4TH GRADE 4-H

TRANSMITTING ENERGY: DAY #1

Sound, Light, Heat, and Electricity

Sound Materials Needed: Large Spoon (Plastic or Wood), Baking Sheet, Plastic Wrap, thin-walled quart bowl (metal preferred), 1 teaspoon or tablespoon of rice

Procedure:

Cover quart bowl with plastic wrap. Make sure that the plastic is tight (like a drum). Place rice on the top of the plastic-wraped covered bowl. Place baking sheet near (not touching) the drum-bowl and hit the back of the sheet with the spoon. Rice should "dance" on the top of the drum. Explain how hitting the sheet produced sound waves. When the sound waves hit the bowl, they caused the air inside of the bowl to move, thus, making the plastic wrap shake and the rice "dance." Ask students other ways that they believe we can recognize sound waves carrying energy. They may mention the damage that loud sounds do to ears, or how you can "feel" music when someone in the car next to you has their speakers too loud, etc.

Electric Circuits Materials Needed: 6 switches, 12 light bulbs in holders, 6 D-cell battery holders, wire, 6 D-cell batteries.

Procedures:

Build a simple circuit with up to six groups of students—do not give them batteries until you check the circuits. (Battery negative to switch, switch to light bulb holder, light bulb holder to battery positive) Once checked over, give students batteries and help the students as needed with putting the battery into the holder correctly (negative to spring). Have them wait to flip the switch until all groups are ready, turn off the lights (or at least dim the room), count-down from 5 and have them flip their switches. (Troubleshoot as needed.) This video can help with understanding simple circuits: https://www.youtube.com/watch?v=VnnpLaKsqGU

Discuss the electrons from the source (battery) going down the conductor to the switch. Show students how the switch works by interrupting the flow of electrons. Discuss how the light (load) works once the circuit is closed, and the fact that electrons are flowing through the bulb and back to the positive side of the battery. Note to the students that the parts they have used form a kind of circle, with the electrons starting at the battery and returning to the battery. So, they can remember the name "circuit" by thinking of a circle. Have students take their circuit apart and put the parts into a baggie.

If extra time remains, have students draw and label the simple circuit they just created.

Indiana Standard:

4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents .

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TRANSMITTING ENERGY:DAY 2

Sound, Light, Heat, and Electricity

Heat Materials Needed: Ice Cube in Baggie (Optional Hand Boiler)

Procedure:

Ask students to describe ice. Usually, they will say something about it being cold. This is really the same as saying that it lacks much energy, as it is not allowing molecules to move past one another. Ask for three volunteers and put an ice cube (still in a baggie) in their closed hand, one at a time. To avoid court costs, do not let them hold the cube for more than a minute. At the end of all of the three students holding the baggie, hold the baggie up and ask students in the class if they notice anything. There should be more water and less ice in the baggie. Then, ask your volunteers to touch the part of their hand where the ice was held. What do they notice. With luck, students will tell you that part of their hand is now cold. An easy way to define "cold" is a lack of heat. So, ask the class, where did the heat from their hands go? The class will hopefully agree that the heat was transferred from the hands of the students into the ice baggie. The hand heat actually added energy to the ice, breaking many of the bonds that were holding the molecules in place (allowing the ice to become liquid). Thus, heat transferred energy from the hands to the ice.

If you have time and resources, a good follow-up would be to allow a student to hold a "hand-boiler." In this case the heat from their hands actually causes the liquid to "boil." Again, this shows a transfer of energy via heat.

Solar Circuits Materials Needed: 3v Solar Cell, 1.5 Volt LED with Wires, Two "Lever" Connectors

Procedures:

Give a basic explanation of how a solar cell works (photons from the sun hit the cell and cause it to shed electrons). Remember, this is for elementary students, no need to talk about the three layers of a solar cell. Electricity is basically the flow of electrons and their accompanying magnetic fields; thus, we can use a solar cell as a source of power.

Using lever connectors, connect a solar cell to the correct side of the LED. (Long pin, Anode to positive. Short pin, Cathode, to negative).

Have students expose the solar cell to as much light as possible and see what the LED does as the solar cell goes from room lights to outdoors, or a lamp in the room.

Indiana Standard:

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4TH GRADE 4-H

TRANSMITTING ENERGY:DAY 3+

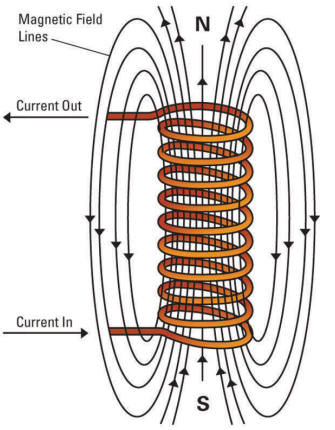
More Fun with Electricity

Electrical Extra Projects Materials Needed:
Circuit kit (used on Day #1), extra bell wire, soft iron rods, 6 paper clips.

Procedure Series vs. Parallel Circuits:

If you have a third day available, modify a simple circuit to show how parallel circuits are preferable to series circuits in most cases. (Have them run two light bulbs in series and then change the wiring to run two light bulbs in parallel). The video below is a good review for the instructor looking at parallel and series and circuits:
www.youtube.com/watch?v=x2EuYqj_0Uk

Electromagnet Procedure:
If time allows, have students modify the circuit and make an electromagnet. A couple of quick warnings, electromagnets can create a good deal of heat and deplete your batteries quickly. Only allow students to turn their magnets on with your permission and don't let them run more than a minute at a time. The magnet is simply made by wrapping (like a spring) some bell wire around a piece of iron (keep the insulation on the wire except at the ends). Make sure that the exposed wire at the end of the "spring" is not touching the iron, then put the magnet into the circuit, replacing the light bulb.



Electromagnet coil, Los Alamos National Labs, www.lanl.gov.

Students can test the magnet without power using a paper-clip (it should fall off). Once you allow them to turn on the power, have them test again with the same paper clip. This experiment is a very good lead-in to the motor video, below.

If extra time is available on any day of the project, this video provides an excellent illustration of how motors work:

https://www.youtube.com/watch?v=CWulQ1ZSE3c&t=225s

Pick your parts to show the students, as this video is really about a 6th-grade level.

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4-H Project: Electricity

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