Summary of Series and Parallel Circuits

Series Circuit Characteristics:

i. **Voltage:** Kirchhoff's voltage law: The total source voltage applied to a series circuit is equal to the total number of individual voltage drops in the series circuit. V_T = sum of all voltage drops.

ii. **Current:** The current must be the <u>same</u> value at any point in the circuit.

iii. **Resistance:**

$R_T = R_1 + R_2 + R_3 + \ldots + R_N$

The large resistor dominates

iv. **Power:**

$P_T = V_T * I_T$, and

$P_T = P_1 + P_2 + P_3 + \ldots\ldots + P_N$

v. **Open circuits** across a series resistor cause the current to go to zero everywhere in the circuit.

vi. **Short circuit** across one resistor in a series resistor network causes the current to increase, but the entire circuit is not shorted.

Parallel Circuit Characteristics:

vii. **Voltage:** The voltage drop across each component is the <u>same</u> as the source voltage.

viii. **Current:** Kirchhoff's Current Law: The sum of the currents into a junction is equal to the sum of the currents leaving that junction.

ix. **Resistance:**
Case 1: All resistors the same value: $R_T = R/N$
Case 2: Two resistors with different values: $R_T = R_1R_2/R_1+R_2$
Case 3: More than two resistors with different values:

$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + \ldots\ldots + 1/R_N$

The small resistor dominates

x. **Power:**

$P_T = V_T * I_T$, and

$P_T = P_1 + P_2 + P_3 + \ldots\ldots + P_N$

xi. **Open circuits** across a parallel resistor cause no change in the good branches.

xii. **Short circuit** across one resistor in a parallel resistor network causes a dead short across the entire parallel resistor network.