Voltage and Current Sources

☆ Ideal Voltage Source: is a current element that maintains a prescribed voltage across its terminals regardless of the current flowing in those terminals.

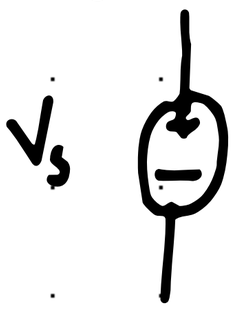
☆ Ideal current source: is a circuit element that maintains a prescribed current through its terminals regardless of the voltage across these terminals.

- Active circuit elements generate power
- Passive circuit elements absorb power (i.e., Resistor)

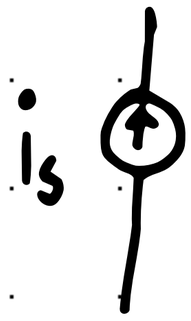
Types of Sources

Independent

Voltage Source



Current Source

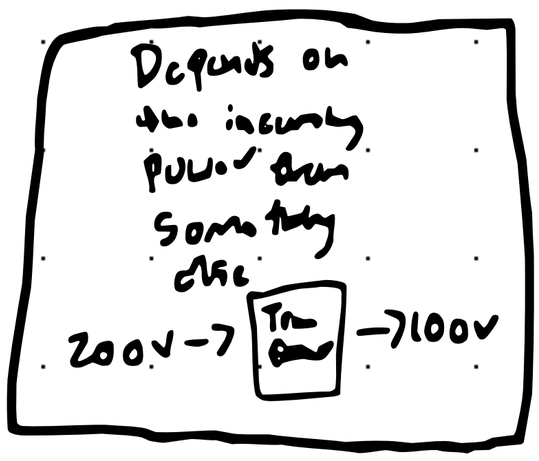


(ex, Battery, Generator)

Dependant

(ex, Transistor)

Depends on the intensity pulled from something else

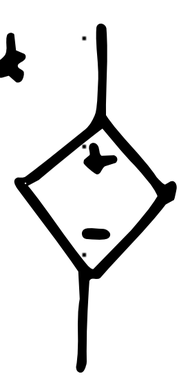


Dependant Voltage Controlled Voltage Source.

Constant Value.

$V_s = \mu V_x$

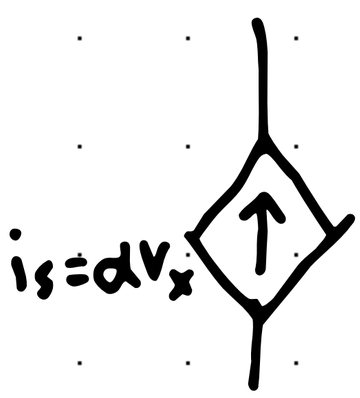
voltage across a certain branch



DVCV

Dependant Voltage Controlled Current Source.

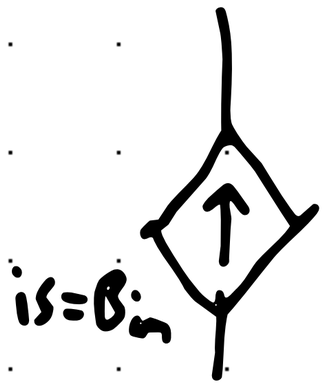
$i_s = \alpha V_x$



DVCC

Dependant Current Controlled Current Source.

$i_s = \beta i_n$



DCCC

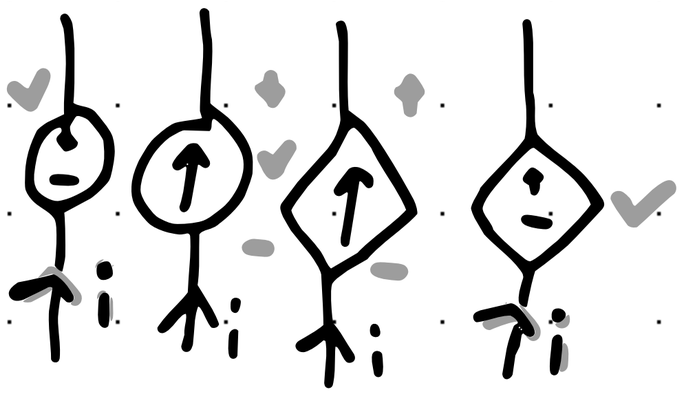
Dependant Current Controlled Voltage Source.

DCCV

The current flows from ⊖ to ⊕

Types of elements in any circuit

Active



The current flows from ⊖ to ⊕

The power is generated

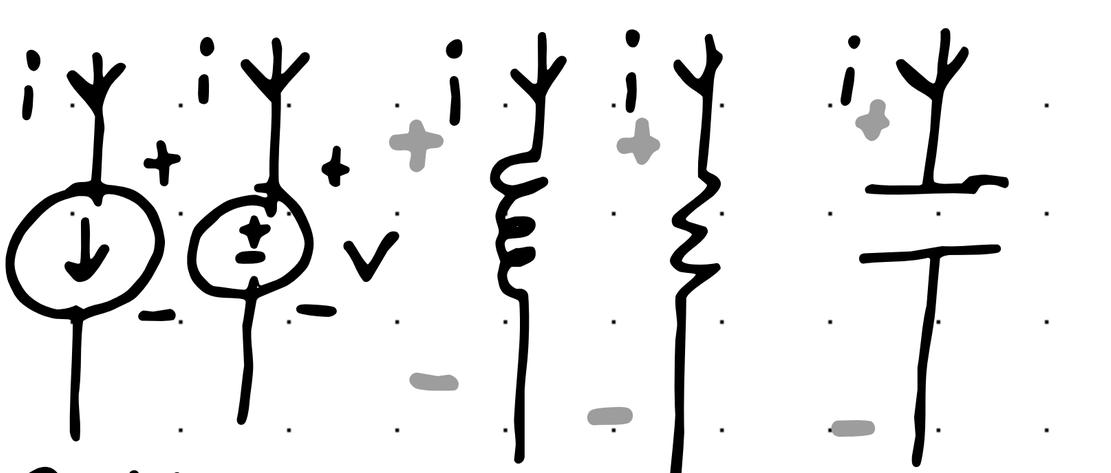
$$p = -vi$$

Dead/Charging Batteries

Batteries can be either or!

Depends on Charging or not.

Passive



Inductor Resistor Capacitor

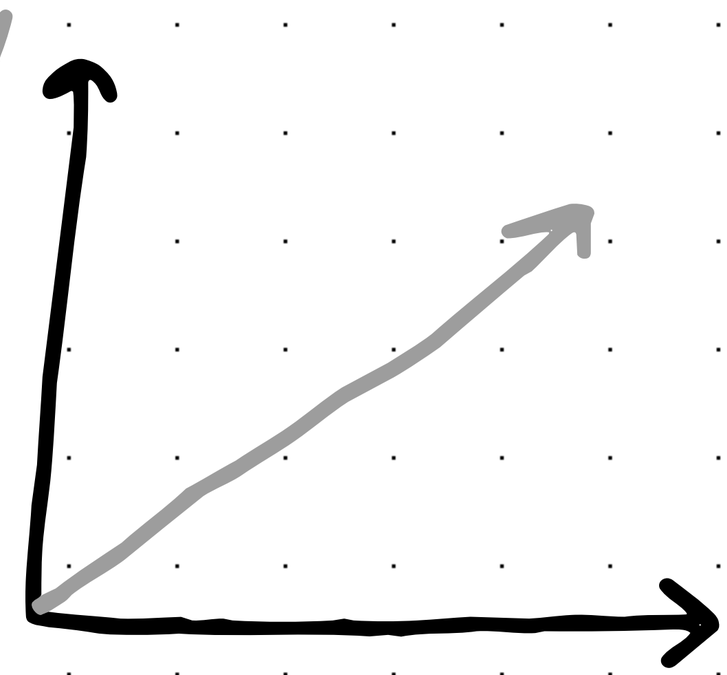
The Current flows from ⊕ to ⊖

The power is absorbed.

$$p = vi$$

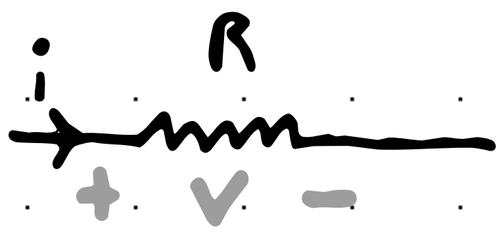
Ohm's Law

Ohm did a bunch of cool experiments with wires, to discover **Resistance!**



Giving us what we call Ohm's...

$$V = IR$$

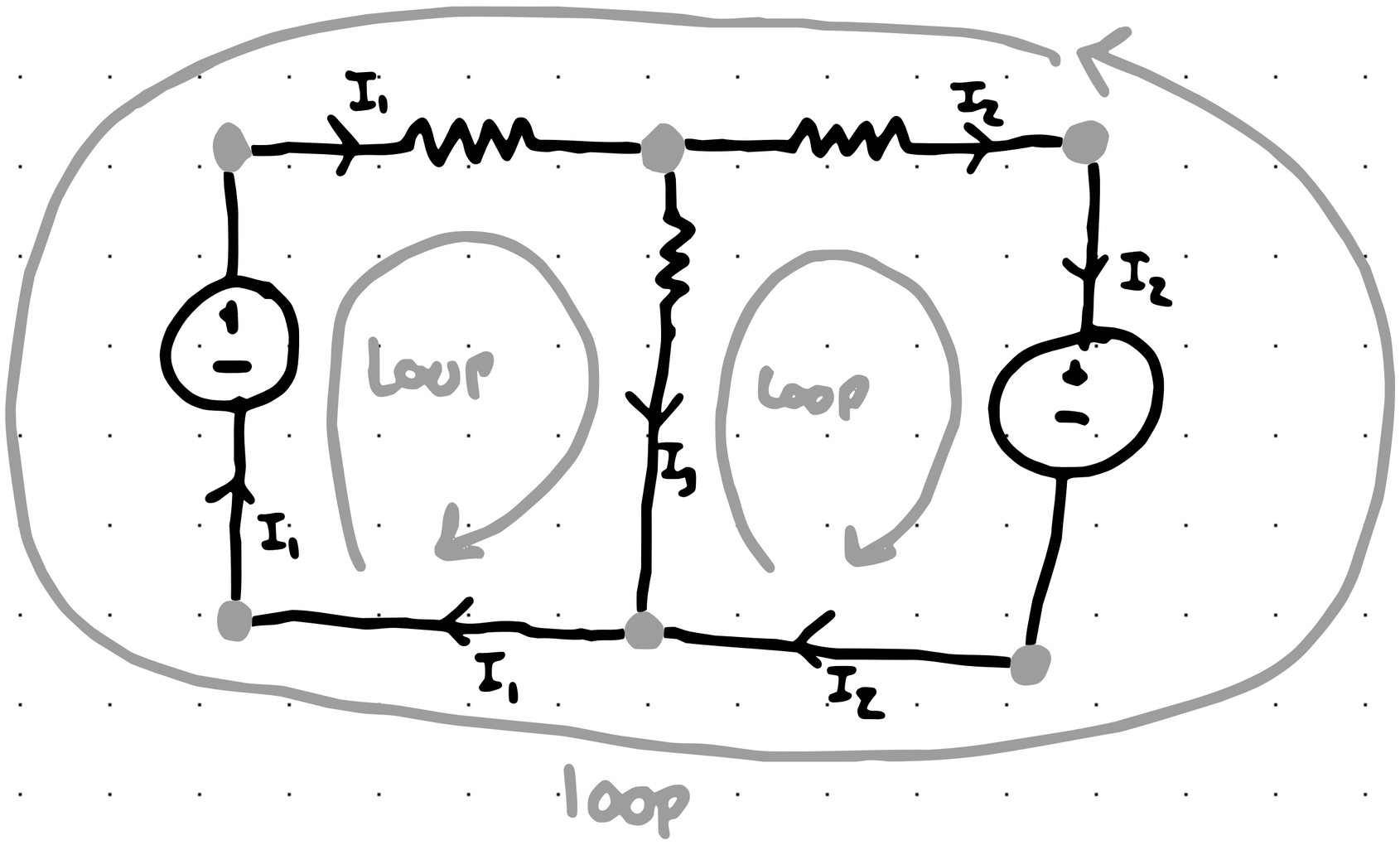


R: **Resistance** → Unit **Ohms** (Ω)

$\frac{1}{R} = G$: **Conductance** → Unit **Siemens** (S)
mhos ($\mho$)

Kirchoff's Laws

ⓐ Kirchoff's Current laws (KCL)



— = Branch

● = Node

$\Sigma I = 0$

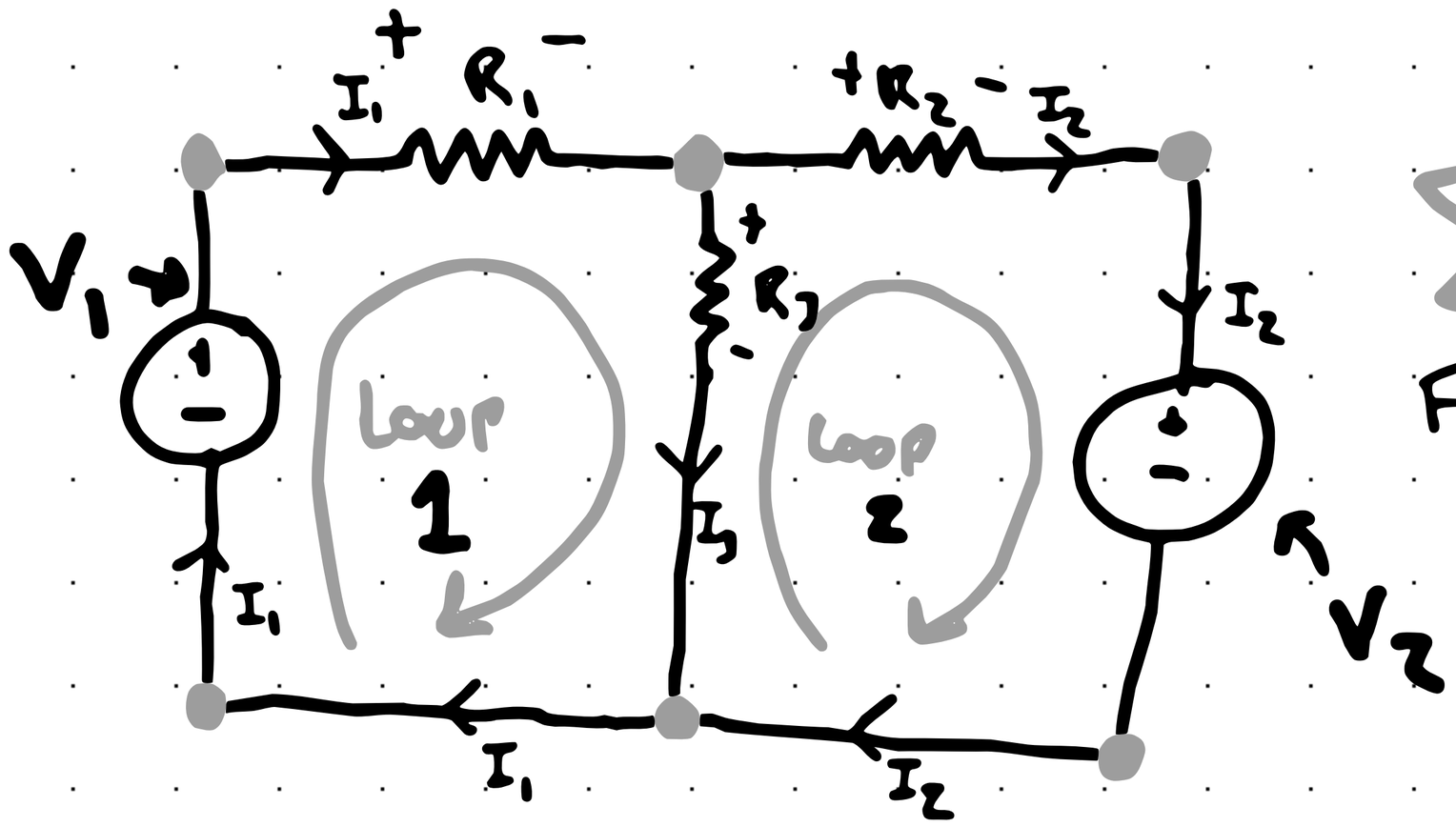
At each node!

Let's assume the current entering the node is positive, and the current leaving is negative

ie, The sum of all currents going in is equal to the sum of all currents going out!

$$I_1 - I_2 - I_3 = 0$$

b) Kirchoff's Voltage laws (KCL)



$$\sum V = 0$$

For each loop

It doesn't matter in which direction you travel around the loop, but **be consistent!**

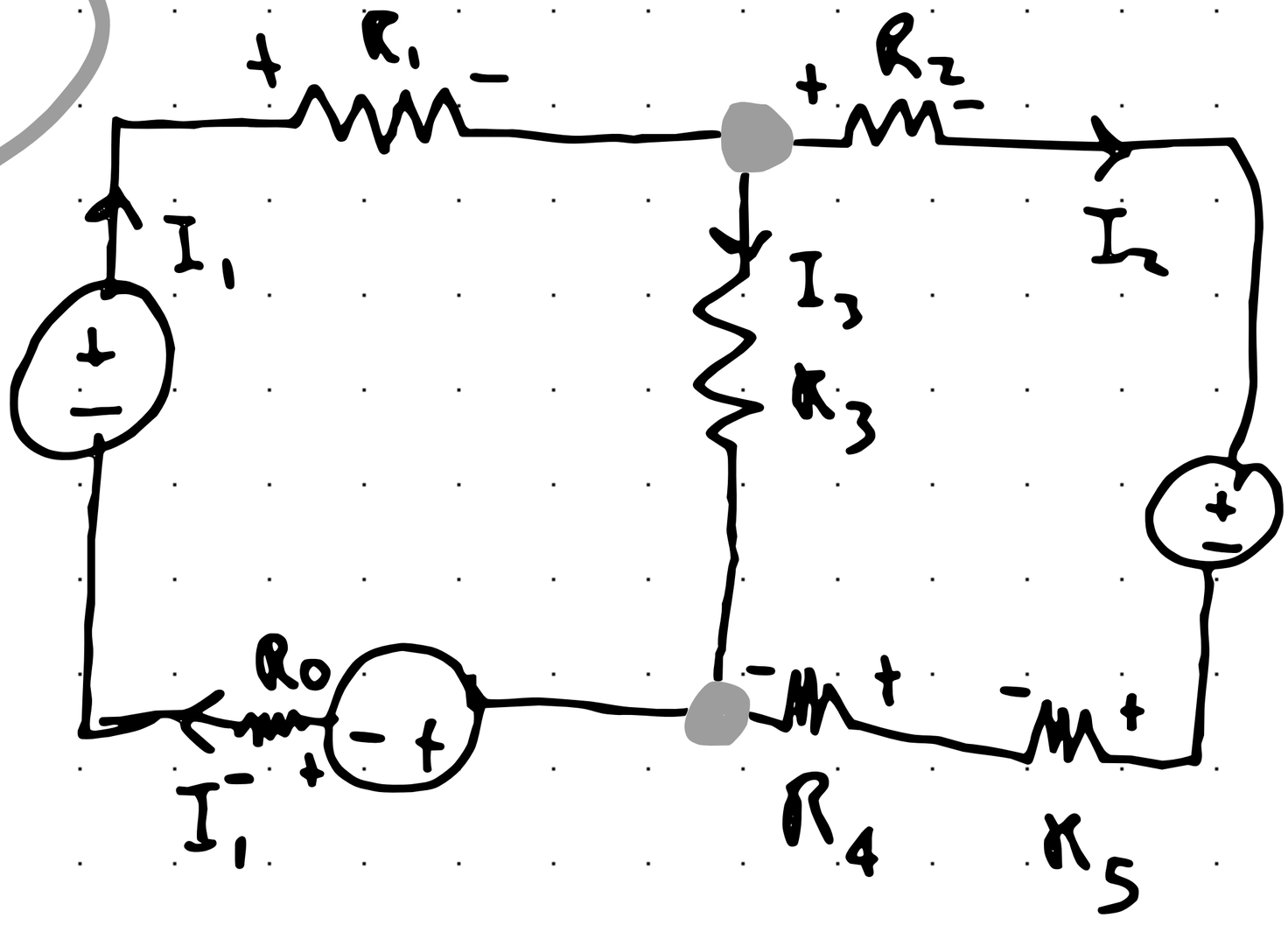
Loop One

$$+V_1 - I_1R_1 - I_3R_3 = 0$$

Loop Two

$$-I_2R_2 + I_3R_3 - V_2 = 0$$

Ex:



$\sum I = 0$

$$I_1 - I_2 - I_3 = 0$$

node 1

$\sum V = 0$

loop ①

$$-V_3 - I_1 R_0 + V_1 - I_1 R_1 - I_3 R_3 = 0$$

$\sum V = 0$

loop ②

$$-I_2 R_4 + I_3 R_3 - I_2 R_2 - V_2 - I_2 R_5 = 0$$