<<1 very positive

Equations:

- $\Delta H_{reaction} = \Sigma[\Delta H_f(products)] - \Sigma[\Delta H_f(reactants)]$

ΔH_f of elements in natural state = 0

- $\Delta S_{reaction} = \Sigma[S_f(products)] - \Sigma[S_f(reactants)]$

- $\Delta G_{reaction} = \Sigma[\Delta G_f(products)] - \Sigma[\Delta G_f(reactants)]$
  ΔG_f of elements in natural state = 0

For Entropy

- $\Delta H = -T\Delta S(surroundings)$
- $\Delta S(universe) = \Delta S(reaction) + \Delta S(surroundings)$
- $\Delta G = -T\Delta S(universe)$

For Delta G:

- $\Delta G = \Delta H - T\Delta S$ (T in K, get ALL quantities in either Joules or Kilojoules)
- $\Delta G° = -RT\ln K$ (R = 8.314, T in K; ΔG° in JOULES)
- (ΔG° refers to energy change going from all things in standard state to equilibrium)
- $\Delta G = \Delta G° + RT\ln Q$
- (ΔG refers to energy change for ANY stage of reaction)

Electrochemistry/Redox notes (Chapter 17)

A. Oxidation and Reduction
   1. Oxidation
      - Loss of electrons: $Na \rightarrow Na^+ + e^-$
      - When a substance gains oxygen: $C \rightarrow CO_2$
      - When a substance loses Hydrogen: $CH_3CH_2OH \rightarrow CH_3CHO$
   2. Reduction
      - Substance gains electrons: $Cl_2 + 2e^- \rightarrow 2Cl^-$
      - Substance loses Oxygen: $HgO \rightarrow Hg$
      - Substance gains Hydrogen: $CH_2CH_2 \rightarrow CH_3CH_3$

B. Ionic and non-ionic redox Reactions