

## Impulse Problems

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*Concept Review:*

- A. *What is meant by the term "Impulse?"*
- B. *What does an "impulse" on an object do to that object?*
- C. *Combine your answers to make an equation relating impulse and momentum.*
1. Delphine hits a 0.050 kg golf ball sitting on the tee, giving it a speed of 75 m/s. What impulse does she impart to the ball?
- m = \_\_\_\_\_
- $v_i$  = \_\_\_\_\_
- $v_f$  = \_\_\_\_\_
2. Richard hits a stationary 0.12 kg hockey puck with a force that lasts for 0.01 s and makes the puck shoot across the ice with a speed of 20 m/s, scoring a goal for the team.
- a. What is the impulse imparted on the puck?
- b. With what force did Richard hit the puck?
3. A tennis ball, mass 0.06 kg, traveling at 10 m/s is returned by Chris Evert. It leaves her racket with a speed of 36 m/s in the opposite direction from which it came.
- a. What is the change in velocity of the ball? (Be careful.)
- b. What is the change in momentum of the tennis ball?
- c. If the tennis ball is in contact with the racket for 0.002 s, with what average force has Chris hit the ball?

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4. Rhonda, who has a mass of 60 kg, is riding at 25 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 to a stop in 0.40 s. What average force does the seatbelt exert on her?
  - If she had not been wearing her seatbelt, and the windshield stopped her head in .001 s, what average force would the windshield have exerted on her?
5. During an autumn storm, a 0.012 kg hail stone traveling at 20 m/s made a 0.2 cm deep dent in the hood of Jeff's car.
- What was the average speed of the hail stone as the car hood brought it to rest?
  - How long did it take the hood to stop the hail stone?
  - What average force did the car exert to stop the hailstone?
  - What average force did the hail stone exert on the car hood?

Answers:

- 1) 3.75 Ns      2. a) 2.4 kg•m/s    b) 240 N      3. a) -46 m/s      b) -2.76 kg•m/s    c) -1380 N  
4. a) -3750 N    b) -1,500,000 N      5. a) 10 m/s      b) 0.0002 s      c) 1200 N  
d) 1200 N, but opposite direction!