CONCEPT: ELASTIC COLLISIONS

TYPES OF COLLISIONS	
ELASTIC	INELASTIC
	Completely Inelastic

- Remember: Momentum is ALWAYS conserved in ALL types of collisions.
  - In Elastic Collisions, _____ is *also* conserved. **(K_i __ K_f)**
- For Elastic Collisions *ONLY*, we often MUST use an extra equation: _____ = _____
  - Because we have 2 EQs with the *same* unknowns, we must solve a System of EQs using _____:
    - **EQ Addition:** Line up equations top-to-bottom, then add & eliminate 1 variable.
    - To 'line up' the EQs to cancel an unknown, you must often multiply an EQ by a number.

EXAMPLE: Two objects (**m_1 = 5kg, m_2 = 3kg**) on a smooth, frictionless surface undergo a head-on elastic collision. Initially, the 5kg block moves to the right at 2m/s, while the 3kg block moves to the left at 4m/s. Calculate the final velocities of both blocks after the collision.

CONSERVATION OF MOMENTUM & ELASTIC COLLISIONS

1) Draw Diagrams for Before & After
2) Write **Cons. of Moment.** & **Elastic Coll.** EQs
3) Solve Sys. of EQs by EQ Addition
4) Plug 1st target into EQs & solve other targets

MOMENTUM & ELASTIC COLLISIONS

$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

$$v_{1i} + v_{1f} = v_{2i} + v_{2f}$$

PROBLEM: Two blocks of equal mass undergo a head-on elastic collision. Object **A** moves to the right at 5m/s, while Object **B** moves to the left at 3m/s. Calculate the magnitude & direction of the two blocks' final velocities after colliding.

CONSERVATION OF MOMENTUM & ELASTIC COLLISIONS

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MOMENTUM & ELASTIC COLLISIONS

$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$ (All types)

$v_{1i} + v_{1f} = v_{2i} + v_{2f}$ (Elastic Collisions ONLY)

- PRO-TIP: When 2 objects of equal mass elastically collide, they "_____" velocities.

CONCEPT: ELASTIC COLLISIONS WITH STATIONARY OBJECTS

- A common setup in elastic collisions is 1 moving object (m_1) hitting a stationary object (m_2).
  - For these problems, v_{2i} = ___, which simplifies our equations.
  - Combining both EQ's, we can get 2 extra equations for v_{1f} & v_{2f}:

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$

$$v_{1i} + v_{1f} = v_{2i} + v_{2f}$$

v_{1f} = _____ v_{2f} = _____

EXAMPLE: In the following examples, a round boulder has a mass of 40kg and a golf ball has a mass 0.1kg. Calculate the final velocities of both blocks after the **elastic** collision for the following 3 cases:

a) Boulder hits with another boulder

- When $m_1 = m_2$ **(Equal Masses):**

$v_{1f} \approx$ ____

$v_{2f} \approx$ ____

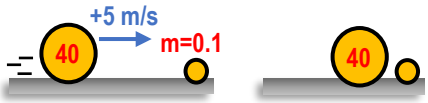
b) Golf ball hits a boulder

- When $m_1 \ll m_2$ **(massive target):**

$v_{1f} \approx$ ____

$v_{2f} \approx$ ____

c) Boulder hits a golf ball



- When $m_1 \gg m_2$ **(massive projectile):**

$v_{1f} \approx$ ____

$v_{2f} \approx$ ____

- After the collision, m_2 ALWAYS moves forward, but m_1 may move forward or backward depending on its mass.