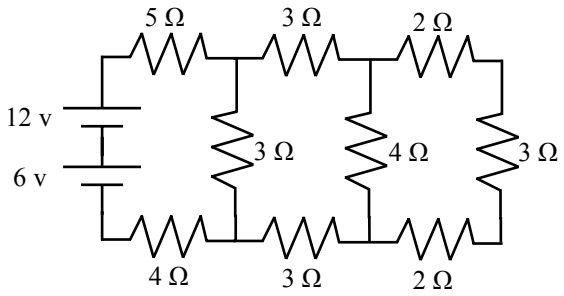
Notes for Electricity 7 (Jan 20 and 23)

1. P = IV and V = IR. Derive an equation for power in a resistor:
2. Check Equation and Variable Sheets
3. Talk again about Electric Fields (and drawing them)
4. Redraw this circuit so that all parallel branches are parallel to each other:

(Hint, start with series resistors: "squish them together" into one branch. May take a couple redraws.)



5. AC versus DC current - AC stands for Alternating Current. DC stands for Direct Current. A battery makes DC current – flowing only one direction. AC current changes directions, constantly alternating from positive to negative. We use AC current in our houses. There is a ground (neutral) wire and a hot wire. The current through the hot wire goes one direction, then the other, switching 60 times a second (called 60 Hertz [Hz]).
6. Cost of Energy and Kilowatt hours:

Your electric company sells electricity in kilowatt-hours. If power is work (J)/time (s), then multiplying by time gives us work. And work is stored energy! So the electric company really does sell you electricity in joules – energy!

$$\text{Power x time} = \frac{\text{work}}{\text{time}} \text{ x time} = \text{work} = \textit{joules} = \textit{energy!}$$

1 kilowatt = 1000 watts.
To get kilowatts, do a conversion:
Ex. 5000 watts is how many kilowatts?

$$(5000 \cancel{\text{W}}) \frac{1 \text{ kW}}{1000 \cancel{\text{W}}} = 5 \text{ kW}$$

Kilowatt-hours (kWh) = P (kW) x t (hr)

Ex. How many kilowatt-hours to run a 10 kW mower for 90 minutes?

Change 90 minutes to 1.5 hours and:

(10 kW) x 1.5 = 15 kWh

Cost of electricity = kWh x price per kWh

Ex. If the electric company sells electricity at .10/kWh. How much does 12 kWh cost?

(12 kWh)(.10) = 1.20 or $1.20

Ex. If the electric company charges $.06 per kWh, how much would it cost to run a 100-watt bulb for 2 hours a day for a month?

1. Power in watts (P = VI)	2. Find kW (divide 1. by 1000)	3. Find kWh (multiply 2. by time in hours)	4. Multiply 3. by cost per kWh
Ex. 100 watt bulb	100 /1000 = .1 kW	2 hours x 30 days = 60 hours (.1 kW)(60hr) = 6 kWh	(6 kWh)(.06) = $.36 36 cents!

7. Capacitor Equations (For capacitors only.) $C = \frac{Q}{\Delta V}$ $PE_{electric} = \frac{1}{2} Q \Delta V$ $C = \varepsilon_o \frac{A}{d}$

C is capacitance in coulombs/volt (how much charge it can hold per volt).
A—area of the plates d—distance between plates
ε_o—permittivity of a vacuum (how good an insulator a vacuum is) = 8.85×10^{-12}

8. Ways to increase capacitance:
   1. Increase distance between plates— Farther apart = more insulation = more charge before it pushes across.
   2. Better dielectric (insulator in between the plates) - again, better dielectric = better insulation = more charge.
   3. Increase plate area—more area = more charge can spread out = more charge can be held before it pushes across.