Flipping Physics Lecture Notes:
AP Physics 1: *Equations to Memorize*

Let me be clear about what I mean by "memorize": I mean you should have the equation memorized, know what it means and know when you can use it. This is a lot more than just being able to write down the equation.

The following equations are *not* on the Equation Sheet provided by the AP College Board for the AP Physics 1 exam:

- $speed = \frac{distance}{time}$; $\vec{v} = \frac{\Delta \vec{x}}{\Delta t}$; $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$
  - Please make sure you understand the differences between vectors and scalars, please.♥
- $\Delta x = \frac{1}{2}\left(v_f + v_i\right)\Delta t$
  - This is another Uniformly Accelerated Motion (UAM) equation you should know.
- $F_{g_{\parallel}} = mg\sin\theta$ & $F_{g_{\perp}} = mg\cos\theta$
  - When an object is on an incline, we often need to sum the forces in the parallel and perpendicular directions, which necessitates resolving the force of gravity into its components in the parallel and perpendicular directions.
  - Note: theta in this equation is the incline angle.
- Equations having to do with Mechanical Energy:
  - $ME_i = ME_f$: Conservation of Mechanical Energy can be used when there is no work done by the force of friction or the force applied.
  - $W_f = \Delta ME$: Can be used when there is no work done by the force applied.
  - $W_{net} = \Delta KE$: Is always true.
- $P = \frac{\Delta E}{\Delta t} = \frac{W}{\Delta t} = \frac{Fd\cos\theta}{\Delta t} = Fv\cos\theta$
  - This is useful because you have power in terms of velocity.
- $\sum \vec{p}_i = \sum \vec{p}_f$
  - Conservation of linear momentum is valid when the net force acting on the system is zero, which is true during all collisions and explosions.
- $\vec{\omega} = \frac{\Delta \vec{\theta}}{\Delta t}$ & $\vec{\alpha} = \frac{\Delta \vec{\omega}}{\Delta t}$
  - Angular velocity and angular acceleration were, sadly, left off the equation sheet.

♥ Yes, that's a double please.

- $\omega_f^{\ 2} = \omega_i^{\ 2} + 2\alpha\Delta\theta$ & $\Delta\theta = \frac{1}{2}\left(\omega_f + \omega_i\right)\Delta t$
    - These two Uniformly Angularly Accelerated Motion (UαM) equations were also, sadly, left off the equation sheet.
- $\vec{v}_t = r\vec{\omega}$
    - The tangential velocity of an object.
- $v_{cm} = R\omega$
    - The velocity of the center of mass of an object rolling without slipping.
- $\sum \vec{F}_{in} = m\vec{a}_c$
    - The equation for the centripetal force acting on an object to keep it moving in a circle.
- $I = \sum_i m_i r_i^2$
    - The moment of inertia or "rotational mass" of a system of particles.
- $\sum \vec{L}_i = \sum \vec{L}_f$
    - Conservation of Angular Momentum, valid when the net external torque acting on the system is zero. $\sum \vec{\tau}_{external} = 0$
- $f_{beat} = \left|f_1 - f_2\right|$
    - The beat frequency heard due to the interference of two similar single frequency sounds.
- $q = ne$
    - The net change on an object equals the number of excess charges times the elementary charge.
- $\Delta V = \frac{\Delta PE_{electrical}}{q}$
    - The electric potential difference equals the change in electrical potential energy divided by charge.
- $P = I\Delta V$ is the only equation for electric power on the equation sheet.
    - However, using $\Delta V = IR \Rightarrow I = \frac{\Delta V}{R} \Rightarrow R = \frac{\Delta V}{I}$ we can find two more.
    - $P = I\Delta V = I\left(IR\right) = I^2 R = \left(\frac{\Delta V}{R}\right)^2 R = \frac{\Delta V^2}{R}$
    - $P = I\Delta V = I^2 R = \frac{\Delta V^2}{R}$ (This is what you should memorize for electric power.)