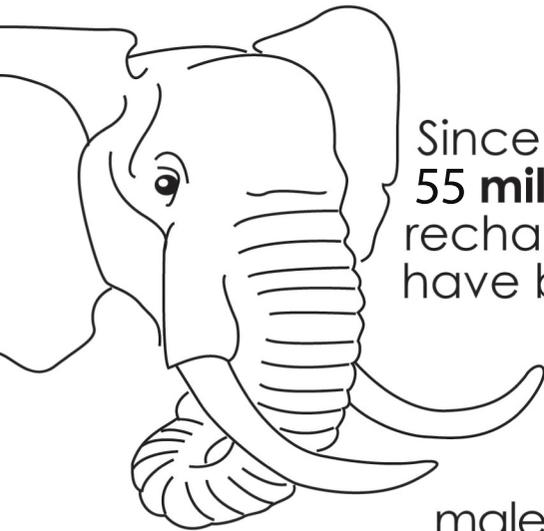


call2recycle®

Educational Booklet

What is Recycling?

To use again, especially to reprocess. Instead of throwing something away, recycling is the process of breaking it down and reusing its parts to make something new.



Since 1996, more than **55 million** pounds of rechargeable batteries have been recycled.

That's about the weight of

4,500

male African elephants

Rechargeable batteries can be recharged up to **1,000 times** and last between 2-5 years. Most cell phones are **retired or replaced** after only 18-24 months.

Why should you **recycle** your **cell phones** and **rechargeable batteries**?

It's good for the environment and when you recycle your cell phones, you can help Boys & Girls Clubs of America.



What can be recycled through the **Call2Recycle** program?

Cell phones and the **rechargeable batteries** found in cordless electronic products such as remote control toys, cordless toothbrushes, power tools, cordless and cell phones, laptop computers, camcorders, and digital cameras.



Americans use an average of

6

cordless products a day

What products are used at your house?

You can help our environment!

Ask your parents to check the portable electronic products in your house. If the rechargeable batteries can no longer hold a proper charge or if there is an old cell phone that no one is using anymore, you can recycle them. Visit the web site at

www.call2recycle.org

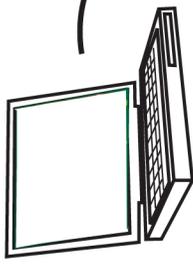
or call toll free

1-877-2-RECYCLE

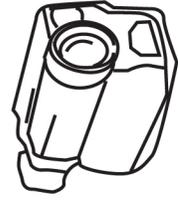
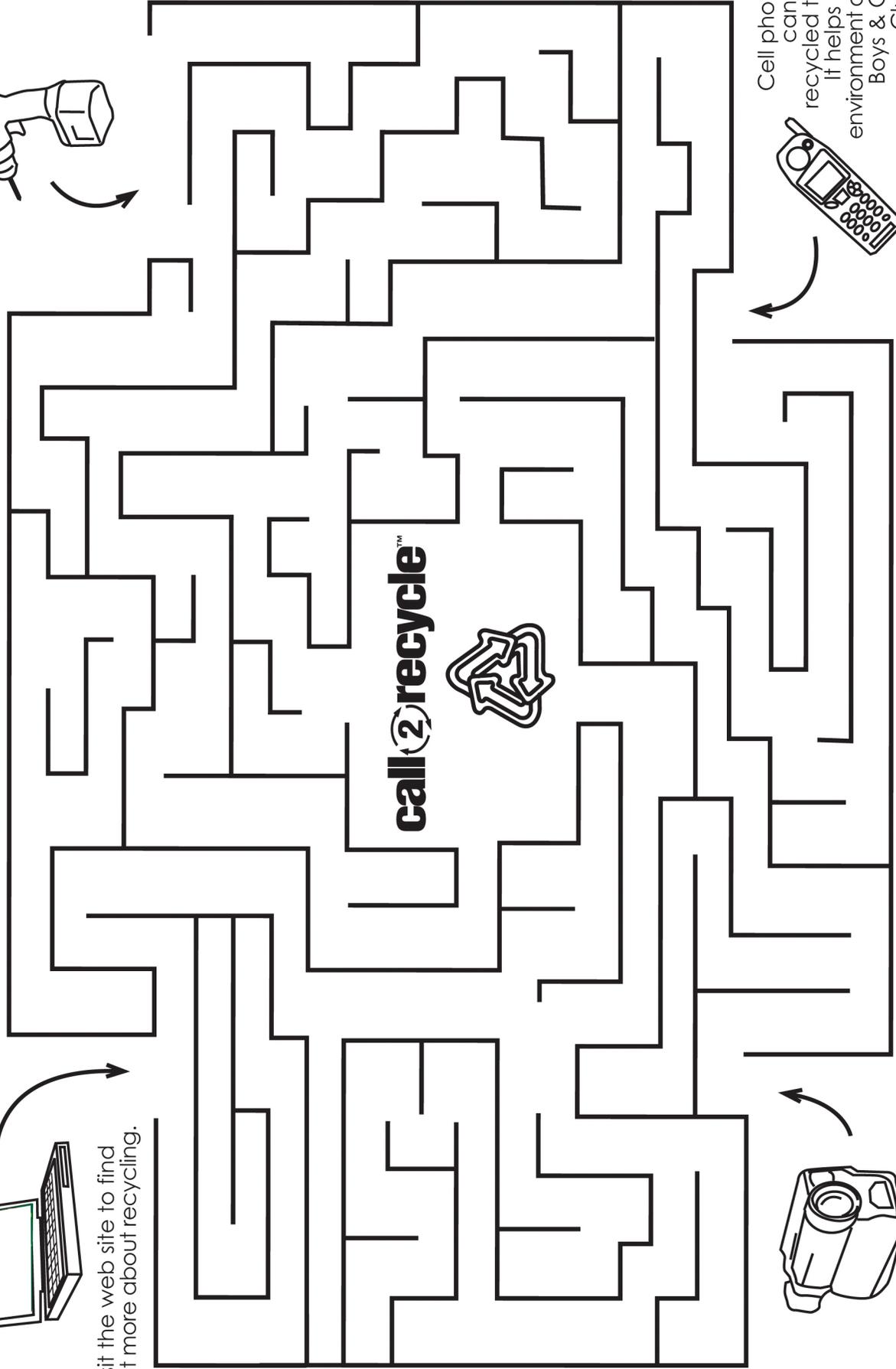
to find a participating drop-off location near you.

Help the rechargeable batteries and cell phones find their way to recycling.

The rechargeable batteries from these cordless electronic products can and should be recycled.



Visit the web site to find out more about recycling.



Cell phones can be recycled too. It helps the environment and Boys & Girls Clubs.



It's Easy!
It's Green!
to be

RecycleTM



Timeline of Electricity and Batteries

600 B.C. The Greek philosopher and scientist, Thales of Miletus - one of the Seven Wise Men of Greece - depicted the ability of picking up a sheet of paper or small straw with an amber rod made of fossilized resin that had been rubbed with a cloth - a form of static electricity.

1600 The basics of electricity are established by English physician and physicist, William Gilbert, the "Father of Electricity," and printed in a thesis entitled *De Magnete*.

1745 Ewald von Kleist developed the Leyden Jar.

1746 Pieter van Musschenbroek, Dutch mathematician and physicist, perfected the principle of the Leyden Jar, called the first capacitor, for the storage of electric charge.

1746 Benjamin Franklin experimented with the study of electricity, which led to the development of a practical condenser or capacitor for storage of static electricity.

1752 Franklin used the kite experiment to identify lightning as electricity after having experimented with electricity for several years. He later developed the Conventional Current Theory which assumes that electricity fluidly flows from plus to minus. Actually, electricity stored in a battery flows from negative to positive.

1784 French physicist, Charles Augustin de Coulomb demonstrated Coulomb's Law in which he showed the relationship of the forces between electric charges and that the electrical charge is on the surface of the conductor.

1791 Italian physician and physicist, Luigi Galvani, incorrectly believed that electricity was present in animals, a theory later corrected by Volta.

1799 - 1800 Count Alessandro Volta, an Italian engineer and physicist and a pioneer in electricity, invents the Voltaic cell, the first "wet primary battery" that could produce electricity through chemical action. The volt is named in his honor.

1802 Johann Ritter, a German physicist, discovered the possibility of a rechargeable battery.

1826 Georg Ohm discovered what is now known as Ohm's Law - the fundamental relationship of electricity.

1831 Michael Faraday from England, an English physicist and chemist, formed what is known as Faraday's Law, the foundation of the scientific study of electricity.

1836 Fellow English physicist and chemist, John Frederic Daniell, invented Daniell's cell.

1840 William George Armstrong, an English inventor, built the hydroelectric machine, a steam water-powered generator which produced frictional electricity.

1859 Raymond Gaston Planté, a French physicist, invented the Lead Acid battery, the first practical secondary battery.

1866 Werner von Siemens of Germany, a member of a scientific family of electrical engineers and industrialists, made innovative improvements to the generator.

1868 Georges Leclanché, a French chemist, developed a primary cell called the Leclanché cell that had an electromotive force of approximately 1.5 volts.

1888 Gassner from Germany made improvements to the dry-cell battery.

1899 Waldmar Jungner from Sweden, invented the Nickel-Cadmium storage battery.

1901 Thomas Edison, American scientist, invented the Nickel-Alkali storage battery.

1932 The duo of Shlecht-Ackermann from Germany, invented the sintered electrode.

1947 Neumann of France achieved the first successful complete sealing of the Nickel-Cadmium battery.

1960-62 Commercial use of sealed Nickel-Cadmium cells in portable devices begun.

1977-78 Lithium primary cells are commercialized.

1978 Sealed-Lead Acid cells become commercially viable.

1983-84 Solar cells introduced commercially.

1989-90 Nickel Metal Hydride introduced as a substitute for Nickel-Cadmium batteries.

1991-92 Rechargeable Zinc-Air batteries introduced for computers.

1992-93 Rechargeable Alkaline cells available to the consumer. Rechargeable Lithium batteries become commercially viable.

1990-92 Carbon-Zinc and alkaline batteries no longer contain mercury.

1994 Reusable Alkaline batteries no longer contain mercury.

1996 *The Mercury-Containing and Rechargeable Battery Management Act* was signed on May 13th by President William Clinton. It established a system for collecting and recycling of Nickel-Cadmium batteries nationally; created a national labeling for these batteries; and phased out the use of mercury in nearly all batteries.

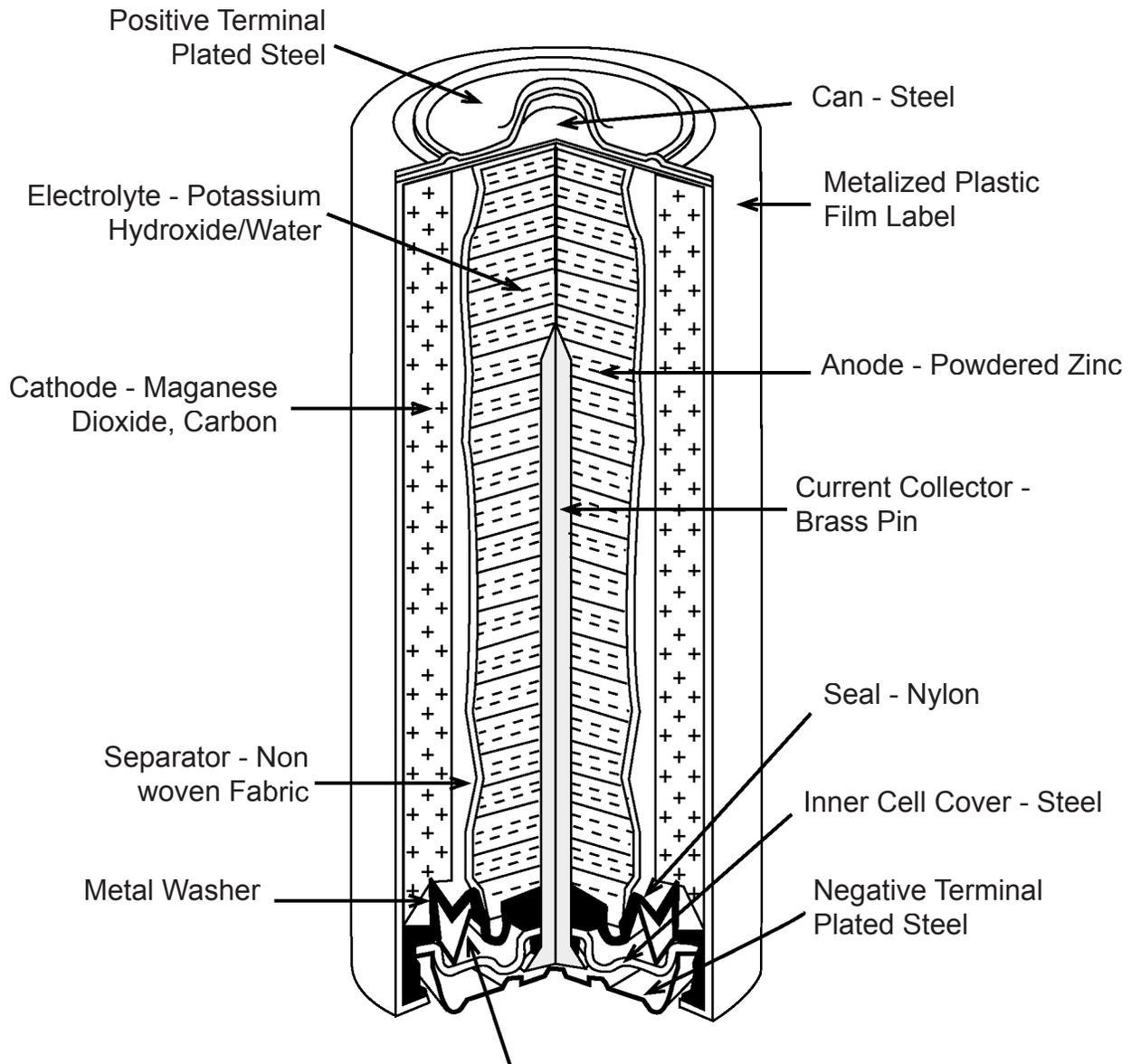
1996 RBRC's Ni-Cd battery recycling program launched in the U.S.

1997 RBRC's Ni-Cd battery recycling program launched in Canada.

2001 RBRC begins collection and recycling of all rechargeable battery chemistries.

Diagram of a Primary Cell Battery

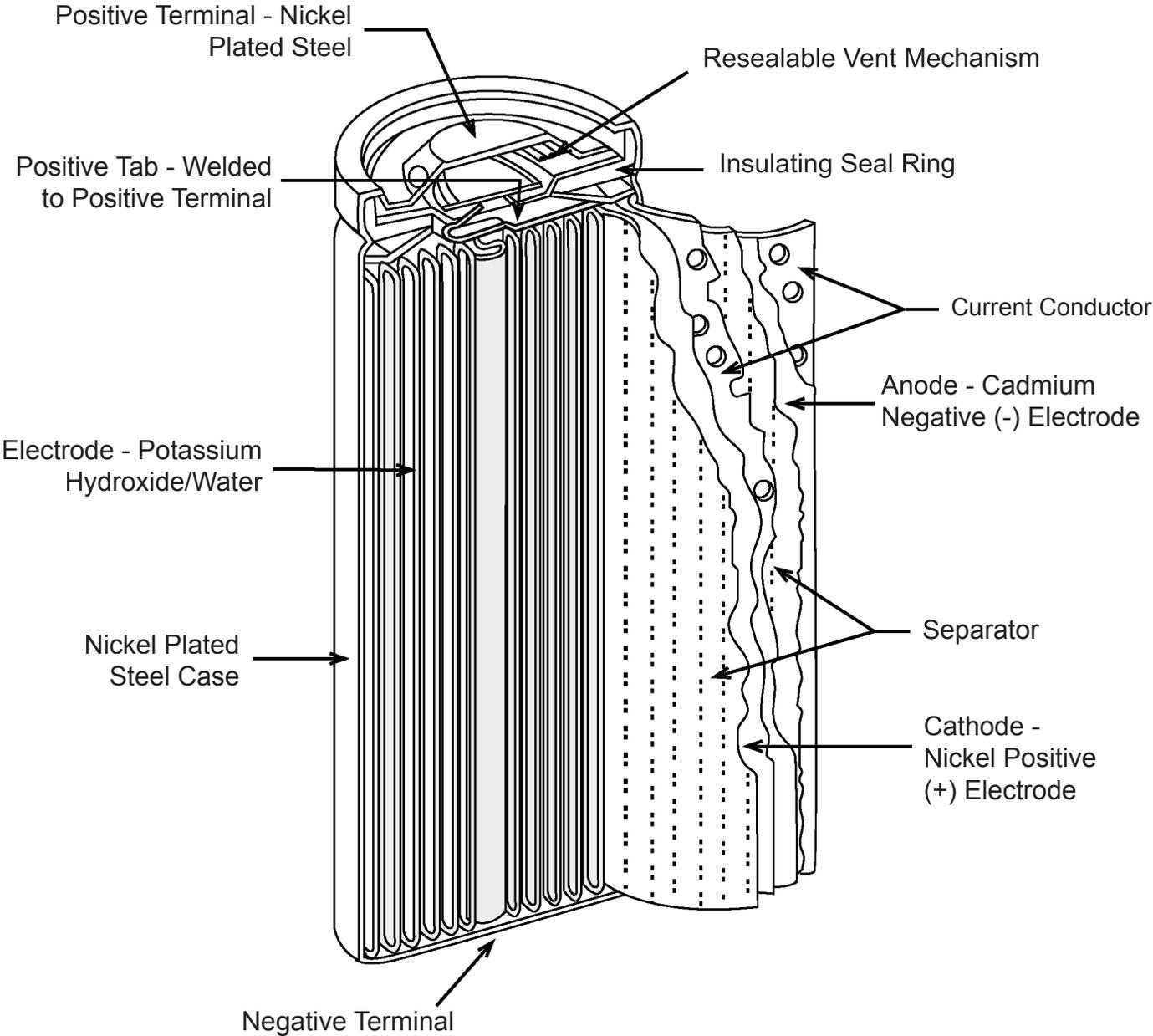
Cutaway View - Typical Alkaline Cell



Source: Energizer Power Systems.

Diagram of a Secondary Cell Battery

Cutaway View - Typical Nickel-Cadmium Cell



Source: Energizer Power Systems.

Battery Characteristics

Primary Batteries (non-rechargeable)

<p>Alkaline Manganese The most popular primary battery in the U.S.; has better performance than the carbon-zinc primary battery; costs more due to better performance. Batteries manufactured after May 13, 1996, contain no added mercury with the exception of button cell batteries which contain a minute quantity of mercury.</p>	Higher energy density, moderate discharge rate, and more expensive than carbon zinc	Check with your local authority	Potassium Hydroxide	Zinc, Manganese Dioxide	Radios, smoke detectors, toys	1.5 V
<p>Carbon Zinc The cheapest primary battery; average performance; good storage life; numerous sizes and shapes available. No mercury is contained in these batteries.</p>	Low energy density, lowest cost	Check with your local authority	Ammonium Chloride, Zinc Chloride	Zinc, Carbon	Flashlights, toys, remote controls	1.5 V
<p>Lithium Light weight; high energy density; long storage life; expensive. Lithium has a great reactivity with water and air, and disposal requires special attention.</p>	High energy density, long shelf life, expensive	Check with your local authority;	Organic Solvents	Lithium and Manganese Dioxide or Polycarbon-monofluoride	Cameras, pagers, keyless locks	3.0 V
<p>Mercuric Oxide Primarily found in button cell batteries for electronics. This battery contains mercury. Federal legislation was enacted on May 13, 1996 that minimizes the amount of mercury contributed by batteries to municipal solid waste. No consumer recycling program (similar to RBRC's) has been established.</p>	Button cells cannot be sold in U.S.	Check with your local authority; special handling required	Potassium Hydroxide	Zinc, Mercuric Oxide	Specialized medical, military, emergency response equipment	1.35 V
<p>Silver Primarily found in button cell batteries; high energy density; moderately expensive; safe.</p>	High energy density, low discharge rate, expensive	Check with your local authority	Potassium Hydroxide	Zinc, Silver Oxide	Watches, calculators, hearing aids	1.55 V
<p>Zinc Air Specialty battery; light weight; good performance; inexpensive; safe.</p>	High energy density, low discharge rate, inexpensive	Check with your local authority	Potassium Hydroxide	Zinc, Carbon	Hearing aids, pagers	1.4 V

Battery Characteristics

Secondary Batteries (rechargeable)

<p>Nickel-Cadmium (Ni-Cd) Popular rechargeable battery; good performance; can be recharged up to 1,000 times; least expensive of the secondary batteries. This battery contains cadmium which is toxic, therefore it is important to recycle these batteries.</p>	Rapid discharge, moderate energy density, relatively inexpensive	Recycle through RBRC program	Potassium Hydroxide	Nickel, Cadmium	Power tools, cordless telephones, professional radios	1.2 V
<p>Nickel Metal Hydride (Ni-MH) Cadmium-free replacement for Ni-Cd; more expensive; good performance; can be recharged up to 1,000 times.</p>	Moderate discharge rate, high energy density, relatively expensive	Recycle through RBRC program	Potassium Hydroxide	Nickel, various rare earth metals	Computers, cell phones, camcorders, power tools	1.2 V
<p>Lithium-ion (Li-ion) Newest rechargeable technology; light weight, excellent performance.</p>	High energy density, moderate discharge rate, expensive	Recycle through RBRC program	Organic Solvent	Graphite, Lithium, Cobalt Oxide	Computers, cell phones	3.0 V
<p>Lead-Acid (Pb) These batteries are the main source of power for cars, trucks, boats, motorcycles, tractors, etc. Because lead is a toxic material, it is important to recycle these batteries. Lead batteries are being recycled at a rate exceeding 90 percent. The active ingredient of lead and sulfuric acid can be very toxic if improperly disposed.</p>	High discharge rate, moderate energy density, inexpensive	Recycle through RBRC program	Sulfuric Acid	Lead	Emergency power, automobiles	2.0 V
<p>Rechargeable Alkaline Moderate performance; can be recharged only a few times; requires special charger; costs less than Ni-Cd.</p>	Moderate discharge rate, more expensive than primary alkaline	Check with your local authority. Does not have to be recycled.	Potassium Hydroxide	Zinc, Manganese Dioxide	Radios, toys, portable CD players	1.2 - 1.75 V

Battery Tips

✓ You Can

- 1 Use rechargeable batteries whenever possible and then recycle them when they can no longer hold a charge.
- 2 Recycle your button batteries. Check with your community's solid waste program to determine where.
- 3 Remove your batteries from equipment that will be stored for any length of time because the battery terminals may leak, corrode and ruin the equipment.
- 4 Clean the contact surfaces when installing your batteries so power will not be wasted.
- 5 Purchase batteries as you need them since they do have a limited shelf life.
- 6 Remove the button batteries in disposable toys, watches, and calculators and recycle them before disposing of the item.
- 7 Follow the charging guidelines provided by the manufacturer. Depending on the individual product, there are specific initial battery charging times (usually overnight) before using the product for the first time. This will enable you to obtain maximum battery capacity.
- 8 Let your battery cool to room temperature before recharging. The charge efficiency of most batteries is greatly reduced at elevated temperatures.
- 9 Recharge batteries when they are near to fully discharged. You can tell that a battery is discharged by a sharp drop in power or speed.
- 10 Recycle your used rechargeable batteries when they can no longer hold a charge.

✗ You Should Not

- 1 Mix old batteries with new ones because this will shorten the life of the new battery.
- 2 Place batteries or equipment with battery included where it will overheat since the heat will speed up the chemical reaction and shorten the battery's life.
- 3 Recharge a battery unless it is actually a rechargeable battery.
- 4 Mix batteries with other objects such as metal keys or change since this can short circuit the battery, causing heat and sparks.
- 5 Mix different kinds of batteries in the same piece of equipment or use rechargeable batteries with common disposable batteries. It may ruin the equipment, shorten the life of the batteries, or cause an explosion.
- 6 Throw away items powered by batteries with the batteries still inside. Remove the batteries and dispose or recycle in the proper manner.
- 7 Take apart or tamper with the case of the battery.
- 8 Reverse the positive and negative terminals of the batteries when installing in equipment or in a recharger.
- 9 Dispose of a battery in a fire or immerse in water.
- 10 Leave the battery in the equipment after it has been fully discharged.

WORD SEARCH



Find the words below in the word search.

Battery
Call2Recycle
Cell Phone
Environment
Rechargeable
Recycle



WORD SCRAMBLE

Unscramble the letters below to find out what types of cordless electronic products are powered by rechargeable batteries.

1. TOEMER ONTLORC RAC
(Hint: Race with this.)
2. EPROW LDILR
(Hint: You drill screws with this.)
3. DACREMROC
(Hint: Record family memories with this.)
4. RELSCODS HEPON
(Hint: Talk to friends on this.)
5. KEWILA ALTIEK
(Hint: Policemen use this to radio for help.)
6. CERTICEL BOTHRUSHOT
(Hint: Clean your teeth with one of these.)

Answers

1) Remote Control Car; 2) Power Drill; 3) Camcorder; 4) Cordless Phone; 5) Walkie Talkie; 6) Electric Toothbrush

You can drop off your old cell phones and used rechargeable batteries at the following retail stores:



For other drop off locations in your area, or to find more information on Call2Recycle, visit www.call2recycle.org or call 1-877-2-RECYCLE.



This activity booklet has been created and supplied by the Rechargeable Battery Recycling Corporation (RBRC). RBRC is a non-profit organization dedicated to the recycling of used rechargeable batteries and old cell phones.