is the opposite of charging. The charges move back from one plate to another until both plates are uncharged again because this is the state of lowest potential energy.

One device that uses a capacitor is the flash attachment of a camera. A battery is used to charge the capacitor, and this stored charge is then released when the shutter-release button is pressed to take a picture. One advantage of using a discharging capacitor instead of a battery to power a flash is that with a capacitor, the stored charge can be delivered to a flash tube much faster, illuminating the subject at the instant more light is needed.

Computers make use of capacitors in many ways. For example, one type of computer keyboard has capacitors at the base of its keys, as shown in **Figure 7.** Each key is connected to a movable plate, which represents one side of the capacitor. The fixed plate on the bottom of the keyboard represents the other side of the capacitor. When a key is pressed, the capacitor spacing decreases, causing an increase in capacitance. External electronic circuits recognize that a key has been pressed when its capacitance changes.

Because the area of the plates and the distance between the plates can be controlled, the capacitance, and thus the electric field strength, can also be easily controlled.

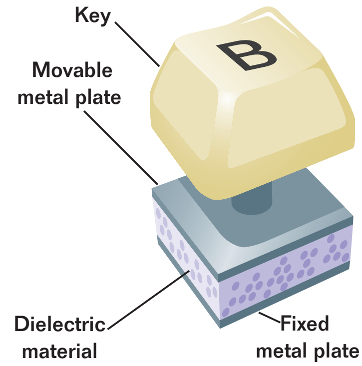

Figure 7
A parallel-plate capacitor is often used in keyboards.

extension

Integrating Biology
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Keyword HF6ELCX

ENERGY AND CAPACITORS

A charged capacitor stores electrical potential energy because it requires work to move charges through a circuit to the opposite plates of a capacitor. The work done on these charges is a measure of the transfer of energy.

For example, if a capacitor is initially uncharged so that the plates are at the same electric potential, that is, if both plates are neutral, then almost no work is required to transfer a small amount of charge from one plate to the other. However, once a charge has been transferred, a small potential difference appears between the plates. As additional charge is transferred through this potential difference, the electrical potential energy of the system increases. This increase in energy is the result of work done on the charge. The electrical potential energy stored in a capacitor that is charged from zero to some charge, *Q*, is given by the following expression:

ELECTRICAL POTENTIAL ENERGY STORED IN A CHARGED CAPACITOR

$$PE_{electric} = \frac{1}{2}Q\Delta V$$

electrical potential energy =
$\frac{1}{2}$(charge on one plate)(final potential difference)

Note that this equation is also an expression for the work required to charge the capacitor.