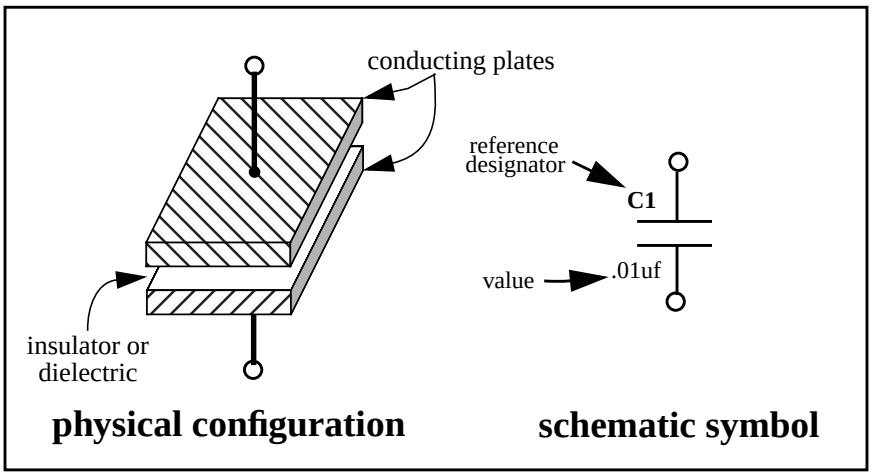
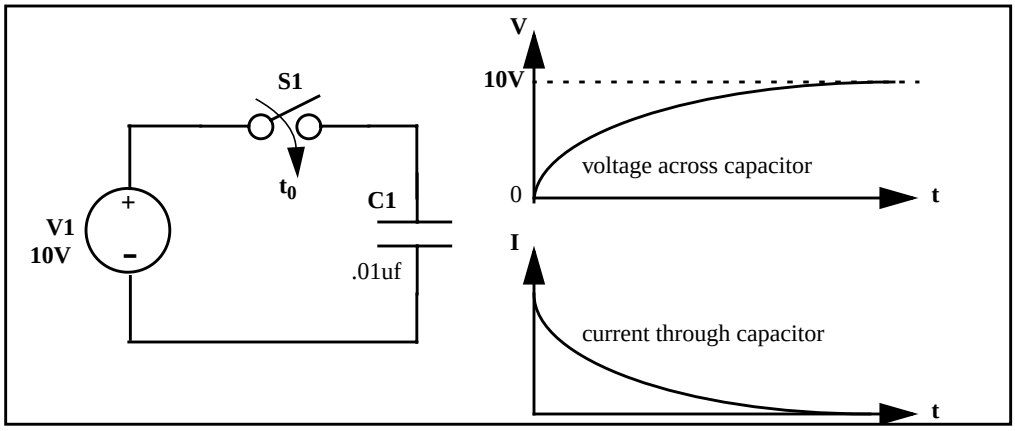
Capacitors

Capacitors are potential energy storage devices. The energy they store is electrical potential energy. The energy is in the form of an electric field or “charge” between two conducting surfaces that are separated by an insulator called a dielectric.



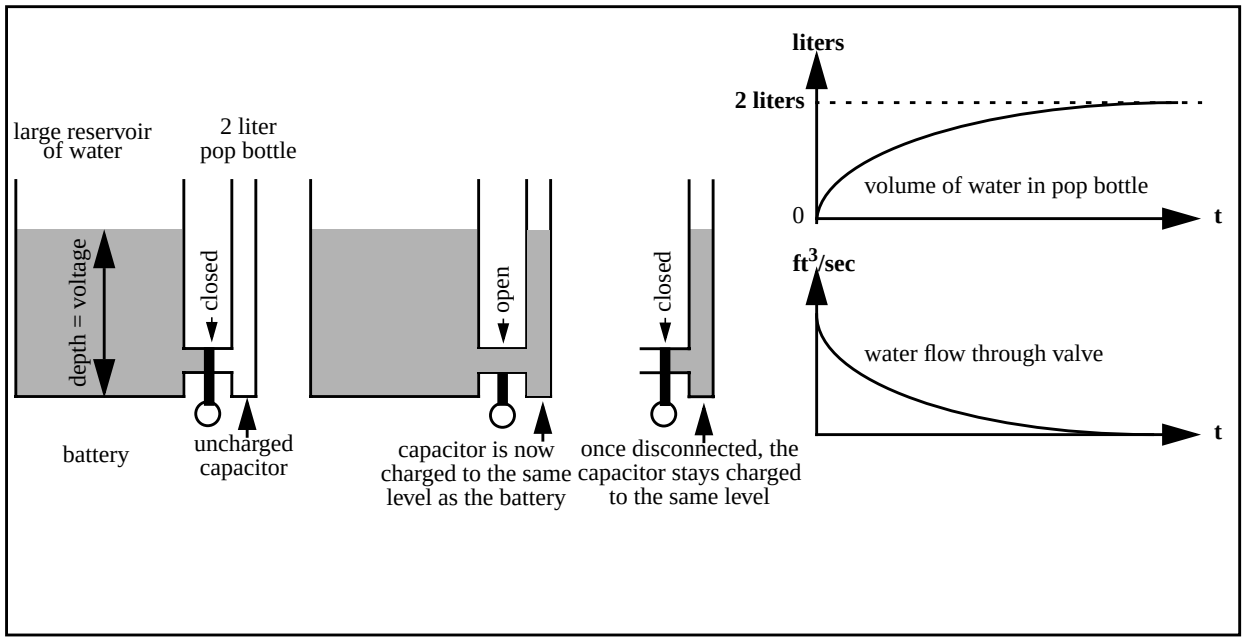
The dielectric may be air, mylar, polyester, mica or a variety of other materials. In the parallel plate capacitor shown above, the conducting plates may be thin sheets of metal. In fact, a rudimentary capacitor may be made by rolling up a sandwich of two aluminum foil sheets with a center insulator of wax paper.

If we apply a battery across the terminals of a capacitor we see the capacitors transient behavior differs from its steady state behavior. See the schematic below.



Assuming that initially, there is no stored charge on the capacitor at t=0, when the switch is closed, the charge on the battery rushes into the capacitor. As the capacitor charges to the batteries potential, the current flow comes to a halt. We say at this point the capacitor is charged. If we disconnect the capacitor from the circuit we would find the voltage across it is equal to the battery.

The water analogy for the capacitor is as shown below. Initially, the water flow from the reservoir is the bottle is rapid and it slows as the water levels equalize. The rate at which the coke bottle water level increases has an exponential characteristic.



Electrically speaking, the coke bottle is holding electric charge in the same way a capacitor does. The ability to store charge is called capacitance and it is measured in farads.