Final Exam – Skills List

1. Given a crystal structure (CsCl, NaCl, fluorite, or zinc blende), and a sufficient set of the theoretical density, the ionic radii, and the atomic weights, calculate the remaining unknown (either the ionic radius or atomic weight of one of the species, or the theoretical density).

2. Given a steady-state diffusion problem and a sufficient set of the concentrations, the sample thickness, the flux, the preexponential, the activation energy for diffusion, and the temperature, solve for the remaining variable.

3. Given a ceramic which follows the Weibull distribution, and the values of any five of ϕ, v, v_0, σ, σ_0, or m, find the value of the remaining variable.

4. Given an overall composition and thermal history on a binary phase diagram determine the phases present and their relative amounts.

5. Given the tensile properties and volume fractions of the fibers and the matrix in a continuous-and-aligned-fiber reinforced composite, calculate the longitudinal strength of the composite, or, given the desired longitudinal strength of a continuous-and-aligned-fiber reinforced composite and the tensile properties of the fibers and the matrix, calculate the volume fractions of the fibers and the matrix.

6. Given any three of the thermal diffusivity, D_T, the thermal conductivity, k, density, ρ, and the heat capacity, c_P, of a material calculate the fourth. Also given any five of T_0, T_s, $T(x, t)$, D_T, x, or t in a semi-infinite conduction with constant surface temperature problem, calculate the sixth.