

College Physics Interactive Applets: Instructors Guide

POOL TABLE

Purpose

This applet uses a virtual pool table to explore conservation of linear momentum and collisions.

Using the Applet

- Note that the word TUTORIAL on the upper right is a link to online instructions for using the applet.
- Configure the applet using the CONTROLS and BEFORE/AFTER DISPLAY templates on the right-hand side.

The Controls

- **Dimensions:** These buttons control whether the collisions are one or two-dimensional.
- **Presets:** There are two preset animations that you can view from this pull-down menu.
- **Next Mass:** This slider sets the mass of the next ball placed on the table.
- **Play/Pause, Reset, Step:** These buttons control the animation.
- **Show Velocity Vectors:** If checked, the applet displays the velocity vectors of the balls on the table as they move.
- **Allow Pockets:** If checked, the table will have pockets into which the balls may fall.
- **Use Friction:** If checked, the balls will slow down as they move across the table.
- **Use Grid:** If checked, displays a coordinate grid on the pool table.
- **Freeze for Collisions:** If checked, the animation freezes every time a collision between two balls occurs.
- **Velocity/Combo. Vel/Momentum/Combo. Mtm:** If checked, these vectors display in the before and after windows. Velocity and Momentum displays the vectors for each ball in the collision; Combo. Vel and Combo. Mtm displays the sum of the velocities and momentums of the two balls.

Quick Demonstration

- Select ONE under DIMENSIONS.
- Deselect COMBO. MTM under BEFORE/AFTER DISPLAY at the bottom right.
- To place a ball on the table:
Put the cursor over the table (a ghost ball appears) → click to set the ball in position → move the mouse to set the initial velocity of the ball → click to set the ball in motion.
- Set MASS to 10.0 and follow the above procedure to place a second ball on the table.
- After they collide, the motion will freeze. Beneath the pool table the before and after pictures will show the momentum vectors of each ball.
- Ask the following questions (Note that correct answers for 1 and 2 cannot be indicated below):
 1. In the before window, in what direction does the total momentum of the balls appear to be?
a) to the right b) to the left
 2. In the after window, in what direction does the total momentum of the balls appear to be?
a) to the right b) to the left
 3. Do the total momentums before and after appear to have the same magnitude?
a) yes b) no
- Select the COMBO. MTM-TOT checkbox. Observe that the total momentum before and after is the same while the individual momentums are not.
- Deselect the COMBO. MTM checkbox. Click somewhere over the pool table to continue the motion. Repeat questions 1 – 3 for the next collision.
- Deselect the MOMENTUM checkboxes and select the COMBO. VEL-TOT checkbox.
- Ask the following question:
 4. How do the total velocities before and after the collision compare?
a) They are the same.
b) **They are different.**
- Click somewhere over the pool table to continue the motion. Repeat question 4 for the next collision.
- Discuss why the total momentum is the same before and after but the total velocity is not the same.

Further Study with the Textbook

- Example 7.10 (page 236)
Have students use the applet to set up a similar one-dimensional collision with a similar ratio of mass and corresponding speeds. Have them explain why one ball rebounds opposite to its original motion while the other ball continues in the same direction as its original motion.
- Example 7.12 (page 239)
Have students use the applet to set up a similar two-dimensional collision with a small mass striking a glancing blow to an initially stationary larger mass. Have them use the after window to verify and understand that the resulting motion as depicted in Fig. 7.20 (b) of this Example is what occurs.
- Example 7.13 (page 241)
Have students use the applet to set up the situation in this Example. They will need to check ALLOW POCEKES and it helps if USE GRID is also selected. Have them try to sink both balls with the shot.

Suggested End-of-Chapter Follow-up Questions

Chapter 7: P-31, P-41 – P-42, P-44 – P-47