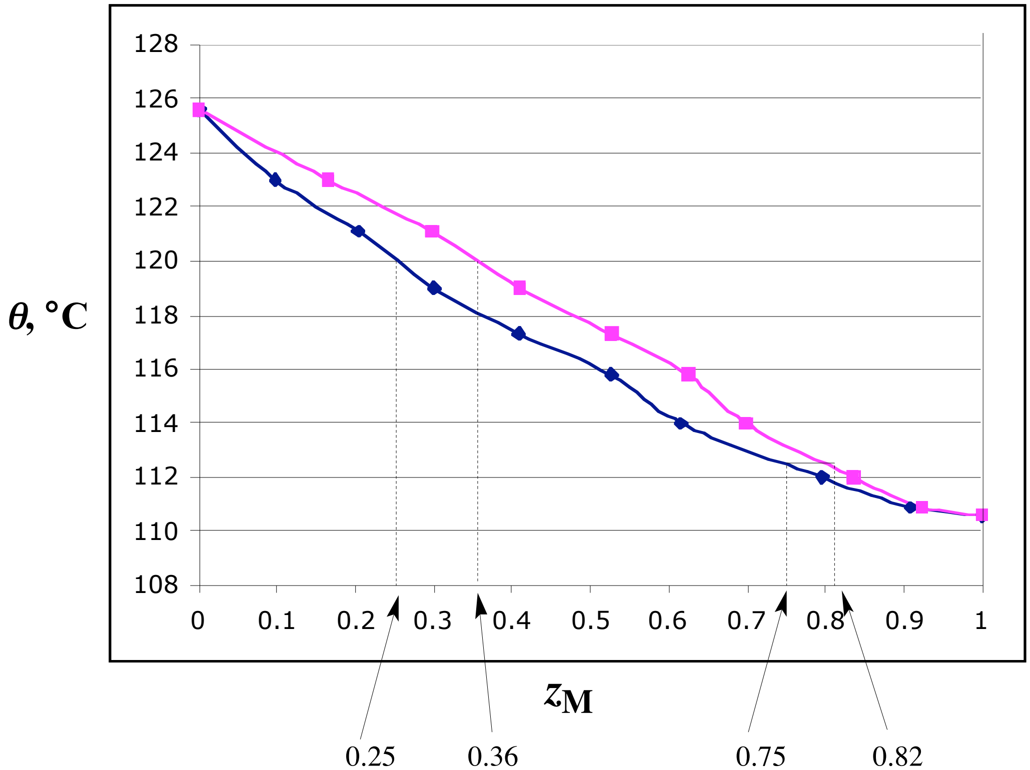
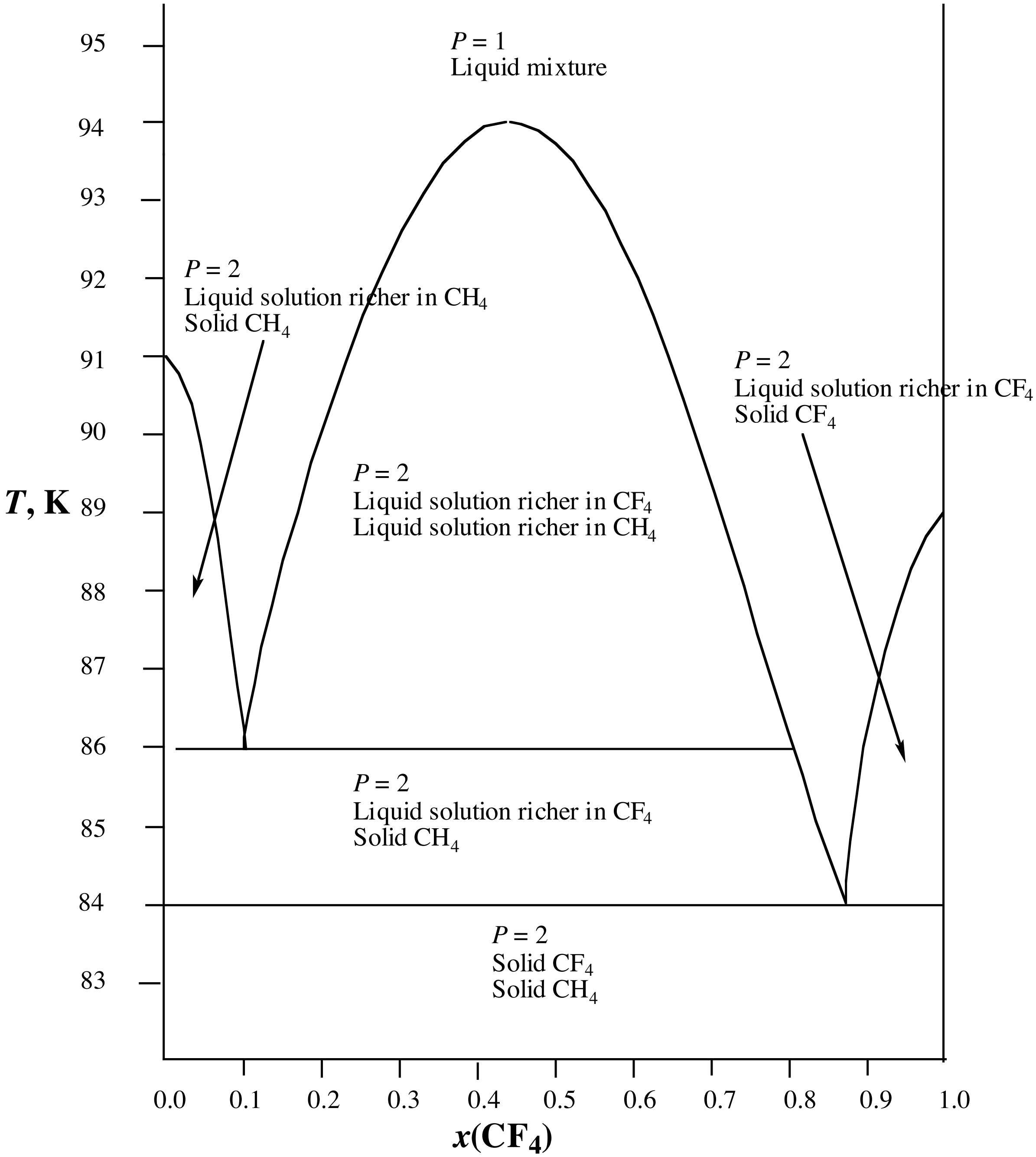
Solutions 8

1.

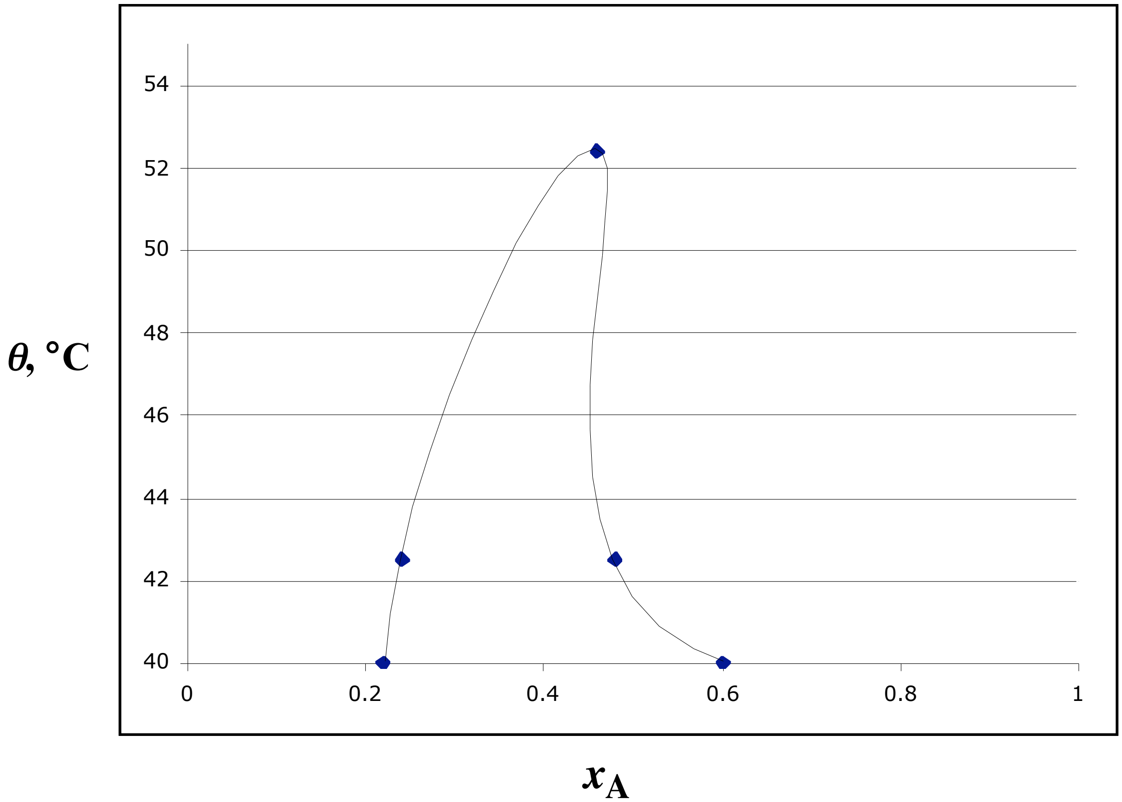


2.



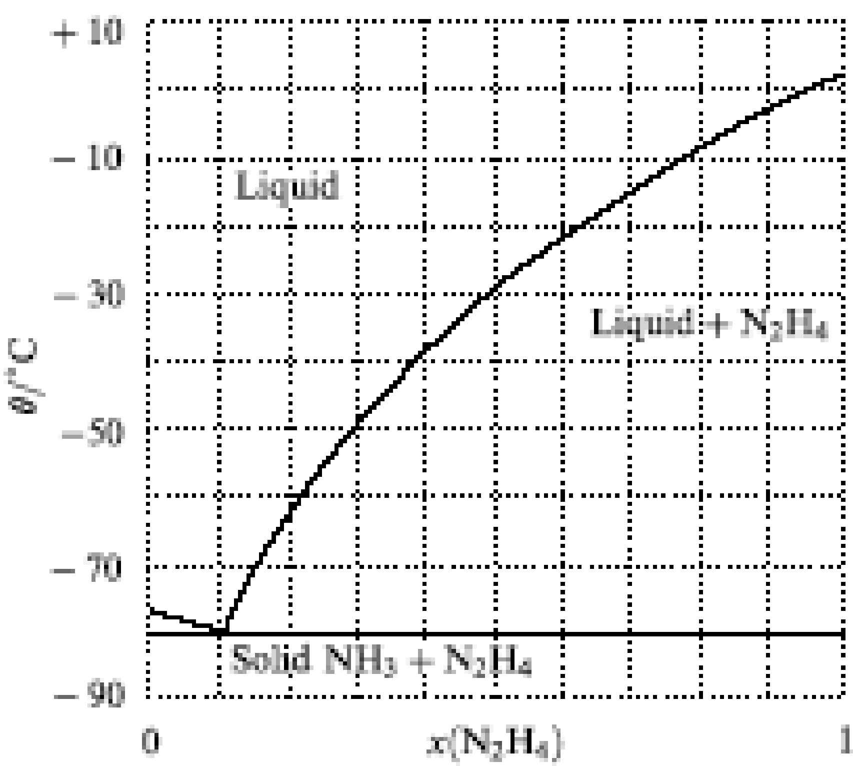
$P = 1$
Liquid mixture
$P = 2$
Liquid solution richer in CH_4
Solid CH_4
$P = 2$
Liquid solution richer in CF_4
Liquid solution richer in CH_4
$P = 2$
Liquid solution richer in CF_4
Solid CF_4
$P = 2$
Liquid solution richer in CF_4
Solid CH_4
$P = 2$
Solid CF_4
Solid CH_4
T, K
95
94
93
92
91
90
89
88
87
86
85
84
83
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
$x(CF_4)$

3.

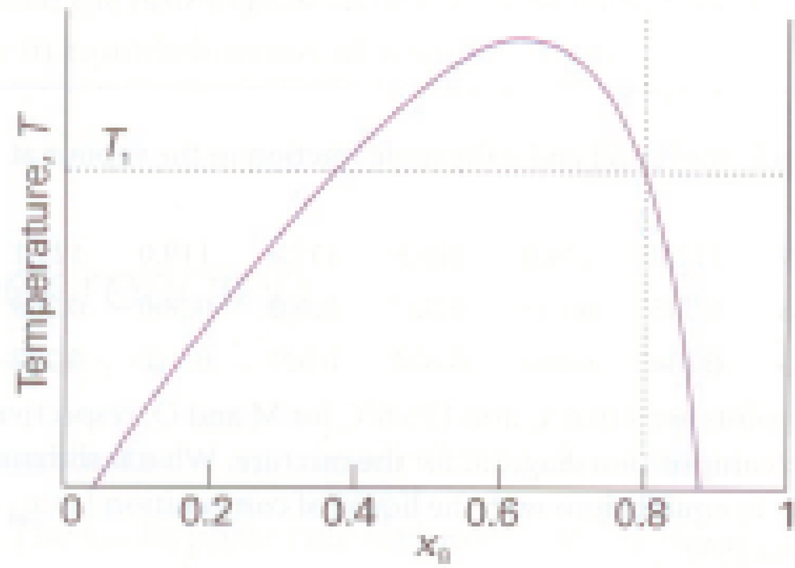


(a) When x_A falls to 0.47, a second liquid phase appears. The amount of new phase increases as x_A falls and the amount of original phase decreases until, at $x_A = 0.314$, only one liquid remains.
(b) The mixture has a single liquid phase at all compositions.

4.



5.



Initially (at the temperature corresponding to the x axis), two liquid phases are present with compositions of I: $x_B \approx 0.87$ and II: $x_B \approx 0.04$. The relative abundance I/II is determined by the lever rule: $(0.8 - 0.04)/(0.87 - 0.80) = 10.86$.

As the temperature is increased along the isopleth (the dashed vertical line), phase I becomes richer in A (poorer in B) and, on the contrary, phase II is being enriched in the B component. Meanwhile, according to the lever rule, the amount of phase I increase, as does the relative abundance I/II. At T_1, when the isopleth crosses the phase boundary, formally still two phases are at equilibrium, the B-rich solution phase and an infinitesimal amount of the A-rich solution. Above T_1, only one liquid phase (merged solution) exists, as the two liquids become completely miscible.

6. See Fig. 8.6. The feature denoting incongruent melting is circled. Arrows on the tie line indicate the decomposition products. There are two eutectics: one at $x_B = \boxed{0.53}$, $T = \boxed{T_2}$; another at $x_B = \boxed{0.82}$, $T = \boxed{T_3}$.

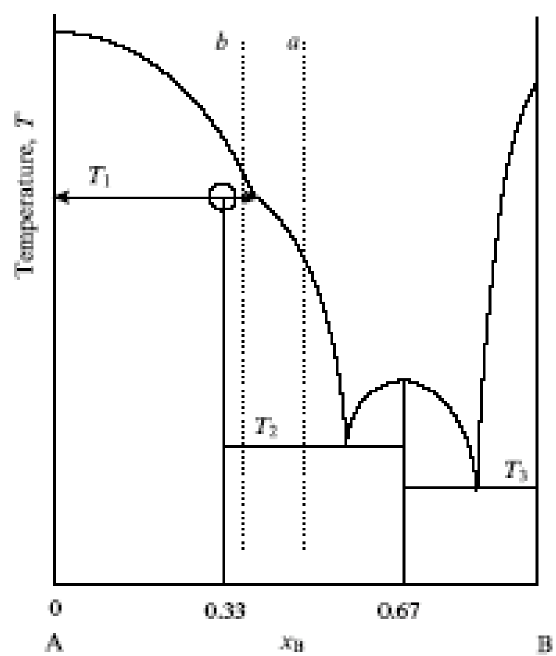


Figure 8.6

7. The cooling curves corresponding to the phase diagram in Fig. 8.7(a) are shown in Fig. 8.7(b). Note the breaks (abrupt change in slope) at temperatures corresponding to points a_1, b_1, and b_2. Also note the eutectic halts at a_2 and b_3.

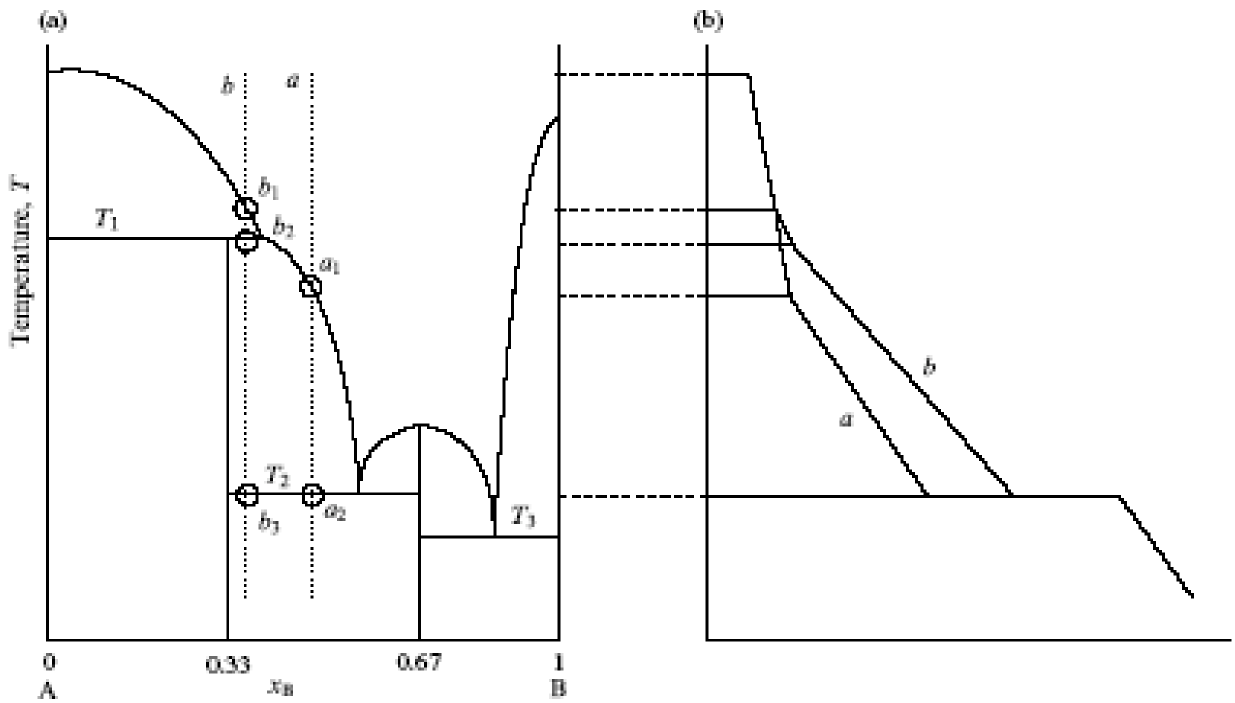
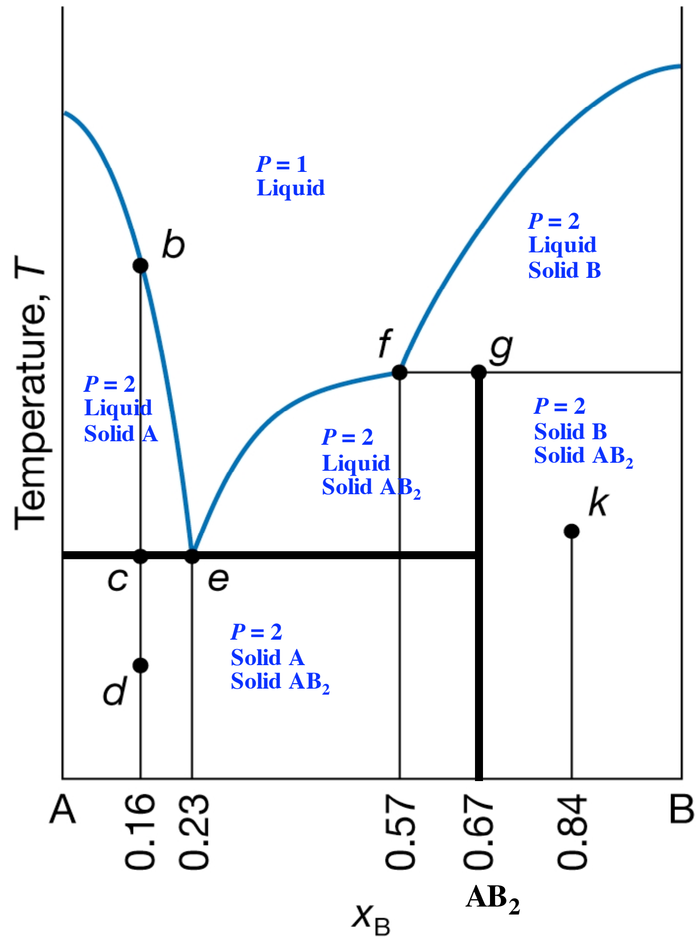


Figure 8.7

8.



Cooling curves