Chemistry-4311
October 23, 2009

Quiz #5 **Name** Key

1. Matching (Use a letter only once)

The change in entropy dS is defined as a.

ΔS for heating a pure substance at constant P is j.

The Gibbs energy, G, is b.

At constant T and P, and for only expansion/compression work, ΔG is g for a spontaneous process and c for equilibrium.

a. dq_{rev}/T
b. $H - TS$
c. zero
d. $nR\ln(V_2/V_1)$
e. $\Delta H/T$
f. $U - TS$
g. negative
h. $-nRT\ln(V_2/V_1)$
i. positive
j. $C_P\ln(T_2/T_1)$

2. For a particular biological reaction taking place in the body at 37 °C, the change in enthalpy is -125 kJ/mol and the change in entropy is -126 J/mol-K. Calculate the change in Gibbs energy.

Constant T $273 + 37 = 310$ K

$\Delta G = \Delta H - T\Delta S$

$\Delta G = -125\times10^3$ J/mol $- 310$ K $\times (-126$ J/mol-K$)$

$= -125\times10^3$ J/mol $+ 39\times10^3$ J/mol $= -86$ kJ/mol

3. One mole of an ideal gas at 15° C is expanded isothermally and reversibly from 1.0 L to 5.0 L. What are the values for w, q, ΔU, ΔH, ΔS, and ΔG (R = 8.314 J/mol-K).

Isothermal, ideal gas: $\Delta U = 0$, $\Delta H = 0$ (+1)

(+1) $\Delta U = q + w$ $w = -RT\ln V_2/V_1 = -8.314\times288\times\ln 5$

$q = -w = RT\ln V_2/V_1 = 3.854$ kJ $= -3.854$ kJ

(+1) $\Delta S = \frac{q_{rev}}{T} = \frac{3,854\text{ J}}{288\text{ K}} = 13.4$ J/K

$\Delta G = \Delta H - T\Delta S = 0 - q_{rev} = -3.854$ kJ