Fall 1987

Two metals, A and B, whose melting points are 350°C and 650°C respectively are miscible in all proportions in the liquid state and are partially soluble in one another in the solid state, the maximum solubilities being 5% A and 2% B by mass. At 200°C the solubilities are 1% A and 0.50% B. The two metals form a compound with formula AB which melts at 450°C. The atomic masses of A and B are 110 and 120 respectively. Eutectics are formed at 7.5% and 60% by mass of B and at temperatures of 300°C and 400°C respectively.

(a) Sketch and label the equilibrium temperature-composition diagram (composition as mass %B). Assume all lines are straight.

(b) For an alloy containing 40% B, estimate the following:

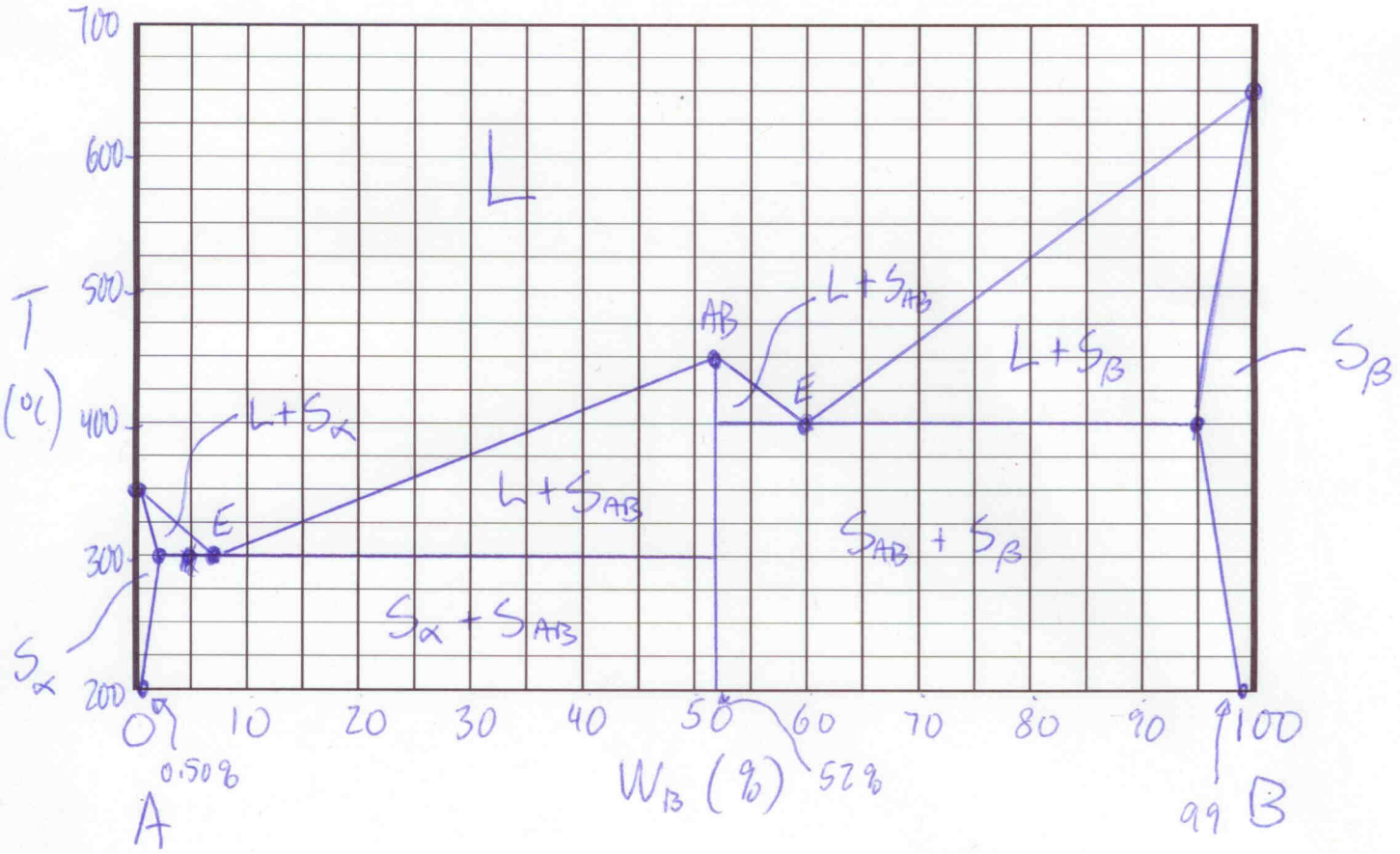
(i) The temperature at which melting begins, on heating from 200°C.

(ii) The temperature at which melting is complete.

(iii) The composition & relative amount of the phases for a mixture in equilibrium at 350°C.

Ans. (b) (i) 300°C, (ii) 400°C,

(iii) $L(18\%B)+S_{AB}(52\%B)$, $m_L=0.55m_{AB}$



(compound AB → 1:1 molar ratio of A and B

so $W_B(\%) = \frac{120}{110+120} = 0.5217 \rightarrow 52.17\%$