Object A of mass 5 kg slides along a frictionless surface at a speed of 3 m/s. It is hit by object B moving at a speed of 6 m/s from behind. The two objects stick together and move at a speed of 4 m/s. What is the mass of object B.

Given:

Mass of A:	$m_A = 5$ kg
Initial speed of A:	$v_{iA} = 3$ m/s
Initial speed of B:	$v_{iB} = 6$ m/s
Final speed of the A+B	$v_f = 4$ m/s

Determine: Mass of B: m_B

Use the law of conservation of momentum: For an isolated system, the total initial momentum, p_i, of the system is equal to the total final momentum, p_f, of the system.

$$p_i = m_A v_{iA} + m_B v_{iB} \text{----------(1)}$$

$$p_f = (m_A + m_B) v_f \text{----------(2)}$$

Since $p_i = p_f$:

$$m_A v_{iA} + m_B v_{iB} = (m_A + m_B) v_f \text{ ----------(3)}$$

Substituting for m_A, v_{iA}, v_{iB}, and v_f in (3):

$$(5 \times 3) + (m_B \times 6) = (5 + m_B) \times 4 \text{ ----------(4)}$$

Rearranging (4):

$$\mathbf{m_B = 5 / 2 = 2.5 \text{ kg}}$$

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