Momentum & Impulse Collisions WEB QUEST

1. Go to http://www.colorado.edu/physics/phet/web-pages/simulations-base.html
2. **Click on Collision Lab**
   - Draw "before-and-after" pictures of collisions.
   - Construct momentum vector representations of "before-and-after" collisions.
   - Apply law of conservation of momentum to solve problems of collisions.
   - Explain why energy is not conserved and varies in some collisions.
   - Determine the change in mechanical energy in collisions of varying "elasticity".
   - What does "elasticity" mean?

Explain to an eighth grader

1. Center of mass

a) Students should understand the technique for finding center of mass, so they can:
   (1) Identify by inspection the center of mass of a symmetrical object.
   (2) Locate the center of mass of a system consisting of two such objects.

b) Students should be able to understand and apply the relation between center-of-mass velocity and linear momentum, and between center-of-mass acceleration and net external force for a system of particles.

c) Students should be able to define center of gravity and to use this concept to express the gravitational potential energy of a rigid object in terms of the position of its center of mass.

2. Impulse and momentum Students should understand impulse and linear momentum, so they can:

a) Relate mass, velocity, and linear momentum for a moving object, and calculate the total linear momentum of a system of objects.

b) Relate impulse to the change in linear momentum and the average force acting on an object.

c) Calculate the area under a force versus time graph and relate it to the change in momentum of an object.

3. Conservation of linear momentum, collisions

a) Students should understand linear momentum conservation, so they can:
   (1) Explain how linear momentum conservation follows as a consequence of Newton's Third Law for an isolated system.
   (2) Identify situations in which linear momentum, or a component of the linear momentum vector, is conserved.
   (3) Apply linear momentum conservation to one-dimensional elastic and inelastic collisions and two-dimensional completely inelastic collisions.
   (4) Apply linear momentum conservation to two-dimensional elastic and inelastic collisions.
   (5) Analyze situations in which two or more objects are pushed apart by a spring or other agency, and calculate how much energy is released in such a process.

b) Students should understand frames of reference, so they can:
   (1) Analyze the uniform motion of an object relative to a moving medium such as a flowing stream.
   (2) Analyze the motion of particles relative to a frame of reference that is accelerating horizontally or vertically at a uniform rate.