Collisions

Pre-Class Questions

Problem Set (due next time)
Ch 8 - 21, 27, 32, 33a

Lecture Outline

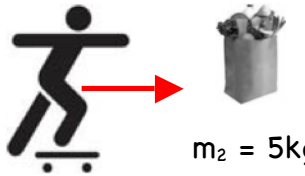
- Inelastic Collisions
- Elastic Collisions

Collision Type	Momentum Conserved?	Energy Conserved?	Kinetic Energy Conserved?
Elastic	yes	yes	yes
Inelastic	yes	yes	no

Example 1: A 1.0kg tomato is thrown at 30m/s toward a boring 9.0kg physics professor's head. It strikes him in the ear and sticks. Find (a)the speed the head and tomato just after impact and (b)the fraction of kinetic energy lost during the collision.

Each situation below consists of 45kg skateboarder gliding by and grabbing a grocery bag. Assume there is no friction. The masses of the grocery bag and the incoming speed of the skateboarder change. The mass and speed are indicated below each sketch. Rank these situations based upon the velocity (not speed) of the skateboarder and bag after the collision.

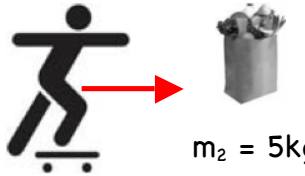
A



m_2 = 5kg

v = 5m/s

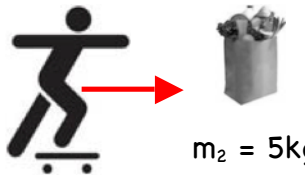
B



m_2 = 5kg

v = 10m/s

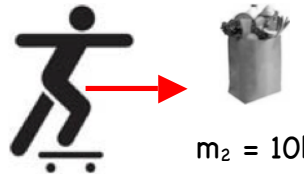
C



m_2 = 5kg

v = 15m/s

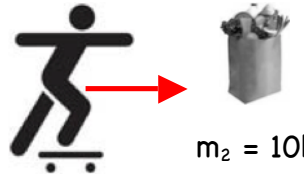
D



m_2 = 10kg

v = 5m/s

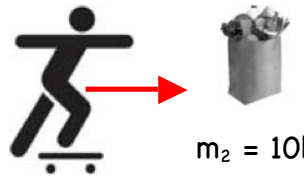
E



m_2 = 10kg

v = 10m/s

F



m_2 = 10kg

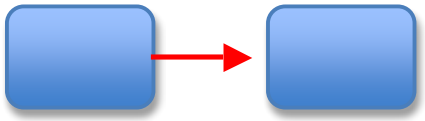
v = 15m/s

Example 2:The cue ball is traveling at 4.80m/s when it has a head-on elastic collision with the eight ball of the same mass. Find the velocities of the two balls after collision.

Example 3: At coin operated pool tables, the cue ball weights slightly more than the eight ball so that the mechanism can return the cue ball on a scratch. Revisit example 2 assuming the cue has 10% more mass than the eight.

Each situation below consists of one block of ice colliding elastically with a second block that starts at rest. Assume there is no friction. The masses of the blocks and the incoming speed of the first block change. The masses and speed are indicated below each sketch. Rank these situations based upon the velocity (not speed) of the first block after the collision.

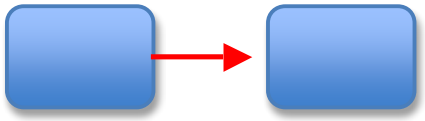
A



m_1 = 1kg m_2 = 1kg

v = 5m/s

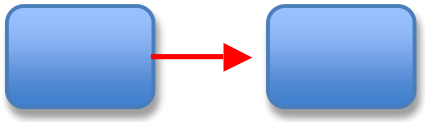
B



m_1 = 1kg m_2 = 1kg

v = 10m/s

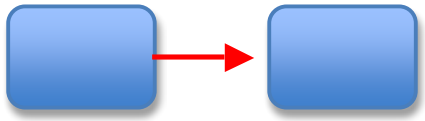
C



m_1 = 5kg m_2 = 5kg

v = 15m/s

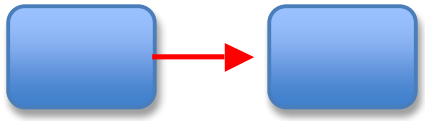
D



m_1 = 1kg m_2 = 2kg

v = 5m/s

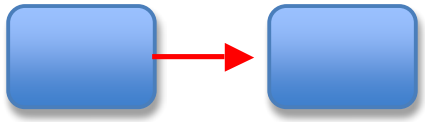
E



m_1 = 2kg m_2 = 1kg

v = 5m/s

F



m_1 = 10kg m_2 = 1kg

v = 5m/s

Lecture 21 - Summary

The Law of Conservation of Linear Momentum is useful for collisions.

Collision Type	Momentum Conserved?	Energy Conserved?	Kinetic Energy Conserved?
Elastic	yes	yes	yes
Inelastic	yes	yes	no