3 electrochemistry things to help you prepare for the quiz on Thursday and the Final Exam:

1. Determining relative strengths of oxidizing and reducing agents. In working this kind of problem, note the similarities to relative acid/base strength problems. In both cases you start with a list of reactions:

acid and base strength				**oxidizing and reducing agent strength**		
K_a	acid dissociation rxn	K_b		E^o_{red}	reduction half rxn	E^o_{ox}
10^{-2}	$HSO_4^- \leftrightarrow H^+ + SO_4^=$	10^{-12}		-0.7	$Zn^{++} + 2e^- \leftrightarrow Zn$	+ 0.7
10^{-5}	$HAc \leftrightarrow H^+ + Ac^-$	10^{-9}		0.0	$H^+ + 2e^- \leftrightarrow H_2$	0.0
10^{-9}	$NH_4^+ \leftrightarrow H^+ + NH_3$	10^{-5}		+0.3	$Cu^{++} + 2e^- \leftrightarrow Cu$	-0.3
HSO_4^- is the strongest acid, NH_3 the strongest base				Cu^{++} is strongest ox.agent, Zn is strongest red. agent		

Things to notice:

- The are two directions for reactions: acids in the forward direction, bases in the reverse direction; reduction in the forward direction, oxidation in the reverse direction.
- There are two pairs of constants, K_a and K_b, E_{red} and E_{oxid}.
- There are some simple rules for determining strength:
  "The larger the Ka, the stronger the acid and the weaker the conjugate base"
  "The larger the Kb, the stronger the base and the weaker the conjugate acid."
  "The stronger the oxidizing agent the more easily a species is reduced"
  "The stronger the reducing agent, the more easily a species is oxidized."
- In table as written, the strongest acid is always in the upper left hand corner (HSO_4^-) and the strongest base in the lower right hand corner (NH_3). The strongest oxidizing agent (most easily reduced) is always in the lower left hand corner (Cu^{++}) and the strongest reducing agent is in the upper right hand corner (Zn).

2. Famous modern batteries use a variety of chemicals to power their reactions. Typical battery chemistries include:

- Zinc-carbon battery - Also known as a standard carbon battery. Zinc-carbon chemistry is used in all inexpensive AA, C and D dry-cell batteries. The electrodes are zinc and carbon, with an acidic paste between them that serves as the electrolyte.
- Alkaline battery - Used in common Duracell and Energizer batteries. The electrodes are zinc and manganese-oxide, with an alkaline electrolyte.
- Lithium photo battery - Lithium, lithium-iodide and lead-iodide, used in cameras because of its ability to supply power surges.
- Lead-acid battery - Used in automobiles. The electrodes are made of lead and lead-oxide with a strong acidic electrolyte. Rechargeable.
- Nickel-cadmium battery - Uses nickel-hydroxide and cadmium electrodes, with potassium-hydroxide as the electrolyte. Rechargeable.
- Nickel-metal hydride battery - Rapidly replacing nickel-cadmium because it does not suffer from the memory effect that nickel-cadmiums do. Rechargeable.
- Lithium-ion battery - Very good power-to-weight ratio, often found in high-end laptop computers and cell phones. Rechargeable.
- Zinc-air battery - Lightweight, rechargeable.
- Zinc-mercury oxide battery - Often used in hearing-aid batteries.
- Silver-zinc battery - Used in aeronautical applications because the power-to-weight ratio is good.
- Metal Chloride battery - Used in electric vehicles.

3. A nice summary of facts on cell construction and convention:

electrochemical cell type	reaction type	ΔG	E	reduction	oxidation	direction of e^- flow	sign at cathode	sign at anode
electrolysis	non-spontaneous	+	-	cathode	anode	e^- flow to cathode	-	+
galvanic (battery)	spontaneous	-	+	cathode	anode	e^- flow to cathode	+	-