Answer on Question #42318-Physics-Mechanics-Kinematics-Dynamics

Two carts, one twice the mass of the other, experience the same force for the same time. What is their difference in momentum? What is their difference in kinetic energy?

Solution

Their difference in momentum is zero, because

$$p_1 = mv_1 = Ft \; and \; p_2 = 2mv_2 = Ft \; \rightarrow \Delta p = p_1 - p_2 = Ft - Ft = 0.$$

The kinetic energy of the first cart

$$K_1 = \frac{mv_1^2}{2} = \frac{p^2}{2m}.$$

The kinetic energy of the second cart

$$K_2 = \frac{2mv_2^2}{2} = \frac{p^2}{4m}.$$

Their difference in kinetic energy

$$\Delta K = K_1 - K_2 = \frac{p^2}{2m} - \frac{p^2}{4m} = \frac{p^2}{4m} = K_2 = \frac{1}{2}K_1.$$