A.P. Physics 1 - Sample Momentum Problems

Sample 1

Assume two rollerbladers (A & B) approach each other as shown below. Find the speed and direction AFTER they collide if they stick together.

$P = m \cdot v$ $\quad$ $P_{before} = P_{after}$

$$(m_A)(v_A) + (m_B)(v_B) = (m_1 + m_2)(v_{final})$$

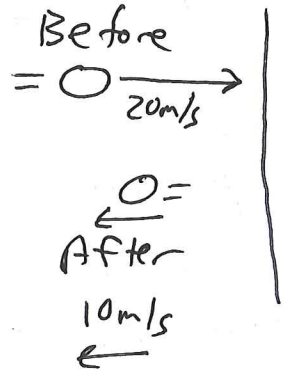
$$(50\,kg)(10\,m/s) + (80\,kg)(-5\,m/s) = (50 + 80\,kg)(v_{final})$$

$$500\,kg\,m/s - 400\,kg\,m/s = 130\,kg(v_f)$$

$$v_f = 0.77\,m/s \text{ to the right}$$

SAMPLE 2

A 0.3 kg superball is thrown at a wall with an initial speed of 20 m/s. Assume it bounces back at (the opposite direction) at 10 m/s and that the contact time during the collision is 0.02 seconds.



A.) Find the ball's Change in momentum

B.) Find the force of impact on the ball

C.) Find the force of the ball on the wall

*d.) If the ball's momentum appears to change, where does it go?? Is momentum really conserved?

A.) $\Delta P = P_{final} - P_{initial} = Impulse$

$P_{final} = (0.3\,kg)(-10\,m/s) = -3\,kg\,m/s$

$P_{initial} = (0.3\,kg)(+20\,m/s) = 6\,kg\,m/s$

$\Delta P = (-3) - (6) = -9$; so a change of 9 kg m/s to the left

B.) $Ft = m\Delta v$

$$F = \frac{m\Delta v}{t} = \frac{9\,kg\,m/s}{.02\,sec} = 450\ Newtons!$$

C.) This is an interactive force with what we found in (B), so also 450 Newtons!

D.) Well, it probably gets transferred to the wall; but the wall's so massive it doesn't appear to move much...