Electrochemistry
CHEM 212

1. Define the following variables and units

variable	definition	Units
q		
n		
F		
W		
E		
ΔG		
I		
R		
P		

2. What are the 5 primary relationships between the relationships above?

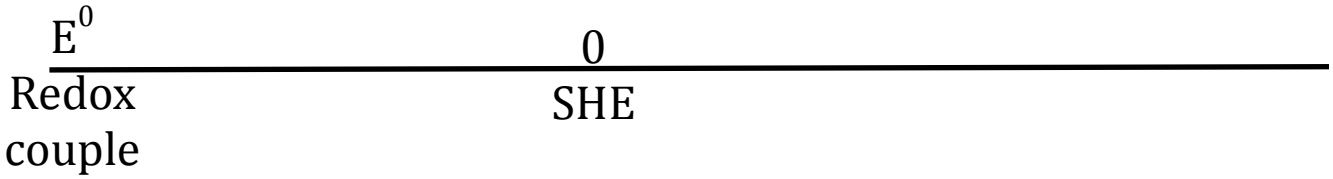
3. Reduction- oxidation (redox) reactions are concerned with electron transfers between species. The **species that gets reduced gains electrons**. **The species that gets oxidized loses electrons**. There are a lot of pneumonic devices to remember this- what's yours?

4. The reactions for oxidation and reduction are generally written separately, called half reactions. These reactions occur at **specific voltage potentials, E^0 for standard conditions**. What are these standard conditions?

5. Redox half reactions are tabulated as reductions. In order to convert it to an oxidation reaction, you simply flip the reaction and change the sign on E^0. Write the following reaction as an oxidation.
   $Cu^{2+} + 2\ e^- \Leftrightarrow Cu$ $\quad E^0 = 0.340$ V

6. In a redox reaction, one of the reduction reactions must get flipped, but which one? For this class, **E^0 for a cell will always be positive**. Place the reactions shown below on the line and show the three potentials between them.

$Fe^{3+} + e^- \Leftrightarrow Fe^{2+}$ $\quad E^0 = 0.77$ V
$Cu^{2+} + 2\ e^- \Leftrightarrow Cu$ $\quad E^0 = 0.34$ V
$Zn^{2+} + 2e^- \Leftrightarrow Zn$ $\quad E^0 = -0.76$ V

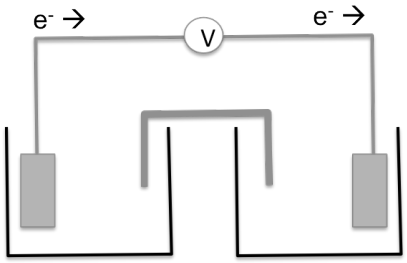


The more positive will always "go as written" and remain a reduction reaction. The less positive reaction will be flipped and become an oxidation reaction. E^0 for the complete cell is the potential difference between the two redox couples.

7. Write the balanced half reactions and full reaction for each redox pair in the previous problem. Then calculate E^0 for each cell.

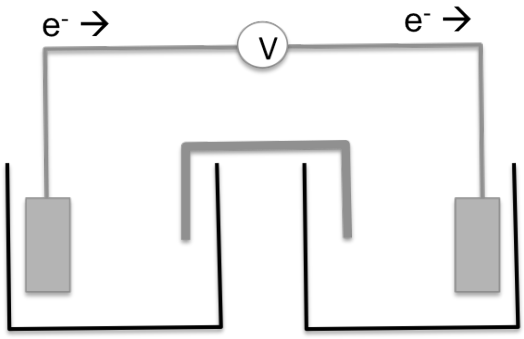
Voltaic Cells

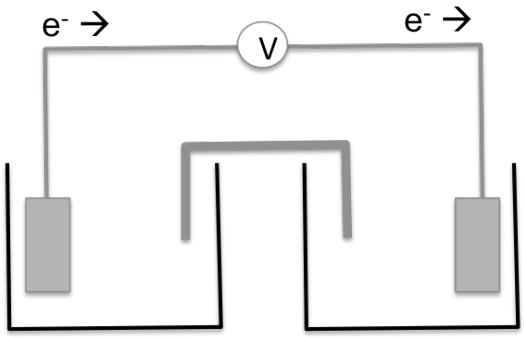
8. Label the following cell with the anode (where oxidation occurs) and cathode (where reduction occurs). What pneumonic device will you use to remember this?

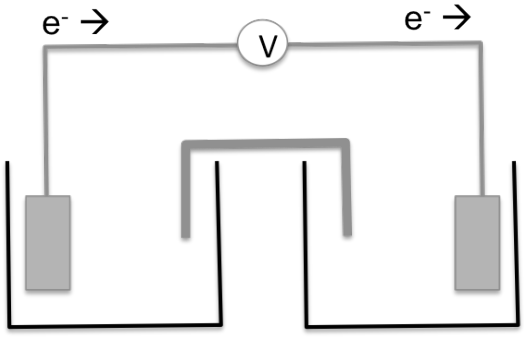


9. In line notation, | = phase boundaries, || = salt bridge
   Cell components are listed in the following order:
   anode | anodic solution || cathodic solution | cathode

10. Draw each of the cells from the previous page on the following diagrams and write them in line notation.







Nonstandard Conditions- Nerst Equation

11. Write the Nerst Equation

12. Calculate E and K for the cell if $[Fe^{2+}]$= 0.034 M, $[Fe^{3+}]$= 0.005 M, $[Cu^{2+}]$= 0.012 M

13. Calculate E and K for the cell if $[Fe^{2+}]$= 0.012 M, $[Fe^{3+}]$= 0.024 M, $[Zn^{2+}]$= 0.037 M

14. Calculate E for the cell if $[Cu^{2+}]= 0.056$ M, $[Zn^{2+}]= 0.017$ M

15. Diagram a pH meter and explain how it measures proton concentration in solution.