

Battery or voltaic cell is a combination of many [electrochemical](http://en.wikipedia.org/wiki/Electrochemical_cell) [Galvanic cells](http://en.wikipedia.org/wiki/Galvanic_cell) of identical type to store [chemical energy](http://en.wikipedia.org/wiki/Chemical_energy) and to deliver higher voltage or higher current than with single cells.

The battery cells create a voltage difference between the terminals of each cell and hence to its combination in battery. When an external electrical circuit is connected to the battery, then the battery drives electrons through the circuit and electrical work is done. Since the invention of the first [Voltaic pile](http://en.wikipedia.org/wiki/Voltaic_pile) in 1800 by [Alessandro Volta](http://en.wikipedia.org/wiki/Alessandro_Volta), the battery has become a common power source for many household and industrial applications, and is now a multi-billion [dollar](http://en.wikipedia.org/wiki/USD) industry.

The name "battery" was coined by [Benjamin Franklin](http://en.wikipedia.org/wiki/Benjamin_Franklin) for an arrangement of multiple [Leyden jars](http://en.wikipedia.org/wiki/Leyden_jar) ,an early type of [capacitor](http://en.wikipedia.org/wiki/Capacitor) after a [battery of cannon](http://en.wikipedia.org/wiki/Artillery_battery).The common usage includes a single electrical cell in the definition. An early form of electrochemical battery called the [Baghdad Battery](http://en.wikipedia.org/wiki/Baghdad_Battery) may have been used in antiquity. However, the modern development of batteries started with the [Voltaic pile](http://en.wikipedia.org/wiki/Voltaic_pile), invented by the [Italian](http://en.wikipedia.org/wiki/Italians) [physicist](http://en.wikipedia.org/wiki/Physicist) [Alessandro Volta](http://en.wikipedia.org/wiki/Alessandro_Volta) in 1800.

**The Flow Chart**



A battery is a device that converts chemical energy directly to electrical energy. It consists of one or more voltaic cells; each voltaic cell consists of two [half cells](http://en.wikipedia.org/wiki/Half_cell) connected in series by a conductive electrolyte containing anions and cations. One half-cell includes electrolyte and the electrode to which [anions](http://en.wikipedia.org/wiki/Ion#Ions) (negatively-charged ions) migrate, i.e. the [anode](http://en.wikipedia.org/wiki/Anode) or negative electrode; the other half-cell includes electrolyte and the electrode to which [cations](http://en.wikipedia.org/wiki/Ion#Ions) (positively-charged ions) migrate, i.e. the [cathode](http://en.wikipedia.org/wiki/Cathode) or positive electrode. In the [redox](http://en.wikipedia.org/wiki/Redox) reaction that powers the battery, reduction (addition of electrons) occurs to cations at the cathode, while oxidation (removal of electrons) occurs to anions at the anode. The electrodes do not touch each other but are electrically connected by the electrolyte, which can be either solid or liquid. Many cells use two half-cells with different electrolytes. In that case each half-cell is enclosed in a container, and a separator that is porous to ions but not the bulk of the electrolytes prevents mixing.

**Primary Batteries**

Primary batteries can produce current immediately on assembly. Disposable batteries, also called [primary cells](http://en.wikipedia.org/wiki/Primary_cell), are intended to be used once and discarded. These are most commonly used in portable devices that have low current drain, are only used intermittently, or are used well away from an alternative power source, such as in alarm and communication circuits where other electric power is only intermittently available. Disposable primary cells cannot be reliably recharged, since the chemical reactions are not easily reversible and active materials may not return to their original forms. Battery manufacturers recommend against attempting to recharge primary cells.

**Secondary Batteries**

Secondary batteries must be charged before use; they are usually assembled with active materials in the discharged state. Rechargeable batteries or [secondary cells](http://en.wikipedia.org/wiki/Secondary_cell) can be recharged by applying electrical current, which reverses the [chemical reactions](http://en.wikipedia.org/wiki/Chemical_reaction) that occur during its use. Devices to supply the appropriate current are called chargers or rechargers.

The more electrolyte and electrode material there is in the cell, the greater the capacity of the cell. Thus a small cell has less capacity than a larger cell, given the same chemistry, though they develop the same open-circuit voltage. The capacity of a battery depends on the discharge conditions such as the magnitude of the current, the duration of the current, the allowable terminal voltage of the battery, temperature and other factors. The available capacity of a battery depends upon the rate at which it is discharged. If a battery is discharged at a relatively high rate, the available capacity will be lower than expected.

**Primary Batteries Lifetime**

Even if never taken out of the original package, disposable or primary batteries can lose 8 to 20 percent of their original charge every year at a temperature of about 20°–30°C.This is known as the "self discharge" rate and is due to non-current-producing "side" chemical reactions, which occur within the cell even if no load is applied to it. The rate of the side reactions is reduced if the batteries are stored at low temperature, although some batteries can be damaged by freezing. High or low temperatures may reduce battery performance. This will affect the initial voltage of the battery. For an AA alkaline battery this initial voltage is approximately normally distributed around 1.6 volts.

**Life of Rechargeable Batteries**

Rechargeable batteries traditionally self-discharge more rapidly than disposable alkaline batteries, especially [nickel](http://en.wikipedia.org/wiki/Nickel)-based batteries; a freshly charged NiCd loses 10% of its charge in the first 24 hours, and thereafter discharges at a rate of about 10% a month. However, modern lithium designs have reduced the self-discharge rate to a relatively low level (but still poorer than for primary batteries). Most nickel-based batteries are partially discharged when purchased, and must be charged before first use.

**Extending Life Batteries**

Battery life can be extended by storing the batteries at a low temperature, as in a [refrigerator](http://en.wikipedia.org/wiki/Refrigerator) or [freezer](http://en.wikipedia.org/wiki/Freezer), because the chemical reactions in the batteries are slower. Such storage can extend the life of alkaline batteries by ~5%; while the charge of rechargeable batteries can be extended from a few days up to several months. In order to reach their maximum voltage, batteries must be returned to room temperature; discharging an alkaline battery at 250 mAh at 0°C is only half as efficient as it is at 20°C. As a result, alkaline battery manufacturers like [Duracell](http://en.wikipedia.org/wiki/Duracell) do not recommend refrigerating or freezing batteries.

**Explosive**

A battery explosion is caused by the misuse or malfunction of a battery, such as attempting to recharge a primary (non-rechargeable) battery, or [short circuiting](http://en.wikipedia.org/wiki/Short_circuit) a battery.With car batteries, explosions are most likely to occur when a short circuit generates very large currents.

**Environmental concern**

The widespread use of batteries has created many [environmental concerns](http://en.wikipedia.org/wiki/Electronic_waste), such as toxic metal pollution. Battery manufacture consumes resources and often involves hazardous chemicals. Used batteries also contribute to [electronic waste](http://en.wikipedia.org/wiki/Electronic_waste). Some areas now have battery [recycling](http://en.wikipedia.org/wiki/Recycling) services available to recover some of the materials from used batteries.Batteries may be harmful or fatal if [swallowed](http://en.wikipedia.org/wiki/Swallowing).Recycling or proper disposal prevents dangerous elements such as [lead](http://en.wikipedia.org/wiki/Lead), [mercury](http://en.wikipedia.org/wiki/Mercury_%28element%29), and [cadmium](http://en.wikipedia.org/wiki/Cadmium) found in some types of batteries from entering the environment.

**Alkaline Battery**

* Alkaline batteries and alkaline cells a battery being a collection of multiple cells are a type of disposable [battery](http://en.wikipedia.org/wiki/Battery_%28electrical%29) or [rechargeable](http://en.wikipedia.org/wiki/Rechargeable_alkaline_battery) battery dependent upon the reaction between [zinc](http://en.wikipedia.org/wiki/Zinc) and [manganese (IV) oxide](http://en.wikipedia.org/wiki/Manganese_%28IV%29_oxide) ,[Zn](http://en.wikipedia.org/wiki/Zinc)/[Mn](http://en.wikipedia.org/wiki/Manganese)[O](http://en.wikipedia.org/wiki/Oxygen)2.
* Alkaline batteries have a higher [energy density](http://en.wikipedia.org/wiki/Energy_density) and longer life which alkalines commonly compete against in [button cells](http://en.wikipedia.org/wiki/Button_cell).
* Capacity of an alkaline battery is larger than an equal size or zinc-chloride cell because the manganese dioxide anode material is purer and denser, and space taken up by internal components such as current collectors is less. An alkaline cell can provide between three and five times as much operating time. capacity of an alkaline battery is strongly dependent on the load.
* The nominal voltage of the alkaline battery cell is 1.5 V. Multiple voltages may be achieved with series of cells. The effective zero-load voltage of a non discharged alkaline battery varies from 1.50 to 1.65 V, depending on the chosen mangan dioxide and the contents of zinc oxide in the electrolyte. The average voltage under load depends on discharge and varies from 1.1 to 1.3 V. The fully discharged cell has a remaining voltage in the range of .8 to 1.0 V.

**Lead-acid Battery**

* Lead-acid batteries, are the oldest type of [rechargeable battery](http://en.wikipedia.org/wiki/Rechargeable_battery). Despite having the second lowest [energy](http://en.wikipedia.org/wiki/Energy)-to-[weight](http://en.wikipedia.org/wiki/Weight) ratio and a correspondingly low energy-to-[volume](http://en.wikipedia.org/wiki/Volume) ratio, their ability to supply high [surge currents](http://en.wikipedia.org/wiki/Surge_current) means that the cells maintain a relatively large ratio make them attractive for use in [motor vehicles](http://en.wikipedia.org/wiki/Motor_vehicle) to provide the high current required by [automobile starter motors](http://en.wikipedia.org/wiki/Automobile_self_starter).
* Battery has one major advantage over other chemistries. It is relatively simple to determine the state of charge by merely measuring the [specific gravity (S.G.)](http://en.wikipedia.org/wiki/Relative_density) of the electrolyte, the S.G. falling as the battery discharges.
* Separators are used between the positive and negative plates of a lead acid battery to prevent short circuit through physical contact, mostly through [dendrites](http://en.wikipedia.org/wiki/Dendrite_%28crystal%29), but also through shedding of the active material. Separators obstruct the flow of ions between the plates and increase the internal resistance of the cell.
* Large backup power supplies for telephone and computer centers, [grid energy storage](http://en.wikipedia.org/wiki/Grid_energy_storage), and off-grid household electric power systems.
* Lead-acid batteries are used in emergency lighting in case of [power failure](http://en.wikipedia.org/wiki/Power_failure).
* Lead acid batteries designed for starting automotive engines are not designed for deep discharge. They have a large number of thin plates designed for maximum surface area, and therefore maximum current output, but which can easily be damaged by deep discharge. Repeated deep discharges will result in capacity loss and ultimately in premature failure, as the [electrodes](http://en.wikipedia.org/wiki/Electrode) disintegrate due to [mechanical stresses](http://en.wikipedia.org/wiki/Mechanical_stress) that arise from cycling. A common misconception is that starting batteries should always be kept on float charge. In reality, this practice will encourage corrosion in the electrodes and result in premature failure. Starting batteries should be kept [open-circuit](http://en.wikipedia.org/wiki/Open-circuit) but charged regularly ,at least once every two weeks to prevent [sulfating](http://en.wikipedia.org/wiki/Sulfation).
* Specially designed deep-cycle cells are much less susceptible to degradation due to cycling, and are required for applications where the batteries are regularly discharged, such as [photovoltaic](http://en.wikipedia.org/wiki/Photovoltaic) systems, [electric vehicles](http://en.wikipedia.org/wiki/Electric_vehicle) ;[forklift](http://en.wikipedia.org/wiki/Forklift), [golf cart](http://en.wikipedia.org/wiki/Golf_cart), [electric cars](http://en.wikipedia.org/wiki/Electric_car) and other and [uninterruptible power supplies](http://en.wikipedia.org/wiki/Uninterruptible_power_supplies). These batteries have thicker plates that can deliver less peak current, but can withstand frequent discharging.
* The capacity of a lead-acid battery is not a fixed quantity but varies according to how quickly it is discharged. An empirical relationship exists between discharge rate and capacity, known as [Peukert's law](http://en.wikipedia.org/wiki/Peukert%27s_law).When a battery is charged or discharged, this initially affects only the reacting chemicals, which are at the interface between the electrodes and the electrolyte. With time, these chemicals at the interface, which we will call an "interface charge", spread by [diffusion](http://en.wikipedia.org/wiki/Diffusion) throughout the volume of the active material.
* Excessive charging of a lead-acid battery will cause emission of hydrogen and oxygen from each cell, as some of the water of the electrolyte is broken down by [electrolysis](http://en.wikipedia.org/wiki/Electrolysis). This process is known as "gassing"
* Currently attempts are being made to develop alternatives to the lead-acid battery (particularly for automotive use) because of concerns about the environmental consequences of improper disposal of old batteries and of lead [smelting](http://en.wikipedia.org/wiki/Smelting) operations.

**Nickel-cadmium Battery**

* The nickel-cadmium battery is a type of [rechargeable battery](http://en.wikipedia.org/wiki/Rechargeable_battery) using [nickel oxide hydroxide](http://en.wikipedia.org/wiki/Nickel_oxide_hydroxide) and metallic [cadmium](http://en.wikipedia.org/wiki/Cadmium) as [electrodes](http://en.wikipedia.org/wiki/Electrode).
* two types of NiCd batteries: sealed and vented
* Sealed NiCd cells may be used individually, or assembled into battery packs containing two or more cells. Small NiCd dry cells are used for portable [electronics](http://en.wikipedia.org/wiki/Electronics) and [toys](http://en.wikipedia.org/wiki/Toy), often using cells manufactured in the same sizes as [primary cells](http://en.wikipedia.org/wiki/Primary_cell). When NiCds are substituted for primary cells, the lower terminal voltage and smaller ampere hour capacity may reduce performance as compared to primary cells.
* Specialty NiCd batteries have a niche market in the area of cordless and wireless [telephones](http://en.wikipedia.org/wiki/Telephone), [emergency lighting](http://en.wikipedia.org/wiki/Emergency_light), model airplanes, as well as [power tools](http://en.wikipedia.org/wiki/Power_tool).
* Nickel-cadmium cells have a nominal cell potential of 1.2 [V](http://en.wikipedia.org/wiki/Volt)
* The batteries are more difficult to damage than other batteries, tolerating [deep discharge](http://en.wikipedia.org/wiki/Deep_discharge) for long periods. In fact, NiCd batteries in long-term storage are typically stored fully discharged commercially available and cheaper
* NiCd cells are available in the same general-purpose physical sizes as [alkaline batteries](http://en.wikipedia.org/wiki/Alkaline_batteries), from AAA through D, as well as several multi-cell sizes, including the equivalent of a 9 volt battery
* The maximum discharge rate for a NiCd battery varies by size. For a common [AA-size](http://en.wikipedia.org/wiki/AA_battery) cell, the maximum discharge rate is approximately 18 amps; for a [D size](http://en.wikipedia.org/wiki/D_battery) battery the discharge rate can be as high as 35 amps.
* NiCd batteries can charge at several different rates, depending on how the cell was manufactured. The [charge rate](http://en.wikipedia.org/w/index.php?title=Charge_rate&action=edit&redlink=1) is measured based on the percentage of the [amp-hour](http://en.wikipedia.org/wiki/Amp-hour) capacity the battery is fed as a [steady](http://en.wiktionary.org/wiki/steady) current over the duration of the charge. Regardless of the charge speed, more energy must be supplied to the battery than its actual capacity, to account for energy loss during charging, with faster charges being more efficient.
* NiCd batteries contain [cadmium](http://en.wikipedia.org/wiki/Cadmium), which is a [toxic](http://en.wikipedia.org/wiki/Toxic) [heavy metal](http://en.wikipedia.org/wiki/Heavy_metals) and therefore requires special care during battery disposal.

**Paper Battery**

* A paper battery is a [battery](http://en.wikipedia.org/wiki/Battery_%28electricity%29) engineered to use a paper-thin sheet of [cellulose](http://en.wikipedia.org/wiki/Cellulose) infused with aligned [carbon nanotubes](http://en.wikipedia.org/wiki/Carbon_nanotubes). nanotubes act as [electrodes](http://en.wikipedia.org/wiki/Electrodes); allowing the storage devices to conduct electricity
* Functions as both a lithium-ion battery and a [supercapacitor](http://en.wikipedia.org/wiki/Supercapacitor), can provide a long, steady power output comparable to a conventional battery, as well as a supercapacitor’s quick burst of high energy
* Integrates all of the battery components in a single structure, making it more energy efficient.
* Paper battery extreme flexibility; the sheets can be rolled, twisted, folded, or cut into numerous shapes with no loss of integrity or efficiency, or stacked, like printer paper (or a [Voltaic pile](http://en.wikipedia.org/wiki/Voltaic_pile)), to boost total output.
* Can be made in a variety of sizes, from [postage stamp](http://en.wikipedia.org/wiki/Postage_stamp) to [broadsheet](http://en.wikipedia.org/wiki/Broadsheet).
* The paper-like quality of the battery combined with the structure of the nanotubes embedded within gives them their light weight and low cost, making them attractive for portable electronics, [aircraft](http://en.wikipedia.org/wiki/Aircraft), [automobiles](http://en.wikipedia.org/wiki/Automobile), and toys
* Ability to use electrolytes in blood make them potentially useful for medical devices such as pacemakers & do not contain any toxic materials and can be [biodegradable](http://en.wikipedia.org/wiki/Biodegradable); a major drawback of chemical cells.

**Super Charge Ion Battery**

* A fast-charging battery
* designed to recharge to 90% capacity within 10 minutes.

**Atomic Battery**

* Atomic battery used to describe a device which uses the emissions from a [radioactive](http://en.wikipedia.org/wiki/Radioactive) [isotope](http://en.wikipedia.org/wiki/Isotope) to generate [electricity](http://en.wikipedia.org/wiki/Electricity).
* Have extremely long life and high energy density, and so are mainly used as power sources for equipment that must operate unattended for long periods of time, such as [spacecraft](http://en.wikipedia.org/wiki/Spacecraft) and automated scientific stations in remote parts of the world.
* Using the energy of [radioisotope](http://en.wikipedia.org/wiki/Radioisotope) decay to provide long-lived power, 10-20 years are being developed internationally.
* Conversion techniques can be grouped into two types: thermal and non-thermal
* The thermal converters, whose output power is a function of a temperature differential, include [thermoelectric](http://en.wikipedia.org/wiki/Thermoelectric) and [thermionic](http://en.wikipedia.org/wiki/Thermionic) generators.
* The non-thermal converters whose output power is not a function of a temperature difference
* A thermionic converter consists of a hot electrode which thermionically emits electrons over a space charge barrier to a cooler electrode, producing a useful power output. [Caesium](http://en.wikipedia.org/wiki/Caesium) vapor is used to optimize the electrode work functions and provide an ion supply (by surface contact ionization) to neutralize the electron space charge.
* Non-thermal converters extract a fraction of the [nuclear energy](http://en.wikipedia.org/wiki/Nuclear_energy) as it is being degraded into heat. Their outputs are not functions of temperature differences as are thermoelectric and thermionic converters. Non-thermal generators can be grouped into three classes.

**Daniell Cell**

* The Daniell cell also called the gravity cell or crowfoot cell was invented in 1836 by [John Frederic Daniell](http://en.wikipedia.org/wiki/John_Frederic_Daniell),
* Consists of a central [zinc](http://en.wikipedia.org/wiki/Zinc) [anode](http://en.wikipedia.org/wiki/Anode) dipping into a porous earthenware pot containing [zinc sulfate](http://en.wikipedia.org/wiki/Zinc_sulfate) solution
* The porous pot is, in turn, immersed in a solution of [copper sulfate](http://en.wikipedia.org/wiki/Copper_sulfate) contained in a [copper](http://en.wikipedia.org/wiki/Copper) can, which acts as the cell's [cathode](http://en.wikipedia.org/wiki/Cathode).
* The use of a porous barrier prevents the copper ions in the copper sulfate solution from reaching the zinc anode and undergoing [reduction](http://en.wikipedia.org/wiki/Redox).
* This would render the cell ineffective by bringing the battery to equilibrium without driving a current.

**Lemon Battery**

* A lemon battery is a device used in [experiments](http://en.wikipedia.org/wiki/Experiments) proposed in many science textbooks around the world.
* It is made by inserting two different [metallic](http://en.wikipedia.org/wiki/Metal) objects, for example a [galvanized](http://en.wikipedia.org/wiki/Galvanization) [nail](http://en.wikipedia.org/wiki/Nail_%28engineering%29) and a [copper](http://en.wikipedia.org/wiki/Copper) coin, into a [lemon](http://en.wikipedia.org/wiki/Lemon).
* The copper coin serves as the positive electrode or cathode and the galvanized nail as the negative electrode or anode.
* These two objects work as [electrodes](http://en.wikipedia.org/wiki/Electrode), causing an [electrochemical](http://en.wikipedia.org/wiki/Electrochemistry) reaction which generates a small [potential difference](http://en.wikipedia.org/wiki/Potential_difference).
* the energy for the battery does not come from the lemon or potato, but rather the energy comes from the metals.
* The metals are [oxidized](http://en.wikipedia.org/wiki/Oxidized), and the energy released provides the power.
* The lemon or potato not merely provides an environment where this can happen, and they are used up in the process, proof of it happens when there are several lemons in a serial connection of lemons.
* [Potatoes](http://en.wikipedia.org/wiki/Potato),[apples](http://en.wikipedia.org/wiki/Apple), or any other fruit or vegetable containing [acid](http://en.wikipedia.org/wiki/Acid) or other [electrolyte](http://en.wikipedia.org/wiki/Electrolyte) can be used, but lemons are preferred because of their higher acidity.

**Optoelectric Battery**

* An opto-electric nuclear battery is a device that converts [nuclear energy](http://en.wikipedia.org/wiki/Nuclear_energy) into [light](http://en.wikipedia.org/wiki/Light), which it then uses to generate [electrical energy](http://en.wikipedia.org/wiki/Electrical_energy). A [beta-emitter](http://en.wikipedia.org/wiki/Beta_particle) such as [technetium-99](http://en.wikipedia.org/wiki/Technetium) or [strontium-90](http://en.wikipedia.org/wiki/Strontium) is suspended in a [gas](http://en.wikipedia.org/wiki/Gas) or [liquid](http://en.wikipedia.org/wiki/Liquid) containing [luminescent](http://en.wikipedia.org/wiki/Radioluminescence) gas molecules of the [excimer](http://en.wikipedia.org/wiki/Excimer) type, constituting a "dust plasma."
* consist of an excimer of argon, xenon, or kryptonin a pressure vessel with an internal mirrored surface, finely-ground [radioisotope](http://en.wikipedia.org/wiki/Radioisotope), and an intermittent [ultrasonic](http://en.wikipedia.org/wiki/Ultrasonic) stirrer, illuminating a photocell with a [bandgap](http://en.wikipedia.org/wiki/Bandgap) tuned for the [excimer](http://en.wikipedia.org/wiki/Excimer).
* High price of the radionuclides.

**Printed Battery**

* Printed electronics is a set of printing methods used to create electrically functional devices.
* Paper has been often proposed to be used as substrate but due the rough surface and high humidity absorption other materials such as plastic, ceramics and silicon has been applied more widely.
* Several printing processes have been piloted and printing preferably utilizes common printing equipment in the graphics arts industry, such as [screen printing](http://en.wikipedia.org/wiki/Screen_printing), [flexography](http://en.wikipedia.org/wiki/Flexography), [gravure](http://en.wikipedia.org/wiki/Gravure), [offset lithography](http://en.wikipedia.org/wiki/Offset_lithography) and [inkjet](http://en.wikipedia.org/wiki/Inkjet).

**Water-activated Battery**

* A water-activated battery is a disposable [reserve battery](http://en.wikipedia.org/wiki/Reserve_battery) that does not contain an [electrolyte](http://en.wikipedia.org/wiki/Electrolyte) and hence produces no [voltage](http://en.wikipedia.org/wiki/Voltage) until it is soaked in [water](http://en.wikipedia.org/wiki/Water) for several minutes.
* Specifically designed to be more [environmentally friendly](http://en.wikipedia.org/wiki/Environmentally_friendly) due to an absence of [heavy metals](http://en.wikipedia.org/wiki/Heavy_metals).
* Most commonly in [radiosondes](http://en.wikipedia.org/wiki/Radiosonde) which cannot contain [heavy metals](http://en.wikipedia.org/wiki/Heavy_metals) because they regularly fall to the ground or [ocean](http://en.wikipedia.org/wiki/Ocean) surface and remain there indefinitely.

**AA Battery**

* An AA battery is a [dry cell](http://en.wikipedia.org/wiki/Dry_cell)-type [battery](http://en.wikipedia.org/wiki/Battery_%28electricity%29) commonly used in portable [electronic devices](http://en.wikipedia.org/wiki/Electronic_device).
* An AA battery measures 51 mm in length
* The capacity of rechargeable AA batteries varies with the technology used.

**Rechargeable Battery**

* A rechargeable battery is a group of one or more [*secondary cells*](http://en.wikipedia.org/wiki/Electrochemical_cell).
* Use [electrochemical](http://en.wikipedia.org/wiki/Electrochemistry) [reactions](http://en.wikipedia.org/wiki/Chemical_reaction) that are electrically reversible.
* Come in many different sizes and use different combinations of chemicals.
* Can offer economic and environmental benefits compared to disposable batteries.
* rechargeable battery types are available in the same [sizes](http://en.wikipedia.org/wiki/List_of_battery_sizes) as disposable types

**Starter Battery**

* car battery is a type of [rechargeable battery](http://en.wikipedia.org/wiki/Rechargeable_battery) that supplies electric energy to an [automobile](http://en.wikipedia.org/wiki/Automobile)
* To power the [starter motor](http://en.wikipedia.org/wiki/Starter_motor), the lights, and the [ignition system](http://en.wikipedia.org/wiki/Ignition_system) of a vehicle’s [engine](http://en.wikipedia.org/wiki/Internal_combustion_engine).
* Describe a [traction battery](http://en.wikipedia.org/wiki/Traction_battery) used for the main power source of an [electric vehicle](http://en.wikipedia.org/wiki/Electric_vehicle).