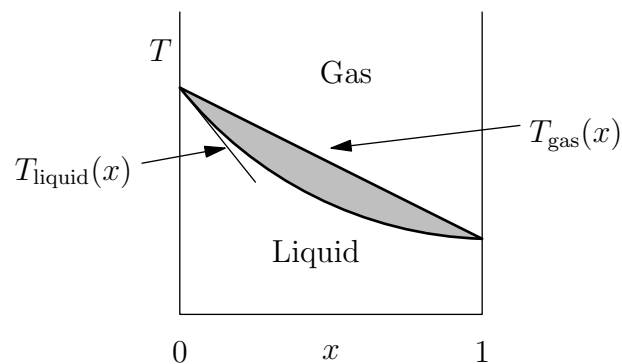


M00T.1—Distillation

Problem

Sketched below is the phase diagram for a solution of two substances, A and B , at pressure $P = 1$ atm, where x is the mass fraction $x = \frac{M_A}{M_A + M_B}$. Assume that in the regime of interest, the boundaries of the two phase regime are sufficiently approximated by the linear functions:

$$\begin{aligned} T_{\text{gas}}(x) &= T_0 - x, \\ T_{\text{liquid}}(x) &= T_0 - 3x. \end{aligned}$$



The shaded region indicates phase coexistence.

A beaker has initially a mixture of liquids at the mass fraction $x_i = 0.2$. The liquid is brought to boil, and maintained at a boiling temperature, at atmospheric pressure.

- Does the boiling increase or decrease the concentration of the A substance in the liquid?
- What portion of the liquid needs to be boiled off in order to change the concentration of A (in the liquid remaining in the beaker) by a factor of 2?