# Introductory Unit on Electricity

For: Lafayette Elementary 2nd Grade
Mrs. Barranco

By: Jon D. Wilson, NMGK-12 Fellow

# Concepts Covered

- Electricity basics
  - electricity vocabulary
  - sources of electricity
- Circuits
  - basic definition
  - series and parallel
  - break in the circuit

# Concepts Covered

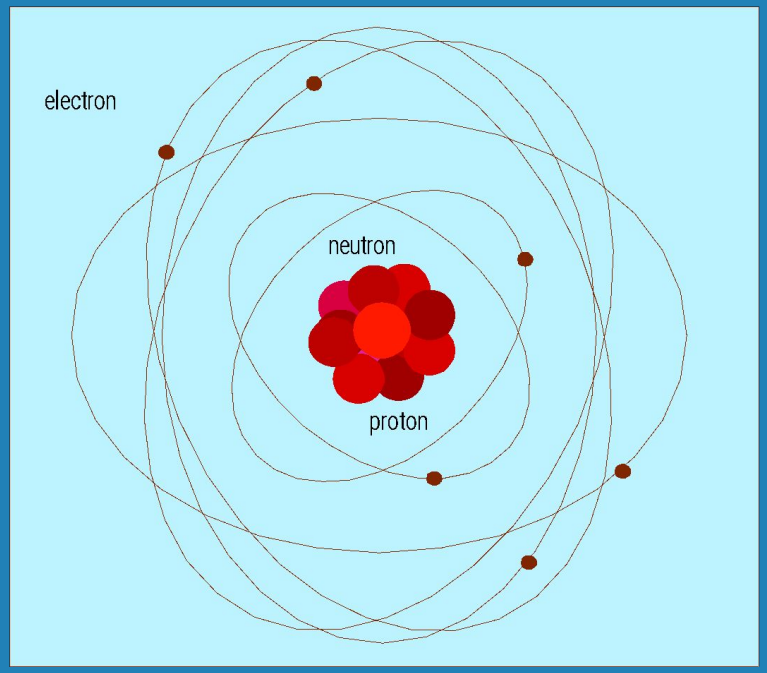
- Power Grid
  - basic parts of the power grid
  - definition of the parts
- Electricity and Solar Energy Fun
  - electricity kit for playing with circuits (inquiry)
  - solar power kits and car (how it works)

# Electricity – Part I

An Introduction

# What is Electricity?

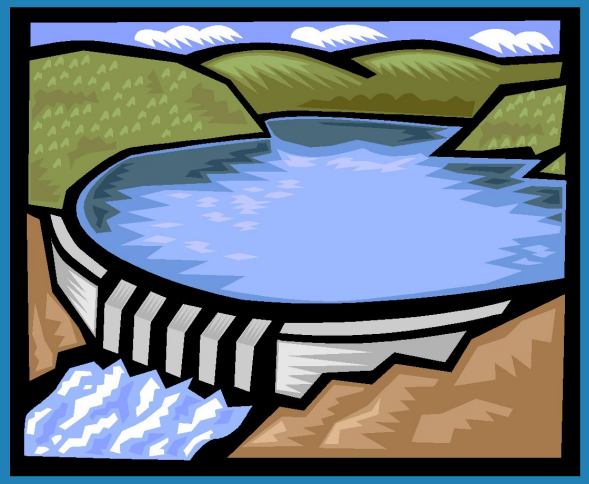
- Electricity is generated from the motion of tiny charged atomic particles called electrons and protons!
- Protons = +
- Electrons = -

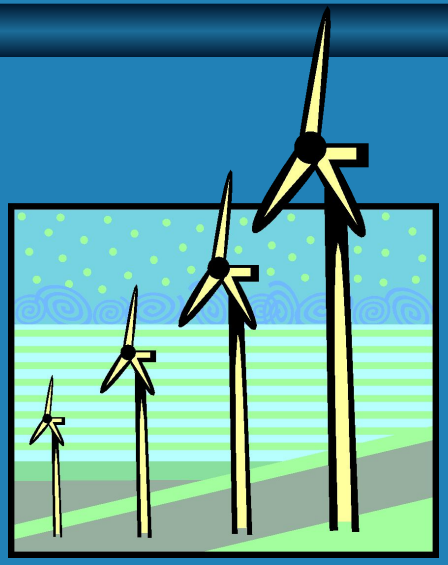


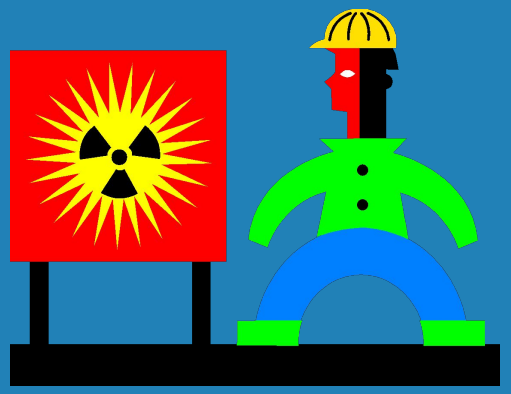
# Types of Sources used to make Electricity

- Thermal
- Geothermal
- Nuclear
- Hydroelectric
- Solar
- Wind

# Pictures of each Source



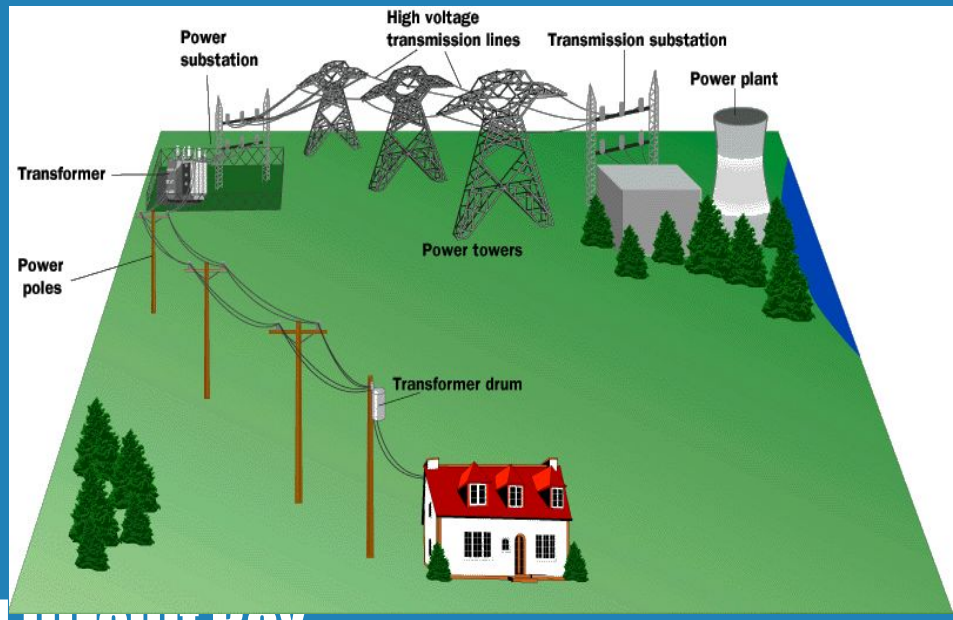




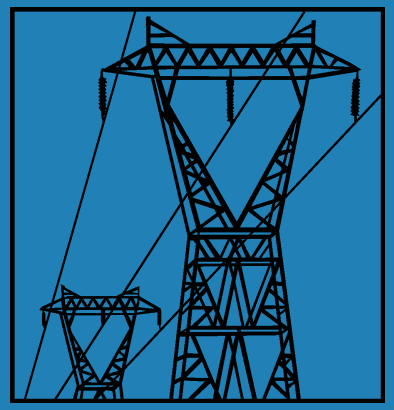
# How do we get Electricity?

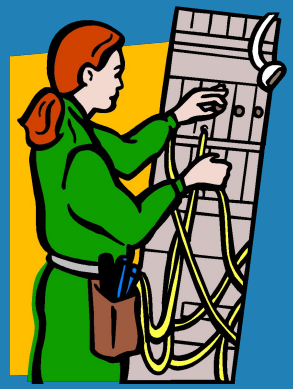
- Energy from one of the sources is converted by machines at the power plant to Electricity and then put onto the Electric Power Grid

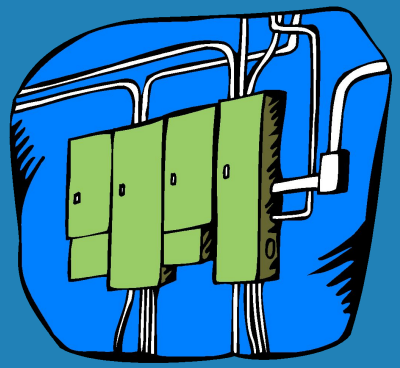
- Electric Power Grid
  - Power Plants
  - Transmission Lines
  - Substations
  - Power Lines
  - Transformers
  - Electrical Wiring and Circuit Box



# Pictures of each piece of the Power Grid!







# Your Electric Vocabulary

- Circuit
- Transformer
- Series Circuit
- Parallel Circuit
- Insulator
- Conductor
- Proton
- Electron

# Life without Electricity---!!!

- How would you prepare your lunch?
- How would you wash clothes?
- When would you go to bed?

- Think about all the luxuries the discovery of Electricity has brought us!
  - No Television
  - No Radio
  - No Lights

# Inventors and Inventions

- 1752 – Lightning Rod
  - Ben Franklin
- 1800 – Electric Battery
  - Count Alessandro Volta
- 1805 – Refrigerator
  - Oliver Evans
- 1876 – Telephone
  - Alexander Graham Bell
- 1879 – Light Bulb
  - Thomas Edison
- 1888 – AC Power
  - Nikola Tesla
- 1910 – Flashlight
  - Conrad Hubert
- 1920 – Traffic Light
  - Garrett Morgan

# More Inventors and Inventions

- 1927 – Television
  - Philo T. Farnsworth
- 1945 – Computer
  - Mauchley and Presper
- 1954 – Microwave
  - Percy Spencer

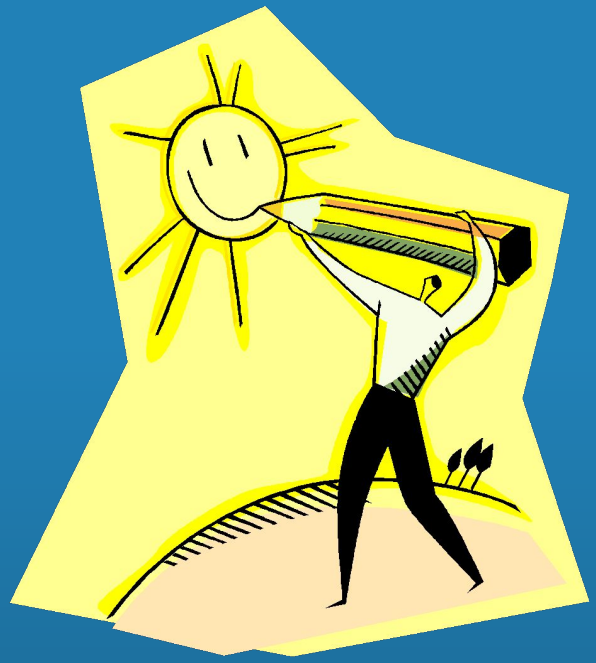
1973 – Internet
Vinton Cerf

1991 - WWW
Tim Berners-Lee

1955 – TV Remote
Eugene Polley

# Electricity – Part II

Fun Fun Fun with Activities....



# Station # 1 - Magnets

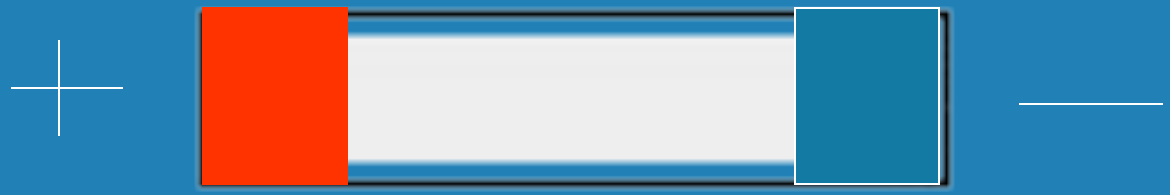
- ***Materials:***
  - 1 set of double-sided magnets
  - 1 set of bar magnets (if possible)
  - small cup of metal shavings (if possible)

# Station # 1 - Follow Directions

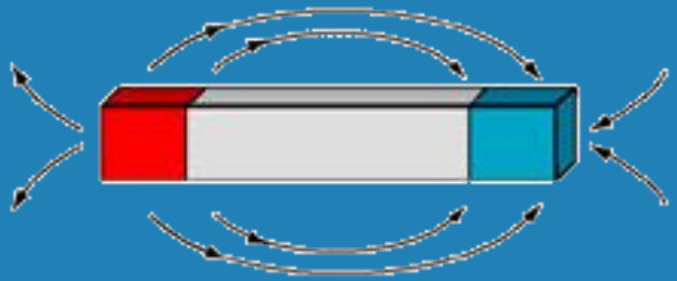
- First, rub the balloon on your head and describe what it does when you bring it near your hair (It is best to let the group member with the longest hair do this). Answer: It makes the hair stand on end.
- If the balloon is positively charged (+), then which charge is in your hair? Answer: negatively charged because they attract.
- If you rub the balloon on your head for 5 seconds (have a group member time you), how many pieces of paper can you pick up? If you rub the balloon on your head for 10 seconds, can more pieces of paper be picked up? Answer: More pieces get picked up because there is more charge.
- What do you think...? Can this balloon be used to make a light bulb light up? Answer: Yes, but it will only light up for a split second.

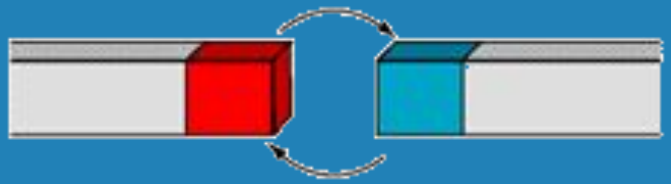

# Station # 1 - Diagram

- **Simple Bar Magnet**



- **Results**





Opposite ends “Attract”

Like ends “Repel”

# Station # 2 - Static Electricity

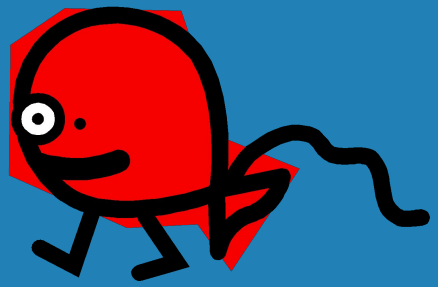
- ***Materials:***
  - 1 balloon
  - 10 small pieces of paper
  - 1 light bulb

# Station # 2 - Follow Directions

- Place the magnets together. Then turn one of them over on its other side and see what happens when you bring the magnets close together.
- Describe what you see and why what you see happens? Answer: The magnets will stick to each other when you have their opposite charged sides facing each other, and they will repel each other when the sides with like charges are facing each other.

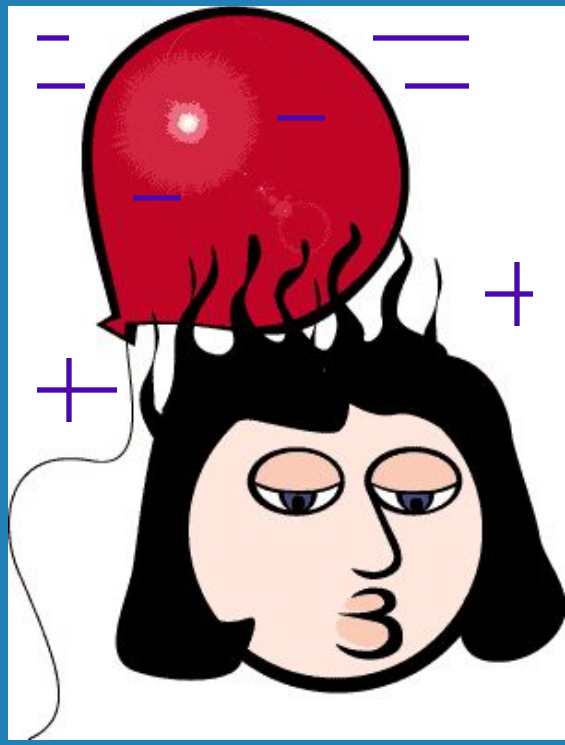
# Station # 2 - Diagram

- **Static Electricity**



After rubbing both of these items, they now have a CHARGE!

Like charges attract



# Station # 3 - Insulators and Conductors

- ***Materials:***
  - 1 Circuit with a 9-volt battery
  - 1 pencil and piece of paper
  - 1 nail
  - 1 match stick
  - 1 paper clip
  - 1 penny
  - 1 eraser

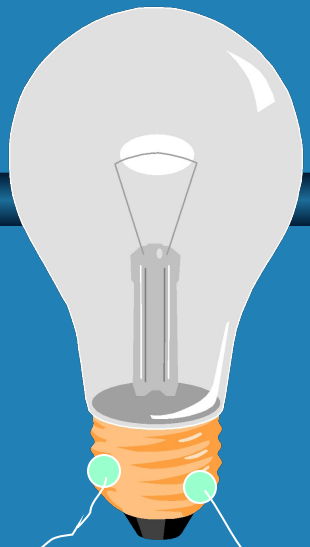
# Station # 3 - Follow Directions

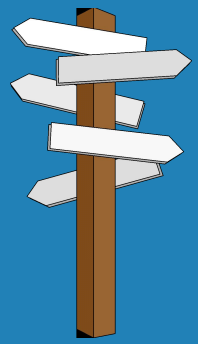
- Before putting each item into the circuit, list which ones you think will be conductors and which will be insulators? **Answer: the nail, the paper clip, and the penny are all conductors.**

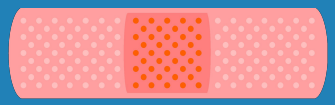
- Place each item into the circuit and see what happens ***(Conductors will keep the light working while insulators will not allow electricity to pass and light up the light bulb).***

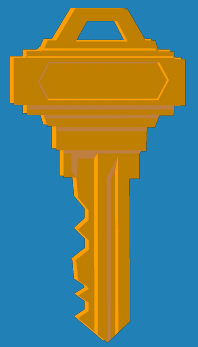
# Station # 3 - Diagram

- Insulators and Conductors







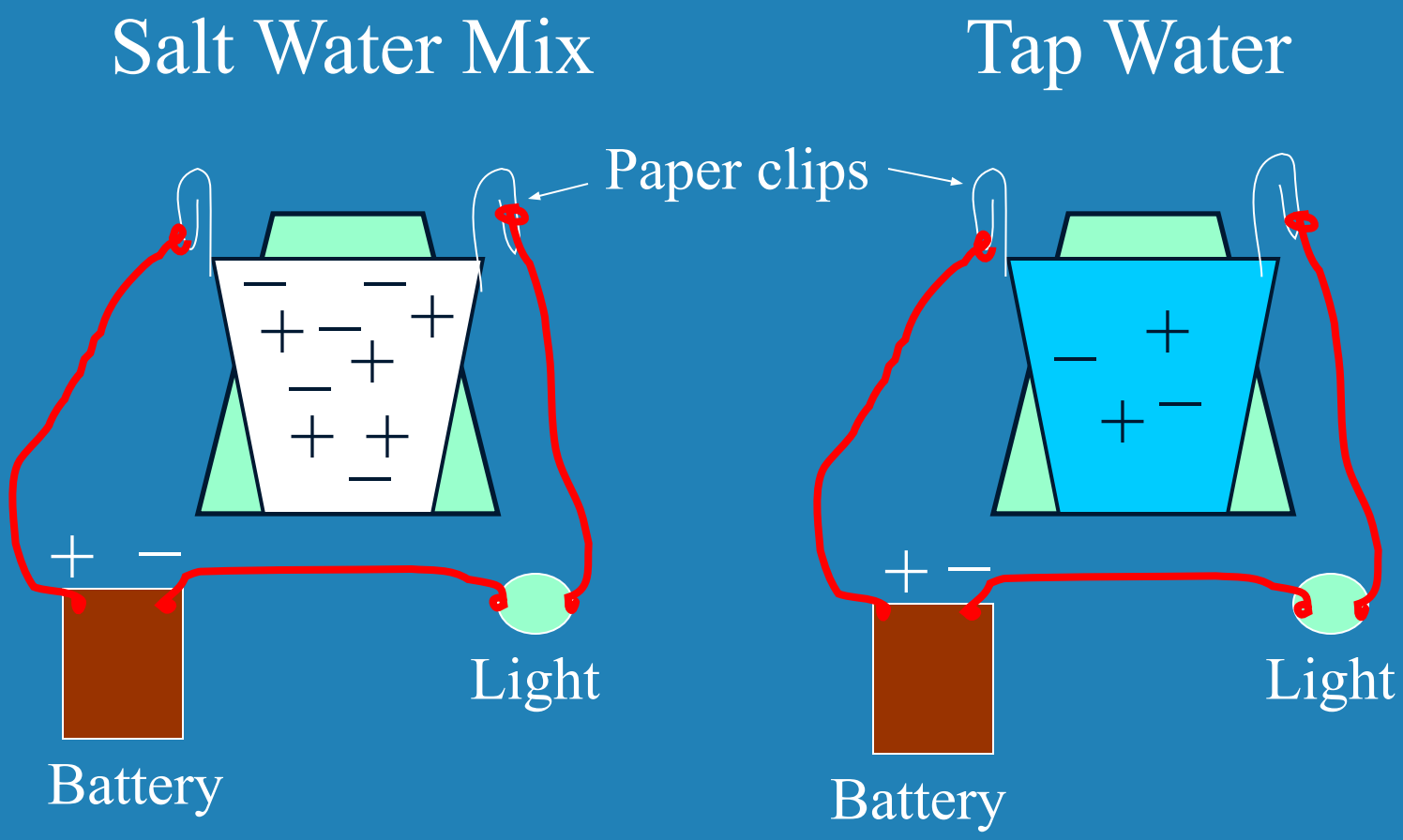
# Station # 4 - Circuit Trivia

- ***Materials:***
  - 1 pre-made circuit (with wires and battery)
  - two styrophone cups
  - 4 paper clips
  - one cup of salt water
  - one cup of regular tap water

# Station # 4 - Follow Directions

- This is a circuit like the one at Station #3. Instead of using one of the items like a paper clip or an eraser, a cup of both fresh water and salt water is used. Do you think both of them will allow the light to keep working or just one? Answer: Both cups of water conduct electricity, but salt water has more floating charges called "ions." The light will be brighter when hooked up to this cup.
- Explain what you think? Answer: ???????

# Station # 4 - Diagram



# Electricity – Part III

- Electricity costs money!
- Safety tips!
- Guest speaker tells all!

| | | | |
|---|---|---|---|
| NAME | JOHN SMITH | ACCOUNT NO. | 001-00001-96 |
| SERVICE LOCATION | 1234 S. 5th | CUSTOMER NO. | 00001-0 |
| TYPE OF SERVICE | RESIDENTIAL | SERVICE FROM | 01/03/99 TO 02/03/99 |

| METER NUMBER | METER READING PRESENT | METER READING PREVIOUS | METER MULTIPLIER | KILOWATT HOURS USED (KWH) | KW DEMAND | BILLING AMOUNTS |
|---|---|---|---|---|---|---|
| 00001 | 8900 | 7000 | 1 | 1900 | | 91.12 |

CURRENT BILLING DETAIL - RATE 100
ENERGY 300 KWH @ .07170/KWH
900 KWH @ .04880/KWH
700 KWH @ .03670/KWH

CURRENT BILLING IS DUE BY 01/31/97

| | |
|---|---|
| CURRENT BILLING | 91.12 |
| PREVIOUS BALANCE | 86.29 |
| PAYMENTS | 86.29CR |
| ADJUSTMENTS | .00 |
| PAST DUE AMOUNT | .00 |
| TOTAL AMOUNT DUE | 91.12 |

PLEASE PAY THIS AMOUNT

| COMPARISON INFORMATION | | | |
|---|---|---|---|
| DAYS IN BILLING PERIOS | KWH BILLED | KWH PER DAY THIS BILLING | SAME PERIOD LAST YEAR |
| 31 | 1900 | 62 | 68 |

*MORE INFORMATION ON REVERSE SIDE*

***KEEP THIS PORTION***

*1½% per month interest will be charged on balance forward.*

***Central Lincoln People's Utility District***

# How you can save electricity and money?

- Light bulb - 0.3 to 0.5 cents  per hour
- Color TV – 0.8 cents per hour
- Computer – 1.5 cents per hour
- Average Shower – 15 cents per shower
- Freezer – 3.7 cents per hour
- Stereo – 2.5 cents per hour
- Water Heater – 22.5 cents per hour

# Always play it safe!


- Safety rules
  - 1 – Never climb trees near power lines
  - 2 – Never go around downed power lines or substations
  - 3 – Never use electrical appliances near the bathtub
  - 4 – Stay away from all electrical equipment (meters, transformers, etc.)
  - 5 – Do not swim or play outside on a stormy day
  - 6 – Never put fingers or other objects near electrical outlets
  - 7 – Obey all safety signs
  - 8 – Never use appliances with cords showing bare wire

# Safety in a storm!

- Stay away from tall objects such as trees
- Stay out of open fields or areas where ***YOU*** are the tallest thing
- If your hair stands on end, crouch low to the ground with as little of your body in contact with the ground as possible

# Electricity Trivia

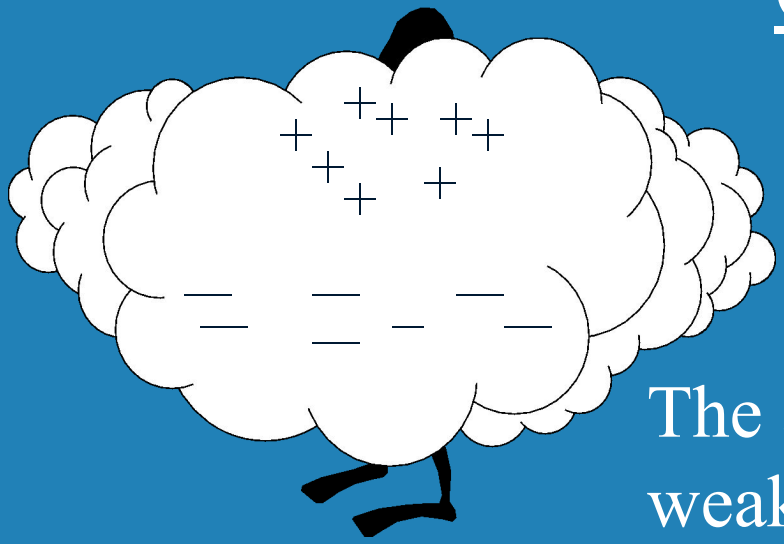
- How does a bird stand on a power line and not get shocked?

- How does lightning work?

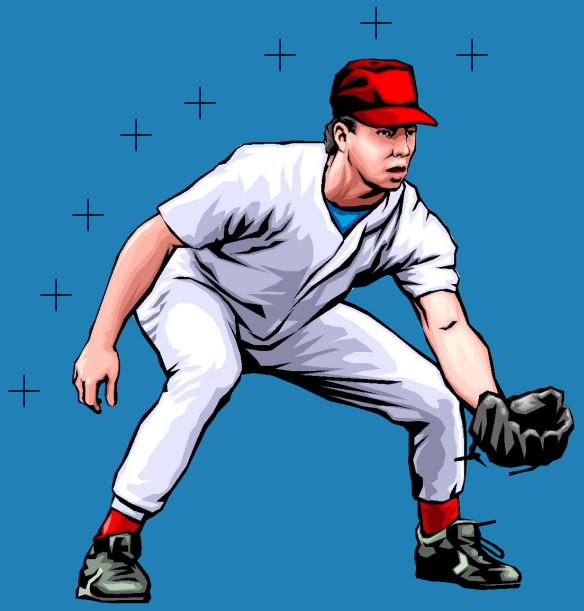
# Lightning and how to be safe

## Clouds move in…

***Thunder travels 1 mile***
***In 4.5 seconds***



The air gets weaker and heats up!



***Lightning travels***
***At 186,000 miles per second***

## The ground….

# Guest Speaker: Mr. Roy Dean Williams

- North East Mississippi Electric Power Association provides power to residents living in the Lafayette County area
- Main topic:  Safety around electricity
- His job requires him to understand how electricity works and how to play it safe around electricity
- Electricity tour around Lafayette Elementary

# Electricity – Part IV

## **This part should be used to challenge 2nd and 3rd graders!

- Exploration of Solar Power
- Experimenting with the Electric Box
- Putting it all together……DESIGNING!!!

# Exploring Solar Power

**1.** The goal of the exploring process is to lead the students up to the challenge of designing their own solar racer as a class.

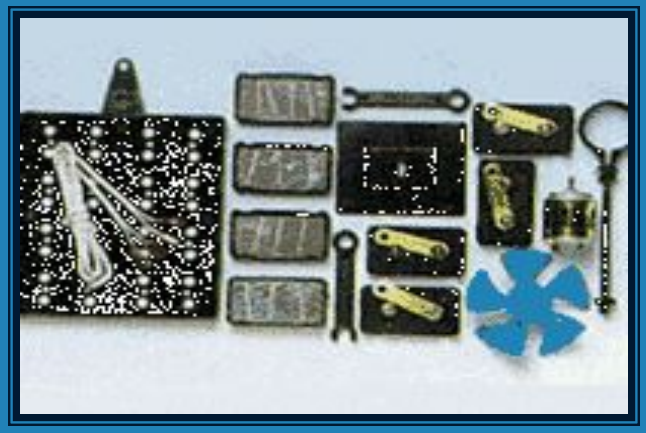
**2.** A pre-made solar powered racer will be shown and questions will be asked about its Design. For instance *should the car be heavy*, etc.

**3.** Other example toys and gadgets harnessing the power of the sun will be shown.

# Exploring the Solar Power - Kits


# Exploring the Solar Power - Cars

# Exploring the Solar Power - Options



# Experimenting with the Electric Box

**1.** An electricity kit and solar power kit will be supplied for the kids to experiment with after the basics of electricity have been covered.

**2.** The basics of how this kit works will be illustrated to the students leaving lots of room to use their imaginations.

**3.** Understanding how things work or influence each other helps in the "DESIGN."

# Experimenting with the Electric Box

# Putting it all together….DESIGN!!!

**1.** Using concepts learned or demonstrated from this unit, the students should then discuss how the provided solar car works.

**2.** Items about the car that should be emphasized are wheel and body design (friction), solar panel hookup (series/parallel), and other elements.

3. If possible, materials should be selected and a small solar powered car designed by the class.

# References


- http://www.ed.uiuc.edu/YLP/96-97/96-97_curriculum_units/Electricity_KPelak/table_content.html
- http://www.powerhousetv.com/kids/energy_basics_words.html
- http://www.brainpop.com/science/electricity/
- http://www.weberelectricsupply.com/sfty.html
- http://www.clarkpublicutilities.com/electric.htm
- http://www.sciencemadesimple.com/static.html
- http://www.cln.org/themes/electricity.html
- http://www.rp-l.com/rplkids.htm
- http://library.thinkquest.org/28032/cgi-bin/psparse.cgi?src=home
- http://www.concord.k12.nh.us/schools/kimball/classes/MITCHELL/elect.htm

# More References

- http://www.energizer.com/learning/default.asp
- http://www.code-electrical.com/historyofelectricity.html
- http://www.howstuffworks.com/battery.htm/printable
- http://www.howstuffworks.com/power.htm/printable
- http://www.howstuffworks.com/framed.htm?parent=link445.htm&url=http://www.techlib.com/electronics/
- http://www.edisonkids.com/
- http://www.eia.doe.gov/kids/electricity.html
- http://www.yeg.co.uk/fun/
- http://home.nycap.rr.com/useless/lightbulbs/

# Total Materials and Price List

- **Radio Shack**
  - Electronic Sensor Lab
    Cat.#: 28-278 Model: 28-278
    $49.99
  - 9 volt battery
  - 9 volt battery cap
  - 6 colored alligotor clipped wires
  - Orange LED with Holder
    Cat.#: 276-272 Model: 276-272
    $2.19
  - Green LED with Holder
    Cat.#: 276-271 Model: 276-271
    $2.19
- **Edmund Scientific**
  - Science with Magnets
    CR30814-43 $15.95
  - Marked Alnico Bar Magnets
    CR30379-08 $7.95

# Total Materials and Price List

- **Edmund Scientific**
  - 0.45V/400mA Encapsulated Solar Cell
    CR30398-10 $5.95
  - Photon Solar Racer Kit
    CR30528-82 $24.95
  - Sunlite Science Kit
    CR30822-20 $24.95
  - Solar Beads
    CR30823-63 $7.95
  - Solar Electricity Kit
    CR30012-31 $9.95
  - Solar Power Explorer Kit
    CR30534-22 $12.95
  - Space Explorer Solar Powered Vehicle
    CR31092-00 $29.95
  - Ultra-Mini Motors
    CR30351-28 $1.95
  - Fischertechniks - Profi Eco Power
    CR31251-00 $129.95
  - Solar Panel Kit - Educational
    CR30398-07 $22.95

# Total Materials and Price List

- **Booksamillion**
  - **Janice Van Cleave's Electricity**
    0471310107
    $9.25 Ages 8-12
  - **Lightning**
    0876146590 $19.95
    Ages 6-9
  - **Flash, Crash, Rumble, and Roll**
    0064451798 $4.95
    Ages 5-9
  - **I Can Read about Thunder and Lightning**
    0816744459 $7.95
    Ages 3-8
  - **The Magic of Electricity**
    0912511524 $7.95
    Ages 3-8
  - **The Magnet Book**
    0806999438 $20.74
  - **Living Without Electricity**
    1561482919 $12.63
  - **A Lightning Bolt is Hotter Than the Sun**
    0761308628 $20.90
    Ages 5-7
  - **Light Sound and Electricity**
    1580863760 $17.95
    Ages 9-12

# Total Materials and Price List

- **Booksamillion**
  - **Ben Franklin's Adventures with Electricity**
    0812097904 $5.95
    Ages 9-12
  - **Ben Franklin and Electricity**
    0791030067 $16.58
    Ages 9-12
  - **All About Electricity**
    0590480774 $3.95
    Ages 4-8
  - **The Magic School Bus and the Electric Field Trip with Bookmark**
    0590446835 $4.99
    Ages 6-9
  - **Circuits, Shocks, and Lightning**
    0739801431 $27.12
    Ages 9-11
  - **Exploring Solar Energy**
    0911168605
    $8.95
  - **Exploring Solar Energy II**
    0911168893
    $14.95
  - **Solar Power**
    0817253629
    $27.12
  - **Energy from the Sun**

# Total Materials and Price List

- **Art.com**
  - The Power of Nature
    IMAGE #1000-7622 $8.99
  - Lightning Over Lake & Mountains
    IMAGE #1007-6870
    $9.99

- **Miscellaneous**
  - 1 regular light bulb
  - Salt
  - Balloon
  - Styophome cups
  - Paper clips
  - Match stick
  - Penny
  - Eraser
  - Small squares of paper
  - Nail

# THE END