

This demonstration illustrates a variety of collisions between balls. The first group of demonstrations shows collisions between equal masses, followed by collisions between unequal masses, with both the smaller mass and the larger mass initially in motion. Finally, collisions of a chain of equal balls, the collision ball apparatus, are shown.[†]

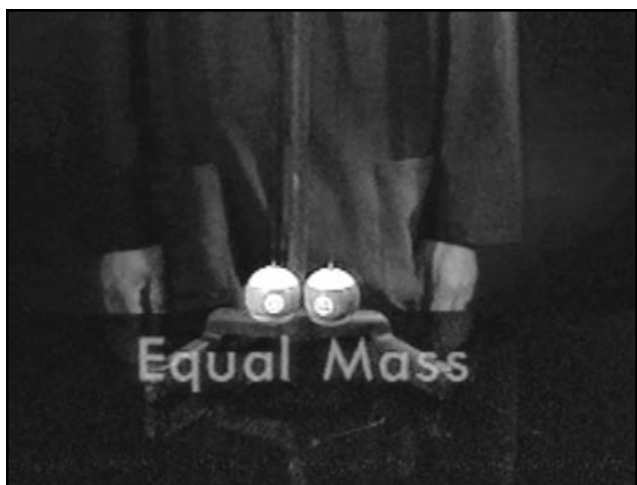


Figure 1

[†] Sutton, *Demonstration Experiments in Physics*, Demonstration M-68, Impact.
Freier and Anderson, *A Demonstration Handbook for Physics*, Demonstration Mg-1, Collision Balls.

These sets of pendulum balls will be used to demonstrate collisions between various masses.

Here is a pair of equal mass balls. When we collide one ball with the other, the two balls trade velocities.

The incoming ball stops, and the stationary ball flies away at the same speed as the incoming ball.

Here's a set of balls with a 3:1 mass ratio. When the small ball strikes the larger one, the small ball bounces back and the large ball moves away slowly.

What will happen if the last collision is reversed?

Now the small ball flies away quickly, and the large ball continues in the same direction at a lower speed.

Here is a set of balls with an 80:1 mass ratio.

When the small ball strikes the larger, it bounces back completely while the larger ball hardly moves.

Here's what happens when the last collision is reversed.

Finally, here is a set of 11 pool balls hung in a row. When we pull back and release one ball, a single ball flies out the other end. If we release a larger number of balls together, the same number flies out the other end.

Equipment

1. Equal mass pair: two billiard balls of identical mass—both with eye screws and a bifilar suspension from a support system.
2. Three-to-one mass ratio: same as above except one sphere is one-third the mass of its companion billiard ball.
3. Eighty-to-one mass ratio: same as above except the larger sphere is eighty times more massive.
4. Set of eleven: eleven equal mass billiard balls equipped and suspended as above with #11 being in the center to help highlight the “5 in” and “5 out” example.