What's on When?

Fourth Grade
Activity: 1
Time: 2 Class Periods

General Description

Students will perform an audit of when electricity is used in their home, combine their data with the class and make an analysis of key usage times. This activity gives students the opportunity to graph real life data.

Objectives

Students will be made aware of the amount of energy used at different times in their homes and discuss how that use could impact limited resources.
Students will plan how they could reduce their family's electrical use and share it with the class.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C4 PO2 Choose an appropriate graphic representation for collected data:

- bar graph
- line graph
- Venn diagram
- model

SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S3C2 PO3 Design and construct a technological solution to a common problem or need using common materials
SC04 S4C3 PO1 Describe ways various resources (e.g., air, water, plants, animals, soil) are utilized to meet the needs of a population
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. Brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S1C1 PO5 Maintain a record (e.g. lists, pictures, journal, folder, notebook) of writing ideas.
W04 S3C2 PO1 Record information (e.g. Observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. Advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E2 Prepare and deliver an oral report in a content area and effectively convey the information through verbal and nonverbal communications with a specific audience

Teacher Information

Students in the 21st century will face an ever changing world that demands more and more energy to grow economically. Some day it will be their job to find solutions for our energy needs. Helping students recognize what limited resources are and how the students can help conserve those resources is the key to a successful future.

Materials

Graph paper
Science notebooks
Poster paper/large construction paper
Chart to keep track of data
Activity Card 4-1

Procedures/Exploration

1. Have students brainstorm all the things in their house that uses electricity.
2. Explain to students that things like the air conditioner, pool pump, dryer, (not washers) and stove all use more electricity than things like lights and computers.
3. For the purposes of this activity students will focus only on outlets.
4. Have the students count how many outlets they have in their house. Remind them to count those outside, in the garage, and to check behind furniture.

*****Warn students not to stick anything into those outlets*****

5. When the students return to school have them multiply the outlets by two.
6. Give the students the Activity Card #4-1, keeping track of what outlets are providing electricity in a given time period, allow them a week to fill in the data.
7. Have each student graph their own data.
8. Graph the class usage.

In groups, have the students discuss how they could reduce the amount of electricity they use at house. Have each group propose a plan that will help their families save energy. Students will present their proposal through the creation of a poster.

What's on When?

Fourth Grade
Activity: 1
Activity Card 4-1

Student's Name: **Date:**

Electricity Use Data Table

Day	Date	Time	Number of outlets in use
Week day		6:00am- 7:00 am	
Week day		6:00am- 7:00 am	
Week day		6:00pm- 7:00 pm	
Week day		6:00pm- 7:00 pm	
Week day		6:00pm- 7:00 pm	
Weekend day		11:00am- 12:00 pm	
Weekend day		3:00 pm- 4:00 pm	

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Do Plants Make a Difference?

Fourth Grade
Activity: 10
Time: 2 Class Periods

General Description

Students collect and record temperature data around school yard and around homes to see whether plants make a difference in air temperature. Students explore ways in which landscaping can help reduce the amount of energy used to heat and cool a building.

Objectives

Students collect and analyze temperature data related to landscape around a building.
Students will research use of landscape to reduce the amount of energy used for heating and cooling.

Arizona State Standards

SC04 S1C2 PO1 Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, and organisms) in all science inquiry
SC04 S1C2 PO2 Plan a simple investigation that identifies the variables to be controlled
SC04 S1C2 PO3 Conduct controlled investigations (e.g., related to erosion, plant life cycles, weather, magnetism) in life, physical, and Earth and space sciences
SC04 S1C2 PO4 Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary)
SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C3 PO2 Formulate conclusions based upon identified trends in data
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO2 Choose an appropriate graphic representation for collected data:

- bar graph
- line graph
- Venn diagram
- model

SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation.

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E2 Prepare and deliver an oral report in a content area and effectively convey the information through verbal and nonverbal communications with a specific audience
LS E3 Interpret and respond to questions and evaluate responses both as interviewer and interviewee

Teacher Information

Plants can help moderate temperature extremes of buildings and absorb heat while reflecting the rays of the sun. Strategically planting trees and shrubs can help reduce energy costs. Familiarize yourself with APS. “Planting Trees” Fact Sheet, Activity Card 4-10. Contact a landscape architect, a representative from the APS Environmental Showcase Home, a climate control expert, a representative from the Desert Botanical Gardens or others to come to speak to your students about their job.

Materials

Thermometers
Graph paper
Paper to create a map or mural
Activity Card 4-10

Procedures/Exploration

1. Students will predict if the air temperature is the same all around us, inside and out. Why might there be a difference?
2. Have the students’ brainstorm how they could find out.
3. Create a data sheet and collect temperatures from recorded spots around the school.
4. Have the students share and graph the information and create a map or mural of recordings.
5. Have students plan to duplicate the activity at their home, making sure they all gather data the same night
6. Bring the information back to share with the class the next day.
7. Share the APS fact sheet “Tree Planting” Activity Card 4-10, with students; or have an outside presenter speak to the students.
8. Have the students research which plants are best for the Arizona climate and why?
9. Which plants are best to help reduce energy costs, how do the plants accomplish this. Present to the information to the class or to the principal.

Tree Planting Fact Sheet

Fourth Grade
Activity: 10
Activity Card: 4-10

Student's Name: **Date:**

- Trees help cool the earth and reduce carbon dioxide. A mature tree can absorb up to 16 pounds of carbon per year.
- Trees planted around your house help moderate the extremes in temperature around your home, therefore helping to reduce the cooling requirements of your air conditioning equipment.
- Low-water use desert shrubs and ground covers can also help reduce the cooling requirements of your home by absorbing the heat and reflecting the rays of the sun.
- Hot west walls can be cooled by appropriately placed trees or a trellis. Trees with dense crowns, broad spreading trees or full trellis vines can be the most effective in reducing the heat impact on the west side of your home. The south side can also benefit from the shade provided by an African sumac (evergreen), a mesquite or a Palo Verde (deciduous, loose leaves).
- Trees and bushes planted to shade patios and driveways can significantly reduce the amount of heat radiating through patio doors and windows.
- Shrubs and ground covers planted close to the house will trap static air between the foliage and the wall, creating an insulating space for year-round energy savings.
- The south side of your house will benefit from deciduous trees planted there. They will prevent the harsh impact of summer sun on the walls, windows and roof. In the winter, they will drop their leaves, allowing the sun to provide radiant heating during the cooler months.
- The east wall will benefit from deciduous trees as well, allowing the warmth of the early morning sun to warm the home in the winter, but protecting from the sun’s impact in the summer.
- The northern side and corners of your home will benefit from evergreens planted there. These can act as a break to the cold winter winds and thus reduce the heating load on your heat pump. Some of the best species of dense branching conifers are Arizona cypress and Australian pine.
- Drought-tolerant trees are best choices for Arizona as they are both suitable for the climate and use only minimal water.
- When planting trees or large shrubs (such as oleanders), you should consider any above-ground or below-ground obstructions or obstacles which may be damaged by the long-term growth of the trees. Consider overhead wires, underground utilities, walls, patios and even your home’s foundation which may be damaged by the tree’s branches or roots.
- Before landscaping your yard, contact Blue Stake at 263-1100 (in Maricopa County), or 1-800-STAKE IT. This free service will mark your underground utility lines so you won’t accidentally dig into the lines.
- Some trees which are most appropriate for planting near power lines in the arid southwest are: Texas Ebony, Chilean Mesquite, Shoestring Acacia, Southwestern Sweet Acacia, Texas Mountain Laurel, Palo Brea and Foothills Palo Verde. Trees which are suitable for planting in the cooler high country (above 4500 feet) are Arizona White Oak, Salt Cedar and Gambel Oak. All of these trees are low water use, hardy and provide a variety of shading/screening, flowers, wildlife habitats and decorative qualities.

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School Energy Audit

Fourth Grade
Activity: 11
Time: 1 Class Period

General Description

Students will gather data to complete a school energy audit and make recommendations to students, staff and maintenance personnel.

Objective

Students will gather and analyze data while conducting a school energy audit.
Students will present their findings and recommendations to students, staff and maintenance personnel.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. Brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S3C2 PO1 Record information (e.g. Observation, notes, lists, charts, map labels, and legends) related to the topic

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E2 Prepare and deliver an oral report in a content area and effectively convey the information through verbal and nonverbal communications with a specific audience

Teacher Background

A 1/4 inch crack under the front door will waste as much energy as a 2 x 2 inch hole in the wall. A building can retain its heat if it has good insulation, weather stripping and caulking.

Contact the school custodian, electrician or other staff who manages the school facilities to come in and talk to your students about their jobs. Also ask them to talk about where the school gets its energy, where the meter is, how to read it, how to troubleshoot electrical or other power problems, safety procedures. You may also want to contact your local utility company for a speaker to come out and talk about energy use and conservation.

Materials

Copies of Activity card 4-11
Thermometer

Procedure/Exploration

1. Student teams are assigned roles within their groups in order to complete the school energy audit.
2. Students brainstorm parameters, variables, and report findings.
3. Plan for further investigation.
4. Students generate recommendations on how to save energy and present those recommendations to students, staff and maintenance personnel.

School Survey

Fourth Grade
Activity: 11
Activity Card: 4-11

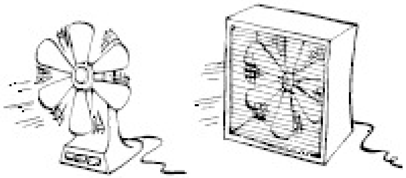
Student's Name: **Date:**

Heating and Cooling System

1. How is your school cooled?
   ☐ evaporative cooling
   ☐ refrigeration
   ☐ other
2. Does each room control its own temperature or is there a central control for the entire school?
   ☐ control its own ☐ central control
   If there is a central control, where is it located?
3. If the temperature in your room is not accurate, record the temperature of your room, record the thermostat reading and figure the difference between the two.
4. What is the daytime temperature setting?
5. What is the nighttime setting?
6. Are filters clean?
   ☐ yes ☐ no
7. What type of fuel is used to heat the school?
8. List at least three kinds of things being done in your school that would be considered a wise use of energy.
   a.
   b.
   c.
9. List at least three areas of energy waste. Include your recommendations on what changes will be needed to make the situation energy efficient.
   a.
   b.
   c.

Kitchen and Cafeteria

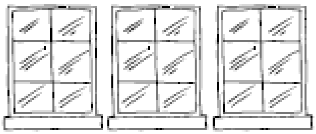
1. What types of energy are used in the kitchen?
   - ☐ electric
   - ☐ natural gas
   - ☐ other
2. List appliances in the kitchen and the hours they are used.



3. Exhaust fans**:** record the number of fans, where they are located, their size and when they are used.
4. Water temperature: measure and record the temperature of the hot water in the following areas:
   - ☐ restrooms
   - ☐ cafeteria/kitchen
   - ☐ dishwasher
   - ☐ other rooms with sinks

   (If most restrooms have sinks, pick three or four as a representative sample.)

Windows, Doors, Walls (Remember not to bother other classes while you do this.)



Windows

1. Are there many windows?

   ☐ many ☐ some ☐ few ☐ none
2. How many windows face

   ☐east ☐south

   ☐north ☐ west

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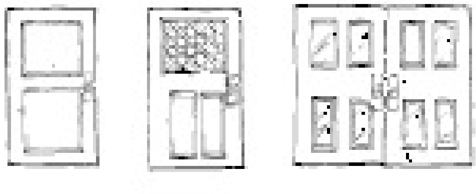
3. Can you open these windows?
   ☐ all ☐ some ☐ few ☐ none
4. Are any windows in full sunlight during the hot months?
   ☐ yes ☐ no
5. Where?
6. How are windows protected from the sun?
7. Do any windows need repairing? (Include what the repairs should be.)
8. How many skylights are in the school?



Doors

1. Do the doors fit snuggly?
   ☐ yes ☐ no
2. Is weather stripping required?
   ☐ yes ☐ no

Walls

1. List the types of materials used for the building's outside walls:
2. Are the walls insulated?
   ☐ yes ☐ no
3. Is the roof insulated?
   ☐ yes ☐ no

In Action! Saving Energy

Fourth Grade
Activity: 12
Time: 1 Class Period

General Description

Students will use data from the school energy audit and research to create a plan for saving energy. Plans will include methods for checking feasibility, informing the community, recruiting community involvement, and measuring success of their plan.

Objective

Students will research data relating to the energy audit they did and develop a plan to save energy at their school.
Students will then present their findings and give their recommendations to students, staff and maintenance personnel.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. Brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S1C1 PO5 Maintain a record (e.g. lists, pictures, journal, folder, notebook) of writing ideas
W04 S3C2 PO1 Record information (e.g. Observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. Advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E2 Prepare and deliver an oral report in a content area and effectively convey the information through verbal and nonverbal communications with a specific audience
LS E3 Interpret and respond to questions and evaluate responses both as interviewer and interviewee
LS E4 Predict, clarify, analyze and critique a speaker's information and point of view

Teacher Background

The depth of this project is dependent upon the amount of time and scope of the project the teacher and students wish to devote. Contact your local utility company for a speaker to talk to your students about the utility business. Gather books, brochures and newspaper articles on the utility business. Should you and your students decide to do oral presentations,

Materials

Activity Cards 4-12a, 4-12b and 4-12c
Story boards
Poster paper
Paints
Colored pencils/crayons
Tape or paste

Procedure/Exploration (allow students to work in groups)

1. Students determine goals, decide on messages and audience.
2. Students brainstorm ways of measuring success of their goals.
3. Students choose the best way to deliver their message. They assign roles and timeline.
4. Students research similar successful programs, determine feasibility (i.e. check permission, scheduling, willingness to participate, etc.)
5. Students create and present materials and message. You could also include calendars, bookmarks, a pledge to help conserve energy which will be published in the school newspaper.
6. Students monitor and evaluate effectiveness of their plan.

Oral Energy Presentations

Fourth Grade
Activity: 12
Activity Card: 4-12a

Student's Name: **Date:**

Presentations

Students should brainstorm what attributes they feel contribute to an effective presentation. They may categorize attributes, prioritize and assign a rating scale for evaluation.

Teachers may prefer to provide more structure initially. The following may be used as a guide. Teacher should choose the parts appropriate for their particular students and put in the form of a template for student use.

Planning Guide

1. Decide what your message is.
2. Decide who needs to hear your message and why.
3. Back up your message with facts and make it fit your audience.
4. Decide which charts/graphs/materials would help your presentation.
5. Determine who the audience is. When will you present to them? Where?
6. Assign preparation responsibilities.
7. Prepare the charts and/or AV equipment.
8. Arrange for any AV equipment needed.

Visual Aid Guideline

1. Practice using the audio visuals.
2. Make sure all of the audience can see and hear.
    a. Stand to the side of the visuals.
    b. Keep the transparencies lined up straight on the projector.
    c. Be sure audio can be heard at the rear of the room.
3. Talk to the audience, not to the visual aid.
    a. Look at the aid only when you want the audience to see it.
    b. Check the audience for feedback as you explains the aid.
4. Explain the audio visuals to the audience.
    a. Make sure they understand what they are seeing and hearing.
5. Remove the aids when not in use.
6. Never allow the light from the projector to shine on an empty screen.
    a. Keep one transparency on while simultaneously sliding the other transparency off the projector.
    b. Or, turn the projector off between transparency presentations.

7. Has your team made sure that it will have the AV and other equipment it need?
8. Overheads Flipchart Markers Overhead projector Screen VCR
9. Arrange for any AV equipment needed.

Tips for Effective Presentations

1. Preparation
    a. Know your audience.
    b. Know your purpose.
    c. Decide on main points.
    d. Organize your material.
    e. Use audio visuals, if possible.
2. Practice
    a. Practice out loud.
    b. Tape record of yourself.
    c. Use a mirror.
3. Preparing yourself
    a. Make a good impression.
    b. Give yourself a pep talk
    c. Dress appropriately.
4. Anxiety/stage fright
    a. Realize that it is normal, natural and necessary.
    b. Use it, do not fight it.
5. Delivery
    a. Work from the outline (or cue cards).
    b. Be flexible and enthusiastic.
6. Verbal reminders
    a. Consider your tone, volume and rate.
    b. Use pauses effectively.
7. Non-verbal aspects
    a. Face your audience and smile.
    b. Maintain eye contact.
    c. Use gestures.
    d. Consider your posture.
8. Practice it again if you need to make changes or feel more comfortable.
9. Get feedback
    a. Talk to individuals.
    b. Have audience fill out an evaluation form.

Energy Storyboards

Fourth Grade
Activity: 12
Activity Card: 4-12b

Storyboard

Visual

Audio

Energy Saving Pledge

Fourth Grade
Activity: 12
Activity Card: 4-12c

Student's Name: **Date:**

I pledge to:

Put paper, glass and aluminum cans in available recycling containers.
Recycling paper, glass and aluminum uses less energy than making brand new material.

Save water at home and at school.
Turning off water while I brush my teeth and being careful to not waste water when I do the dishes will save lots of water.

Take my showers in 5 minutes or less.
Taking shorter showers saves the energy used to heat water and saves gallons of water for other purposes.

Turn off the TV when I am done watching it.
It is an easy thing to do. Mom and Dad will sure be impressed. It saves more the 100 watts every hour.

Tell my teacher about this pledge.
I am proud of myself for taking this pledge. I feel good about making my community a more efficient place to live.

Visit my electric utility to learn about conservation.
My utility wants to make conservation happen. They can give me even more information on ways I can help.

Ride my bike or walk whenever I can.
Cars produce the most pollution when they are warming up, especially for short trips. Biking and walking are good exercise.

Turn off the lights when I am not using them.
If every American household turned off two unneeded 60 watt bulbs for four hours per day, we could save all the energy from the oil spilled in Prince William Sound in just 10 days!

Signed:

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Read Your Meter

Fourth Grade
Activity: 13
Time: 1-3 Class Periods

General Description

Students will be able to construct and accurately read an electric meter.

Objective

Students will develop the ability to accurately read electric meters and to recognize how they can conserve energy.

Arizona State Standards

SC04 S1C2 PO4 Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary)
SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S4C3 PO3 Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience.

Teacher Background

Residential electric meters have either four or five dials. The pointers on the dials move either clockwise or counterclockwise; you can tell by the way the numbers are arranged on each dial.

The aluminum disk moves based on how much energy is being used in the home; the more one uses, the faster the disk revolves.

Familiarize yourself with APS' Meter Reading Fact Sheet, Activity Card 4-13a. You may want the students to work in groups. Help the students construct a model meter with four or five dials and movable pointers.

Materials

Tag board
Small paper plates
Brads
Marking pens
Activity Card 4-13a and 4-13b
Graph papers

Procedure/Exploration

1. Share with your students the information on APS' Meter Reading Fact Sheet.
2. Have your students construct a model meter; perhaps have a model already prepared.
3. Have the students brainstorm on ways of conserving energy thereby slowing down the aluminum disk.

Optional Activity

Using Activity Card 4-13b, have students, over a two week period, read their meters at home and devise a plan for saving electricity and share the information by creating a poster.

Meter Reading Fact Sheet

Fourth Grade
Activity: 13
Activity Card: 4-13a

Student's Name: **Date:**

A meter measures electricity. Through your meter's glass enclosure, you can see a revolving aluminum disk and a series of dials and pointers. The amount of electricity you use determines the speed at which the disk moves. The more electricity you use, the faster it turns. Each revolution represents a portion of an electric energy unit called a watt-hour. This watt-hour measurement is transferred from the disk through a series of gears to the digital numbers or pointers on the dials.

What makes your meter disk turn? There are two sets of connections which cause your meter to register:

1. The amount of current flowing into the house
2. The voltage at which the current is flowing

Your meter is basically a small induction motor run by magnetic forces created by electricity in a set of **coils.** The **voltage coil** is a winding of wire connected to the power supply lines. The **current coil** is a winding of wires connected with the household wiring. When current passes through these coils, the disk is forced to run at a speed exactly proportional to the number of watts (amps x volts) of electricity power being used.

Friction inside the meter is all but eliminated with the use of a magnetic suspension system which uses a magnetic field to float the disk and its shaft in the air. To help maintain accuracy provided by magnetic suspension and other design features, the meter is sealed with filters which keep its interior free of dust and other contaminants that can cause inaccurate meter registration. In the illustration below, the figures above each of the dials indicate the number of kilowatt-hours (kwh) registered by the meter during the time the hand on that dial made one complete revolution.
So, when the hand on the right-hand dial has passed from one figure to the next, 1/10 of 10kwh, or 1 kwh has been used.

During the time that the pointer on any one dial is making a complete revolution from "0" to "0", the pointer on the next dial to the left will pass from one figure to the next. Therefore, although a pointer on one dial may appear to have arrived on a given figure, that figure should not be read unless the pointer on the dial to the right has reached or passed "0". For example, the pointer on the 10,000 dial looks as if it is on the "0" , but you should read that dial as a "9" because the pointer on the 1,000 dial, to the right, has not made a complete revolution to "0". The correct reading is shown under the dials.

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Meter Reading Optional Activity

Fourth Grade
Activity: 13
Activity Card: 4-13b

Student's Name: **Date:**

This activity is designed as a two-week activity involving three meter readings. The teacher may wish to have the meters read each day at the same time for more practice, accuracy and as a means of comparing daily consumptions. (How does a weekday compare to a Sunday? Why?)

A. Read your kilowatt-hour meter at home and record the reading. A.________

B. Read one week later and record the reading. B. _______

C. Subtract B from A to determine kwh used during the first week of your experiment. C._______

During the second week, encourage your family to conserve all the electricity they possible can. Generate a plan to conserve energy.

D. At the end of the second week, again read your meter and record. D.__________

E. Subtract D from B to determine kwh used during the second week of your experiment.
E.___________

F. Subtract E from C to determine how much electric energy your family saved over the previous week. F. ___________

1. Were you successful in saving energy during the second week? Or, did you see more? Why?

2. Why would someone with an electrically-heated or cooled home have to consider the thermostat setting?

3. List all the energy-saving steps your family took and share it with the class.

APS Power Posse™

The Big Drip

Fourth Grade
Activity: 14
Time: 1 Class Period

General Description

Students will investigate how much water is wasted by a dripping faucet. Students will identify other areas where natural resources are wasted and then brainstorm ways to conserve water and energy.

Objectives

Students identify natural resources that are being wasted and then propose a solution.

Arizona State Standards

SC04 S4C3 PO2 Differentiate renewable from non-renewable resources
SC04 S4C3 PO3 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. Brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S1C1 PO5 Maintain a record (e.g. lists, pictures, journal, folder, notebook) of writing ideas
W04 S3C2 PO1 Record information (e.g. Observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. Advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

Teacher Information

Fixing a leaky faucet is just one example of a variety of ways to save energy in a home. This activity is designed as a springboard to motivate students to investigate other ways to save energy in a home.

Materials

Water
Measuring cup
Activity Card 4-14

Procedures/Exploration

1. Have the students brainstorm the difference between renewable and non-renewable resources.
2. Discuss conservation. Here are some questions to start the discussion with:
    a. Ask if anyone has ever had a leaky faucet in their household. If yes, ask them to describe the rate of water flow. Was it the hot water or cold? Does a leaky hot water faucet waste energy? How?
3. Discuss the activity on Activity Card 4-14 and tell students they will do this at home. Suggest they get help from family members.
4. Have the students return with the data the next day and complete the calculations as a group.
5. Students will calculate the rate of the dripping water and then calculate the amount of energy lost if the water was from a hot water faucet.
6. Discuss the results of the activity. Have students investigate other ways to save energy in the home.

Extension

Have the students create brochures on how to conserve water and energy based on what they learned during this activity and others.

The Big Drip

Fourth Grade
Activity: 14
Activity Card: 4-14

Student's Name: **Date:**

Directions

1. Turn cold water on so that it just drips.
2. Place a measuring cup (use a clear cup with ounces marked) under the leaking faucet. Start timing for 15 minutes.
3. Turn off the water after 15 minutes and record your finding in the chart below.
4. Bring data back to school where you will calculate the amount of water that would leak in 1 hour, 1 day, 1 week, and 1 year.

Time	Amount of Water (ounces)
after 15 minutes	
in 1 hour	
in 1 day	
in 1 week	
in 1 year	

5. Divide the total number of ounces produced by a leaky faucet in one year by 128. This gives the number of gallons wasted in one year. Record below.
   Number of gallons wasted in one year ________________________
6. If you did this with a hot water faucet, calculate the amount of energy that would be wasted in one year (by type of water heater):
   OIL Heater - Divide the total number of gallons wasted in one year by 110.
   Number of gallons of oil-heated water wasted_______________
   GAS Heater - Multiply the total number of gallons wasted in one year by .84.
   Number of cubic feet of gas-heated water wasted____________________
   ELECTRIC Heater- Multiply total number of gallons wasted by .25.
   Number of kilowatt-hours wasted__________________________
7. What other resources do you use that you could conserve?

   How would you conserve those resources?

APS Power Posse™

Make it Last

Fourth Grade
Activity: 15
Time: 1 Class Periods

General Description

Students will understand the meaning of conservation as it applied to natural resources.

Objectives

Students will observe and experience the depletion of a classroom resource.
Students will observe the depletion of three different energy sources.
Students will develop their own definition of limited resources.

Arizona State Standards

SC04 S4C3 PO1 Describe ways various resources (e.g., air, water, plants, animals, soil) are utilized to meet the needs of a population
SC04 S4C3 PO3 Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

Teacher Information

Students need to understand what a limited resource is in order to plan how to conserve resources. Giving students the opportunity to experience resources that become depleted gives them a better understanding of the need to conserve.

Materials

Flashlight
Small candle (tea light or birthday candle)
Science notebooks
Matches
Stickers or decorator pencils or free homework passes

Procedures/Exploration

1. Have the students predict how long the battery will last in flash light if they leave it on. Turn the flashlight on and leave it on until the energy is depleted. Relate this idea to the fact that the amount of energy is limited.
2. Have the students predict how long they think the candle will burn. The energy in the candle is stored chemical energy. This energy is also limited.
3. Put the stickers/pencils/ homework passes at the front of the room. Tell the students that they are going to see how long they can make the supply last. When the stickers/pencils/ homework passes have all been used they will not be replenished. Tell the students that they may get stickers/pencils/ homework passes whenever they would like to get one. (Pencils do not need to be used up to get another one.)
4. When the supply is gone ask the students to explain what limited resources and conservation means to them.

Give Me Some Static

Fourth Grade
Activity: 16
Time: 1 Class Period

General Description

Students will be given an opportunity to play with static electricity and investigate what kind of energy it is and what it is capable of doing. Students will understand how static electricity is a natural force.

Objectives

Students will demonstrate that static electricity has the ability to attract and repel objects.
Students will relate static electricity to their everyday life.

Arizona State Standards

SC04 S1 C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S5 C3 PO1 Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects

W04 S3C2 PO1 Record information (e.g. Observation, notes, lists, charts, map labels, and legends) related to the topic

Teacher Information

Static electricity is an important concept to introduce to students, it helps them to understand that electricity is a naturally occurring phenomena. Students have often experienced static electricity without really knowing what is happening. Giving students the opportunity to investigate what is happening will increases their understanding of the natural world.

Materials

Balloons
Different types of Fabric
Water (running slowly from a faucet)
String
Styrofoam peanuts
Aluminum foil
Paper from a hole punch

Teacher Preparation

1. Divide students into groups
2. Give students the balloons and fabric
3. Ask students to see if they can pick up the paper without touching it
4. Have students share how they picked up the paper, what worked best.

Procedures/Exploration

1. The students will perform the following experiment: rub a balloon on a piece of fabric of their choosing.
2. Hold the balloon close to a slow tickle of running water: The students will write down their observations in their science notebooks.
3. Using the paper holes from a hole punch again rub the balloon with a piece of fabric
4. Hold the balloon about four inches away from the paper after rubbing it on a sweater. Record the observations in a science notebook.
5. Have the students tie two balloons together using a second balloon.
6. Rub both balloons with the same fabric; hold them by the center of the string, record observations.
7. Put the Styrofoam peanuts between the balloons. Record your observations.
8. Rub the balloons with the different fabric; hold them by the center of the string, record observations.
9. Put the Styrofoam peanuts between the balloons. Record your observations.
10. Provide students the time to discuss what they have discovered about static electricity.
11. Ask students to explain why when clothes come out of the dryer they sometimes have static and record their answers in their science notebook.

To Light or Not to Light

Fourth Grade
Activity: 17
Time: 1 Class Periods

General Description

Students will investigate what makes good conductors and good insulators.

Objectives

Students will differentiate between a conductor and an insulator.
Students explain the use of insulators and conductors.

Arizona State Standards

SC04 S5C3 PO3 Explain the purpose of conductors and insulators in various practical applications
SC04 S1C1 PO2 Formulate a relevant question through observations that can be tested by an investigation
SC04 S1C2 PO1 Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry
SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry

W04 S3C2 PO1 Record information (e.g. Observation, notes, lists, charts, map labels, and legends) related to the topic

Teacher Information

Electricity comes to our homes through insulated metal cables supported by towers. The cables hang from long insulators. This then will keep the dangerous electric current from traveling from the cables down through the towers. It is important for students to understand the difference between an insulator and conductor in order to be safe around electricity.

Materials (per group)

Battery
Light bulb
Light bulb holder
Three Wires with alligator clips on the ends
Pencil
Paper clip
Rubber band
Penny
Glass rod
Plastic rod
Poster Paper

Procedures/Exploration

1. Place the light bulb into the socket.
2. Connect one end of an alligator wire to the light socket and other end to the battery.
3. Connect the second wire to the battery and leave the opposite end loose.
4. Connect the third wire to the opposite side of the light bulb holder and leave the opposite end loose.
5. Predict and group the objects into conductors and insulators.
6. Test the objects by putting them between the two loose ends of the wires.
7. Record and discuss your results with your group.
8. Students will share their results in the form of a poster

Make Your Own Battery

Fourth Grade
Activity: 18
Time: 1 Class Period

General Description

Students will build components of a battery and test what materials work best.

Objectives

Students will build a battery using specific directions.
Students will describe the interaction of components within a battery.
Students will test different materials to determine which work best.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S3C2 PO3 Design and construct a technological solution to a common problem or need using common materials
SC04 S2C2 PO2 Describe the interaction of components in a system (e.g., flashlight, radio)
SC04 S5C3 PO1 Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects

W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic

Teacher Information

Batteries are an energy source you can carry around with you. A battery changes chemical energy into electrical energy, or electricity. Electricity can then be changed into light, heat, motion, or sound energy.

Materials (per group)

Two pieces of wire
Six copper pennies
Tape
Pen
Saucer
Scissors
Sheet of aluminum foil
Warm salt water
Headphones
Notebook paper or science journals

Procedures/Exploration

1. Draw and cut six paper and six foil circles. Use the pennies to make the circles.
2. Tape one wire to a coin and the other wire to a foil circle.
3. Dip a paper circle in the warm salt water.
4. Put the wire with the foil circle in the saucer. Then put a wet paper circle and a coin on top. The wire goes under the foil.
5. Repeat step 4, building layers of foil, wet paper, and coins. The coin with the wire goes on top. You have made a battery.
6. Wrap the end of one wire to the stem of the headphone plug.
7. Put on the headphones. Scrape the wire against the plug.
8. Record and discuss your results.

Simple Circuit

Fourth Grade
Activity: 19
Time: 1 Class Period

General Description

Students will demonstrate and create a simple circuit using provided materials.

Objectives

Students will create a simple circuit.

Arizona State Standards

SC04 S5C3 PO1 Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects
SC04 S5C3 PO2 Construct series and parallel electric circuits
SC04 S1C2 PO1 Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry
SC04 S2C1 PO2 Describe the interaction of components in a system (e.g., flashlight, radio)
SC04 S3 C2 PO1Describe how science and technology (e.g., computers, air conditioning, medicine) have improved the lives of many people

W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic

Teacher Information

Simple materials can be used to create a series circuit, one of the two types of circuits students need to make. A series circuit will light all the bulbs in a line. A parallel circuit is a circuit in which one light can be off while another is on.

A bulb in a holder is preferred; however a small bulb also can be used without the holder. If this is the case the student should not handle the light bulb.

Materials

C or D battery
Two wires with alligator clips on each end
One light bulb
One light bulb holder
Science Notebook
Poster Boards

Procedures/Exploration

1. The students should be allowed to experiment and explore the materials.
2. Tell the students that it is their job to make the light bulb light.
3. Students should record what they try and what works and what does not.
4. As the students work circulate around the room asking the students questions about what is working and what is not.
5. Have the students write out how they made the light bulb light and illustrate it.
6. Have students share whole group what worked in their group.
7. Taking a correct student illustration use it to accurately label the parts of a circuit. (load=light bulb, wire=conductor, energy source=battery
8. Give the students materials to see if they can make more than one light bulb light at the same time.

Lights On!

Fourth Grade
Activity: 2
Time: 2 Class Periods

General Description

Students will survey their homes to chart usage of lights in each room. Students will determine where, when, and what kind of lights are being used.

Objectives

Students will collect data pertaining to the use of lights in their homes.
Students will analyze the use of lights in their homes.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g., brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S1C1 PO5 Maintain a record (e.g., lists, pictures, journal, folder, notebook) of writing ideas
W04 S3C2 PO1 Record information (e.g., Observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g., advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E2 Prepare and deliver an oral report in a content area and effectively convey the information through verbal and nonverbal communications with a specific audience
LS E3 Interpret and respond to questions and evaluate responses both as interviewer and interviewee
LS E4 Predict, clarify, analyze and critique a speaker's information and point of view

Teacher Background

Lights consume about 20% of all energy used in the United States. Saving energy helps ensure that we all have enough energy to meet our needs. Saving energy can help reduce the effects that producing energy may have on our environment. Saving energy can mean saving money. How are we using lights at home?

Materials

Lights On! Home Survey form, Activity Card 4- 2
Chart paper
Markers
Graph paper

Procedure/Exploration

1. Have the students brainstorm items containing light bulbs of any kind. (Remember toaster oven, refrigerator, sewing machine, etc.)
2. Model how to draw a map of a house, numbering the rooms.
3. Provide the students with time to draw maps of own homes and predict where the lights are and what kind of lights they are.
4. Students review Lights On! Home Survey chart, Activity Card 4-2, which will be completed at home.
5. Discuss results of home lights surveys. In what room were lights left on most frequently? What is the total number of hours that lights were left on in vacant rooms? Graph class results.
6. Brainstorm as a class how this number can be reduced?
7. Ask the students "How many lights did you observe in your home?" Graph class results.
8. Ask the student, how many lights were incandescent and how many were fluorescent?" Graph class results.
9. Ask the students, "How can you use what you have learned to save energy?"
10. Ask the students, "Did you observe any other things using energy in your home?"

Lights On!
Home Survey

Fourth Grade
Activity: 2
Activity Card: 4-2

Student's Name: **Date:**

Draw a map of your home on the back of this paper. Remember to show directions, and to number the rooms. Think about where lights may be located. At home, draw the lights on your map as you observe them. Label the lights **"I"** for incandescent and **"F"** for fluorescent. Assign each room in your house a number. Check the rooms every 15 minutes. Put the times you check on the blank lines and put an X in the box if lights are left on in a VACANT room.

Time	Room #1	Room #2	Room #3	Room #4	Room #5	Room #6

Parent Signature: ___________________________

APS Power Posse™

Making a Flashlight

Fourth Grade
Activity: 20
Time: 2 Class Periods

General Description

Students who have some understanding of electricity will enjoy this activity since they will be asked to create a flashlight thus demonstrating their understanding of a small system and how electricity travels through a flashlight to make it work. This is not an activity to use at the beginning of an electricity unit.

Objectives

Students will create a flashlight using house hold materials and identify the importance of each component and the components interact.

Arizona State Standards

SC04 S5C3 PO1 Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects
SC04 S1C2 PO1 Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry
SC04 S2C1 PO2 Describe the interaction of components in a system (e.g., flashlight, radio)
SC04 S3C2 PO1 Describe how science and technology (e.g., computers, air conditioning, and medicine) have improved the lives of many people

W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic

Teacher Information

Light is a form of energy known as radiant energy because of how it spreads, or radiates, from its source. Students will construct a flashlight using basic everyday materials. The flashlight will convert the electricity into light. Students will use their skills as a scientist to complete a task, identify problems, resolve those problems, and identify the components of a system.

Materials (per flash light to be made)

Science Journals
Activity Card 4-20
Empty water bottle (700ml size works best)
Two "C" batteries
Paper fasteners/brads
Sharp pencil
Aluminum foil
Cotton (or old newspaper)
Bulb
Bulb holder
Paper clip

Three pieces of insulated wire (each about 8" long)
Wire cutters
Electric tape
Scissors/utility knife
Ruler
Index card

Procedures/Exploration

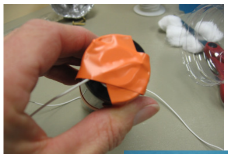
1. As the students work through this task, have them diagram the components of the flashlight and journal problems they had and how they solved them. Children must work in a minimum of pairs. Some steps require extra hands.
2. The teacher may want to prepare the bottles for the students. Peel off the label and throw away the screw top. Using pointed scissors or a utility knife cut the top of the bottle off at about 2.5 inches from the top.

3. Cut the neck off the bottle also. Allow the students to line the inside of the bottle top with aluminum foil and put a hole where the liquid pours out. Shiny side out works best. Set aside.

4. Using a sharp object put two holes into the side of the bottle about an inch apart. (an electric drill does a nice job and could be drilled before the students start working with the bottle) Set aside.

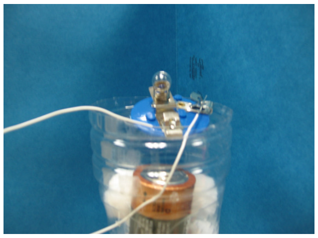
5. Tape the two batteries together making sure the positive end is lined up to a negative end. Use electrical tape and make sure it is a tight hold.

6. Using the wire cutters strip the insulation off the ends of all three wires.

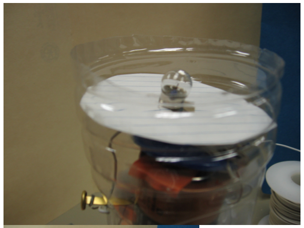


7. Take one wire and tape it to the bottom, the flat end, of one of the batteries. Use electrical tape for this step.
8. Slide the batteries into the water bottle and then feed the wire through the bottom hole in the bottle. Feed it from the inside to the outside.

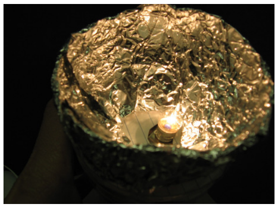
9. Stuff some cotton or old newspaper into the bottle to hold the batteries still. DO NOT stuff it to the top.
10. Put the light bulb into the holder.
11. Feed another wire through the top hole, place the bulb and holder on top of the battery and attach the wire to the holder.
12. Attach the last wire to the other side of the light holder and the other end to the battery on top. You will now want to squish those wires into the bottle and set the light bulb on the top.
13. The wires which are through the holes in the side of the bottle can be touched together as a test. If the light bulb lights proceed, otherwise check all your connections before finishing.



14. Take a brad and wrap the un-insulated end of the wire around the brad and then push the remaining wire back into the bottle and force the brad into the hole.
15. Do the same for the second wire and brad.



16. Cut the index card into a circle the same diameter as the bottle.
17. Cut a hole in the center of the index card to let the light bulb go through and place as a shield over the wires.
18. Take the top of the bottle and place as a reflector. See diagram.
19. Hang the paper clip on the top brad and gentle touch the bottom brad and your flashlight should work.

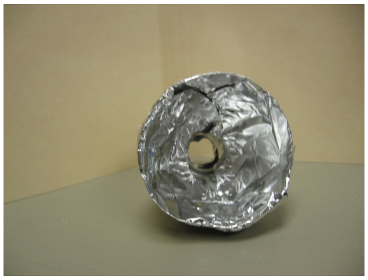


Discussion

Ask the students what struggles they had and what they did to problem solve. Ask them how they worked like a real scientist. Have students share a model of their flashlight and discuss why each component is critical in the design.

Flashlight

Fourth Grade
Activity: 20
Activity Card: 4-20

	Prepare the bottles for the students. Peel off the label and throw away the screw top. Using pointed scissors or a utility knife cut the top of the bottle off at about 2.5 inches from the top.
	Cut the neck off the bottle also. Line the inside of the bottle top with aluminum foil.
	Using a sharp object put two holes into the side of the bottle about an inch apart.
	Tape the two batteries together making sure the positive end is lined up to a negative end.
	Use electrical tape and make sure it is a tight hold.

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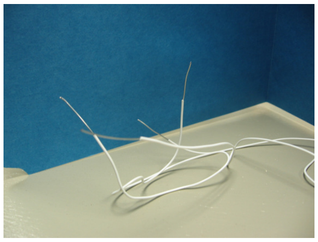
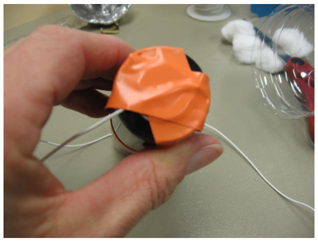
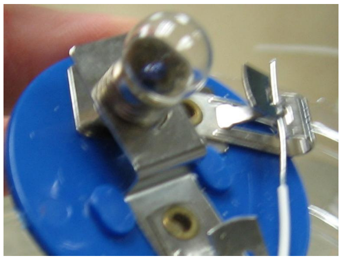
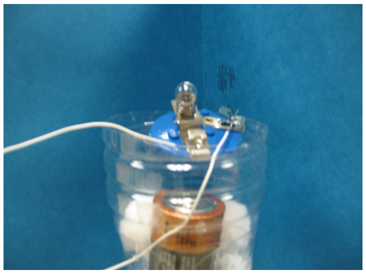
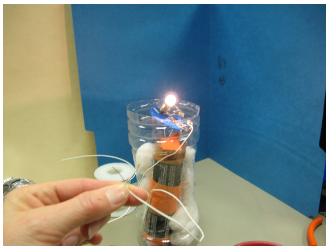
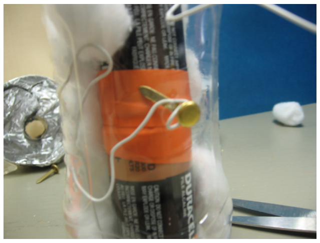
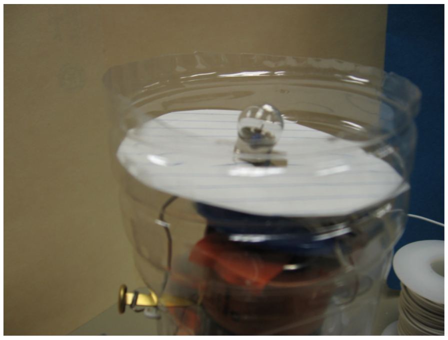
	Using the wire cutters strip the insulation off the ends of all three wires.
	Take one wire and tape it to the bottom, the flat end, of one of the batteries. Use electrical tape for this step.
	Slide the batteries into the water bottle and then feed the wire through the bottom hole in the bottle. Feed it from the inside to the outside
	Stuff some cotton or old newspaper into the bottle to hold the batteries still. DO NOT stuff it to the top.
	Put the light bulb into the holder. Feed another wire through the top hole, place the bulb and holder on top of the battery and attach the wire to the light bulb holder.
	APS Power Posse™

	Attach the last wire to the other side of the light holder and the other end to the battery on top. You will now want to squish those wires into the bottle and set the light bulb on the top.
	The wires which are through the holes in the side of the bottle can be touched together as a test. If the light bulb lights proceed, otherwise check all your connections before finishing
	Take a brad and wrap the un-insulated end of the wire around the brad and then push the remaining wire back into the bottle and force the brad into the hole. Do the same for the second wire and brad.
	Cut the index card into a circle the same diameter as the bottle. Cut a hole in the center of the index card to let the light bulb go through and place as a shield over the wires.

	Take the top of the bottle and place as a reflector.
	Hang the paper clip on the top brad and gentle touch the bottom brad and your flashlight should work.

School Lights

Fourth Grade
Activity: 3
Time: 2 Class Periods

General Description

Students will survey classrooms to chart usage of lights at school. Students will determine where, when and what kind of lights are being used.

Objectives

Students will collect data pertaining to the use of lights in the school.
Students will analyze the use of lights in the school and devise a plan to reduce the use of electricity.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g., Brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S3C2 PO1 Record information (e.g., observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g., advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data

Teacher Background

Lights consume about 20% of all energy used in the United States. Saving energy helps ensure we all have enough energy to meet our needs. Saving energy can help reduce the effects that producing energy may have on our environment. Saving energy can mean saving money. Work with the students to determine how your school is using lights in the school?

Have an energy expert from your school (custodian), a district support services person or someone from your local utility come in and talk to the students about their job

Materials

Paper to make maps of the school
School Lights Survey, Activity Card 4-3
Poster paper
Chart paper
Crayons/markers

Procedure/Exploration

1. Distinguish between incandescent and fluorescent lights.
2. Develop rules for the survey.
3. Brainstorm places around the school grounds where there might be light bulbs identify the two types.
4. Models the image of an aerial view of a school, correctly label the map.
5. Have students create an accurate map of their school.
6. Divide the students into teams assigning them an area of the school to survey.
7. Remind students of rules for surveying. Have them complete the survey.
8. Discuss and post results of School Lights Surveys.
9. Have the students share their results of school lights survey and generate further questions based on what they discovered. List these questions on large chart paper.
10. Did students notice other uses of energy on the school grounds? List responses on the chart for future use.
11. Design slogans/artwork for poster to be distributed around the school and at home to remind people to turn off lights when not in use.

Possible Extension

Continue research in order to answer the questions the students generated.

School Lights Survey

Fourth Grade
Activity: 3
Activity Card: 4-3

Student's Name: **Date:**

Team names:____

School: ____________________________________ Date:__________

Inside and outside lights:______________________________________

Where are the lights located? ___________________________________

What is their purpose? ____

How many hours are they turned on? _____________________________

List any areas where there are more lights than necessary. ____________________

____

List any areas where more lights are needed. _________________________

____

List any areas where lights are burning in vacant rooms. ____________________

____

Are there two sets of switches in the room so you could turn on half the lights? __________

____

Complete the chart:

Areas	incandescent or fluorescent	time observed	purpose	# lights
1.				
2.				
3.				
4.				
5.				

Questions Generated:

____

____

____

____

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What's Watt?

Fourth Grade
Activity: 4
Time: 2 Class Periods

General Description

Students will survey rooms to chart usage of lights at home. Students will determine total wattage of lights used and determine how they can reduce usage.

Objectives

Students will assess the wattage of incandescent and fluorescent bulbs in their homes.
Students will develop a plan to reduce the usage of electricity in their homes.

Arizona State Standards

SC04 S1C2 PO4 Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (e.g., metric, U.S. customary)
SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S4C3 PO3 Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S3C4 PO1 Write persuasive text (e.g., advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., square feet or square miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

Teacher Background

An incandescent bulb, invented by Thomas Edison and most commonly used in the home, glows when its filament is heated to a high temperature by the electricity flowing through it thereby getting very hot when turned on. It has changed very little in the last 100 years. Incandescent lighting is very inefficient - only about 10% of the energy input becomes light and the rest is wasted energy.

In a fluorescent light, electrical energy is used much more efficiently, lasts much longer and uses much less energy to produce the same amount of light. Electrons emitted by an electrode in the conventional fluorescent light excite atoms, producing ultraviolet light. This ultraviolet light causes the phosphor layer, which coats the inside of the fluorescent tube, the fluorescent, to emit light ... but very little energy. There are now also compact fluorescent bulbs which can screw directly into most lamps and ceiling fixtures. Students should have their parents help them with this activity.

Teacher Materials

Sample incandescent light bulb and a fluorescent bulb
Activity Card 4-4
Graph paper

Procedure/Exploration

1. Students brainstorm items containing light bulbs of any kind. (Remember microwave oven, refrigerator, sewing machine, stove, dryer etc.)
2. Explain that wattage is a measure of electrical power. Show students how to find the wattage of an incandescent light bulb and a fluorescent light bulb.
3. Model for students how to complete the wattage chart. Remind them to ask their parents for help.
4. Share results of wattage surveys. Graph student results.
5. Students record in logs what they have learned.
6. Students will create an advertisement encouraging consumers to purchase one light bulb over another.

Bulb Wattage

Fourth Grade
Activity 4
Activity Card: 4-4

Student's Name: **Date:**

Record the number of bulbs of each level of wattage in your home; have your parents help you. Then complete the total wattage in the table below.

Answer the following questions:

1. Are there fixtures or lamps in your home that have more then one light bulb?
2. Are all the bulbs on when the fixture is in use?
3. Are they all necessary?
4. Do any rooms have both overhead lighting and lamps?
5. Did you find any rooms where both were on at the same time?
6. What can you do at home to conserve energy using what you have learned in this activity?

Total wattage is calculated by the bulb size times the number of bulbs (Bulb size x # of bulbs)

Bulb size	**Number of Bulbs**	**Total Wattage Bulb size x number of bulbs**
25		
40		
60		
75		
100		
150		
3-way		

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Which Bulb Is Best?

Fourth Grade
Activity: 5
Time: 1 Class Period

General Description

Students will compare cost and efficiency of incandescent and fluorescent lights.

Objectives

Students will calculate the cost and efficiency of incandescent and fluorescent lights to decide which light bulb would be the better choice.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g., brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S1C1 PO5 Maintain a record (e.g., lists, pictures, journal, folder, notebook) of writing ideas
W04 S3C2 PO1 Record information (e.g., observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g., advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., square feet or square miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

Teacher Background

An incandescent bulb, invented by Thomas Edison and most commonly used in the home, glows when its filament is heated to a high temperature by the electricity flowing through it thereby getting very hot when turned on. It has changed very little in the last 100 years. Incandescent lighting is very inefficient - only about 10% of the energy input becomes light and the rest is wasted energy.

In a fluorescent light, electrical energy is used much more efficiently, lasts much longer and uses much less energy to produce the same amount of light. Electrons emitted by an electrode in the conventional fluorescent light excite atoms, producing ultraviolet light. This ultraviolet light causes the phosphor layer, which coats the inside of the fluorescent tube, the fluorescent, to emit light ... but very little energy. There are now also compact fluorescent bulbs which can screw directly into most lamps and ceiling fixtures.

Students should have their parents help them with this activity

Materials

Pictures of both types of light bulbs
Copies of Activity Card 4-5
Calculators

Procedure/Exploration

1. Have the students brainstorm items containing light bulbs of any kind. (Remember toaster oven, refrigerator, sewing machine, etc.)
2. Explain that wattage is a measure of electrical power. Show students how to find the wattage of an incandescent light bulb and a fluorescent light bulb.
3. Model for students how to complete the wattage chart. Remind them to ask their parents for help.
4. Share results of wattage surveys. Graph student results.
5. Students record in logs what they have learned.

Possible Extension

Students can design a brochure providing the facts about incandescent and fluorescent light bulbs.

Are All Lights Created Equal?

Fourth Grade
Activity: 5
Activity Card: 4-5

Student's Name: **Date:**

*The standard unit of measure of electrical use is a kilowatt-hour (divide the wattage by 1000 to convert to kwh). The total energy cost is the life expectancy multiplied by both the energy used and the utility cost per kwh.

Example: $\frac{\text{18 watts}}{1{,}000} \text{ x } \$.05 \text{ x } 10{,}000 = \$9.00$

	Compact Fluorescent 1,100 lumens	Incandescent 1,180 lumens
Bulb wattage	18 watt	75 watts
Life expectancy	10,000 hours	750 hours
* Total energy cost $ $ (at your cost per kwh)		
Cost of new bulb	+ $ 10.00	+$1.00
Lifetime cost	= $	= $
Number of bulbs to equal longer life bulb	x 1	x
Life cycle cost comparison	= $	= $

* * *

Compact fluorescent bulbs last 10 times longer than incandescent bulbs. If an incandescent bulb lasts 1,000 hours, how many hours will a compact fluorescent bulb last?

A fluorescent bulb requires much less energy than an incandescent. If you replace one 100 watt incandescent bulb with an equally luminous, but much more efficient 27 watt compact fluorescent:

> You'll save the equivalent of 800 pounds of energy producing coal and over
> 365 pounds of Carbon Dioxide and other gases will not be released into the atmosphere

If everyone in our classroom installed one compact fluorescent in his or her home, how many pounds of coal would be saved?

Why do you think compact fluorescent lights cost more at the store? Do you think compact fluorescent lights will always cost more at the store than other kinds of lights?

Watts Up?

Fourth Grade
Activity: 6
Time: 1 Class Period

General Description

Students will discover that personal lifestyle can impact the amount of energy used. Students will discuss how their families could reduce energy usage. Students will then put into place a plan for their family to reduce the use of electricity.

Objective

Students will evaluate their own use of energy and develop a plan to reduce energy consumption.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S1C1 PO5 Maintain a record (e.g. lists, pictures, journal, folder, notebook) of writing ideas
W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data.

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E2 Prepare and deliver an oral report in a content area and effectively convey the information through verbal and nonverbal communications with a specific audience

Teacher Background

Helping students understand that their actions and behaviors can make them more aware that they have control over certain aspects of their lives.

Materials

Paper
Colored pencils/crayons
Large stapler or book binder
Activity Cards 4-6a and 4-6b

Procedure/Exploration

1. Brainstorm with students jobs that they do at home or that someone who they live with do. Brainstorm ways to do a list the jobs using less energy.
2. Tell students to think about wise or wasteful energy usage at home.

   For example:
   - Are the lights and TV left on when no one was in the room?
   - Do you know what you want before you open the refrigerator door or do you stand there with the door open?
   - Do you take a bath or a shower?
   - Are the outside doors shut tightly?
   - Brainstorm other activities.
3. Students will select one family member to observe and record energy usage for one half hour daily for a week. Students will be using this information to help their family develop a plan to conserve energy.
4. Students will make a book, showing alternative ways of doing things to conserve energy. Each student folds pieces of paper in half and writes “Energy User” at the top of some and “Energy Wiser” at the top of the others.
5. Have the student bind their books, present their findings to the class, and share the book with their families.

What's Up?

Fourth Grade
Activity: 6
Activity Card: 4-6a

Student's Name: **Date:**

Choose a family member to observe for one half hour daily for a week. Record energy use.

Person observed:
Day:
Time:
Energy use: Comments: + -

For example:
Person observed: my brother, Don
Day: September 10, 1996
Time: 4:00-4:30 p.m.

Energy use:	Comments:	+	-
1. Stood holding the refrigerator door open for two minutes while trying to decide what to eat.	Took too much time. Unnecessary loss of energy.		x
2. Came home and shut the door tightly.	No excessive heat loss.	x	

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Using Energy

Fourth Grade
Activity: 6
Activity Card: 4-6b

Student's Name: **Date:**

The list below contains things that use energy to do a job for us. Can you think of a way the job might be done with less energy?

color television set

dishwasher

small load of laundry in washing machine

automobile

air conditioner

heated water bed

hot bath

thermostat at 70° in the winter

electric can opener

electric toothbrush

incandescent lights

electric calculator

electric razor

automatic garage door opener

boiling pan of water

computer

swimming pool

X-box

cooling the house

heating the house

windows

cooking

heating a pool

Hot Stuff

Fourth Grade
Activity: 7
Time: 1 Class Period

General Description

We use lots of energy heating hot water. Students will compare hot water usage in taking a bath or shower. This should be optional since not every student has both a bathtub and a shower.

Objective

Students will measure and evaluate the amount of hot water used when people take a shower versus a bath.

Arizona State Standards

SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience.

Teacher Background

Students are required to explore and evaluate ways in which to conserve resources. Electricity and water are resources that the students encounter everyday. Helping students understand that the simple things they do every day impacts the use of resources will enable them to make better decisions in the future.

Materials

Paper (poster board or tag board)
Meter sticks
Colored pencils/crayons
Activity Card 4-7

Procedure/Exploration

1. Give students time to practice using the meter stick by measuring items in the room.
2. Distribute Hot Stuff chart (Activity Card 4-7) and explain it to students.
3. After a week, chart class average results.
4. Did you find any difference in taking a shower or a bath in the number of centimeters (cm) of water used? (Taking a bath uses more water than taking a shower.)
5. Which method is the best energy saver? (Since energy is used to heat the water for baths and showers, and showers use less water, the shower is the best energy saver.)
6. Would you advise a person who wants to save energy to take a bath or shower?
7. Why?
8. Have the students generate a short talk about the benefits of either showering or bathing.

Hot Stuff

Fourth Grade
Activity: 7
Activity Card: 4-7

Day	cm Recorded for Bath	cm Recorded for Shower
1		
2		
3		
4		
5		
6		
7		
Totals		

Average totals =
Total divided by 3

1. Take a bath. Use a meter stick before you enter the tub to see how many centimeters of water you use. Record your answer.
2. The next day, take a shower, but first plug the drain. This will allow you to catch all the water used in your shower. Measure the water after your shower. Record your answer.
3. Repeat until the chart is completed. If necessary share data among classmates.

Electrical Safety Audit

Fourth Grade
Activity: 8
Time: 1 Class Period

General Description

Students act as electrical safety auditors to generate a safety checklist for a particular kind of site. Students should contact people in charge of safety and maintenance for guidance in procedures if possible.

Objective

Students will develop a safety tip poster to others about how to remain safe around electricity.

Arizona State Standards

SC04 S3C2 PO1 Describe how science and technology (e.g., computers, air conditioning, and medicine) have improved the lives of many people.
SC04 S3C2 PO2 Describe benefits (e.g., easy communications, rapid transportation) and risks (e.g., pollution, destruction of natural resources) related to the use of technology
SC04 S3C2 PO3 Design and construct a technological solution to a common problem or need using common materials

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)

W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. advertisements, paragraph) that attempts to influence the reader **(Create a poster)**

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E3 Interpret and respond to questions and evaluate responses both as interviewer and interviewee

Teacher Background

Students act as electrical safety auditors to generate a safety checklist for a particular kind of site. Students should contact people in charge of safety and maintenance for guidance in procedures if possible.

Materials

Activity Card 4-8
Poster Paper
Markers/colored pencils

Procedure/Exploration

1. Students work in teams to brainstorm possible safety issues for various sites.
2. Students should be encouraged to contact people in charge of safety and maintenance for guidance in procedures if possible.
3. Students will select a site and generate an expanded Safety Checklist
4. Hand out Activity Card 4-8 which could be used to conduct a safety audit.
5. Students will create posters to share their safety tips with adults and students.

Extension

Students could be invited to other classrooms to share what they learned about safety in order to help other students be safe.

Safety Check List

Fourth Grade
Activity: 8
Activity Card: 4-8

Student's Name: **Date:**

Inspection site - check one

____Home/Apartment ____School ____Office

	Yes	No
1. Are open outlets covered with childproof caps?		
2. Are electrical cords in good condition?		
3. Are extension cords used correctly?		
4. Is anyone in the building trained in CPR?		
5.		
6.		
7.		
8.		
9.		
10.		

Does That About Cover It?

Fourth Grade
Activity: 9
Time: 1 Class Period

General Description

After reviewing energy uses, students will collect data on temperatures inside and outside during the day around various windows. Students will collate and graph data to look for patterns and variables affecting passive solar heat absorption and radiation. Students will share the information with adults that can make changes to reduce waste.

Objectives

Students collect and analyze temperature data around various types of window treatments.

Arizona State Standards

SC04 S1C2 PO1 Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, and organisms) in all science inquiry
SC04 S1C2 PO2 Plan a simple investigation that identifies the variables to be controlled
SC04 S1C2 PO3 Conduct controlled investigations (e.g., related to erosion, plant life cycles, weather, magnetism) in life, physical, and Earth and space sciences
SC04 S1C2 PO4 Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary)
SC04 S1C2 PO5 Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
SC04 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends
SC04 S1C3 PO2 Formulate conclusions based upon identified trends in data
SC04 S1C4 PO1 Communicate verbally or in writing the results of an inquiry
SC04 S1C4 PO2 Choose an appropriate graphic representation for collected data:

- bar graph
- line graph
- Venn diagram
- model

SC04 S1C4 PO3 Communicate with other groups or individuals to compare the results of a common investigation
SC04 S4C3 PO4 Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes)

W04 S1C1 PO1 Generate ideas through a variety of activities (e.g. brainstorming, graphic organizers, drawing, writer's notebook, group discussion, printed material)
W04 S3C2 PO1 Record information (e.g. observation, notes, lists, charts, map labels, and legends) related to the topic
W04 S3C4 PO1 Write persuasive text (e.g. advertisements, paragraph) that attempts to influence the reader

M04 S2C1 PO3 Interpret graphical representations and data displays including single-bar/circle graphs, two-set Venn diagrams, and line graphs that display continuous data
M04 S4C4 PO1 Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles)
M04 S4C4 PO3 Select an appropriate tool to use in a particular measurement situation

LS E1 Prepare and deliver an organized speech and effectively convey the message through verbal and nonverbal communications with a specific audience
LS E2 Prepare and deliver an oral report in a content area and effectively convey the information through verbal and nonverbal communications with a specific audience
LS E3 Interpret and respond to questions and evaluate responses both as interviewer and interviewee

Teacher Information

In hot climates, a typical three-foot by four-foot window can add $24.00/year in air conditioning costs. 10-25% of a typical American homes air conditioning or heated air leaves through the windows. According to the U.S. Department of Housing & Urban Development, any method that stops the sun before it gets through the glass is seven times as effective at keeping you cool as blinds or curtains on the inside. Window treatments such as sun screens, awnings, shade trees in front of windows, dual pane or glazed panes can help increase passive solar energy efficiency.

Materials

Activity Card 4-9

Procedures/Exploration

1. Teacher introduces lesson: .We have been looking at some energy use inside a building.
2. Are there factors which affect the energy we use? Teacher may want to draw a pie graph of Home Energy Use with the following: Heating and cooling: The largest amount of home energy is used for heating and cooling. What can we do to use heating and cooling more wisely? Appliances: Home appliances use about 1/4 of home energy. How can we be more energy efficient when we use appliances at home? Hot Water Use: A water heater can use almost as much energy as all other appliances. What can we do to use hot water more wisely at home? Lighting: Lighting uses the least amount of energy at home. How can we use lights more wisely at home?
3. Teacher charts student responses to the questions. What have we learned so far?
4. Teacher asks, .For what is the largest part of our energy at home used?
5. I understand that up to one fourth of our heating and cooling energy can be lost through windows. How could we find out more about the temperature around different kinds of windows?
6. Help students generate ideas and a plan for collecting data. (i.e.: Record type and location of windows and window treatments and record temperature inside and outside of window at regular intervals of time.)
7. Design data collection sheets.
8. Students record data and report findings to the group. Collate class data.
9. Look for patterns. Make recommendations.

Using Energy

Fourth Grade
Activity: 9
Activity Card: 4-9

Student's Name: **Date:**

- In hot climates, a typical three-foot by four-foot windows can add $24/year in air-conditioning costs.
- 10-25% of a typical American home's space conditioning energy leaves through the windows.
- According the U.S. Department of Housing and Urban Development, "Any method that stops the sun before it gets through the glass is seven times as effective at keeping you cool as blinds or curtains on the inside".
- Sun screens, a variety of which are available on the market, stop the sun's heat and glare before entering the window. They are almost like having a shade tree in front of every window on your home.
- Sun screens reflect, absorb and dissipate a large portion of the sun's heat and glare before it reaches and penetrates the glass surface. Sun screens can block up to 70 percent of the heat and glare common to the Arizona summertime.
- Sun screens block the sun, not the view; can be installed in place of regular insect screens; work with windows open or closed; and reduce glare and improve daytime privacy.
- APS recommends the use of sun screens in the cooling season as an affordable way to block the sun's radiant heat. Sun screens will reduce your energy consumption which may lower your electric bill.
- Sun screens should be removed in the winter to allow for passive solar heat gain to warm your house interior.
- Dual-pane windows and insulated or gas-filled windows, act as an insulation shield against heat loss in winter and conduction heat gain in summer.
- Traditional, single-glazed windows have an R-value of 1.0 while current window technologies can attain R-values of 4.0 or higher. (In other words, state-of-the art window technologies are at least four-times as efficient at stopping heat transfer as are single-pane windows.)
- Dual-pane or multipane windows are a little more energy-efficient than storm windows because they create an insulated air vacuum between the panes which reduces conductive heat transfer.
- A thin transparent metallic coating bonded to the glass between the panes increase the efficiency of dual pane glass by reducing the flow of radiant heat between the panes.
- Low-E, or low emissivity, window treatments act to reflect unwanted heat from passing through your windows. They keep heat outside during the hot summer months.
- Low-E window films, applied on the inside of your south-, east- or west-facing windows and glass doors, reflect infrared and ultraviolet light while allowing most of the visible light (daylight) to enter. These films can reduce solar energy gain by 50% during the summer.
- Using the currently available home window technologies could save the United States four million barrels worth of oil and gas per day, at costs of several dollars per barrel (42 gallons) saved.