A pitcher throws a 0.15-kg baseball so that it crosses home plate horizontally with a speed of 20 m/s. The ball is hit straight back at the pitcher with a final speed of 22 m/s. What is the impulse delivered to the ball?

- A. 0.30 kg m/s towards pitcher
- B. 0.30 kg m/s toward batter
- C. 6.3 kg/m/s toward pitcher
- D. 6.3 kg m/s toward batter

**Answer:**

\[ I = \Delta P = m(v_f - v_i) = 0.15 \times (-22 - 20) \text{ kg m/s} = -6.3 \text{ kg m/s} \]

Negative means toward pitcher.

Find the average force exerted by the bat on the ball if the two are in contact for \(2.0 \times 10^{-3}\) s.

- A. \(3.1 \times 10^3\) N towards pitcher
- B. \(3.1 \times 10^3\) N towards batter
- C. 6.3 N towards batter
- D. 6.3 N towards pitcher

**Answer:**

\[ F = \frac{I}{\Delta t} = \frac{-6.3}{0.002} \text{ N} \]

Two objects collide head on. Their masses and initial velocities are given. If the 10 kg mass has a final velocity of -0.1 m/s, what is the final velocity of the 1 kg mass?

- A. -10 m/s
- B. -1 m/s
- C. 0.1 m/s
- D. 10 m/s

**Answer:**

\[ m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f} \]

\[ 10 (1) + 1 (-1) = 10 (-0.1) + v_{2f} \]

\[ v_{2f} = 10.1 \text{ m/s} \]

**Correct Answer:** D. 10 m/s