

Quiz 3 2008  
Chemistry 112

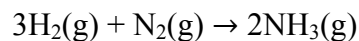
1. Make a table showing when  $\Delta G$  will be negative, i.e., the process will be spontaneous, for all positive/negative combinations of  $\Delta H$  and  $\Delta S$ .

$\Delta H$	$\Delta S$	$\Delta G$	Conditions
+	+	- (spontaneous)	At high enough T
+	-	+ (not spontaneous)	ever
-	+	- (spontaneous)	always
-	-	- (spontaneous)	At low enough T

2. If  $\Delta G^\circ_{\text{rxn}}$  has a large negative value, what can you say about the equilibrium constant?  
Answer in one short sentence.

*The equilibrium constant K will be large and positive.*

3. a) What is  $\Delta S^\circ_{\text{rxn}}$  for the reaction



if we know the following third law entropies (with units of  $\text{J K}^{-1} \text{mole}^{-1}$ ):

$$S^\circ(\text{H}_2) = 130.7 \quad ; \quad S^\circ(\text{N}_2) = 191.6 \quad ; \quad S^\circ(\text{NH}_3) = 192.4$$

$$\Delta S^\circ_{\text{rx}} = 2(192.4) - [3(130.7) + 191.6] = 198.9 \text{ J/K} \cdot \text{mole}$$

b) Express the rate of the reaction,  $v$ , in terms of the time derivative of  $[\text{H}_2]$ .

$$v = -\frac{1}{3} \frac{d[\text{H}_2]}{dt}$$