34. (*a*) For a perfectly elastic collision, we use momentum conservation:

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$, or $m_1(v_1 - v_1') = m_2(v_2' - v_2)$.

Kinetic energy is conserved, so we have

$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = \frac{1}{2}m_1v_1'^2 + \frac{1}{2}m_2v_2'^2$, or $m_1(v_1^2 - v_1'^2) = m_2(v_2'^2 - v_2^2)$,

which can be written as

$m_1(v_1 - v_1')(v_1 + v_1') = m_2(v_2' - v_2)(v_2' + v_2)$.

When we divide this by the momentum result, we get

$v_1 + v_1' = v_2' + v_2$, or $v_1' - v_2' = v_2 - v_1$.

If we use this in the definition of the coefficient of restitution, we get

$e = (v_1' - v_2')/(v_2 - v_1) = (v_2 - v_1)/(v_2 - v_1) = 1$.

For a completely inelastic collision, the two objects move together, so we have

$v_1' = v_2'$, which gives $e = 0$.

(*b*) We find the speed after falling a height *h* from energy conservation:

$\frac{1}{2}mv_1^2 = mgh$, or $v_1 = (2gh)^{1/2}$.

The same expression holds for the height reached by an object moving upward:

$v_1' = (2gh')^{1/2}$.

Because the steel plate does not move, when we take into account the directions we have

$e = (v_1' - v_2')/(v_2 - v_1) = [(2gh')^{1/2} - 0]/\{0 - [-(2gh)^{1/2}]\}$, so $\boxed{e = (h'/h)^{1/2}.}$

35. Momentum conservation for the explosion gives us

$0 = m_1v_1' + m_2v_2'$;

$0 = m_1v_1' + 3m_1v_2'$, or $v_1' = -3v_2'$.

On the horizontal surface after the collision, the normal force on a block is $F_N = mg$.
We relate the speed of a block immediately after the collision to the distance it slides from the work-energy principle for the sliding motion:

$W_{fr} = \Delta KE$;

$-\mu_k mgd = 0 - \frac{1}{2}mv^2$, or $d = \frac{1}{2}v^2/\mu_k g$.

If we use this for each block and form the ratio, we get

$d_1/d_2 = (v_1/v_2)^2 = (-3)^2 = \boxed{9,}$ with the lighter block traveling farther.

36. For the momentum conservation of this one-dimensional collision, we have

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$.

(*a*) If the bodies stick together, $v_1' = v_2' = V$:

(5.0 kg)(5.5 m/s) + (3.0 kg)(– 4.0 m/s) = (5.0 kg + 3.0 kg)V, which gives $V = \boxed{v_1' = v_2' = 1.9 \text{ m/s}.}$

(*b*) If the collision is elastic, the relative speed does not change:

$v_1 - v_2 = -(v_1' - v_2')$, or 5.5 m/s – (– 4.0 m/s) = 9.5 m/s = $v_2' - v_1'$.

The momentum equation is

(5.0 kg)(5.5 m/s) + (3.0 kg)(– 4.0 m/s) = (5.0 kg)v_1' + (3.0 kg)v_2', or

(5.0 kg)v_1' + (3.0 kg)v_2' = 15.5 kg·m/s.

When we combine these two equations, we get $\boxed{v_1' = -1.6 \text{ m/s}, v_2' = 7.9 \text{ m/s}.}$

(*c*) If m_1 comes to rest, $v_1' = 0$.

(5.0 kg)(5.5 m/s) + (3.0 kg)(– 4.0 m/s) = 0 + (3.0 kg)v_2', which gives $\boxed{v_1' = 0, v_2' = 5.2 \text{ m/s}.}$

(*d*) If m_2 comes to rest, $v_2' = 0$.

(5.0 kg)(5.5 m/s) + (3.0 kg)(– 4.0 m/s) = (5.0 kg)v_1' + 0, which gives $\boxed{v_1' = 3.1 \text{ m/s}, v_2' = 0.}$

(*e*) The momentum equation is

(5.0 kg)(5.5 m/s) + (3.0 kg)(– 4.0 m/s) = (5.0 kg)(– 4.0 m/s) + (3.0 kg)v_2',

which gives $\boxed{v_1' = -4.0 \text{ m/s}, v_2' = 12 \text{ m/s}.}$

The result for (*c*) is reasonable. The 3.0-kg body rebounds.

The result for (*d*) is not reasonable. The 5.0-kg body would have to pass through the 3.0-kg body.

To check the result for (*e*) we find the change in kinetic energy:

$\Delta KE = (\frac{1}{2}m_1v_1'^2 + \frac{1}{2}m_2v_2'^2) - (\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2)$

$= \frac{1}{2}[(5.0 \text{ kg})(5.5 \text{ m/s})^2 + (3.0 \text{ kg})(-4.0 \text{ m/s})^2] - \frac{1}{2}[(5.0 \text{ kg})(-4.0 \text{ m/s})^2 + (3.0 \text{ kg})(12 \text{ m/s})^2]$

$= +156$ J.

Because the kinetic energy cannot increase in a simple collision, the result for (*e*) is not reasonable.