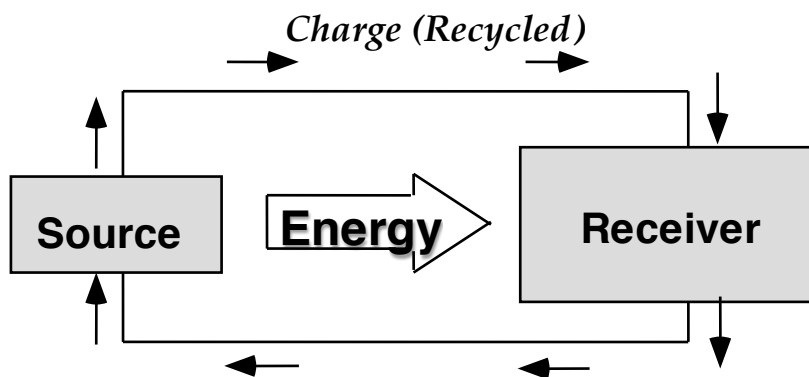


## Unit 11 – Reading 3 - Energy in electric circuits

“Energy” is best defined as **an invisible substance that can be stored in matter and transferred to other matter** -- and is what gives matter the **ability to make something happen**. We have identified a number of things that happen in circuits – charges move, bulb filaments become hot and give off light. What is the source of the energy that makes it possible for these things happen?

In most of the circuits we have observed, the source of the stored energy has been the battery. You know that batteries eventually wear down, and may become “dead”. This means that they no longer have sufficient energy stored in them to make something happen in a circuit. Some batteries are called “rechargeable” and can be re-used. This is an incorrect term, however, since the battery’s task was never to supply charge to the circuit – it was already there! These batteries would more properly be called “re-energizeable”.



**Figure 3.12**  
**DIAGRAM REPRESENTING RECYCLING CHARGE AND ONE-WAY TRANSFER OF ENERGY FROM SOURCE TO RECEIVER**

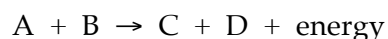
In a circuit, charge originates in every conductor, and constantly re-cycles around the circuit. However, energy leaves the energy source where it is stored and travels one-way to a receiver.

Energy can leave a circuit as heat or light energy from the bulbs (the receivers of the energy). The energy source might be the stored energy in a battery, or the stored energy in muscles, or other energy sources.

## Stored Energy and Rechargeable Batteries

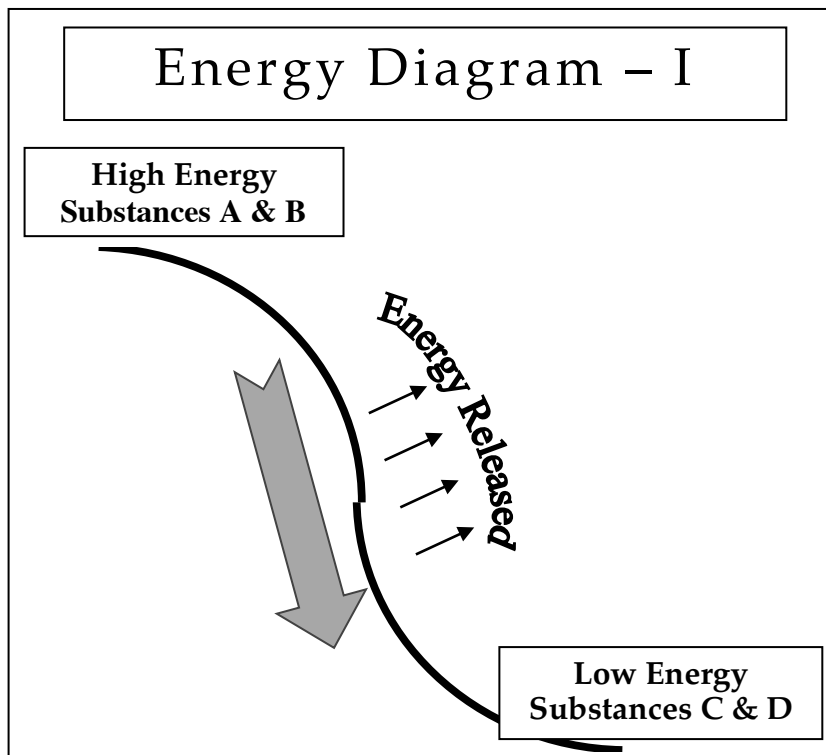
A fresh battery (such as a single D-cell) generally contains two substances, which we will refer to as A and B. These are high-energy substances (like some foods are known to be excellent sources of energy), which means that energy is stored in the chemical bonds within these

substances. These two chemicals react inside the battery cell and release the energy that pushes charges around the circuit. The reaction is 'rolling down' the energy hill when energy is released from the cell. The equation for the reaction is:



Eventually, however, substances A and B will be used up – completely converted into low-energy substances C and D. When only substances C and D are left, we refer to the battery as 'dead'.

Some batteries, however, are designed so that the chemical process is reversible. By



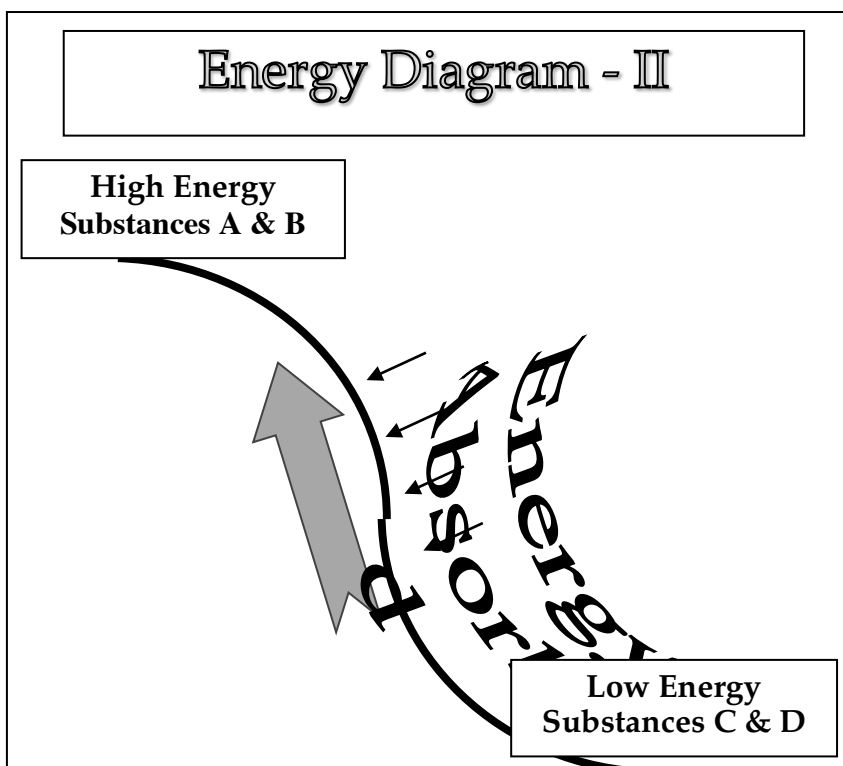
pumping energy back into the system from another source, the chemical reaction can be forced in the opposite direction.

The diagram at right demonstrates energy being absorbed into the battery, 'climbing the energy hill'. The equation for the reaction is:



The battery is now 'refreshed' or '**re-energized**' and can be used again to pump charges around a circuit.

(The term 'rechargeable' is misleading, since a battery *never* runs out of charge. Charge is present everywhere in the circuit, and is not supplied by the battery. The battery simply supplies the energy needed to make the



charge move through the circuit. The term  
“re-energizeable battery” would be more appropriate.)