

2.7 Conservation of Momentum

In any system, momentum is conserved.

The Law of Conservation of Momentum states:

We will use a baseball game with a pitcher throwing the ball at a batter as an example.

The total momentum *before* impact (before the ball is hit) is:

After impact, the *total momentum of the bat and ball is still the same*, except some of the momentum of the bat has been transferred to the ball.

This is because momentum is always conserved.



Basically:

Using this concept, explain why:

- a. The white ball in pool slows down after impacting the black.

- b. When suddenly braking in a car, your body moves forward (thankfully you are wearing a seatbelt).

Use the information and steps below to work out the **speed of the baseball after impact**.

A batter swings his 2 kg bat at 10 m/s to hit a 0.3 kg baseball off a batting tee. After impact his bat speed drops to 7.0 m/s.

Step 1: Calculate the *total momentum of the bat and ball before impact*.

	Total Momentum before impact =
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Step 2: Calculate the *momentum of the known components following impact* (i.e. the bat).

	Momentum of the bat after impact =
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Step 3: Calculate the momentum needed to obey the law that *total momentum before impact equals the total momentum after impact*.

This will be the momentum of the ball.

	Momentum of the ball after impact =
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Step 4: Rearrange the equation Momentum = mass x velocity to calculate the velocity of the ball.

	Velocity of the bat after impact =
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A handy hint is to remember the momentum equation in the form of a triangle. It makes rearranging the equation easier.

