Electrical Quantities Their Units, and Resistors

ELECTRICAL TERMS:

Current:

Ampere:

ELECTRICAL TERMS:

Current: the flow of charge (electrons) in a wire (C/sec)

Ampere: the unit of current (amp, A)

1 A = 1 C/sec

ELECTRICAL TERMS:

Voltage: the common way we describe the tendency of charge to move; energy/charge or work/charge

Volt: the unit of voltage (V)
1V = 1 Joule/C

Voltage Sources: batteries, dams, solar panels, generators, etc...

Analogy:

Moving Mass	Moving Charge
A mass that falls converts GPE into KE (or other)	A charge in an electric field "falls" converting EPE into KE (or other)
A mass falls through a height (feet, meters, etc...)	A charge falls through a potential difference (voltage)
Gravity does work on mass and transfers energy to it when the mass goes from high to low elevation	The E-field does work on a + charge and transfers energy to it when the charge goes from a high voltage to a low voltage.

Voltage is always describing a difference in the EPE that *any* charge would have between two points.

There is only going to be a voltage between two points if there are other charges somewhere nearby that can push or pull other charge (our flowng electrons, current) around.

ELECTRICAL TERMS:

Circuit:

Resistance:

Ohm:

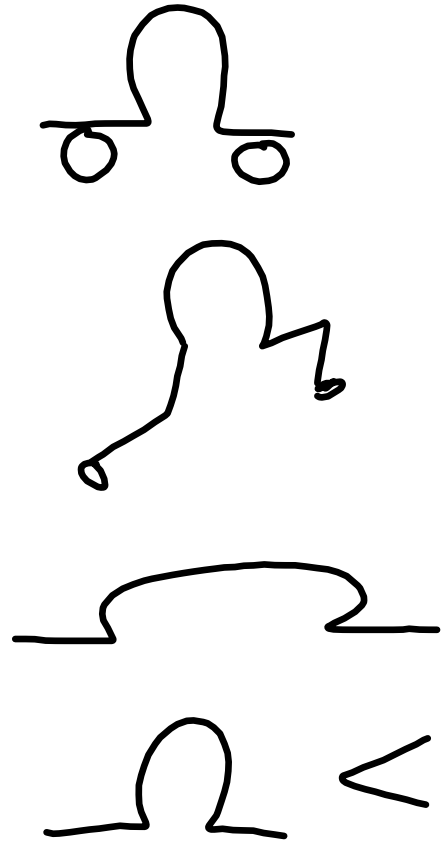
ELECTRICAL TERMS:

Circuit: a grouping of wires and devices that provide for the controlled flow of current.

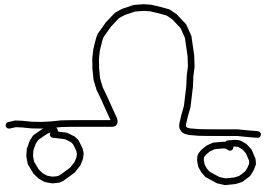
Resistance: the characteristic of a material (like a wire) that resists the flow of current when a potential difference is placed across the material.

Ohm: the unit of resistance (Ω)

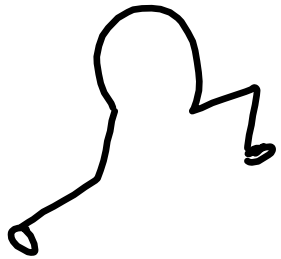
What are these?



What are these?



MOBILE OHM

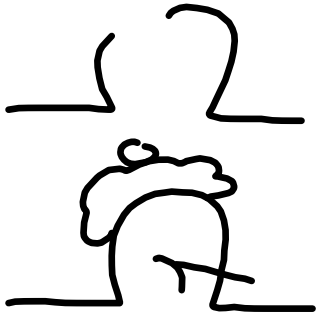


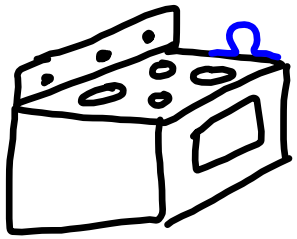
OHM RUN

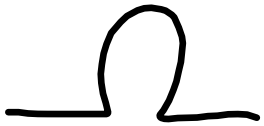
OHM STRETCH

OHM LESS

What are these?

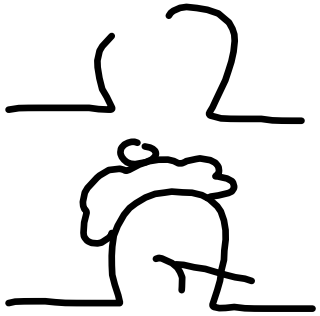






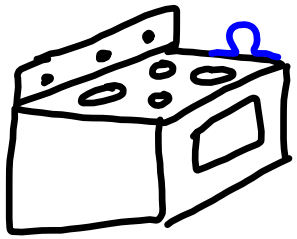
F x d

What are these?

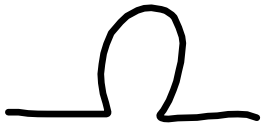


BROKEN OHM

OHM SICK



OHM ON THE RANGE



OHM WORK

ELECTRICAL TERMS:

Power:

Watt:

ELECTRICAL TERMS:

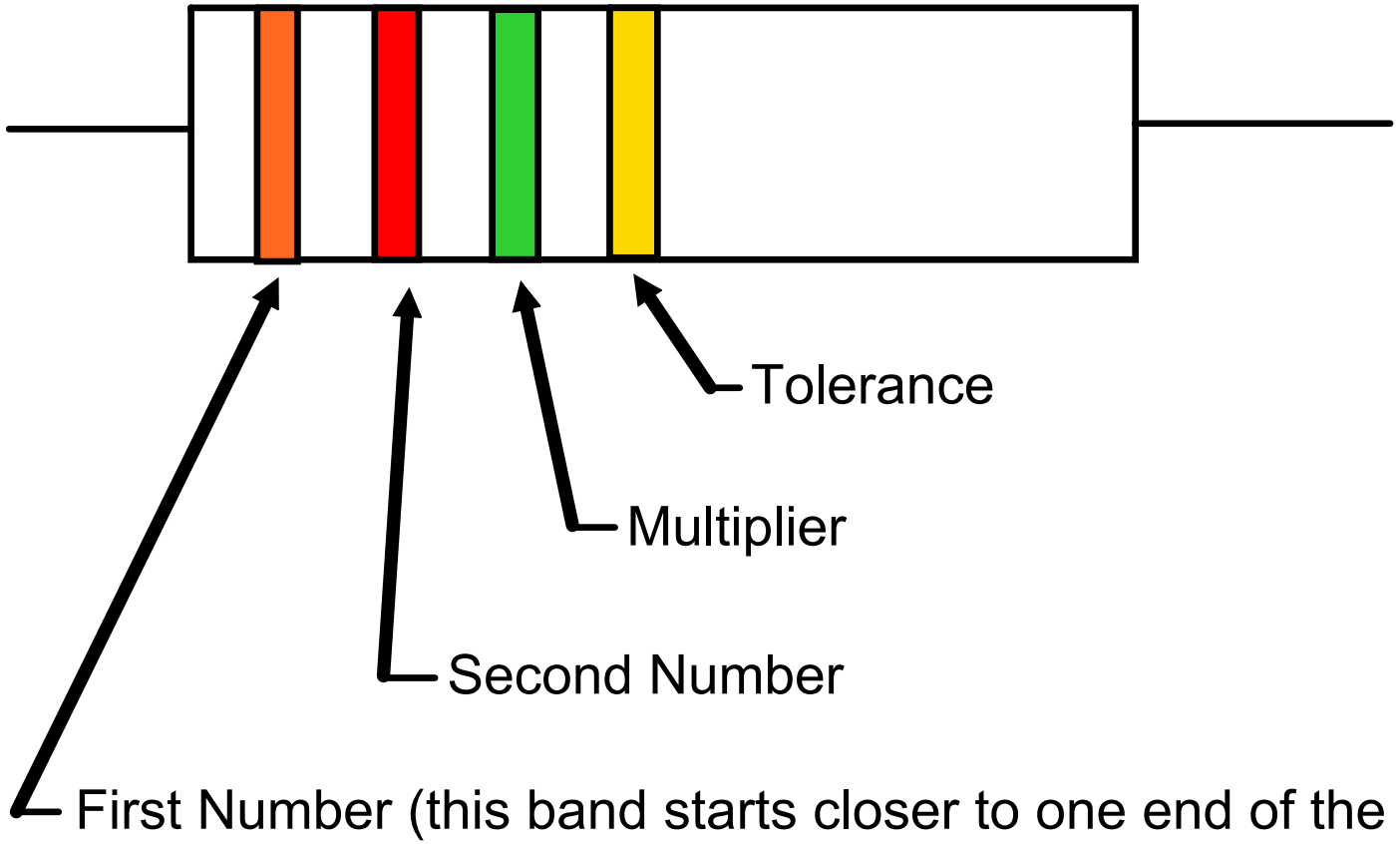
Power: The rate at which energy is transformed or work is done.
P = Energy/time or
P = Work / time

Watt: the unit of power
1 W = 1 Joule/sec = 1 J/sec

Variables used in Electronics:

Quantity	Symbol	Unit of Measure
Charge	Q	Coulomb (C)
Current	I	Ampere (A)
Voltage	V	Volt (V)
Resistance	R	Ohm (Ω)
Power	P	Watt (W)

Resistor Labeling -- Using Colors



COLOR	First Number	Second Number	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		--
White	9	9		--
Gold	--	--	0.1	+/- 5%
Silver	--	--	0.01	+/- 10%
No Color	--	--		+/- 20%

Resistor Labeling -- Example

$32 \times 100000 = 3200000\,\Omega \left(\frac{1\,M\Omega}{1000000\,\Omega}\right)$

$= 3.20\,M\Omega$ $\pm 5\%$

TODAY

- ON A PIECE OF PAPER, EVERYONE MUST DO THE FOLLOWING FOR 10 RESISTORS:

1) DRAW THE COLORS

2) DETERMINE THE R WITH THE TABLE

$25 \times 10 = \underline{250 \pm 5\% \ \Omega}$

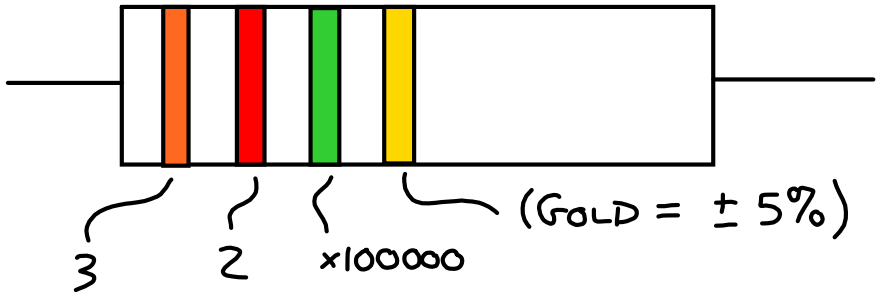
3) MEASURE THE R WITH THE DMM $237\ \Omega$

4) COMMENT ~ DOES THE DMM & COLOR CODE AGREE? YES = ☺

NO = ☹

- MUST USE 10 DIFFERENT RESISTORS.

Resistor Labeling -- Example



Labelled Resistance = 32 x 100000 = 3,200,000 Ω
= 3.2 MΩ

Tolerance Range: 3200000 x .05 = ± 160,000 Ω
= ± 160 kΩ

To be in range, the actual value of the resistor must be

Greater than: 3200000 - 160000
= 3040000 Ω
= 3.04 MΩ
&

Less than: 3200000 + 160000
= 3360000 Ω
= 3.36 MΩ

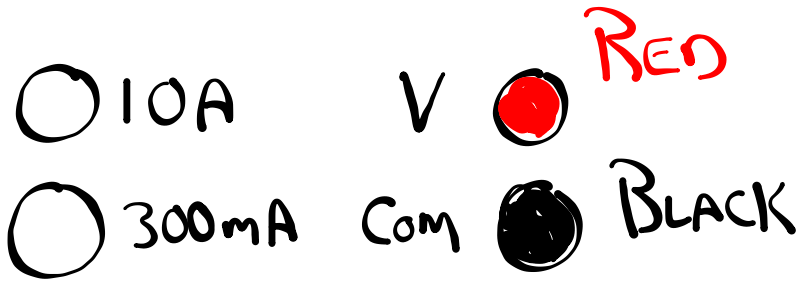
Digital Multimeters (DMM)

We will use them to measure:

1. Resistance
2. Voltage
3. Current
4. To test for continuity (see if a wire is broken).

Measuring Resistance

1) Place Leads:



2) Turn The Dial To "Ω"

3) Isolate The Component Whose Resistance You Want To Measure (Take it out of the circuit)

4) Touch The Leads To Either End of The Component.

5) Read The Value

6. Turn OFF

RESISTOR ACTIVITY

Sharing a DMM in your groups, EVERYONE AS AN INDIVIDUAL SHOULD do the following:

1. Obtain a resistor.
2. On a piece of paper, indicate the four color bands by writing the names of each color in order. (Remember to start from the correct end -- gold or silver is usually the fourth band, but never the first).
3. Below each color, place the number each color represents.
4. Below this, determine the size of the resistor, including the tolerance.
5. Use the DMM to measure the actual resistance.
6. Comment on whether the bands and your reading match.
7. Repeat for 10 total resistors.
8. Turn your paper in for scoring.