Quiz. 4/25/13

① What is the voltage for following reaction @ equilibrium?

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ ... dead battery?

(B.) So cell potential is zero.

② The reaction taking place in a nicad cell.

$2H_2O + Cd(s) + 2Ni(OH) \rightarrow Cd(OH)_2(s) + 2Ni(OH)_2(s)$

The emf of the cell when fully charged is 1.25V.

What is reaction free energy? $F = 96,485$ C/mole$^-$

-241 kJ/mol

ΔG = charge x voltage.

$\Delta G = -nFE$.

charge potential.

$n = 2$

③ What will happen to voltage if lower Zn^+ concentration?

What would happen to potential?

Assume we are at standard conditions.

→ The voltage will increase...

→ voltage does not change a LOT, but it changes.

→

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

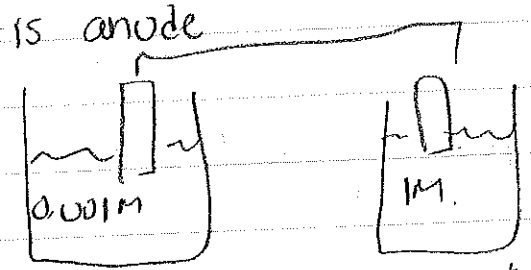
↓

drive to right.

For ernest equation assume standard temp.

$Cu(s) \mid Cu^{2+}(.001M) \parallel Cu^{2+}(1M) \mid Cu(s)$

What is anode



$Cu(s) \rightarrow Cu^{2+} + 2e^-$ $\quad Cu^{2+} + 2e^- \rightarrow Cu(s)$

$Cu + Cu^{2+} \rightarrow Cu^{2+} + Cu$

- difference in energy cause electrons to move.
- difference in concentrations.

cathode has lower free energy since electrons move from anode to cathode.

The concentration at cathode will ↑ as electrons move.

The concentration at anode will ↓ as electrons move.

Poll: Calculate the emf of the cell:

$Cu(s) \mid Cu^{2+}(aq, .001M) \parallel Cu^{2+}(aq, 1M) \mid Cu(s)$

Standard potential will be zero because they are same forward & Backward.

$$E^\circ - \frac{0.0591}{n} \log Q$$

$\log Q \rightarrow \frac{\text{Products}}{\text{Reactants}} \quad \frac{.001M}{1M}$

$$0.34 = E^\circ - \frac{0.0591}{2} \log \frac{.001M}{1M}$$

$Q = (-3)(2)$ $\quad$ 0.088 V.

Think abt why this cell produces a voltage:
more concentrated cell lower free energy.

4.) • What is the standard potential based on K^+ ion concentration inside & outside the cell?

$$E^0 = \frac{-.0591}{1n} \log \frac{K^+_{out}}{K^+_{in}} \quad \frac{4mM}{150mM} = \boxed{93\ mV.}$$