Thermal Physics Cheat Sheet

Thermodynamics

Basics[1-3]

Temperature & Boltzmann Factor[4]

Maxwell-Boltzmann Distribution[5]

Pressure & Ideal Gas Law[6]

Molecular Flux & Effusion[7]

Mean Free Path & Collisions[8]

Energy[11]

Adiabatic Processes[12]

Heat Engine 2nd Law[13]

Entropy[14]

Thermodynamic Potentials[16]

Internal energy, U

$$dU = TdS - pdV \tag{1}$$

Enthalpy, H

$$H \equiv U + PV = \{(3)\} = H(S,p) \tag{2}$$

$$dH = \{(1)\} = TdS - pdV + pdV + VdP = TdS + Vdp \tag{3}$$

$$\Delta H = \begin{cases} exothermic & \Delta H < 0 \\ endothermic & \Delta H > 0 \end{cases} \tag{4}$$

Helmholtz function, F

$$F \equiv U - TS = \{(6)\} = F(T,V) \tag{5}$$

$$dF = \{(1)\} = TdS - pdV - TdS - SdT = -SdT - pdV \tag{6}$$

Gibbs function, G

$$G \equiv H - TS = \{(8)\} = G(T,p) \tag{7}$$

$$dG = \{(3)\} = TdS + VdP - TdS - SdT = -SdT + VdP \tag{8}$$

Maxwell Relations[16]

Derivation of generalized maxwell

$$df\left(x,y\right) = \left(\frac{\partial f\left(x,y\right)}{\partial x}\right)_y dx + \left(\frac{\partial f\left(x,y\right)}{\partial y}\right)_x dx \tag{9}$$

Work Generalization[17]

3rd Law[18]

Classical Statistical Mechanics

Equipartition[19]

Partition Function[20]

Statistical Mechanics on Ideal Gases[21]

Chemical Potential[22]

Quantum statistics

Bose-Einstein Distribution[29]

Bose Gases[30]

Fermi-Dirac Distribution[29]

Fermi Gases[30]

Phonons[23,34]

Real Gases[26.1,26.4]

Phase Transisions[28.1-3]

Copyright © 2013 Jim Holmström

http://www.cheatsheet.jim.pm?subject=thermalphysics