Question 1:

   a) What is the difference between a phase and a micro constituent?
   b) What are some limitations of phase diagrams?

Question 2:

i)   Is it possible to have a copper-nickel alloy that, at equilibrium, consists of a liquid phase of composition 20 wt% Ni-80 wt% Cu and also an α phase of composition 37 wt% Ni-63 wt% Cu? If so, what will be the approximate temperature of the alloy? If this is not possible, explain why.

ii)   Briefly explain why, upon solidification, an alloy of eutectic composition forms a microstructure consisting of alternating layers of the two solid phases.
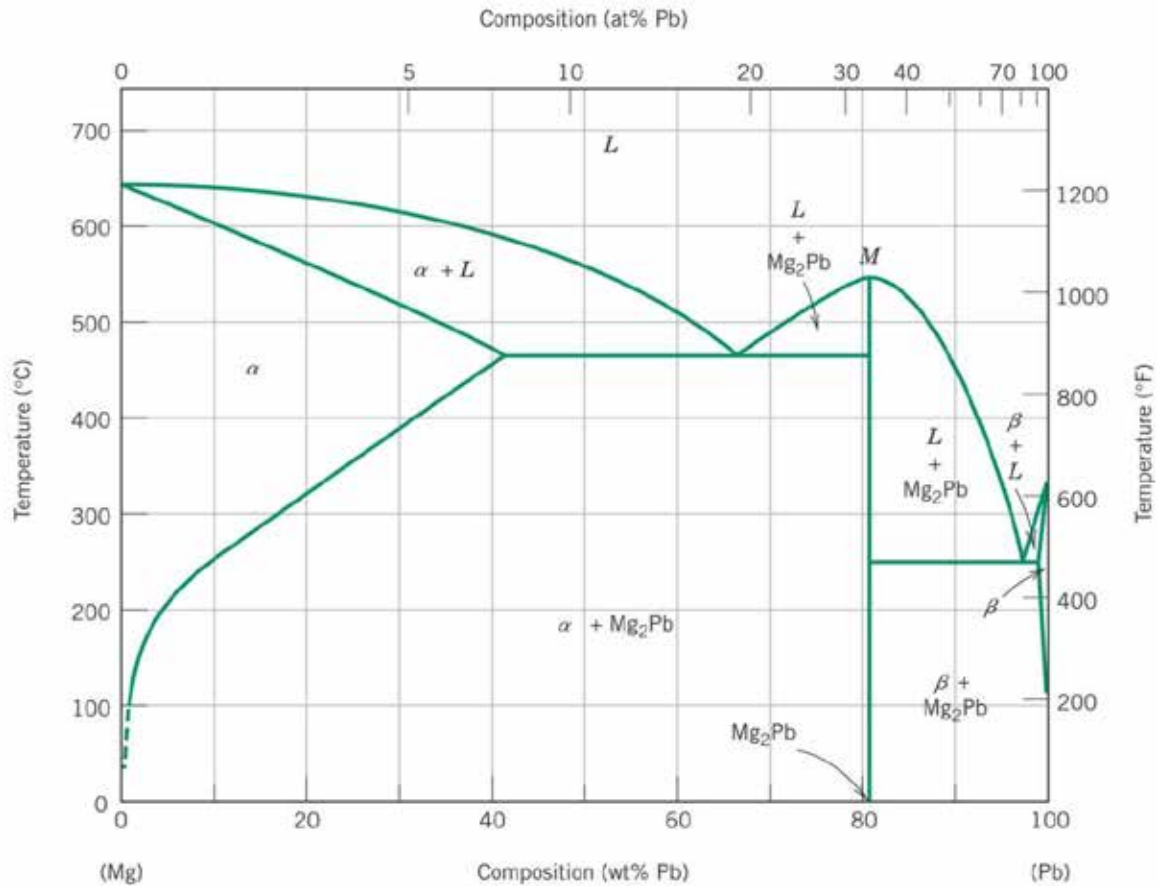
Question 3:

Construct the hypothetical phase diagram for metals A and B between temperatures of 600°C and 1000°C given the following information (assume all phase boundaries are straight lines):

   ·   The melting temperature of metal A is 940°C.
   ·   The solubility of B in A is negligible at all temperatures.
   ·   The melting temperature of metal B is 830°C.
   ·   The maximum solubility of A in B is 12 wt% A, which occurs at 700°C.
   ·   At 600°C, the solubility of A in B is 8 wt% A. One eutectic occurs at 700°C and 75 wt% B -25 wt%A.
   ·   A second eutectic occurs at 730°C and 60 wt% B-40 wt% A.
   ·   A third eutectic occurs at 755°C and 40 wt% B-60 wt% A.
   ·   One congruent melting point occurs at 780°C and 51 wt% B-49 wt% A.
   ·   A second congruent melting point occurs at 755°C and 67 wt% B-33 wt% A.
   ·   The intermetallic compound AB exists at 51 wt% B-49 wt% A.
   ·   The   intermetallic   compound AB_2 exists   at   67   wt%   B-33   wt%   A.

Question 4:

Cite the phases that are present and the phase composition for the following alloy.

   (1) 37 lbm Pb and 6.5 lbm Mg at 400 °C

Composition (at% Pb)

Question 5:
A 50 wt% Pb-50 wt% Mg alloy is slowly cooled from 700°C (1290°F) to 400°C (750°F). Use Magnesium-Lead Phase Diagram from Question 2.
      (a) At what temperature does the first solid phase form?
      (b) What is the composition of this solid phase?
      (c) At what temperature does the liquid solidify?

Question 6:
Consider 1.0 kg of austenite containing 1.15 wt% C, cooled to below 727°C (1341°F).
      (a) How many kilograms each of total ferrite and cementite form?

(b) How many kilograms each of pearlite and the proeutectoid phase form?

(c) Schematically sketch and label the resulting microstructure.