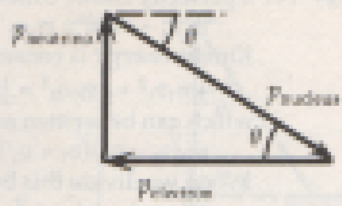
37. Because the initial momentum is zero, the momenta of the three products of the decay must add to zero. If we draw the vector diagram, we see that



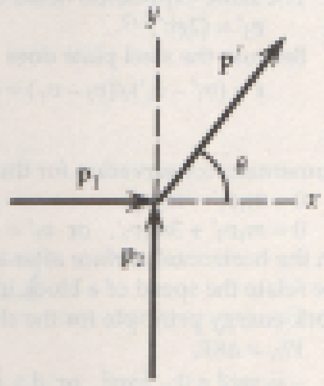
$$p_{nucleus} = (p_{electron}^2 + p_{neutrino}^2)^{1/2}$$
$$= [(9.30 \times 10^{-23}\ \text{kg}\cdot\text{m/s})^2 + (5.40 \times 10^{-23}\ \text{kg}\cdot\text{m/s})^2]^{1/2}$$
$$= \boxed{1.08 \times 10^{-22}\ \text{kg}\cdot\text{m/s}.}$$

We find the angle from

$$\tan\theta = p_{neutrino}/p_{electron}$$
$$= (5.40 \times 10^{-23}\ \text{kg}\cdot\text{m/s})/(9.30 \times 10^{-23}\ \text{kg}\cdot\text{m/s})$$

= 0.581, so the angle is $\boxed{30.1° \text{ from the direction opposite to the electron's.}}$

38. For the collision we use momentum conservation:



x-direction: $m_1v_1 + 0 = (m_1 + m_2)v' \cos\theta$;

$(4.3\ \text{kg})(7.8\ \text{m/s}) = (4.3\ \text{kg} + 5.6\ \text{kg})v' \cos\theta$, which gives

$v' \cos\theta = 3.39\ \text{m/s}$.

y-direction: $0 + m_2v_2 = (m_1 + m_2)v' \sin\theta$;

$(5.6\ \text{kg})(10.2\ \text{m/s}) = (4.3\ \text{kg} + 5.6\ \text{kg})v' \sin\theta$, which gives

$v' \sin\theta = 5.77\ \text{m/s}$.

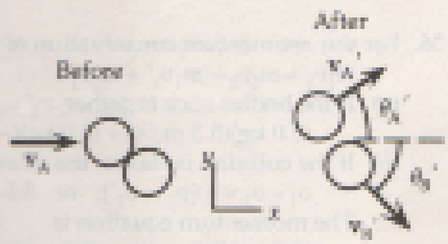
We find the direction by dividing the equations:

$\tan\theta = (5.77\ \text{m/s})/(3.39\ \text{m/s}) = 1.70$, so $\theta = \boxed{60°.}$

We find the magnitude by squaring and adding the equations:

$v' = [(5.77\ \text{m/s})^2 + (3.39\ \text{m/s})^2]^{1/2} = \boxed{6.7\ \text{m/s}.}$

39. (*a*) Using the coordinate system shown, for momentum conservation we have



$$\boxed{\begin{array}{l} x\text{-momentum: } m_Av_A + 0 = m_Av_A' \cos\theta_A' + m_Bv_B' \cos\theta_B'; \\ y\text{-momentum: } 0 + 0 = m_Av_A' \sin\theta_A' - m_Bv_B' \sin\theta_B'. \end{array}}$$

(*b*) With the given data, we have

x: $(0.400\ \text{kg})(1.80\ \text{m/s}) = (0.400\ \text{kg})(1.10\ \text{m/s}) \cos 30° + (0.500\ \text{kg})v_B' \cos\theta_B'$,

which gives $v_B' \cos\theta_B' = 0.678\ \text{m/s}$;

y: $0 = (0.400\ \text{kg})(1.10\ \text{m/s}) \sin 30° - (0.500\ \text{kg})v_B' \sin\theta_B'$,

which gives $v_B' \sin\theta_B' = 0.440\ \text{m/s}$.

We find the magnitude by squaring and adding the equations:

$v_B' = [(0.440\ \text{m/s})^2 + (0.678\ \text{m/s})^2]^{1/2} = \boxed{0.808\ \text{m/s}.}$

We find the direction by dividing the equations:

$\tan\theta_B' = (0.440\ \text{m/s})/(0.678\ \text{m/s}) = 0.649$, so $\theta_B = \boxed{33.0°.}$