Title: Transforming Energy -

A 5E PBL unit on energy by Maridee Stanley

Lesson Objective: After creating and experimenting with various devices that transfer and transform energy, students use the engineering design cycle to create an energy-saving device that transforms energy.

Driving Questions:

What is energy?

How can we transfer energy?
How can we change energy from one form to another?
What effects does human use of energy have on our environment?
How can we reduce the harmful effects human use of energy has on our planet?

Grade Level: 4th

Materials:
computers with internet access, science and engineering notebooks (could be composition books) Steve Spangler Energy Tube, Hand crank emergency radio, conductive (salt based) play dough, clay or insulating (sugar based) playdough, LED mini lights, AA batteries and 4 pack battery holders with leads, 2032 lithium coin batteries, copper adhesive tape, Chibitronics LED stickers, paper, binder clips, markers, Snap Circuit Jr kits, ping pong balls, box lid, pinwheel, MakeyMakey, bananas, paper plates, aluminum foil, cardboard, chart paper, small paper cup, marbles or small toy cars, . For student projects in elaborate section students may also need multimeter, small motors, or other materials

Standards: [Idaho state standard 4 PS-1-Energy]

And in greater depth, the following NGSS PE(s) addressed:

ENERGY; **4-PS3-2.**	**Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** [Assessment Boundary: Assessment does not include quantitative measurements of energy.]
4-PS3-4.	**Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*** [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or

	sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]
4-PS3-3	**Ask questions and predict outcomes about the changes in energy that occur when objects collide.** [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]
4-ESS3-1.	**Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.** [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]
ENGINEERING; **3–5-ETS1-1.**	**Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
3–5-ETS1-2.	**Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
3–5-ETS1-3.	**Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved**

Disciplinary Core Ideas

<u>Energy</u> **PS3.A: Definitions of Energy**	§ The faster a given object is moving, the more energy it possesses. (4-PS3-1) § Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3) § Energy is present whenever there are moving objects, sound, light,

PS3.B: Conservation of Energy and Energy Transfer	or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2),(4-PS3-3) § Light also transfers energy from place to place. (4-PS3-2) § Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2),(4-PS3-4)
PS3.C: Relationship Between Energy and Forces	§ When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)
PS3.D: Energy in Chemical Processes and Everyday Life	§ The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)
<u>ESS3.A: Natural Resources</u>	§ Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)
<u>Engineering</u> **ETS1.A: Defining Engineering Problems**	Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4-PS3-4)
ETS1.B: Developing Possible Solutions	§ Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3–5-ETS1-2) § At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3–5-ETS1-2) § Tests are often designed to identify failure points or difficulties,

ETS1.C: Optimizing the Design Solution	which suggest the elements of the design that need to be improved. (3–5-ETS1-3) Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3–5-ETS1-3)

Science and Engineering Practices

Asking Questions and Defining Problems	Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. § Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)
Planning and Carrying Out Investigations	Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. § Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2)
Constructing Explanations and Designing Solutions	Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. § Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1) § Apply scientific ideas to solve design problems. (4-PS3-4)
Obtaining, Evaluating, and Communicating Information	Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods. § Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)

Cross Cutting Concepts:

Energy and Matter	§ Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Cause and Effect **Influence of Engineering, Technology, and Science on Society and the Natural World**	§ Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS3-2) -- § Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1) Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2)((3–5-ETS-1 &2)

Common Core Standards;

ELA/Literacy –

RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1)

RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1)

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1)W.4.2.a–d Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-PS3-3),(4-PS3-4)

W.4.8.a–d Recall relevant information from experiences or gather relevant information from print and digital sources; take notes, paraphrase, and categorize information, and provide a list of sources. CA (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4)

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1

Engage: Pique Student Curiosity about Phenomena,Connect to Prior Knowledge and Experience, Generate Student Questions		Estimated Time:45 minutes - Day 1
1.Invite students to view a new kind of painting. Go to http://highlowtech.org/?p=2286 and show students the vimeo video full screen. Ask students "What did you notice? What did you wonder?" If no one asks about the blowing dandelions, show the video again and ask students to notice what happens when the artist blows on the painting. Write student questions on board. 2.Invite students to listen to music and show a hand crank radio. Pretend to look for "on" button. Comment that the radio doesn't have a cord to plug it in and ask students for suggestions. If a student suggests batteries, point out that there is no place to put batteries. Ask various student volunteers to help turn on the radio until a student turns crank and the radio starts playing. Ask students what they noticed and what they wondered. Write student questions on board. 3.Turn the light switch on and off a few times. Ask students how they think the switch controlled the light and note their understanding or misconceptions.. 4.Pick up energy stick by center and show it to students while it does nothing. Ask a volunteer to hold one end and move your hand to the other. Ask to shake the students' other hand. Energy stick will suddenly make lights and sound. Allow students to play with energy stick(s) for a few minutes. Ask students what they observed and what they wondered. Record student questions on board. If student questions do not already include the first two driving questions, steer students' wondering to include them and distill student questions down to driving questions. Inform students that they will discover the answers to their questions as they explore and create a variety of devices that use and transform energy. Pass out notebooks and have students write the driving questions and any additional questions they have in their notebooks.		
Teacher's Role	Teacher Questions	Student's Role
Show. Demo. Record student questions. Pass out science/engineering notebooks	What did you notice? What did you wonder? What do these phenomena have in common?	Observe, play Ask questions Record their own questions in journal

Explore:Provides Common Base of Experiences for Students Hands-on Learning, Contextualize Language, Use of Scaffolding, Use of Multiple Intelligences, Check for Understanding	Estimated Time: 15-30 minutes/day X 6 days, 1st day (day 2 of unit) for introducing centers and concepts, next 6 days for centers. Days 2-7 .
Introduction to circuits: Have several students form a ring and hold hands.Have two students let go of hands and hold ends of energy stick instead. Have all students join the ring and note that as long as all students are touching, the energy stick will make sound and light. Inform students that they created a circuit. Have two adjacent students let go and ask class what happened. Note that if the circuit is broken at any place the energy using device will not work. Inform students that they will build circuits to carry	

electricity at several stations.
Introduction to centers: Teacher gives overview/demo of each center and reminds students to take notes in their journals. Teacher points out that students have a design constraint, the budget, at squishy circuits and chibitronics but are otherwise encouraged to be as creative and artistic as possible. Show "Squishy Circuit Basics" video from http://courseweb.stthomas.edu/apthomas/SquishyCircuits/videos2.htm and show squishy circuit slide show.
Show "Simple Circuit Tutorial" at https://chibitronics.com/simple-circuit-tutorial/ and show chibitronics card making slide show. Teacher notes that students will initially follow directions in kit at snap circuit center but may then get creative. Teacher instructs students to share and take turns as they explore the activities at the MakeyMakey center then work as a team to change one of the fruit instruments into an instrument using materials found at that center. Teacher informs students they will read/discuss some predetermined informational texts at the research center and are free to conduct additional research on energy,the effects of human use of energy on the environment,clean energy, and circuits after that.
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Centers: Divide students into six groups. Groups cycle through the following six centers, doing one or two centers a day for about 15-30 minutes each. Each group starts at a different center. All students keep notes in their science notebooks on their observations/ discoveries/creations at each station. Students draw and label a diagram on the energy transfers that they create or research at each center. Teacher circulates among groups to facilitate. Teacher asks questions to steer student thinking and discovery. Teacher provides technical assistance when necessary.(In the alternative, if you don't wish to run 6 centers at once you could do each of the activities for the whole group on different days but this requires more materials.)

Squishy Circuit Playdough Art Center:
Inform students they have a budget of 1 battery pack with 4 batteries and 2 leads, 1 cup of conductive play dough , one LED light.. Be creative. Each student makes two decorative playdough sculptures joined by LED light.. If it doesn't work the first time, problem-solve. After successfully creating the initial project, students may move on to serial circuits and use insulating playdough or clay as well as conductive playdough to make a work of art that lights up. Print out the PDF instruction cards on circuit basics from http://courseweb.stthomas.edu/apthomas/SquishyCircuits/PDFs/Circuit%20Basics.pdf and keep at this center.

Chibitronics Light-up Card Center:
Students design and make individual cards (holiday card, birthday card, mother's day card etc) or a name tag, picture, or sign with a word that is personally meaningful to student that uses copper tape as part of the design and which acts as a circuit that lights up an LED sticker powered by a 2032 coin battery. The budget is 18 inches of copper tape, one LED sticker and one 2032 lithium coin battery plus paper or cardstock, markers and clips. Can also use cellophane and tissue paper if desired. To assist students, the teacher can provide copies of pre-designed circuits from the chibitronics website if desired. See: **https://chibitronics.com/templates/**

Kinetic Enery Transfer - Roll and Crash Center:
Students can use a commercial marble maze or make their own ramp out of cardboard and use small toy cars such as hot wheels. In either case, students put a small paper cup at end of ramp. Students roll marble or car down ramp to crash into cup and observe what happens. Students experiment with different ramp heights. Student experiment with different masses of the cups by stacking more cups or putting something in cup. Students observe and record the differences when height or masses are changed. Students note where energy is coming from [energy giver - the marble or car] and where it is transferred to [the energy receiver - the cup]. Students note that object at top of ramp has stored gravitational potential energy which become kinetic energy when pushed down ramp, that a bit of kinetic energy transforms to sound energy when objects crash, that a tiny bit of energy changes to heat although not enough for us to feel, and that friction slows objects at bottom of ramp.

Snap Circuit Center
Using Snap Circuit kits students follow directions to make a variety of devices such as fans, buzzers, and lights. After successfully following directions for one device students may freestyle.

MakeyMakey and Blow and Roll Center
Students take turns playing premade MakeyMakey banana piano and fruit or play dough bongos then as a group design and build their own piano or bongos using cardboard, paper plates, aluminum foil, tape, and markers. While waiting for turn to play the instruments, students may blow on pinwheels, blow ping pong balls in box lids, and play finger soccer in box lids. (Copy paper box lids work well.)

Research Center:
Have Students read "The Energy Musical" for background information.
Have students view:
https://www.s-cool.co.uk/gcse/physics/energy-transfers/revise-it/types-of-energy-transfers animated page on energy transfer.

Have students view, compare, discuss with group the pictures and videos below

- Guiding questions: How are these pictures related? What is going on in these pictures and videos? What is the same about them? What is different about them? Which method for getting electricity or heat for cooking do you think is best?

https://www.youtube.com/watch?v=gzt-45ePI7w (large equipment strip mining for coal, tearing up earth)

http://assets.inhabitat.com/wp-content/blogs.dir/1/files/2015/12/Wind-Turbines-Windmill-Farm.jpg wind turbine picture https://www.youtube.com/watch?v=dngqYjHfr98 solar cells video https://www.youtube.com/watch?v=kzaK7HqN-pI solar oven video

Teacher's Role	Teacher Questions	Student's Role
Introduce concept of energy and circuit and introduce each center. During centers circulate among groups asking questions to prod problem solving. Answer questions when necessary to minimize frustration. Provide vocabulary as it becomes relevant. Debrief centers after each day.	Where did the energy come from? Where did it go? How did it change? What have you tried so far? Have you tried ___? (eg turning LED around)	Make/build/create, problem solve,observe, research, discuss with peers, listen, compare and contrast

Explain: Listening, Speaking, Reading and Writing to Communicate Conceptual Understanding	Estimated Time: Two 30 minute sessions - Days 8-9
Day 8: Teacher asks students what they had for breakfast, then asks "Why did you eat breakfast? If students answer "Because I was hungry", ask "Why were you hungry?" Have students show how they move when they feel energetic. Teacher demos walking briskly or dancing. Then have students show how they feel when they are tired. Teacher models slouching in chair. Lead discussion to the realization that we need energy to move and live. Teacher invites students to close their eyes and make a "movie" in their brains as they listen to the following narrative. "The sun shines on the earth, sending energy to our planet in the form of light. Some of the light touches the surface of the earth and warms it. The energy of light has become the energy of heat. Some light falls on the leaves of an apple tree. The leaves use the energy of light to rearrange molecules of water and CO2 gas into sugar molecules. Now the energy of light has become food energy which is chemical energy. Now the energy is in the apple. You eat the apple. Now the energy is in you. You use some of that energy to run around. You get warm and your body heat slightly warms up the air around you. Now press your hands firmly together and rub them against each other quickly. What do you feel? Yes, You feel heat. Now, hold your hands up and let the heat go into the air. The energy of light from the sun became chemical energy and then kinetic energy (motion),then heat energy. The energy is now in space. It is lost to us but it still exists in the universe" Have students open eyes, get into their groups, imagine an energy path such as the ones you narrated,and illustrate that energy path on chart paper, labeling each form of energy. Do a gallery walk of the posters. Day 9: Invite students to once again close their eyes and make a movie in their head about the following narrative. "Now go back in time 100 million years. Dinosaurs roam the earth. The sun shines on the earth. Leaves change the energy of light into food energy. A dinosaur eats the leaves. Now the energy is in that	

herbivore which uses some of the energy to move around. A bigger dinosaur eats the herbivore. Now the energy is in that carnivore. Some of that energy is still in the dinosaur when it dies. Time passes. The dinosaur gets covered up and eventually decomposes underground. Millions of years pass. The dead dinosaur and other organic material is gradually changed into oil. In modern times humans pump that oil out of the ground and refine it into gasoline. Your mom puts that gas into her car where it is burned to move the pistons to turn the wheels of the car to drive you to school. The energy of light from the sun millions of years ago became chemical energy which became heat energy which became kinetic energy and got you to school. Unfortunately, the car also caused some pollution and contributed to global warming. Now imagine the sun shining on the earth in modern times. It heats the earth unevenly which causes variations in air pressure which causes wind. The wind turns a wind turbine which generates electricity which is used to charge an electric car. That car could also drive you to school but without as much pollution or greenhouse gases. Or, you could bike to school and cause no pollution or greenhouse gases." Hold discussion on the effects of fossil fuels and use of renewable energy. Have students meet in groups and come up with an energy path that uses renewable energy, illustrate on chart paper, labeling forms of energy. Do a gallery walk of the posters.

Teacher's Role	Teacher Questions	Student's Role
Facilitate integration. Provide mini lessons, labels and definitions as needed.	What forms of energy do we use every day? Where did that energy come from? Is that energy renewable? What are the advantages of renewable energy? What are the disadvantages of fossil fuels.	Students generate explanations of phenomenon orally and in writing and develop models (mental and physical). Students apply cross cutting concepts.

Elaborate:Students apply/transfer their understanding of phenomenon to new situations and practice skills/science and engineering practices. Group Projects, Plays, Murals, Songs, Connections to Real World, Connections to other Curricular Areas	Estimated time: two to three weeks
Teacher reviews engineering design design process with students. Students work individually or form new groups of 2,3, or at most 4. Students apply engineering design loop to create an energy saving device using renewable energy such as solar, wind, wave or pedal power and utilizing at least at least one transformation of energy such as solar to thermal, solar to electrical to light or sound, wind to electrical, to kinetic, etc. The device could be as simple	

as a solar oven made from cardboard box and foil or as complex as a wind turbine generating electricity to power another device.		
Teacher's Role	Teacher Questions	Student's Role
Facilitate, assist with material procurement	Where does the energy originate? How does it transform? How does this help our environment? How does it assist people?	Create, problem solve, test, improve

Evaluate: Thinking Maps, Summarize Lesson and Review Vocabulary, Variety of Assessment Tools		Estimated Time
Students give an oral presentation of their energy saving device, answering the predetermined questions (see Teacher Questions below) as well as any follow up questions. Students apply rubric to their own project. Teacher also applies rubric. As a final journal entry, student reflects on their :own learning, summarizing what they have learned, answering their owns questions from the beginning of the unit, and noting how their understanding of the phenomenon has changed.		
Teacher's Role	Teacher Questions	Student's Role
Teacher reads each student's science journals. Teacher applies rubric to each group's project.Teacher interviews students during student presentations. If a grade is needed it will be a combination of the rubric on the project, the science and engineering notebook as a whole and the reflection which is the last journal entry in the notebook.	Teacher gives students the following questions in advance and students answer during presentation: "What is the function of your device? What powers the device? How does the energy change? How does the energy travel? Where does the energy go? How will it reduce our dependence on fossil fuels? How will this benefit our world?" Teacher asks follow up questions as needed.	Reflect on learning and how their thinking about the phenomenon has changed. Write reflection in journal. Answer student's own questions in journal Present energy saving project to peers, teacher (and parents if possible) either in class or at STEAM Night.Students ask questions of peers during presentations.. Students express what they like about peers' projects.

Rubric and can be found at -
http://www.quickrubric.com/r#/qr/marideestanley/energy-saving-device-project2

Extend: Class puts on a production of *The Energy Musical, (see attached)* either as a full production for entire school or as readers theater for another class and parents.

Resources http://courseweb.stthomas.edu/apthomas/SquishyCircuits/videos2.htm
https://chibitronics.com/simple-circuit-tutorial
https://www.stevespanglerscience.com

The Energy Musical

By Maridee Stanley

E=MC2

The Energy Musical

(Scene 1-in front of closed curtain: The "Cool Kids" enter from both sides and hang out, being cool, using various electronic devices such as I-pods, hand-held video games, and cell phones, talking and texting on their cells. Two more concerned citizen cool kids run in from opposites sides, yelling)

Concerned citizens: Oh no! We're having an energy crisis!

(Scientist enters)

Other Cool kids: Energy, what's that?

Scientist: Energy is the capacity to do work.

Cool Kids: What's that?

Scientist: Energy is what runs all your gadgets. (Points to gadgets) Energy is what runs you. (Runs in place)

Cool Kids: But what is energy?

Scientist: Energy comes in many forms: light, heat, sound, motion, electricity, chemical energy. Energy can change from one form to another.

Cool Kids: But what is energy?

Scientist: Well, most of our energy is some form of electromagnetic energy.

Cool Kids: But what is energy?

Scientist: Energy here on planet Earth, our energy, all starts with the sun.

(As curtain opens, revealing the rest of the cast, Cool Kids and Scientist run to sides of stage and sit on edge of stage. They sing along with performers on stage.)

(Scene 2: The Sun stands on a ladder, shining flashlights down on rest of cast. Cast sings the Solar Sun Song to tune of Raffi's "Mister. Sun")

Oh solar sun, sun

Solar, solar sun
Please shine down on me.

Oh, solar sun, sun
Solar, solar sun
with your nuclear energy.

Nuclear fusion inside our star
Releases the energy that runs your car.

Oh, solar sun, sun
Solar, solar sun
Please shine down on me.

Electromagnetic energy runs you and me.
Photons are the carrier of this energy.

Oh solar sun, sun
Solar, solar sun
Please shine down on me.

Energy comes to us in the form of light,
Shining down upon us from our star so bright.

Oh solar sun, sun
Solar, solar sun
Please shine down on me.

(Scientist and Cool kids jump up and move to center of stage. Rest of cast moves back and sits.)

Cool Kid 1: Does that mean I'm solar powered?

Scientist: In an indirect way, we all are.

Cool Kid 2: How can that be?

Scientist: To get the energy of the sun into you, you need the help of a plant and the process called "photosynthesis".

(Scientist and Cool Kids run to sides of stage and sit, and then sing along with cast who sing the "Photosynthesis Song" to tune of "Farmer in the Dell". A couple of Cool Kids rearrange atoms of $6H_2O$ & $6CO_2$ to make $C_6H_{12}O_6$ on a tri-fold board.)

The sun shines on the plants.
It gives plants energy.
It gives the energy of light
To grass and bush and tree.

The plant changes the light
to different energy.
Plants change the energy of light
To food for you and me.

Photosynthesis,
We can't live without this.
H_2O and CO_2
Becomes a sugar molecule.

Another thing it gives
To help us all to live
Is oxygen for us to breathe

So thank the grass and trees and leaves.

(Scientist and Cool Kids jump up and move to center of stage.

(Scene 3)

Cool Kid 3: But what if you are a carnivore and don't eat plants?

Scientist: Those photons of energy move through the food web, reaching everyone.

(The food chain runs in and everyone signs the "Food Web Song" to tune of "The green grass grows all around)

The sun shines down all around, all around.
The sun shines down all around.
The green grass grows all around, all around.
The green grass grows all around.

The rabbit eats the grass.
The coyote eats the rabbit.
The wolf eats the coyote.
The tick eats the wolf.

The green grass grows all around, all around.
The green grass grows all around.

The bird eats the tick.
The cat eats the bird.
The eagle eats the cat.
The cougar eats the eagle.

The green grass grows all around, all around.
The green grass grows all around.

The flee eats the cougar.
The spider eats the flee.
The crane fly eats the spider.
The frog eats the crane fly.

The green grass grows all around, all around.
The green grass grows all around.

The snake eats the frog.
The hawk eats the snake.
The worms eat the hawk.
The worms become dirt.

The green grass grows all around, all around.
The green grass grows all around.

The dirt makes more grass.
The cow eats the grass.
The cow becomes a cheese burger.
You eat the cheese burger.

The green grass grows all around all around.
The green grass grows all around.

Now you are the grass and the rabbit and the wolf.
You are the flee and the spider and the fly.

You are the frog and the snake and the hawk.
(slow and deliberate) You are them all! (pause)

And the green grass grows all around, all around.
The green grass grows all around.

(Food Chain exits)

(Scene 4)
Cool Kids 4&5: Now I understand how the sun's energy gets in us. But how does it get in a car that runs on gasoline?
Scientist: Gasoline is made out of oil which was made out of organisms that lived millions of years ago.

(Oil drop rises up and rappers chants the "Oil Rap"

I'm oil. I'm oil.
I live beneath the soil.

I used to be a dinosaur
some million years ago.
But then I died and I got buried
Way down low.

If I got buried in a place
That was just right
I turned into petroleum
Oh, what a sticky sight.

I still had energy in me
When I died.
Photons from the distant sun
are still inside.

It took a hundred million years
to make this drop.
But now I'm almost gone so
using oil has got to stop!

Cool kids 4 & 5: Is that why we are having an energy crisis?
Scientist: Yes!
CooL kids 4 & 5: What can we do?

Scientist: There is plenty we can do.

(Everyone chants while unfurling the banner:)

Reduce, reuse, recycle.
Stop wasting. Start walking.
Use alternative energy.
Buy local. Think global.
Take care of our planet.

Scientist: Let's have an Earth Day Celebration!

(Everyone sings "Celebration" to Kool and the Gangs "Celebration)

Celebration.   Come on
Let's celebrate the Earth
The home that gave us birth.

Celebration.   Come on
Let's celebrate the Earth
The home that gave us birth.

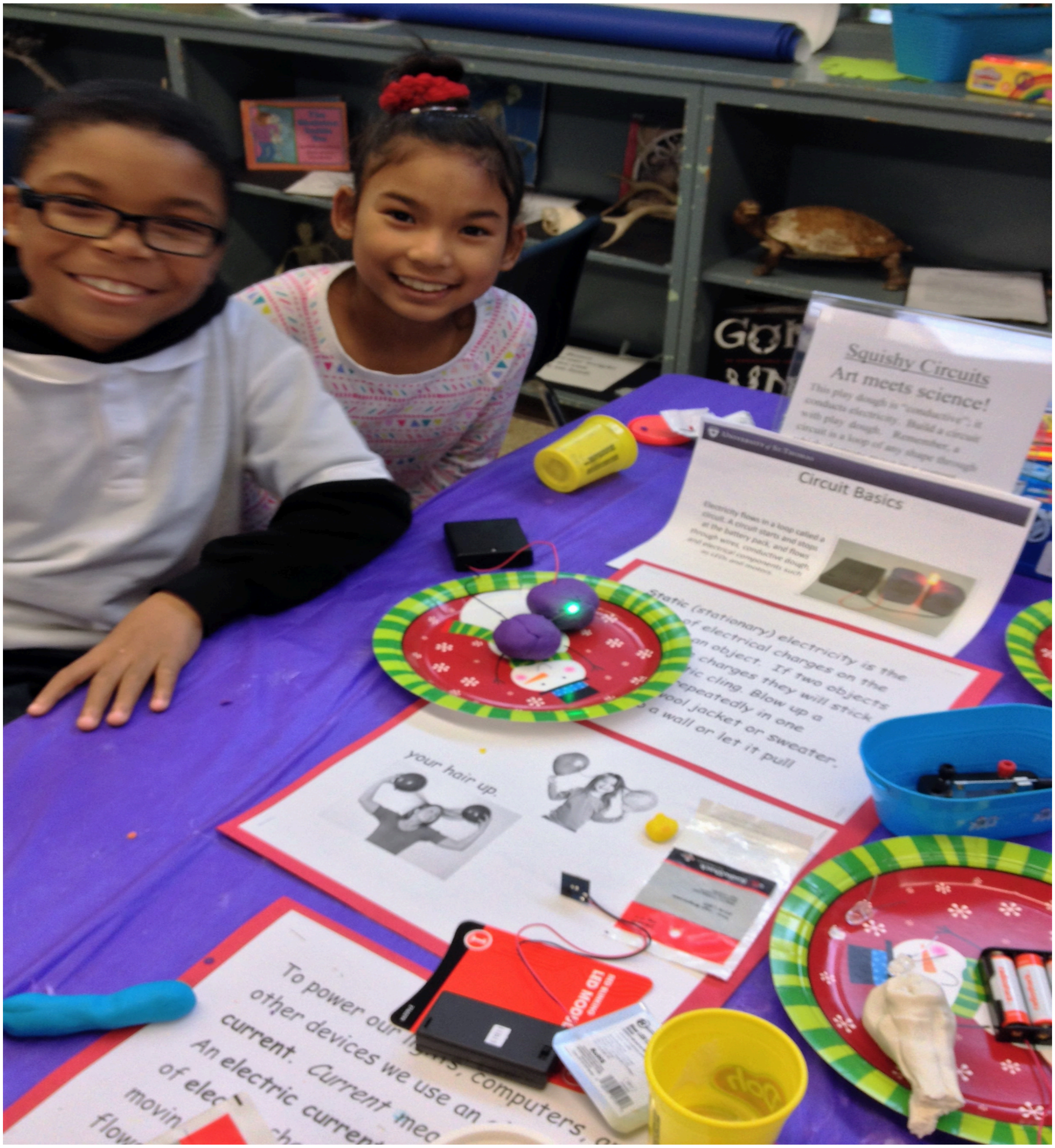
Celebration.   Come on
Let's celebrate the Earth
The home that gave us birth.

Celebration.   Come on!

Everyone bows. Curtain closes.


Advanced Electrical Engineering
for intermediate and middle school students.
•Collaborate with a partner.
•Read the directions carefully.
•Follow the diagrams exactly.
•Keep the materials for each kit separate.
Contains: 15 pc and 1 manual
fun learning all about electronics


COLLEGE


Squishy Circuits
Art meets science!
Circuit Basics
Static (stationary) electricity is the
of electrical charges on the
an object. If two objects
charges they will stick
tic cling. Blow up a
repeatedly in one
wool jacket or sweater.
a wall or let it pull
your hair up.
To power our lights, computers, and
other devices we use an
current. Current mea
An electric curren
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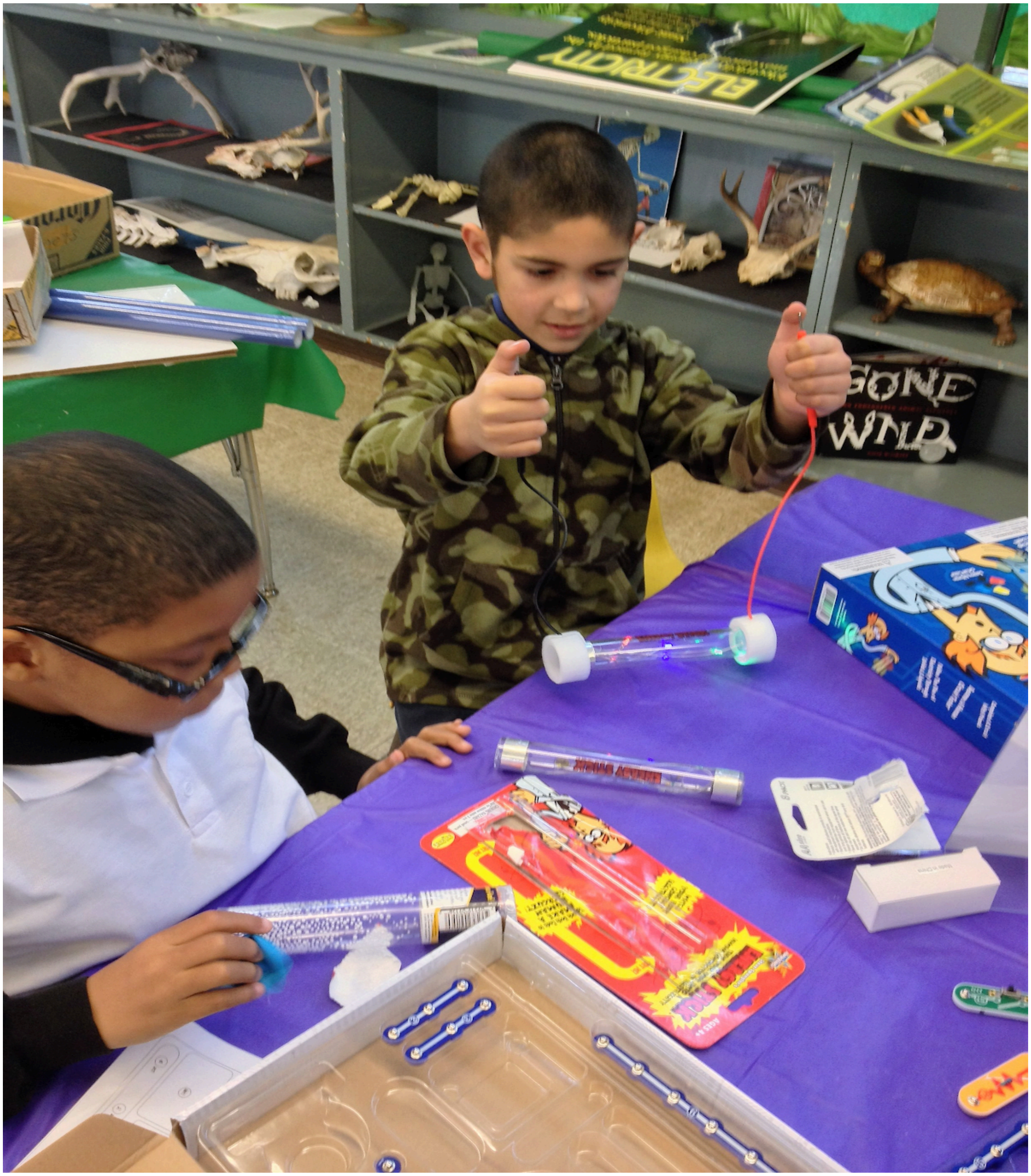
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