💥 Topic: Elastic and Inelastic Collisions

✅ A - Aim

To understand the **difference between elastic and inelastic collisions**, and how **momentum and energy** are conserved or lost in different types of collisions.

💡 C - Concept

- A **collision** occurs when two bodies exert forces on each other over a short time.

- **Elastic Collision**: Both **momentum and kinetic energy are conserved**.

- **Inelastic Collision**: **Momentum is conserved**, but **kinetic energy is not**.

- **Perfectly inelastic collision**: Objects stick together after collision.

⚙️ H - How it works

- Use **momentum conservation** in all types of collisions.

- Use **kinetic energy conservation** only for **elastic** collisions.

- In inelastic collisions, part of the kinetic energy is converted into other forms (heat, sound, deformation).

🧮 E - Equations/Formulas

1. **Momentum Conservation** (all collisions):
   $$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

2. **Kinetic Energy Conservation** (elastic only):
   $$\frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2 = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$$

3. **Final Velocity (perfectly inelastic)**:
   $$v = \frac{m_1 u_1 + m_2 u_2}{m_1 + m_2}$$

4. **Coefficient of restitution (e)**:
   $$e = \frac{v_2 - v_1}{u_1 - u_2}$$

   ○ $e = 1$: perfectly elastic

   ○ $0 < e < 1$: inelastic

   ○ $e = 0$: perfectly inelastic

🔢 S - Steps to solve problems

1. Write down the **mass and velocities** before and after collision.

2. Use **momentum conservation equation**.

3. If elastic, also apply **kinetic energy conservation**.

4. Solve the system of equations.

5. For perfectly inelastic, use combined mass formula.

📘 E - Example

Q: A 1 kg ball moving at 4 m/s collides with a 2 kg stationary ball. If the collision is perfectly inelastic, find their final velocity.
Sol:

● Use: $v = \frac{m_1 u_1 + m_2 u_2}{m_1 + m_2}$