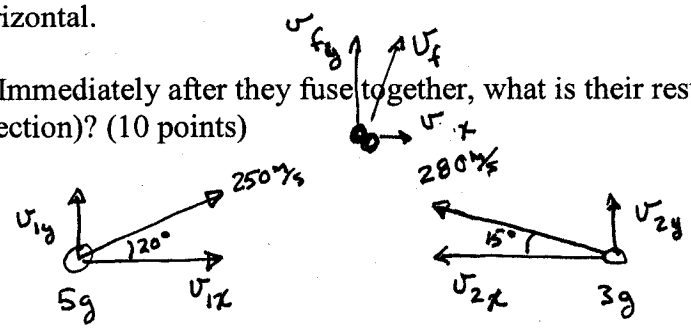
Name KEY SP211 Quiz

In the Battle of Gettysburg, the fighting was so intense that several bullets struck each other and fused together. Assume a 5.00 g Union bullet moving to the right at a speed of 250.0 m/s at an angle $\theta_1 = 20°$ above the horizontal collides with a 3.00 g Confederate bullet moving to the left at a speed of 280.0 m/s at an angle of $\theta_2 = 15°$ above the horizontal.

a. Immediately after they fuse together, what is their resulting velocity (magnitude and direction)? (10 points)



$$m_1 v_{1x} - m_2 v_{2x} = (m_1 + m_2) v_{fx} = (5g)(250 m/s)\cos 20° - (3g)(280 m/s)\cos 15° = (8$$

$$m_1 v_{1y} + m_2 v_{2y} = (m_1 + m_2) v_{fy} = (5g)(250 m/s)\sin 20° + (3g)(280 m/s)\sin 15° = (8g$$

$$v_{fx} = \frac{1170 \frac{g\cdot m}{s} - 811 \frac{g\cdot m}{s}}{8g} = 44.9 m/s$$

$$v_{fy} = \frac{427 \frac{g\cdot m}{s} + 217 \frac{g\cdot m}{s}}{8g} = 80.5 m/s$$

$$v_f = \sqrt{v_{fx}^2 + v_{fy}^2} = \sqrt{(44.9 m/s)^2 + (80.5 m/s)^2} = \boxed{92.2 m/s} \qquad \theta = \tan^{-1}\left(\frac{v_{fy}}{v_{fx}}\right) = \tan^{-1}\left(\frac{80.5 m/s}{44.9 m/s}\right) =$$

b. How much total kinetic energy is lost in the collision? (5 points)

$$K_i = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2}(.005 kg)(250 m/s)^2 + \frac{1}{2}(.003 kg)(280 m/s)^2$$

$$= 156.25 J + 117.6 J = 274 J$$

$$K_f = \frac{1}{2}(m_1 + m_2) v_f^2 = \frac{1}{2}(.008)(92.2 m/s)^2 = 34 J$$

$$\Delta K = K_f - K_i = 34J - 274J = \boxed{-240J}$$