CG1111 Week 2 studio 1

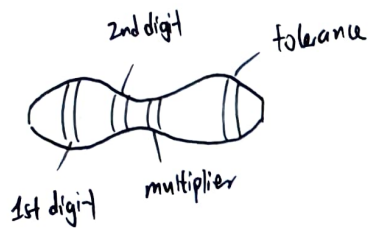
Resistor Color Codes

resistance values of resistors are often in the form of color codes on their casings

nominal values ± tolerance (uncertainty)

* Measurements / quantities without knowledge of its uncertainty is meaningless

4 band resistors

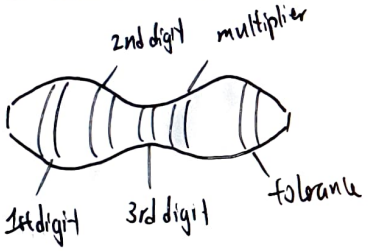


$(\text{colour}_1\ \text{colour}_2) \cdot 10^{\text{colour}_3}\ \pm\ \text{colour}_4\ \%$

colour 1: yellow, colour 2: violet, colour 3: orange, colour 4: gold

$(47) \cdot 10^3 \pm 5\% = 47000 \pm 5\%\ \Omega$

5 band resistors



$(\text{colour}_1\ \text{colour}_2\ \text{colour}_3) \cdot 10^{\text{colour}_4}\ \pm\ \text{colour}_5\ \%$

Actual resistance for any resistor in good working condition is always within the tolerance of the nominal value

Activity 1

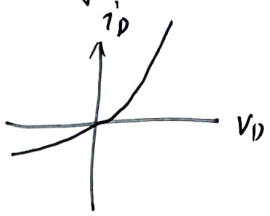
No.	band 1 (colour, code)	band 2 (colour, code)	band 3 (colour, code)	tolerance (colour, %)	nominal value Ω	Actual value Ω
1	brown, 1	green, 5	brown, 1	gold, ±5%	150 ± 5%	148
2	grey, 8	red, 2	brown, 1	gold, ±5%	820 ± 5%	805
3	brown, 1	green, 5	red, 2	gold, ±5%	1500 ± 5%	1475

Digital Multimeter

act as voltmeter to measure AC/DC voltage
ammeter to measure current
ohmmeter to measure resistance

red probe – V terminal
black probe – COM terminal

))) dial used to check for electrical connectivity and test diode for polarity



i-V characteristic of diodes

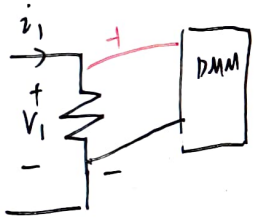
precautions

if range of quantity measured is unknown, select max range then gradually decrease

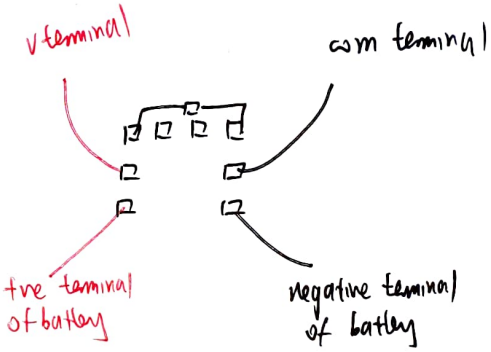
never input voltage / current exceeding value set on DMM

always disconnect test leads before switching ranges

Measure voltage in parallel



red positive
black negative

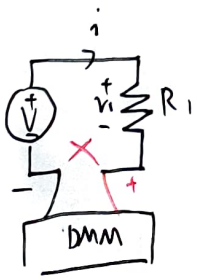


* polarity important

Measure current in series

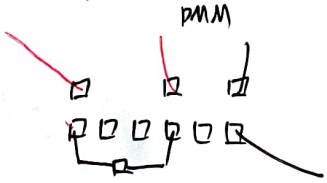
need to break circuit to insert DMM in series

convenient to break in between voltage source and components



ammeter has close to 0 internal resistance so as not to affect circuit current

always disconnect power supply from circuit first



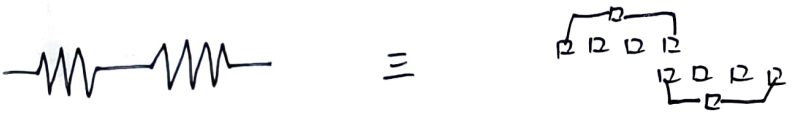
Breadboard

top and bottom rows connected horizontally

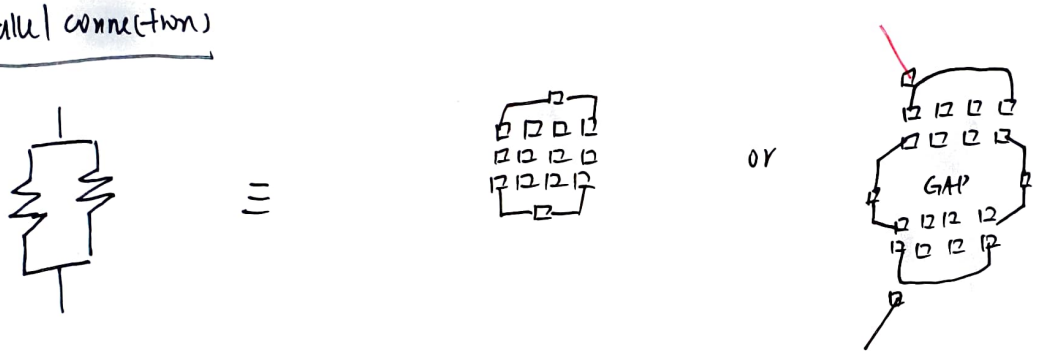
middle section connected vertically

gaps indicate breakage in electrical connection

series connections



parallel connections

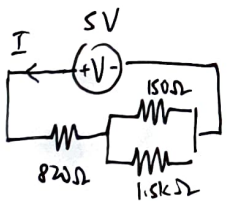


USB Breakout Cable

DC power supply

~5V fixed red wrt black

Activity 2



Theory

$$R_{eff} = 820\Omega + \frac{1}{\frac{1}{150\Omega} + \frac{1}{1500\Omega}}$$

$$= 956.36\,\Omega$$

$$I = \frac{5V}{956.36\,\Omega} = 5.23\,mA$$

voltage across 820 Ω resistor $= IR_1 = 4.29\,V \pm$ uncertainty

OR $\frac{R_1}{R_{eff}} \cdot V = 4.29V \pm$ uncertainty

(voltage divider)

voltage across 150 Ω 1.5kΩ resistor = $5 - IR_1$ = 0.71 V ± uncertainty

current through 820 Ω resistor = 5.23 mA (main branch current)

current through 150 Ω resistor = $\frac{150}{1050} \times 5.23\ mA$

$= 4.75\ mA$

current through 1.5k Ω resistor = $\frac{150}{1050} \times 5.23\ mA$

$= 0.475\ mA$

} current divider

Resistor	Predicted voltage (V)	Actual voltage (V)	Predicted current (mA)	Actual current (mA)
820 Ω	4.29	4.37	5.23	5.33
150 Ω	0.71	0.73	4.75	4.82
1.5k Ω	0.71	0.73	0.48	0.49

experimental results do follow quite closely with theory within uncertainty

Bitscope Micro

mixed signal oscilloscope capable of capturing both digital and analog signals.

functions as an arbitrary waveform generator (AWG)
- sine (tone)
- square (step)
- triangular (ramp)

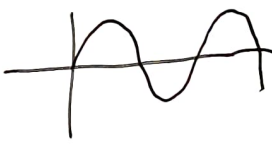
Loop-back test

Arbitrary Waveform Generator

red probe to AWG pin, mini grabber to a wire to serve as a simple bus

CHA and CHB probes to the other end of the wire

click WAVE button to generate a sine wave

turn on CHB, green CHB wave superimposes CHA yellow sine wave 

adjust scales to differentiate signals

course adjustment → right click & select from menu of options

fine adjustment → click and drag up & down