Donald P. Shiley School of Engineering
EGR 221 Materials Science
Assignment 7, Fall 2015

1) Define a slip system. What defines a slip plan and a slip direction within a crystal? What is the main slip system in a BCC crystal?
2) Define/describe the differences between resolved shear stress and critical resolved shear stress.
3) Consider a metal with a single crystal oriented such that the normal to the slip plane is 30° and the angle to the slip direction is 65°, with respect to the tensile axis (the loading direction). If the critical resolved shear stress is 21 MPa, what applied normal stress is required to cause the single crystal to yield?
4) Repeat problem 3, but with a differently oriented crystal. A single crystal oriented such that the normal to the slip plane is 45° and the angle to the slip direction is 45°, with respect to the tensile axis (the loading direction). If the critical resolved shear stress is 21MPa, what applied normal stress is required to cause the single crystal to yield?
5) Are single crystal metals (and alloys) isotropic with regards to yield strength? Are polycrystalline metals (and alloys) isotropic with regards to yield strength? Explain.
6) Briefly explain why high angle grain boundaries are more effective at preventing dislocation slip than low angle grain boundaries.
7) Briefly explain why FCC materials tend to be more ductile than BCC materials.
8) Does increasing the dislocation density (in other words, more dislocations per volume) increase strength, decrease strength of have no effect on strength of an alloy? Explain.
9) Briefly describe one way to increase dislocation density and one way to decrease dislocation density.
10) Why would metals behave as brittle materials if they have no dislocations?
11) Explain what each of the following strengthening mechanisms are and explain how dislocations are involved with each:
    a. Grain size reduction
    b. Solid-solution strengthening
    c. Strain hardening