The Resistor Color Code

The general purpose carbon film resistors which are used in electrical and electronic circuits are marked using a four colored bands system. The 4th color band indicates the resistor’s tolerance and is normally gold. This means that the resistor is within 5% plus or minus of the marked value. A silver 4th color band indicates a 10% tolerance. The first three bands determine the value of the resistor. The first two bands determine the value of the resistor and the third band determines the multiplier for the first two digits. Simply stated, the value of the third band determines the number of zeros to add to the first two color values.

Example 1

Resistor color bands: Blue, Grey, Brown, Gold. The color code is reproduced for convenience.

Band 1: Blue = 6
Band 2: Grey = 8
Band 3: Brown = 1, add one zero to the first two numbers

Therefore the value of this resistor is 680 Ohms. This is written as 680R.

<table>
<thead>
<tr>
<th>color</th>
<th>band1</th>
<th>band2</th>
<th>band3</th>
</tr>
</thead>
<tbody>
<tr>
<td>black</td>
<td>0</td>
<td>0</td>
<td>none</td>
</tr>
<tr>
<td>brown</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>red</td>
<td>2</td>
<td>2</td>
<td>00</td>
</tr>
<tr>
<td>orange</td>
<td>3</td>
<td>3</td>
<td>000</td>
</tr>
<tr>
<td>yellow</td>
<td>4</td>
<td>4</td>
<td>0000</td>
</tr>
<tr>
<td>green</td>
<td>5</td>
<td>5</td>
<td>00000</td>
</tr>
<tr>
<td>blue</td>
<td>6</td>
<td>6</td>
<td>000000</td>
</tr>
<tr>
<td>violet</td>
<td>7</td>
<td>7</td>
<td>0000000</td>
</tr>
<tr>
<td>grey</td>
<td>8</td>
<td>8</td>
<td>0000000</td>
</tr>
<tr>
<td>white</td>
<td>9</td>
<td>9</td>
<td>000000000</td>
</tr>
</tbody>
</table>
The second resistor color code skill is converting a numerical resistor value into the correct color bands. Since most circuit diagrams list numerical values on schematic symbols, this skill allows design engineers and technicians to select the correct device from a stock of resistors.

**Example 2**

What are the color bands on a 10 kΩ resistor with a 5% tolerance?

**Step 1**: Convert from kilo-Ohms to Ohms 10 kΩ = 10 000 Ohms.

**Step 2**: Look at the first digit is 1. 1 = Brown. This will be the first color band on the left.

**Step 3**: Look at the next digit after the number 1. This is a 0. 0= Black. This will be the second color band.

**Step 4**: What remains is 000 (three zeros). An Orange third band indicates three zeros. This will be the third color band.

**Step 5**: The fourth band is the tolerance, which is 5%. This is represented by the color Gold.
Complete the following exercises and submit them for grading.

**Exercise 1**

Using the color chart above, decode the value of the following resistors and indicate the tolerance:

1. Brown, Black, Red, Gold. ______________________
2. Yellow Violet, Yellow, Gold. ______________________
3. Brown, Black, Green, Gold. ______________________
4. Blue, Grey, Black, Gold. ______________________
5. Orange, White, Orange, Gold. ______________________

**Exercise 2**

What are the color bands on the following value resistors all of which have a 5% tolerance?

1. 22 kΩ ____________________________________________
2. 10 Ω ____________________________________________
3. 10 kΩ ___________________________________________
4. 470 kΩ _________________________________________
5. 33 kΩ __________________________________________
6. 220 kΩ _________________________________________