

# LESSON PLAN



## Which type of battery is the best?

**Grade Level:** Middle school and High school

**Lesson Overview:** Students will learn how to set up a circuit using a battery and the attributes of different types of batteries.

**TEKS:**

**Math:** 6.10 (A,D), 8.5 A, 8.12 C

**Science:** 6.1, 6.2, 6.3, 6.4(A), 7.1, 7.2, 7.3, 7.4, 8.1, 8.2, 8.3, 8.4(A), 8.5, IPC 1, 2, 6(D), Environmental Sciences 1, 2, 3(B), 5(C), Physics 1,2

**Social Studies:** 6.2, 7.20

**Time:** one hour

**Materials:** wire strippers, a string of holiday lights, wire connectors with alligator clips, battery holders, AA or AAA batteries of different brands and varieties

**Vocabulary:** alkaline, NiCad, insulator, connector, circuit

**Background:** The first batteries were developed by Alessandro Volta in about 1800. His battery was made of a series of silver and zinc disks separated with a sheet of pasteboard covered in salt water. The current was generated when the first silver disk connected with a wire to the last zinc disk.

Batteries come from the manufacturer with labels such as "heavy duty," "long lasting alkaline," and "environmentally friendly rechargeable." How are you supposed to know which ones to use?

Heavy Duty batteries cost the least upfront, but usually last only 30% as long as an alkaline battery. Alkaline batteries are more expensive, have longer lives. They can hold the full charge for years thus making them good for use in flashlights or smoke detectors. Rechargeable batteries are the most expensive to purchase initially, but only cost pennies to recharge and are more economical in the long run. These can be recharged hundreds of times. NiCad rechargeable batteries lose some of their charge each day and should not be used in things that are used infrequently. Alkaline rechargeable batteries can be used for anything a regular battery could be used for, but they only have half the life of a non-rechargeable alkaline battery.

## Setting the Stage:



**Activity One:** Cut the lights apart from a standard strand of holiday lights. Strip the insulation off the ends of each light. Use the wire connectors to make a complete circuit using the battery, battery holder, and holiday lights. Give each lab group a different brand of battery, making sure all groups have batteries of the same voltage and size. Start all circuits at the same time and leave on for 45 minutes. Record observations every 15 minutes. By the end of the time, some light bulbs will be dimmer than others and you will be able to see which batteries last the longest.

**Extension:** Replicate the experiment, but leave it set up over the entire class day. Have students record when each set begins to dim and when they go out. This can be done even if your students switch rooms, because each set of new students will record their observations on one lab sheet. Collect the data and place it on an overhead. Have each class graph the data.

## Discussion:

Which battery was the first to go dim during a one class period time frame?

Which battery was the first to go out? The last to go out?

What is the difference between a NiCad rechargeable battery and an alkaline rechargeable battery?

Which battery is the best battery for the environment?

Which type of battery would you use in a portable stereo? Explain your reasoning.

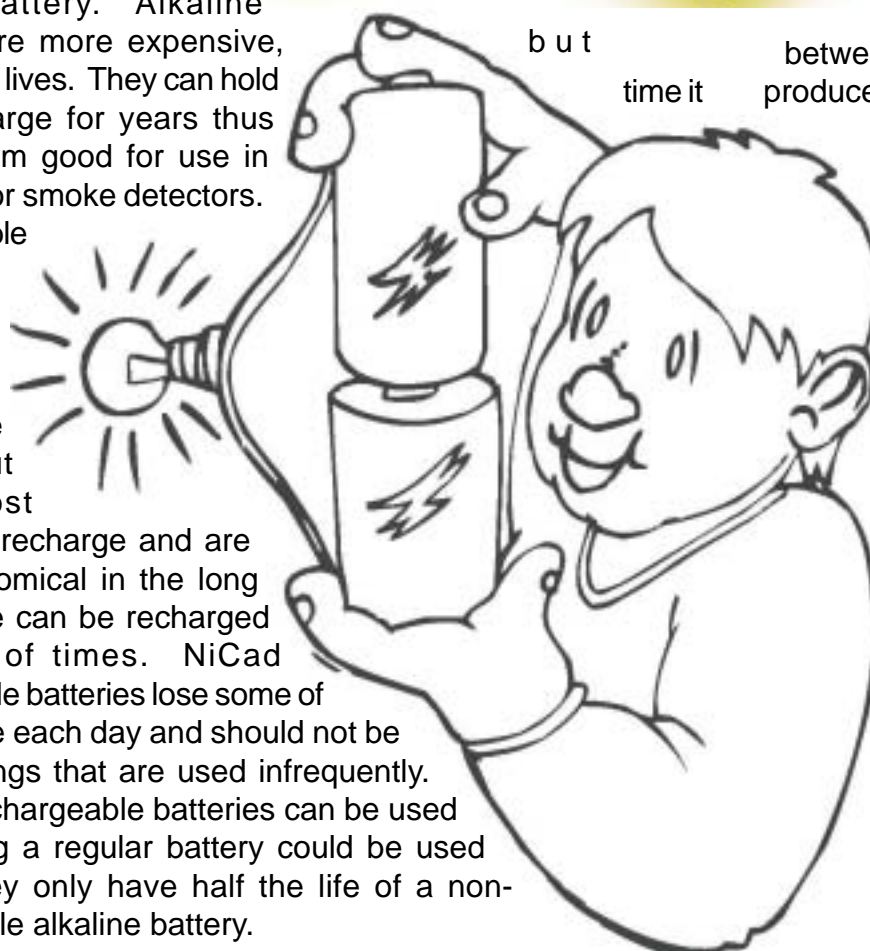
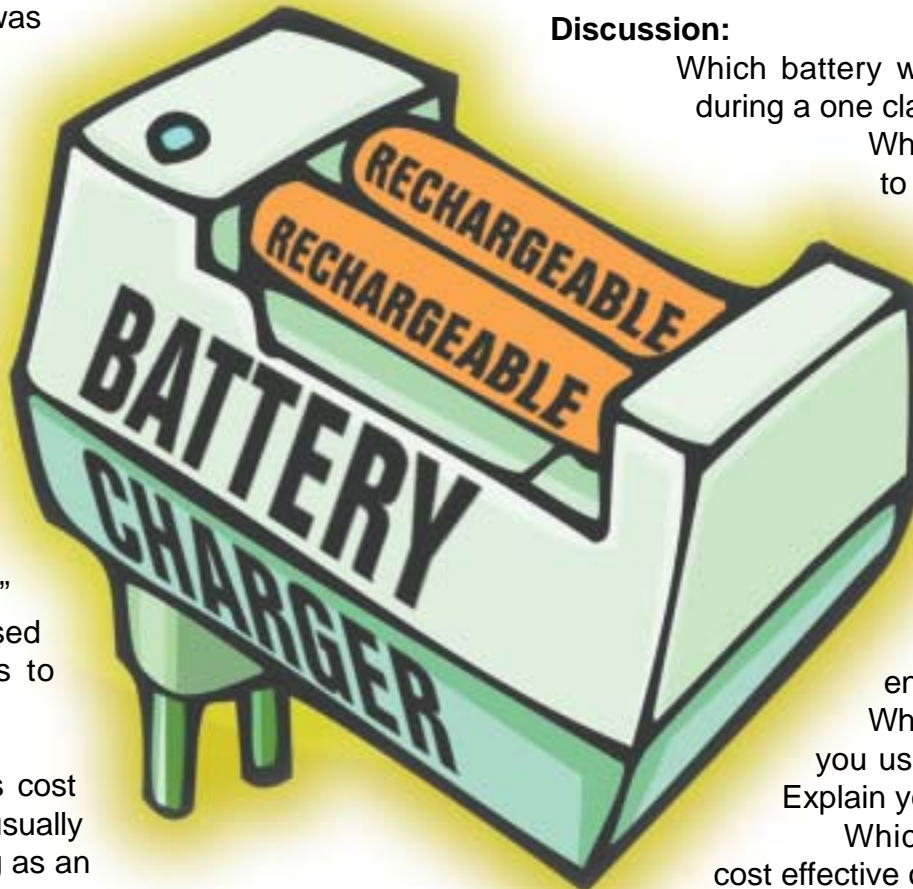
Which battery is the most cost effective or the "best deal"?

What connection would you make between cost of the battery and length of time it produced light?

Why is it important to not use NiCad batteries in a smoke detector?

## Resources:

- [www.Batterycouncil.org/batteries.html](http://www.Batterycouncil.org/batteries.html)
- [www.Chem1.com](http://www.Chem1.com)- an online chemistry book for upper level students
- <http://www.howstuffworks.com/battery.htm/printable>
- <http://www.energizer.com/learning/historyofbatteries.asp> a great history lesson
- [www.wattwatchers.org](http://www.wattwatchers.org)



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 "Currently, more than eight million people around the world die each year because they are too poor to stay alive. Every morning our newspapers could report, "More than 20,000 people perished yesterday of extreme poverty." (About 1.1 billion people are in extreme poverty — subsisting on \$1 or less per day.) Our generation can choose to end that extreme poverty by 2025. These are the economic possibilities of our time:  
 To meet the Millenium Development Goals by 2015  
 To end extreme poverty by 2025  
 To ensure well before 2025 that all of the world's poor countries can make reliable progress up the ladder of economic development  
 To accomplish all of this with modest financial help foro the rich countries, more than is now provided, but within the bounds of what they have long promised."

*The End of Poverty*, 2005, Dr. Jeffrey Sachs. [www.earthinstitute.columbia.edu/](http://www.earthinstitute.columbia.edu/)

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