1. A household electrical outlet has an EMF of 100 Volts. (assume negligible internal resistance).
   1.a Assume that 10 100 Watt light bulbs in parallel are plugged into this outlet. Assume that in this configuration the power in each light bulb is 100 Watts. What is the current through each light bulb? (recall 1 Watt = 1 Joule/second).
   1.b What is the resistance of each light bulb?
   1.c If the same 10 light bulbs are plugged into this outlet in series, what is the total resistance of the circuit?
   1.d What is the current in the circuit in part c.?
   1.e How much total power is dissipated in the 10 light bulbs in series in part c.?

2. A circuit has a battery with a 12 V EMF and three additional $2 \times 10^{-6} F$ capacitors - 2 in parallel and 1 in series with the parallel combination.
   2.a What is the total capacitance of the circuit.
   2.b What is the total stored charge?
   2.c What is the voltage across the two capacitors in parallel?
   2.d How much energy is stored in the $2 \times 10^{-6} F$ capacitor that is in series with the parallel combination?

3. Three long parallel wires are in the $x - z$ plane. Assume that the wires are in the $z$-direction in the $x - z$ plane, with identical currents $I$ in the $+z$ direction. The perpendicular distance between the adjacent wires is $d$.
   3.a What is the magnitude and direction of the magnetic field at a distance $2d$ to the right of the wire on the right?
   3.b What is the force per unit length on the middle wire due to the magnetic field of the outer two wires (magnitude and direction)?
   3.c What is the force per unit length on the wire furthest to the right due to the magnetic field of the other two wires (magnitude and direction).
   3.d What is the force per unit length on the wire furthest to the right due to the magnetic field of the other two wires if the current in the wire on the right is set to 0 (magnitude and direction)?

4. A $1 \times 10^{-6} F$ capacitor is charged by an EMF of 12 Volts. The EMF is removed and a resistor of unknown resistance is placed across the leads of the capacitor.
4.a If the capacitor discharges to $1/e$ of its initial charge in .1 second, what is the unknown resistance?

4.b What is the charge on the capacitor as a function of time?

4.c What is the current through the resistor as a function of time?

4.d How much power is dissipated as heat in the resistor as a function of time?

\[ e = 2.71828 \quad \mu_0 = 4\pi \times 10^{-7}Tm^2/A \]