

PRACTICE C

Stopping Distance

1. How long would the car in Sample Problem C take to come to a stop from its initial velocity of 20.0 m/s to the west? How far would the car move before stopping? Assume a constant acceleration.
2. A 2500 kg car traveling to the north is slowed down uniformly from an initial velocity of 20.0 m/s by a 6250 N braking force acting opposite the car's motion. Use the impulse-momentum theorem to answer the following questions:
 - a. What is the car's velocity after 2.50 s ?
 - b. How far does the car move during 2.50 s ?
 - c. How long does it take the car to come to a complete stop?
3. Assume that the car in Sample Problem C has a mass of 3250 kg .
 - a. How much force would be required to cause the same acceleration as in item 1? Use the impulse-momentum theorem.
 - b. How far would the car move before stopping? (Use the force found in a.)

Force is reduced when the time interval of an impact is increased

The impulse-momentum theorem is used to design safety equipment that reduces the force exerted on the human body during collisions. Examples of this are the nets and giant air mattresses firefighters use to catch people who must jump out of tall burning buildings. The relationship is also used to design sports equipment and games.

Figure 4 shows an Inupiat family playing a traditional game. Common sense tells us that it is much better for the girl to fall onto the outstretched blanket than onto the hard ground. In both cases, however, the change in momentum of the falling girl is exactly the same. The difference is that the blanket “gives way” and extends the time of collision so that the change in the girl's momentum occurs over a longer time interval. A longer time interval requires a smaller force to achieve the same change in the girl's momentum. Therefore, the force exerted on the girl when she lands on the outstretched blanket is less than the force would be if she were to land on the ground.



Figure 4

In this game, the girl is protected from injury because the blanket reduces the force of the collision by allowing it to take place over a longer time interval.