pg 178) #22

$V_{thrower} \rightarrow (m_1 + m_2)\vec{V}_{i\,1+2} = m_1 V_{F_1} + m_2 V_{F_2}$

m_1 = snowball

m_2 = thrower

V

$$\vec{V}_{F_2} = \frac{(m_1 + m_2)\vec{V}_{i\,1+2} - (m_1 V_{F_1})}{m_2}$$

$$\rightarrow \vec{V}_{F_2} = \frac{(65.0\text{kg} + .045\text{kg}) + 2.50\text{m/s} - (.045\text{kg} \cdot +30.\text{m/s})}{65.0\text{kg}}$$

$$\vec{V}_{F_{thrower}} = 2.48\ \text{m/s}$$

$\vec{V}_{catcher}$

m_1 = snowball

m_2 = catcher

$$(m_1 \cdot \vec{V}_i) + (m_2 \cdot \vec{V}_i) = (m_1 + m_2) \cdot \vec{V}_F$$

$$\vec{V}_F = \frac{(m_1 \cdot \vec{V}_i) + (m_2 \cdot \vec{V}_i) - \text{[illegible]}}{(m_1 + m_2)}$$

$$\rightarrow \vec{V}_F = \frac{(.045\text{kg} \cdot +30.0\text{m/s}) + (60.0\text{kg} \cdot 0\text{m/s})}{(.045\text{kg} + 60.0\text{kg})}$$

$$\vec{V}_{F_{catcher}} = .022\ \text{m/s}$$

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m_1 = single car = 2.00×10^4 kg

m_{2+3} = coupled cars = 4.00×10^4 kg

$$(m_1 v_{i_1}) + (m_{2+3} \cdot \vec{v}_{i_{2+3}}) = (m_1 + m_{2+3}) \vec{v}_{F_{1+2+3}}$$

$$\vec{v}_{F_{1+2+3}} = \frac{(m_1 \vec{v}_{i_1})}{(m_1 + m_{2+3})} + (m_{2+3} \cdot \vec{v}_{i_{2+3}})$$

$$\vec{v}_{F_{1+2+3}} = \frac{((2.00 \times 10^4 \text{ kg} \cdot +3.0 \text{ m/s}) + (4.00 \times 10^4 \text{ kg} \cdot +1.2 \text{ m/s}))}{(2.00 \times 10^4 \text{ kg} + 4.00 \times 10^4 \text{ kg})}$$

$$\vec{v}_{F_{1+2+3}} = +1.8 \text{ m/s}$$

38 a)

$m_{tot} = 4 \cdot 2.50 \times 10^4 \text{ kg}$

$m_{3 cars} = 3 \cdot 2.50 \times 10^4 \text{ kg}$

$m_{1 car} = 1 \cdot 2.50 \times 10^4 \text{ kg}$

$$(m_{tot} \cdot \vec{v}_i) = (m_{3 cars} \cdot \vec{v}_F) + (m_{1 car} \cdot \vec{v}_F)$$

$$\vec{v}_i = \frac{(m_{3 cars} \cdot \vec{v}_F) + (m_{1 car} \cdot \vec{v}_F)}{m_{tot}}$$

$$\vec{v}_i = \frac{(3 \cdot 2.50 \times 10^4 \text{ kg} \cdot -2.00 \text{ m/s}) + (1 \cdot 2.50 \times 10^4 \text{ kg} \cdot -4.0 \text{ m/s})}{(4 \cdot 2.50 \times 10^4 \text{ kg})}$$

$$\vec{v}_i = -2.50 \text{ m/s}$$

40 a.) For all problems can't have same mass, so equation becomes

$$\vec{v}_{1i} + \vec{v}_{2i} = \vec{v}_{1F} + \vec{v}_{2F}$$

- since an elastic head on collision momentum is transfered between each other, the velocities are exchanged

a) $\vec{v}_{1i} = +1.50 \text{ m/s} \rightarrow$ so $\vec{v}_{2F} = +1.50 \text{ m/s}$

$\vec{v}_{2i} = 0 \text{ m/s} \rightarrow$ so $\vec{v}_{1F} = 0 \text{ m/s}$

b.) $\vec{v}_{1i} = +1.50 \text{ m/s} \rightarrow \vec{v}_{2F} = +1.50 \text{ m/s}$

$\vec{v}_{2i} = -1.00 \text{ m/s} \rightarrow \vec{v}_{1F} = -1.00 \text{ m/s}$

c) $\vec{v}_{1i} = +1.50 \text{ m/s} \rightarrow \vec{v}_{2F} = +1.50 \text{ m/s}$

$\vec{v}_{2i} = +1.00 \text{ m/s} \rightarrow \vec{v}_{1F} = +1.00 \text{ m/s}$