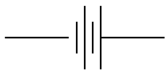
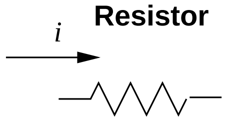
Circuit Elements

Battery



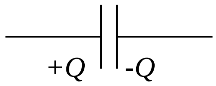
Voltage gains when going from small hash to big hash (left to right in this case)

Resistor



Voltage drops by *iR* when passing through resistor in same direction as current.

Capacitor



Voltage drops by *Q/C* when passing from +*Q* side to -*Q* side.

RC Circuits

Equations:

Current through a resistor in an RC circuit:

$$I(t) = I_0 e^{-t/\tau}\ , \quad \tau = RC$$

Q_0 is the charge at $t = 0$, and Q_∞ is the charge after a long time.
Charge on a capacitor in an RC circuit:

$$Q(t) = (Q_0 - Q_\infty)e^{-t/\tau} + Q_\infty, \quad \tau = RC$$

Q_0 is the charge at $t = 0$, and Q_∞ is the charge after a long time.

Assorted Facts:

1. The charge on a capacitor can not change instantaneously if connected in series with a resistor.
2. The current through a resistor can change instantaneously.
3. Sum of voltages around closed loop is zero. (Kirchoff's law #1)
4. Sum of currents into a node is zero. (Kirchoff's law #2)

Units:

Quantity	Units	Conversion
Electric Field	$(N/C),\ (V/m)$	$1(N/c) = 1(V/m)$
Charge	$(C),\ (e)$	$1e = 1.6 \cdot 10^{-19}C$
Voltage	(V)	$1(V) = 1(J/C)$
Current	(A)	$1(A) = 1(C/s)$
Capacitance	(F)	$1(F) = 1(C/V)$
Resistance	(Ω)	$1(\Omega) = 1(V/A)$