Electrical Sources

Definition: An electrical source is a device capable of converting non-electric energy to electric energy.

Battery – converts chemical to electrical energy

Generator – converts mechanical energy to electrical energy

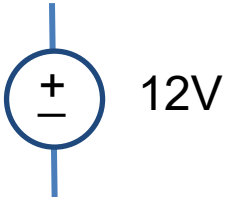
Windmill – converts wind to electrical energy

Solar cell – converts sunlight to electrical energy

Voltage Sources

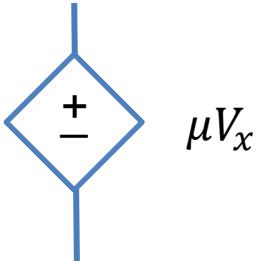
Definition: A voltage source produces a constant voltage across its terminals regardless of the current flowing through it.

Independent voltage sources – produces the same voltage regardless of any other voltage/current elsewhere in the circuit.



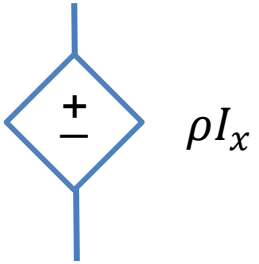
Voltage controlled voltage source – produces a voltage which depends on V_x, some other voltage elsewhere in the circuit.

μ =dimensionless constant of proportionality



Current controlled voltage source – produces a voltage which depends on I_x, some other current elsewhere in the circuit.

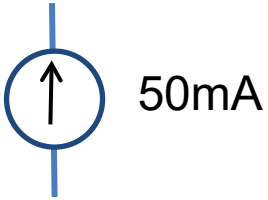
ρ =constant of proportionality in volts/amp



Current Sources

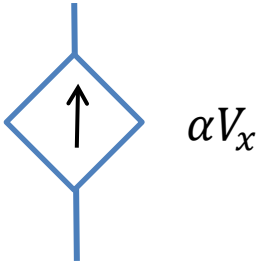
Definition: A current source produces a constant current through its terminals regardless of the voltage across it.

Independent current sources – produces the same current regardless of any other voltage/current elsewhere in the circuit.



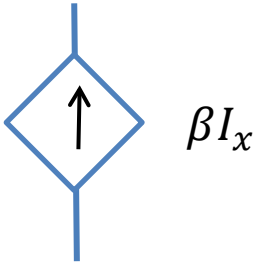
Voltage controlled current source – produces a current which depends on V_x, some other voltage elsewhere in the circuit.

α =constant of proportionality in amps/volt



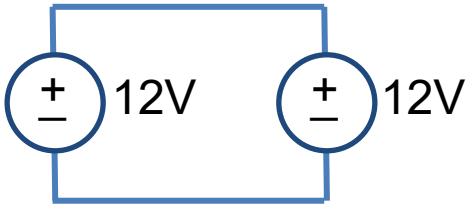
Current controlled current source – produces a current which depends on I_x, some other current elsewhere in the circuit.

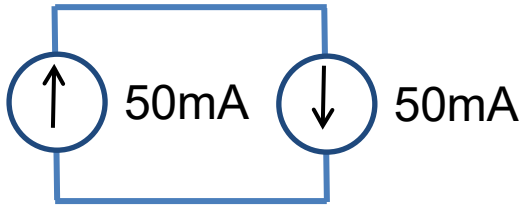
β =dimensionless constant of proportionality

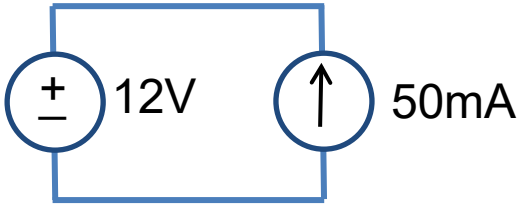


Electrical Sources

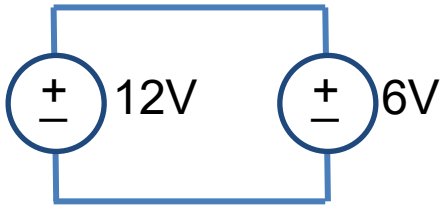
Voltage and current sources cannot be connected in arbitrary manners. The following examples show both valid and invalid connections.

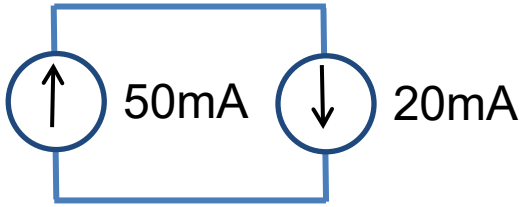


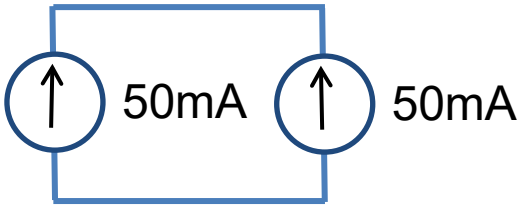




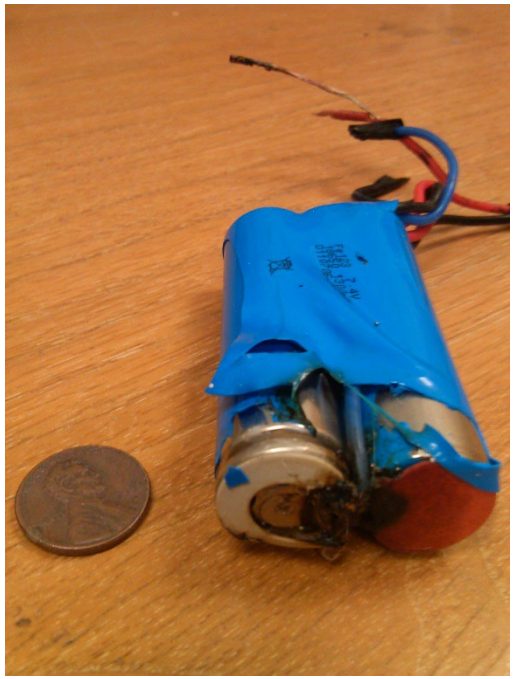
VALID





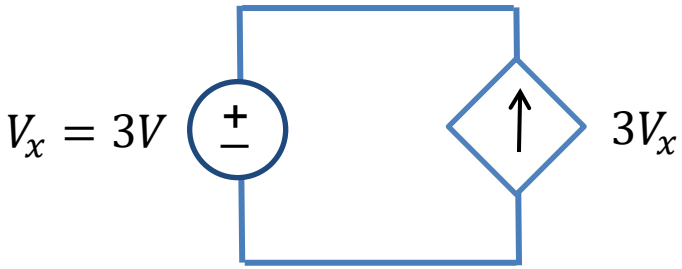


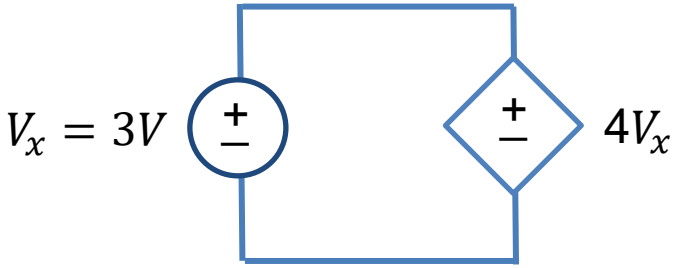
INVALID

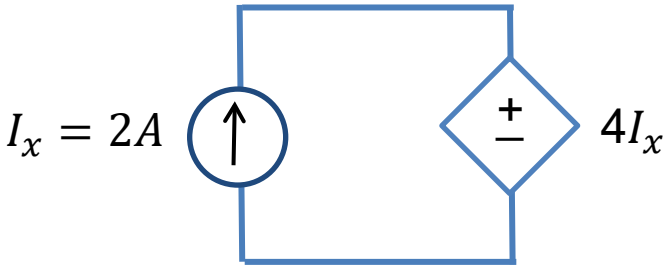


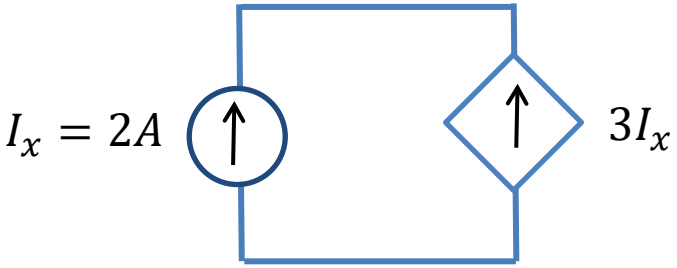
Electrical Sources

Here are some more examples of both valid and invalid source connections.









VALID

INVALID

Example

For the circuit shown:

(a) What value of V_g is required in order for the interconnection to be valid?

(b) For the value of V_g found in part (a), what is the power associated with the 8A current source?