

# AP CHEMISTRY

## TOPIC 11: ELECTROCHEMISTRY, PART C, EXAMPLES, PART II

Day 128:

- Electroplating

Example #1:

10.0 amperes of current is passed through an electrolytic cell filled with molten lithium chloride, LiCl, for 500 seconds. Calculate the mass (in grams) of lithium that are plated on the cathode?

Answer:

$$I = \frac{q}{t}$$

$$q = It$$

$$q = (10.0 \text{ Amp})(500 \text{ sec}) = 5000 \text{ Amp} \cdot \text{sec (coulombs)}$$

$$\frac{5000 \text{ coulombs}}{96500 \text{ coulombs}} \times \frac{1 \text{ mol } e^{-1}}{1 \text{ mol } e^{-1}} \times \frac{1 \text{ mol Li}}{1 \text{ mol } e^{-1}} \times \frac{6.941 \text{ g}}{1 \text{ mol Li}} = 0.360 \text{ g Li}$$

Example #2:

How long (in minutes) must a current of 5.00 A be applied to a solution of  $\text{Ag}^{+1}$  to produce 10.5 grams of silver metal? (31.3 minutes)

$$\frac{10.5 \text{ g Ag}}{107.87 \text{ g}} \times \frac{1 \text{ mol Ag}}{1 \text{ mol Ag}} \times \frac{1 \text{ mol } e^{-1}}{1 \text{ mol } e^{-1}} \times \frac{96500 \text{ A} \cdot \text{sec}}{1 \text{ mol } e^{-1}} = 9393.25 \text{ A} \cdot \text{sec (coulombs)}$$

$$q = It ; \frac{q}{I} = t ; t = \frac{9393.25 \text{ A} \cdot \text{sec}}{5.00 \text{ A}} = 1878.65 \text{ sec}$$

$$\frac{1878.65 \text{ sec}}{60 \text{ sec}} \times \frac{1 \text{ min}}{60 \text{ sec}} = 31.3 \text{ min}$$

Example #3:

If 3.00 A of current is passed through an electrolytic cell containing a concentrated  $\text{CuSO}_4$  solution for 2.0 hours, how many grams of copper metal can be collected (plated) at the cathode? (7.11 grams Cu)

$$q = It = (3.00 \text{ A})(7200 \text{ sec}) = 21600 \text{ A} \cdot \text{sec}$$

$$\frac{21600 \text{ A} \cdot \text{sec}}{96500 \text{ A} \cdot \text{sec}} \times \frac{1 \text{ mol } e^{-1}}{2 \text{ mol } e^{-1}} \times \frac{1 \text{ mol Cu}}{1 \text{ mol } e^{-1}} \times \frac{63.55 \text{ g}}{1 \text{ mol Cu}} = 7.11 \text{ g}$$