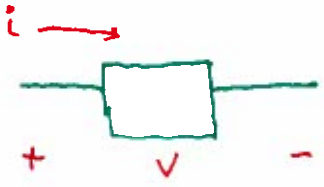
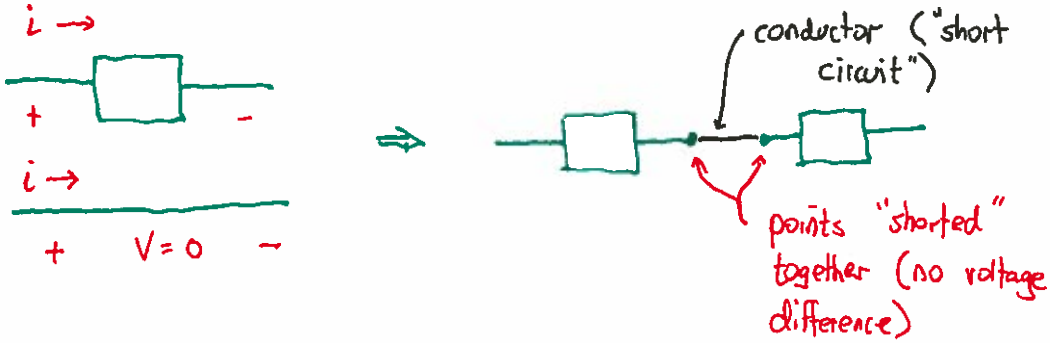
Thursday, January 14, 2015

Circuit elements (continued)

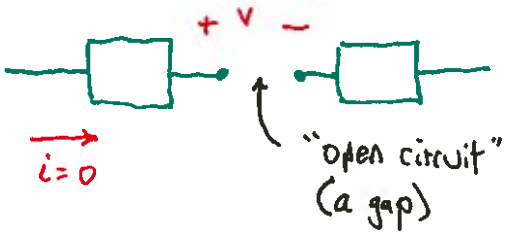
All circuit elements are characterized by their voltage-current relationship.



Conductors (wires)



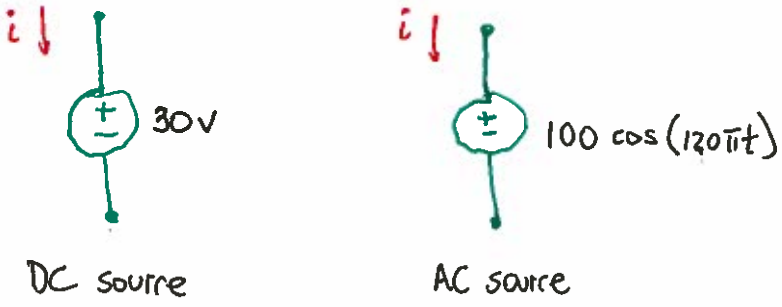
The absence of a conductor between other circuit elements is an open circuit.



Sources

Independent voltage sources:

Symbol:



DC source AC source

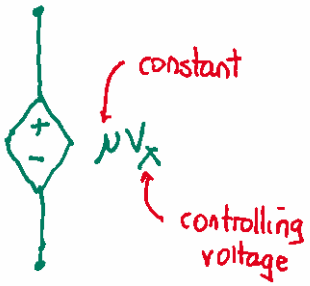
Properties:

- voltage is specified explicitly – not dependent on any other factor
- voltage unchanged by whatever its connected to (i.e., voltage is independent of the current through it).

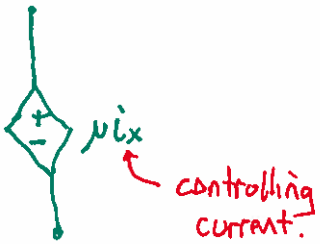
Dependent voltage sources:

- Have the same properties as independent voltage sources, except the value of the voltage depends on either a voltage or current elsewhere in the circuit.

VCVS
(voltage-controlled VS)

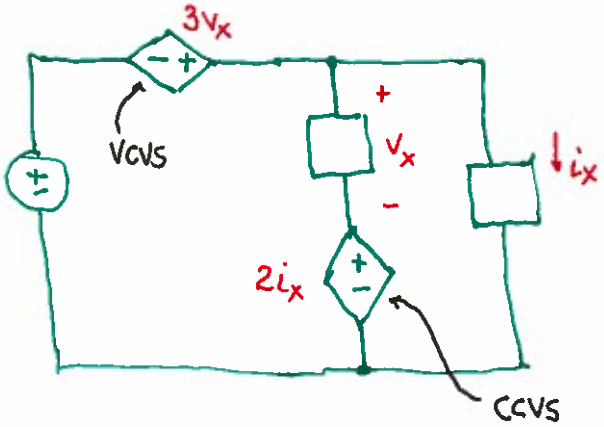


CCVS
(current-controlled VS)



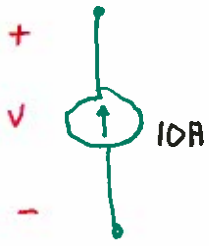
There can be DC or AC dependent sources as well.

A circuit using dependent voltage sources...

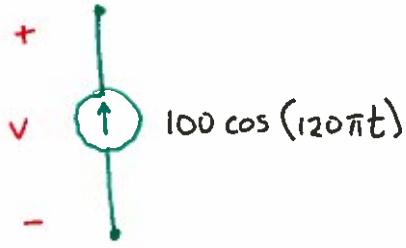


Independent current sources:

Symbol:



DC source



AC source

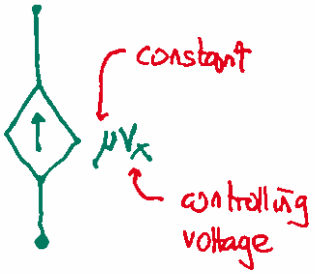
Properties:

- current specified explicitly — not dependent on any other factor
- current unchanged by whatever it is connected to (i.e., current is independent of the voltage across it).

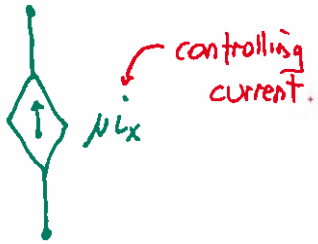
Dependent current sources:

- Same properties as independent, except current depends on voltage or current elsewhere.

VCCS
(voltage-controlled CS)

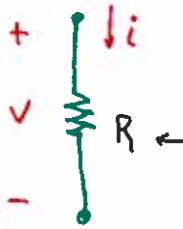


CCCS
(current-controlled CS)



Resistors

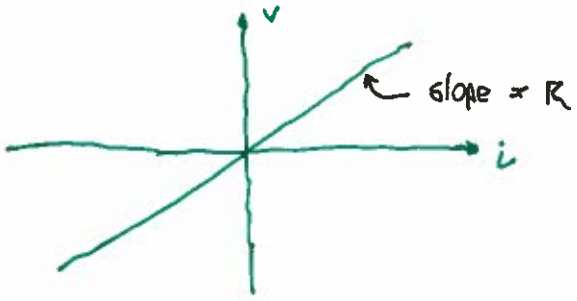
Circuit symbol:



← resistance in Ohms (Ω), R is a constant

Important: direction of i, polarity of v, defined as shown for Ohm's Law — resistor is always absorbing energy.

$V = iR$ Ohm's Law



Suppose we have labelled a resistor this way:

Ohm's Law then states $V = -iR$