Elastic Collisions

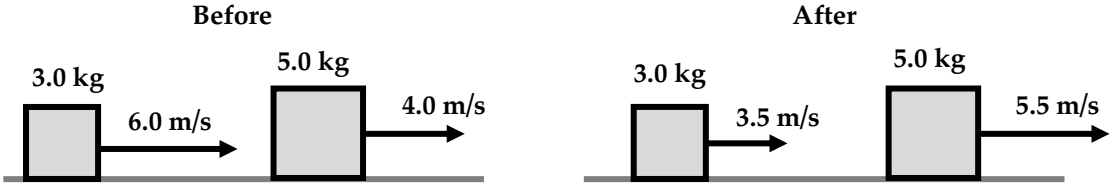
For a collision occuring in an isolated system, total system momentum is always conserved. However, another quantity having to do with moving objects – kinetic energy – is not necessarily conserved. Collisions in which kinetic energy is conserved (as well, as momentum) are referred to as **perfectly elastic collisions**. The extent to which kinetic energy is conserved provides a measure of how elastic a collision is. While perfectly elastic collisions conserve 100% of the system kinetic energy, other collisions can demonstrate a good deal of elasticity but not be considered **perfectly elastic**.

1. Kinetic energy (KE) is calculated as $\mathbf{KE = 0.5 \cdot m \cdot v^2}$. For the following situations calculate the total system KE ($KE_1 + KE_2$) before and after the collision. Which, if any, are perfectly elastic?

Collision #1

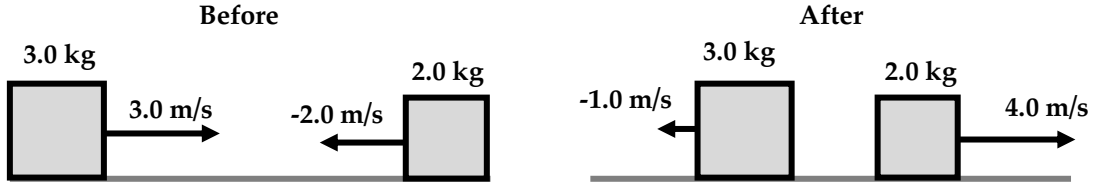
Total KE_{before}: **Total KE_{after}:**

Collision #2



Total KE_{before}: **Total KE_{after}:**

Collision #3



Total KE_{before}: **Total KE_{after}:**

2. For which collisions is the total (*system*) kinetic energy conserved? _____

3. Based on this limited data, can you claim that it is possible for system momentum to be conserved even though system kinetic energy is <u>not</u> conserved? Make a claim and support it with evidence and reasoning.

4. **The Big Challenge:** Inspect the velocity values for any case in which the collision was **perfectly elastic**. There are four velocities – v_1, v_2, v_1', and v_2'. (The **'** symbol indicates *after collision*.) Based on this limited data, make a claim regarding the relationship between these velocities for instances in which the collision is perfectly elastic. Express your claim in the form of an equation that consists of the symbols for thes four velocities. And show some calculations that provide the evidence and reasoning for your claim. (NOTE: this is a number puzzle. Approach it as a puzzle solver.)