Before we start to analyse circuits, two **very important** distinctions must be made.

1. **Electrons** flow from **negative terminal (cathode)** to the **positive terminal (anode)**
2. **Current**, however, is defined as a flow of **positive charges** from the **positive terminal (anode)** to the **negative terminal (cathode)**.

This convention is truly inconvenient for the purpose of instruction (since there are no positive flowing charges), but ultimately it makes no difference in terms of circuit design. For example, as a battery drains, the negative side becomes less negative (or more positive) and the positive side becomes less positive (or more negative). Electrons leaving or "positives" coming in; it doesn't make a difference. The effect is the same.

Series Circuit:

Rules:

1. The **current** moving through **each resistors** is the **same** as the **total current**

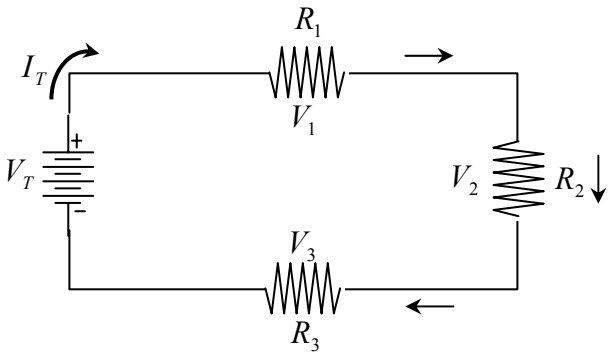
$$I_T = I_1 = I_2 = I_3$$

2. The **sum of the voltages** across the **resistors** is **equal** to the **total** voltage

$$V_T = V_1 + V_2 + V_3$$

3. The **total resistance** of the circuit is **equal** to the **sum** of the all the **resistors in series**

$$R_T = R_1 + R_2 + R_3$$



Parallel Circuit:

Rules:

1. The **voltage** across **each resistors** is the **same** as the **total voltage**

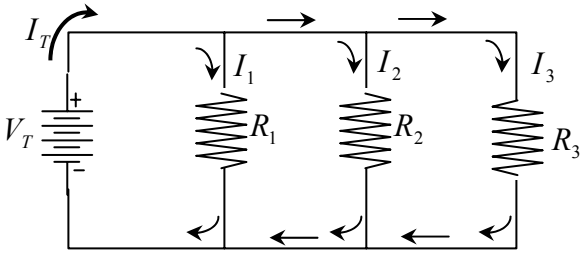
$$V_T = V_1 = V_2 = V_3$$

2. The **sum of the currents** through the **resistors** is **equal** to the **total** current

$$I_T = I_1 + I_2 + I_3$$

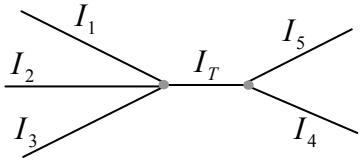
3. The **reciprocal** of the **total resistance** of the circuit is **equal** to the **sum** of the all the **reciprocals of resistors in series**

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$



Kirchhoff's Laws:

Current law: The total current following into a junction is equal to the total current flowing out.



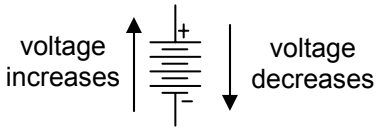
$$I_1 + I_2 + I_3 = I_T = I_4 + I_5$$

Voltage law: The sum of all the voltages increases and decreases in a closed loop will equal zero.

Clarification: when analysing a closed loop there will be voltage increase and decrease

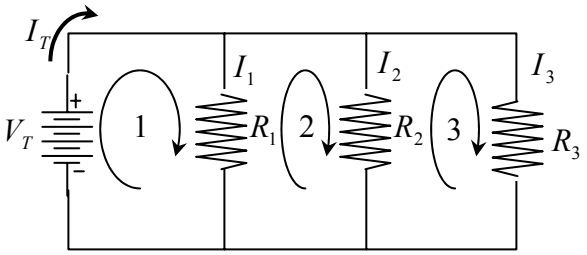
Rules:

1. Voltage **sources increase** the voltage moving from the negative to the positive side and **decrease** when moving from the **positive** to the **negative** side.



2. Voltage increases (+) when going **against** the current flow (i.e. moving upstream requires work), and voltage decreases (-) when going **with** the current flow.

Example:

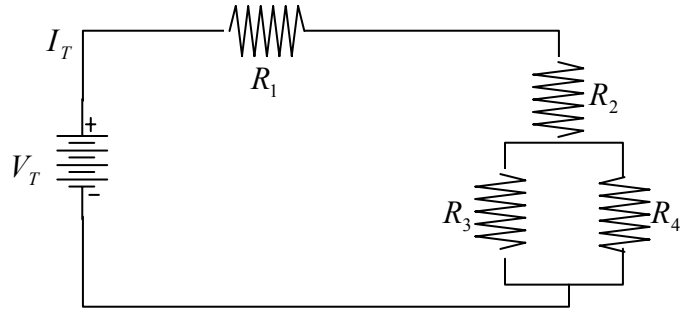


Loop 1: $V_T + V_1 = 0$ where V_T is positive (increase)and V_1 is negative (drop)

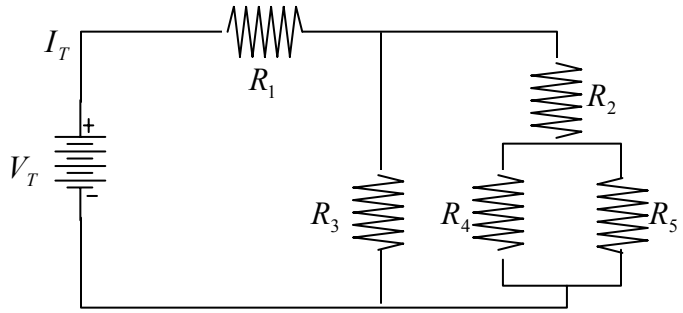
Loop 2: $V_1 + V_2 = 0$ where V_1 is positive (increase) and V_2 is negative (drop)

Loop 3: $V_2 + V_3 = 0$ where V_2 is positive (increase) and V_3 is negative (drop)

Example: Solve the following circuit



	V	I	R	P
1			10	
2			20	
3		2		
4			60	
T	150			450



	V	I	R	P
1	25	1.0		
2		0.75	62.5	
3	75			18.75
4			50	
5			150	
T				