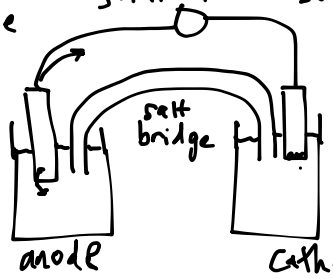
7).

$Cu \mid Cu^{2+} \parallel Cu^{2+} \mid Cu$

anode — anodic solution — cathodic solution — cathode



$Cu \rightarrow Cu^{2+} + 2e^-$ ↑

$Cu^{2+} + 2e^- \rightarrow Cu$ ↖

Concentration cells

- identical half-rxns
- $\mathcal{E}^\circ = 0$ V
- reduction: $Cu^{2+} + 2e^- \rightarrow Cu$ (0.34 V)
- oxidation: $Cu \rightarrow Cu^{2+} + 2e^-$ (−0.34 V)
- $\mathcal{E}$ nonstandard conditions gives a battery

$$\mathcal{E} = \cancel{\mathcal{E}^\circ} - \frac{0.05916}{2} \log \frac{0.150}{0.0120}$$

$\cancel{\mathcal{E}^\circ} = 0$

12).

$$E = -nF\mathcal{E}^\circ$$

$$-\left(3 \text{ mole}^-\right)\left(\frac{96485 \text{ C}}{1 \text{ mol } e^-}\right)\left(1.75 \text{ V}\right)$$

$$506,546 \text{ J} \times \frac{1 \text{ kJ}}{1000 \text{ J}} = 506.546$$

507 kJ

voltaic

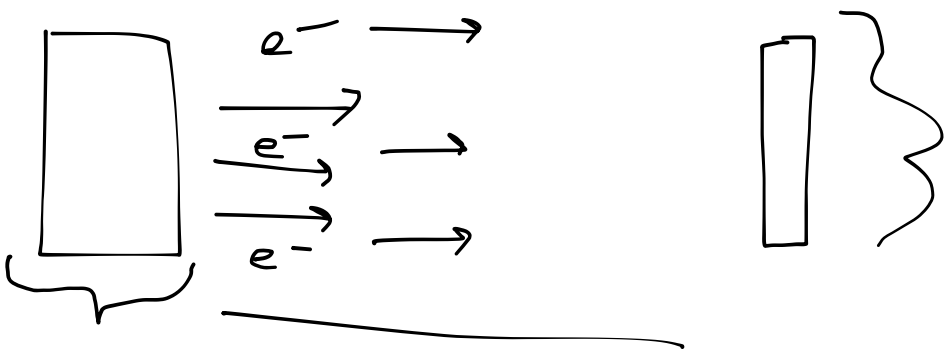
$+E^\circ$

$-\Delta G$ (spontaneous)

electrolytic

$-E^\circ$

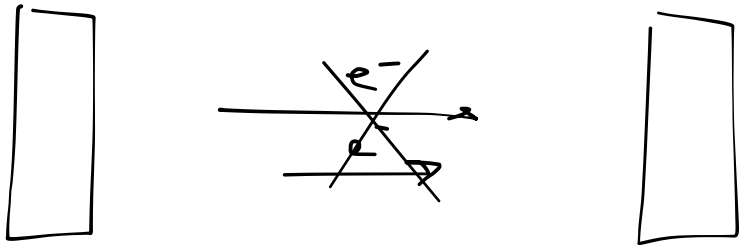
$+\Delta G$ (non-spont.)



anode

cathode

$E^\circ = \underline{2V}$



ox.

$E^\circ = 0V$

red.

battery dead