

AP CHEMISTRY

TOPIC 11: ELECTROCHEMISTRY, PART A, EXAMPLES PART II

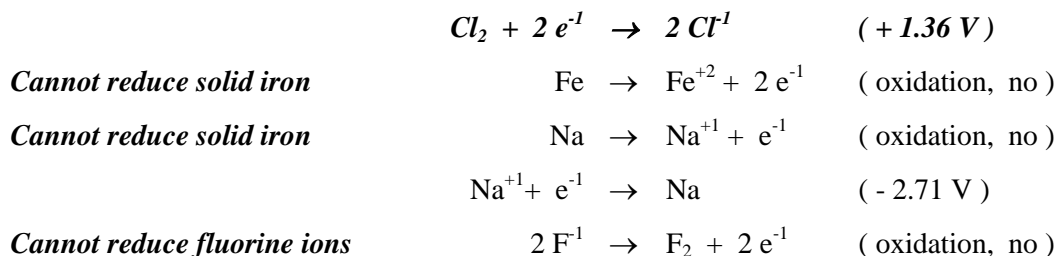
Day 125:

- Oxidation / Reduction (review)
- Reduction Potentials
- Voltage and Spontaneity

Example #1:

Which of the following will be the best oxidizing agent: Cl_2 , Fe, Na, Na^+ , F^- ? Explain why.

Oxidizing Agent = substance (compound or element) that allows another substance to be oxidized (lose electrons) - Also, within the oxidizing agent, one of the elements is being reduced (gain electrons).



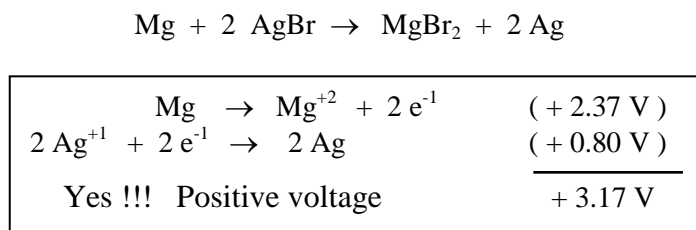
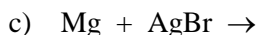
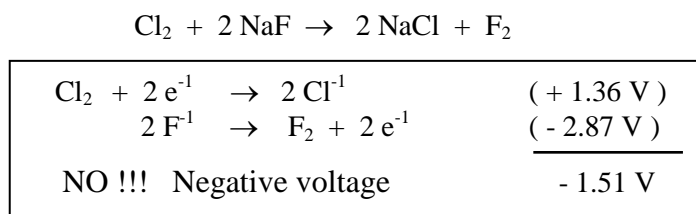
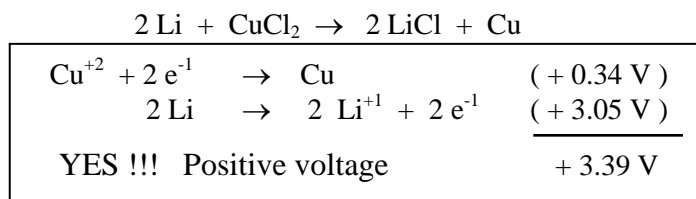
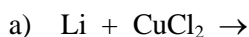
Example #2:

A piece of copper metal is placed into solutions containing each of the following three cations. Which ion(s) will be reduced by the copper metal: Sn^{+2} , Zn^{+2} , Ag^{+1} ? Explain why.

$\text{Cu} \rightarrow \text{Cu}^{+2} + e^-$ (- 0.34 V) $\text{Sn}^{+2} + 2 e^- \rightarrow \text{Sn}$ (- 0.14 V) <hr style="width: 50%; margin-left: auto; margin-right: 0;"/> - 0.48 V NO !!! (negative voltage)	$\text{Cu} \rightarrow \text{Cu}^{+1} + e^-$ (- 0.34 V) $\text{Zn}^{+2} + 2 e^- \rightarrow \text{Zn}$ (- 0.76 V) <hr style="width: 50%; margin-left: auto; margin-right: 0;"/> - 1.10 V NO !!! (negative voltage)	$\text{Cu} \rightarrow \text{Cu}^{+1} + e^-$ (- 0.34 V) $\text{Ag}^{+1} + e^- \rightarrow \text{Ag}$ (+ 0.80 V) <hr style="width: 50%; margin-left: auto; margin-right: 0;"/> + 0.46 V YES !!! (positive voltage)
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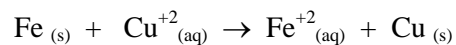
Example #3:

Is the reaction spontaneous or non-spontaneous? Explain why and show all work.



Example #4: (what is not given on the equation sheet is the equivalent of a coulomb = $J V^{-1}$)

Calculate the standard free-energy change for the reaction shown below:



$Fe \rightarrow Fe^{+2} + 2 e^{-1}$	(+ 0.44 V)
$Cu^{+2} + 2 e^{-1} \rightarrow Cu$	(+ 0.34 V)
	<hr/>
YES !!!	+ 0.78 V

$$\Delta G = - n \mathfrak{F} E^0$$

$$\Delta G = -(2 \text{ mol } e^{-}) \left(\frac{96,500 \text{ J}}{V \cdot \text{mol } e^{-}} \right) (+0.78 \text{ V}) = -1.51 \times 10^5 \text{ J}$$

Recall, ΔG 's units are typically in kilojoules:

$$\frac{-1.51 \times 10^5 \text{ J}}{1000 \text{ J}} \times \frac{1 \text{ kJ}}{1000 \text{ J}} = -1.51 \times 10^2 \text{ kJ}$$

Negative ΔG = spontaneous