Worksheet 10

Some things to note that are often misunderstood:

- **A multi-cell battery is comprised of voltaic cells wired in series, so the battery voltage equals the sum of the voltages of the individual cells.**
- **Although many metals react more readily than iron to form oxides, their oxides provide a protective coating against further corrosion. The corrosion product of iron ("rust") flakes off and exposes a fresh surface to further corrosion.**
- **In an electrolytic cell a constant input of energy from an external direct current (dc) source, such as a battery, is used to drive a non-spontaneous reaction. The voltage of the battery must be more positive than the absolute value of the voltage for the electrolysis reaction.**
- **Given current and time, you can find the charge by the product of current and time. Then, use the Faraday as a conversion factor to get moles of e^-. If you use the coefficients in the balanced equation to find the mole ratios, you can figure out the moles of product. From there use molar mass or standard molar volume as a conversion factor to find grams or liters of product.**

1. What is rust? What causes it to form? What can be done to prevent its formation?

2. For a lead storage battery:

(a) Sketch one cell that shows the anode, cathode, electrolyte, direction of electron and ion flow, and sign of the electrodes.

(b) Write the anode, cathode, and overall cell reactions.

(c) Calculate the equilibrium constant for the cell reaction ($E°$ = 1.924 V).

(d) What is the cell voltage when the cell reaction reaches equilibrium?

3. How many grams of HgO react at the cathode of a mercury battery when 2.00 g of zinc is consumed at the anode?

4. Magnesium metal is produced by the electrolysis of molten magnesium chloride using inert electrodes.

(a) Sketch the cell, label the anode and cathode, indicate the sign of the electrodes, and show the direction of electron and ion flow.

(b) Write balanced equations for the anode, cathode, and overall cell reactions.

5. How many grams of silver will be obtained when an aqueous silver nitrate solution is electrolyzed for 20.0 min with a constant current of 2.40 A?

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6. How many grams of $PbSO_4$ are reduced at the cathode if you charge a lead storage battery for 1.50 h with a constant current of 10.0 A?