**b)** Kinetic energy calculations, unlike momentum, require converting units to standard units. Also, consider speed.

before collision

(1) (2)

$m_1 = 0.225$ kg $m_2 = 0.125$ kg

$v_1 = 0.300$ m/s $v_2 = 0.100$ m/s

after collision

(1) (2)

$m_1 = 0.225$ kg $m_2 = 0.125$ kg

$v_1' = 0.222$ m/s $v_2' = 0.240$ m/s

Kinetic energy of object 1 before

$$E_{k1} = \frac{1}{2} m_1 v_1^2$$
$$= \frac{1}{2}(0.225 \text{ kg})(0.300 \text{ m/s})^2$$
$$= 1.0125 \times 10^{-2} \text{ J}$$

Kinetic energy of object 2, before

$$E_{k2} = \frac{1}{2} m_2 v_2^2$$
$$= \frac{1}{2}(0.125 \text{ kg})(0.100 \text{ m/s})^2$$
$$= 6.25 \times 10^{-4} \text{ J}$$

Kinetic energy of object 1, after

$$E_{k1}' = \frac{1}{2} m_1 (v_1')^2$$
$$= \frac{1}{2}(0.225 \text{ kg})(0.222 \text{ m/s})^2$$
$$= 5.5445 \times 10^{-3} \text{ J}$$

Kinetic energy of object 2, after

$$E_{k2}' = \frac{1}{2} m_2 (v_2')^2$$
$$= \frac{1}{2}(0.125 \text{ kg})(0.240 \text{ m/s})^2$$
$$= 3.60 \times 10^{-3} \text{ J}$$

Total kinetic energy before collision

$= 1.0125 \times 10^{-2}$ J $+ 6.25 \times 10^{-4}$ J

$= 1.075 \times 10^{-2}$ J

Total kinetic energy after collision

$= 5.5445 \times 10^{-3}$ J $+ 3.60 \times 10^{-3}$ J

$= 9.1445 \times 10^{-3}$ J

Mechanical (kinetic) energy lost in collision

$= 1.075 \times 10^{-2}$ J $- 9.1445 \times 10^{-3}$ J

$= 1.61 \times 10^{-3}$ J

$\therefore$ collision is inelastic.

**12. a)** before collision

→

(1) (2)

Consider right as positive

$m_1 = 10.0$ g $m_2 = 30.0$ g

$\vec{v}_1 = 20.0$ cm/s $\vec{v}_2 = 0$

$\vec{p}_1 = 200$ g·cm/s $\vec{p}_2 = 0$

$\therefore \vec{p}_{\text{before}} = \vec{p}_1 + \vec{p}_2 = 200$ g·cm/s

after collision

← →

(1) (2)

$m_1 = 10.0$ g $m_2 = 30$ g

$\vec{v}_1' = -6.0$ cm/s $\vec{v}_2' = ?$

$\vec{p}_1' = -60$ g·cm/s $\vec{p}_2' = ?$

$\vec{p}_{\text{sys(after)}} = \vec{p}_{\text{sys(before)}} = 200$ g·cm/s

$\vec{p}_2' = 200$ g·cm/s $- (-60$ g·cm/s$)$

$= 260$ g·cm/s

$$\vec{v}_2' = \frac{\vec{p}_2'}{m}$$
$$= \frac{260 \text{ g·cm/s}}{30.0 \text{ g}}$$
$$= 8.67 \text{ cm/s right}$$

**b)** Kinetic energy calculations, unlike momentum, require converting units to standard units.

before collision

(1) (2)

$m_1 = 0.0100$ kg $m_2 = 0.0300$ kg

$v_1 = 0.200$ m/s $v_2 = 0$

after collision

(1) (2)

$m_1 = 0.0100$ kg $m_2 = 0.0300$ kg

$= -0.060$ m/s $v_2' = 0.0867$ m/s