AP Chemistry Daily Videos

9.9 Cell Potential Under Nonstandard Conditions

Video #1

1. What are standard conditions? Does $\Delta G=\Delta G°$ at standard conditions?

2. What is the difference between $E°_{cell}$ and E_{cell}?

3. If you have the following redox reaction: $Cu^{2+}_{(aq)} + Zn_{(s)} \rightarrow Cu_{(s)} + Zn^{2+}_{(aq)}$ in a 1.0 M $ZnSO_4$ and 1.0M $CuSO_4$ solution (used in standard conditions). Calculate Q.

Answer check: You should have written $Q=[Zn^{2+}]/[Cu^{2+}]$ because solids are left out. According to our concentrations Q=1. Q will always be equal to 1 in standard conditions.

4. There are 2 ways of knowing which way a reaction will proceed to reach equilibrium: A) compare Q to K B) the sign of ΔG. If ΔG=neg and Q<K then the reaction proceeds towards the products. What happens to Q and ΔG as the reaction proceeds and reactants turn into products? See Khan Academy Link for detailed answer.

Answer check: As product increases and reactant decreases Q↑. There's a formula that relates Q to ΔG. $\Delta G=\Delta G°+RT\ln Q$

Based on this formula, as Q↑,ΔG↑, until the reaction reaches equilibrium. At equilibrium: Q=K and ΔG gets larger until it equals 0. When ΔG=0 neither reactants or products are favored.

5. Note: The reaction $\Delta G=\Delta G°+RT\ln Q$ at equilibrium becomes $0=\Delta G°+RT\ln K$ or $\Delta G°= -RT\ln K$. Make sure you pick the correct equation depending on if you are at equilibrium or not.

6. @ 0:47 Does cell potential change as concentration or pressures of aq and gases change?

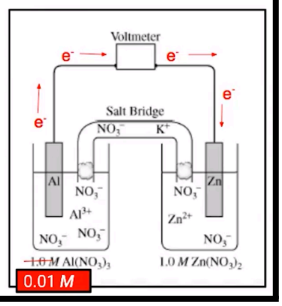
7. Complete the following table to relate these concepts to a battery.

Condition of Battery	ΔG (-,+,0?)	E_{cell}(-,+,0?)	Q related to K?	At equilibrium?
New		+High	Q<K	
Used (Reactants have decreased concentration as they turned into product; Product concentration increased)				
Dead				Yes

8. Make a statement relating how E_{cell} changes as Q approaches K, until Q=K at equilibrium. Hint, E_{cell} is measured in Volts, meaning how much potential energy a reaction has.

9. Try the problem on your own. Then evaluate your work and identify any errors you may have made.

If the concentration of $Al(NO_3)_3$ in the $Al(s)/Al^{3+}(aq)$ half-cell is lowered from 1.0 *M* to 0.01 *M* at 25°C, does the cell voltage increase, decrease, or remain the same? Justify your answer.



10. @ 4:37 What advice did your instructor give you?

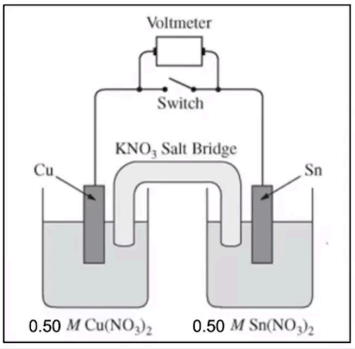
11. How did you do on the two multiple choice questions?

12. Try the problem on your own. Then evaluate your work and identify any errors you may have made.

A nonstandard cell is made using 0.50 M solutions of $Cu(NO_3)_2$ and $Sn(NO_3)_2$.

(a) Is the cell potential of this nonstandard cell greater than, less than, or equal to the cell potential of a standard cell made with 1.0 M solutions of $Cu(NO_3)_2$ and $Sn(NO_3)_2$? Justify your answer.

(b) Both the standard and nonstandard cells can be used to power an electronic device. Would the nonstandard cell power the device for the same time, a longer time, or a shorter time, as compared with the standard cell? Justify your answer.



13. Summarize the main points of this video.