HOMEWORK # 2

BIOL/CHEM 5312

due Friday, February 6, 2015

van Holde et al. , Chapter 2, p.104-105, problems **2.5, 2.6, 2.7, 2.8**

For particles, use the Boltzmann constant, $k= 1.38 \times 10^{-16}$ erg K^{-1}
For moles, use $R= 8.31$ J K^{-1} $mole^{-1}$ (10^7 erg = 1 Joule)

Also,

1.0 One of the so-called Maxwell relations is $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$

This comes from **dE = TdS - PdV** ,

since dE is an exact differential, $T = \left(\frac{\partial E}{\partial S}\right)_V$ and $-P = \left(\frac{\partial E}{\partial V}\right)_S$

Therefore, by Euler's criterion,

$$\frac{\partial}{\partial V}\frac{\partial E}{\partial S} = \left(\frac{\partial T}{\partial V}\right)_S \quad \text{and} \quad \frac{\partial}{\partial S}\frac{\partial E}{\partial V} = -\left(\frac{\partial P}{\partial S}\right)_V .$$

$$\therefore \quad \left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

Using similar expressions for **dH** and **dG**, derive two other Maxwell relations.

2.0 ITC problem

Ligand A has an extremely high affinity for a receptor, and it cannot be measured by simple isothermal calorimetry. A second ligand, B, has an affinity of 2×10^7 M^{-1} for the same receptor. If the affinity for A is measured in the presence of 250 μM ligand B, the apparent value is found to be 2×10^8 M^{-1}. What is the affinity of the receptor for ligand A?