



CHEM 160

THERMODYNAMICS

Key Terms:

ΔG – Gibbs free energy

ΔH – Enthalpy [KJ/mol]

ΔS – Entropy [J/K]

Key Equations:

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

$$S = k \ln W \quad (k = \text{Boltzmann} = 1.38 \times 10^{-23})$$

$$W = B^N \quad (B = \# \text{boxes}, N = \# \text{molecules})$$

$$\Delta G^\circ_{\text{rxn}} = [\sum \Delta G^\circ_{\text{Products}}] - [\sum \Delta G^\circ_{\text{Reactants}}]$$

(Same table for ΔH° and ΔS°) (Σ =Sum of)

Key Concepts:

$\Delta G > 0 \Rightarrow$ non-spontaneous

$\Delta H > 0 \Rightarrow$ Endothermic

$\Delta G < 0 \Rightarrow$ spontaneous

$\Delta H < 0 \Rightarrow$ Exothermic

ΔG° , ΔH° , $\Delta S^\circ \Rightarrow$ Standard conditions : 1 atm, 1M, 25°C

*These numbers can be read from a table

ΔS (entropy) is defined as the disorder (or randomness) of a system. The second law of thermodynamics states that in a spontaneous process, the total entropy increases ($\Delta S > 0$).

Entropy and Pressure are inversely related; as pressure increases, entropy decreases.

Entropy and Temperature are directly related; as temperature increases, entropy increases.

ΔH	ΔS	ΔG
(-)	(+)	(-)
(+)	(-)	(+)
(+)	(+)	(+)
(-)	(-)	(-)

*How to read the table:

If ΔH (-) and ΔS (+), then ΔG is (-)





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Note: First two rows are true at all temperatures; Last two rows are true at low temps, the opposite is true for high temps



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