



# EXPERIMENT 10

ELECTROLYSIS & AVOGADRO'S CONSTANT

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# *Spontaneity*

## Spontaneous Chemical Reactions

Reactions that take place on their own with a decrease in Gibbs free energy ( $\Delta G < 0$ ).



## Nonspontaneous Chemical Reactions

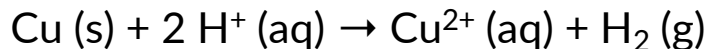
Reactions that do not take place on their own with an increase in Gibbs free energy ( $\Delta G > 0$ ).

The reverse of a spontaneous reaction will be nonspontaneous.



*Today*

## REACTION OF INTEREST



This is a nonspontaneous reaction.

In an electrolytic cell, there are two half-reactions.

Oxidation at the (+) electrode:  $\text{Cu (s)} \rightarrow \text{Cu}^{2+} \text{(aq)} + 2 \text{e}^-$

Reduction at the (-) electrode:  $2 \text{H}^+ \text{(aq)} + 2 \text{e}^- \rightarrow \text{H}_2 \text{(g)}$

Numerical value of Avogadro's constant ( $N_A$ )

$$N_A = \frac{\text{\# of electrons}}{\text{moles of electrons}}$$

$$\text{mol } e^- = 2 \times (\text{mol } H_2)$$

$$\text{mol } H_2 \rightarrow n_{H_2} = \frac{P_{H_2} V}{RT}$$

$$\text{\# of } e^- = \frac{\text{charge flowed}}{\text{charge on } 1 e^-}$$

$$\text{charge on } 1 e^- = 1.6022 \times 10^{-19} \text{ C}$$

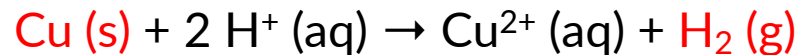
$$\text{Charge (C)} = \text{Current (A)} \times \text{time (s)}$$

$$\text{Current (A)} = \frac{\text{Voltage (V)}}{\text{Resistance } (\Omega)}$$

*Purpose 1*

## *Purpose 2*

### Molar mass of Cu



moles Cu lost = moles of H<sub>2</sub> (g) produced

# *Notes*

1. Screw clamp needs to be tight.
2. Suck up the sulfuric acid through the gas buret slowly.
3. Next week: make-up week
  - Register/check with me today
  - Meet in SCL 111 at 1pm next week