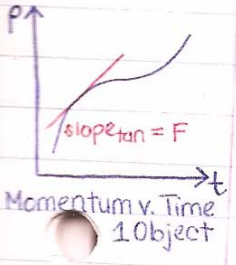
Class Notes - Lecture 14 (Biswas) 8 October 2009

Supplemental instructor exam review on Monday (12 October)
No homework due next week (14 October)

s, d, f orbital shapes from Schroedinger equation
(KE + PE) is conserved: $KE = \frac{1}{2}mv^2 = \frac{p^2}{2m}$; p = momentum ; PE is electrostatic

Chapter 6: Momentum & Collisions

Example: What is scarier - the Juggernaut or a track star running at you?
Because $KE = \frac{1}{2}mv^2$ (scalar, no direction), $KE_j >> KE_t$ and Juggernaut is scarier.



To compensate and avoid losing direction, use $\vec{p} = m\vec{v}$ (vector)
SI Units: $kg \cdot m/s$

In time Δt, $v_i \rightarrow v_f$: $\begin{cases} \vec{p}_i = m\vec{v}_i \\ \vec{p}_f = m\vec{v}_f \end{cases}$

$\therefore \Delta\vec{p} = \vec{p}_f - \vec{p}_i = m\vec{v}_f - m\vec{v}_i = m(\vec{v}_f - \vec{v}_i) = m\Delta\vec{v}$ (mass doesn't change)

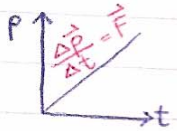
$\therefore \Delta\vec{p}/\Delta t = m \cdot \Delta\vec{v}/\Delta t$

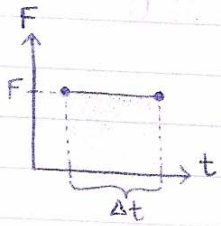
$\therefore \lim_{\Delta t \to 0} \Delta\vec{p}/\Delta t = \lim_{\Delta t \to 0} m\Delta\vec{v}/\Delta t = m\vec{a} = F$

Impulse

When a single, constant force acts on the object, an impulse is delivered to the object, $\vec{I} \equiv \Delta\vec{p}$ (vector)

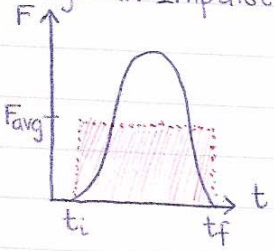
constant F: $\vec{I} = \Delta\vec{p} = \vec{F}\Delta t$ graph is a straight line





$\vec{F}\Delta t$ = area under curve

Avg. F in Impulse



$\vec{I} = \Delta\vec{p} = \vec{F}_{avg}\Delta t$ (A rectangle)

Find Favg so that A under curve = A rectangle

Impulse Momentum Thm: $\vec{I} = \vec{F}\Delta t = \Delta\vec{p} = m\vec{v}_f - m\vec{v}_i$

For changing Force: $\vec{I} = \vec{F}_{avg}\Delta t = \Delta\vec{p}$

If Δp is constant, increasing Δt will reduce F_{avg} and vice versa

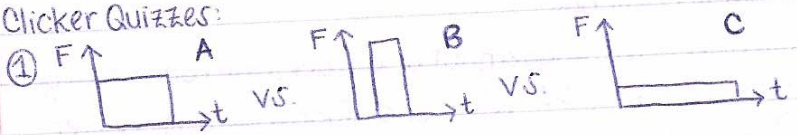
Examples: stopping slowly vs. slamming on the car brakes

hitting a golf ball: large F_{avg}, small Δt "follow thru"

design of car w/ crash test: increase Δt, reduce F_{avg}

driver's seat goes slower than front of car

Clicker Quizzes:

① 

All F equal

$\vec{p}$ all equal

② All F equal (same graphs)

safest = C

③ Question 16.

(a) Impulse: 6.3 towards pitcher $(kg(m/s)/s)$

(b) F_{avg}: 3.1×10^3 N towards pitcher

(a) $\vec{I} = \Delta\vec{p} = m(v_f - v_i)$

$= m(-22-20)$

(b) $-6.3/2.0\times10^{-3} = -3150$