OBJECTIVES

Chapter 4 - Conservation of Net Charge

1. Define, explain, compare and contrast the following terms and concepts:
   - Electric charge
     - positive charge (q^+)
     - negative charge (q^-)
     - net charge (q)
     - unit of charge -- Coulomb
     - smallest granule of charge, e.g. charge per electron
   - Application of Accounting Principle for Positive/Negative Charge
     - rate of accumulation of positive/negative charge within the system
       - amount of positive/negative charge within the system
         - positive/negative charge density (C/m^3)
         - specific charge and molar specific charge
     - transport rate of positive/negative charge across system boundaries
     - generation/consumption rate of positive/negative charge within the system
   - Application of Accounting Principle for Net Charge
     - rate of accumulation of net charge within the system
       - amount of net charge within the system
         - charge density (C/m^3)
     - transport rate of net charge
       - electric current (ampere)
     - generation/consumption rate of net charge within the system
       - **Empirical result ====> Net charge is conserved !**
   - Important assumptions
     - steady-state system
     - no accumulation of net charge
     - ideal circuit element (resistor, capacitor, conductor, and inductor)
       - ideal circuit elements cannot accumulate net charge.
   - Ohm's Law (constitutive relation between voltage change across a resistor and the current flowing through the resistor)
     - unit of resistance -- ohm

2. Given a system with specified positive/negative/net charge transport rates, calculate the rate of accumulation of positive/negative/net charge within the system. Additionally calculate the amount of positive/negative/net charge accumulation if a time interval is specified.

3. Given an electrical network consisting of ideal circuit elements (conductors, resistors, capacitors, and inductors), apply the conservation of net charge equation to develop a set of equations involving only currents that can be used to calculate the electric current in each branch of the network. (This does not require knowing the voltage-current relationship for any of the circuit elements.)

4. Given an electrical network consisting of only resistors, current sources, and voltage sources, apply conservation of charge combined with Ohms Law to solve for all the voltages and currents in the network. Also be able to determine if you have sufficient information to solve for the unknowns. [Application of Kirchoff's Voltage "Law" is not allowed.]