Formula Sheet

Mechanics

$m\frac{d\underset{\sim}{v}}{dt} = \underset{\sim}{F}$ $K_2 - K_1 = W$

$K = \frac{1}{2}mv^2$ $W = -\int_{\underset{\sim}{x}_1}^{\underset{\sim}{x}_2} d\underset{\sim}{x}\cdot\underset{\sim}{F}$

circular motion

$a = \omega^2 r$, $v = \omega r$, $\omega = \frac{2\pi}{T}$

$\underset{\sim}{v} = \underset{\sim}{a}t + \underset{\sim}{v}_0$, $v^2 = v_0^2 + 2ax$

$\underset{\sim}{x} = \underset{\sim}{x}_0 + \underset{\sim}{v}_0 t + \frac{1}{2}\underset{\sim}{a}t^2$

$m_e = 9.1\times10^{-31}\,kg$

$m_p = 1.67\times10^{-27}\,kg$

harmonic motion

$\ddot{x} + \omega^2 x = 0$

Rotational Motion

$\frac{dL}{dt} = \frac{d}{dt} I\omega = \tau$

$\tau = F\ell$

$K = \frac{1}{2}I\omega^2$

$I = \sum_i m_i r_i^2$

Electrostatics

$\underset{\sim}{F} = q'\underset{\sim}{E}$, $U = q'V$

$\oint \underset{\sim}{E}\cdot d\hat{A} = \frac{q}{\epsilon_0}$

$\underset{\sim}{E} = \frac{q}{4\pi\epsilon_0}\frac{\hat{r}}{r^2}$ pt charge

$V_2 - V_1 = -\int_{x_1}^{x_2} \underset{\sim}{E}\cdot d\underset{\sim}{x}$

$V = \frac{q}{4\pi\epsilon_0}\frac{1}{r}$ pt charge

$V = -Ex$ uniform E

$\underset{\sim}{E} = \frac{\lambda}{2\pi\epsilon_0}\frac{\hat{r}}{r}$ line charge

$\underset{\sim}{E} = -\nabla V$

$E = \frac{\sigma}{\epsilon_0}$ surface conductor

$E_x = -\partial V/\partial x$

$E_y = -\partial V/\partial y$

$E = \frac{\sigma}{2\epsilon_0}$ sheet charge

$E_z = -\partial V/\partial z$

$\frac{1}{4\pi\epsilon_0} = 9\times10^9\,\frac{Nm^2}{C^2}$, $\epsilon_0 = 8.85\times10^{-12}\,\frac{C^2}{Nm^2}$

$e = 1.6\times10^{-19}\,C$, $1eV = 1.6\times10^{-19}\,J$

$p = qd$ dipole, $\underset{\sim}{\tau} = \underset{\sim}{p}\times\underset{\sim}{E}$ dipole

$U = -\underset{\sim}{p}\cdot\underset{\sim}{E}$ dipole

$E = p/4\pi\epsilon_0 r^3$ dipole