

Momentum and Collisions

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A: Conservation of Momentum.

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That is a “rho”, not a p!
Momentum is a *vector* quantity!

Momentum and Collisions

What is the momentum of a 1,052 kg Honda Civic traveling at 100 km/h?

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The Law of Conservation of Momentum

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Therefore, when comparing two different moments in a closed system:

$$\text{total initial momentum} = \text{total final momentum}$$

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Now the 1,052 kg Honda traveling at 100 km/h crashes into a stationary pickup. The two vehicles stick together and roll forward. How fast is the mess rolling forward?

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The pickup has a mass of 2,000 kg.

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What is the recoil velocity of a 5.0 kg rifle that shoots a 0.020 kg bullet at 620 m/s?

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A billiard ball of mass $m_1 = 0.2 \text{ kg}$ and $v_1 = 10 \text{ m/s}$, 0° collides with another ball of the same mass, initially at rest. The first ball is deflected by 30° and has a final velocity of 8 m/s .

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Center of Mass

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Alternately stated:

The center of mass of a system moves as if the mass were concentrated at that point

Center of Mass

$$x_{\text{CM}} = \frac{m_1x_1 + m_2x_2 + \cdots + m_nx_n}{m_1 + m_2 + \cdots + m_n}$$

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$$x_{\text{CM}} = \frac{\sum_{i=1}^n m_i x_i}{\sum_{i=1}^n m_i}$$

Center of Mass

Three point masses a , b , and c are located at $(1,4)$, $(-2,2)$, and $(3,-1)$, respectively.

$$m_a = 3\text{g}, m_b = 4\text{g}, m_c = 5\text{g}$$

Where is the center of mass located?