

Answer on Question#38769 – Physics – Mechanics | Kinematics | Dynamics

A 45.0 kg ice skater stands at rest on the ice. A friend tosses the skater a 5.0 kg ball. The skater and the ball then move backwards across the ice with a speed of .50 m/s. what was the speed of the ball at the moment just before the skater caught it?

Solution:

This is a conservation of momentum problem.

Before skater catches the ball, the total momentum in the system is the momentum of the moving ball which is

$$5\text{kg} \times v_{\text{ball}}$$

This must be the total momentum after skater catches the ball.

After skater catches the ball, the total mass of the skater and the ball is $45 + 5 = 50$ kg; the momentum of the ball/ skater system is then

$$50 \text{ kg} \cdot 0.5 \frac{\text{m}}{\text{s}} = 5\text{kg} \times v_{\text{ball}}$$

$$v_{\text{ball}} = \frac{50 \text{ kg} \cdot 0.5 \frac{\text{m}}{\text{s}}}{5\text{kg}} = 5 \text{ m/s}$$

Answer: speed of the ball was 5 m/s.