



Physics Olympiad and Problem Solving Programs
N210 - Introductory Physics Olympiad
Problem Set 10.2 - Mock Exam: Impulse and Momentum Solutions
Name: _____ Date: _____

Instruction: This is a self-proctored, *closed-book* mock exam. You have 20 minutes to answer the following questions.

1. \boxed{B} . $mv = (m + M)V$ so $V = \boxed{\frac{m}{m + M}v}$.
2. \boxed{C} . $J = mv = (m + M)V$ so $V = \boxed{\frac{J}{m + M}}$.
3. \boxed{A} . From the conservation of momentum, we have $v = v_1 + 2v_2$. From the conservation of energy, we have $v^2 = v_1^2 + 2v_2^2$, which means $v + v_1 = v_2$. Thus, $v = v_2 - v + 2v_2$ so $v_2 = \boxed{\frac{2}{3}v}$ to the right.
4. \boxed{D} . $J = Ft = \Delta P$, which gives $(100)(t) = (200)$ so $t = \boxed{2 \text{ s}}$.
5. \boxed{A} . $m_1v_1 + m_2v_2 = (m_1 + m_2)v$ or $v = \frac{m_1v_1 + m_2v_2}{m_1 + m_2} = \frac{(75)(6) - (100)(8.0)}{75 + 100} = \boxed{-2.0 \text{ m/s}}$ in the direction of the 100-kg player.
6. \boxed{A} . First, we calculate the speed of car B just before the collision. $v = v_0 + at = (25) + (-2)(1.2) = 22.6 \text{ m/s}$. So, $25 - 22.6 = \boxed{2.4 \text{ m/s}}$.
7. \boxed{E} . $\Delta p_1 = m(v - v_1) = m(23.8 - 25) = -1.2m$. $\Delta p_2 = m(v - v_2) = m(23.8 - 22.6) = 1.2m$. The magnitudes of change in momentum are the same.