Physics 603 Some important ideas since the midterm
Update from Spring 2012
version 0.7

General ideas: Dependence on spatial dimension and energy dispersion relation
Density of states (DOS)
Doable models: 2-state/Ising, SHO, ideal gas
Homework problems and tweaks thereof
How to calculate canonical and grand canonical partition functions Z_N and $\mathcal{Z}$; then how to get U, βpV, F, S, Cv, etc. from them. How to calculate number of configurations of certain energy, etc., to get W (or Ω) and then S from it.

Why/how the Boltzmann factor arises
Liouville theorem and its implications; Legendre transformations: how to do them and what they accomplish
Extensive and intensive thermodynamic variables
Meaning, role, and importance of λ_T
How to go from discrete sums over momentum or wavevectors to integrals over them, and why this can fail for Bose condensates
Equipartition and generalizations, meaning of negative temperature
Properties of ideal gas
Diatomic gases: vibrational, rotational degrees of freedom, freeze-out, nuclear-spin & rotational angular mom.
~~Chemical equilibrium, writing down the reaction constant from the chemical equation~~
Bose gas, Bose-Einstein distribution
Role of polylogarithm and what happens in Bose-Einstein condensation
Behavior of chem. pot. μ and fugacity z
How Planck formula explains blackbody radiation
Einstein & Debye models and what they mean
Fermi gas and Fermi-Dirac distribution function
Sommerfeld expansion to lowest order and applications to U, Cv, Pauli paramagnetic susceptibility χ_p
~~Virial expansion, $B_2(T)$ and $B_3(T)$ for simple interactions~~
Phase transitions, van der Waals equation of state and Maxwell construction, coexistence regions; phase diagrams; first order vs. continuous
Ising model results: mean field/Bragg-Williams, quasichemical/Bethe-Peierls-Weiss, 1D, results of exact 2D
Applications of Ising model: 2-state systems, lattice gas, binary alloy
Landau theory of phase transitions