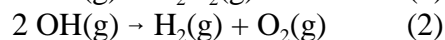
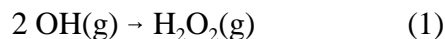


CHEM442-001/002
College of Charleston
Spring 2000
Exam I

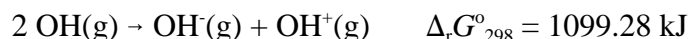
1(10). Consider the following two chemical reactions



Given $\Delta_f G^\circ_{298}/(\text{kJ mol}^{-1}) = 34.23$ for $\text{OH}(\text{g})$ and -105.57 for $\text{H}_2\text{O}_2(\text{g})$, calculate $\Delta_r G^\circ_{298}$ for each reaction.

Which reaction is more spontaneous?

2(10). For the reaction



the value of $\Delta_r H^\circ_{298} = 1068.10 \text{ kJ}$ and is relatively constant over small temperature intervals. Calculate $\Delta_r G^\circ_{200}$ for this reaction.

Has the spontaneity of this reaction increased at this lower temperature?

3(10). Beginning with the differential energy expression

$$dG = -S dT + V dP$$

derive the Maxwell relationship that begins ($\partial S/\dots$).

4(20). Consider an infinite universe of atomic hydrogen at 5 K. Calculate $\Delta\epsilon$, the energy difference in J between the $n = 5$ and the $n = 1$ energy levels.

Calculate N_5/N_1 , the ratio of the numbers of atoms in the $n = 5$ level compared to the $n = 1$ energy level.

5(30). Given

$$R_{n,l}(r) = - \left[\frac{(2Z/na_0)^3 (n-l-1)!}{2n[(n+l)!]^3} \right]^{1/2} e^{-\rho/2} \rho^l L_{n+l}^{2l+1}(\rho)$$

where $\rho = (2Z/na_0)r$ and

