Impulse and Momentum – Practice Problems

Momentum \( P = mv \)

Impulse \( F \Delta t = \Delta (mv) \)

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3) A tennis ball traveling at 10.0 m/s is returned by Venus Williams. It leaves her racket with a speed of 36.0 m/s in the opposite direction from which it came.
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4) To demonstrate his new high-speed camera, Flash performs an experiment in the physics lab in which he shoots a pellet gun at a pumpkin to record the moment of impact on film. The 1.0-g pellet travels at 100. m/s until it embeds itself 2.0 cm into the pumpkin. What average force does the pumpkin exert to stop the pellet?
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6) Rhonda, who has a mass of 60.0 kg, is riding at 25.0 m/s in her sports car when she must suddenly slam on the brakes to avoid hitting a dog crossing the road. She is wearing her seatbelt, which brings her body to a stop in 0.400 s.
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   a) What average force did the seatbelt exert on her?
   b) If she had not been wearing her seatbelt, and the windshield had stopped her head in $1.0 \times 10^{-3} \text{ sec}$, what average force would the windshield have exerted on her?
   c) How many times greater is the stopping force of the windshield than the seatbelt?

7) In Sharkey’s Billiard Academy, Maurice is waiting to make his last shot. He notices that the cue ball is lined up for a perfect head-on collision, as shown. Each of the balls has a mass of 0.0800 kg and the cue ball comes to a complete stop upon making contact with the 8 ball. Suppose Maurice hits the cue ball by exerting a force of 180 N for $5.00 \times 10^{-3} \text{ sec}$, and it knocks head-on into the 8 ball. Calculate the resulting velocity of the 8 ball.

8) During an autumn storm, a 0.012-kg hail stone traveling at 20.0 m/s made a 0.20-cm-deep dent in the hood of Phil’s new car. What average force did the car exert to stop the damaging hail stone?
1) A golfer hits a 0.050-kg golf ball, giving it a speed of 75 m/s. What impulse does he impart to the ball?

2) Joe hits a stationary 0.12-kg hockey puck with a force that lasts for $1.0 \times 10^{-2}$ sec and makes the puck shoot across the ice with a speed of 20.0 m/s, scoring a goal for the team. With what force did Joe hit the puck?

3) A tennis ball traveling at 10.0 m/s is returned by Venus Williams. It leaves her racket with a speed of 36.0 m/s in the opposite direction from which it came.
   a) What is the change in momentum of the tennis ball?
   b) If the 0.060-kg ball is in contact with the racket for 0.020 s, with what average force has Venus hit the ball?

4) To demonstrate his new high-speed camera, Flash performs an experiment in the physics lab in which he shoots a pellet gun at a pumpkin to record the moment of impact on film. The 1.0-g pellet travels at 100. m/s until it embeds itself 2.0 cm into the pumpkin. What average force does the pumpkin exert to stop the pellet?
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Impulse and Momentum – Practice Problems

Momentum \( P = mv \)
Impulse \( F\Delta t = \Delta (mv) \)

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