Honors Physical Science

Momentum and Impulse Problems

$$p=mv I=Ft ∆p=Ft mv\_{initial}=mv\_{final}$$

1. Jennifer, who has a mass of 50.0 kg, is riding at 35.0 m/s in her red sports car when she must suddenly slam on the brakes to avoid hitting a deer crossing the road. She strikes the air bag, that brings her body to a stop in 0.500 s. What average force does the seat belt exert on her?

If Jennifer had not been wearing her seat belt and not had an air bag, then the windshield would have stopped her head in 0.002 s. What average force would the windshield have exerted on her?

1. A hockey player applies an average force of 80.0 N to a 0.25 kg hockey puck for a time of 0.10 seconds. Determine the impulse experienced by the hockey puck.
2. If a 5-kg object experiences a 10.-N force for a duration of 0.10-second, then what is the momentum change of the object?
3. In a physics lab, 0.500-kg cart (Cart A) moving rightward with a speed of 92.8 m/s collides with a 1.50-kg cart (Cart B) moving leftward with a speed of 21.6 m/s. The two carts stick together and move as a single object after the collision. Determine the post-collision speed of the two carts.
4. A 25.0-gram bullet enters a 2.35-kg watermelon and embeds itself in the melon. The melon is immediately set into motion with a speed of 3.82 m/s. The bullet remains lodged inside the melon. What was the entry speed of the bullet?
5. A 25.0-gram bullet enters a 2.35-kg watermelon with a speed of 217 m/s and exits the opposite side with a speed of 109 m/s. If the melon was originally at rest, then what speed will it have as the bullet leaves its opposite side?

1. Suppose that you have joined NASA and are enjoying your first space walk. You are outside the space shuttle when your fellow astronaut of approximately equal mass is moving towards you at 2 m/s (with respect to the shuttle). If she collides with you and holds onto you, then how fast (with respect to the shuttle do you both move after the collision?