

Problem from Atkins Chapter 9 (with some rewording)

- 9.19.a) The standard Gibbs free energy of formation of $\text{NH}_3(\text{g})$ is -16.5 kJ/mole at 298 K and one atm. What is the spontaneous direction of reaction if the partial pressures of the gases are 3.0 atm , 1.0 atm , and 4.0 atm for N_2 , H_2 , and NH_3 , respectively?

From last year's take-home

In a recent research paper, a Swiss group studied the Cellular Prion Protein (PrP^{C}), the putative infective agent in spongiform encephalopathy, also known as mad cow disease. They found that this protein forms dimers in solution. Using ELISA, they determined the equilibrium constant for dimerization at three temperatures.

T(°C)	4	25	37
K (nM^{-1})	0.25	0.33	0.39

It is standard practice in biochemistry to report equilibrium constants with units. Convert to the appropriate dimensionless quantity for calculations. The standard state for species in solution is one molar. $\text{nM} = 10^{-9} \text{ M}$.

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- If the initial concentration of PrP^{C} at 25°C is 1.0 nM , what fraction dimerizes at 25°C ?
- What is $\Delta_r G^\circ$ for dimerization at 25°C ?
- What are $\Delta_r H^\circ$ and $\Delta_r S^\circ$ for this reaction?