

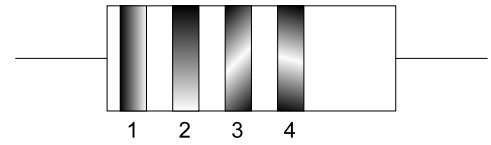
# 15 Electrodynamics

Enrichment: RESISTORS

Name \_\_\_\_\_

Inquiry Physics

You have found that greater resistance in a circuit results in lower current. Any material has some innate resistance to current, even such excellent conductors as copper wire. In wires, that resistance is a nuisance. In other situations, resistance is useful.



Band four is often a color that does not appear in the list for Band one. This allows you to tell which band is which.

Everyday appliances and electrical gadgets contain resistors to regulate the current. Too much current could easily overload the circuits in your calculator, for example. Specialized resistors have color-coded rings on their outer coverings that indicate exactly how much resistance in ohms ( $\Omega$ ) the resistor will theoretically give to a circuit. The 4-band resistor color-coding scheme, that yields 2 significant figures of precision, is shown below; some resistors use 5 bands for 3 sig figs.

**Band 1**

First Digit:

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

**Band 2**

Second Digit:

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

**Band 3**

Put the first two digits together and then multiply by:

- Silver: multiply by .01
- Gold: multiply by .1
- Black: multiply by 1
- Brown: multiply by 10
- Red: multiply by 100
- Orange: multiply by 1,000
- Yellow: multiply by 10,000
- Green: multiply by 100,000
- Blue: multiply by 1,000,000

**Band 4**

Indicates Resistor Accuracy  
(below are a few examples)

- Black or no band: accurate to  $\pm 20\%$
- Silver: accurate to  $\pm 10\%$
- Gold: accurate to  $\pm 5\%$

So a resistor labeled BROWN-BLACK-BROWN-GOLD means  
 $10 \times 10 = 100 \Omega$  to within  $\pm 5\%$ , or  $\pm 5 \Omega$ . So it is between  $95 \Omega$  and  $105 \Omega$ .

While a resistor labeled RED-GREEN-YELLOW-SILVER means  
 $25 \times 10,000 = 250,000 \Omega$  within  $\pm 10\%$ , or  $\pm 25,000 \Omega$ , or  $225,000 \Omega$  to  $275,000 \Omega$ .

What would be the color code for a high-quality  $66 \Omega$  resistor?

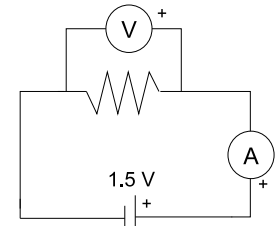
\_\_\_\_\_

What would be the color code for a high-quality  $37,000 \Omega$  resistor?

\_\_\_\_\_

Let's find out how close the theoretical value of some resistors are to their measured values in an actual circuit. At your lab station you will find three resistors, leads, a power supply, and meters. Set up a circuit like the one diagramed at right to test your resistors. Be very precise in reading the ammeter and voltmeter! **SET THE POWER SUPPLY AT 1.5 V - DO NOT EXCEED THAT VOLTAGE.**

$$\% \text{ error} = \left| \frac{\text{measured} - \text{theoretical}}{\text{theoretical}} \right| \times 100$$



Resistor	Voltage (V)	Current (A)	Actual Resistance ( $\Omega$ ) found with Ohm's Law	Labeled Resistance ( $\Omega$ )	Percentage Error
1					
2					
3					

