**Objective:

1# To introduce the Multimeter, the breadboard, the power supply, resistors and their color code.

2# To learn to properly use the lab instrument & the correct method of measuring electrical quantities with each instrument.

**Theory:

1-The Digital Multimeter [DMM]:

Is advice used to measure values of electrical quantities; such as Voltage, current, resistance, etc.

2- The Breadboard:

It's a tool used for effecting connections between electronic components without the need for soldering & in versatile manner. it consist of groups of columns and rows of socket connected together in systematic way. And have 2 part, thinner which has 2 long row of sockets connected together& the long busses of this part used for power distribution,& the other part is the larger which consist of columns of 5 socket connected together (every 5 socket beside others make one node" point between 2 component or more").

3- The Power Supply"PS":

It's a DC power supply used to generate constant voltage "CV"or constant current"CI".& the unit in lap has 2 variable supplies can use independently to achieve +ve or –ve output.

4- Resistors:

It's manufactured to specific amount of resistance(force encountered for flow of charge happened as result of collision between charge & atom's).there is many purposes to use it in circuits such as providing voltage drops,……. .the relative size of it varies with its wattage(power)rating (larg size indicates high power →P=I^2* R ,,I in ampere ,P in watt) & related to it's current carrying capacity (large current → higher temperatures ,so that larger surface need

for the heat to be dissipated→ large resistor size indicates high power),the resistor measured by ohmmeter part of DMM (it's basically Voltmeter &Ammeter),finally the resistance value is the ratio of voltage to current.the resistor manufactured as multiples of 10 of: 1 1.2 1.5 1.8 2 2.2 2.7 3 3.3 3.9 4.7 5.1 5.6 6.2 6.8 7.5 8.2 9.1(if require value in not slandered we can use parallel & series method) &in fix power mainly: 1/8,1/4,1/2,1,2… watts

5- Color code:

It's used to identify the value of the resistors (where 4 or 5 bands printed on end of it, & read from end that the band closest to it)

** Equipment:

Digital Multimeter (DMM) , Power Supply (PS),wires,5 resistors, leads.

**Procedure:

@^Part one:^ measured the value of 5 resistors

1. I will take 5 different resistors.
2. read their values by color code(theoretical value)as following:

First start reading from end that the band closest to it (if there is no closet band then band one should not gold, silver or no color) then the 1st & 2nd band represent 1st & 2nd digits, 3rd band indicates power 10 multiply by 1st 2 digits, the 4th band the tolerance (as in the table) & I will explain this way in the calculation in more detail.

Color	Band 1&2	Band 3	Band 4
Black	0	1	-
Brown	1	10	1%
Red	2	100	2%
Orange	3	1k	-
Yellow	4	10k	-

Green	5	100k	0.5%
Blue	6	1M	0.25%
Violet	7	-	0.1%
Gray	8	-	-
White	9	-	-
Gold	-	0.1	5%
Silver	-	0.01	10%
No color	-	-	20%

3. read the resistors values by using DMM (measured value) as the following:

$ switch the DMM on.

$ connect the 2 leads 1st one to the common socket & 2nd to v, Ω socket.

$ The rotor should be at Ω symbol.

$ put the desired resistor in the breadboard.

$ touch the probe tips to the end of the end of the resistor

$ read the value displayed (its unit will appear beside the Value).

	R1	R2	R3	R4	R5
Band color	O,O,Bk,Go	Bu,R,R,R	W,Br,R,Bu	Br,R,O,Go	Gn,Bu,R,Go
Measured value	32.65Ω	6.17KΩ	9.086kΩ	11.849kΩ	5.506kΩ
Theoretical value	31.35 - 34.65 Ω	6.076- 6.324 KΩ	9.077-9.123 kΩ	11.4 -12.6 kΩ	5.32 -5.88 kΩ

Note:

** There is percentage of error between theoretical & measured value and the actual value within the tolerance.

** If we measured the value of the resistance in circuit make sure that the PS off or the output off since if you don't make this the DMM will measured the resistance of itself

** If we connect the two terminal of the resistance in the same node the DMM will read zero value since the resistor will become as short circuit

@^Part two a: ^ obtain a certain voltage from power supply (P.S) & measured the values by DMM.

1-use p.s:

$switch the power supply on & make sure the output switch off

$ reduce the value of the current to the minimum value

$ Switch on the output switch (output on →lamp turn on).

$increase value of the voltage to desired value (3) by controlled of coarse & fine (controlled of decimal) which placed under the rotor of voltage.

2-Now we wanted to measure these values by DMM as below:

$the 2 lead connect to v,Ω socket(+ve lead→red) & common socket(-ve lead→black)

$the rotor should be at Vdc

$ touch the probe tips to the end of the end of probe tips of the power supply

$ read the value displayed(it's unit will appear beside the value).

Repeat that for V= 6, V=8

Vs(V)	3	6	8
Measured value	3.0018	5.997	7.996

Note:

*not all of the values measured by the DMM equal the exact value because of the internal resistance in the DMM

*if the value –ve that main the probes are reversed

* make sure the output bottom pressed after we reach the desired value

@^part two B:^ obtain a certain current from power supply.

$switch the power supply on & make sure the output switch off

$ reduce the value of the voltage to the minimum value

$ switch on the output switch(output on →lamp turn on).

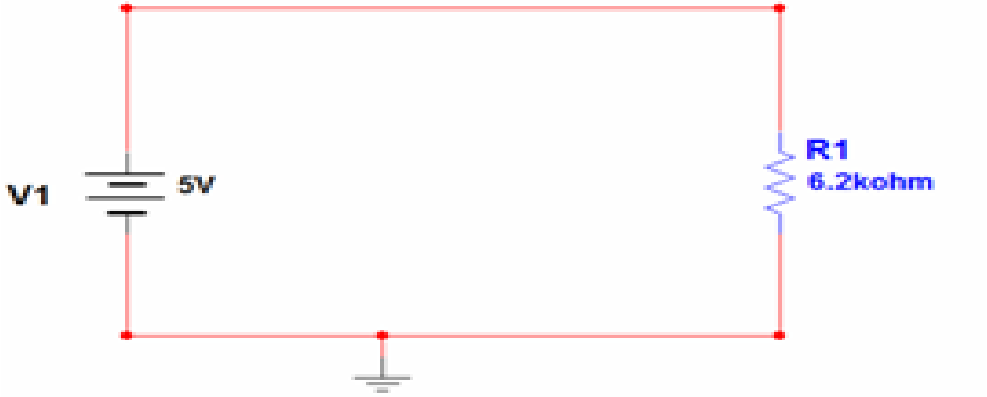
$increase value of the current to desired value (10)

Now we wanted to measured this values by DMM as below:
$the 2 lead connect to mA socket(+ve probe) & common socket(-ve probe)
$the rotor should be at mA
$ touch the probe tips to the end of the end of probe tips of the power supply& read the display value

Note:

* the reads value will indicate the current direction
* make sure the output bottom pressed after we reach the desired value

@^part three:^find I, V , Pdissipated into resistor.



in the circuit above we wanted to measured the value of V1,Vr1, Ir1,Pr1 ,but we should first connect this circuit as below:

1. we need resistor of 6.2kΩ so we will take the resistor R2 in the first part & place it in the breadboard in the different nodes(the point between 2 component or more)
2. supply the circuit with 5V by the power supply as in part Two-A-1
3. coil wires around the probes & then fix it in the breadboard in same node where the resistor connected.
4. we now determine the value of V1 as in part two A-2
5. now determine the value of Vr1 by:
   $connect the 2 lead to v,Ω socket & common socket
   $the rotor should be at Vdc

$ touch the probe tips to the end of the end of the resistor in parallel (since there is an internal high resistance in the DMM" voltmeter" which consider as O.C) & place the red probe on higher voltage point & black one on lower point

$read the value display.

6. to read the value of Ir1 :

$take term of the voltage supply the circuit &put it far away in any node you does not work in.

$connect the 2 lead to mA socket & common socket

$the rotor should be at mA

$ touch the probe tips to the end of the end of the resistor and voltage supply in series (since the DMM Ammeter has low internal resistance)

$read the value display.

7. to determine Pr1 use this law: Pr1= Ir1*Vr1

Which this value will determine in previous part

Quantity	V1	Vr1	Ir1	Pr1
Value	4.996 v	4.994 v	0.793 mA	3.96 mw

Note: the above values match with the theoretical value but it's not the exact value because there resistance in the wires & the equipment you use

@part four: measured my body resistance:

$ switch the DMM on.

$ connect the 2 leads 1st one to the common socket & 2nd to v, Ω socket.

$ The rotor should be at Ω symbol.

$holding one probe between the thumb $ forefinger of each hand & read the value display

Note: the value will be very high so that the value display in the DMM will not fixed

**Conclusion:

A. Connect DMM in incorrect way or choos the wrong selection of the switch may make personal injury &damage the DMM or the equipment.
B. To measured the voltage Between any two point the voltmeter made in parallel with components between those two points (because it has large internal resistance and consider as (O.C)) but the current made in series with the component(because An Ammeter has very small internal resistance and tread as (S.C)).
C. If probes are reversed when you reading the voltage the value will be negative of the original value.
D. The value you measured is not exactly the right value because there is a resistance in the equipment you used.
E. the reads value of the current by the DMM will indicate the current direction .
F. you should make sure that the output bottom in P.S pressed after we reach the desired value.
G. There is percentage of error between theoretical & measured value and the actual value within the tolerance.
H. If we measured the value of the resistance in circuit make sure that the PS off or the output off since if you don't make this the DMM will measured the resistance of itself.
I. If we connect the two terminal of the resistance in the same node the DMM will read zero value since the resistor will become as short circuit.
J. In breadboard every 5 hole beside other represent one node.
K. You can connect any number of component in the same node by using the breadboard.

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Experiment "1" (Lab. Equipment Familiarization)

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