Physics 101: Conceptual Physics Formula Sheet

Constants

$g \approx$ 10 m/s^2 (acceleration near Earth's surface)

$G =$ 6.67 x 10^{-11} Nm^2/kg^2 (Gravitational constant)

$k =$ 9 x 10^9 Nm^2/C^2 (electrostatic constant)

$M_E =$ 5.972 x 10^{24} kg, $R_E =$ 6.378 x 10^6 m (Earth)

$M_\bullet =$ 7.348 x 10^{22} kg, $R_\bullet =$ 1.737 x 10^6 m (Moon)

$M_\odot =$ 1.989 x 10^{30} kg, $R_\odot =$ 6.96 x 10^8 m (Sun)

Mechanics

$\sum \mathbf{F} \equiv \mathbf{F}_{\text{net}} = 0$ (Newton's 1st Law)

$\sum \mathbf{F} \equiv \mathbf{F}_{\text{net}} = m\mathbf{a}$ (Newton's 2nd Law)

$\mathbf{F}_{1,2} = -\mathbf{F}_{2,1}$ (Newton's 3rd Law)

$F_g = GMm/r^2$ (Universal law of gravitation)
$F_g = mg$ (gravitational force near Earth's surface)

$\mathbf{p} = m\mathbf{v}$ (momentum)

$F\Delta t = \Delta(mv)$ (impulse)

$W = Fd$ (Work)

$E_{tot} = U + K$ (total energy)

$K = \frac{1}{2}mv^2$ (kinetic energy)

$U = mgh$ (grav. potential energy)

$\tau = F_\perp d$ (torque), $\perp$ means that force and distance have to be perpendicular

$L = I\omega$ (angular momentum)

$F_{net} = mv^2/r$ (centripetal force)

Electricity & Magnetism

$F_e = kQq/r^2 = qE_e$ (Coulomb's Law)

$E_e = kQ/r^2$ (Electric Field)

$V = IR$ (Ohm's Law)

$P = IV = I^2R = V^2/R$ (Electic Power)

$R_{\text{eq}} = R_1 + R_2 + ...$ (Series Circuit)

$\frac{1}{R_{\text{eq}}} = \frac{1}{R_1} + \frac{1}{R_2} + ...$ (Parallel Circuit)

$R_{\text{eq}} = \frac{R_1 R_2}{R_1 + R_2}$ (special case for 2 parallel resistors)

$F_B = qv_\perp B$ (Magnetic Force) $\perp$ means that velocity and magnetic field have to be perpendicular

Kinematics (Linear Motion)

$\bar{v} = \frac{v_0 + v}{2} = \frac{d}{t}$ (average speed)

$v = v_0 + at$ (speed)
$a = \frac{v - v_0}{t}$ (acceleration)

$d = v_0 t + \frac{1}{2}at^2$ (distance)

Kinematics (Projectile Motion)

$x = x_0 + v_{0,x}t + \frac{1}{2}a_x t^2$

$v_x = v_{0,x} + a_x t$

$y = y_0 + v_{0,y}t + \frac{1}{2}a_y t^2$

$v_y = v_{0,y} + a_y t$