Donald P. Shiley School of Engineering
EGR 221 Materials Science
Assignment 9, Fall 2015

*NOTE: various graphs, some from your textbook, have been included at the end of this assignment. They may or may not be useful. If you do use them in your work, be sure to copy them into your homework – mark on them appropriately, and **cite** them.*

1) The following are often used as prefixes or suffixes in technical vocabulary in medicine, physics, engineering, etc. For each of these, determine the origin (Latin or Greek), "translate" it into English, and provide a common example of its use. Example:
REF: I used http://wordinfo.info/words/index/info/search_box/index for the following answers.

Homo
Latin origin meaning: human beings, mankind; literally, "man"; however, it generally also includes, "woman" or "women". As in *homo sapiens*
Also in Greek: Greek origin meaning: same, equal, like, similar, common; one and the same. As in homogenized milk (milk that has been processed to prevent the cream from separating).

Provide a similar description/answer for the following: hetero, poly, iso, trop, plast, morph, hyper, hypo, meta, eu, pro, pre oid, ic, ous, ite
You may use the same link I referenced above or other sources, but you MUST cite your sources (like I have).

2) The following (a through l) are to be graded as single problems each.
For lead-tin (Pb-Sn) alloy, answer the following questions. Clearly mark the phase diagram to help communicate your answers where appropriate. Use a straight edge (your ID card may be pretty straight). You may use the space below to answer the questions. Note, the phrase "slowly cooled" is meant to imply that equilibrium has been attained.

a) What critical but basic assumption is necessary to answer the following types of questions regarding reading a phase diagram?

b) What is the eutectic composition and the eutectic temperature for Pb-Sn?

c) Regardless of temperature, what is the maximum amount of tin that can be dissolved in lead (α phase)? What is the maximum amount of lead that can be dissolved in tin (β phase)?

d) Cite the phases that are present and the composition of each phase:
   i) C_0 = 10%Sn, 90%Pb, 200°C
   ii) C_0 = 30%Sn, 70%Pb, 180°C
   iii) C_0 = 90%Sn, 10%Pb, 180°C
   iv) C_0 = 62%Sn, 38%Pb, 190°C
   v) C_0 = 62%Sn, 38%Pb, 180°C

e) If the microstructure of a Pb-Sn alloy at 185°C is composed of 75wt% α and 25wt% liquid, approximately what is the overall composition of the alloy?

f) If an alloy composed of 30wt% Sn and 70wt% Pb is slowly cooled from liquid to 185°C, what phases would be present and what is their composition?

g) If an alloy composed of 30wt% Sn and 70wt% Pb is slowly cooled from liquid to 185°C, how much of each phase will be present?

h) If an alloy composed of 30wt% Sn and 70wt% Pb is slowly cooled from liquid to 180°C, what phases would be present and what is their composition?

i) If an alloy composed of 30wt% Sn and 70wt% Pb is slowly cooled from liquid to 180°C, what would the weight percentage be of α and β?

j) If an alloy composed of 30wt% Sn and 70wt% Pb is slowly cooled from liquid to 180°C, what would the weight percentage be of the microstructures referred to as primary α and of eutectic structure? Hint: consider problem (g) above – the α is happy being α at 185°C and at 180°C, so it remains (primary α) but the liquid upon solidification goes through the eutectic reaction resulting in a eutectic microstructure.

k) What is one common application of Pb-Sn alloy? Are electronics companies in the United States allowed to use Pb-Sn alloys? What about companies in Europe?

l) Sketch the appearance of the microstructure in part (j) labeling and describing the various constituents.