Constants:

$\sigma=5.670400\times10^{-8}\,W/m^2\cdot K^4$; $N_A=6.02\times10^{23}$; $R=8.314\,J/mol\cdot K$; $R=0.08206\,\frac{L\cdot atm}{mol\cdot K}$; $k=\frac{R}{N_A}=1.381\times10^{-23}\,J/molecule\cdot K$

Unit conversion:

- $T_F=\frac{9}{5}T_C+32$; $T_K=T_C+273.15$; $1\,cal=4.186\,J$; $1\,kcal=1000\,cal=4186\,J$; $1\,Btu=252\,cal=1055\,J$

Formula:

- $\Delta L=\alpha L_0\Delta T$ (thermal expansion in 1 dimension) $\Delta V=\beta V_0\Delta T$ (thermal expansion in 3 dimension)
- $Q=mc\Delta T$; $Q=nC\Delta T$ (C is molar heat capacity, could be either C_V or C_p)
- $Q=mL$ (L: latent heat)
- $H=\frac{dQ}{dt}=kA\frac{T_H-T_L}{L}$ (heat conduction); $H=Ae\sigma T^4$ (heat radiation)
- $pV=nRT$ (ideal gas); $(p+\frac{an^2}{V^2})(V-nb)=nRT$ (van der Waals gas (non-ideal gas))
- $K_{tr}=\frac{3}{2}nRT$ (total kinetic energy); $E_k=\frac{1}{2}m(v^2)_{av}=\frac{3}{2}kT$ (single molecule kinetic energy)
- $v_{rms}=\sqrt{\frac{3kT}{m}}=\sqrt{\frac{3RT}{M}}$ (rms speed of gas molecules); $C_V=\frac{dof}{2}R$ (molar heat capacity in constant volume condition)
- $W=\int_{V_1}^{V_2}p\,dV$ (work done by a system); $\Delta U=Q-W$ (first law of thermodynamics)
- $C_V+R=C_p$ (for ideal gas)
- $pV^\gamma=constant$ (for ideal gas undergoes adiabatic process) where $\gamma=\frac{C_p}{C_V}$
- $e=\frac{W}{|Q_H|}=1-\left|\frac{Q_C}{Q_H}\right|$ (efficiency of heat engine)
- $e=1-\frac{1}{r^{\gamma-1}}$ (efficiency of Otto cycle engine); $e_{Carnot}=\frac{T_H-T_C}{T_H}$ (efficiency of Carnot cycle engine)
- $K=\frac{|Q_C|}{|W|}=\frac{H}{P}$ (coefficient of performance)
- $\Delta S=\int_1^2\frac{dQ}{T}$ (Entropy); $\Delta S\geq0$ (second law of thermodynamics)