a) $\bar{T}_1 = 50°C$ $p_{D_1} = 0{,}12$ bar, $T_2 = 250°C$, $p_{D_2} = 40$ bar

Graphische Lösung

$\bar{T}_1 = 50°C = 323\,K \Rightarrow 1/T_1 = 0{,}00310$

$p_1 = 0{,}12$ bar $\Rightarrow \ln(p_1/\text{bar}) = -2{,}12$

$T_2 = 250°C = 523\,K \Rightarrow 1/T_2 = 0{,}00191$

$p_2 = 40$ bar $\Rightarrow \ln\left(\frac{p_2}{\text{bar}}\right) = 3{,}69$

$\Rightarrow A = 13{,}015$ $B = 4882{,}4\,K$

$$\ln(p_D/\text{bar}) = 13{,}015 - \frac{4882{,}4\,K}{T}$$

$$\rightarrow p_D = p_{max} \cdot e^{-\frac{\Delta E}{kT}} \quad \left(= c \cdot e^{-\frac{\Delta E}{kT}}\right)$$

$p_{max} = e^{13{,}015}$ bar $= 4{,}5 \times 10^5$ bar

$\Delta E = B \cdot k = 4882\,K \cdot 1{,}38 \times 10^{-23}$ J/K =

$= 6{,}74 \times 10^{-20}$ J $= 0{,}42$ eV

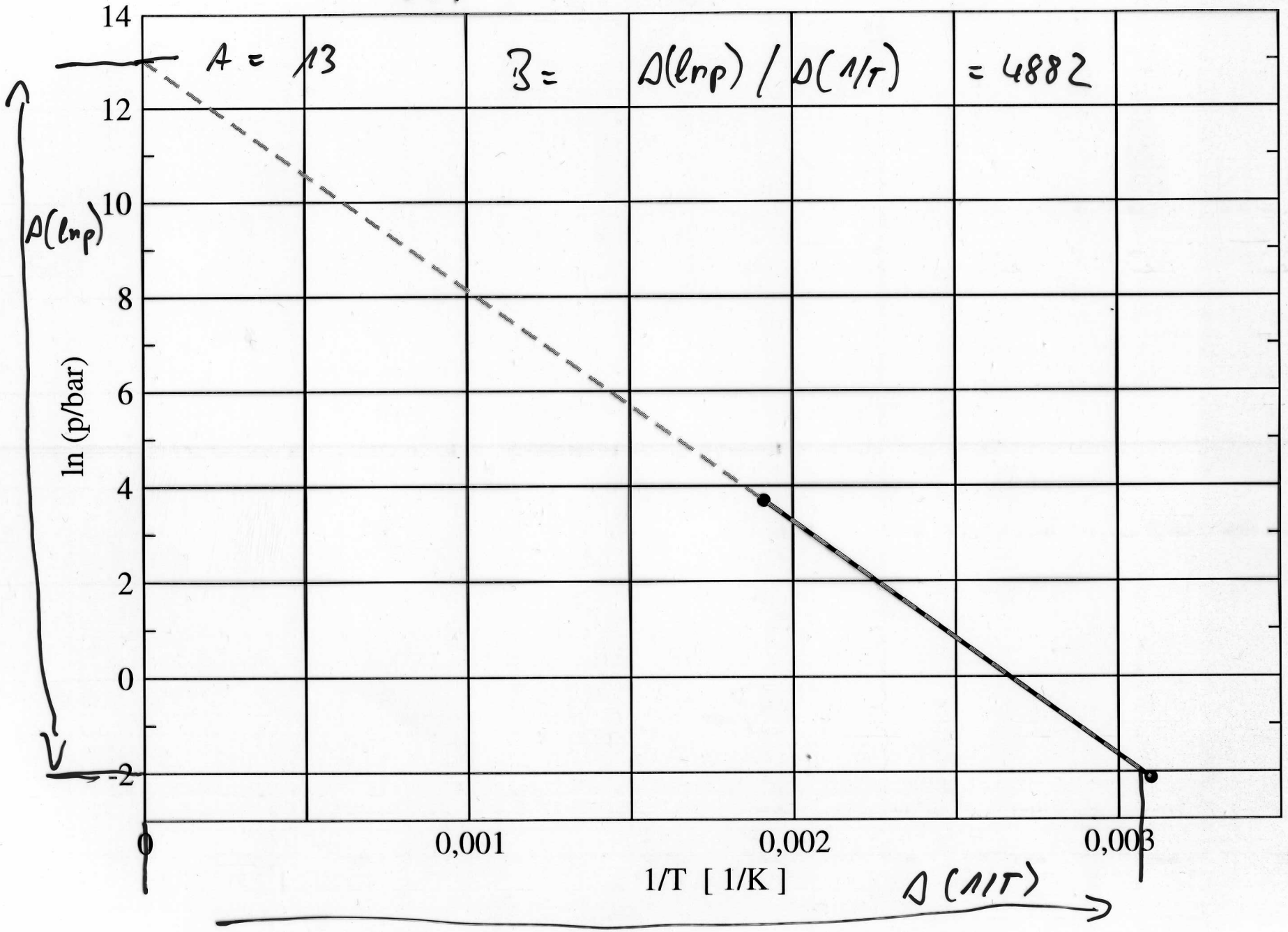
b) $\frac{dp_D}{dT} = -p_{max} \cdot \frac{\Delta E}{k} e^{-\frac{\Delta E}{kT}} \left(-\frac{1}{T^2}\right)$ war falsch in Vorlesung !!

$= -p_{max} \cdot B/T^2 \cdot e^{-B/T}$

i) $20°C = 293\,K$ $dP/dT = 1{,}5 \times 10^{-3}$ bar/K

ii) $200°C = 473\,K$ $dP/dT = 3{,}23 \times 10^{-1}$ bar/K ($\times 200$ ↑)

$\ln p = A - B/T$


A = 13
B = Δ(lnp) / Δ(1/T) = 4882
14
12
10
8
6
4
2
0
-2
ln (p/bar)
Δ(lnp)
0
0,001
0,002
0,003
1/T [1/K]
Δ (1/T)