Collisions and Conservation of Energy

Pre-Lecture Questions

Problem Set #24 (due next time)

Lecture Outline

1. One Dimensional Collisions
2. Two Dimensional Collisions

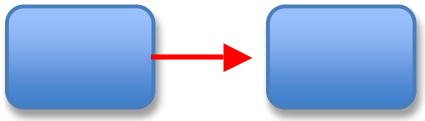
Pre-Class Summary:

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

Example 1: A neutron traveling at 4.80×10^6 m/s has a head-on elastic collision with another neutron initially at rest. Find the velocities of each of the neutrons after collision.

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.

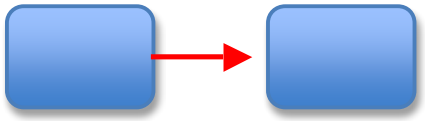
A



m_1 = 1kg m_2 = 1kg

v = 5m/s

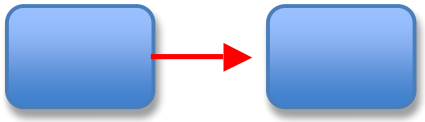
B



m_1 = 1kg m_2 = 1kg

v = 10m/s

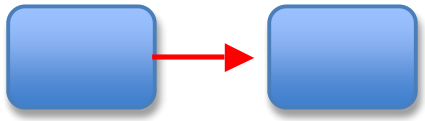
C



m_1 = 5kg m_2 = 5kg

v = 15m/s

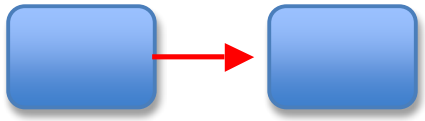
D



m_1 = 1kg m_2 = 2kg

v = 5m/s

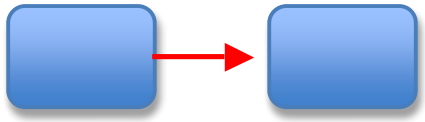
E



m_1 = 2kg m_2 = 1kg

v = 5m/s

F



m_1 = 10kg m_2 = 1kg

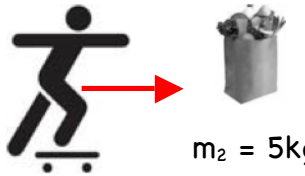
v = 5m/s

An Inelastic Collision

Example 2: A homerun can leave the bat at about 110mph (49m/s), while an average fastball heads toward the batter at about 92mph (41m/s). The mass of a baseball is 145g while a typical bat has a mass of 36oz (1.0kg). The (center-of-mass) speed of the bat when it strikes the ball is about 50mph (22m/s). Find (a)the speed of the bat just after hitting the ball and (b)determine if the collision is elastic.

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.

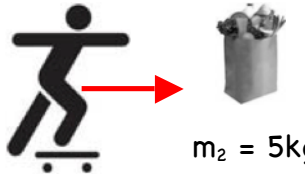
A



m_2 = 5kg

v = 5m/s

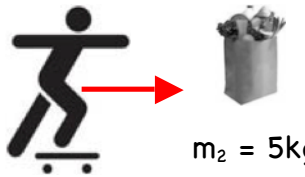
B



m_2 = 5kg

v = 10m/s

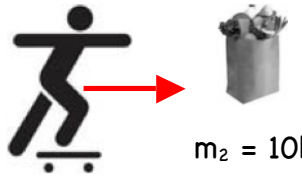
C



m_2 = 5kg

v = 15m/s

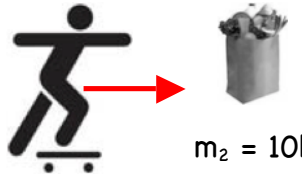
D



m_2 = 10kg

v = 5m/s

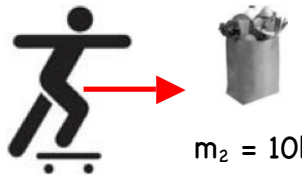
E



m_2 = 10kg

v = 10m/s

F



m_2 = 10kg

v = 15m/s

Example 3: A neutron traveling at 4.80×10^6 m/s when it has an elastic collision with another neutron. The original neutron heads off at a 30° angle. Find the velocities of each of the neutrons after collision and the direction of the second neutron.

Lecture 24 - Summary

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

Summary of the Course to Date