Phys 1401 Formula Sheet

$$\Delta x = x_f - x_i$$

$$v_{av} = (x_f - x_i)/\Delta t$$

$$a_{av} = (v_f - v_i)/\Delta t$$

$$v_f = v_i + at$$

$$v_{av} = (v_i + v_f)/2$$

$$\Delta x = (v_i + v_f)(t/2)$$

$$\Delta x = v_i t + (a/2)t^2$$

$$v_f{}^2 = v_i^2 + 2a\Delta x$$

$$g = -9.8 \text{ m/s}^2$$

$$A_x = A \cos\theta$$

$$A_y = A \sin\theta$$

$$A = \sqrt{(A_x^2 + A_y^2)}$$

$$\theta = \arctan(A_y/A_x)$$

$$R_x = A_x + B_x$$

$$R_y = A_y + B_y$$

$$R = \sqrt{(R_x^2 + R_y^2)} = \sqrt{\{(A_x + B_x)^2 + (A_y + B_y)^2\}}$$

$$\theta = \arctan(R_y/R_x) = \arctan\{(A_y + B_y)/(A_x + B_x)\}$$

$$r_x = x$$

$$r_y = y$$

$$\Delta\mathbf{r} = \mathbf{r}_f - \mathbf{r}_i$$

$$\Delta r_x = \Delta x = x_f - x_i$$

$$\Delta r_y = \Delta y = y_f - y_i$$

$$\mathbf{v}_{av} = \Delta\mathbf{r}/\Delta t$$

$$v_{avx} = \Delta x/\Delta t$$

$$v_{avy} = \Delta y/\Delta t$$

$$\mathbf{a}_{av} = \Delta\boldsymbol{v}/\Delta t = (\mathbf{v}_f - \mathbf{v}_i)/\Delta t$$

$$a_x = 0 \text{ m/s}^2$$

$$a_y = g = -9.8 \text{ m/s}^2$$

$$v_{fx} = v_{ix}$$

$$\Delta x = v_{ix}t$$

$$v_{fy} = v_{iy} + gt$$

$$\Delta y = v_{iy}t + (g/2)t^2$$

$$v_{fy}{}^2 = v_{iy}{}^2 + 2g\Delta y$$

$$\Delta y = (v_{iy} + v_{fy})(t/2)$$

$$F_{net} = ma$$

$$\mathbf{F}_{AB} = -\mathbf{F}_{BA}$$

$$w = m|g|$$

$$f = \mu N$$

$$\mu_s > \mu_k$$

$$\mathbf{F}_{net} = \Sigma\,\mathbf{F} = \mathbf{F}_1 + \mathbf{F}_2 + \ldots = 0$$

$$\Sigma F_x = F_{1x} + F_{2x} + \ldots = 0$$

$$\Sigma F_y = F_{1y} + F_{2y} + \ldots = 0$$

$$\mathbf{F}_{net} = \Sigma\,\mathbf{F} = \mathbf{F}_1 + \mathbf{F}_2 + \ldots = m\mathbf{a}$$

$$\Sigma F_x = F_{1x} + F_{2x} + \ldots = ma_x$$

$$\Sigma F_y = F_{1y} + F_{2y} + \ldots = ma_y$$

$$w_{||} = m|g| \sin\theta$$

$$w_{\perp} = m|g| \cos\theta$$

$$a = (m|g| \sin\theta)/m = |g| \sin\theta$$

$$\Sigma F_{ext} = m_{total}a$$

$$W = F_{||}\, d$$

$$W = Fd\cos\theta$$

$$W_{net} = W_1 + W_2 + \ldots$$

$$W_{net} = F_{net}\, d\cos\theta_{net}$$

$$W_{net} = mv_f{}^2/2 - mv_i{}^2/2$$

$$KE = mv^2/2$$

$$W_{net} = KE_f - KE_i = \Delta KE = mv_f{}^2/2 - mv_i{}^2/2$$

$$W_c = -\Delta PE_c = -(PE_{cf} - PE_{ci})$$

$$ME = KE + PE$$

$$ME = mv^2/2 + PE$$

$$\Delta KE = -\Delta PE$$

$$KE_i + PE_i = KE_f + PE_f$$

$$W_g = -(PE_{gf} - PE_{gi}) = -\Delta PE_g$$

$$W_g = -m|g|(y_f - y_i)$$

$$PE_g = m|g|y$$

$$ME_g = mv^2/2 + m|g|y$$

$$mv_i^2/2 + m|g|y_i = mv_f^2/2 + m|g|y_f$$

$$W_s = -(PE_{sf} - PE_{si}) = -\Delta PE_s$$

$$F_{sx} = -kx$$

$$F_s = k|x|$$

$$W_s = -(kx_f^2/2 - kx_i^2/2)$$

$$PE_s = kx^2/2$$

$$ME_s = mv^2/2 + kx^2/2$$

$$mv_i^2/2 + kx_i^2/2 = mv_f^2/2 + kx_f^2/2$$

$$W_{net} = W_c + W_{nc}$$

$$W_{nc} = \Delta KE + \Delta PE = \Delta ME$$

$$W_{nc} = (mv_f^2/2 + m|g|y_f) - (mv_i^2/2 + m|g|y_i)$$

$$W_{nc} = (mv_f^2/2 + kx_f^2/2) - (mv_i^2/2 + kx_i^2/2)$$

$$\mathbf{p} = m\mathbf{v}$$

$$p = mv$$

$$\mathbf{I} = \mathbf{F}\Delta t$$

$$I = F\Delta t$$

$$F = m\Delta v/\Delta t = (mv_f - mv_i)/\Delta t$$

$$F = (p_f - p_i)/\Delta t = \Delta p/\Delta t$$

$$I = \Delta p$$

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$

$$m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)V$$

$$m_bv_b = (m_b + m_p)V$$

$$v_b = (m_b + m_p)V/m_b$$

$$V = \sqrt{(2|g|h)}$$

$$v_b = (m_b + m_p)\sqrt{(2|g|h)}/m_b$$

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$

$$v_{1i} - v_{2i} = -(v_{1f} - v_{2f})$$

$$m_1\mathbf{v}_{1i} + m_2\mathbf{v}_{2i} = m_1\mathbf{v}_{1f} + m_2\mathbf{v}_{2f}$$

$$m_1v_{1ix} + m_2v_{2ix} = m_1v_{1fx} + m_2v_{2fx}$$

$$m_1v_{1iy} + m_2v_{2iy} = m_1v_{1fy} + m_2v_{2fy}$$

$$\theta = s/r$$

$$\text{rad} = (180/\pi)\ \text{deg}$$

$$\text{deg} = (\pi/180)\ \text{rad}$$

$$f = 1/T$$

$$\omega = 2\pi f = 2\pi/T$$

$$v = 2\pi r/T = 2\pi rf = \omega r$$

$$a_c = v^2/r$$

$$F_c = ma_c = mv^2/r$$

$$\Delta\theta = \theta_f - \theta_i$$

$$\omega_{av} = (\theta_f - \theta_i)/\Delta t$$

$$\alpha_{av} = (\omega_f - \omega_i)/\Delta t$$

$$a_{net} = \sqrt{(a_c^2 + a_t^2)}$$

$$\Delta s = r\Delta\theta$$

$$v = r\omega$$

$$a_t = r\alpha$$

$$\omega_f = \omega_i + \alpha t$$

$$\Delta\theta = \omega_i t + \alpha t^2/2$$

$$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$$

$$\Delta\theta = (\omega_f + \omega_i)t/2$$

$$F_g = Gm_1m_2/r^2$$

$$G = 6.67 * 10^{-11}\ \text{N m}^2/\text{kg}^2$$

$$|\tau| = |F|r_\perp$$

$$|\tau| = |F|r \sin\theta$$

$$\tau = \pm|F|r \sin\theta$$

$$\tau_{net} = \tau_1 + \tau_2 + \ldots$$

$$\sum \mathbf{F} = \mathbf{F}_1 + \mathbf{F}_2 + \ldots = \mathbf{0}$$

$$\sum F_x = F_{1x} + F_{2x} + \ldots = 0$$

$$\sum F_y = F_{1y} + F_{2y} + \ldots = 0$$

$$\sum \tau = \tau_1 + \tau_2 + \ldots = 0$$

$$x_g = (\sum_i m_ix_i)/(\sum_i m_i) = (m_1x_1 + m_2x_2 + \ldots)/(m_1 + m_2 + \ldots)$$

$$y_g = (\sum_i m_iy_i)/(\sum_i m_i) = (m_1y_1 + m_2y_2 + \ldots)/(m_1 + m_2 + \ldots)$$

$$\tau = mr_\perp^2\alpha$$

$$I = mr_\perp^2$$

$$\tau = I\alpha$$

$$I = \sum_i m_i r_{i\perp}^2 = m_1 r_{1\perp}^2 + m_2 r_{2\perp}^2 + \ldots$$

$$KE_{rot} = I\omega^2/2$$

$$KE_{rol} = KE_{tra} + KE_{rot} = Mv^2/2 + I\omega^2/2$$

$$L = I\omega$$

$$\tau_{net} = \Delta L/\Delta t$$

$$I_i\omega_i = I_f\omega_f$$

$$Stress = F/A$$

$$modulus = stress / strain$$

$$Y = (F/A)/(\Delta L/L)$$

$$S = (F/A)/(x/h)$$

$$B = (-F/A)/(\Delta V/V)$$

$$\rho = m/V$$

$$P = F/A$$

$$P = P_o + \rho|g|h$$

$$P_g = P_{at} + \rho|g|h$$

$$P_g = P_{at} - \rho|g|h$$

$$P_g = \rho|g|h$$

$$B = V\rho_f|g|$$

$$W_f = W_a - B$$

$$W_a = \rho_o V|g|$$

$$W_f = (\rho_o - \rho_f)V|g|$$

$$\rho_o/\rho_f = V_i/V$$

$$A_1v_1 = A_2v_2$$

$$P_1 + \rho|g|y_1 + \rho v_1^2/2 = P_2 + \rho|g|y_2 + \rho v_2^2/2$$

$$T/°\mathrm{K} = T/°\mathrm{C} + 273$$

$$T/°\mathrm{F} = (9/5)T/°\mathrm{C} + 32$$

$$T/°\mathrm{C} = (5/9)(T/°\mathrm{F} - 32)$$

$$(T - T_o)/(L - L_o) = m$$

$$T = mL + b$$

$$\Delta L = \alpha L_o \Delta T$$

$$L = L_o\{1 + \alpha(T - T_o)\}$$

$$A = A_o\{1 + 2\alpha(T - T_o)\}$$

$$\Delta A = 2\alpha A_o \Delta T$$

$$V = V_o\{1 + 3\alpha(T - T_o)\}$$

$$\Delta V = 3\alpha V_o \Delta T$$

$$V_1 P_1/T_1 = V_2 P_2/T_2$$

$$P_1 V_1 = P_2 V_2$$

$$V_1/T_1 = V_2/T_2$$

$$N_A = 6.02e23$$

$$n = m/M_g$$

$$n = N/N_A$$

$$PV = nRT$$

$$R = 8.3\ \mathrm{J}/°\mathrm{K}/\mathrm{mole}$$

$$PV = N\kappa_\beta T$$

$$\kappa_\beta = 1.38e\text{-}23\ \mathrm{J}/°\mathrm{K}/\mathrm{mole}$$

$$E = 3\kappa_\beta T/2$$

$$E_T = 3N\kappa_\beta T/2$$

$$E_T = 3nRT/2$$

$$v_{RMS} = \sqrt{(3\kappa_\beta T/m_o)}$$

$$m_o = M_{kg}/(1000N_A)$$

$$v_{RMS} = \sqrt{(3000RT/M_{kg})}$$

$$Q = mc\Delta T$$

$$Q_c = -Q_h$$

$$m_c c_c (T_f - T_c) = -m_h c_h (T_f - T_h)$$

$$H_f = mL_f$$

$$H_v = mL_v$$

$$Q/\Delta t = \kappa A(T_2 - T_1)/L$$

$$P_e = \sigma e A T_e^4$$

$$\sigma = 5.7e\text{-}8\ \mathrm{W}/\mathrm{m}^2/°\mathrm{K}^4$$

$$P_a = \sigma e A T_a^4$$

$$P_{net} = P_e - P_a = \sigma e A(T_e^4 - T_a^4)$$

$$W = P\Delta V$$

$$\Delta U = U_f - U_i$$

$$\Delta U = Q - W$$

$$\Delta U = Q - P\Delta V$$

$$W = Q_H - Q_C$$

$$E = 1 - Q_C/Q_H$$

$$E_C = 1 - T_C/T_H$$

$$\Delta S = S_f - S_i$$

$$\Delta S = Q/T$$

$$G = H - TS$$