Equation Sheet - College Physics

$g = 9.8\ m/s^2$
$G = 6.67\times10^{-11}\ Nm^2/kg^2$
$M_E = 5.98\times10^{24}\ kg$
$R_E = 6.38\times10^{6}\ m$
$\rho_{air} = 1.29\ kg/m^3$
$\rho_{water} = 1000\ kg/m^3$
$1\ atm = 1.01\times10^{5}\ Pa$
$R = 8.31\ J/mole\ K$
$R = 0.0821\ Li\text{-}atm/mole\ K$
$k_B = 1.38\times10^{-23}\ J/K$
$V_{light} = 3\times10^{8}\ m/s$
$N_A = 6.02\times10^{23}$
$\sigma = 5.67\times10^{-8}\ W/m^2K^4$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\bar{v} = \frac{\Delta x}{\Delta t} = \frac{x - x_0}{t - t_0}$$
$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{v - v_0}{t - t_0}$$
$$v = v_0 + a\,t$$
$$x - x_0 = v_0 t + \frac{1}{2} a\,t^2$$
$$v^2 = v_0^2 + 2a(x - x_0)$$
$$x - x_0 = \frac{1}{2}(v + v_0)t$$

$$\sum F = m\,a$$
$$w = m\,g$$
$$f_{s,k} = \mu_{s,k}\,n$$

$$W = F\Delta x\cos\theta$$
$$KE = \frac{1}{2}mv^2$$
$$W_{net} = \Delta KE$$
$$PE = mgy$$
$$PE = \frac{1}{2}kx^2$$

$$KE_i + PE_i = KE_f + PE_f$$
$$W_{nc} = \Delta KE + \Delta PE$$
$$\bar{P} = \frac{W}{\Delta t}$$
$$\bar{P} = Fv$$

$$p = mv$$
$$impulse = F\Delta t$$
$$F\Delta t = \Delta p = mv_f - mv_i$$

Conservation of Momentum
$$m_1\vec{v}_{1i} + m_2\vec{v}_{2i} = m_1\vec{v}_{1f} + m_2\vec{v}_{2f}$$
Conservation of Kinetic Energy
$$\frac{1}{2}m_1v_{1i}^2 + \frac{1}{2}m_2v_{2i}^2 = \frac{1}{2}m_1v_{1f}^2 + \frac{1}{2}mv_{2f}^2$$

$$\bar{\omega} = \frac{\Delta\theta}{\Delta t} = \frac{\theta - \theta_0}{t - t_0}$$
$$\bar{\alpha} = \frac{\Delta\omega}{\Delta t} = \frac{\omega - \omega_0}{t - t_0}$$
$$\omega = \omega_0 + \alpha\,t$$
$$\theta - \theta_0 = \omega_0 t + \frac{1}{2}\alpha\,t^2$$
$$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$$
$$\theta - \theta_0 = \frac{1}{2}(\omega + \omega_0)t$$

$$s = r\theta$$
$$v_t = r\omega$$
$$a_t = r\alpha$$
$$a_c = \frac{v^2}{r} = r\omega^2$$

$$F_{grav} = \frac{Gm_1m_2}{r^2}$$
$$T^2 = \left(\frac{4\pi^2}{GM}\right)r^3$$
$$v^2 = \frac{GM}{r}$$
$$v = \frac{2\pi r}{T}$$
$$g = \frac{GM}{r^2}$$
$$PE = -\frac{Gm_1m_2}{r}$$

$I_{ring} = mr^2$
$I_{disc} = 0.5\,mr^2$
$I_{sphere} = 0.4\,mr^2$

$$\tau = rF\sin\theta$$
$$\Sigma\tau = I\alpha$$
$$KE_{rot} = \frac{1}{2}I\omega^2$$
$$L = I\omega$$

Cons. of Angular Momentum
$I_i\omega_i = I_f\omega_f$

$$\rho = \frac{m}{V}$$
$$P = \frac{F}{A}$$
$$P = P_0 + \rho gh$$
$$F_{buoyant} = \rho Vg$$
$$A_1v_1 = A_2v_2$$
$$P + \frac{1}{2}\rho v^2 + \rho gy = \text{constant}$$

$$T_C = T_K - 273$$
$$T_F = \frac{9}{5}T_C + 32$$
$$Q = mc\Delta T$$
$$Q = mL$$
$$PV = nRT$$
$$PV = NkT$$
$$PV = \frac{2}{3}\left(\frac{N}{V}\right)\left(\frac{1}{2}m\overline{v^2}\right)$$
$$\frac{1}{2}m\overline{v^2} = \frac{3}{2}k_BT$$
$$U = \frac{3}{2}nRT$$
$$v_{rms} = \sqrt{\frac{3k_BT}{m}}$$

$$Q = mc\Delta T$$
$$Q = mL$$
$$\frac{Q}{\Delta t} = \frac{kA(T_h - T_c)}{L}$$
$$P = \sigma Ae\left(T^4 - T_s^4\right)$$

$$W = -P\Delta V$$
$$\Delta U = Q + W$$
$$e = \frac{W}{|Q_{in}|} = 1 - \frac{|T_C|}{|T_h|}$$

$$F_s = -kx$$
$$T = 2\pi\sqrt{\frac{m}{k}}$$
$$\lambda\,f = v$$
$$v = (331m/s)\sqrt{\frac{T}{273}}$$