Median 91
Two 100's

Chemistry – 4311
October 24, 2014

Exam #2 **Name** Key

(20) 1. Matching (use a letter only once)

The thermodynamic definition of entropy is that dS equals ___e___.

For an increase in entropy there is an ___q___ in disorder.

The Gibbs energy G equals ___c___.

For a spontaneous process at constant T and P, ΔG is ___r___.

At the ___a___ point, the solid, liquid, and vapor phases are in equilibrium,

The chemical potential is the partial molar ___i___.

For an ideal liquid or gas mixture, ___h___ or l is zero.

Raoult's Law is ___f___.

Protein unfolding is an ___p___ process.

Henry's Law applies when the solute mole fraction approaches ___t___.

a. triple

b. ΔS_{mix}

c. H - TS

d. one

e. dq_{rev}/T

f. $P_1 = x_1 P_1^*$

g. decrease

h. ΔH_{mix}

i. Gibbs energy

j. Tdq_{rev}

k. $P_1 = P_1^*/x1$

l. enthalpy

m. positive

n. exothermic

o. critical

p. endothermic

q. increase

r. negative

s. H + TS

t. zero

$c = 3.00 \times 10^8$ m/s

$h = 6.626 \times 10^{-34}$ J s

R= 8.314 J/mol-K

R= 1.987 cal/mol-K

R= 0.08206 L-atm/mol-K

$N_A = 6.02 \times 10^{23}$

1 atm = 101.325 kPa

$k_B = 1.381 \times 10^{-23}$ J/K

(10) 2. Select the correct equation for ΔS.

Ideal gas expansion or compression: d

Heating or cooling a pure substance without a phase change at constant P: a

A phase transition at equilibrium: b

Mixing two ideal gases: e

Transition between two states with probabilities W_1 and W_2: f.

a. $C_p\ln(T_2/T_1)$
b. $\Delta H_{trans}/T_{trans}$
c. $k_B\ln(W)$
d. $nR\ln(V_2/V_1)$
e. $-R(n_1\ln x_1 + n_2\ln x_2)$
f. $k_B\ln(W_2/W_1)$
g. $C_p(T_2 - T_1)$
h. $k_B\ln(W_2 \times W_1)$

(10) 3. The molar heat of vaporization of ethanol is 39.3 kJ/mol and the boiling point of ethanol is 78.3 °C. Calculate ΔS_{vap} for 0.25 mole of ethanol

$$\Delta S_{vap} = \frac{39.3\ kJ/mol \times 0.25\ mole}{351.3\ K} = 0.0278\ kJ/K$$

$$= 27.8\ J/K$$

unit, +1
0.25 moles, +2
°C → K, +1
eq., +6

(10) 4. Calculate the value of ΔS in heating 2 moles of an ideal gas from 50 to 100 °C at constant pressure; Cp = 5R/2.

$$\Delta S = C_p \ln T_2/T_1 = \frac{5}{2} \times 8.314 \times \ln \frac{373}{323}$$ (2×)

$$= 5.98\ J/K$$

unit, +1
2 moles, +1
°C → K, +2
Eq., +6

(10) 5. Explain why molar S° values may be only zero or positive.

$\bar{S}^\circ$ at 0 K is zero for a perfect crystal and greater than zero [$\bar{S}^\circ(0K) = k\ln W$] for an imperfect crystal with disorder. As the temperature is increased from 0 K, the substance acquires more disorder and $\bar{S}^\circ$ increases!

+8 state 2nd Law