

ECE 109L - THE VERY BASICS - LAB 1

MEASURING CURRENT

FALL 2006

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OBJECTIVE

The objective of this lab is to learn how to measure currents in resistor circuits and to see how the choice of a current's reference direction affects its sign.

LAB

1. **PreLab** - Mathcad is a program that graphs functions, solves equations and does symbolic manipulations. The big advantage of Mathcad is how easy it is to learn and use - especially how easy it is to change the value of a parameter and see what happens to all the variables and graphs that depend on it. Run and obtain a printout of the following Mathcad programs.

PROGRAM 1 - Simple Calculating

$$2 + 3 \sqrt{5} =$$

1. The square root symbol is on the arithmetic palette
2. When you type the equal sign Mathcad will display the answer just like a regular calculator

PROGRAM 2 - Variables

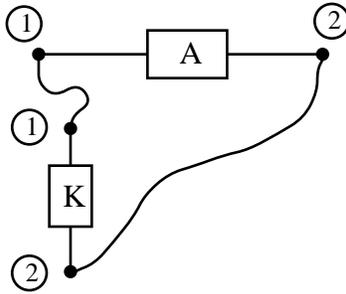
$$\begin{aligned}x &:= 5 \\y &:= x + 3 \\y &= \end{aligned}$$

1. Press the return after entering each line
2. The symbol `:=` can be obtained by typing a *colon*. It's also on the Arithmetic Palette. In the first line it tells Mathcad that x is equal to 5 and in the second line it tells Mathcad that y is equal to the expression x+3
3. Typing y and then a "regular" equal sign on the keyboard tells Mathcad to find the value of y
4. If you change the value of x then the value of y will change
5. The placement of equations matters. The equation for y cannot come before you tell Mathcad the value of x. If you do something Mathcad doesn't like then the corresponding equation or variable will turn red.

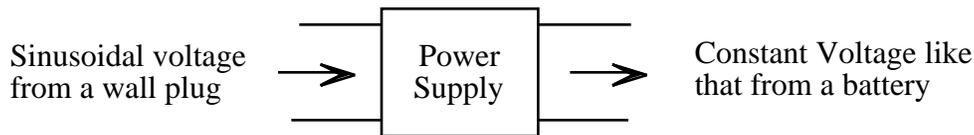
PROGRAM 3 - Range Variables

$$\begin{aligned}n &:= 2, 3 .. 5 \\2*n &= \end{aligned}$$

1. The first line tells Mathcad that
 - a. The first value of $n = 2$
 - b. The second value of $n = 3$
 - c. The difference between consecutive values of n is $3-2 = 1$
 - d. The last value of $n = 5$
 2. The symbol `..` can be obtained by typing a *semicolon*. It's also on the Arithmetic Palette as `m..n`
 3. When you type $2*n =$ Mathcad will generate a table of numbers - one for each value of n
2. Use your clip leads to put together the following "resistor" circuit

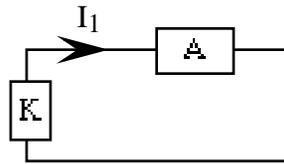


Then connect up your **power supply** - a magical circuit that turns sinusoidal voltages from wall sockets into constant voltages as follows

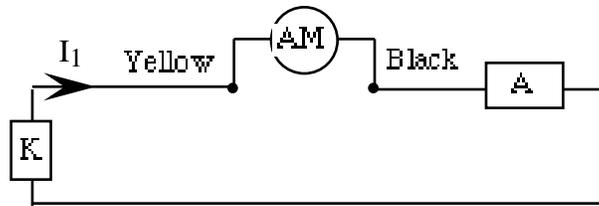


to the red and black connectors on the left side of your resistor boxes. It's the power supply that exerts the force in our circuit that gets the charges moving. Draw a picture of the circuit above for your lab report.

3. To **measure the current** I_1 in a circuit like the one you just built

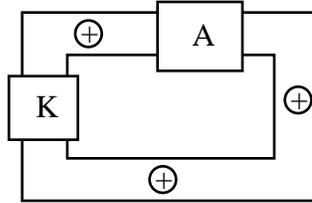


we **insert** a current meter with the leads connected as follows

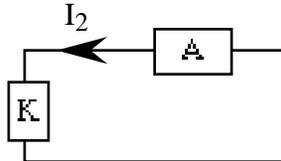


so the reference arrow is pointing from the yellow to black lead as indicated. With the meter connected this way it will give us the **conventional current** corresponding to the flow of equivalent positive charge. We set the meter to DCA (Direct Current or constant Amps). It's usually good practice to start from the highest possible scale and then work your way down until you get a reading. Large currents can cause damage if the meter is set to read a small current.

- PreLab** - Draw a picture of your circuit with the meter inserted to measure the current I_1 . Be sure to indicate the colors of the leads and the numbers 1 and 2 showing how the circuit is connected
- Measure I_1
- Now make use of your result in part (b) to draw a diagram like the following with arrows that show the direction the equivalent positive charge is flowing in the circuit.



4. Let us again measure the current in our circuit - but this time with the reference arrow reversed as follows



- PreLab** - Redraw the circuit with the current meter inserted to measure I_2 . Be sure to indicate the colors of the leads
- Measure I_2
- Make use of your result in part (b) to draw a diagram showing the flow of equivalent positive charge. How is your result related to what you got for the epc flow in Problem (3) above. Explain what's going on
- Write an equation for I_1 as a function of I_2
- Describe in words how I_2 is related to I_1