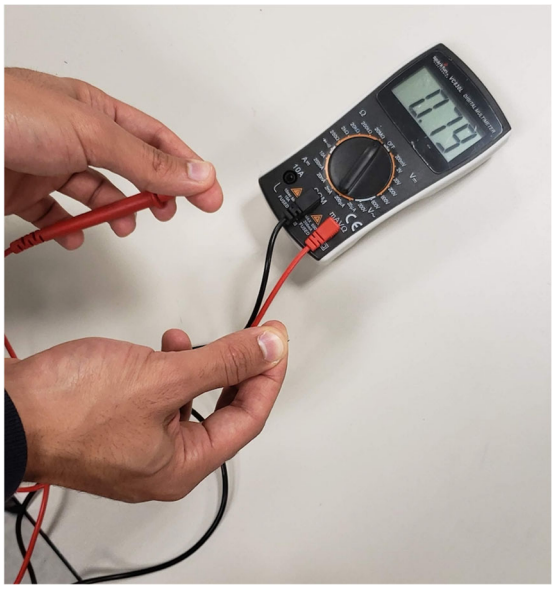
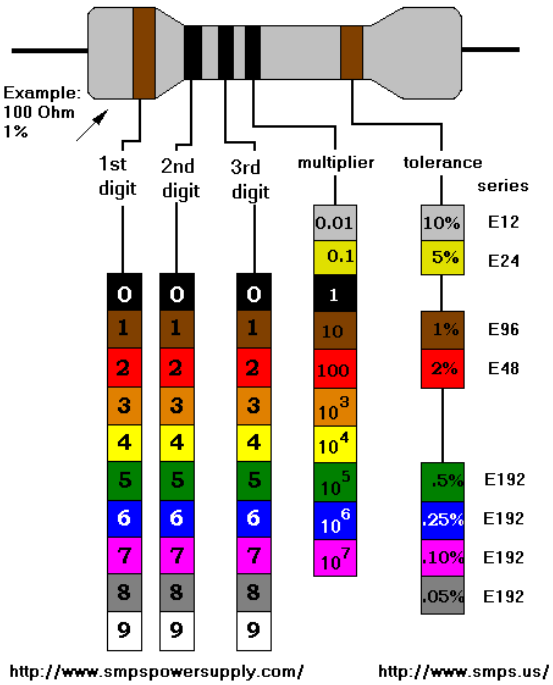
Lab 2 - Introduction to resistors, breadboard and multimeters

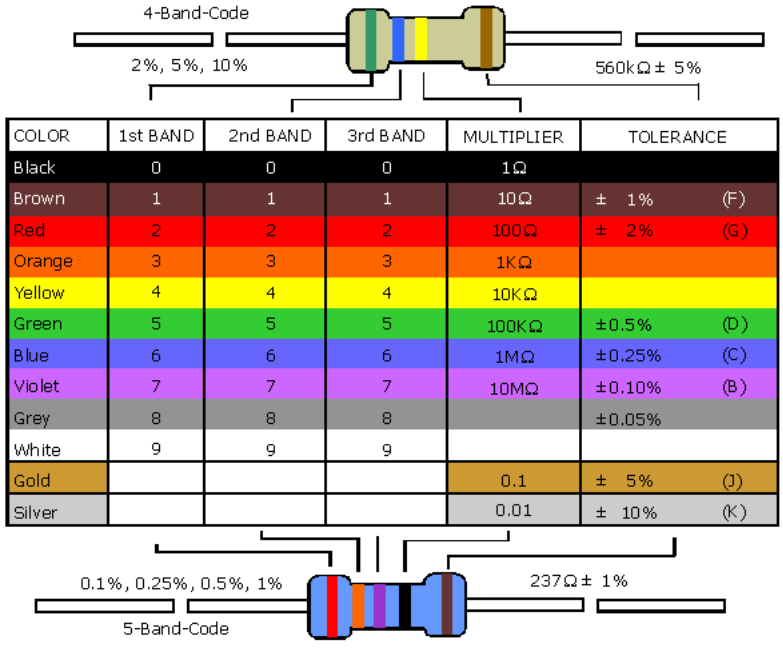
To do this lab you will need: the breadboard, multimeter, 3 different resistors and a 9 v battery with its clips

1. Get your multimeter and two probes.
2. Turn the multimeter on and switch the dial to the "Ohm" range.
3. Now verify basic function by gently touching the probes together.
4. Comment on what happens



5. Using your fingers (see Figure), hold one of the meter probes to each end of the resistor.
6. What do you record?
7. Using one of the resistor color code chart (four bands and five bands) following compare the value of what you measured with the multimeter and the color code chart. (Note that then second chart really combines both types of resistors.)
8. Are your measurements within the calculated tolerance?





COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE	
Black	0	0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1KΩ		
Yellow	4	4	4	10KΩ		
Green	5	5	5	100KΩ	±0.5%	(D)
Blue	6	6	6	1MΩ	±0.25%	(C)
Violet	7	7	7	10MΩ	±0.10%	(B)
Grey	8	8	8		±0.05%	
White	9	9	9			
Gold				0.1	± 5%	(J)
Silver				0.01	± 10%	(K)

9. Now try this measurement again by putting the resistor on the table and pressing the probe to the leads.
10. Measure the actual resistances for all three resistors:

R_1 =
R_2 =
R_3 =

SERIES CIRCUIT ANALYSIS

11. Let's take a look at the circuit with resistors in series, shown below.
12. What should the resistance between nodes A and B equal? That is, calculate this value using the measured values.

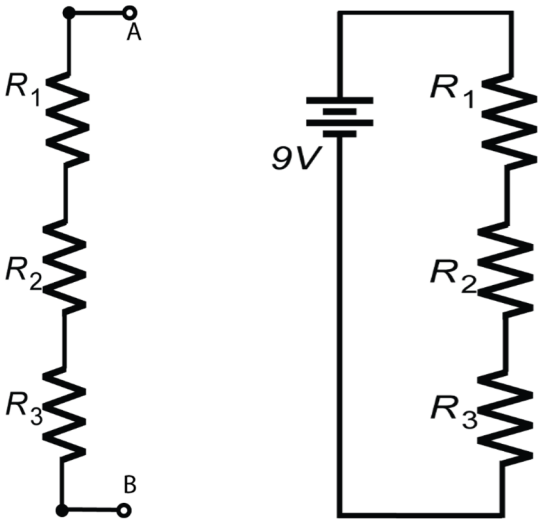
$R_{AB\ Series\ calculated}$ =

13. Build this circuit on your breadboard. Verify AB resistance via multimeter measurement is the same as the value you obtained in step 12..

$R_{AB\ Series\ measured}$ =

14. Is it the same value as in Step 12? If not, explain why?

15. Snap a photo of your breadboard circuit and include it in your report.



16. Measure the actual output voltage of the 9V battery:

$V_{BATTERY}$ =

17. Now connect a 9V battery per circuit.
    a) Measure the voltage across each resistor. Add up these 3 voltages Should it be the same as the value in Step 16? If not, explain why?

$V_{R1\ measured}$ =
$V_{R2\ measured}$ =
$V_{R3\ measured}$ =

$V_{AB\ calculated}$ =

b) Now measure these voltages and determine the voltage from a to b of the series circuit.

$V_{AB\ Series}$ =

c) How do the results in Steps a) and b) compare?

18. How much current should flow through R_1, R_2, and R_3 that is from a to b? Perform this calculation. Calculate the current through R_1, R_2, and R_3 and the current through the series circuit.

$I_{R1\ calculated} = V_{R1\ measured}$ / R1 measured
$I_{R2\ calculated} = V_{R2\ measured}$ / R2 measured
$I_{R3\ calculated} = V_{R3\ measured}$ / R3 measured

$I_{AB\ calculated} = V_{AB\ Series}$ / Sum of (R1 measured+ R2 measured+ R3 measured)

a) How do these currents compare to each other and the current from a to b compare?

19. Snap a photo for your lab report.

PARALLEL CIRCUIT ANALYSIS

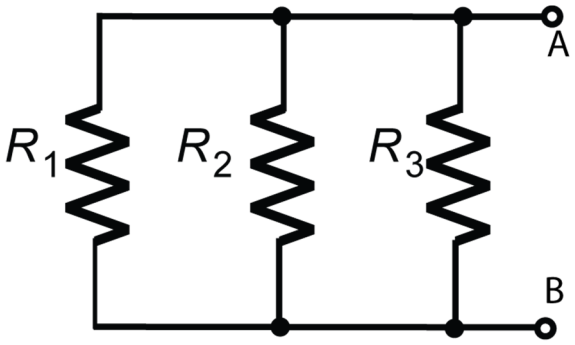
20. Build a parallel circuit, per diagram below.
21. Without using the multimeter calculate What should the resistance between A and B be?

$R_{AB\ Parallel\ calculated}$ =

22. Verify this via multimeter measurement. What do you record?

$R_{AB\ Parallel\ measured}$ =

23. Snap a photo.



24. Measured the battery voltage.

$V_{BATTERY}$ =

25. Now connect a 9V battery per circuit below.
    a) How much voltage should be across R_1, R_2, and R_3 ? Should it be the same as the value in Step 25? If not, explain why?

$V_{R1\ calculated}$ =
$V_{R2\ calculated}$ =
$V_{R3\ calculated}$ =

$V_{AB\ calculated}$ =

    b) Now measure these voltages and determine the voltage from a to b of the series circuit.

$V_{R1\ measured}$ =
$V_{R2\ measured}$ =
$V_{R3\ measured}$ =

$V_{AB\ measured}$ =

c) How do these voltages compare to each other and with the voltages calculated in Steps a) and b) compare?

28. Without using your multimeter calculate how much current should now flow through R_1, R_2, and R_3 and the current flowing through the parallel circuit? Comment on this result.

$I_{R1\ calculated} = V_{R1\ measured} / R1\ measured$
$I_{R2\ calculated} = V_{R2\ measured} / R2\ measured$
$I_{R3\ calculated} = V_{R3\ measured} / R3\ measured$

$I_{AB\ parallel}$ = Sum of $I_{R1\ calculated} + I_{R2\ calculated} + I_{R3\ calculated}$

Calculate the total current using the value of the Voltage in step 24 and the value of the current resistance in step 22.

$I_{AB\ parallel}$ =

a) How do these currents compare to each other and the current from a to b compare?

29. Snap a photo.

SERIES/PARALLEL CIRCUIT ANALYSIS

30. Let's build the following circuit.

31. What should the resistance between nodes A and B equal? That is, calculate this value.

$R_{AB\ calculated}$ =

32. Verify this via multimeter measurement. What do you record?

$R_{AB\ measured}$ =

33. Measured the battery voltage.

$V_{BATTERY}$ =

34. Now connect a 9V battery per circuit below.
    a) How much voltage should be across R_1, R_2, and R_3 ? Should it be the same as the value in Step 33? If not, explain why?

$V_{R1\ calculated}$ =
$V_{R2\ calculated}$ =
$V_{R3\ calculated}$ =

$V_{AB\ calculated}$ =

    b) Now measure these voltages and determine the voltage from a to b of the series circuit.

$V_{R1\ measured}$ =
$V_{R2\ measured}$ =
$V_{R3\ measured}$ =

$V_{AB\ measured}$ =

    c) How do these voltages compare to each other and with the voltages calculated in Steps a) and b) compare?

35. Without using your multimeter calculate how much current should now flow through R_1, R_2, and R_3 and the current flowing through the parallel circuit? Comment on this result.

$I_{R1\ calculated}$ =
$I_{R2\ calculated}$ =
$I_{R3\ calculated}$ =

I_{AB} =

36. Without using your multimeter calculate how much current should now flow through R_1, R_2, and R_3 and the current flowing through the circuit circuit? Comment on this result.

$I_{R1\ calculated}$ =
$I_{R2\ calculated}$ =
$I_{R3\ calculated}$ =

I_{AB} =

a) How do these currents compare to each other and the current from a to b compare?

37. Snap a photo.