Announcements

- Turn on the Clicker (the red LED comes on).
- Push “Join” button followed by “20” followed by the “Send” button (switches to flashing green LED if successful).

- Kinetics lab handout is available in the lab handout section of the class web site.

- We're moving fast enough that we will probably start on the next section (Kinetics) during lecture next Tuesday. Look for an e-mail with suggested reading and problems tomorrow or over the weekend.

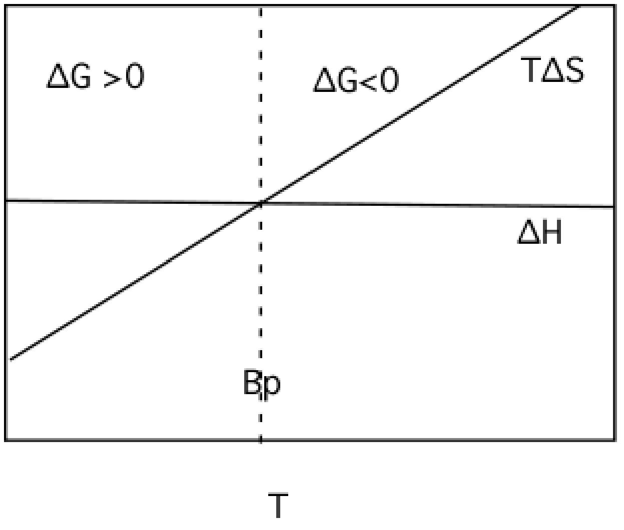
Review

- Enthalpies of Solution
  - Contributions: $\Delta H_{ionic} > 0$, $\Delta H_{H\text{-}bonds} > 0$, $\Delta H_{ion\text{-}dipole} < 0$
    - $\Delta H_{H\text{-}bonds} + \Delta H_{ion\text{-}dipole} = \Delta H_{hyd}$
  - $\Delta H_{soln} = \Delta H_{hyd} + \Delta H_{ionic}$, overall sign depends on balance.
- S quantifies the disorder of a system
  - larger S means more disorder
  - Spontaneous processes: $\Delta S_{univ} = \Delta S_{sys} + \Delta S_{surr} > 0$
  - $\Delta S_{sys} \approx \Delta S^o_{rxn} = \Sigma S^o_{prod} - \Sigma S^o_{reac}$
- $\Delta G = \Delta H_{sys} - T\Delta S_{sys}$ is easier to use than ΔS_{univ}
  - $\Delta G < 0$ = spontaneous, (exergonic) $\Delta G > 0$ non-spontaneous (endergonic)

Review

- $\Delta G = \Delta H - T\Delta S$
  - $\Delta H < 0$, $\Delta S > 0$ $\Delta G < 0$ always spontaneous
  - $\Delta H < 0$, $\Delta S < 0$ ΔG ? spontaneous at low T
  - $\Delta H > 0$, $\Delta S < 0$ $\Delta G > 0$ never spontaneous
  - $\Delta H > 0$, $\Delta S > 0$ ΔG ? spontaneous at high T

Water near its boiling point is example of the last case.



Calculating ΔG

- From ΔH^o_f and S^o
  - Calculate ΔH^o and ΔS^o, then use in $\Delta G = \Delta H - T\Delta S$
  - Ex: $NaCl(s) + H_2O(l) \text{ ---> } Na^+(aq) + Cl^-(aq) + H_2O(l)$

	$NaCl(s)$	$H_2O(l)$	$Na^+(aq)$	$Cl^-(aq)$	$H_2O(l)$
$S^o (J \cdot mol^{-1} K^{-1})$	72.1	70.0	59.0	56.5	70.0
$\Delta H^o_f\ (kJ \cdot mol^{-1})$	-411.2	-285.8	-240.1	-167.2	-285.8

$\Delta S^o_{RXN} = 43.4$ J/K $\Delta H^o_{RXN} = 3.9$ kJ

$$\Delta G^o_{RXN} = 3.9 \times 10^3 \text{ J} - (298 \text{ K})(43.4 \text{ J/K}) = -9.0 \times 10^3 \text{ J}$$

Calculating ΔG

- From ΔG^o_f
  - $\Delta G^o_{RXN} = \Sigma\Delta G^o_f(\text{prod}) - \Sigma\Delta G^o_f(\text{reac})$
  - Note: like ΔH^o_f, for elements in their standard state $\Delta G^o_f=0$
  - Ex: $NaCl(s) + H_2O(l) \text{--->} Na^+(aq) + Cl^-(aq) + H_2O(l)$

$\Delta G^o_f(kJ{\bullet}mol^{-1})$ -384.2 -237.2 -261.9 -131.2 -237.2

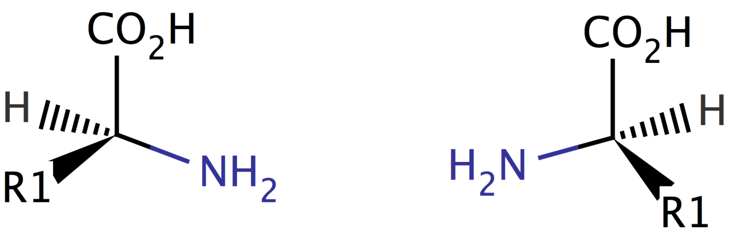
ΔG^o_{RXN} = (1mol Cl^-)(-131.2 kJ/mol) + (1mol Na^+)(-261.9 kJ/mol)

-(1mol NaCl)(-384.2 kJ/mol) = -8.9 kJ

Chang Table 22.2

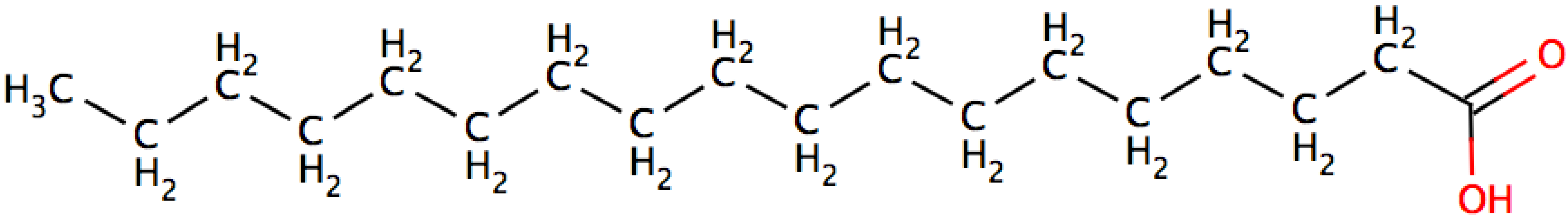
Stereoisomerism

- Four (4) different groups attached to a single carbon can be arranged in two different ways that are mirror images of each other.
- The two forms are called enantiomers or stereoisomers.
- A carbon with 4 different groups around it is called a chiral center.
- Most enzymes in our bodies only work with one enantiomer.

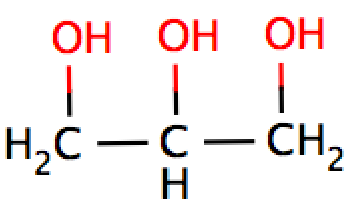


Lipids

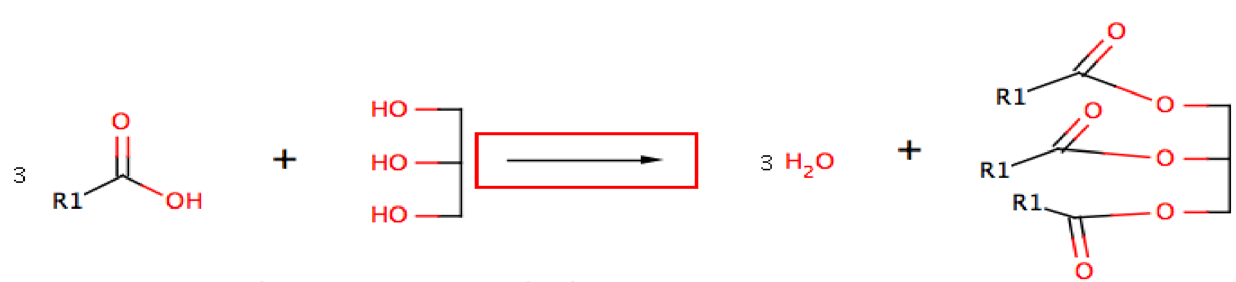
- Fatty acids bound to glycerol in a condensation reaction.



  - Fatty Acid
    - Saturated have no double bonds in chains
    - Unsaturated have double bonds in chains



  - Glycerol



Cartoon of Condensation RXN