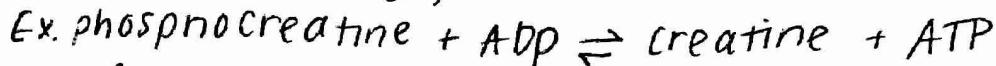


Free Energy Change Under Nonstandard Conditions

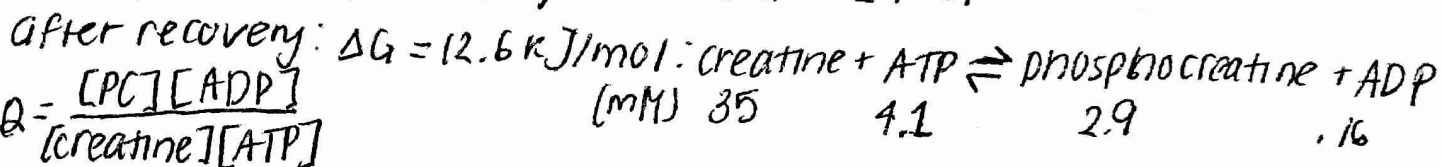
$$\Delta G = \Delta G^\circ + RT \ln(Q)$$



concent. (mM) 25 4.0 13 0.013

$$\Delta G = \Delta G^\circ + RT \ln(Q) = -12.6 \text{ kJ/mol} + (8.315 \times 10^{-3} \text{ kJ/mol K}) 310 \text{ K} \cdot \ln Q$$

$$Q = \frac{(0.013 \times 10^{-3})(13 \times 10^{-3})}{(25 \times 10^{-3})(4.0 \times 10^{-3})} \quad \Delta G = -29 \text{ kJ/mol}$$



ΔG° and K : at equilibrium, $Q=K$ and $\Delta G = 0$

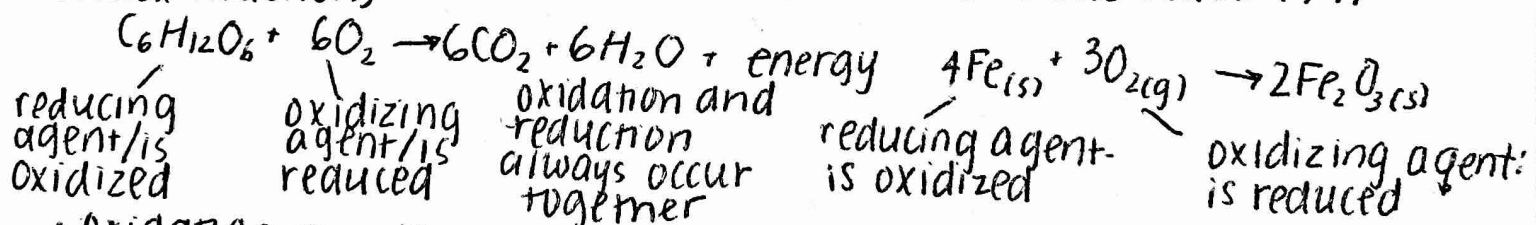
Equation becomes $0 = \Delta G^\circ + RT \ln(K) \rightarrow \Delta G^\circ = -RT \ln K$

April 12, 2019 Electrochemistry I

Electrochemistry: study of the interchange between chemical + electrical energy

- Determining whether a particular oxidation-reduction reaction is spontaneous: generating electric current from spont. redox rxn
- Using an electric current to drive a nonspontaneous redox rxn

Redox Reactions



- Oxidation numbers: to keep track of what loses electrons and what gains them

↳ if oxidation # increases $\rightarrow$ element oxidized
 " decreases $\rightarrow$ element is reduced

Rules to assign oxidation states

✓ Elements = 0

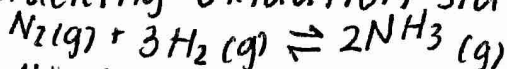
✓ monatomic ion = charge

✓ O: -2 (unless peroxide = -1)

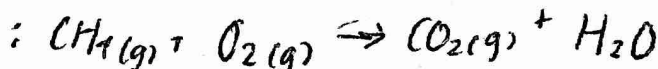
✓ H: +1 (unless a metal hydride = -1)

✓ The sum of the oxidation numbers equals the overall charge (0 in a compound)

Tracking Oxidation States



Nitrogen: oxidation # decreased, so nitrogen reduced



following carbon: oxidation # is increased, so carbon is oxidized

corrosion: process by which something deteriorates because of oxidation

"Acids are corrosive"