Possibly Useful Information

Fluids (Ideal):

$$\rho = \frac{m}{V} \qquad p = \frac{F}{A} \qquad p = p_0 + \rho g h \qquad p_{gauge} = p - p_0$$

$$F_B = \text{weight of fluid displaced} = \rho_{\text{fluid}} V_{sub} g$$

$$R_m = \rho A v = \text{constant} \qquad R_V = Av = \text{constant} \qquad p + \frac{1}{2}\rho v^2 + \rho g h = \text{constant}$$

Temperature, Heat & the First Law of Thermodynamics:

	$dL = L_0 \alpha dT$	$dQ = mcdT$	$dQ = ncdT$
α constant:	$\Delta L = L_0 \alpha \Delta T$	$\Delta A = A_0 (2\alpha \Delta T)$	$\Delta V = V_0 (3\alpha \Delta T) = V_0 \beta \Delta T$
c constant:	$Q = mc\Delta T$	$Q = nc\Delta T$	$Q = mL$

$$\Delta E_{\text{int}} = Q - W \qquad dE_{\text{int}} = dQ - dW \qquad W = \int_{V_i}^{V_f} P dV$$

$$P_{cond} = \frac{Q}{t} = \frac{kA(T_H - T_C)}{L} \qquad P_{net} = P_{abs} - P_{rad} = \sigma \varepsilon A (T_{env}^4 - T^4)$$

Kinetic Theory:

$$n = \frac{N}{N_A} = \frac{M_{sam}}{M} = \frac{M_{sam}}{mN_A} \qquad PV = nRT = Nk_B T \qquad v_{rms} = \sqrt{\frac{3RT}{M}}$$

$$f(v) = 4\pi \left(\frac{M}{2\pi RT} \right)^{3/2} v^2 e^{-Mv^2/2RT} \qquad \bar{v} = \sqrt{\frac{8RT}{\pi M}} \qquad v_{mp} = \sqrt{\frac{2RT}{M}}$$

$$K_{ave} = \frac{3}{2} k_B T \text{ (per molecule)} \qquad E_{\text{int}} = \frac{3}{2} nRT \text{ (monatomic only)}$$

$$c_V = \frac{f}{2} R \qquad c_P = c_V + R \qquad \Delta E_{\text{int}} = nc_v \Delta T$$

$$PV^\gamma = \text{constant} \qquad TV^{\gamma - 1} = \text{constant} \qquad \gamma = \frac{c_P}{c_V}$$

$$W = P\Delta V \qquad W = nRT \ln\left(\frac{V_f}{V_i}\right) \qquad W = \frac{P_f V_f - P_i V_i}{1 - \gamma} = \frac{nR\Delta T}{1 - \gamma}$$

$$Q = nc_V \Delta T \qquad Q = nc_P \Delta T \qquad Q = nRT \ln\left(\frac{V_f}{V_i}\right)$$

$H_2O_2N_2Cl_2Br_2I_2F_2$

Entropy & the Second Law of Thermodynamics:

$$e = \frac{|W|}{|Q_H|} = \frac{|Q_H| - |Q_C|}{|Q_H|} \qquad \kappa = \frac{|Q_C|}{|W|} = \frac{|Q_C|}{|Q_H| - |Q_C|}$$

$$e_{car} = \frac{T_H - T_C}{T_H} \qquad \kappa_{car} = \frac{T_C}{T_H - T_C}$$

$$\oint dE_{\text{int}} = 0 \qquad \oint_{reversible} dS = 0 \qquad \Delta S = \int \frac{dQ}{T} \qquad S = k_B \ln \Omega$$

Some special cases:

$$\Delta S = nc_V \ln\left(\frac{T_f}{T_i}\right) + nR \ln\left(\frac{V_f}{V_i}\right) \qquad \Delta S = mc \ln\left(\frac{T^2}{T^2 - (\Delta T)^2}\right)$$

Constants and Conversions:

$g = 9.81\ \frac{\text{m}}{\text{s}^2}$ $\quad \rho_{H_2O} = 10^3\ \frac{\text{kg}}{\text{m}^3}$ $\quad \rho_{air@STP} = 1.29\ \frac{\text{kg}}{\text{m}^3}$

$R = 8.31\ \frac{\text{J}}{\text{mol}\cdot\text{K}} = 0.0821\ \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}$ $\quad N_A = 6.02\times10^{23}\,\text{mol}^{-1}$

$k_B = 1.38\times10^{-23}\ \frac{\text{J}}{\text{K}}$ $\quad \sigma = 5.67\times10^{-8}\ \frac{\text{W}}{\text{m}^2\cdot\text{K}^4}$

1 L = 10^3 cm^3 = 10^{-3} m^3 $\quad$ STP = 1 atm & 0 ^{o}C

1 cal = 4.186 J $\quad$ 1 atm = 1.01×10^5 Pa $\quad$ 1 kW$\cdot$hr = 3.6×10^6 J

$T_c = T_K - 273^{o}$ $\quad T_F = T_R - 459^{\circ}$ $\quad$ 1 C^{o} = 1.8 F^{o}

$c_{water} = 1.0\ \frac{\text{cal}}{\text{g}\cdot\text{C}^{\circ}}$ $\quad c_{Al} = 0.212\ \frac{\text{cal}}{\text{g}\cdot\text{C}^{\circ}}$

$L_{f,water} = 80\ \frac{\text{cal}}{\text{g}}$ $\quad L_{v,water} = 540\ \frac{\text{cal}}{\text{g}}$