

Teacher's Guide for the Physics of Pool by Joseph Formaggio

There are a few main ideas that we hope students take away from this video:

- (a) **Conservation of linear momentum:** Conservation laws play an extremely important role in many aspects of physics. The idea that a certain property of a system is maintained before and after something happens is quite central to many principles in physics. In the pool example, we concentrate on the conservation of linear momentum. We illustrate how when two objects collide (in this case, two billiard balls), the sum of their momenta remains constant. We first illustrate this with two balls that collide and move in the same direction, and then again when the two balls travel in different directions. For the latter point, we illustrate the velocity (and momentum) really is a vector quantity. We conclude the section with the idea that linear momentum is conserved for any “closed” system by showing what happens when a collision occurs with a much larger object such as the pool table.

- (b) **Angular Momentum, Torque and Friction:** The latter half of the video is aimed at trying to look into why certain objects roll, as opposed to slide. We do this by looking at how striking a ball with a cue stick at different locations produces different effects.

Though not required, students who have been exposed to some physics would benefit most from this video. In mathematically rigorous classes, students can concentrate on the details of vectors and conservation of linear momentum. However, such is not a pre-requisite for the video lesson. During the video breaks, we recommend students try to work out some of these ideas in discussions between themselves and their peers. After the video is complete, instructors may encourage students to think more about certain concepts, such as friction, by having materials of different surface roughness available and exploring how these objects slide across one another.