Momentum and Impulse

1. Under what circumstances could an object initially at rest be struck and move at a greater speed after collision than the incoming object?
2. A 180-kg bumper car carrying a 70-kg driver has a constant velocity of 3.0 m/s [E]. Calculate the momentum of the car-driver system. [7.5 x 102 kg\*m/s]
3. A 65-kg girl is driving a 535-kg snowmobile at a constant velocity of 11.5 m/s [60.0° N of E]. Calculate the momentum of the girl-snowmobile system. [6.90 x 103 kg\*m/s [E60° N]]
4. The combined mass of a bobsled and two riders is 390 kg. The sled-rider system has a constant momentum of 4.68 x 103 kg\*m/s [W]. Calculate the velocity of the sled. [12.0 m/s [W]]
5. Many modern rifles use bullets that have less mass and reach higher speeds than bullets for older rifles, resulting in increased accuracy over longer distances. The momentum of a bullet is initially 8.25 kg\*m/s [W]. What is the momentum if the speed of the bullet increases by a factor of $\frac{3}{2}$ and its mass decreases by a factor of $\frac{3}{4}$? [9.28 kg\*m/s [ W]
6. A loaded transport truck with a mass of 38 000 kg is travelling at 1.20 m/s [W]. What will be the velocity of a 1400-kg car if it has the same momentum? [32.6 m/s [W]]
7. To improve the safety of motorists, modern cars are built so the front end crumples upon impact. A 1200-kg car is travelling at a constant velocity of 8.0 m/s [E]. It hits an immovable wall and comes to a complete stop in 0.25 s.
	* 1. Calculate the impulse provided to the car. [9.6 x 103 Ns [W]]
		2. What is the average net force exerted on the car? [3.8 x 104 N [W]]
8. Two people push a car for 3.64 s with a combined net force of 200 N [S].
	* 1. Calculate the impulse provided to the car. [728 Ns [S]]
		2. If the car has a mass of 1100 kg, what will be its change in velocity? [0.662 m/s [S]]
9. A dog team pulls a 400-kg sled that has begun to slide backward. In 4.20 s, the velocity of the sled changes from 0.200 m/s [backward] to 1.80 m/s [forward]. Calculate the average net force the dog team exerts on the sled. [190 N [Forward]]