Reminders 2-26-08:

- Next Webassign Due February 27
- Electric Energy Conceptual Questions Today
- Answers to chapter 17-18 Conceptual questions (not assigned) will be posted.
- Read Chapter 18
- Multi-meter Quiz
- Exam 2 Chapters 15-18 Tuesday March 4

Objectives:

- Electric Circuits
- Ohm's Law
- Series and Parallel Circuits

- A copper wire has a resistance of 10 ohms at 20°C. How does its resistance change its temperature rises to 100°C ($\alpha = 20 \times 10^{-3}/°C$)?
- If it is hooked up to a 24V power supply, calculate the current through it.

$$\frac{L}{A}\rho = \frac{L}{A}\rho_0\left[1 + \alpha(T - T_0)\right] \qquad T_0 \approx 20°C$$

$$R = R_0\left[1 + \alpha(T - T_0)\right]$$

$$= 10\left[1 + \alpha\, 80C^\circ\right]$$

$$\alpha_{Cu} = 20 \times 10^{-3}/C^\circ$$

$$R = 10\left[1 + (20 \times 10^{-3}/C^\circ)80\right]$$

$$= 26\,\Omega$$

$$I = \frac{V}{R} = \frac{24V}{26\,\Omega} = 0.92A$$

$$V \cdot A = \frac{J}{C} \cdot \frac{C}{s} = \frac{J}{s} = \text{Watts}$$

Units of Power

- **A 100 W light bulb is rated at 120 V. How much current must pass through the bulb to dissipate energy at this rate? What is the resistance of the bulb? What happens as it heats up? How much does it cost to run light-bulb for 24 hours if it costs $0.080 per kilowatt-hour?** (Ans: 0.83 Amps; 19¢)

$P = IV \quad I = \frac{P}{V} = \frac{100\,W}{120\,V} = 0.83\,A$

$Energy = \frac{(100\,\frac{J}{s})(86{,}400\,\frac{s}{day})}{1000\,\frac{J}{s}\;3600\,\frac{s}{hr}\cdot hr}$

$Cost = \frac{(100\,\frac{J}{s})(86{,}400\,\frac{s}{day})}{3.6\times10^{6}\,J}(.08) = 19¢$

$P = VI \quad V = IR$

$P = (IR)I = I^2R$

$P = V\left(\frac{V}{R}\right) = \frac{V^2}{R}$

- **A battery is designed to deliver 31 A for 2.0 hrs before becoming totally discharged.**
  - **How many coulombs of charge can it deliver?**
  - **What is the corresponding number of electrons?**
  - **If a battery charger delivers 2.0 A of current, how long will it take to recharge the battery?**

$I = \frac{\Delta Q}{\Delta t}$ $\Delta Q = I \Delta t$

$\Delta Q = (31\,A)(2\,hr)(3600)$

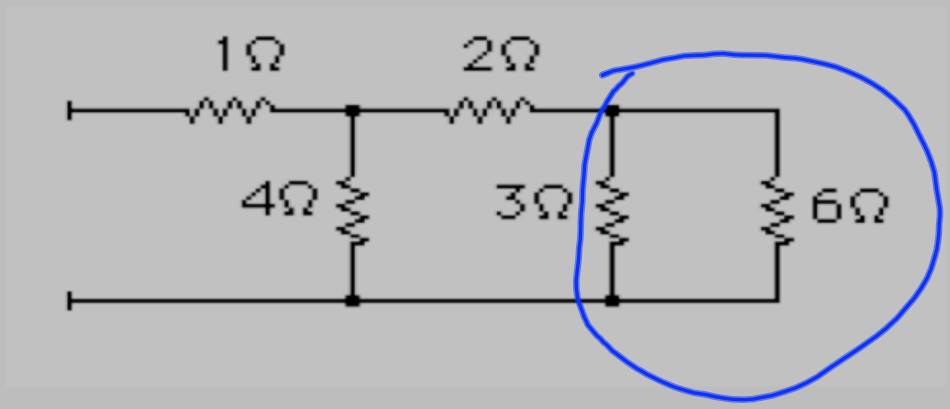
$= 2.2 \times 10^5\,C$

$\#\ electrons = \frac{2.2 \times 10^5\,C}{1.6 \times 10^{-19}\,C/el} \approx 1.4 \times 10^{24}\,el.$

$\Delta t = \frac{\Delta Q}{I} = \left(\frac{2.2 \times 10^5\,s}{2\,A}\right) \frac{1}{3600\,\frac{s}{hr}}$

$= 31\,hr$

- **Find the equivalent resistance of the circuit below.**



$\frac{1}{3} + \frac{1}{6} = \frac{1}{R}$ $R = 2\Omega$