
Part A: Concepts

Answer in complete sentences.

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1. When you jump off a wall and land, you bend your knees instead of landing stiff-legged. Your change in momentum is the same either way. Use $F\Delta t = \Delta p$ to explain why bending your knees hurts less.

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2. Show that a newton-second (N·s) is the same unit as a kilogram meter per second (kg·m/s). Hint:
 $1 \text{ N} = 1 \text{ kg}\cdot\text{m}/\text{s}^2$.

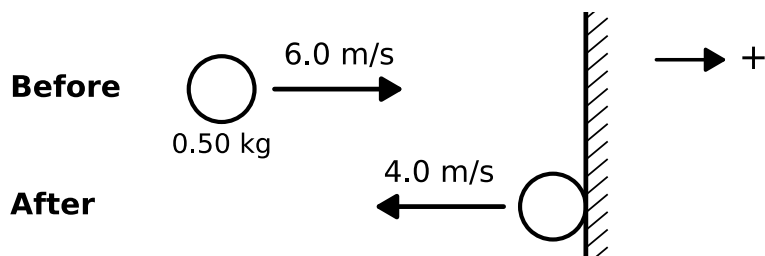
Part B: Calculations

Show knowns, equation, substitution, and answer with units. Right is positive.

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3. A golf club hits a 0.0450 kg golf ball that is sitting at rest on a tee. The ball leaves the club at 60.0 m/s, and the contact lasts 0.000500 s. Find the change in the ball's momentum and the average force of the club on the ball.

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4. A 1,200 kg car is moving at 20.0 m/s. The brakes apply a steady stopping force of $6.00 \times 10^3 \text{ N}$. How long does it take the car to stop?

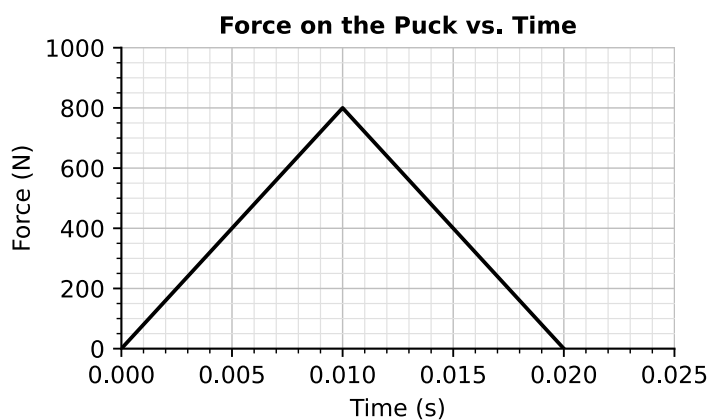
5. A 0.50 kg ball hits a wall moving right at 6.0 m/s and bounces straight back to the left at 4.0 m/s, as shown. The ball touches the wall for 0.020 s.



- Find the change in the ball's momentum. Watch the signs.
- Find the average force of the wall on the ball, with direction.

Part C: Force-Time Graphs

6. A hockey stick strikes a 0.16 kg puck that starts at rest. The graph shows the force on the puck.



- Find the impulse on the puck from the area under the graph.
- Find the puck's speed after it leaves the stick.
- A different stick gives the same impulse in 0.010 s. Sketch or describe how its graph would look.