Chemistry-4311
October 31, 2014

Quiz # 7 **Name** Key

$R = 1.987$ cal K^{-1} mol^{-1} $= 8.314$ J K^{-1} mol^{-1} $= 0.08206$ L atm K^{-1} mol^{-1}
$K = {}^{\circ}C + 273.15$

1. Matching (Use a letter only once)

The standard state activity of a solid is a.

The Gibbs energy ΔG_r° for a reaction is d.

If ΔG_r° is negative for a reaction, then the Equilibrium constant K is c one.

Adding a catalyst to a reaction system will change its equilibrium constant. (yes or no) j.

The change in the equilibrium constant versus temperature, the van't Hoff equation, is given by b.

a. one
b. $\ln(K_2/K_1) = -\Delta H_r^{\circ}/R\,(T_2^{-1} - T_1^{-1})$
c. larger than
d. $-RT\ln K$
e. zero
f. $-RT\ln Q$
g. smaller than
h. yes
i. $\ln(K_2/K_1) = -\Delta G_r^{\circ}/RT$
j. no

+2 2. For the reaction $C_2H_4 + H_2 \leftrightarrow C_2H_6$ at 298 K, ΔG_f° is 68.12 kJ/mol for C_2H_4, -32.9 kJ/mol for C_2H_6, and 0.0 kJ/mol for H_2.

a. Calculate ΔG_r° for the reaction at 298 K.

$$\Delta G_r^{\circ} = -32.9 - (+68.12) = -101.02 \text{ kJ/mole}$$

b. Calculate the equilibrium constant K for the reaction at 298 K.

$$\Delta G_r^{\circ} = -RT\ln K = -101020 \frac{\text{J}}{\text{mole}} = -8.314 \frac{\text{J}}{\text{mol-K}} \times 298\text{K} \ln K$$

$$\ln K = 40.79 \qquad K = 5.10 \times 10^{17}$$

+3 3. The folded ↔ unfolded equilibrium constant for a certain peptide is 0.001 at 298 K and 1.0 at 350 K. What is ΔH_r° for this reaction?

$$\ln \frac{1.0}{0.001} = \frac{-\Delta H_r^{\circ}}{R}\left[\frac{1}{350} - \frac{1}{298}\right]$$

$$\Delta H_r^{\circ} = +115.2 \text{ kJ/mol}$$