Basic Electronics

A circuit is a closed path for electron (current) flow
A circuit must have four key elements

- A voltage source
- A load - A resistor is an example of a load
  - a resistor makes resistance to current flow
- A complete path
- A switch

Voltage is the force in a voltage source and is measured in VOLTS. The symbol for voltage is "**V**"

Current is (how fast) the measure of the flow of electricity in a circuit and it is measured in Amps.
"Amps" is a short form for Amperes. The symbol for Current is "**I**".

Resistance is the opposition to current flow. The symbol for resistance is "**R**". Resistance is measured in OHMS (Ω for short).

A **multimeter** is an instrument used to measure voltage, current, and resistance in a circuit.

A resistor is a small electronic component used to add resistance (or load) in a circuit.

Resistor values are given in ohms (**Ω)**.

Circuit Drawing and electronic schematic diagram symbols

These are some proper symbols used to draw diagrams (schematics) in electronic circuits.

Wire

(the dots indicate connection points)

Switch (open) 

Switch (closed)

Resistor

Voltmeter (measures voltage)

Ohmmeter (measures resistance)

Ammeter (measures current)

Light bulb

Diode

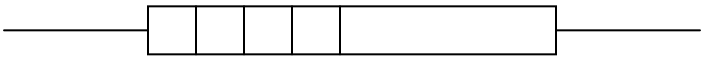
LED (light emitting diode)

The Resistor colour code

The code is a convenient way to tell the resistance of a resistor.
(It is also used for other components such as capacitors)

Coloured bands are placed on a resistor. Each band has a numerical value.

Bands are read from left to right.



First band = first digit
Second Band = second digit
Third Band (may no be present) = third digit if a fourth band is present
Fourth band = multiplier
Last band (usually separated from the others) = the tolerance (how accurate the R value is)

The following table must be memorized

COLOUR OF BAND	FIRST BAND	SECOND BAND	Multiplier	Tolerance
BLACK	0	0	1	
BROWN	1	1	10	
RED	2	2	100	
ORANGE	3	3	1,000	
YELLOW	4	4	10,000	
GREEN	5	5	100,000	
BLUE	6	6	1,000,000	
VIOLET	7	7	10,000,000	
GRAY	8	8	100,000,000	
WHITE	9	9	1,000,000,000	
SILVER				+/- 10%
GOLD				+/- 5%

Type of Circuits

There are basically two types of circuits:

- Series Circuits
- Parallel Circuits

Series Circuits
In series circuits there is one path for current flow.
This is an example of series circuit

Parallel circuits
In parallel circuits there could be two or more paths for current flow
This is an example of a parallel circuit

EXAMPLE: What is the value of resistance of a resistor with the following coloured bands:

Yellow, green, red, gold

Solution

Yellow = 4 → first number = 4
Green = 5 → second number = 5
Red (in the third band) = X100

∴ THE VALUE OF THE RESISTOR IS 45x100 = 4,500 ohms OR 4.5kΩ (4.5 KILO-OHMS)
Since the last band is gold, the accuracy of this resistor is ± 5%. This means that it can have a value that can go from a high value of [4500 + 5%*(4500)] = [4500 + 225] = 4725 Ω
to a low value of [4500 – 5%*(4500)] = [4500 – 225] = 4275 Ω

EXERCISES

A. Find the resistance for the following resistors and state the high/low range for each.
   1. brown, black, red, gold
   2. orange, yellow, red, silver
   3. blue, black, green, silver

B. Draw a circuit diagram, using proper symbols to show the following
   1. A series circuit with a battery, an ammeter, and a light bulb
   2. A parallel circuit with a battery, a voltmeter, an a light bulb

NAME:_____ PARTNER:_____ GROUP:_____

LAB 1. Using the multimeter to measure resistance

Purpose: to measure the resistance of several resistors and compare the measured value of each resistor with the manufacturer's value from the colour code printed on it.

Materials: Kit with multimeter and wire leads
5 different Resistors (from your teacher)
Colour code chart

Procedure:

1. Obtain the materials
2. Calculate the value of each resistor using the colour code chart
   Show all your work
3. Enter the Value on the Observation table provided (Table 1)
4. Calculate the high/low range of each resistor – show your work
5. Enter the Value on the Observation table provided (Table 1)
6. Using the multimeter. Set it on the resistance scale (Ω). Measure the value of each resistor. Remember to start at the lowest value (200 Ω) and then move up the scale when necessary.
7. Enter the Value on the Observation table provided (Table 2)
8. Have your partner measure the value of each resistor and enter the second reading in the space provided on the table (Table 2)
9. Calculate the average value for the measured resistance
   Use the following formula and enter the vale in Table 2.

10. Calculate the % error between the average measured resistance and the colour-code resistance read in step 5. Use the formula below and enter the value of %error in Table 2.

Calculations:

*Hand in your calculations on a separate sheet – be neat and show all your work

Observations Tables:

Table 1

Resistor	Colours	Colour Code Value (ohms)	High/Low Range
1			
2			
3			
4			
5			

Table 2

Resistor	Measured Value 1 (from multimeter) first reading	Measured Value 2 (from multimeter) second reading	Average Measured Value	% Error
1				
2				
3				
4				
5				

Conclusions:

State your conclusions about the accuracy of the multimeter reading as compared to the colour-code resistance value and its tolerance.