Name: _____

Class: _____

Due Date: _____

Physics Topic 18B – Momentum in Two Dimensions

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. E: A 4.00 kg block is moving east at 5.00 m/s on a frictionless horizontal surface. It collides with a 6.00 kg block initially at rest. The 4.00 kg block then moves northeast at 3.00 m/s at an angle of 30.0° above the horizontal.

   a. **Use a pencil!** Draw an initial and final figure.

Initial	Final

   b. Use the law of conservation of momentum for each axis to determine the final speed (in m/s) and direction (in degrees) of the 6.00 kg block.

c. Is momentum conserved?

d. What is the initial total kinetic energy?

e. What is the final total kinetic energy?

f. Is kinetic energy conserved?

g. Is this an elastic or inelastic collision?

h. Is total energy conserved?

2. A mass $m_1 = 6.40$ kg is moving towards the left with a velocity of 11.2 m/s when it collides with a second mass $m_2 = 4.60$ kg which is initially at rest. After the collision the first mass bounces off to the right of the initial path of motion with a velocity of 9.50 m/s at an angle $\alpha = 20.4°$ north of west while the second mass m_2 bounces off to the left of the original path of motion with a velocity at an angle β.

   a. **Use a pencil!** Draw an initial and final figure.

Initial	Final

   b. Use the law of conservation of momentum for each axis to determine the final speed (in m/s) and direction (in degrees) of the 4.60 kg block.

3. E: A mass $m_1 = 6.20$ kg is moving north with a velocity of $v_1 = 13.5\ \frac{\text{m}}{\text{s}}$ when it collides perpendicularly with another mass $m_2 = 4.40$ kg moving east with a velocity of $v_2 = 8.80\ \frac{\text{m}}{\text{s}}$. m_1 runs into m_2 in an inelastic collision and both masses stick together and move off after the collision with a mass m_f at an angle θ_f. Determine the final magnitude and direction of m_f.

   a. **Use a pencil!** Draw an initial and final figure.

Initial	Final

   b. Use the law of conservation of momentum for each axis to determine the final speed (in m/s) and direction (in degrees) of the 4.20 kg block.