Physics
Chapter 6: Momentum and Collisions

Section 6.3

Elastic and Inelastic Collisions

Elastic and Inelastic Collisions

--Kinetic energy is conserved in perfectly <u>elastic collisions</u>.

--The total kinetic energy before the collision is equal to the kinetic energy after the collision.

--Elasticity refers to the ability of a substance to return to its original shape after being distorted by a force.

--The ability to stretch a large distance, like a rubber band, is resiliency.

--In perfectly <u>inelastic collisions</u>, kinetic energy is not conserved.

--The lost kinetic energy is usually changed to a non-mechanical form of energy, usually heat.

--Two objects that collide in a <u>perfectly inelastic collision</u> stick together and move as one object after the collision.

--Most collisions on the Earth are neither perfectly elastic or perfectly inelastic.

Momentum in Elastic and Inelastic Collisions

--<u>Momentum</u> is conserved in both elastic and inelastic collisions.

--What happens to the momentum of a ball that undergoes an inelastic collision with the Earth?

A: The momentum is transferred to the Earth, but since the mass of the Earth is so huge compared to the mass of the ball, the change in the Earth's velocity is imperceptible.

Equations for Elastic, Head-On Collisions

--For an elastic collision between two objects, with one of the bodies at rest before collision and the motion along a straight line, the concepts of conservation of kinetic energy and of momentum can be combined to give the following equations:

$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} \cdot v_1 \qquad v_2' = \frac{2m_1}{m_1 + m_2} \cdot v_1$$

--Note that V_2 equals zero and is not in either equation.

Example: What is the velocity of m_1 and m_2 after collision if v_1 is 2.0 m/s, and m_1=0.20 kg and m_2= 0.30 kg? (v_2 = 0)

$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} \cdot v_1 = \frac{0.20kg - 0.30kg}{0.20kg + 0.30kg} \cdot 2.0\, m/s = -0.4\, m/s$$

$$v_2' = \frac{2m_1}{m_1 + m_2} \cdot v_1 = \frac{2 \cdot (0.20kg)}{0.20kg + 0.30kg} \cdot 2.0\, m/s = 1.6\, m/s$$