

# cheg325 homework7 SIS 11.5-6

AUTHOR  
kyle wodehouse

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I'll first assume that we don't need to worry about reactions. we know that for a system to be fully specified we need to have  $\mathcal{P}(\mathcal{C} + 1)$  variables specified.

we know that the temperature must be the same on both sides of the membrane which gives us  $\mathcal{P} - 1$  more specification

the condition for equilibrium that  $\bar{G}^I = \bar{G}^{II}$  gives us  $(\mathcal{C} - 2)(\mathcal{P} - 1)$  since only  $\mathcal{C} - 2$  can move between phases.

now, we can figure out our phase rule

$$\begin{aligned}\mathcal{F} &= \mathcal{P}(\mathcal{C} + 1) - [(\mathcal{P} - 1) + (\mathcal{C} - 2)(\mathcal{P} - 1)] \\ &= \mathcal{P}\mathcal{C} + \mathcal{P} - [\mathcal{P} - 1 + (\mathcal{C} - 2)(\mathcal{P} - 1)] \\ &= \mathcal{P}\mathcal{C} + \mathcal{P} - [\mathcal{P} - 1 + \mathcal{C}(\mathcal{P} - 1) - 2(\mathcal{P} - 1)] \\ &= \mathcal{P}\mathcal{C} + \mathcal{P} - [-\mathcal{P} + 1 + \mathcal{C}(\mathcal{P} - 1)] \\ &= \mathcal{P}\mathcal{C} + \mathcal{P} + \mathcal{P} - 1 - \mathcal{C}(\mathcal{P} - 1) \\ &= \mathcal{P}\mathcal{C} - \mathcal{P}\mathcal{C} + 2\mathcal{P} + \mathcal{C} - 1 \\ &= 2\mathcal{P} + \mathcal{C} - 1\end{aligned}$$

and our osmotic equilibrium is two phases, so

$$\boxed{\mathcal{F} = \mathcal{C} + 3}$$

# filler