Form A:	2. C	3. F	4. B	5. C	6. C	7. C	8. B	9. A
Form B:	2. B	3. A	4. C	5. F	6. B	7. C	8. C	9. C
Form C:	2. C	3. C	4. B	5. A	6. C	7. F	8. B	9. C
Form D:	2. B	3. C	4. C	5. C	6. B	7. A	8. C	9. F

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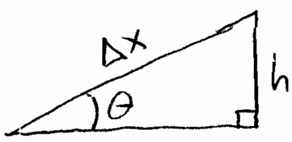
10) Translate



$\vec{v}_i = 0$ $\qquad a = 3.45\,m/s^2$ $\qquad \Delta t = 10.0\,s$

$\theta = 30.0^\circ$ $\qquad m = 65.0\,kg$ $\qquad P(ave) = ?$

Equate

$$P_{avg} = \frac{\Delta E}{\Delta t} \qquad K = \frac{1}{2}mv^2 \qquad U_g = mgy$$

$$\vec{v}_f = \vec{v}_i + \vec{a}\,\Delta t \qquad \vec{x} = \vec{x}_i + \vec{v}_i\,\Delta t + \frac{1}{2}\vec{a}(\Delta t)^2$$

Solve

$$v_f = 0 + a\Delta t \qquad v_f = a\Delta t \qquad \Delta x = \frac{1}{2}a(\Delta t)^2$$

$$\sin\theta = \frac{h}{\Delta x} \qquad h = \sin\theta\,\Delta x = \frac{1}{2}\sin\theta\, a(\Delta t)^2$$

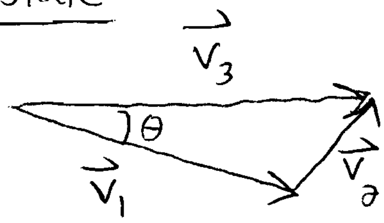
$$\Delta E = \Delta K + \Delta U_g = \frac{1}{2}mv_f^2 + mgh$$

$$P_{avg} = \frac{\frac{1}{2}mv_f^2 + mgh}{\Delta t} = \frac{\frac{1}{2}m(a\Delta t)^2 + mg\left(\frac{1}{2}\sin\theta\, a(\Delta t)^2\right)}{\Delta t}$$

$$P_{avg} = \frac{1}{2}ma\Delta t\left(a + g\sin\theta\right) = \frac{1}{2}(65.0)(3.45)(10.0)\left(3.45 + 4.90\right)$$

$$P_{avg} = 9360\,W$$

11) Translate



$\vec{v}_1 = (125\,m/s,\ \theta$ south of east$)$

$\vec{v}_2 = (30.0\,m/s,$ northeast$)$

$\vec{v}_3 = (v_3,$ east$)$

Equate

$\vec{v}_3 = \vec{v}_1 + \vec{v}_2$ $\qquad v_y = v\sin\theta$

Solve

$\vec{v}_{3y} = \vec{v}_{1y} + \vec{v}_{2y}$ $\qquad 0 = (-v_1\sin\theta) + (v_2\sin 45.0°)$

$v_1\sin\theta = \frac{\sqrt{2}}{2}v_2$ $\qquad \sin\theta = \frac{\sqrt{2}v_2}{2v_1}$

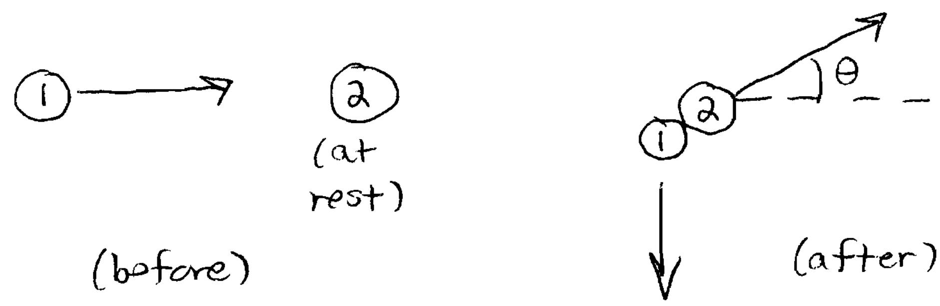
$$\theta = \sin^{-1}\left(\frac{\sqrt{2}v_2}{2v_1}\right) = \sin^{-1}\left(\frac{\sqrt{2}(30.0)}{2(125)}\right) = 9.77°$$

$\theta = 9.77°$ south of east

12) Translate

$m_1 = m \qquad \vec{v}_{1i} = (v, \text{right}) \qquad \vec{v}_{1f} = (v', \text{down})$

$m_2 = 2m \qquad \vec{v}_{2i} = 0 \qquad \vec{v}_{2f} = ?$



Equate

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

Solve

$\vec{x}: \quad \vec{p}_{1ix} + \vec{p}_{2ix} = \vec{p}_{1fx} + \vec{p}_{2fx} \qquad mv + 0 = 0 + 2m\vec{v}_{2fx}$

$\vec{y}: \quad \vec{p}_{1iy} + \vec{p}_{2iy} = \vec{p}_{1fy} + \vec{p}_{2fy} \qquad 0 + 0 = -mv' + 2m\vec{v}_{2fy}$

$K: \quad \frac{1}{2}m_1v_{1i}^2 + \frac{1}{2}m_2v_{2i}^2 = \frac{1}{2}m_1v_{1f}^2 + \frac{1}{2}m_2v_{2f}^2$

$\frac{1}{2}mv^2 + 0 = \frac{1}{2}m(v')^2 + \frac{1}{2}2mv_{2f}^2 \qquad v^2 = (v')^2 + 2(v_{2f})^2$

$\vec{x}: \vec{v}_{2fx} = \frac{v}{2} \qquad \vec{y}: \vec{v}_{2fy} = \frac{v'}{2} \qquad v' = 2\vec{v}_{2fy}$ (substitute)

$v^2 = (2v_{2fy})^2 + 2(v_{2f})^2 = 4v_{2fy}^2 + 2(v_{2fx}^2 + v_{2fy}^2)$

$v^2 = 4v_{2fy}^2 + 2\left(\left(\frac{v}{2}\right)^2 + v_{2fy}^2\right) = 4v_{2fy}^2 + \frac{v^2}{2} + 2v_{2fy}^2$

$\frac{v^2}{2} = 6v_{2fy}^2 \qquad v_{2fy} = \frac{v}{\sqrt{12}}$

$$v_{2fx} = \frac{v}{2} \qquad v_{2fy} = \frac{v}{\sqrt{12}}$$

$$v_{2f} = \sqrt{v_{2fx}^2 + v_{2fy}^2} = \left(\left(\frac{v}{2}\right)^2 + \left(\frac{v}{\sqrt{12}}\right)^2 \right)^{1/2} = \left(\frac{v^2}{4} + \frac{v^2}{12} \right)^{1/2}$$

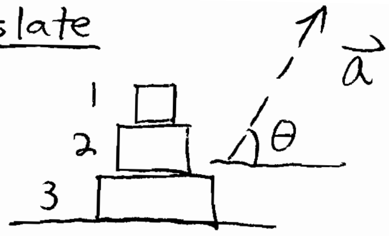
$$v_{2f} = \left(\frac{3v^2}{12} + \frac{v^2}{12} \right)^{1/2} = \left(\frac{4v^2}{12} \right)^{1/2} = \left(\frac{v^2}{3} \right)^{1/2} = \frac{v}{\sqrt{3}}$$

$$\theta = \tan^{-1}\left(\frac{v_{2fy}}{v_{2fx}} \right) = \tan^{-1}\left(\frac{\frac{v}{\sqrt{12}}}{\frac{v}{2}} \right) = \tan^{-1}\left(\frac{2}{\sqrt{12}} \right)$$

$$\theta = \tan^{-1}\left(\frac{2}{2\sqrt{3}} \right) = \tan^{-1}\left(\frac{1}{\sqrt{3}} \right) = 30.0^\circ$$

$$\vec{v}_{2f} = \left(\frac{v}{\sqrt{3}}, 30.0^\circ \right) = \left(\frac{\sqrt{3}\,v}{3}, 30.0^\circ \right)$$

13) Translate



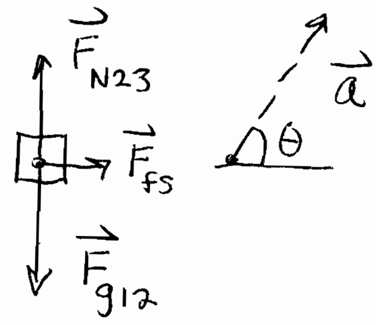
$\theta = 60.0^\circ$ $\quad a = 2.50\ m/s^2$

$F_{g1} = 20.0N$ $\quad g = 9.80\ m/s^2$

$F_{g2} = 25.0N$ $\quad F_{N23} = ?$

$F_{g3} = 30.0N$

FBD: 1 and 2 combined



Equate

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

Solve

$$\Sigma \vec{F}_y = m\vec{a}_y \qquad F_{N23} - F_{g12} = m_{12}\, a \sin\theta$$

$$F_{N23} = F_{g12} + m_{12}\, a \sin\theta \qquad m_{12} = \frac{F_{g12}}{g}$$

$$F_{N23} = F_{g12} + \frac{aF_{g12}}{g}\sin\theta = F_{g12}\left(1 + \frac{\sin\theta a}{g}\right)$$

$$F_{N23} = (20.0 + 25.0)\left(1 + \frac{(\sin 60.0^\circ)(2.50)}{(9.80)}\right) = 54.9N$$