HW7-4 Soln)

Consider the three masses to constitute the system. Then, there are no external forces (at least, horizontally, and no net forces vertically) and so total momentum (horizontally) is conserved. Let the signs of the velocities denote the directions.

$m_1v_{1i} + m_2v_{2i} + m_3v_{3i} = m_1v_{1f} + m_2v_{2f} + m_3v_{3f}$

all the masses stick together, so there is only one v_f :

$m_1v_{1i} + m_2v_{2i} + m_3v_{3i} = (m_1 + m_2 + m_3)v_f$

$v_f = (m_1v_{1i} + m_2v_{2i} + m_3v_{3i})/(m_1 + m_2 + m_3) = (6(4) + 7(2) + 2(-5))/(6 + 7 + 2) =$ 1.87 m/s

Does the order of collision matter? Assuming that all three actually do collide (no problem in this case), no. One need only group the terms on the left side of the equation above in different ways to see that the final momentum will be the same regardless of collision order. This is one of the strengths of the momentum picture; we need not consider how the interaction occurs, but rather only the initial and final states.