**Sheet 2**

**PHASE DIAGRAMS**

**Q1-2** A lead–tin alloy of composition 30 wt% Sn–70 wt% Pb is slowly heated from a temperature of 150oC

**(a)** At what temperature does the first liquid phase form?

**(b)** What is the composition of this liquid phase?

**(c)** At what temperature does complete melting of the alloy occur?

**(d)** What is the composition of the last solid remaining prior to complete melting?



**Q2-2** A 2.0-kg specimen of an 85 wt% Pb–15 wt% Sn alloy is heated to (200oC ); at this temperature it is entirely an α-phase solid solution. The alloy is to be melted to the extent that 50% of the specimen is liquid, the remainder being the α phase. This may be accomplished by heating the alloy or changing its composition while holding the temperature constant.

**(a)** To what temperature must the specimen be heated?

**(b)** How much tin must be added to the 2.0-kg specimen at 200oC to achieve this state?

**Q3-2** Consider a Pb–15% Sn alloy. During solidification, determine (a) the composition of the first solid to form, (b) the liquidus temperature, solidus temperature, solvus temperature, and freezing range of the alloy, (c) the amounts and compositions of each phase at 260°C, (d) the amounts and compositions of each phase at 183°C, and (e) the amounts and compositions of each phase at 25°C.

**Q4-2** Consider a Pb–70% Sn alloy. Determine

(a) if the alloy is hypoeutectic or hypereutectic,

(b) The composition of the first solid to form during solidification,

(c) The amounts and compositions of each phase at 184°C,

(d) The amounts and compositions of each phase at 182°C,

(e) The amounts and compositions of each micro constituent at 182°C, and

(f) The amounts and compositions of each phase at 25°C.

**Q5-2** A Pb–Sn alloy contains 23% primary α and 77% eutectic micro constituent.

Determine the composition of the alloy.

**Q6-2** Calculate the total amount of α and β and the amount of each micro constituent in a Pb–50% Sn alloy at 182°C. What fraction of the total α in the alloy is contained in the eutectic micro constituent?

**Q7-2** Based on the following observations, construct a phase diagram. Element *A* melts at 850°C and element *B* melts at 1200°C. Element *B* has a maximum solubility of 5% in element *A*, and element *A* has a maximum solubility of 15% in element *B*. The number of degrees of freedom from the phase rule is zero when the temperature is 725°C and there is 35% *B* present. At room temperature 1% *B* is soluble in *A* and 7% *A* is soluble in *B*.