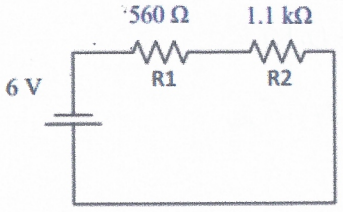
Intro to Digital Fabrication

Electronics Problem Set 1

1 Use the following circuits to practice analyzing series resistance. Determine the requested information and sketch the minimized equivalent circuit



R_T = 560Ω + 1.1 kΩ = 1.660 kΩ

I_T = 6V / 1660k = 0.0036 A

V_{R1} = 0.0036A × 560Ω = 2.024V

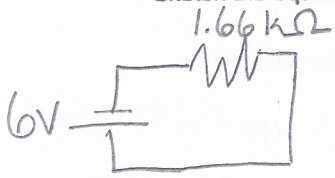
V_{R2} = 0.0036A × 1100Ω = 3.975V

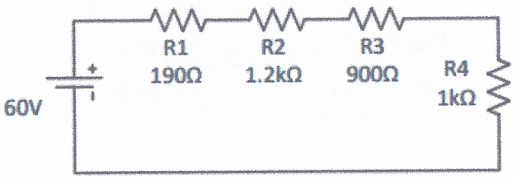
P_{R1} = 2.024V × 0.0036A = 0.007 W

P_{R2} = 3.975V × 0.0036A = 0.014W

P_T = 6V × 0.0036A = 0.021 W

Sketch the equivalent circuit:





R_T = 190 + 1200 + 900 + 1000 = 3.29 kΩ

I_T = 60V / 3290Ω = 0.018 A

V_{R1} = 0.018 × 190Ω = 3.4V

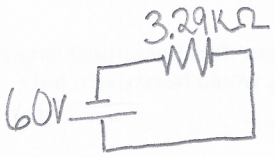
V_{R2} = 0.018 × 1200Ω = 21.8 V

V_{R3} = 0.018 × 900Ω = 16.4V

V_{R4} = 0.018 × 1000Ω = 18.0V

P_T = 60V × 0.018A = 1.094 W

Sketch the equivalent circuit:



2 Use the following circuits to practice analyzing parallel resistance. Determine the requested information and sketch the minimized circuits.

R_T = 9.705Ω

I_T = 5V/9.705Ω = 0.515$\overline{1}$A

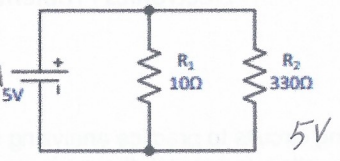
I_{R1} = 5V/10Ω = .5A

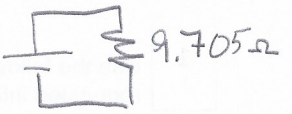
I_{R2} = 5V/330Ω = 0.015$\overline{15}$A

P_{R1} = 5V × .5A = 2.5W

P_{R2} = 5V × 0.015$\overline{15}$A = 0.07$\overline{5}$W

P_T = 5V × 0.515$\overline{1}$A = 2.5757W





$\frac{1}{R_T} = \frac{1}{10\Omega} + \frac{1}{330\Omega} = 0.10303$

$R_T = \frac{1}{0.10303} = 9.705\Omega$

R_T = 58.44Ω

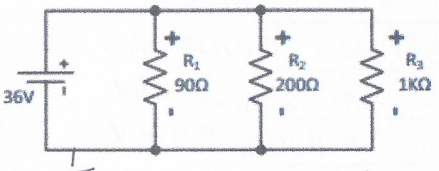
I_T = 36V/58.44Ω = .616A

I_{R1} = 36V/90Ω = 0.4A

I_{R2} = 36V/200Ω = 0.18A

I_{R3} = 36V/1000Ω = 0.036A

P_T = 36V × .616A = 22.176W



$\frac{1}{R_T} = \frac{1}{90} + \frac{1}{200} + \frac{1}{1000} = 0.01711$

$R_T = \frac{1}{0.01711} = 58.44\Omega$

Is the total resistance larger than the largest single resistor or smaller than the smallest resistor? Is this what you would have expected?

Smaller than the smallest resistor. Yes, this is what I expected because I watched your video

Does the total current equal the sum of the currents through each resistor?

Yes, as with the second example above; $I_T = I_1 + I_2 + I_3$

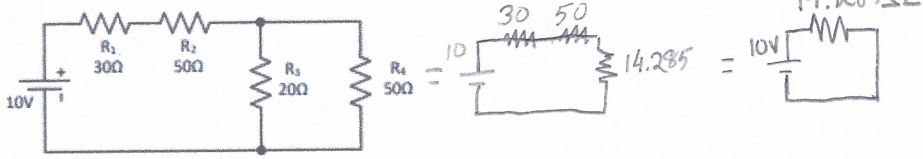
$= .616A = .4A + .18A + .036A$

3 Analyze the circuits to determine the following. Sketch the minimized equivalent circuit.

R_T = 94.285Ω

I_T = 0.106 A

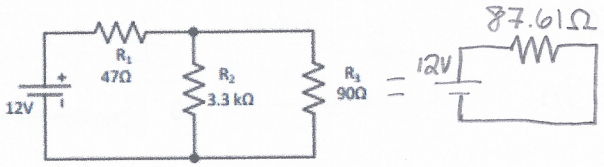
P_T = 1.06W



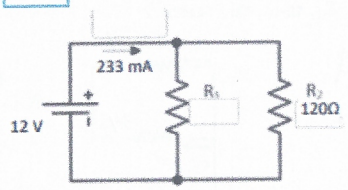
R_T = 87.61Ω

I_T = 0.137A

P_T = 1.643W



4 Determine the value for the missing component in the following circuits.



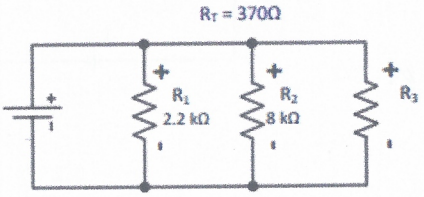
$A_2 = \frac{12V}{120\Omega} = 0.1A$

$A_T - A_2 = A_1 = 0.133A$

$A_1 = \frac{12V}{X\Omega} = 0.133A$

$X = \frac{12}{0.133} = 90.23\Omega$

R_1 = 90.23Ω



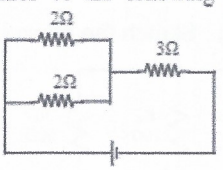
$\frac{1}{R_T} = \frac{1}{370} = 0.0027$

$0.0027 - \frac{1}{2200} - \frac{1}{8000} = 0.000998$

$\frac{1}{0.000998} = 1001.84\Omega$

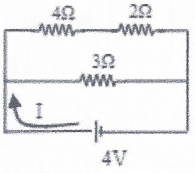
R_3 = 1001.84Ω

5 Calculate the equivalent resistance of the following compound circuit



$R_T = \frac{1}{\frac{1}{2}+\frac{1}{2}} + 3 = 4\Omega$

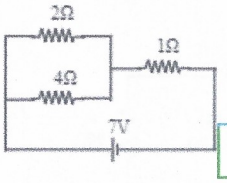
6 Calculate the equivalent resistance R and the total current I.



$R_T = \frac{1}{\frac{1}{4+4}+\frac{1}{3}} = 2.\overline{18}\Omega$

$I_T = \frac{4}{2.\overline{18}} = 1.8\overline{3}A$

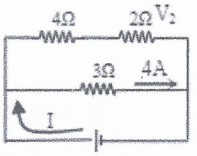
7 Calculate the equivalent resistance R and the total current I



$R_T = \frac{1}{\frac{1}{2}+\frac{1}{4}} + 1 = 2.3\overline{3}\Omega$

$I_T = \frac{7}{2.3\overline{3}} = 3A$

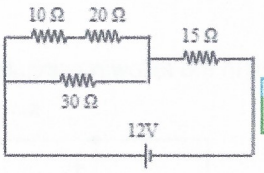
8 Calculate the the total current I, total voltage V and V_2. $R_T = 2\Omega$



$\frac{V_T}{R_1} = I_1 = 4 = \frac{X}{3} \Rightarrow X = 12V$

$I_T = \frac{12V}{2\Omega} = 6, I_2 = I_T - I_1 = 6 - 4 = 2A$

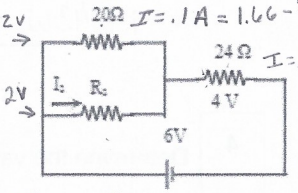
9 Calculate the equivalent resistance R and the total current I



$R_T = \frac{1}{\frac{1}{10}+\frac{1}{20}} + 15 = 30\Omega$

$I_T = \frac{12V}{30\Omega} = 0.4A$

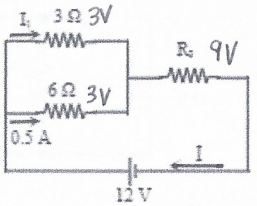
10 Calculate the R_2, and I_2.



$I_2 = .06\overline{6}A$

$R_2 = 30$

11 Calculate the I_2 , R_3, the total current I.

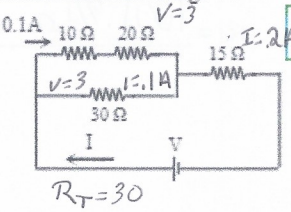


$I_2 = \frac{3V}{3\Omega} = 1A$

$R_3 = 6\Omega$

$I_T = 1.5A$

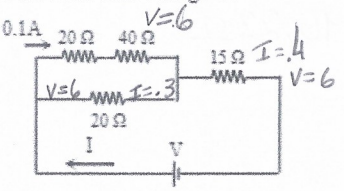
12 Calculate the the total current I and total voltage V.



$I_T = 0.2A$

$V = 3 + 3 = 6V$

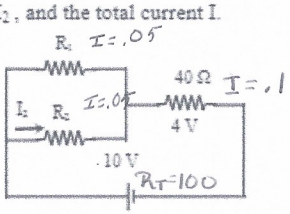
13 Calculate the the total current I and total voltage V.



$I_T = 0.4A$

$V = 12V$

14 If $R_1 = R_2$, calculate the R_1, I_2 , and the total current I.

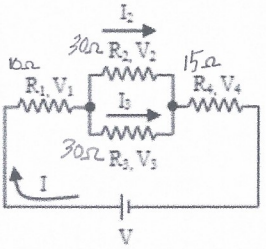


$R_1 = 120\Omega$

$I_2 = 0.05A$

$I_T = 0.1A$

15 Use the diagram to calculate a) the total resistance in the circuit, b) the total current through the circuit, c) the total power the circuit consume, and d) the current through R_2. (where $R_1 = 10\Omega$, $R_2 = 30\Omega$, $R_3 = 30\Omega$, $R_4 = 15\Omega$, V = 12V)



$R_T = 40\Omega$

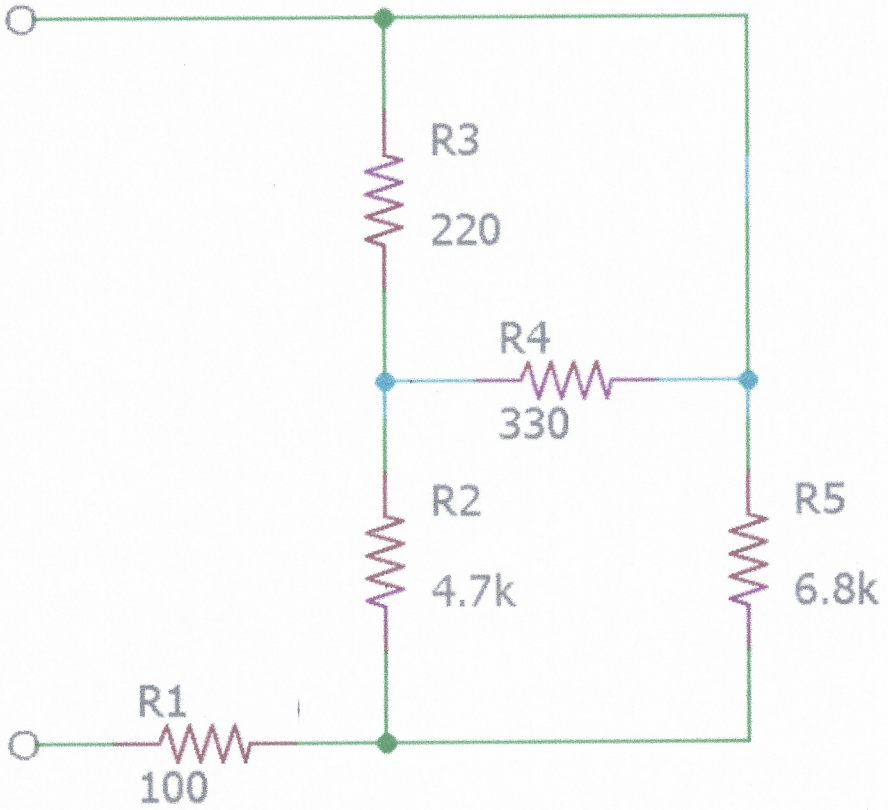
$I_T = 0.3A$

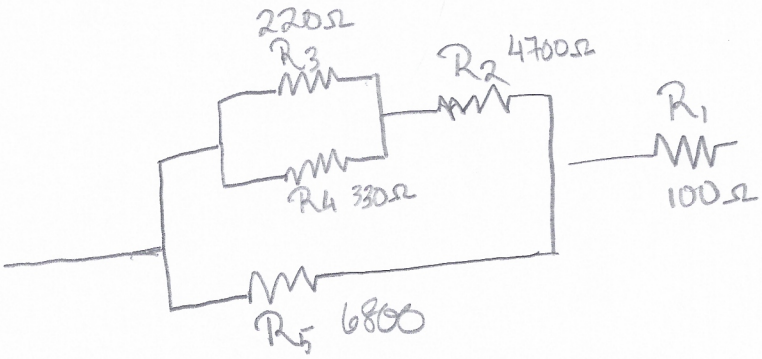
$P_T = 3.6W$

$I_2 = 0.15A$

16

Find the equivalent resistance for the following set of connected resistors:





$R_T = 2924.76$