Thermodynamic Variables

Generalized forces			**Generalized displacements**	
Pressure	P		Volume	V
Surface tension	σ		Area	A
Tension	J		Length	L
Magnetic field	$\mathcal{H}$		Magnetization	**M**
Electric field	$\mathcal{E}$		Polarization	**P**
Chemical potential	μ		Number	N
Temperature	T		Entropy	S

Write X for V, A, L, (V**M**), or (V**P**)
Write Y for ($-P$), σ, J, $\mathcal{H}$, or $\mathcal{E}$

Potentials			
Energy	E		$dE = TdS + YdX + \mu dN$
Enthalpy	H	$E-XY$	$dH = TdS - XdY + \mu dN$
Helmholtz free energy	A	$E-ST$	$dA = -SdT + YdX + \mu dN$
Gibbs free energy	G	$E-TS-XY$	$dG = -SdT - XdY + \mu dN$
Grand potential	Φ	$E-TS-\mu N$	$d\Phi = -SdT + YdX - Nd\mu$

Response functions		
Heat capacity at constant X	C_X	$\left(\frac{\partial E}{\partial T}\right)_X$
Heat capacity at constant Y	C_Y	$\left(\frac{\partial H}{\partial T}\right)_Y$
Compressibility	$\kappa_{S \text{ or } T}$	$-\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_{S \text{ or } T}$
Thermal expansion coefficient	α_P	$\frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P$
Magnetic susceptibility	$\chi_{S \text{ or } T}$	$-\left(\frac{\partial M}{\partial \mathcal{H}}\right)_{S \text{ or } T}$

Maxwell relations	
$\left(\frac{\partial X}{\partial y}\right)_Y = \left(\frac{\partial x}{\partial Y}\right)_y$	$\left(\frac{\partial X}{\partial x}\right)_Y = -\left(\frac{\partial y}{\partial Y}\right)_x$

Variable pairs (X,Y) and (x,y). Here X includes S and N, and Y includes T and μ.