Name: KEY

Date: _____

Section C D F

The Masters School
Mr. Alex Rawson
Physics

# ***Momentum I***

1. A truck loaded with sand is moving down the highway in a straight path.
   a. What happens to the momentum of the truck if the truck's velocity is increasing? *(circle one)*
      i. Momentum decreases
      ii. Momentum increases
      iii. Momentum stays the same
      iv. I don't know.
   b. What happens to the momentum of the truck if sand leaks at a constant rate through a hole in the truck bed while the truck maintains a constant velocity? *(circle one)*
      i. Momentum decreases
      ii. Momentum increases
      iii. Momentum stays the same
      iv. I don't know.

2. Calculate the linear momentum for each of the following cases. *Remember to put units and direction.*
   a. a proton with mass $1.67 \times 10^{-27}$ kg moving with a velocity of $3.2 \times 10^{6}$ m/s straight up

$p = mv = (1.67 \times 10^{-27})(3.2 \times 10^{6}) = 5.34 \times 10^{-21}$ kg·m/s up

   b. a 15.0 g bullet moving with a velocity of 700 m/s to the right

$p = mv = (.015)(700) =$ 10.5 kg·m/s to the right

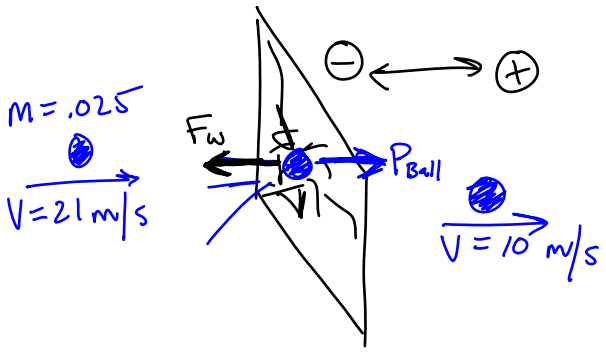
   c. a 95 kg sprinter running with a velocity of 40 m/s southwest

$p = mv = (95)(40) =$ 3800 kg·m/s southwest

   d. Earth ($m$ = 5.98 x $10^{24}$ kg) moving in its orbit with a velocity equal to 2.98 x $10^{4}$ m/s west

$p = mv = (5.98 \times 10^{24})(2.98 \times 10^{4}) = 1.78 \times 10^{29}$ kg·m/s west

3. A 0.025 kg golf ball moving at 21 m/s crashes through the window of a house in 2.0 x $10^{-4}$ s. After the crash, the ball continues in the same direction with a speed of 10 m/s. Assuming the force exerted on the ball by the window was constant, what was the magnitude of this force?




$\Delta p = F \Delta t$

$mV_f - mV_i = F\Delta t$

$m(V_f - V_i) = F_{window}\Delta t$

$.025(10 - 21) = F_w(2.0 \times 10^{-4})$

$.025(-11) =$

$\frac{-.275}{2.0 \times 10^{-4}} = F_w = -1375\ N$

4. A 0.150 kg baseball moving at 24 m/s is slowed to a stop ($V_f = 0$) by a catcher in 0.007 s.

   a. What constant force did the catcher exert on the ball during this time?

$mV_f - mV_i = F\Delta t$

$-(.15)(24) = F(.007)$

$-514.3\ N = F_{catcher}$ (toward the pitcher)

   b. How far did the ball travel before stopping? (*remember to use your Chapter 3 formulas)*

$\Delta x = \frac{1}{2}(V_i + V_f)\Delta t$

$\Delta x = \frac{1}{2}(24 + 0).007$

$\Delta x = .084\ m$

$\Delta x = 8.4\ cm$