Impulse

Impulse is defined as the **change in momentum**. <- (Stress the definition)

We can derive the change in momentum from Newton's Second Law:

$F_{Net} = ma \Rightarrow F_{Net} = m\frac{\Delta v}{t} \Rightarrow F_{Net} \cdot t = m\Delta v$

Impulse

$\Delta p = m\Delta v = F \cdot t$

change in momentum (p)

Which gives us a final formula of:

$$\Delta P = m \cdot \Delta V = F \cdot t$$

$(kg \cdot m/s)$ $(N \cdot s)$

Since Force and momentum are both vectors, Impulse is also a vector and direction is important.

Ex. A baseball bat applies a force of 50N (in the positive direction) to a 500g baseball for a time period of 0.1s.

0.5kg

a) What is the impulse of the ball?

$Impulse = F \cdot t = 50N \cdot 0.1s = 5\ Ns$

b) If the ball had an initial velocity of -3m/s. What was the balls final velocity?

(1) $m\Delta V = F \cdot t$

(2) $m(V_f - V_i) = F \cdot t$

(3) $V_f - V_i = \frac{F \cdot t}{m}$

(4) $V_f = \frac{F \cdot t}{m} + V_i$

$V_f = \frac{50N \cdot 0.1}{0.5kg} + (-3)$

$V_f = 7m/s$

Ex. A soccer player kicks a 0.450kg ball at 13m/s east. If the goalie stops the ball by exerting a 135N force, how long did it take to stop the ball?

$F \cdot t = m\Delta V$

$t = \frac{m\Delta V}{F}$

$t = \frac{0.45(13)}{135} = 0.043s$

Ex. Explain, using the principle of impulse, why an athlete (for golf, hockey, tennis, baseball) will use a "follow through" for their swings for their shots/hits?

Given the formula: Force and mass will be constant. But a follow through increases the time the ball/puck is in contact with the stick/racket/whatever. Therefore there is a greater change of velocity

$F \cdot t = m \cdot \Delta V$

Const. ↑Increase Const. ↑Increase