EXPERIMENT 1

INTRODUCTION TO LABORATORY INSTRUMENTS

1.1 Objective:

In this experiment, multimeters and some circuit components are introduced. You will learn the following things:

i. Reading the color codes of resistors.
ii. Using a multimeter for resistance measurements.
iii. Measuring DC currents and voltages with a digital multimeter in a resistive circuit
iv. Characteristics of resistors in parallel and series

1.2 Equipment List:

- Multimeter,
- CADET,
- Carbon Resistors (one 3.3kΩ, three 10kΩ, one 1kΩ)

1.3 Preliminary Work:

1. Solve the circuits given below (Figure 1, 2, 3, 4, and 5); find all currents and voltage values where R_1=1 kΩ, R_2=10 kΩ, R_3=3.3 kΩ.

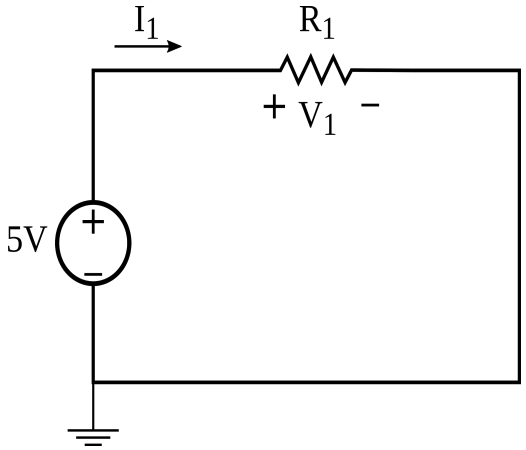


Figure 1

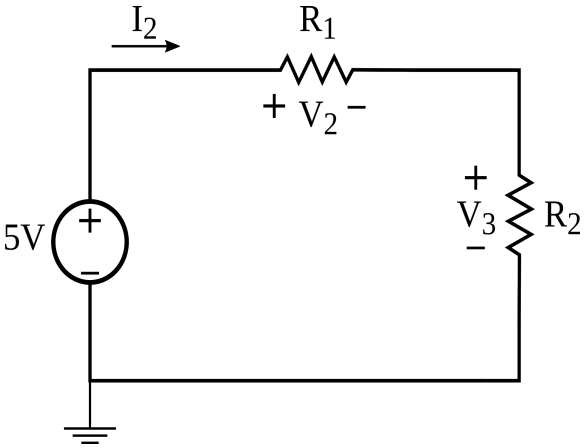


Figure 2

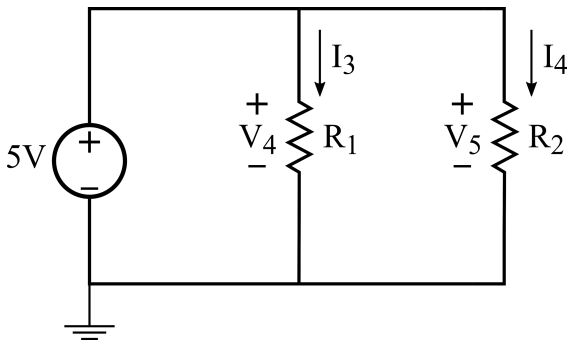


Figure 3

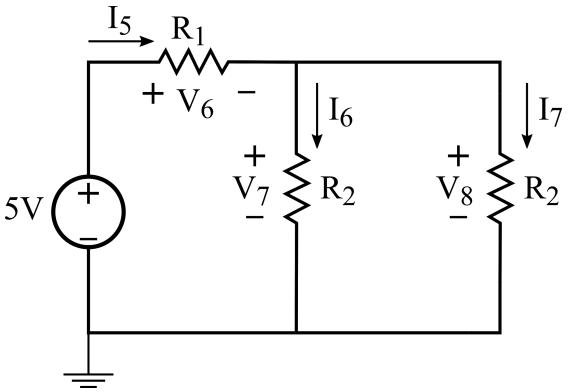


Figure 4

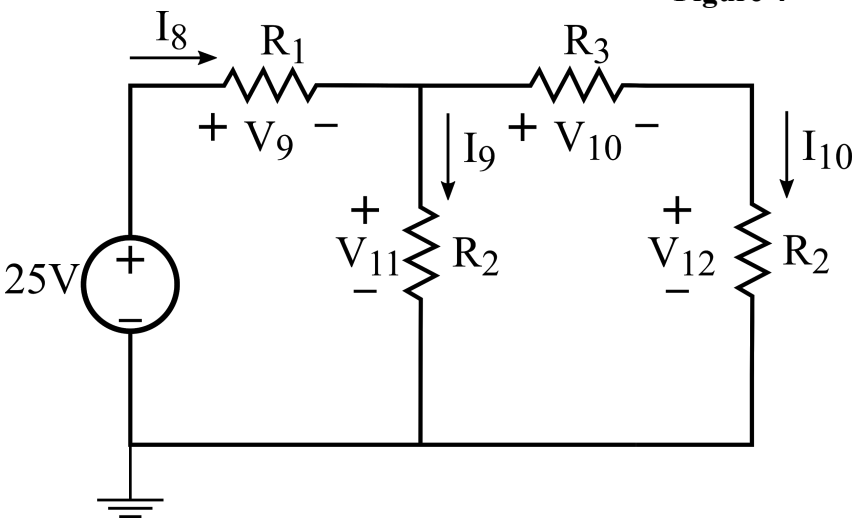


Figure 5

2. Calculate the current (I_{11}) of the circuit in Figure 6 by using node analysis. Calculate the equivalent resistance (R_{ab}) by using this current.
Note: To simplify calculations, use 10/3.3 ≈ 3.

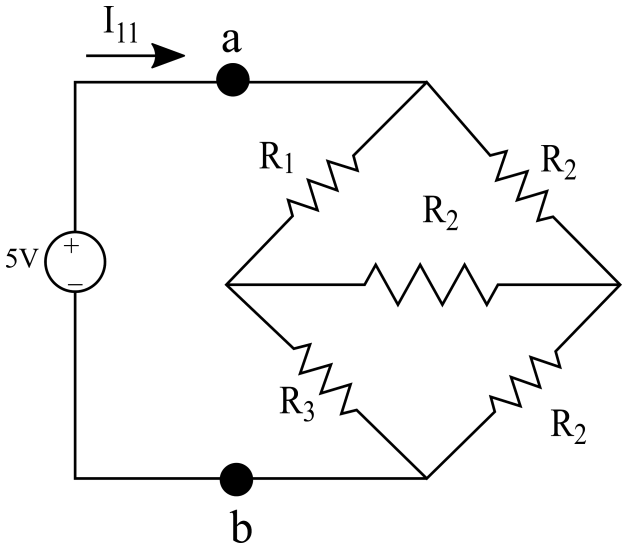


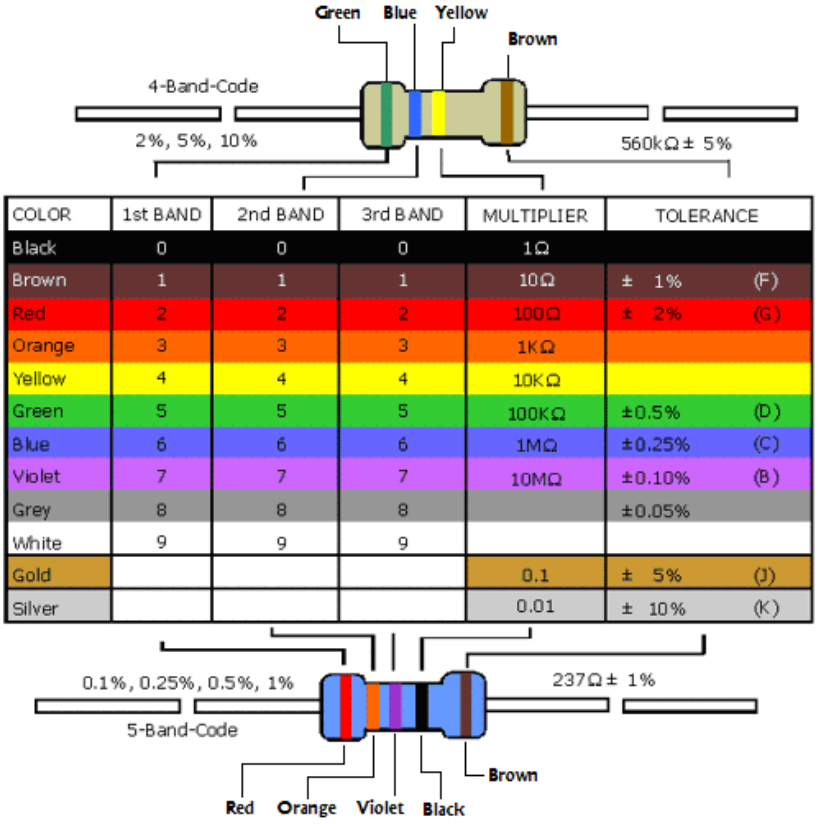
Figure 6

3. Write the color codes of resistors in Table 1 according to Table 2

Table 1

Resistors	Color Codes (10% Tolerance)
22 kΩ	
3.3 kΩ	
12 kΩ	
18 kΩ	
1 MΩ	

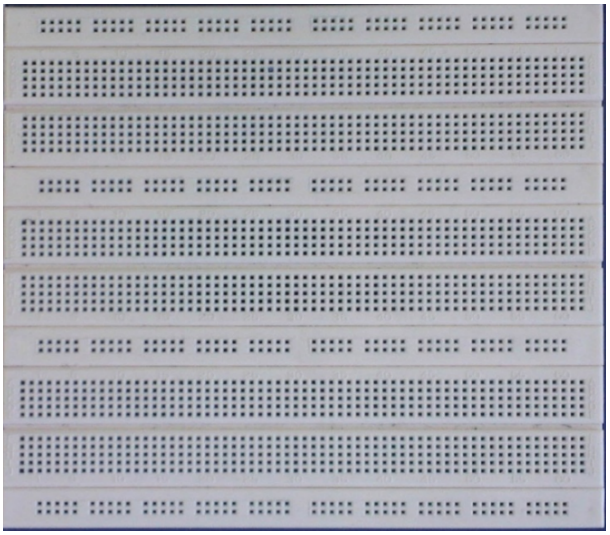
Table 2



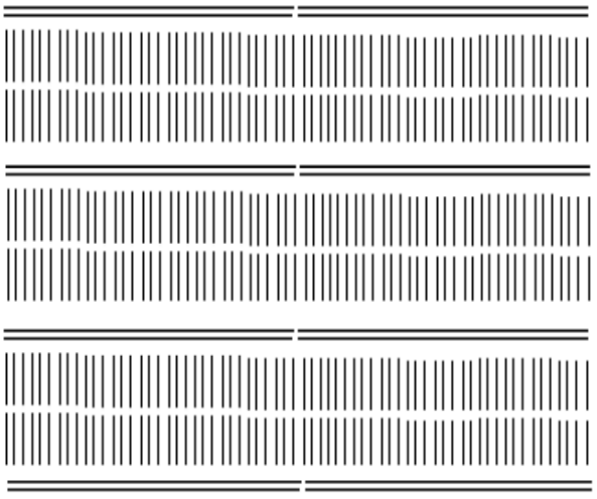
COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE	
Black	0	0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1KΩ		
Yellow	4	4	4	10KΩ		
Green	5	5	5	100KΩ	±0.5%	(D)
Blue	6	6	6	1MΩ	±0.25%	(C)
Violet	7	7	7	10MΩ	±0.10%	(B)
Grey	8	8	8		±0.05%	
White	9	9	9			
Gold				0.1	± 5%	(J)
Silver				0.01	± 10%	(K)

1.4 Supplemental Knowledge:

i. Make sure that you have the necessary instruments and components. The layout of the breadboards on your cadets is shown below. All circuits will be set up on these breadboards during lab sessions. The breadboards have a set of holes spaced 0.1 inches apart and arranged in a pattern similar to that shown below. There are two horizontal lines with several groups of five holes in each line at the top and bottom edge of the board. Holes on the breadboard, shown in Figure 7(a), are electrically interconnected, as shown in Figure 7(b). There are two sets of vertical lines with five holes in each line at the center section of the breadboard. There is a 0.3-inch space between the top and bottom set to match the standard spacing of pins on integrated circuit (IC) chips. The holes will accept the solid wire leads of most electronic components.



(a)



(b)

Figure 7. (a) Top view, **(b)** inner connections of the breadboard

A configuration example of three resistors in series on the breadboard is shown in Figure 8.

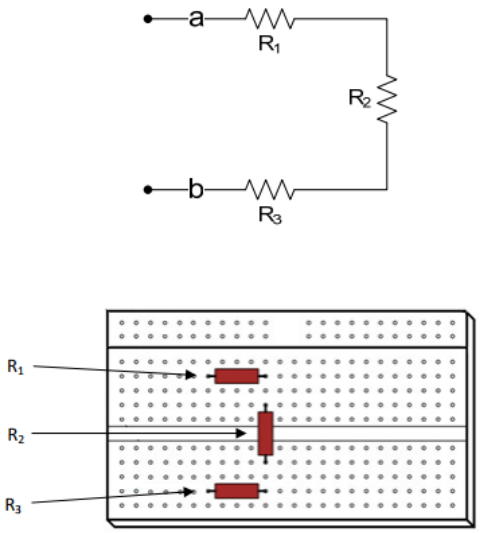


Figure 8. Configuration example of resistors on the breadboard

ii. To measure the ***voltage across*** a resistor, the voltmeter must be connected to the resistor in parallel, as shown in Figure 9.

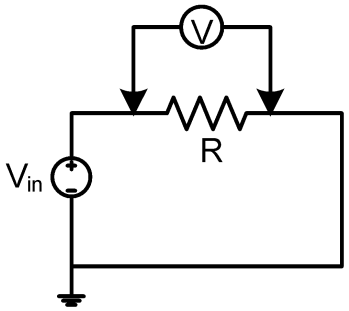


Figure 9

To measure the ***current through*** a resistor, the ampere-meter must be connected to the resistor in series, as shown in Figure 10.

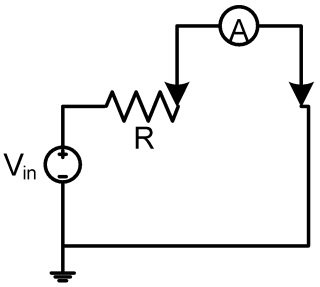


Figure 10

1.4 Experimental Work:

Important: Show a sample of the measurement in each work to the conducting research assistant for RA signature.

1.

- **i.** Read the color codes, determine the nominal value and tolerance of each carbon resistor and record them.
- **ii.** Measure the values of the resistors with the digital multimeter and record them.
- **iii.** Compare the measured and nominal values of the resistors.

2. Set the multimeter to DC voltage measurement and measure the DC voltage supply outputs on CADET.

3. Set up the circuits given in preliminary work part 1. Measure and record all the currents and the voltages using the digital multimeter. Compare your experimental results with your calculations.

4. Set up the circuit given in Figure 6. Measure and record equivalent resistance (R_{ab}) and current (I_{11}) using the digital multimeter. Compare your experimental results with your calculations.

5. Give a brief conclusion about what you have observed in the experiment(s).

EXPERIMENT 1
REPORT SHEET

Name & Surname :

Date :

Experimental Work:

1.

Color Code	Nominal Value	Tolerance (%)	Measured Value

RA Signature:

Comment:

2.

	Adjustable (+13) volts	+5 volts	Symmetric supply (+12) volts	Symmetric supply (-12) volts
Voltage Supply Outputs				

RA Signature:

3.

	Voltages				Currents	
	Measured	Calculated			Measured	Calculated
V_1				I_1		
V_2				I_2		
V_3				I_3		
V_4				I_4		
V_5				I_5		
V_6				I_6		
V_7				I_7		
V_8				I_8		
V_9				I_9		
V_{10}				I_{10}		
V_{11}						
V_{12}						

RA Signature:

Comment:

4.

	Measured	Calculated
R_{ab}		
I_{11}		

RA Signature:

5. Conclusion: