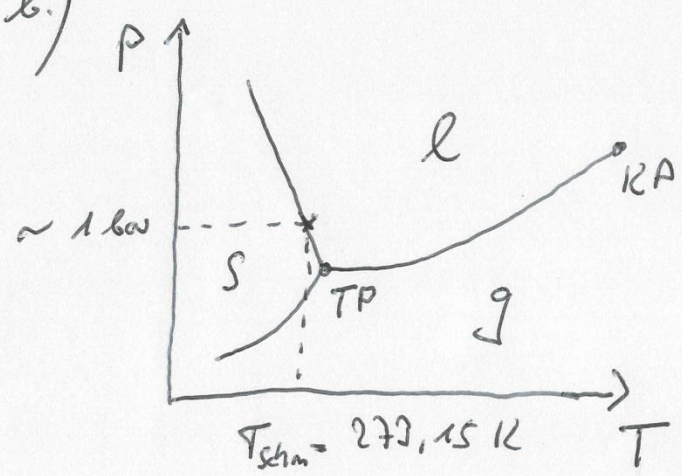
1.)

a.) 273,15 K oder 0 °C

b.)



- Feste und flüssige Phase im GGW
- Nicht Tripelpunkt weil Normaldruck

2.) Clausius - Clapeyron: $\ln\left(\frac{p_2}{p_1}\right) = \frac{\Delta H_V}{R} \times \left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

a.) $\ln\left(\frac{5,3}{1,3}\right) = \frac{\Delta H_V}{8,314\ J/molK} \times \left(\frac{1}{359,0\ K} - \frac{1}{392,2\ K}\right)$

$1,405 = \Delta H_V \times (2,836 \times 10^{-5}\ J^{-1}mol)$

$\Rightarrow \Delta H_V = 49,5\ kJ/mol$

b.) Normalsiedepunkt $\rightarrow$ Normaldruck

$\ln\left(\frac{101,3}{5,3}\right) = \left(\frac{49,5 \times 10^3\ J/mol}{8,314\ J/molK}\right) \times \left(\frac{1}{392,5\ K} - \frac{1}{T_S}\right)$

$2,950 = 15,17 - \frac{5954\ K}{T_S} \quad T_S = 487\ K \simeq 214\ °C$

c.) $\Delta S_V(T_S) = \frac{\Delta H_V(T_S)}{T_S} \simeq \frac{49,5 \times 10^3\ J/mol}{487\ K} = 102\ J/Kmol$

3.)

a.) $pH = -\log [H_3O^+]$

b.) Henderson - Hasselbalch: $pH = pK_S + \log\left(\frac{[A^-]}{[HA]}\right)$

i.) $pK_S = 4{,}76$; $[HA] = [A^-] = \frac{0{,}025\,\ell \times 0{,}1\,\frac{mol}{\ell}}{0{,}050\,\ell} = 0{,}05\,\frac{mol}{\ell}$

$$pH = 4{,}76 + \log\left(\frac{0{,}05}{0{,}05}\right)$$

$$\Rightarrow pH = 4{,}76$$

ii.) $$pH = pK_S + \log\left(\frac{[A^-] - c_S}{[HA] + c_S}\right)$$

$$n_S = 0{,}1\,mol/\ell \times 0{,}0005\,\ell = 5 \times 10^{-5}\,mol$$

$$n_{HA} = n_{A^-} = 0{,}1\,mol/\ell \times 0{,}025\,\ell = 2{,}5 \times 10^{-3}\,mol$$

$$pH = 4{,}76 + \log\left(\frac{\frac{2{,}5 \times 10^{-3}}{0{,}0505} - \frac{5 \times 10^{-5}}{0{,}0505}}{\frac{2{,}5 \times 10^{-3}}{0{,}0505} + \frac{5 \times 10^{-5}}{0{,}0505}}\right)$$

$$\Rightarrow pH = 4{,}74$$

4.) Expansion bei $p = \text{const}$

$$w = -p\,\Delta V \quad \text{(Volumenarbeit)}$$

$$p = 1\ \text{atm} \times \left(1{,}013 \times 10^5\ \text{Pa}/\text{atm}\right) = 1{,}01 \times 10^5\ \text{Pa}$$

$$\Delta V = 100\ \text{cm}^2 \times 10\ \text{cm} \times \left(\frac{1\ \text{m}}{100\ \text{cm}}\right)^3 = 1{,}0 \times 10^{-3}\ \text{m}^3$$

mit $1\ \text{J} = 1\ \text{Pa m}^3$

$$w = -\left(1{,}01 \times 10^5\ \text{Pa}\right) \times \left(1{,}0 \times 10^{-3}\ \text{m}^3\right)$$

$$= -1{,}0 \times 10^2\ \text{J}$$