta = 45^\circ$

$F_Y = 88N\sin 45^\circ$

$\hookrightarrow = 62.2\,N$

$F_x = 88\,N\cos 45^\circ$

$\hookrightarrow = 62.2\,N$

(b) $f_k = F\cos\theta$, since V is constant

$\hookrightarrow = 62.2\,N$ (3)

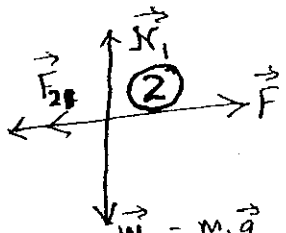
(d) $a = \frac{\Delta V}{\Delta t} = \frac{\left(1.5\,\frac{m}{s} - 0\right)}{2.5\,s} = \frac{1.5}{2.5}\,\frac{m}{s^2} = 0.6\,\frac{m}{s^2}$ (2). We must have: $\sum F_x = ma$

$\Rightarrow F\cos\theta - f_k = 14.5\,kg\left(0.6\,\frac{m}{s^2}\right) \Rightarrow \frac{F}{\sqrt{2}} = 62.2\,N + 8.7\,N \Rightarrow F = 100.3\,N$ (5)

10 4-45 For block 1:

$\sum F_x = m_1 a$, $\sum F_y = 0$ (1)

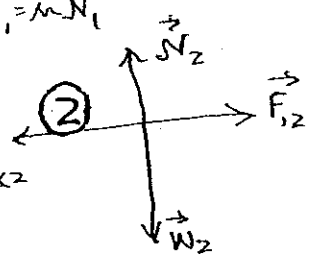
$$\boxed{F - F_{21} - f_{k1} = m_1 a,\ N_1 = m_1 g}$$



For block 2: (1)

$$\boxed{F_{12} - f_{2k} = m_2 a,\ N_2 = m_2 g}$$

$f_{k1} = \mu N_1$



If we add the two x-components,

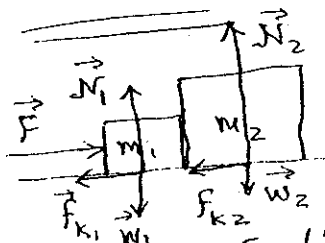
$F - (f_{k1} + f_{k2}) = (m_1 + m_2)a$

$\Rightarrow F - g(m_1 + m_2)\mu = (m_1 + m_2)a$

$$\Rightarrow a = \frac{F - g(m_1 + m_2)(0.15)}{m_1 + m_2} = \frac{730\,N - 9.8\,\frac{m}{s^2}(185\,kg)(0.15)}{185\,kg}$$

$\hookrightarrow = 3.95\,\frac{m}{s^2} - 1.47\,\frac{m}{s^2} = 2.48\,\frac{m}{s^2}$

$\Rightarrow \boxed{a = 2.48\,m/s^2}$ (2)



$m_1 = 75\,kg$, $F_{12} = F_{21}$ (action, reaction pair)

$m_2 = 110\,kg$, $F = 730\,N$

$\mu = 0.15$

From (2) we have,

$F_{12} = m_2 a + \mu m_2 g = m_2(a + \mu g)$

$\hookrightarrow = 110\,kg\,(2.48 + 1.47)\,\frac{m}{s^2}$

$\hookrightarrow = 110\,kg\,(3.95)\,\frac{m}{s^2} = 434.5\,N$

$\Rightarrow F_{12}(= F_{21}) = 434.5\,N$ (2)