PLTW Engineering

10-12/Series Circuit Properties

April 20, 2020

10-12/DE
Lesson: **4/20/2020**

Objective/Learning Target: Students will be able to identify a series circuit and explain the charictaristics of a series circuit.

Circuits consisting of just one battery and one load resistance are very simple to analyze, but they are not often found in practical applications. Usually, we find circuits where more than two components are connected together.

When every electron that leaves the negative terminal of the power source has only one path for the current to flow, then the circuit is a Series Circuit.

Probably the most important aspect of the series circuit is having only one path for current flow, thus each component has the same current flowing through it as flows through the entire circuit.

Since there is only one path for current flow then it is the same current that goes through Resistor 1, Resistor 2, Resistor 3, and so on.

The total resistance is greater than any one resistance. Maybe that is obvious but the total resistance of all the components is going to be greater than any one resistance.

Likewise, the total power is greater than any one component dissipation so the total power dissipation of this circuit is going to be greater than any single component.

Voltage in a series circuit

Larger resistance drops have higher voltage drops. That may not be so obvious, but if we remember what we talked about regarding voltage in terms of Ohms law -

We said that voltage equals I x R, now remember that we have the same current flowing through this entire circuit.

If the resistance goes up then the voltage drop across that component will increase.
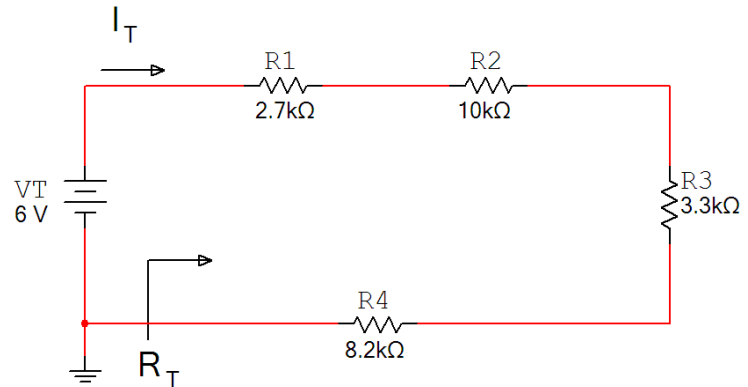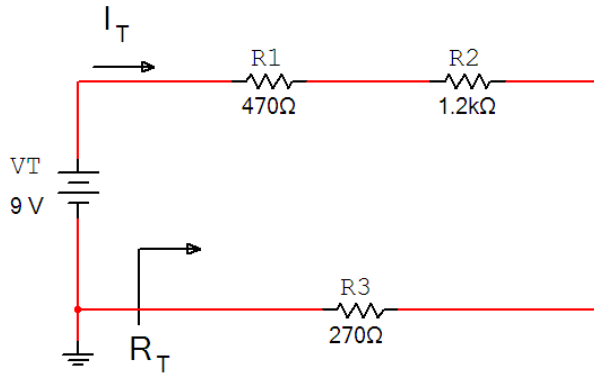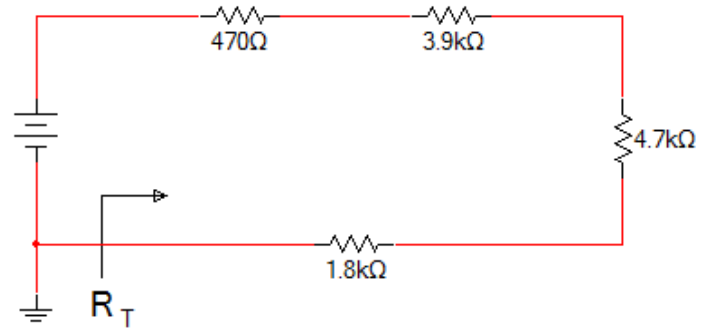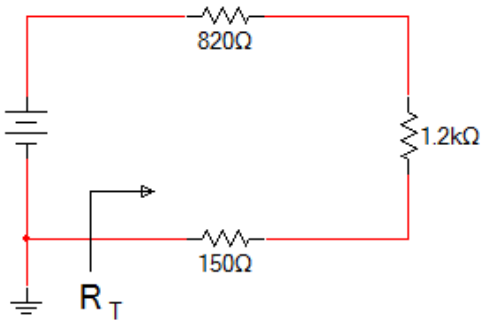
Power in a resistance circuit can be thought of as heat dissipated by the resistors and we measure power in a quantity called watts.

Total power in a series circuit is determined by the sum of the individual power dissipations. The total power will equal the sum of all the individual powers within the circuit.

The 2 power formulas are current times resistance and we will also use current squared times resistance.

Schematics of a series circuit

820Ω

1.2kΩ

150Ω

R$_T$

470Ω

3.9kΩ

4.7kΩ

1.8kΩ

R$_T$

I$_T$

R1
470Ω

R2
1.2kΩ

VT
9 V

R3
270Ω

R$_T$

I$_T$

R1
2.7kΩ

R2
10kΩ

VT
6 V

R3
3.3kΩ

R4
8.2kΩ

R$_T$

1. Electrons leave which pole to flow?
2. How many directions does the current flow in a series circuit?
3. True or false? – Each component in a series circuit contains the same current.
4. Larger resistance drops have larger _____ drops.
5. In a series circuit as the resistors are decreasing voltage what is happening to their temperatures?
6. Name one of the equations for power in a series circuit.

Series Circuits and their uses

A science based view of series circuits