

Team: _____

Gibbs free energy Assessment

1. Under what conditions will a reaction with a decreasing entropy be thermodynamically favorable?
2. Under what conditions will an endothermic reaction be thermodynamically favorable?
3. An exothermic reaction is thermodynamically **unfavorable** under what conditions of temperature **and** entropy change?
4. Complete the table below.

	Reaction	Enthalpy (+/-)	Entropy (+/-)	Favorable at what values of temperature? (high, low, all, none)
a	$\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \leftrightarrow \text{PCl}_5(\text{g}) + 92.5 \text{ kJ/mol}$			
b	$2\text{NH}_3(\text{g}) \leftrightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \quad \Delta\text{H} = +92\text{kJ/mol}$			
c	$4\text{PH}_3(\text{g}) \leftrightarrow \text{P}_4(\text{s}) + 6\text{H}_2(\text{g}) \quad \Delta\text{H} = -37\text{kJ/mol}$			
d	$181.6 \text{ kJ/mol} + 2\text{HgO}(\text{s}) \leftrightarrow 2\text{Hg}(\text{l}) + \text{O}_2(\text{g})$			

5. The equilibrium constant of a reaction is $K=1$.
 - a. Large values of K show the forward reaction is favorable. What does a reaction with an equilibrium constant equal to 1 imply about the relationship between the concentration of reactants and products?
 - b. Calculate the value of the Gibbs free energy change of this reaction at standard state.
 - c. Find the temperature at which this reaction with $\Delta\text{H} = -11.7 \text{ kJ/mol}$ and $\Delta\text{S} = -105 \text{ J/molK}$ would become thermodynamically favorable.