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| **Momentum**  **Internet Lab – Momentum and Collisions** | **Name:**  **Date:** | **Period:** |

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| **Website: http://phet.colorado.edu/**  *Play with the Sims 🡪 Physics🡪 Motion 🡪 Collision Lab*  **Introduction:**  When objects move, they have *momentum*. Momentum, p, is the product of an object’s mass (kg) and its velocity (m/s). The unit for momentum, p, is kg·m/s. During a collision objects transfer momentum to each other, resulting in different motions than before the collision. In this activity you will study the motion colliding objects. |  |

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| **ELASTIC Collisions** |  |

1. What defines a collision as being elastic?
2. Simulate the four elastic collisions below. Complete the table using math formulas and the simulation.

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|  |  | | **BEFORE COLLISION** | | **ptotal** | **AFTER COLLISION** | |
| **#** | **m1** | **m2** | **v1** | **v2** | **v1** | **v2** |
| 1 | 2.0 kg | 2.0 kg | 1.5 m/s |  | 0 kg·m/s |  |  |
| 2 | 2.5 kg | 5.0 kg |  | -1.0 m/s | 0 kg·m/s |  |  |
| 3 | 3.0 kg | 6.0 kg | 2.0 m/s | 0.0 m/s |  |  |  |
| 4 | 6.0 kg |  | 2.0 m/s | -1.0 m/s | 8.0 kg·m/s |  |  |

1. Two objects with the same mass move toward each other with the same speed and experience an elastic collision. Compare the **final velocities** of each object to their **initial velocities**.
2. A less-massive moving object has an elastic collision with a more-massive object that is not moving. Compare the **initial velocity** (speed and direction) of the less-massive object to its **final velocity**.

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| **INELASTIC Collisions** |  |

1. What defines a collision as being inelastic?
2. Simulate the four inelastic collisions below. Complete the table using math formulas and the simulation.

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|  |  | | **BEFORE COLLISION** | | **ptotal** | **AFTER COLLISION** |
| **#** | **m1** | **m2** | **v1** | **v2** | **v1 and v2** |
| 1 | 2.0 kg | 2.0 kg | 1.5 m/s | 0 |  |  |
| 2 | 3.0 kg | 6.0 kg | 1.5 m/s | -0.75 m/s |  |  |
| 3 | 1.5 kg | 5.0 kg | 2.0 m/s | 0.2 m/s |  |  |
| 4 | 10.0 kg |  | 2.0 m/s | -1.0 m/s | 10.0 kg·m/s |  |

1. Two objects moving toward each other with **different** momentums experience an inelastic collision. In which direction will both objects travel after the collision?
2. A less-massive object is moving in the same direction as a more-massive object, but with a higher speed. They experience an inelastic collision. Describe the **speed** of the **more-massive** object after the collision.
3. Objects 1 has half the mass of object 2 and the objects move toward each other and experience an inelastic collision. If both objects do **not** move after the collision compare the velocity of **both** objects **before** the collision.
4. Show **mathematically** the total momentum before the collision in trial #1 is conserved after the collision.