Form A: 2. E 3. D 4. B 5. D 6. E

Form B: 2. E 3. E 4. D 5. B 6. D

Form C: 2. D 3. E 4. E 5. D 6. B

Form D: 2. B 3. D 4. E 5. E 6. D

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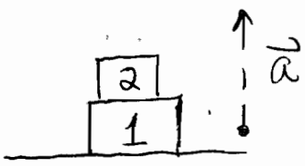
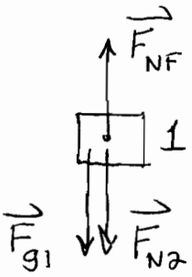
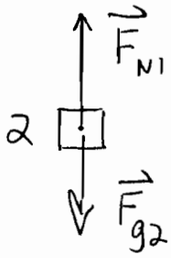
7. Translate







$m_1 = 5.00\,kg$ $m_2 = 2.00\,kg$ $a = 2.50\,m/s^2$ $g = 9.80\,m/s^2$

$F_{N2} = ?$ $\vec{F}_{NF} = ?$

Equate

$\Sigma\vec{F} = \vec{F}_{NET} = m\vec{a}$ $\vec{F}_G = m\vec{g}$

Solve

$2: \Sigma\vec{F} = F_{N1} - F_{g2} = m_2 a$ $F_{N1} = F_{g2} + m_2 a = m_2 g + m_2 a$

$F_{N1} = m_2(g+a)$

$F_{N1} = F_{N2}$ (Newton's 3rd Law)

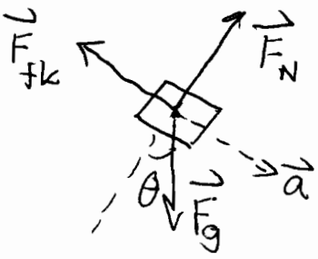
$F_{N2} = m_2(g+a) = (2.00)(9.80 + 2.50) = \underline{24.6\,N}$

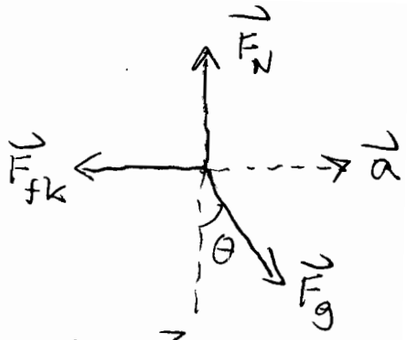
$1: \Sigma\vec{F} = F_{NF} - F_{g1} - F_{N2} = m_1 a$ $F_{NF} = F_{g1} + F_{N2} + m_1 a$

$F_{NF} = m_1 g + m_1 a + F_{N2} = m_1(g+a) + m_2(g+a) = (m_1+m_2)(g+a)$

$F_{NF} = (5.00 + 2.00)(9.80 + 2.50) = \underline{86.1\,N}$

8. Translate





$m = 65.0\,kg$ $\theta = 30.0^\circ$ $a = 0.800\,m/s^2$ $\mu_k = ?$

Equate

$\Sigma \vec{F} = \vec{F}_{NET} = m\vec{a}$ $F_{fk} = \mu_k F_N$

Solve

$x: \Sigma \vec{F}_x = F_g \sin\theta - F_{fk} = ma$ $F_{fk} = F_g \sin\theta - ma$

$y: \Sigma \vec{F}_y = F_N - F_g \cos\theta = 0$ $F_N = F_g \cos\theta$

$$\mu_k = \frac{F_{fk}}{F_N} = \frac{F_g \sin\theta - ma}{F_g \cos\theta} = \frac{mg\sin\theta - ma}{mg\cos\theta}$$

$$\mu_k = \frac{g\sin\theta - a}{g\cos\theta} = \frac{(9.80)(0.500) - (0.800)}{(9.80)(\sqrt{3}/2)}$$

$\mu_k = 0.483$ (Wet snow is sticky!)

9. Translate

$m_1 = 2250\,kg$ $\quad \vec{v}_{1i} = (25.0\,m/s, 90.0^\circ)$

$m_2 = 3500\,kg$ $\quad \vec{v}_{2i} = (20.0\,m/s, 135^\circ)$

$\vec{v}_f = ?$

Equate

$\vec{p} = m\vec{v}$ $\qquad v = \sqrt{v_x^2 + v_y^2}$ $\qquad \theta = \tan^{-1}\left(\frac{v_y}{v_x}\right)$

Solve

x: $\vec{p}_{1ix} + \vec{p}_{2ix} = \vec{p}_{1fx} + \vec{p}_{2fx}$

$0 + m_2 v_{2i}\cos 135^\circ = m_1\vec{v}_{fx} + m_2\vec{v}_{fx} = (m_1 + m_2)\vec{v}_{fx}$

$\vec{v}_{fx} = \frac{m_2 v_{2i}\cos 135^\circ}{m_1 + m_2} = \frac{(3500)(20.0)(-\sqrt{2}/2)}{(2250 + 3500)} = -8.608256\,m/s$

y: $\vec{p}_{1iy} + \vec{p}_{2iy} = \vec{p}_{1fy} + \vec{p}_{2fy}$

$m_1 v_{1i} + m_2 v_{2i}\sin 135^\circ = m_1\vec{v}_{fy} + m_2\vec{v}_{fy} = (m_1 + m_2)\vec{v}_{fy}$

$\vec{v}_{fy} = \frac{m_1 v_{1i} + m_2 v_{2i}\sin 135^\circ}{m_1 + m_2} = \frac{(2250)(25) + (3500)(20)(\sqrt{2}/2)}{(2250 + 3500)}$

$\vec{v}_{fy} = +\frac{56250 + 49497.5}{5750} = +18.390865\,m/s$

$v_f = \sqrt{v_{fx}^2 + v_{fy}^2} = \sqrt{(-8.608256)^2 + (18.390865)^2} = \underline{20.3\,m/s}$

$\theta = \tan^{-1}\left(\frac{v_{fy}}{v_{fx}}\right) = \tan^{-1}\left(\frac{18.390865}{-8.608256}\right) = -64.9 + 180^\circ = \underline{115^\circ}$

$(90.0^\circ \le \theta \le 180^\circ)$ ✓