Faraday's Laws Calculations

1. A spoon was electroplated by electrolysing a solution of $AgNO_3$ and using the spoon as the cathode. A current of 0.150 A was passed through the solution for 30.0 minutes. What mass of silver was deposited?

2. What mass of nickel will be deposited when a solution of nickel(II) chloride is electrolysed for 8.00 hours with a current of 3.00 A, if the current efficiency of the process is 95.0%?

3. The anode reaction in a lead-acid accumulator can be represented as:

$$Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$$

If an accumulator contains 4.50×10^2 g of lead in its anode plates, calculate

(a) the total electric charge it could deliver without being recharged, and
(b) the length of time the battery could supply a current of 1.25 A, assuming a constant current was maintained.

4. A steel jetty is protected from corrosion by an impressed current system. An electric circuit is set up using scrap iron as the anode and the steel jetty as the cathode. A current of 5.00 A is passed through the circuit. The electrode reactions are:

Anode: $Fe \rightarrow Fe^{2+} + 2e^-$

Cathode: $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

Calculate for a 24.0 hour period

(a) the charge which passes through the circuit,
(b) the mass of iron lost at the anode, and
(c) the volume of hydrogen produced at S.T.P.

5. Three cells are connected in series and contain respectively solutions of $AgNO_3$, $CuSO_4$ and Na_2SO_4. During electrolysis 20.0 g of silver is deposited in the first cell. Calculate

(a) the mass of copper produced in the second cell, and
(b) the volume of oxygen produced at S.T.P.in the third cell.

6. Two electrolytic cells connected in series contain solutions of copper(II) sulfate and an unknown metal(III) sulfate. The passage of an electric current through the cells results in the deposition of 2.54 g of copper in the first cell and 1.39 g of the unknown metal in the second cell. Calculate the relative atomic mass of the unknown metal.

7. A solution of copper(II) sulfate was electrolysed, resulting in 3.18 g of copper being deposited at the cathode. The oxygen formed at the anode was collected over water at 20.0 °C and 105 kPa pressure. If the vapour pressure of water at 20.0 °C is 2.34 kPa calculate the volume occupied by the oxygen.