Tutorial problems and questions

1. Shown in Fig. 17 is the water-salt phase diagram. As is clear from the figure, there is an eutectic reaction at -21^{0}C where pure ice and pure salt are formed. Thus, given the sea water contains 3.5% salt, it is possible to extract pure water from the same by cooling it just below -21^{0}C. Calculate the amount of pure water that you can extract from sea water by cooling it?

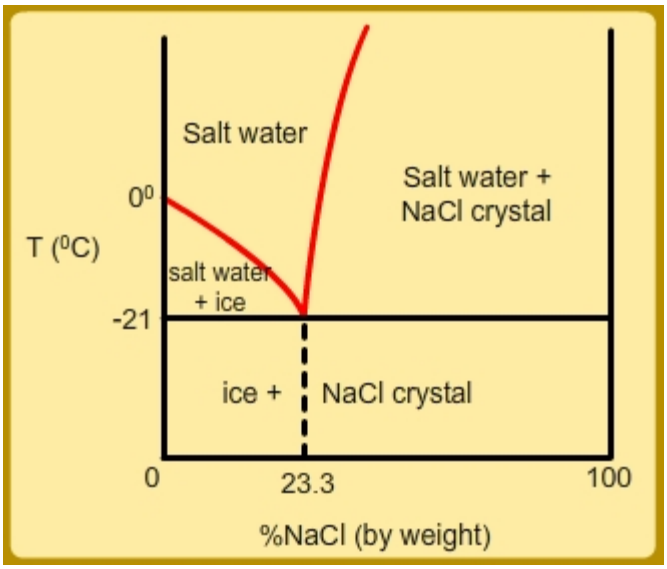

Figure 17: Water-salt phase diagram.

Answer

We use the Lever rule. Since the overall composition is 3.5%, and the eutectic composition is 23.3%, we get the ice fraction as $\frac{23.3-3.5}{23.3-0.0} = 0.85$. So, one can extract about 85% of pure water from the sea water by cooling just below the eutectic line.

2. Shown in Fig. 18 is a simple phase diagram which has a miscibility gap at low temperatures. Show the G versus x_B diagram at the tempratures T_1 and T_2 marked on the phase diagrm.

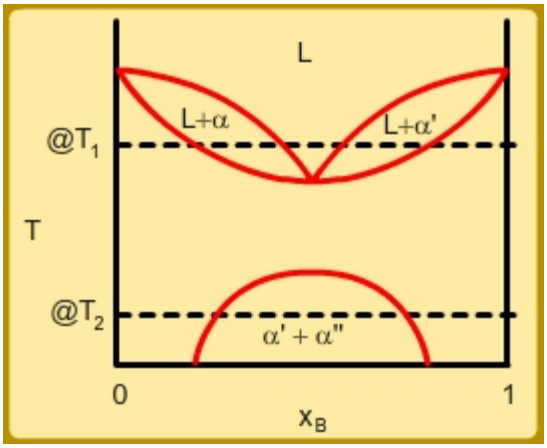

Figure 18: Phase diagram with a miscibility gap at low temperatures.

Answer

See Fig. 19.

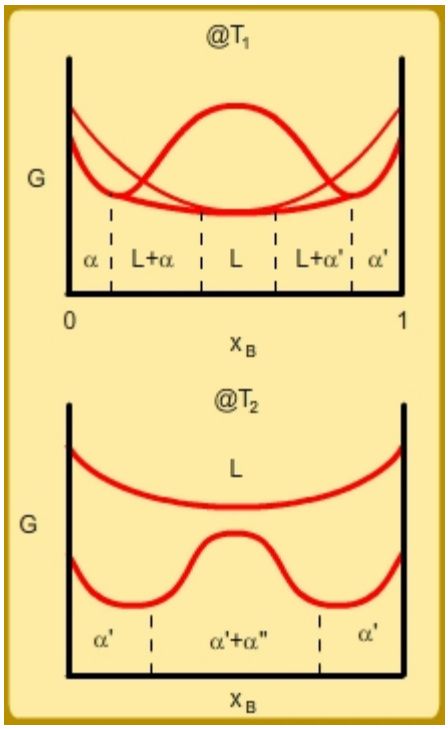

Figure 19: Solution to porblem 2 above

3. Consider a binary alloy in which P is also allowed to change; how many phases can be at equilibrium in such a system?

Answer

Since $P + F = C + 2 = 2 + 2 = 4$, and since at best *F = 0*, the number of phases that can be at equilibrium in such a system is 4.