PH112
Quiz 5 Review
Review Session 2/27/19

Chapter 7: Work and Kinetic Energy

$W = F * \Delta x$
$= F \cdot dx$
$= F\cos(\theta) * x$
$= \int F(x)\, dx$
= area under F-x curve
$= \Delta K$ (for chapter 7 perspective, no U)
$= \Delta E_{total}$ (external work on system for chapter 8 perspective)
$= -dU$ if E_mec is conserved)
$= \Sigma W$

$W_g = -mg\Delta h$ = integral of -mg
$W_k = -1/2kx^2$ = integral of -kx
$K = 1/2mv^2$
$P = dW/dt$
$= F \cdot v$

Chapter 8: Potential Energy

$U = -F \cdot dx$
= negative of work done by a force to get to a particular configuration
$U_g = mgh$
$U_s = 1/2kx^2$
Force is conservative if total work along a closed path is 0; these are path-independent
- Else nonconservative

Energy is always conserved
- Mechanical energy is not always conserved, but when it is then $E_{mec\_2} = E_{mec\_1}$

$E_{mec} = U + K$
$\Delta E_{mec} = \Delta U + W$ (here work is an "internal work" equal to ΔK, not work done on the system)
- if E_mec conserved, $\Delta U = -W$
  - then $dU = -W = -Fdx \Rightarrow F = -dU/dx$
  - useful b/c intermediate states do not have to be considered
  - conservation of E_mec if no deformation of material, heat loss, (kinetic) friction

$E_{total} = E_{mec} + E_{th} + E_{int}$
$\Delta E_{total} = \Delta E_{mec} + \Delta E_{th} + \Delta E_{int}$ (most general form)
- pretty much ignore E_int, E_th is applicable if there is friction/heat
- potential energy diagrams
  - turning points and equilibrium points (neutral, stable, unstable)

$W = \Delta E_{total}$ (work done on the system)

Chapter 9: Linear momentum & COM

$COM = 1/M * \int r\, dm$
- or, for constant density: $COM = 1/P * \int r\, dP$

Choose a good reference pt for COM for easy calculation
Take advantage of symmetries (spherical, linear)
$F_{net} = M * a_{com}$

= dp/dv

- Net force can be thought of as concentrated at center of mass -- internal forces have no effect

$p = M * v_{com}$ (momentum of system)

$J = \int F(t)\, dt$ (impulse on system)

$= \Delta p$

Make sure to think about when energy and linear momentum are conserved. They are not mutually inclusive/exclusive!

- If both are conserved, you may need to end up using both
- If only one is conserved, make sure you do not use the wrong one.

Problems from class

Set up center of mass of two sticks
Spring and a dome question
Rockets
Two boats w/ coal
Boat with dog and person on both ends, switch sides
Conveyor belt
Ballistic pendulum