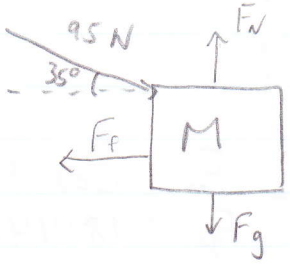
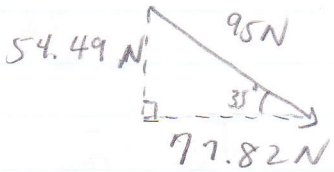
Textbook Solutions

Pg 171, # 11

11.



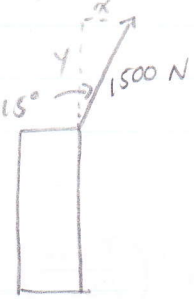
$\vec{v} = 1.2\ m/s$
$\vec{a} = 0\ m/s^2$



$F_f = -F_{ax} = -77.82\ N$

Pg 173, # 16

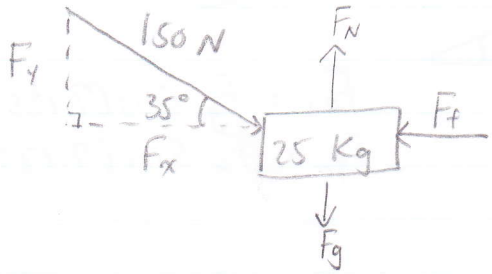
16.



ⓐ $(1500\ N)\cos 15$
$= 1448.89\ N$

ⓑ $(1500\ N)\sin 15$
$= 388.23\ N$

17.



ⓐ $F_y = 150\sin 35°$
$= -86.04\ N$

$F_x = 150\cos 35°$
$= 122.87\ N$

ⓑ $F_N = -(F_g + F_y) = -[(-86.04\ N) + (-245.25\ N)]$
$= 331.29\ N$

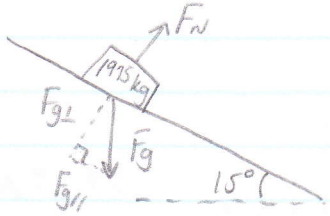
← $(25\ Kg)(-9.81\ m/s^2)$

ⓒ $F_{net} = F_x + F_f = 122.87\ N + (-85\ N)$
$= 37.87\ N$

ⓓ $F_{net} = m\vec{a}$
$37.87\ N = (25\ Kg)\ \vec{a}$
$\vec{a} = 1.51\ m/s^2$

Pg 191 # 24 ~26

24.



$d = 42\ m$
$V_f = ?$
$\vec{a} = ?$

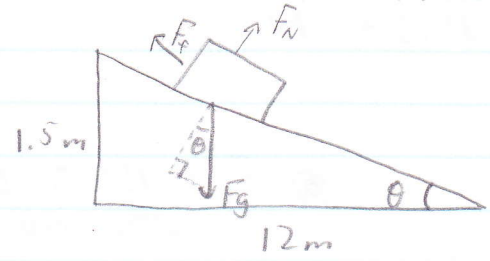
$F_N = -F_{g//}$, $F_{net} = F_{g\perp}$

$F_{g\perp} = \cos 15° \cdot (1975\ kg)(-9.81\ m/s^2)$
$F_{g\perp} = 18714.57\ N$

$F_{net} = ma$
$18714.57\ N = (1975\ kg)\,\vec{a}$
$\vec{a} = 9.48\ m/s^2 = 9.5\ m/s^2$

$V_f^2 = V_i^2 + 2ad$
$V_f^2 = 0 + 2(9.5\ m/s^2)(42\ m)$
$V_f = 796\ N = 800\ N$

25.



$\theta = \tan^{-1}\left(\frac{1.5m}{12m}\right)$
$\theta = 7.125°$

$F_{g\perp} = F_g \cos(7.125°)$
$F_{g//} = F_g \sin(7.125°)$

ⓐ $F_f = 0\ N$, $F_{net} = m\vec{a}$
$F_{g//} = m\vec{a}$
$F_g \sin(7.125°) = m\vec{a}$
$mg \sin(7.125°) = m\vec{a}$
$1.22\ m/s^2 = \vec{a}$
$1.2\ m/s^2 = \vec{a}$

ⓑ $F_f = \mu F_N = (0.11) F_N$, $F_N = F_{g\perp}$

$F_{net} = m\vec{a} \Rightarrow F_{g//} + F_f = m\vec{a}$
$F_{g//} + \mu F_N = m\vec{a}$
$mg \sin(7.125) + (0.11)\, mg \cos(7.125°) = m\vec{a}$

$g \sin(7.125°) + (0.11) g \cos(7.125°) = \vec{a}$

$1.217 \text{ m/s}^2 + 1.071 \text{ m/s}^2 = \vec{a}$

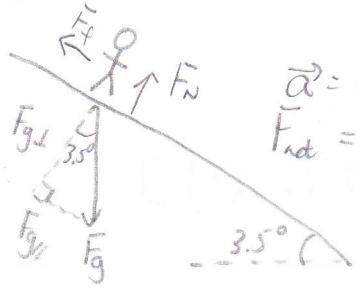
Note that F_f is in the negative direction!

$1.217 \text{ m/s}^2 - 1.071 \text{ m/s}^2 = \vec{a}$

$0.146 \text{ m/s}^2 = \vec{a}$

$\vec{a} = 0.15 \text{ m/s}^2$

26.



$\vec{a} = 0 \text{ m/s}^2$

$F_{net} = 0 \text{ N}$

$F_N = -F_{g\perp}$, $F_f = -F_{g\parallel}$, $F_f = \mu F_N$

$F_{g\perp} = F_g \cos 3.5° = mg \cos 3.5°$ $\quad F_{g\parallel} = F_g \sin 3.5° = mg \sin 3.5°$

$F_f = \mu F_N$

$F_{g\parallel} = \mu F_{g\perp}$

$mg \sin 3.5° = \mu\, mg \cos 3.5°$

$\sin 3.5° = \mu \cos 3.5°$

$\mu = 0.061$

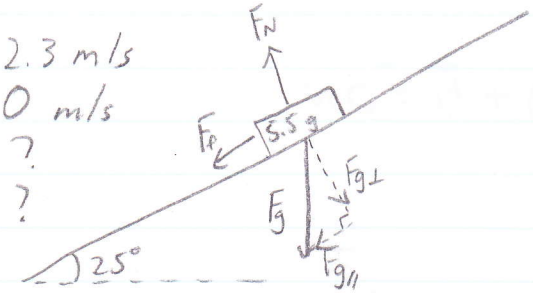
Pg. 194, # 27, 28

27. $V_i = 2.3 \text{ m/s}$

$V_f = 0 \text{ m/s}$

$d = ?$

$\vec{a} = ?$



$F_{g\perp} = F_g \cos 25°$

$= mg \cos 25°$

$F_{g\parallel} = F_g \sin 25°$

$= mg \cos 25°$

$F_N = -F_{g\perp}$, $F_f = \mu F_N$

$F_f = (0.40)(mg \cos 25)$

$F_f = (0.40)(0.0055 \text{ kg})(9.81 \text{ m/s}^2) \cos 25$

$F_f = -0.01956 \text{ N}$

$F_{g//} = mg \sin 25°$

$F_{g//} = (0.0055\ kg)(9.81\ m/s^2) \sin 25°$

$F_{g//} = -0.0228\ N$

$F_{net} = m\vec{a}$

$F_f + F_{g//} = m\vec{a}$

$-0.01956\ N - 0.0228\ N = (0.0055\ kg)\vec{a}$

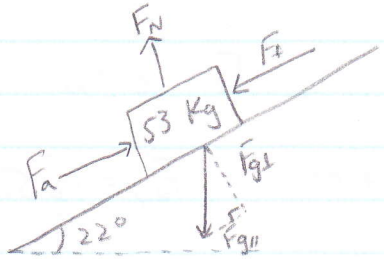
$\vec{a} = -7.7\ m/s^2$

$V_f^2 = V_i^2 + 2ad$

$0 = (2.3\ m/s)^2 + 2(-7.7\ m/s^2)\, d$

$d = 0.34\ m$

28.



$F_g = (53\ kg)(-9.81\ m/s^2)$

$F_g = -519.93\ N$

$F_{g\perp} = F_g \cos 22°$

$F_{g\perp} = -482.07\ N$

$F_{g//} = F_g \sin 22°$

$F_{g//} = -194.77\ N$

$F_N = -F_{g\perp} = 482.07\ N$

$\vec{a} = 0\ m/s^2$, $F_{net} = 0\ N$

$F_a + F_{g//} + F_f = 0\ N$

$373\ N + (-194.77\ N) + F_f = 0\ N$

$F_f = -178.23\ N$

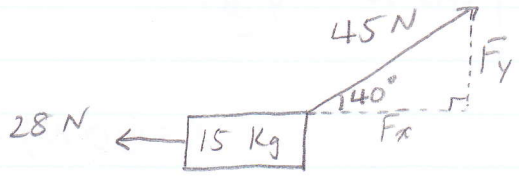
$F_f = \mu F_N$

$178.23\ N = \mu(482.07\ N)$

$\mu = 0.37$

Pg 208, # 24 ~ 26, 36

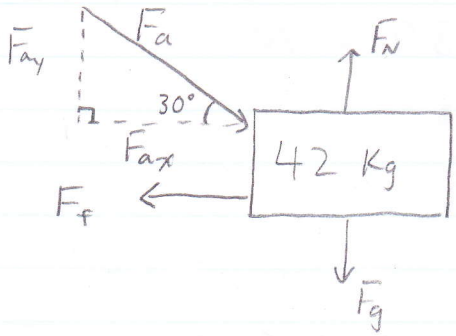
24.



$F_x = (45\ N)\cos 40°$
$F_x = 34.472\ N$

$F_{net} = m\vec{a}$
$34.472\ N - 28\ N = (15\ kg)\,\vec{a}$
$\vec{a} = 0.43\ m/s^2$

25.



$F_a = 450\ N$
$\mu = 0.60$

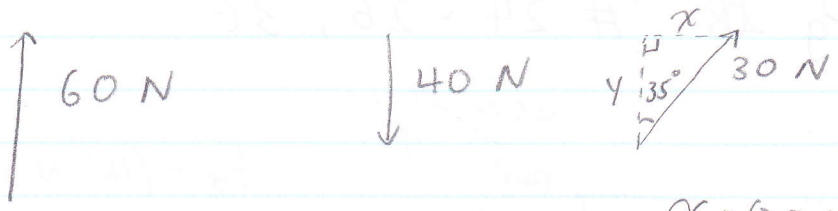
ⓐ $F_f = \mu F_N = (0.60)\,F_N$

$F_N + F_{ay} + F_g = 0\ N$
$F_N - (450\ N)\sin 30° + (42\ kg)(-9.81\ m/s^2) = 0\ N$
$F_N = 637.02\ N$

$F_f = (0.60)(637.02\ N)$
$F_f = -382.212\ N = -380\ N$

ⓑ $F_{net} = m\vec{a}$
$F_{ax} + F_f = m\vec{a}$
$(450\ N)(\cos 30°) - 382.212\ N = (42\ kg)\,\vec{a}$
$389.71\ N - 382.212\ N = (42\ kg)\,\vec{a}$
$\vec{a} = 0.1785\ m/s^2$
$\vec{a} = 0.18\ m/s^2$

26.



$x = (30\,N)\cos 35°$

$x = 24.6\,N$

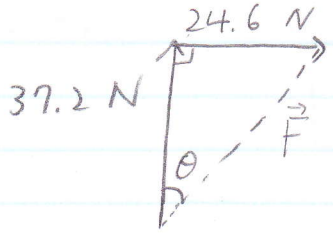
$y = (30\,N)\sin 35°$

$y = 17.2\,N$

All vertical forces: $60\,N - 40\,N + 17.2\,N$

$= 37.2\,N$

Total:

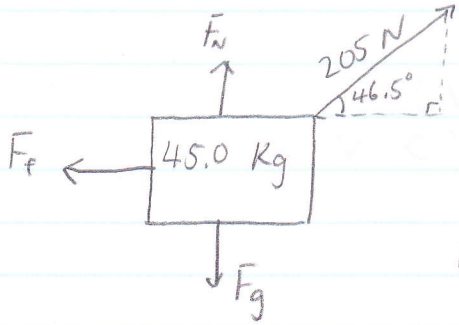


$\vec{F} = \sqrt{(37.2)^2 + (24.6)^2} = 44.6\,N$

$\tan\theta = \frac{24.6\,N}{37.2\,N} \Rightarrow \theta = 33.48°$

Net force: $44.6\,N\ [N\ 33.48°\ E]$

36.



$t = 2.50\,s$

$V_i = 1.00\,m/s$

$V_f = 1.50\,m/s$

$\vec{a} = \frac{V_f - V_i}{t} = \frac{0.50\,m/s}{2.50\,s}$

$\vec{a} = 0.2\,m/s^2$

@ $F_{net} = m\vec{a}$

$F_{net} = (45.0\,Kg)(0.2\,m/s^2)$

$F_{net} = 9\,N$

(b) $F_{ax} = 205\ N \cos 46.5^\circ$

$F_{ax} = 141.113\ N$

$F_{net} = F_{ax} + F_f = 9\ N$

$141.113\ N + F_f = 9\ N$

$F_f = -132.113\ N$

(c) $F_{ax} = 141.113\ N$

(d) $F_f = \mu F_N$, $F_g + F_N + F_{ay} = 0\ N$

$F_{ay} = 205\ N \sin 46.5^\circ$

$F_{ay} = 148.7\ N$

$F_g + F_N + F_{ay} = 0\ N$

$(45.0\ kg)(-9.81\ m/s^2) + F_N + 148.7\ N = 0\ N$

$F_N = 292.75\ N$

$132.113\ N = \mu (292.75\ N)$

$\mu = 0.4513$

$\mu = 0.451$