CS 20 Laboratory 1: Introduction to Electric Circuits

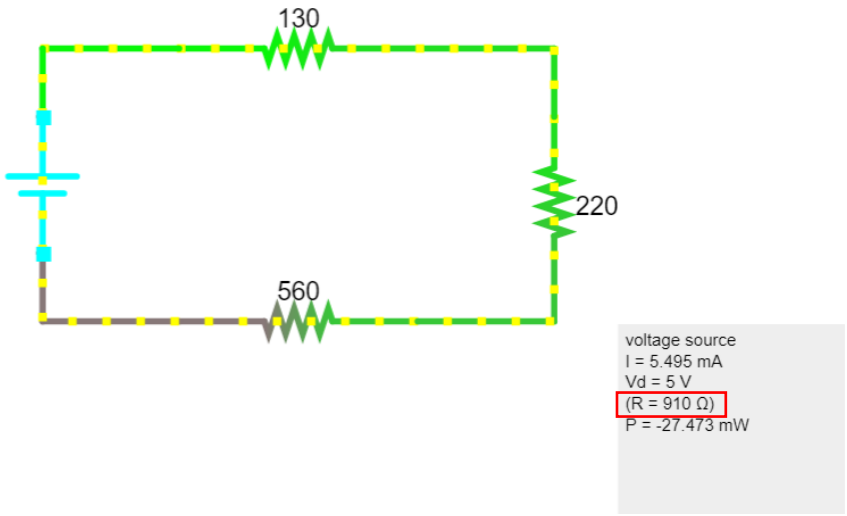
1. Resistor Color Bands

Label	Resistor Color Bands	Computed Resistance
R1	Brown, Orange, Brown, Gold	130 Ω, 5%
R2	Red, Red, Brown, Gold	220 Ω, 5%
R3	Green, Blue, Brown, Gold	560 Ω, 5%
R4	Brown, Red, Red, Gold	1200 Ω, 5%

2. **Series Circuits**

(a) Since the circuit is in series, $R_{eff} = R_1 + R_2 + \cdots + R_n$

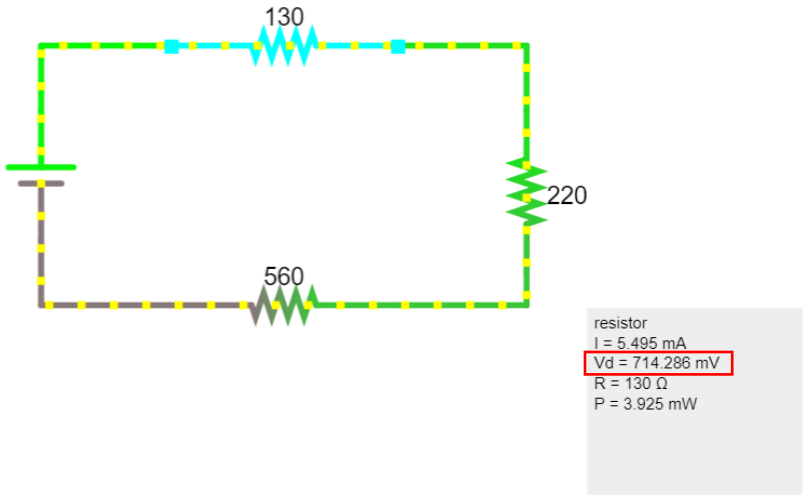
$R_{eff} = R_1 + R_2 + R_3 = 130\ \Omega + 220\ \Omega + 560\ \Omega = 910\ \Omega$



(b) In the previous item, the resistance is given by $R_{eff} = 910\ \Omega$ and voltage is 5 V.

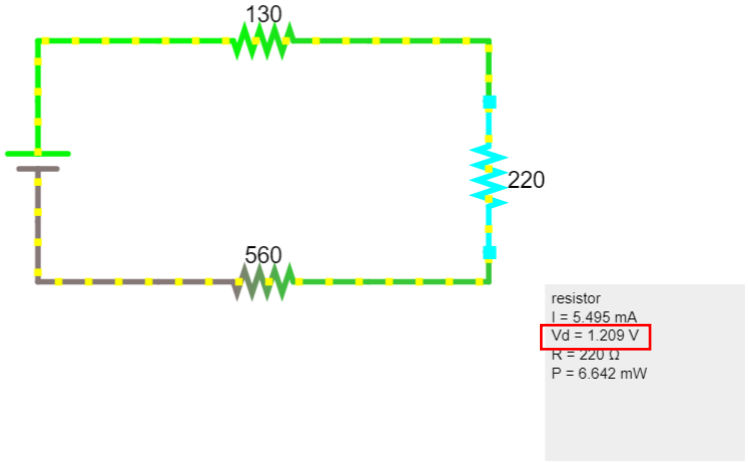
For V_1:

$$V_1 = \left(\frac{R_1}{R_{eff}}\right)(V) = \left(\frac{130\ \Omega}{910\ \Omega}\right)(5V) = 0.7142857143\ V \approx 0.714\ V\ or\ 714.286\ mV$$



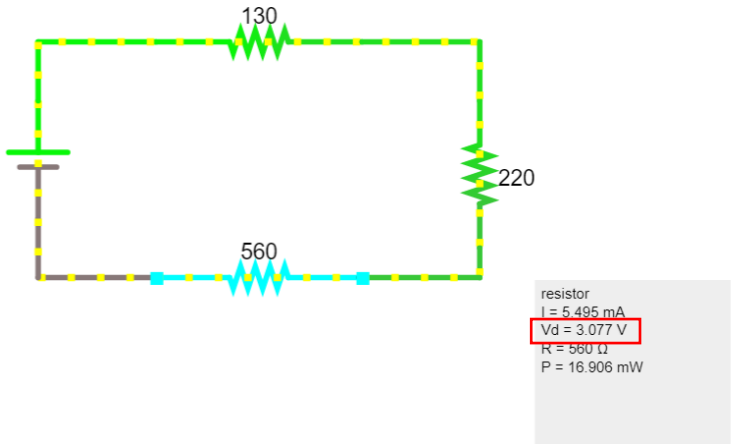
For V_2:

$$V_2 = \left(\frac{R_2}{R_{eff}}\right)(V) = \left(\frac{220\,\Omega}{910\,\Omega}\right)(5V) = 1.208791209\,V \approx 1.209\,V$$



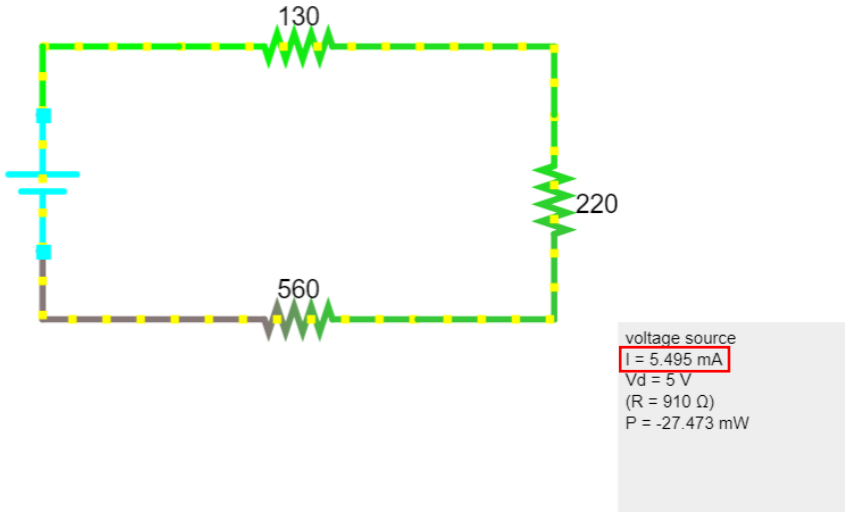
For V_3:

$$V_3 = \left(\frac{R_3}{R_{eff}}\right)(V) = \left(\frac{560\,\Omega}{910\,\Omega}\right)(5V) = 3.076923077\,V \approx 3.077\,V$$



(c) To compute for the theoretical current through the circuit, use Ohm's Law:

$$I = \frac{V}{R} = \frac{5\ V}{910\ \Omega} = 5.94505495 \times 10^{-3} A \approx 5.495\ mA$$

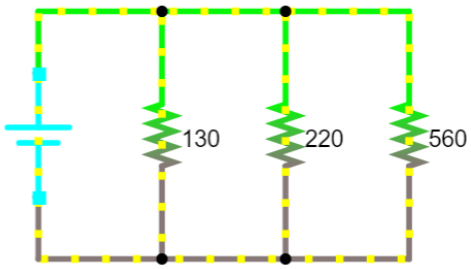


3. **Parallel Circuits**

(a) Since the circuit is in parallel, $\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$

$$\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{130\ \Omega} + \frac{1}{220\ \Omega} + \frac{1}{560\ \Omega} = \frac{1123}{80080}\ \Omega$$

$$R_{eff} = \left(\frac{1}{R_{eff}}\right)^{-1} = \left(\frac{1123}{80080}\Omega\right)^{-1} = 71.30899377\ \Omega \approx 71.309\ \Omega$$



voltage source
I = 70.117 mA
Vd = 5 V
(R = 71.309 Ω)
P = -350.587 mW

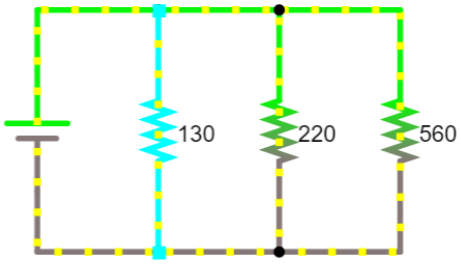
(b) In the previous item, the resistance is given by $R_{eff} \approx 71.309\ \Omega$ and voltage is 5V.

To solve the theoretical current of each resistor, compute first for the current through the entire network:

Using Ohm's Law, $I = \frac{V}{R} = \frac{5\ V}{71.309\ \Omega} = 0.07011738262\ A \approx 0.07A\ or\ 70.117\ mA$

For i_1:

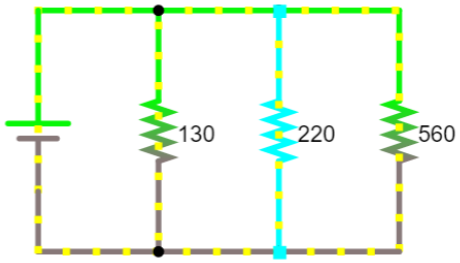
$$i_1 = \left(\frac{\frac{1}{R_1}}{\frac{1}{R_{eff}}}\right)(i) = \left(\frac{\frac{1}{130\ \Omega}}{\frac{1}{71.309\ \Omega}}\right)(0.07A) = 0.03846153846\ A \approx 0.0385\ A\ or\ 38.462\ mA$$



resistor
I = 38.462 mA
Vd = 5 V
R = 130 Ω
P = 192.308 mW

For i_2:

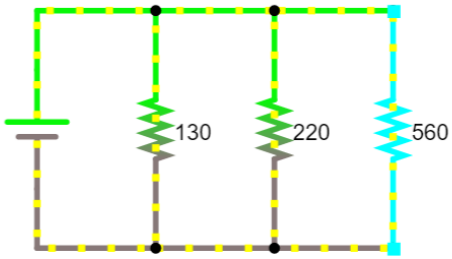
$$i_2 = \left(\frac{\frac{1}{R_2}}{\frac{1}{R_{eff}}}\right)(i) = \left(\frac{\frac{1}{220\ \Omega}}{\frac{1}{71.309\ \Omega}}\right)(0.07A\ ) = 0.02272727273\ A\ \approx 0.0227\ A\ or\ 22.727\ mA$$



resistor
I = 22.727 mA
Vd = 5 V
R = 220 Ω
P = 113.636 mW

For i_3:

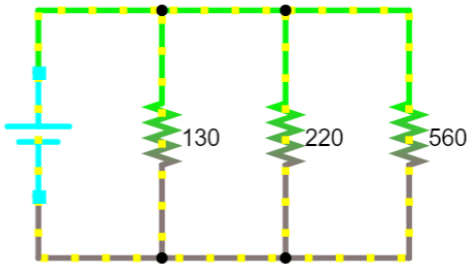
$$i_3 = \left(\frac{\frac{1}{R_3}}{\frac{1}{R_{eff}}}\right)(i) = \left(\frac{\frac{1}{560\ \Omega}}{\frac{1}{71.309\ \Omega}}\right)(0.07A\ ) = 8.928571429\ \times\ 10^{-3}\ A\ \approx 8.929\ mA$$



resistor
I = 8.929 mA
Vd = 5 V
R = 560 Ω
P = 44.643 mW

(c) To compute for the theoretical voltage through the circuit, use Ohm's Law:

$$V = IR = (0.07A)(71.309\ \Omega\ ) = 5V$$



voltage source
I = 70.117 mA
Vd = 5 V
(R = 71.309 Ω)
P = -350.587 mW