Chemistry-4311
November 4, 2016

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}
$K = {}^{o}C + 273.15$

1. Matching (Use a letter only once)

ΔG_r for a chemical reaction is given by h.

If the chemical reaction is endothermic, the equilibrium constant j with increase in temperature.

The equilibrium constant varies versus temperature according to a.

Adding a catalyst to a chemical reaction changes the equilibrium constant. (True or False). b

At equilibrium d is zero.

a. $\ln(K_2/K_1) = (-\Delta H_r^{o}/R)[T_2^{-1} - T_1^{-1}]$
b. false
c. decreases
d. ΔG_r
e. $-RT\ln K$
f. true
g. $K_2/K_1 = R\ln(T_2/T_1)$
h. $\Delta G_r^{o} + RT\ln Q$
i. ΔG_r^{o}
j. increases

2½ 2. 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^{o} for this reaction?

$$\ln \frac{K_2}{K_1} = -\frac{\Delta H_r^{o}}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$$

$$\ln \frac{1.0}{0.001} = -\frac{\Delta H_r^{o}}{8.314}\left[\frac{1}{350} - \frac{1}{298}\right]$$

$\Delta H_r^{o} = 115,193$ J
$= 115.193$ kJ

2½ 2. For the reaction $C_2H_4 + H_2 \leftrightarrow C_2H_6$ at 298 K, ΔG_f^{o} 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^{o} for the reaction at 298 K.

$\Delta G_r^{o} = \Delta G_f^{o}(C_2H_6) - \Delta G_f^{o}(C_2H_4)$
$= -32.9 - 68.12 = -101$ kJ

b. Calculate the logarithm of the equilibrium constant lnK for the reaction at 298 K.

$\Delta G_r^{o} = -RT\ln K$

-101×10^3 J $= -8.314 \times 298 \ln K$

$\ln K = 40.8$

$K = 5.06 \times 10^{17}$