Conservation of Momentum in One Dimension

1. Why did cannons on 16th- to 19th-century warships need a rope around the back, tying them to the side of the ship?
2. A 110-kg astronaut and a 4000.0-kg spacecraft are attached by a tethering cable. Both masses are motionless relative to an observer a slight distance away from the spacecraft. The astronaut wants to return to the spacecraft, so he pulls on the cable until his velocity changes to 0.80 m/s [toward the spacecraft] relative to the observer. What will be the change in velocity of the spacecraft? [0.022 m/s [towards the astronaut]]
3. A 75-kg hunter in a stationary kayak throws a 0.72-kg harpoon at 12 m/s [right]. The mass of the kayak is 10.0 kg. What will be the velocity of the kayak and hunter immediately after the harpoon is released? [0.10 m/s [left]]
4. A student is standing on a stationary 2.3-kg skateboard. If the student jumps at a velocity of 0.37 m/s [forward], the velocity of the skateboard becomes 8.9 m/s [backward]. What is the mass of the student? [55 kg]
5. A student on a skateboard, with a combined mass of 78.2 kg, is moving east at 1.60 m/s. As he goes by, the student skilfully scoops his 6.4-kg backpack from the bench where he had left it. What will be the velocity of the student immediately after the pickup? [1.5 m/s [E]]
6. A 1050-kg car at an intersection has a velocity of 2.65 m/s [N]. The car hits the rear of a stationary truck, and their bumpers lock together. The velocity of the car-truck system immediately after collision is 0.78 m/s [N]. What is the mass of the truck? [2.5 x 103 kg]