PS 4: 2D Conservation of Momentum

1. Batman (mass = 91 kg) jumps straight down from a bridge onto a boat (mass = 510 kg) in which a criminal is fleeing. The speed of the boat is initially 11 m/s. What is the speed of the boat after Batman lands in it?

2. A 1500-kg car traveling east with a speed of 16 m/s collides at an intersection with a 2500-kg van traveling north at a speed of 18 m/s. Find the speed of the wreckage after the collision, assuming the vehicles undergo a perfectly inelastic collision.

3. An explosion blows a rock into three parts. A 3.0 kg piece flies due east at 8 m/s. A 1.0-kg piece flies north at 12 m/s. Determine the mass and direction of motion of the third piece if it has a speed of 30 m/s.

4. Two bicyclists approach an intersection, one from the east and the other from the south. The cyclist from the east has a mass of 110 kg and travels at 12.5 m/s and the one from the south has a mass of 140 kg and is traveling at 25 m/s. They collide and the bicycles become locked together. What is the speed of entangled pair after the collision?

5. A bucket of mass 3 kg slides across a frictionless frozen pond at 6 m/s. It starts to rain (straight down, not at an angle) and the bucket collects 2-kg of rainwater. What is the momentum of the bucket with the water inside?

6. Three hockey players all converge on the puck. Player A mass has a mass of 77 kg and is moving north at 8 m/s. Player B has a mass of 84 kg and is moving south at 6 m/s. Player C has a mass of 69 kg and is moving east at 3 m/s. Their sticks and arms entangle as they collide. What is the speed of the combined trio?