APPENDIX I:
RESISTOR CODES

PHYSICS 212—LABORATORY

INTRODUCTION

Resistors are designed to restrict current flow through a circuit. The amount of resistance is measured in Ohms (Ω).Calculating the resistances and tolerances of transistors can be confusing at first (see Laboratory 8, Ohm's Law), but mastering the calculations is essential if you are to be successful in executing many of the electronics experiments for this class.

CALCULATION OF RESISTANCE VALUE

Resistor color codes conform to the SI protocol—that is, they follow a standard format agreed upon by electrical engineers worldwide. The standard color chart and the color bands located on each resistor can be used to determine which resistor is needed in a circuit or what resistance a particular resistor will provide. The resistance value for most small-wattage resistors is indicated by the colored bands on the case of the resistor.
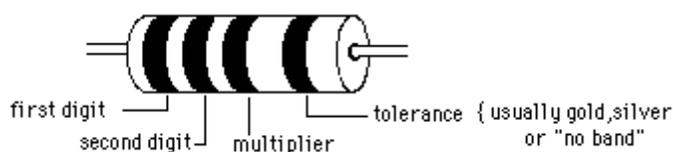
Figure 1.—**Color bands on a resistor**

The bands for a 4-band transistor (Figure 1) from left to right are:

- First significant digit
- Second significant digit
- Multiplier
- Tolerance

For the values of the standard colors, a mnemonic may help you remember **B**lack (0), **B**rown(1), **R**ed (2) , **O**range (3) , **Y**ellow (4) , **G**reen (5) , **B**lue (6) , **V**iolet (7) , **G**ray (8), **W**hite (9). Several mnemonics follow:

Bad **B**ooze **R**ots **O**ur **Y**oung **G**uts **B**ut **V**odka **G**oes **W**orse
Big **B**oys **R**ace **O**ur **Y**oung **G**irls **B**ut **V**iolet **G**enerally **W**ins
Black **B**irds **R**uin **O**ur **Y**ellow **G**rain, **B**utchering **V**ery **G**ood **W**heat

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

Figure 2.—**Standard color values on resistors.**

In addition to the colors above, gold and silver may be used for multiplier of 0.1 and tolerance of 5% (for **gold**) and a multiplier of 0.01 and tolerance of 10% (for **silver**); no color indicates a tolerance of 20% (see Figure 3).
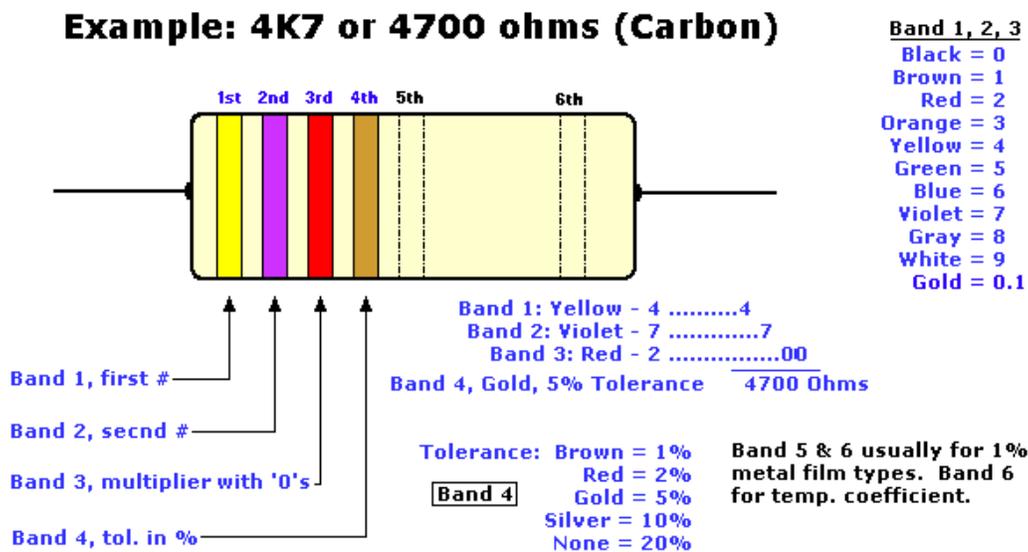

Figure 3.—**SI color code and resistance values (right column) and tolerances (bottom center), with example of 4-band resistor. Figure courtesy of and copyrighted by Tony van Roon, Univ. of Guelph, Ontario, Canada.**
http://www.uoguelph.ca~antoon/gadgets/resistors/resistor.htm

Calculation of resistance and tolerance for a different 4-band resistor is shown in Figure 4 (top), and that for a 5-band resistor is given in Figure 3 (bottom).
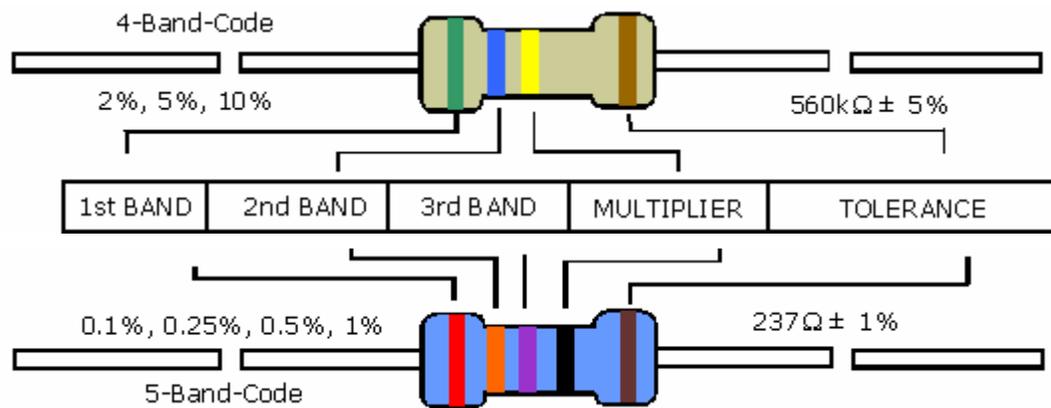
Figure 4.— (Top) Four-band resistor, reading from left to right, Green (=5), Blue (=6), Yellow (=× 4), and Brown (=1) or $56 \times 10^4 \; \Omega \pm 5\%$ or $560k \; \Omega \pm 5\%$. ***(Bottom)*** Five-band resistor, reading Red (2), Orange (3), Violet (7), Black (0), and Brown (1) or $237 \times 10^0 \; \Omega \pm 1\%$ or $237 \; \Omega \pm !\%$. Modified from Electronix Xpress/RSR, **http://elexp.com**, with permission.

INTERNET SITES FOR HELP

Still confused? A search on the Internet, using the search words **"Resistor Codes"** will turn up numerous websites with colorful depictions of the transistor color codes and instructions on how to calculate the resistances and tolerances for 4-band, 5-band, or 6-band resistors. Several of these URLs are reproduced below and also appear on the laboratory computers for your use.

(1). http://www.elexp.com/t_resist.htm

(2). http://www.mycableshop.com/techarticles/ResCodes.htm

(3). http://www.ee.washington.edu/circuit_archive/resistorcodes.html

(4). http://www.dragon-it.co.uk/links/resistor_codes.htm

(5). http://www.electrician.com/resist_calc/resist_calc.htm

(6). http://xtronics.com/kits/rcode.htm

(7). http://samengstrom.com/elec/resistor/

(8). http://litec.rpi.edu/LITEC_Tutorials_3_7/Hardware/Circuit_Components/ Res_Calculator /Resistors.html

(9). http://www.corvair.ca/resistor_codes.htm

(10). http://www.proaxis.com/~iguanalabs/resistors.htm

Numbers 5 and 7 actually have a calculator that will do the math for you, and number 10 has a detailed tutorial.

B L A N K   P A G E