Grossmont College Name: \_\_\_\_\_KEY\_\_\_\_\_\_\_\_\_\_\_\_

Chemistry 120

Spring 2015, Quiz 6 Date: \_\_\_\_\_\_\_\_\_\_\_\_

1. For the following reactions, predict whether they will tend to be spontaneous at high, low, all temperatures, or non-spontaneous at any temperature and why?
2. H2O(l) H2O(*g*) ΔH = +44 kJ

Unfavorable enthalpically (endothermic), but favorable entropically (liquid to gas a more random state) (ΔS > 0). The favorable entropic term is maximized at high temp. Therefore, high temperature may favor spontaneity.

1. 3S2(*g*) 2S3(*g*) ΔH = +227 kJ

Unfavorable enthalpically (endothermic), and unfavorable entropically (overall reduction in number of gaseous molecules, more order). There is no temperature at which this reaction will proceed spontaneously

1. For a certain reaction, ∆H°= -89.5 kJ and ∆S°= -138 J/K. Determine ∆Ssurr and ∆Suniv (in J/K) for this reaction at 750 K. Based on these results, is the reaction spontaneous at this temperature? Explain briefly

-89.5 kJ x 1000 J/ 1 kJ = - 89,500 J

∆Ssurr= - ∆Hsys/ T = - (- 89,500 J) / (750 K) = + 119 J/K

∆Suniv= ∆Ssys+ ∆Ssurr = - 138 J/K + 119 J/K = - 19 J/K

The reaction is NOT spontaneous because the total entropy of the universe would decrease which is contrary to the second Law of Thermodynamics

1. The standard entropy of liquid POCl3 (l) is 264 J/mole·K and the standard entropy of gaseous POCl3 (g) is 370 J/mole·K. The normal boiling point of POCl3 is 106 °C. Determine the heat of vaporization, ∆H°vap, of liquid POCl3 (l) in kJ/mole.

At equilibrium, ∆G = 0

∆G = ∆H - T ∆S = 0

∆H = T ∆S = [(273 + 106) K ] [ (0.370 - 0.264) kJ/mole x K ]

∆H = 40.2 kJ/mole