Note: this should have been covered last time

Voltage & current sources (pp. 17 ÷ 22)

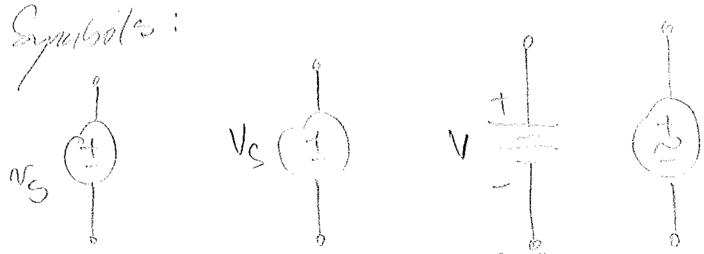
Reminder: Please come and ask questions!

Ideal independent voltage sources

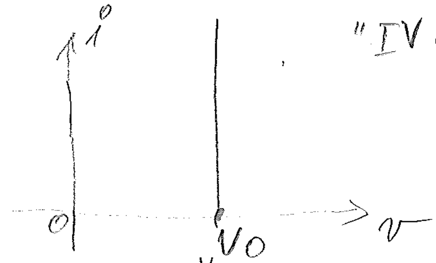
A circuit element characterized by a terminal voltage independent of the current thru it.

"IV characteristic"

Symbols:

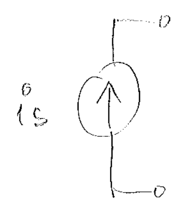


general DC source Battery AC source.

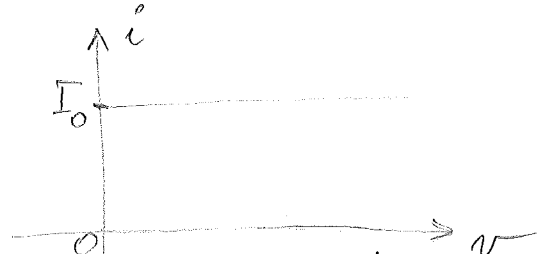


DC voltage source

Ideal independent current sources

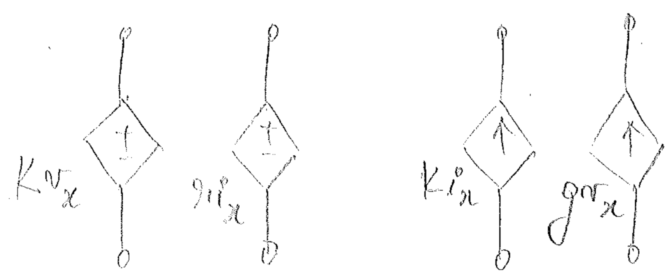


The current is independent of the voltage accross it.



DC current source.

Dependent sources (or controlled sources)



voltage-controlled voltage source	-"-	-"-	-"-
	-"-	-"-	-"-

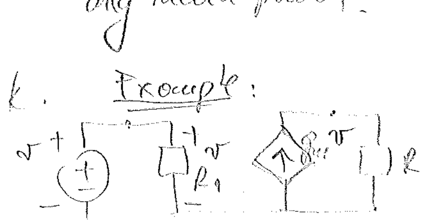
- The controlling variable is a different voltage or current existing somewhere else in the circuit.
- V, I sources are **active** elements (capable of supplying power). Passive elements can only receive power.

Networks and circuits

The interconnection of 2 or more circuit elements $\triangleq$ network.

A network that has at least a loop $\triangleq$ circuit.

Example:



Ohm's Law (pp. 22 ÷ 28)

When subject to a test voltage v, a resistance R conducts a current i that is linearly proportional to the applied voltage:

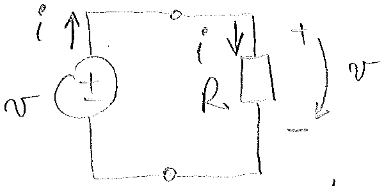
$$(1) \quad \boxed{i = \frac{1}{R} \cdot v}$$

$[\Omega]$ Ohm $\frac{[1V]}{[1A]}$

and whose direction is always through the resistance out of the positive terminal of the source:

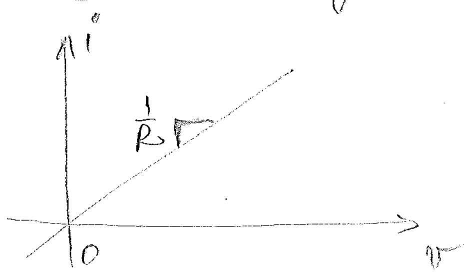
- Alternatively when a current i is forced thru a voltage is developed at terminals.

$$(2) \quad \boxed{v = R \cdot i}$$

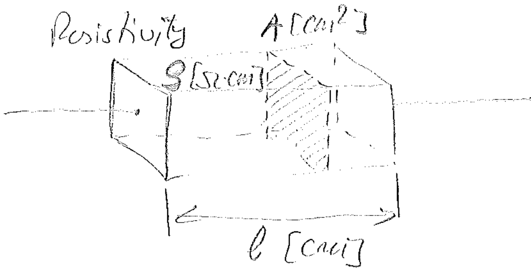


- The iv characteristic is a straight line:

Δ This linear relationship between voltage and current is called Ohm's law.



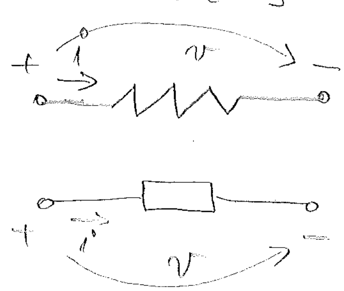
- Example 1: a simple resistor:



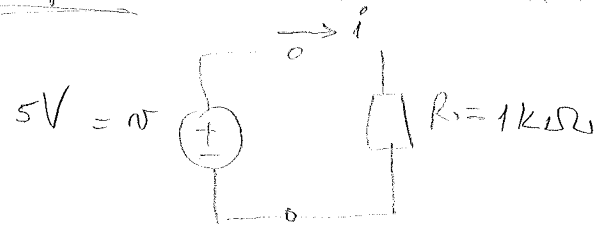
$$R = \rho \frac{l}{A} \quad [\Omega]$$

- where resistivity is a "measure" of the easiness with which electrons can travel thru the material
- OR: better said: R represents the ability to oppose current flow!

Symbol:



- Example 2: Power absorbed by a resistor:



$$p = v \cdot i = v \cdot \frac{v}{R} = \frac{v^2}{R} = \frac{25\ V^2}{1k\Omega} = \frac{25\ V^2}{10^3\ \Omega} = 25 \cdot 10^{-3}\ W = 25\ mW$$

$$(3) \quad \boxed{p = v \cdot i = \frac{v^2}{R} = R i^2}$$

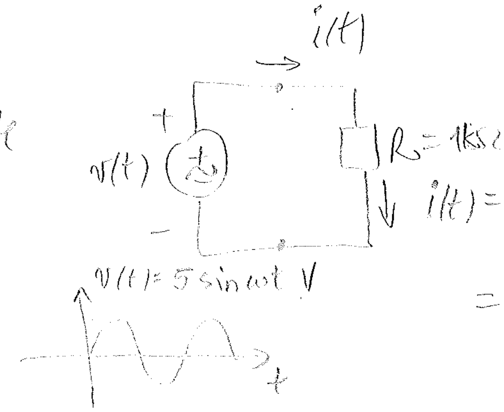
Conductance $G = \frac{1}{R}$ is the inverse of resistance!

(4) $$G = \frac{1}{R} = \frac{i}{v} \quad [S]$$ siemens

Final remark:

$p(t) = v(t)\, i(t)$

$i(t) = \frac{v(t)}{R}$: example



$i(t) = \frac{5 \sin\omega t \ V}{1k\Omega}$

$= \frac{5}{1000} \sin\omega t \ A$

Reminder You'll get a HW assignment.