Summary of lecture 6

• Example: Carbon monoxide poisoning

System of haemoglobin (Hb) either unbound or bound with carbon monoxide (CO) or oxygen (O_2) at T = 310 K.

Grand partition function :

$$\mathcal{Z} = e^0 + e^{\frac{\mu(O_2) - \epsilon(O_2)}{k_B T}} + e^{\frac{\mu(CO) - \epsilon(CO)}{k_B T}}$$

$$= 1 + 40 + 120$$

$$= 161$$

Probability to be unbound $= \dfrac{1}{161} \approx 0.6\%$

Probability to be bound with $O_2 = \dfrac{40}{161} \approx 25\%$

Probability to be bound with CO $= \dfrac{120}{161} \approx 75\%$

Binding energies:

$$\epsilon(CO) = -0.85 eV$$
$$\epsilon(O_2) = -0.7 eV$$

Assuming $\sim 1\%$ concentration of CO:

$$\mu(CO) = -0.7 eV$$
$$\mu(O_2) = -0.6 eV$$