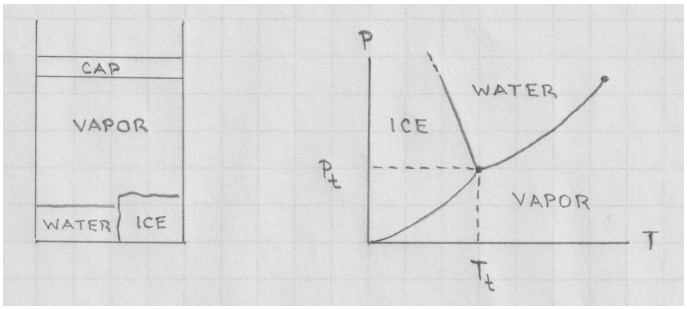
[tex207] Destabilization of triple-point equilibrium II

A cylindrical vessel with a mobile (piston-like) cap of some weight contains $m_s = 1\text{g}$ of ice, $m_l = 1\text{g}$ of water, and $m_g = 1\text{g}$ of H_2O vapor at triple-point equilibrium. There is no heat transfer through any surface and no friction. When the weight of the cap is slightly reduced, it slowly moves upward and stops at a higher position. During this quasistatic process the temperature and the pressure differ only minimally from their triple-point values. Assume the volumes taken up by water and ice to be negligible compared to the volume of the vapor.

(a) Give a detailed description of what happens inside the cylinder while the cap moves upward and what the content looks like once the cap has come to a rest.
(b) Calculate the mass of each phase remaining in the container at the new equilibrium.

Triple-point data: temperature $T_t = 273\text{K}$, pressure $p_t = 611\text{N/m}^2$, vapor density $\rho = 600\text{g/m}^3$, latent heats $L_{lg} = 2495\text{J/g}$, $L_{sl} = 335\text{J/g}$, $L_{sg} = L_{sl} + L_{lg}$.



Solution: