**Answer on Question #48487-Physics-Mechanics-Kinematics-Dynamics**

A body of mass $m_1$ standing on a smooth plane of ice throws a ball of mass $m_2$ horizontally on the surface of ice. If $x$ be the distance between them after a time $t$, then find the amount of work done by the boy in throwing the ball?

**Solution**

The work done by the boy in throwing the ball is equal to the difference of kinetic energy of the system:

$$W = K_f - K_i = \left(\frac{m_1 v_1^2}{2} + \frac{m_2 v_2^2}{2}\right) - 0 = \frac{m_1 v_1^2}{2} + \frac{m_2 v_2^2}{2}.$$

We know that

$$v_1 + v_2 = \frac{x}{t}.$$

From the conservation of momentum:

$$m_1 v_1 = m_2 v_2 \to v_2 = v_1 \frac{m_1}{m_2}.$$

Thus

$$v_1 + v_1 \frac{m_1}{m_2} = \frac{x}{t} \to v_1 = \frac{m_2}{m_1 + m_2}\frac{x}{t};\ v_2 = \frac{m_1}{m_1 + m_2}\frac{x}{t}.$$

So,

$$W = \frac{m_1}{2}\left(\frac{m_2}{m_1 + m_2}\frac{x}{t}\right)^2 + \frac{m_2}{2}\left(\frac{m_1}{m_1 + m_2}\frac{x}{t}\right)^2 = \frac{m_1 m_2}{m_1 + m_2}\frac{x^2}{2t^2}.$$

**Answer:** $\boldsymbol{\frac{m_1 m_2}{m_1 + m_2}\frac{x^2}{2t^2}}$.