

Answer on Question #47714-Physics-Mechanics-Kinematics-Dynamics

By reference to Newton's laws of motion, deduce that when two particles collide, momentum is conserved.

Answer

From Newton's Third law – when objects are in contact, the forces exerted by the objects on each other are equal and opposite:

$$\overrightarrow{F_{AB}} = -\overrightarrow{F_{BA}}.$$

From Newton's Second law (collision time is the same) - impulses are equal and opposite:

$$\overrightarrow{F_{AB}}\Delta t = m_A \overrightarrow{\Delta v_A}; \overrightarrow{F_{BA}}\Delta t = m_B \overrightarrow{\Delta v_B}$$

$$\overrightarrow{F_{AB}}\Delta t = -\overrightarrow{F_{BA}}\Delta t \rightarrow m_A \overrightarrow{\Delta v_A} = \overrightarrow{\Delta p_A} = -m_B \overrightarrow{\Delta v_B} = -\overrightarrow{\Delta p_B}.$$

Therefore changes in momentum are equal and opposite. Total change in momentum is zero:

$$\overrightarrow{\Delta p} = \overrightarrow{\Delta p_A} + \overrightarrow{\Delta p_B} = -\overrightarrow{\Delta p_B} + \overrightarrow{\Delta p_B} = 0.$$