19

a) $\vec{p} = m\vec{v} = 1200\text{kg}(20.0\text{m/s}) = \boxed{24{,}000\ \text{kg m/s}}$

b) $\Delta\vec{p} = \vec{p}_f - \vec{p}_0 = 0 - 24{,}000\ \text{kg m/s} = \boxed{-24{,}000\ \text{kg m/s}}$

c) $\vec{I} = \Delta\vec{p} = \boxed{-24{,}000\ \text{kg m/s}}$

d) $\Sigma\vec{F}\cdot t = \vec{I} \Rightarrow \Sigma\vec{F} = \frac{\vec{I}}{t} = \frac{-24{,}000\text{kg m/s}}{5\text{s}} = \boxed{-4{,}800\ \text{kg m/s}^2 \text{ or N}}$

20

E is + W is -

a) $\Sigma\vec{p}_0 = \vec{p}_{01} + \vec{p}_{02} = m_1\vec{v}_{01} + m_2\vec{v}_{02} = (4\text{kg})(6\text{m/s}) + (6\text{kg})(-4\text{m/s})$

$\boxed{\Sigma\vec{p}_0 = 0}$

b) $\boxed{\Sigma\vec{p}_0 = \Sigma\vec{p}_f = 0}$

c) $\Sigma\vec{p}_f = 0 = m_1\vec{v}_{f1} + m_2\vec{v}_{f2} \Rightarrow v_{f2} = \frac{-m_1\vec{v}_{f1}}{m_2} = \frac{-4\text{kg}(-5\text{m/s})}{6\text{kg}} = \boxed{3.33\text{m/s}}$

d) $\vec{I}_1 = \Delta\vec{p}_1 = \vec{p}_{f1} - \vec{p}_{01} = m_1\vec{v}_{f1} - m_1\vec{v}_{01} = m_1(\vec{v}_{f1} - \vec{v}_{01}) = 4\text{kg}(\quad)$

$\boxed{\vec{I}_1 = \quad = 44\ \text{kg m/s}}$

21

a) $\Sigma\vec{p}_0 = m_1\vec{v}_{10} + m_2\vec{v}_{20} = 2\text{kg}(3\text{m/s}) + 2\text{kg}(2\text{m/s}) = \boxed{10\ \text{kg m/s}}$

b) $\vec{I}_2 = \Delta\vec{p}_2 = m_2\Delta\vec{v}_2 = m_2(\vec{v}_{2f} - \vec{v}_{20}) = 2\text{kg}(2.9\text{m/s} - (\text{m2m/s}))$

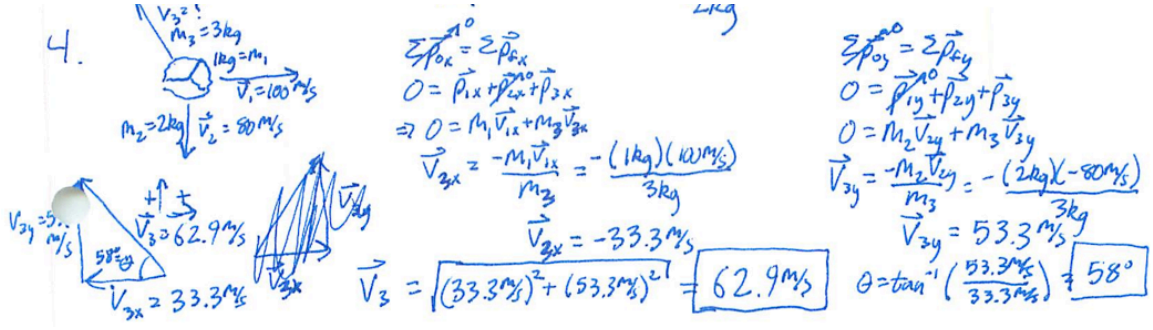
$= \boxed{1.8\ \text{kg m/s}}$

c) $\Sigma\vec{p}_0 = \Sigma\vec{p}_f = m_1\vec{v}_{1f} + m_2\vec{v}_{2f}$

$\vec{v}_{1f} = \frac{\Sigma\vec{p}_0 - m_2\vec{v}_{2f}}{m_1} = \frac{10\text{kg m/s} - 2\text{kg}(2.9\text{m/s})}{2\text{kg}} = \boxed{2.1\text{m/s}}$

22

4.



$\Sigma\vec{p}_{0x} \overset{0}{=} \Sigma\vec{p}_{fx}$

$0 = \vec{p}_{1x} + \vec{p}_{2x} \overset{0}{} + \vec{p}_{3x}$

$\Rightarrow 0 = m_1\vec{v}_{1x} + m_3\vec{v}_{3x}$

$\vec{v}_{3x} = \frac{-m_1\vec{v}_{1x}}{m_3} = \frac{-(1\text{kg})(100\text{m/s})}{3\text{kg}}$

$\vec{v}_{3x} = -33.3\text{m/s}$

$\Sigma\vec{p}_{0y} \overset{0}{=} \Sigma\vec{p}_{fy}$

$0 = \vec{p}_{1y} \overset{0}{} + \vec{p}_{2y} + \vec{p}_{3y}$

$0 = m_2\vec{v}_{2y} + m_3\vec{v}_{3y}$

$\vec{v}_{3y} = \frac{-m_2\vec{v}_{2y}}{m_3} = \frac{-(2\text{kg})(-80\text{m/s})}{3\text{kg}}$

$\vec{v}_{3y} = 53.3\text{m/s}$

$\vec{v}_3 = \sqrt{(33.3\text{m/s})^2 + (53.3\text{m/s})^2} = \boxed{62.9\text{m/s}}$

$\theta = \tan^{-1}\left(\frac{53.3\text{m/s}}{33.3\text{m/s}}\right) = \boxed{58°}$