BASIC ELECTRONICS

Measurement of Resistance

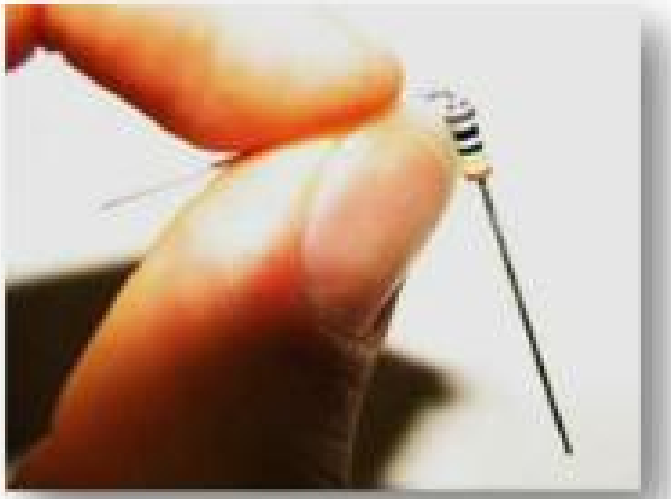
Objectives of Experiment

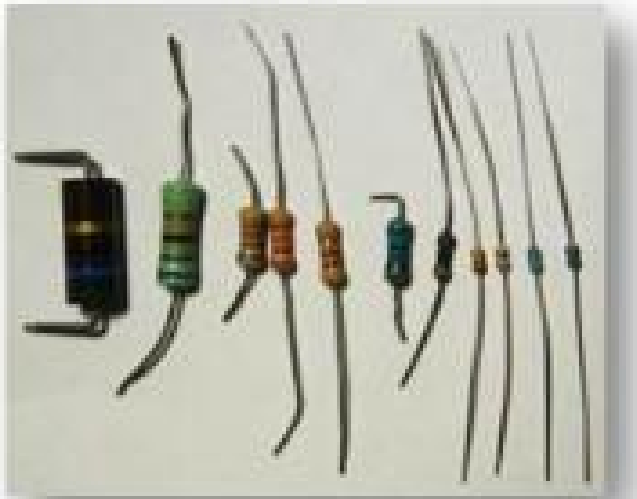
At the end of the experiment the student would be able to

- Explain the function and unit of Resistors
- Measure the value of a Resistor
- Measure the tolerance of a Resistor
- Explain the types of Resistors

Resistors

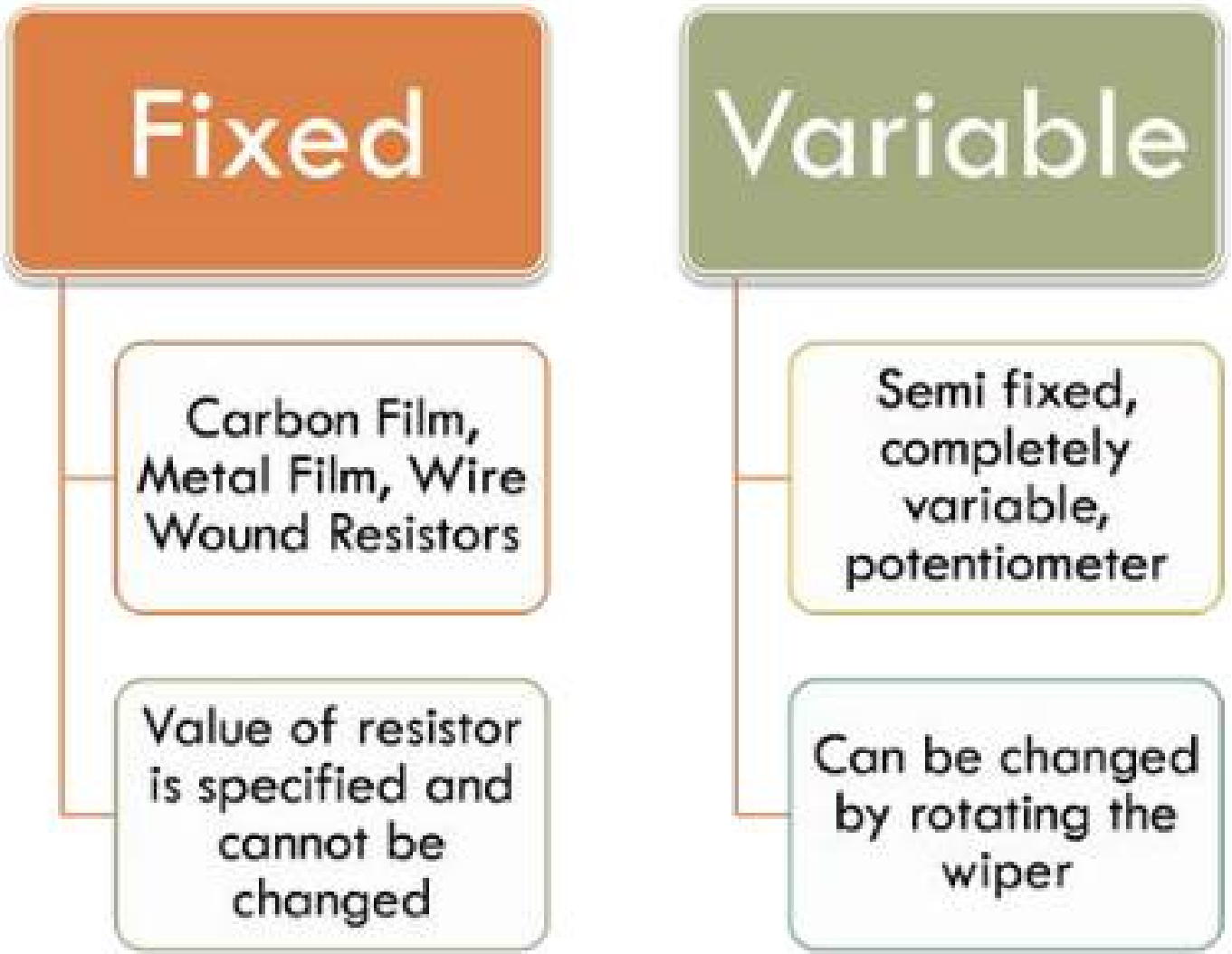
- Oppose the flow of current (electrons)
- A small device – cylindrical in shape





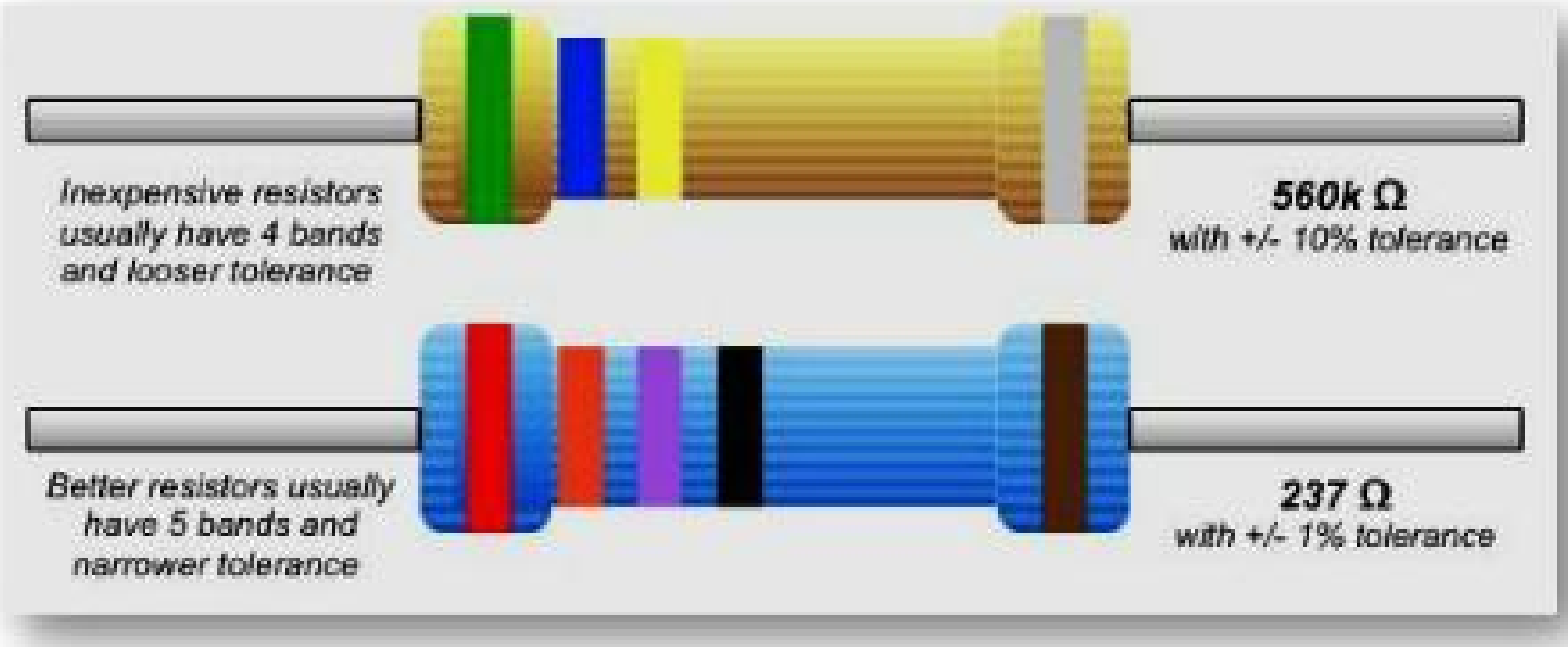
- Resistance is measured in 'Ohm'
- 1000 Ohm Resistor is shown as 1k Ohms and 1000K Ohm Resistor is shown as 1M Ohm.

Types of Resistors



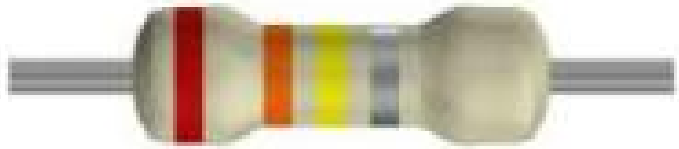
Reading Value of Fixed Resistors

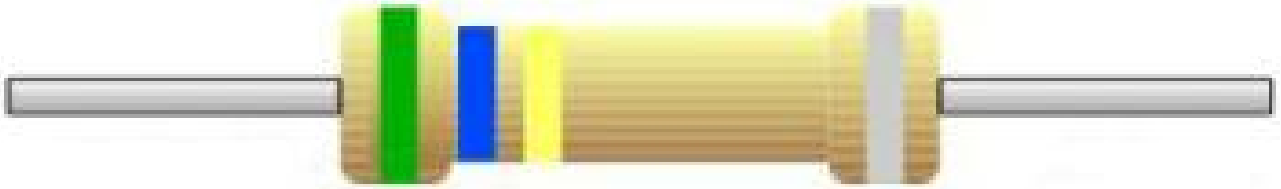
- Resistors are color coded as they are too small for the value to be written on them
- There are 4 or 5 bands of color. Value of a Resistor is decoded from these band of colors



Reading Value : Step 1

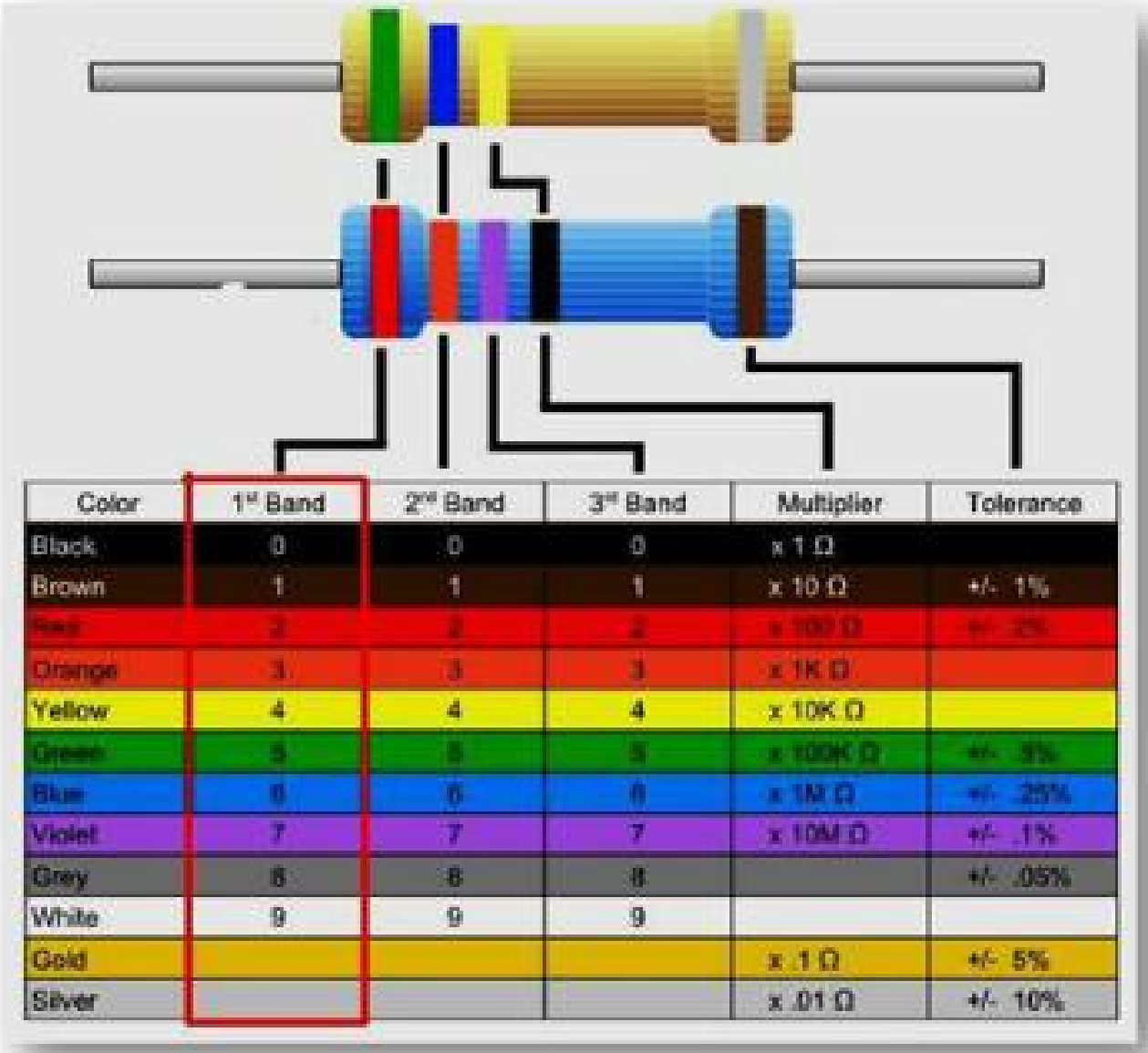
- If your resistor has four color bands, turn the resistor so that the gold or silver band is on the right hand side or the end with more bands should point left.





Reading Value : Step 2

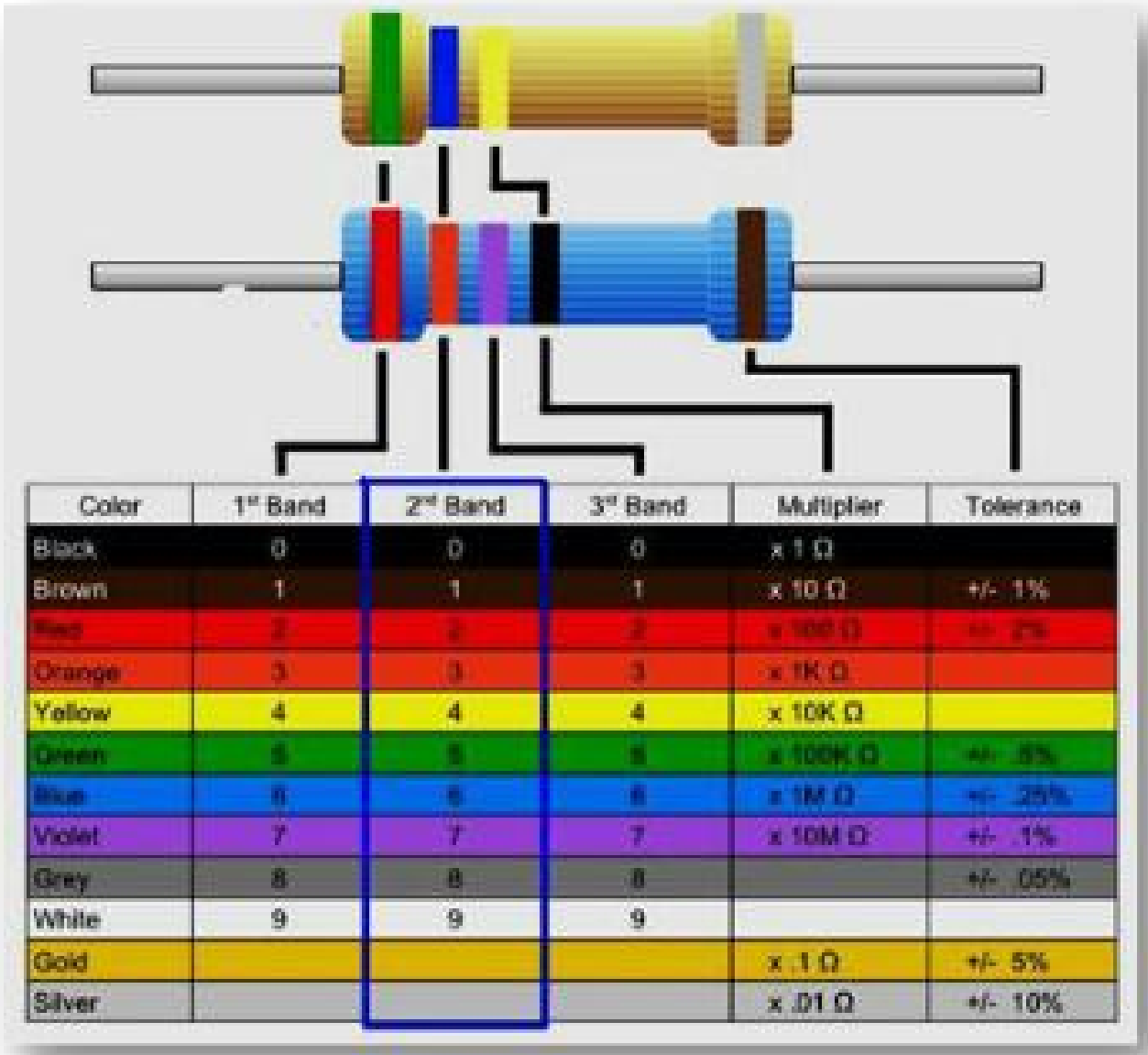
The first band is now on the left hand side. This represents the first digit. Based on the color make a note of the digit. In this case – 4 band its '5' and for 5 band its '2'.



Color	1st Band	2nd Band	3rd Band	Multiplier	Tolerance
Black	0	0	0	x 1 Ω	
Brown	1	1	1	x 10 Ω	+/- 1%
Red	2	2	2	x 100 Ω	+/- 2%
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- 5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

Reading Value : Step 3

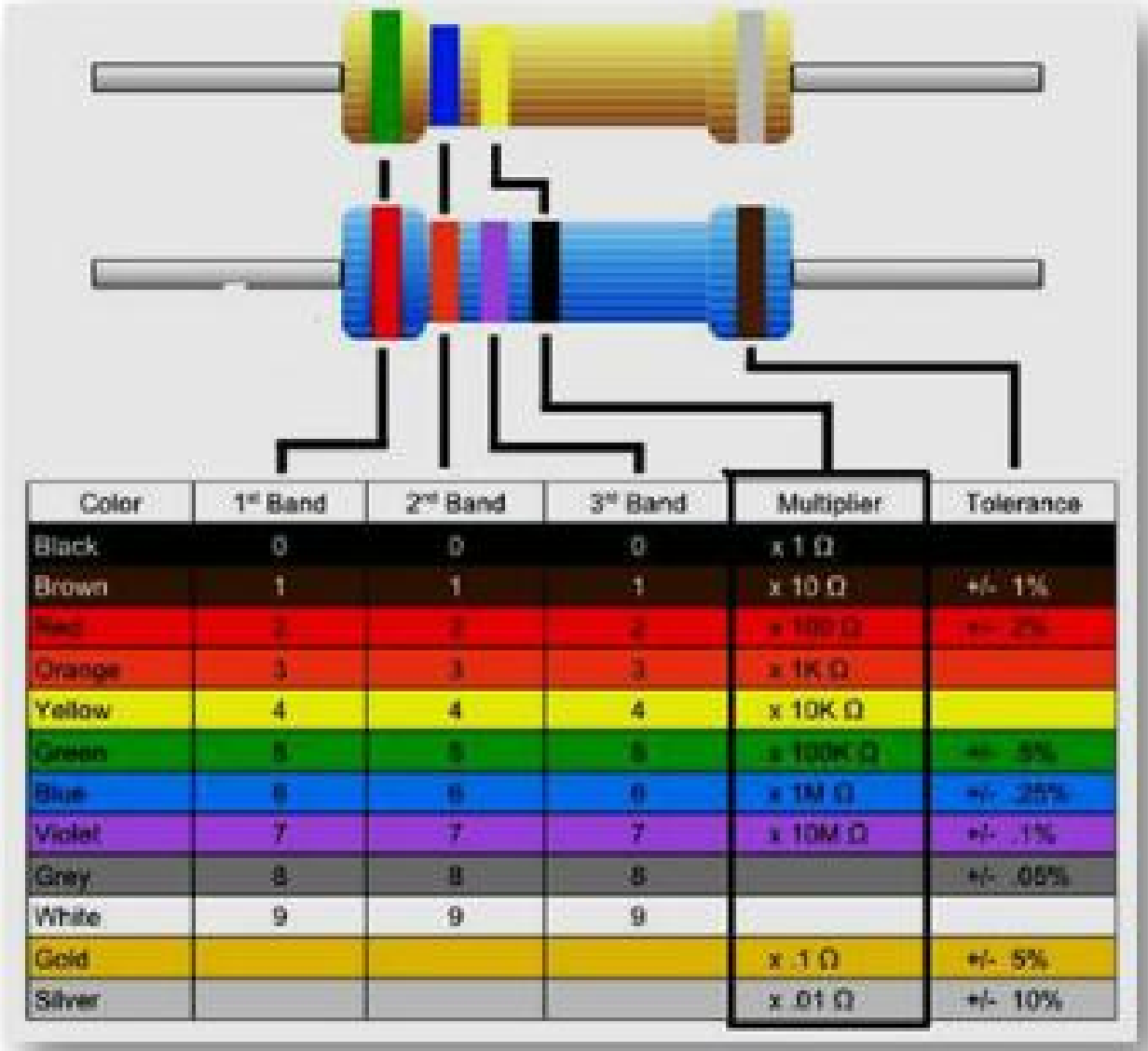
The second band represents the second digit. The colors represent the same numbers as did the first digit. In this case – 4 band its '6' and for 5 band its '3'.



Color	1st Band	2nd Band	3rd Band	Multiplier	Tolerance
Black	0	0	0	x 1 Ω	
Brown	1	1	1	x 10 Ω	+/- 1%
Red	2	2	2	x 100 Ω	+/- 2%
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- .5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

Reading Value : Step 4

The third band divulges how many zeros to add/divide to the first two numbers – for a 4 band Resistor. In this case – 4 band its '4' zeroes to be added. So value is 560K.



Color	1st Band	2nd Band	3rd Band	Multiplier	Tolerance
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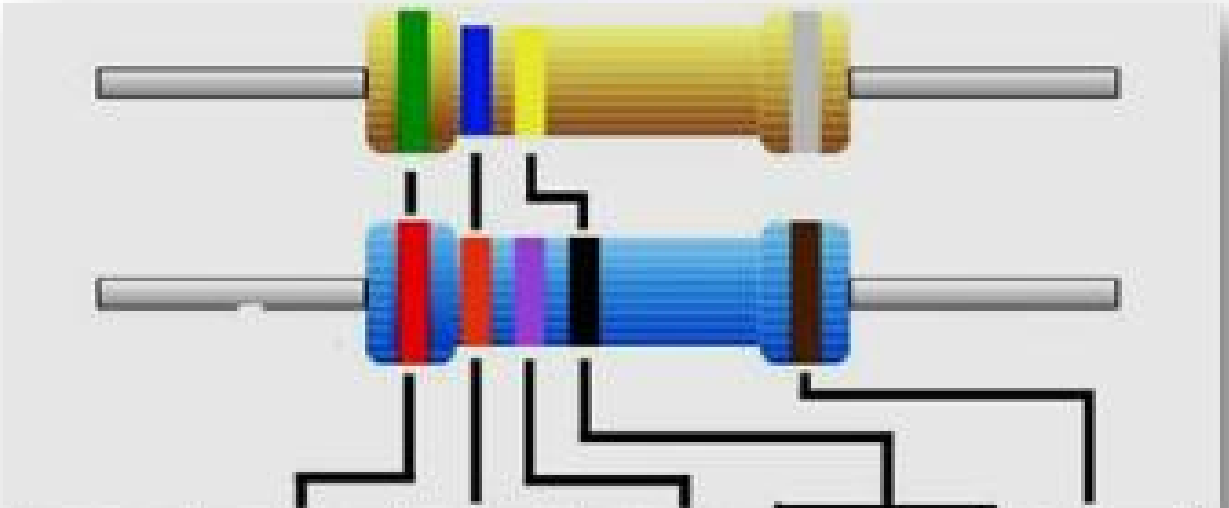
Red	2	2	2	x 100 Ω	+/- 2%
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- 5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

Reading Value : Step 5

The third band denotes the 3rd digit – for a 5 band Resistor. In this case – 5 band its '7'. So the value of the 5 band resistor is 237 Ohms as its multiplier digit is '0'.



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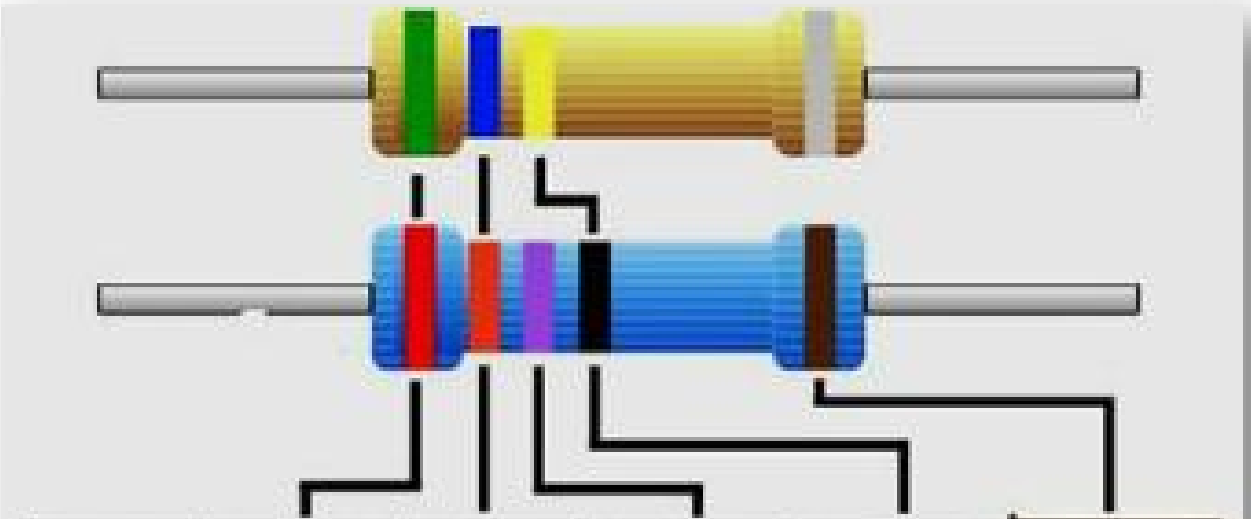
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- .5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

Tolerance

The last band denotes the tolerance. So the value of the 4 band resistor it is +/- 10% while for the 5 band resistor it is +/- 1%.



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Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- .5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

Tolerance

- Tolerance of a Resistor is also an important property to consider
- A 100 Ohm resistor with a10% tolerance can mean its value can be any fixed value between 90 to 110 Ohms
- A 120 Ohm resistor with a 10% tolerance can mean its value can be any fixed value between 108 and 132 ohms
- So there is some overlap between 100 Ohm and 120 Ohm resistance in terms of its limits

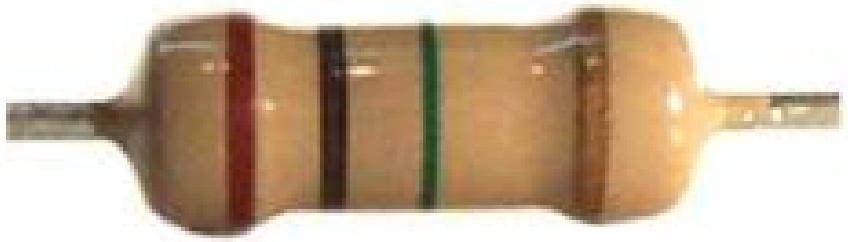
Mnemonic to Remember

Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9
Gold	

"B B ROY of Great Britain had a Very Good Wife"

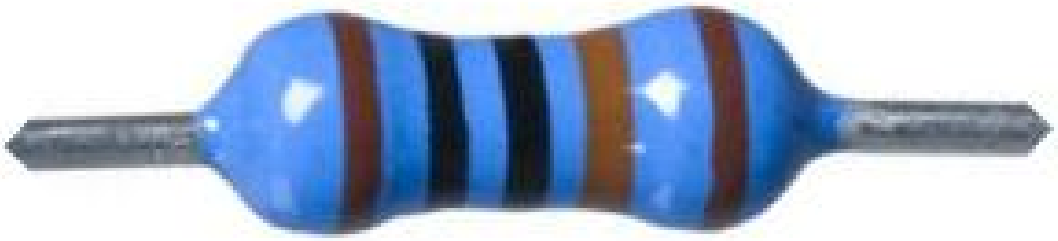
Carbon Film Resistors

- Most general purpose, cheap resistor
- Tolerance of Resistance value is usually +/- 5%
- Power ratings of 1/8W, 1/4W and ½ W are usually used
- Con : Tend to be electrically noisy



Metal Film Resistor

- Used when higher tolerance is needed ,ie more value
- They have about +/-0.05 % tolerance



Wire Wound Resistors

- A wire wound resistor is made of metal resistance wire, and because of this they can be manufactured to precise values
- Also, high wattage resistors can be made by thick wire material
- Wire wound resistors in a ceramic case are called as ceramic resistors
- Have very high power ratings

Recap Objectives of Experiment

At the end of the experiment the student would be able to

- Explain the function and unit of Resistors
- Measure the value of a Resistor
- Measure the tolerance of a Resistor
- Explain the types of Resistors