Basic Electronics Part 10
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A capacitor has two conducting surfaces separated by an insulator. Capacitors are electrical devices that store electrical energy. One way to look at this idea of storing electrical energy is to consider the circuit in Fig. 1.

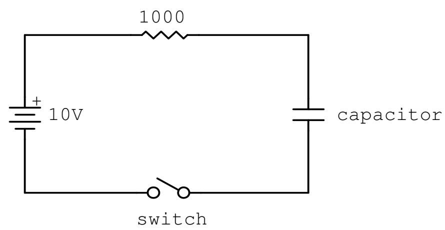

Fig. 1

Notice the capacitor schematic diagram looks like two parallel conductors with a space between them. This symbol accurately pictures capacitor construction. When we close the switch, electrons leave the negative battery terminal. The positive battery terminal attracts electrons, and they move through the circuit. We can use Ohm's Law to calculate the current when we first close the switch.

$$I = \frac{E}{R} = \frac{10\ volts}{1000\ ohms}.$$

So $I = 10\ mA$.

This current cannot continue for long, however. The electrons reach the capacitor, but they can't get through it because there is an insulating layer between the conductors. Two things happen. First, electrons move onto the conductor surface. These electrons exert an electric force to repel electrons from the opposite conductor. Second, the positive battery terminal attracts electrons from the second conductor. As electrons move off the second conductor, it has a positive charge.

The negative charge on the first capacitor plate also repels any more electrons that try to reach it. At first there are few electrons and this force is small. The battery pushes with a stronger force, so electrons continue to accumulate. As more electrons pile up, the force becomes stronger. Eventually, the repelling force of electrons on the capacitor plate equals the battery force, and no more electrons flow onto the capacitor.

While electrons are piling up on one capacitor plate, the battery is pulling electrons off the other plate. As the battery pulls electrons off that plate it becomes more difficult to pull electrons away. The forces reach a balance, and the battery can't pull any more electrons off the capacitor plate.

When we first close the switch, the current is 10 mA. The current immediately begins to decrease. Also, when we first close the switch, there is no voltage on the plates of the capacitor, however, as the electric charge builds up, there is a voltage across them. When that voltage reaches the battery voltage, current no longer flows in the circuit. As charge builds up on the capacitor plates, then, there is an electric field between the plates. This electric field between the capacitor plates represents stored electrical energy. The capacitor will store this energy as long as the charge remains on the capacitor plates.

If we remove the capacitor from the circuit, a perfect capacitor would not lose any charge. Since no capacitor is perfect, some of the charge will leak through the insulation between the capacitor plates and some charge will leak off the capacitor from the capacitor leads. You should be careful of charged capacitors because if you accidentally contact the leads, you can receive an electrical shock.