3/29 Today: Finish ch 17
3/31 Sunday: problem club with Ali
4/1 Monday: Review
4/2 Tuesday: Expt 10, problem club with Ali
4/3 Wednesday: CK

$\Delta G = \Delta G^\circ + RT\ln Q$ ← not at equilibrium

$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ ← 298 K

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

at equilibrium, $\Delta G = 0$ — Q_c, K_c for solutions

$0 = \Delta G^\circ + RT\ln K$ — Q_p, K_p for gases

$\Delta G^\circ = -RT\ln K$

$\Delta G = -RT\ln K + RT\ln Q = RT\left(\ln \frac{Q}{K}\right)$

if $Q > K$ shift L, $\frac{Q}{K} > 1$, $\Delta G > 0$, ~~spont~~. non-spont.

if $Q < K$ shift R, $\frac{Q}{K} < 1$, $\Delta G < 0$, spont.

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ $\Delta S < 0$ $\Delta G < 0$ $\Delta H < 0$

enthalpy driven reaction

urea:

$2NH_3(g) + CO_2(g) \rightarrow \text{urea}(s) + H_2O(l)$

$\Delta S < 0$ $\Delta G < 0$ $\Delta H < 0$ enthalpy driven reaction

$\Delta G^\circ = -13.6\text{ kJ}$, $\Delta H^\circ = -133.3\text{ kJ}$ $\Delta S^\circ = ?$

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

$-13.6\text{ kJ} = -133.3\text{ kJ} - (298\text{ K})(\Delta S^\circ)$

$\Delta S^\circ = -0.402\text{ kJ/K} = \boxed{-402\text{ J/K}}$

At what temperature does this reaction go from ~~n~~spontaneous to nonspontaneous?

$\Delta G = 0$, $T = \Delta H° / \Delta S°$

$T = \dfrac{-133.kJ}{-.402kJ/k} = \boxed{332k}$

· What is ΔG at 340k?

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

$\Delta G = -133.3kJ - (340)(-.402kJ/k)$

$\Delta G = +3.4kJ$

· Calculate K_p for this reaction

$\Delta G° = -RT \ln k$

$-13.6\, kJ = -(8.314 \times 10^{-3}\, kJ/mol \cdot k)(298k) \ln k$

$5.49_{mol} = \ln k$

$K_p = 242$

P	$2NH_3(g)$	+	$CO_2(g)$	$\rightarrow$	urea (s)	+	$H_2O(l)$
I	2.0atm		1.0atm		0		0
C	-2x		-x		+x		+x
E	2.0-2x		1.0-x		x		x

$Q_p = \dfrac{1}{(P_{NH_3}^2)(P_{CO_2})} = \dfrac{1}{(2)^2(1)} = 0.25$

$Q_p < K_p$ so shift R

blue tech: $CO(NH_2)_2 \xrightarrow{\Delta} NH_3(g) + CO_2(g)$

$4NH_3(g) + 4NO(g) + O_2(g) \rightarrow 4N_2(g) + 6H_2O(g)$ ΔH could be +/-

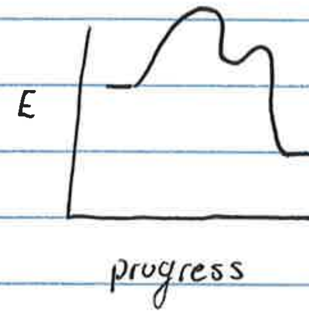
$\Delta S = +$

$\Delta G = -$

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$ $\Delta S > 0$, $\Delta H < 0$ $\Delta G < 0$

mechanism:

1. $H_2O_2 + I^- \rightarrow H_2O + IO^-$ (slow)
2. $IO^- + H_2O_2 \rightarrow H_2O + O_2 + I^-$



I^- is catalyst