K-5 Energy Sparks Table of Contents

Energy Use at Home

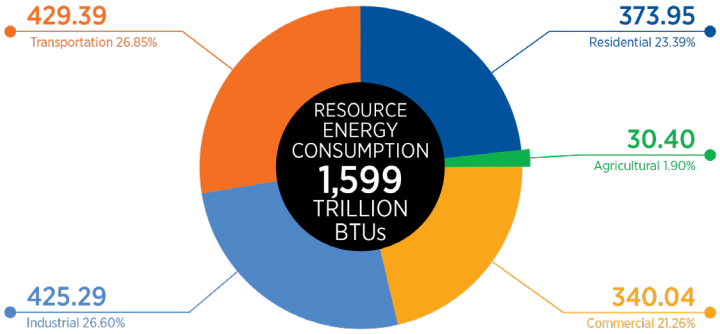
Inventory the ways you use energy in your home. Draw a simple map of your home. Mark different spots on the map and show how energy resources are being used. Things to consider include the following:

- Lights and appliances using electricity
- Hot water in sinks, bathtubs, and showers (water heater powered by natural gas or electricity)
- The furnace keeping rooms warm (powered by electricity or natural gas)
- The air conditioner using electricity
- The oven using natural gas or electricity

Energy Use in Wisconsin

Look at the pie chart showing the energy use of sectors of society. You, your family, and your classmates are within the residential sector. Who or what is in the other sectors and what do they use energy for? Think about some of the things you do. Where do your clothes come from? What about the food you eat? First, people must grow your food, and then it has to get to the grocery store. Use the table below to list items you use or things you do during one day or one week. Then use the boxes under the appropriate sector to describe what energy must be used for you to do the activity or for the item to be produced. One example has been provided. Redraw the pie chart on a poster. Illustrate each section with appropriate pictures of things that use energy. For example, the Agriculture section could include illustrations of tractors, while the Transportation section could contain pictures of cars, trains, and airplanes.

Wisconsin Resource Energy Consumption, by Economic Sector. 2015 (Trillions of Btu and Percent of Total)



Source: Wisconsin Office of Energy Innovation. Wisconsin Energy Statistics Book, 2018.

ENERGY-GO-ROUND				
Activity	**Agriculture**	**Industry**	**Transportation**	**Commercial**
Buy a baseball bat	Grow the tree (forestry)	Process the bat	Transport wood to industry, then to store	Display bat in lighted store

Energy and Transportation

Collect songs, poems, and stories about automobiles and traveling. Then perform them for parents or other audiences.

Create a travel map. Obtain a map of your community and identify places you, your friends, and your family travel to and from. Trace these pathways on the map and insert symbols to represent how you move from one place to another. For example, if you walk to school, put a stick figure next to the pathway. If your family drives to the supermarket, put a tiny car next to that route on the map.

Develop a travel time line. Illustrate the time line with pictures and descriptions. For example, types of land travel may begin with foot travel and progress to horse-drawn vehicles, trains, trolley cars, the first automobiles, trucks and jeeps, and more modern versions of cars. Continue the time line with an illustration of what you envision vehicles will look like in the future.

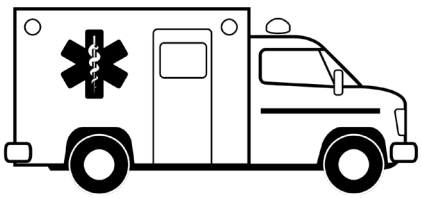
See who in the class can design the best paper airplane or the fastest toy boat, or who can devise a model car that runs on rubber band power.

Make a collage of different vehicles and categorize them. Ideas for different groups include people-powered vehicles (bicycles, skateboards, in-line skates), gasoline-powered vehicles (automobiles, motorcycles, small boats), and diesel fuel-powered vehicles (trucks, buses, boats, trains). Near each category, identify things that are carried by the vehicles, such as people or types of cargo.

Energy Use in the Workplace

Have each member in the class list a career of an adult family member or friend. Brainstorm how each of these careers depends on energy. Identify the source of energy used to accomplish the job responsibilities. Sources may include electricity, gasoline, or muscle power. Adult family members or friends can be interviewed to supplement the information.

Create an energy career network! Identify different career titles of people who work in your community. Write each title on a card and attach a picture if you have one. Make sure to include the people involved directly with supplying energy to homes and businesses (for example, electricians, power plant operators, LPG distributors, solar energy consultants). Determine how different workers within the community are dependent upon each other, focusing on energy connections. Post the cards on the wall and use yarn to indicate the energy connections. Attach another card near each piece of yarn to describe the connection. For example, between the gasoline station owner and the baker could be a card stating, “The gasoline station owner supplies the fuel for the trucks that the baker uses to deliver bread to the grocery store.” The card associated with the connection from the baker to the natural gas line maintenance worker may have the words, “The baker uses ovens that are fueled by natural gas.”



Inventory the different ways workers in your community get from one place to another. These methods may include automobiles, trucks, fire engines, buses, bicycles, etc. Next to each item identify the energy source that makes the movement possible (gasoline, people-power or food, diesel fuel).

Exploring Heat

Explore How Heat Energy Affects Our Lives

Put on a fashion show presenting how heat influences what we wear when outside during different seasons.

Survey friends to find out who likes summer and who likes winter best and why.

Find out how much it costs to provide heat for a twenty-minute shower compared to a ten-minute shower.

Exploring Sound

Explore How Sound Energy Affects Our Lives

Make a sound map of a room or an outdoor environment. Sit in one spot and indicate that spot by drawing an X in the middle of a piece of paper. When you hear a sound, mark on the map where it comes from relative to where you are sitting. You can identify the sound by drawing the source, using words to define or describe the sound, or by creating symbols that represent the loudness of the sound. Have a friend sit in your spot and see if he or she hears similar or different sounds.

Keep a journal of different sounds you hear each day. What sounds help wake you up and which help put you to sleep? Which sounds do you like and which do you want to avoid?

Are you or a friend hearing impaired? What is being done to help people with this challenge? Learn the alphabet in sign language if you do not already know it. If you know sign language, teach it to someone else. What forms of energy can help compensate for lack of sound?

Explore How Movement Creates Sound

Background

Sound is a form of energy that involves movement of molecules. The molecules move back and forth, transferring sound energy from one molecule to the next. We create sound when we transfer the kinetic energy of movement to another object, causing the molecules to vibrate.

Clap your hands. When you slapped your hands together, where did the energy go? Some of it went to create the sound. Strike objects against other objects and compare the sounds. How does wood sound beating against wood compared to wood beating against a piece of metal?

Blow air across an empty bottle, through your cupped hands, or against a blade of grass held between your thumbs. What sounds can you create? Create your own instrument. Describe what you did to make the sound.

Explore How Sound Creates Movement

Background

When sound energy comes in contact with another object, the sound energy can be converted to another form, such as movement.

Place a shallow dish of water on visualiser and project. Strike a tuning fork near the water. Look at the water

projected at the screen. Do you see movement?

Feel your Adam's apple, or vocal cords, as you hum and talk. Do you feel any vibrations? Hold your hands near a radio. Do you sense movement? Look at the windows in a building when a large, loud truck passes by on the street. Does anything happen?

Study how sound energy makes the tiny bones in your ear vibrate. You hear because these tiny bones move and stimulate nerve endings that send messages to your brain. Make a model of the ear. Write a skit or a report that stresses the importance of protecting your ears, and present it to the class.

Simulate a Sound Wave

Background
Sound travels in waves called longitudinal waves, which consist of the back and forth movement of molecules. The molecules are compressed together and then expanded. The molecules stay in the same area, but the sound energy is passed along.

Put a Slinky on the floor. Pull on one end and let go. Watch the wave (the compression and expansion of the coils) move from one end to another. You can also hold a long elastic band taut and tug on one end. Someone holding onto the middle lightly can feel the wave pass through.

Make a toy telephone by tying a tin can on each end of a long string. Pull the string so it is very tight. Talk into one can and have a friend listen at the other. Can your friend hear your voice in the tin can? Can you hear your friend's voice? What happens if someone else holds onto or bends the string in the middle?

Show how sound energy travels from one molecule to the next by setting up a row of marbles. Gently hit the marble on one end and a marble at the other end will roll out of the line. The energy was transferred to each marble along the line until it reached the last marble. This simulation emphasizes that it is the sound energy, not the molecules, that move from one location to another.

Exploring Light Energy

Explore How Light Energy Affects Our Lives

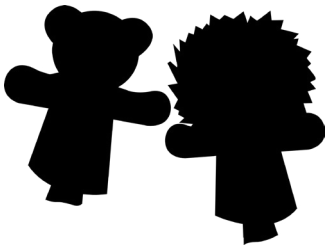
Identify sources of light around your home and school. Things to look for include light bulbs, computers, televisions, flashlights, lights in clocks, matches, fireplaces, gas burners. What is Earth's major source of light? The sun!

Write a short story about how lights communicate information. For example, what types of lights are there on a school bus? What do they mean? What would happen if Garret Morgan hadn't invented the automatic stoplight?

Explore Where Light Can and Cannot Go

Inventory things that are transparent (light passes through) such as clear glass. Now identify translucent things. Light passes through translucent things, but you cannot see through them very well (sometimes not

at all). For example, paper is a translucent material. Hold it up to a light. Light can shine through a piece of paper, but you can't see through it. Finally, identify opaque things (items light does not pass through). Humans are opaque, and so is a piece of wood.



Explore shadows. Put on a shadow puppet play. Watch your shadow at different times of the day and different times of the year. Keep a shadow journal. Compare your notes with a friend.

Can you bend light? What happens to light when it travels through water? Put a pencil in a glass of water. The pencil looks bent because light travels differently through water than it does through air.

Calculate how many times in one second light can travel back and forth to a nearby town. Light travels at 186,000 miles per second. If the town is 50 miles away, you need to divide the speed of light by the distance of the town (186,000 ÷ 50 = 3,720 times). What if you had to drive back and forth 3,720 times? How long would it take? Let's say you drove 60 miles per hour. Multiply the number of times (3,720) by the number of miles (50) to get the 186,000 miles that you would travel. Divide this by 60 miles per hour. The result is 3,100 hours! (This is 129.17 days (3,100 hours ÷ 24 hours/day) or 4.31 months (129.17 days ÷ 30 days/month).

Exploring Movement

Explore How Movement Affects Our Lives

Inventory the different ways you move all day (with your feet, in a wheelchair, in a car, in a bus).

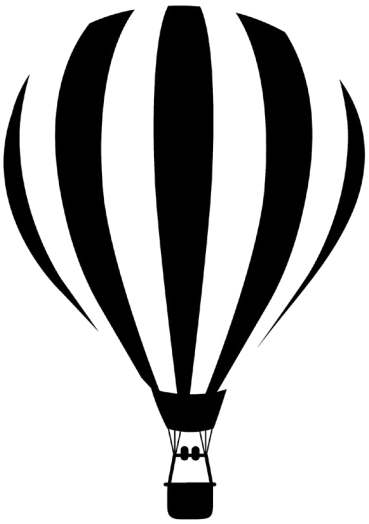
Categorize things based on how they move from one place to another. Create a collage for each category.

Look for things that move on the ground.

- Contrast how people and other animals move.
- Compare things that move on wheels. Which are people-powered? Which are powered by some other source?

Look for things that move through the air.

- Which are moved by wind?
- Which are flying on their own?
- Which burn fuel to move?



Create a scavenger hunt game where you must find things based on how they move. Examples include finding something that stays in place but spins around, finding something that moves back and forth like a pendulum, and finding something that moves people from one floor of a building to another.

Exploring Magnetic Forces

Background

Though we do not think about magnets often, magnetism and its companion, electromagnetism, are the basis for much of our standard of living. Every electric motor, generator, and transformer is dependent upon a magnetic field. Even our telephones must have a magnetic field to work. Countless technologies that we use daily are possible because of magnetism. Although the reason magnetism works is not yet completely clear, its effects and laws are quite simple. Magnetic poles that are alike repel, and unlike poles attract. One theory for this is that the molecules in a magnet are grouped in what are called domains. Each domain acts like a tiny magnet. In magnetic materials, the domains are lined up, which means that they work together to attract things in the same direction. If the domains are not lined up, then the object is not magnetized. Objects that are made out of metals containing iron, nickel, cobalt, and steel are attracted to magnets.

Compare putting different ends of two magnets toward each other. Describe how the different arrangements feel. Identify the positive and negative ends of a magnet and summarize how you can arrange magnets to attract and repel each other.

Gather a bunch of small objects (a pin, a pen, a nail, some paper clips, a coin, a piece of chalk, a piece of wood). Guess whether they will be attracted to the magnet or not; then test your guesses. Create a chart like the one below and categorize the objects. What do the objects that are attracted to the magnet have in common?

Magnetic Attraction Chart		
Attracts	**Repels**	**Has No Effect**

Make a chain of nails or paper clips using a magnet. How many can you suspend?

Put paper clips on top of a piece of paper and put the magnet under the paper. Try to “walk” the paper clips across the sheet of paper. Use the magnet to try to move the paper clips inside an empty plastic bottle. Test the magnet through a variety of other materials with different thicknesses.

How far above an object can you hold a magnet and still get the object to move toward the magnet? Get a variety of magnets and test their strength. Use a ruler and measure the farthest distance the magnets can be from an object and still attract it.

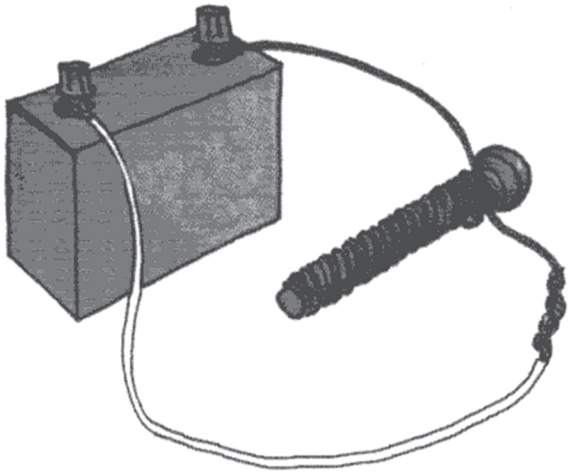
Make a “floating” paper clip for an audience. Tie a paper clip to a black thread and tape the other end of the thread to the table. Hold a black piece of paper behind the paper clip. (This will make the string harder to see.) Now hold the magnet above the paper clip. Try to move the paper clip toward the magnet (without the paper clip actually touching the magnet) until the string is taut. Depending on the strength of the magnet and your patience, you should be able to hold the paper clip at the end of the string by the force of the magnet without the magnet and the paper clip ever touching.

Put paper clips in a shallow bowl of water. Now try to use the magnet to pick up the paper clips without touching the magnet to the water. Can you do it? Will the magnet work under water?

Look for the different ways we use magnets. Many people have refrigerator magnets. Design your own refrigerator magnet and give it to someone as a gift.

Make a magnet out of a nail. Stroke the nail about a dozen times in the same direction with a magnet. Now test to see if the nail will pick things up. You can demagnetize the nail by striking it with a hammer or dropping it.

Another way to make a nail magnetic is through electricity. **Caution: Only use batteries for this activity. Do not use electricity from a wall outlet.** You'll need a 4.5 volt battery, a nail, tape, alligator clips (optional), scissors, and 60 inches (152 cm) of coated copper wire. Remove a little coating from each end of the wire, and attach the alligator clips (if you have them). Attach one end of the wire to a terminal on the battery. (NOTE: Use tape or alligator clips. Some batteries have screws.) Test the nail with a paper clip to make sure it is not magnetic. Wind the wire around the nail. Make three layers of wrapped wire, using tape to secure each layer. Now attach the other end of the wire to the other terminal on the battery. Does the nail attract objects now?



Shocking Static Electricity

Background

Have you ever received a shock when touching a metal object or light switch on a cold day? Have your clothes ever clung to each other after coming out of the dryer? Have you made a balloon "stick" to the wall by rubbing it against a wool sweater? When you move your feet along the carpet, when clothes brush against each other in the dryer, or when you rub a balloon against your sweater you're transferring charges (electrons) from one object to another. One object ends up with more electrons than the other. This buildup of electrons is called static electricity. Objects with fewer electrons (with a positive charge) pull or attract the object with more electrons (a negative charge). For example, when you rub a balloon against your sweater, you are enabling electrons to move or be transferred from the cloth to the balloon (the atoms in the balloon hold onto their electrons more tightly than the atoms in the cloth do, so the cloth loses its electrons).

Try rubbing a plastic spoon with wool. Bring the rubbed spoon near some Styrofoam peanuts laying on a table and observe what happens. Experiment with the spoon and the Styrofoam peanuts. Try to get the peanuts to levitate. Then answer the following questions:

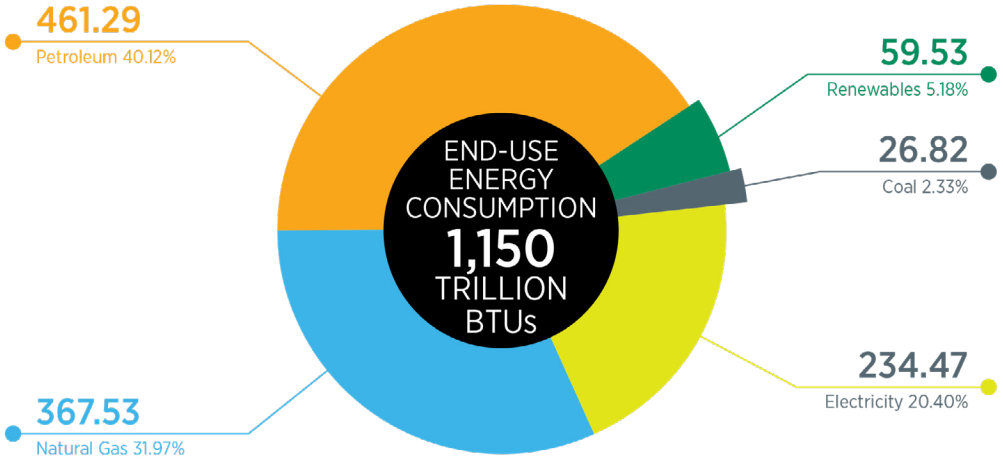
- What form of energy was used to suspend the peanuts? (electrical energy)
- What form or forms of energy was present in the "floating" peanuts? (kinetic energy)

When you rubbed the spoon with the wool, you were transferring something from the wool to the spoon. Do you know what it was? (The wool loses negative charges [electrons] to the spoon.)

Introducing Energy Resources

Redraw the pie chart below that shows the energy resources we use in Wisconsin. Illustrate it with pictures you draw or clip from magazines that represent each type of fuel.

Wisconsin End-Use Energy Consumption, by Type of Fuel. 2015
(Trillions of Btu and Percent of Total)



Source: Wisconsin Office of Energy Innovation. Wisconsin Energy Statistics Book, 2018.

Many fiction and nonfiction stories are written about different energy resources. For example, learn how Columbus used wind power to travel across the Atlantic Ocean. Ask a senior citizen what it was like to stoke a furnace with coal to warm his or her house. Read about life on an oil rig.

Introducing Renewable and Nonrenewable Energy Resources

Heat a pie pan by putting it over a small candle. **Caution: Have an adult help you with this. Wear protective gloves and keep flame away from your clothes and body.** What happens as the candle burns? Where does the candle material go? Look at the black material collected on the pie pan and remember the heat you felt from the candle. These two items used to be in the candle. The candle symbolizes a nonrenewable energy source. Nonrenewable resources include fossil fuels (coal, natural gas, petroleum) and nuclear resources. Now heat the pie pan by putting it in the sunlight. The sun is here every day, so it is an example of a renewable resource. Other renewable resources include trees, falling water, and the wind. NOTE: Although a tree (wood) will burn down, you can grow new trees. The material used to make candles (petroleum) is limited in supply.

Fossil Fuel Products Made from Oil

Read through the oil (petroleum) products list below. Make a check next to the products that you used, consumed, or purchased during the day of your survey. Write a story using as many of the items on the list as possible. (Source: American Petroleum Institute.)

____ Ammonia
____ Anesthetics
____ Antifreeze
____ Antihistamines
____ Antiseptics
____ Appliance housings
____ Artificial limbs
____ Artificial turf
____ Aspirin
____ Awning and umbrellas
____ Balloons
____ Bandages
____ Boats
____ Bubble gum
____ Building Materials
____ Cameras
____ Candles
____ Car enamel
____ Car parts
____ Car sound insulation
____ Cassettes
____ Caulking and putty
____ Charcoal lighters
____ Cigarette filters
____ Cleaning utensils
____ Combs and brushes
____ Containers
____ Cortisone
____ Cosmetics
____ Crayons
____ Credit cards
____ Curtains
____ Dentures
____ Deodorant
____ Detergents
____ Dishwashing liquids
____ Dry-cleaning fluids
____ Dyes
____ Earphones
____ Electric blankets
____ Electrician's tape
____ Enamel
____ Epoxy paint
____ Eyeglasses
____ Face and hand cream
____ Faucet washers
____ Fertilizers
____ Fishing equipment
____ Flashlights
____ Flavoring
____ Food preservatives
____ Furniture
____ Glues and adhesives
____ Glycerin
____ Guitar strings
____ Hair coloring
____ Hair curlers
____ Hearing aids
____ Heart valves
____ Hoses
____ House paint
____ Imitation leather
____ Ink
____ Insecticides
____ Insect repellent
____ Insulation
____ Life jackets
____ Linoleum
____ Loudspeakers
____ LP records
____ Luggage
____ Motorcycle helmets
____ Movie film
____ Nylon rope
____ Oil filters
____ Oil filters
____ Paint brushes
____ Paint rollers
____ Pan handles
____ Pantyhose
____ Parachutes
____ Partitions
____ Perfumes
____ Permanent-press clothes
____ Petroleum jelly
____ Photographs
____ Pillows and mattress filling
____ Plastic bags
____ Plastic pipe
____ Refrigerants
____ Rip-stop nylon
____ Roofing
____ Rubbing alcohol
____ Rugs
____ Safety glass
____ Sails
____ Sedatives
____ Shampoo
____ Sneakers
____ Soft contact lenses
____ Solvents
____ Sports car bodies
____ Sports equipment
____ Stretch fabrics
____ Sunglasses
____ Sweaters
____ Synthetic rubber
____ Tents
____ Tires
____ Tool boxes
____ Tool racks
____ Toothbrushes
____ Toothpaste
____ Toys
____ Transparent tape
____ Typewriter ribbons
____ Unbreakable dishes
____ Underwear
____ Uniforms
____ Upholstery
____ Vacuum bags
____ Vacuum filters
____ Vaporizers
____ Vitamin capsules
____ Yarn
____ Zippers

Sunvestigations

Sun Heating

Caution: Never look directly at the sun; it can damage your eyes. Place one bottle of water in the shade and one in a sunny place. After a half hour or longer, compare how warm the water is in each bottle. If available, use thermometers to compare temperatures.

How do glass and plastic affect the sun's heating ability? Put a thermometer in an empty clear plastic bottle and leave it out in the open. Do the same for a glass bottle. Make sure the thermometer bulbs touch only air. Compare the temperatures after an hour. Experiment with different colored bottles. If the bottle is opaque, remove the thermometer and read the temperature quickly because it will be affected by the outside temperature.

Make solar tea by putting tea bags in a clear jar containing water. Let the jar stand in the sun for at least an hour.

Which color absorbs heat best? Place ice cubes in plastic bags on construction paper of different colors. (To make this a good experiment, make sure that each ice cube has an equal volume of water.) Time which one melts the fastest. What happens if you put the ice cube on aluminum foil?

Set up an experiment to show whether a house with a black roof or a white roof is cooler inside. Form a hypothesis first, then test it. What were the results? Why do you think it turned out the way it did?
Use the sun's heat to dehydrate food. Place grapes and other fruit in a shallow pan and cover with a plastic screen. Set in a sunny spot for several hours. Extend this activity by weighing the food before and after you set it in the sun and note the changes.

Observe and measure an evaporating puddle on a warm, sunny day. Use chalk and draw a circle around the perimeter. Wait 15 minutes to one hour and redraw the outline. Wait the same amount of time and trace the outside again. The size of the puddle should decrease over time. An alternative is to measure the decreasing height of a small pile of snow on a warm, sunny spring day.

Use the sun's energy to remove the salt from salt water. Put some salt water in a clear sealed container and place it in a sunny spot. Wait a few hours until condensation forms. Taste the water collected on the side of the container; it should be salt-free. When water evaporates, it leaves the salt behind. How can you revise this experiment to collect the salt-free water more efficiently?

Sunlight

Use a prism to investigate the light spectrum. Select paints or crayons that match the colors emitted from the prism and create a poster about the importance of sunshine in your life.

Experiment with mirrors to make reflections. Turn the mirror back and forth to make bursts of light. Create different patterns using the light flashes. Create a code with a friend using the patterns and send messages back and forth.

Shadows

Investigate what happens to the length of shadows in the morning, afternoon, and evening. Trace others' shadows on large pieces of butcher paper. Compare the proportions. Compare the length of shadows at the same time of the day but at different times of the year.

Make a simple sundial. Put a piece of paper on the ground. Stick a pencil through a piece of paper into the ground. Pencil should stick straight up, perpendicular to the ground. Note the time of day and write this at the tip of the pencil's shadow. Repeat this step every hour throughout the school day. The next day, test your sundial. Put the pencil and paper on the ground and see if the shadow falls on the correct spot. Can you use your own shadow to guess what time of the day it is?

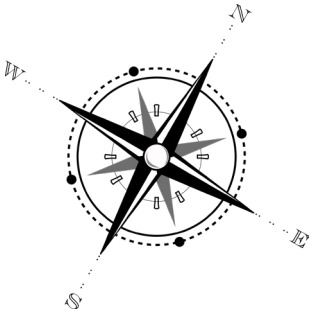
Seasons

Compare the time of day and where on the horizon the sun sets in summer, fall, winter, and spring. How do the outside temperatures vary? What do people wear each season in response to temperature changes?

Which is your favorite season? Why? Collect and read books and poems about the seasons. Write your own song, poem, or story. Make sure to include information about the sun (its height in the sky, the length of the day, etc.).

Sun Directions

Use the sun to determine which direction the front of your school faces. Which side or part of the school faces the sun when it rises? Label this east. Label the opposite side west. Which side or part of the school is in the shade? This is the northern side.



Put thermometers in windows that face each direction (N, S, E, and W). Compare the temperatures throughout the day. If a plant needs full sunshine all day, where should you put it? What about a plant that needs partial sunlight? Or one that prefers shade?

Trace It Back to the Sun

Background

The sun is our main source of energy. The food we eat gets its energy from the sun. Even activities like turning on a light and driving a car depend on the sun's energy. Fossil fuels—coal, oil, natural gas—once were living organisms that depended on the sun. So when we drive a car, we're indirectly using the sun's energy. Think of the different things you do each day and trace them back to the sun. Examples include turning on a light (electricity is often generated from coal, which used to be a living organism that depended on the sun), heating a home with wood (wood comes from trees that used the sun's energy to grow), and lifting a book bag (energy comes from food that came from a plant that used the sun's energy).

Investigate whether plants need sunlight to grow. What happens if you try to grow plants without exposure to light? What else do plants need to grow? Find out through a controlled experiment where you plant several seeds of the same type. Allow all the plants to sprout and grow to a few inches in height. Then, allow one plant (the control) access to sunlight, water, and air. Have another plant get air and water but no sunlight (put the plant in a dark closet). Let the third plant get sunlight and water but no air (cover the plant with a plastic bag). Provide the fourth plant with sunlight, air, and soil, but no water. Make careful observations of what you see happening to each plant.

Compare the weight of a bean or pea seed to when it has grown into a plant. Report on how the plant used the sun's energy to increase its "biomass," or to grow.

Make a food chain that traces items in your lunch back to the sun. For example, bread comes from wheat, which is a plant that uses the sun's energy to grow. Ham comes from pigs that eat corn that uses the sun's energy to grow.

Solar Power

Get a simple solar cell and coated wires. Many science supply companies and electronic supply stores sell simple kits. Experiment using the cell to operate small items such as flashlight bulbs, buzzers, and small fans. Try using the solar cell on a cloudy day and with different types of artificial light (e.g., fluorescent and incandescent light bulbs).

Look for use of solar panels around your community. Some homes may have them on their roofs. Many calculators use solar cells. In some places, highway construction signs use solar energy. Take pictures of items that use solar energy and keep a photo album (you may need to ask landowners for permission first).

Sun Safety

Although the sun is the energy source for life on Earth, it can also cause damage. Consider the following safety tips and draw posters to represent each one:

- Do not look directly at the sun
- Wear sunglasses when outside
- Use sunscreen on your skin for protection
- Remember, you can get sunburned even on cloudy days
- Do not leave children or pets inside a parked car (even if the windows are open)

Windy Wonders

Wind in the Classroom

Drop feathers or blow bubbles and watch where they go. Do they fall straight down or do they float in a certain direction?

Drape a thin piece of plastic lengthwise over a pencil (secure it with tape if necessary). Go to different locations around the room (near windows and doors, over a heater, in the center) and hold very still. Does the plastic move?

Wind Outside the Classroom

Use a pinwheel or plastic draped over a pencil (see preceding description) to compare the speed of wind in different locations around the school yard. You may also want to compare the wind from one day to another. Develop a scale to classify wind speeds (e.g., gusty, gentle, still) and keep a record of wind speeds.

Wind Power

Collect pictures of windmills from Wisconsin and around the world. Research how windmills have been used to pump water and generate electricity.

Wind Travel

Research how explorers used the wind to sail around the world. How did the wind help and hinder their journeys?

Have a mini-sailboat contest. Your boat can be made out of wood, cork, Styrofoam, or anything that will float. Use a toothpick to support the sail. What can you make the sail out of? Try a leaf, a piece of paper, or scrap material.

Water Fun

Water Heat

Compare how fast water and air heat up. Suspend two thermometers in two different bottles. Fill one bottle with water and leave one empty. Put the bottles in the sun and wait five minutes. How do the temperatures differ?

Water Power

Hydroelectric power plays an important role in Wisconsin's economic development. Take a field trip to visit a local dam. Research and present a paper on the history of hydroelectric power in Wisconsin.

Make a model of a dam. Use a plastic bottle and punch a small hole in one side. Hold your finger over the hole and fill the jug with water. Remove your finger and watch the water pour out. Experiment with different size holes at various heights. Compare the speed and volume of water flowing out when the jug is full to when it's nearly empty. See if you can create a door for the dam that slides up and down, trapping water when closed and allowing it to flow when open.

Working Water

What businesses in your community use water to help them work? For example, look at fire prevention companies or stations, paper mills, and other manufacturers. Find out the role of water in helping produce electricity in coal and nuclear power plants.

Investigate ways water can do work. Use water to:

- lift a pencil 3 inches (7.5 cm) off a flat surface;
- move a pencil 10 inches (25 cm) across a surface;
- wind a piece of thread around a pencil;
- drop a pencil from a height of 5 inches (12.5 cm);
- throw a soft object 2 feet (60 cm);
- grind a cracker into small pieces;
- break open a hollow object; and
- rotate a series of gears.

Electricity in Our Lives

Gather a group of your classmates and stand in a semicircle. Choose a person to stand in the center and act out something he or she does each day. The observers should call out, clap their hands, or ring a bell if the actor's activity requires electricity.

Find out which fuel sources your local utilities use. Write a brief description of each fuel type, including where it comes from and if it is renewable or nonrenewable.

Simple Machines

Work and Machines

Background

Try these activities:

- *Push against a wall*
- *Keep your hand above your head for one minute*
- *Hold a pile of books in the air*
- *Stand perfectly still for two minutes*
- *Open and close a window*

Did you perform work in any of these activities? The scientific definition of work is: Work = Force x Distance. Therefore, only the last activity was actually work, because it included moving something over a distance. A force can move things, therefore it gives things energy. In other words, a force is a push or pull. What things do you push or pull? You may bounce a ball, climb stairs, carry books, or open and close doors. Play charades to show how you push or pull things every day.

Our ability to do work comes from the energy stored in our muscles, which comes from food. Wouldn't it be nice to have something that allowed us to use less of our energy to get things done? We already do! Machines! We make machines do some of the work, which makes the work we do easier (we exert less force and use less of our own energy). Force (a push or a pull) is used to make machines work. There are several categories of simple machines. These include the inclined plane, the wedge, the screw, the lever, the wheel and axle, and pulleys.

Find pictures in magazines of people using machines or tools to help them work. Compare the types of machines. See if you can group some into the machine categories based on their similarities.

Inclined Planes

Use a spring scale to compare the amounts of force needed to lift an object and to pull it up a ramp. If you do not have a spring scale, make a simple one by securing a paper clip to one end of a ruler and putting a rubber band on the clip. Attach a brick, book, rock, or other weight to the spring scale or to the rubber band. Lift the brick from the floor to a table using the spring scale or rubber band. Determine the measurement on the scale, or see how far the rubber band stretches. Next, lean a board against the table, and lift the brick using the scale or rubber band to pull it up.

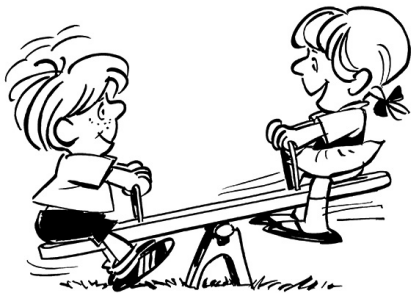
- How much force is needed to pull up the brick?
- Compare the height of the table to the length of the board to determine the distances the brick was moved.
- The board you leaned against the table is an example of an inclined plane. Can you think of another example? Inclined planes increase the distance objects must move, but the amount of force required is less.
- What happens to the distance and force when you change the length of the board?

The Lever

Background

Would you believe there is an apparatus on many playgrounds that is actually a simple machine? This machine is the seesaw. The seesaw is an example of a lever, a simple machine used to lift objects. There are many examples of levers in your life. These include a bottle opener, a pair of tweezers, a crowbar, and a pair of pliers.

You can experiment with a seesaw. If you and two other children (who each weigh about the same as you) are playing on a seesaw, how would you position yourselves so one of you could lift the other two? Sketch how this would look and then try it out. Revise your drawing as needed.



Make your own seesaw using a lever (a long piece of wood) and a fulcrum (a triangular piece of wood). Position the fulcrum under the middle of the lever, and place several books (called the "load") on one end.

- How can you make the lever lift the load? (Push down on one end of the lever, and the other will move up; the direction of the force is switched.)
- Experiment with the placement of the fulcrum. Is it easier to lift the load when the fulcrum is in the middle, or closer to one end of the lever? Does it matter where you push down on the lever? Which position requires you to move the lever down the furthest to lift the load to its highest position?

Friction: Stop and Go

Background

Work isn't always easy. There always seems to be something that adds resistance. Slide your book across your desk, or roll a ball on the floor. Why do they stop, instead of sliding and rolling forever? They stop because friction slows down the movements of two objects touching each other.

Move different objects (for example, a pencil eraser, a whiteboard eraser, a piece of wood, a small stone, a milk carton, a plastic cup) across a table. Use a spring scale to compare the different amounts of force needed to move these objects. Attach the scale to an object, and use the scale to pull it along. The scale should be parallel to the top of the table. Instead of a spring scale, you can also tie a string around an item, attach a rubber band to the string with a paper clip, and compare how far the rubber band stretches with different items. Drape something rough over the table, and try the experiment again. How does this affect the movement of objects? Which objects produce more friction?

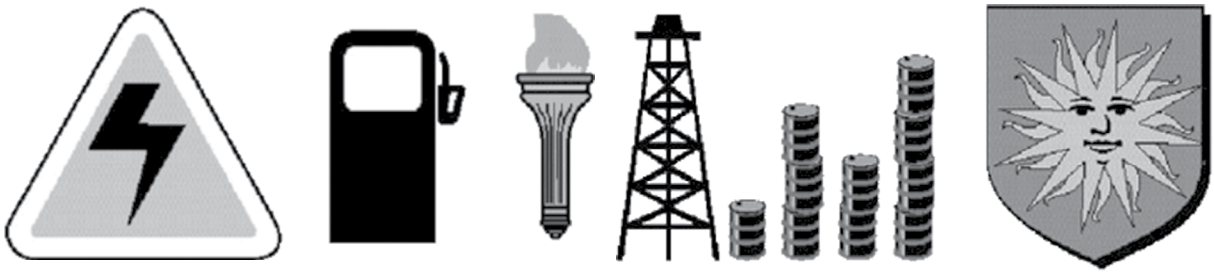
Make a list of forms of energy that are evident when you move one object against another. What examples of sound energy do you hear when you rub a piece of wood across sandpaper? Rub it back and forth a few times; how does the wood feel now? (It should feel warm, showing the presence of heat energy.) Where did the energy come from that enabled you to move the wood? (Hint: What did you eat for breakfast this morning?)

Write a short story about life without friction. It should become evident that life could be very dangerous without it. Also, without friction, applying force would be difficult. For example, imagine trying to peddle a bike or using the brakes if there were not friction.

Energy and Culture

Energy Symbols

Look for symbols that represent different energy sources or uses of energy. What might each of the symbols below represent?



Examine state government seals to see if they contain energy symbols. Below are just a few. Compare the seals of energy-producing states, like West Virginia, with states that do not have fossil fuel supplies, such as Wisconsin and Kansas. What might the other symbols in the seal represent? How would you revise the Wisconsin state seal to better depict how the state gets and uses energy?

North Dakota

Ohio

Wisconsin

West Virginia

Sun Inspirations

Take a walk on a sunny day. Look for reflections, shadows, and bright areas. Sit in a favorite spot and create a drawing that records some of the things you've observed.

Many stories and poems have been written about the sun. Written material includes stories about shadows, myths about the origin of the sun, and parables about the importance of and how we use the sun. Read a few of these and share your thoughts about them with a friend. Write your own story or poem.

Produce a dance or play that shows that the sun has energy. Below are a few suggested themes.

- Show how the sun heats water and causes it to evaporate.
  (Suggestion: Students representing water molecules can stand in a group and move faster when the sun shines on them, and one or two molecules can move so fast they leave the water and become water vapor.)
- Illustrate that the sun provides living things with energy.
  (Suggestion: Have a student representing an object such as a flower turn to face another student [the sun], smile, and stretch his or her arms toward the sun.)

Make a sun out of construction paper and surround it with things that depend on it for life. You can also add labels that identify things the sun does for us. Have everyone in the class write short statements about why the sun is important to them and post them near the paper sun. This activity can be adapted to create a sun mobile.

Make sun prints using light-sensitive photographic paper (available at a photography or craft store). Practice by putting objects on a piece of regular paper. When you find a pattern you like, sit in a shaded area and arrange the objects on the light-sensitive paper (you'll need to prepare these in a darkroom). Cover the arrangement and the light-sensitive paper with cardboard, and carry it into the sunlight. Remove the top piece of cardboard and expose the arrangement to the sun for about two minutes. Take the objects off the light-sensitive paper and remove the paper from the cardboard. Quickly rinse the paper in developing liquid (this process should be done by an adult unless only water is used). Share the print with a friend. NOTE: A simpler version of this activity is to use dark construction paper and cover portions of it with designs and letters you've cut out. When left in the sun for several hours (at least four), the uncovered portions will be bleached by the sun. The covered portions will retain the original color. Weigh down the designs and letters so they don't shift or blow away.

Wind Inspirations

Many stories and poems have been written about the wind. Read a few of these and share your thoughts about them with a friend. Write a poem about wind blowing. How does a cool breeze make you feel if it's hot outside? What about a warm breeze on a cool day?

Make a set of wind chimes. Use old silverware, pieces of shells, tin cans, etc.

Produce a dance or a play that shows wind energy. A few ideas follow.

- Symbolize the wind blowing through a tree and making the tree move.
  (Suggestion: Students who are trees should stand with extended arms and another student representing the wind should run by, causing trees to sway.)
- Interpret the wind passing through chimes and making them tinkle. (Use a variation of the previous suggestion.)

Water Inspirations

Watch water flowing down a stream or sidewalk after a rainstorm. Is the water carrying anything? Does it reflect light? Write a story or song about the sounds and sights that come from moving water. Throw pebbles in a pond or puddle. Watch the wave patterns that form. See if you can make small and big waves.

Many stories and poems have been written about water. Read a few of these and share your thoughts about them with a friend. Then write your own story or poem.

Produce a dance or a play that shows water energy. For example, show water falling to the ground as rain and making sounds when it hits a roof. (Suggestion: Have students drum their fingers and make sounds that represent raindrops hitting the ground.)

Comparing Energy Use in the Past and Present

Develop a list of recreational activities you like to do with your friends or family. How many of these depend on electricity? How many rely on gasoline? Research what families in Wisconsin did for entertainment in the 1700s and 1800s. Would you be interested in doing any of these activities?

Read stories related to different end uses of energy (travel, heating, electricity, etc.) and summarize what you have learned. Write your own story or poem about adventures using energy.

Consumption Patterns

Read or watch Dr. Seuss's *The Lorax*. What energy consumption issues are shown? Devise an energy plan for the Oncelers.

Energy and the Environment

Many energy resources (fossil fuels such as coal and petroleum products) are burned to provide us with energy. Burning releases heat and light energy, but also waste materials such as carbon dioxide and soot particles. Dangerous gases are also released when an automobile burns gasoline.

Investigate what other things are produced by a burning candle besides light and heat. Hold a piece of glass over a burning candle to collect the soot. **Caution: Use pot holders. Soot can harm your lungs if you breathe it in, and it also coats trees and buildings.** Research different types of air pollution and design a poster that shows the results of your research. Include things that individuals can do to reduce the amount of pollution they add to the air.

Write a rap song or create a poster that stresses the importance of staying away from gasoline fumes. Relay the importance of not being in heavy traffic for too long or not standing near the back of a parked, running car.

Analyzing Appliances

Make a list of electrical appliances you use every day. Here are some things to do with that list.

- Determine how much you value appliances. Which could you live without? Which do you need? Rank each appliance from one to five, with five indicating the most valuable one(s). If you had to reduce the number of appliances you use by half, which would you eliminate?
- Survey your parents and grandparents to find out how many of these appliances they used when they were your age. If they didn't use these appliances, what did they use instead?
- Write a story describing how you use the items on your list. Then write one about how you would live without using these appliances.

Analyzing Different Modes of Travel

Inventory how many people drive alone in their cars at certain times of the day (8 a.m. to 9 a.m. and 5 p.m. to 6 p.m.).

Compare how it feels to ride a bike with deflated and inflated tires. Which requires more energy? How does this relate to making sure the tires of a car are inflated properly?

Inventory your class to find out how their adult family members get to work each day. Categorize the modes of travel under public transportation (like city buses) and private (like cars, walking, biking). You can also note whether they travel alone or with other passengers.

Compare the pros and cons of public versus private travel. Create or adapt a table such as the one below.

Considerations	Single Passenger Car	City Bus (public)
Time		
Convenience		
Cost (see Calculating Costs for Automobile Travel on next page)		
Conserving Energy		
Meeting People		

Calculating Costs for Automobile Travel (single passenger)

With an adult family member or friend who can drive, figure out how many miles and how much time it takes you to get to your destination. Find out if the driver knows how many miles the car gets per gallon of gasoline. If he or she does not, use 22 miles per gallon as the figure. Identify the average price of gasoline per gallon. Divide the number of miles it takes to get from the starting and ending place by the miles per gallon, then multiply by the cost of gasoline. For example, if the distance is 15 miles and the average cost of gasoline is $1.25 per gallon, you would divide 15 miles by 22 miles per gallon, and multiply by $1.25 miles per gallon to get $0.85.

$$15 \text{ miles} \times \frac{\cancel{\text{gallon}}}{22 \cancel{\text{ miles}}} \times \frac{\$1.25}{\cancel{\text{gallon}}} = \$0.85$$

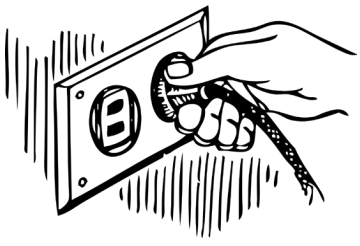
However, this value does not consider all the costs, such as maintenance (e.g., oil changes), parking fees (if any), insurance, etc. Realistically, another dollar or two could be added to the cost of gasoline used to travel one way.

Electrical Safety

Human bodies can be conductors of electricity, but becoming a conductor can harm or kill them. You may have heard of someone receiving a shock or being electrocuted.

Discuss the following rules with a group of friends and make posters to illustrate the messages. Ask your teacher for a good place to post them (the library, a grocery store, the post office).

- Never climb power poles or trees near power lines.
- Never fly kites near power lines.
- Stay away from fallen power lines.
- Keep ladders, TV antennas, and everything else away from power lines.
- Don't touch anything electrical when you are wet.
- Never pull a plug out of an outlet by the cord.
- Don't plug too many electrical devices into one outlet.
- Never use radios, hair dryers, or other electrical devices in bathtubs or showers.
- Keep fingers and other objects away from electrical outlets.



Invite a safety representative from your local utility to come to class and give a presentation. Ask your teacher for the address of your local utilities.

Be an Energy Saver

Background

Have you ever gobbled down a candy bar or piece of fruit and then noticed that your friend is still eating slowly? Your food is gone, but your friend's lasted longer. Your friend conserved the food rather than eating it quickly. The same could be said of using energy resources. We can use them quickly or we can conserve them. What will happen if we use them more quickly? They will be gone sooner.

Learn Ways to Save Energy

See how long it takes to boil water in a covered saucepan compared to one that is not. Use equal amounts of water and pans of the same size and shape. Try cooking two eggs for the same length of time in a pan that is covered and one that is not. Which egg is cooked more thoroughly?

Looking for Energy Leaks

Make a draftometer and look for ways to stop warm air currents from leaving your house (or cold air from coming into your house). The draftometer is a sheet of thin plastic draped over a pencil. Hold the draftometer near closed windows and doors, and see if the plastic wavers. If it does, air currents are probably moving about. Discuss with family members or teachers ways to prevent warm air from leaving the house.

Insulation: Stopping Energy Leaks

Try to keep an ice cube from melting by insulating it. Locate five different materials that you think will be poor conductors of heat energy. Obtain five small plastic bags, place one ice cube in each and put those bags into larger ones. Test each material that you think will be a good insulator by inserting each into one of the larger bags (but outside the bags with the ice cubes). Place all the bags in the sunlight. Check each occasionally to see which bag has the least melted water.

Promote Wise Energy Use Habits

Make a list, such as the one below, of things you can do to help save energy. Develop a skit or a storybook about reasons people should adopt these habits:

- Turn off lights and television when no one is in the room
- Make sure the door is not left open in winter (when heating) or summer (when the air conditioner is on)
- Decide what you want from the refrigerator before you open it
- Reuse bags to carry purchases from stores
- Put on a sweater instead of turning on the heat
- Walk or ride a bike instead of using the car for short errands
- Take shorter showers (but clean thoroughly)
- Only run the dishwasher and washing machine when they are full
- When hand washing the dishes, fill up the sink or a tub with rinse water rather than letting the water run to rinse each dish

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