2 Ideal Types of Collisions

Elastic - "Bounce" - Kinetic energy is conserved

\[ E_{P\text{ before}} = E_{P\text{ after}} \]
\[ m_1\vec{v}_{i1} + m_2\vec{v}_{i2} = m_1\vec{v}_{f1} + m_2\vec{v}_{f2} \]
\[ \frac{1}{2}m_1v_{i1}^2 + \frac{1}{2}m_2v_{i2}^2 = \frac{1}{2}m_1v_{f1}^2 + \frac{1}{2}m_2v_{f2}^2 \]

Inelastic - "Stick" (aka. "smush") - Kinetic energy is lost to heat

\[ E_{P\text{ before}} = E_{P\text{ after}} \]
\[ m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2} \]
\[ \frac{1}{2}m_1v_{i1}^2 + \frac{1}{2}m_2v_{i2}^2 = \frac{1}{2}m_1v_{f1}^2 + \frac{1}{2}m_2v_{f2}^2 + \text{heat} \]

Swinging balls:
If you lift up one ball to the side, exactly one ball will come out the other side.
Why is this always the case?
Because this is the only possibility which satisfies both conservation of momentum and conservation of energy.

See page 19 for discussion and solution.