Energy Chains

Students will act out a skit to demonstrate how energy makes its way from the sun to us, allowing us to run, play and even do homework. Students will understand that energy doesn't get "used-up" it just changes form with some unusable energy escaping along the way.

Grade Level: 3rd Grade

Phenomena:
How does the energy from the sun eventually pass its way down to us?

Objectives:
- Students will interpret conservation of energy in their own words.
- Students will distinguish 3 different types of energy.
- Students will create an energy chain that traces energy from the original source to its conversion to heat, light or sound.

Materials:
- Sun, plant, and cow costumes
- 5-6 Balloons
- Packing Peanuts
- Blank/ Scrap Paper for each student
- Sets of laminated energy chain cards for student groups*
- Copies of "Our Energy Chain" worksheet for each student
- Laminated print outs of large energy chain images

Appendixes:
- Teacher's guide for Activity 1: Page 5

Time Considerations:
Preparations: 20 minutes
Lesson Time: 50-60 minutes
Introduction: 20minutes
Activity 1: 10-15 minutes
Activity 2: 10 minutes
Activity 3: 20 minutes

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Next Generation Science Standards

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Science and Engineering Practices (SEP):
Obtaining, evaluating, and communicating information.

Disciplinary Core Ideas:
Natural Resources

Crosscutting Concepts:
Cause and Effect

Excellence in Environmental Education Guidelines

Strand 2.1—The Earth as a Physical System
(C—Energy): While they may have little understanding of formal concepts associated with energy, learners are familiar with the basic behavior of some different forms of energy

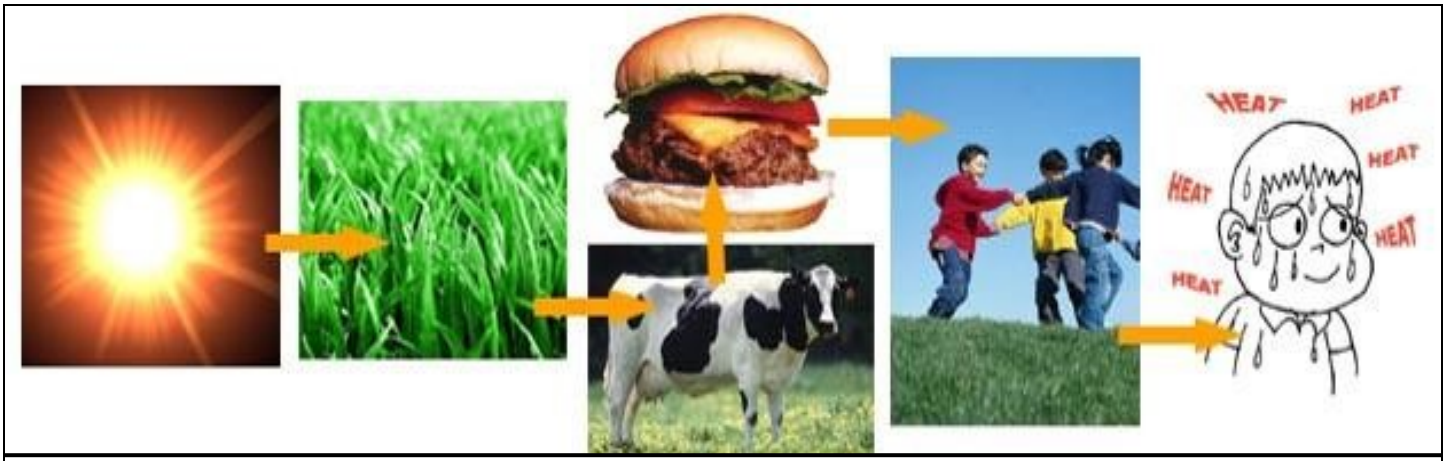
Strand 2.2 -*The Living Environment* *(D—Flow of matter and energy):* Learners know that living things need some source of energy to live and grow.

Background

Everything on Earth including the planet itself contains at least a little bit of energy. Sometimes energy is easy to recognize as we burn gasoline, watch children on the playground or lay in the sun. Other types of energy are almost impossible to notice and we take them for granted.

According to the first law of thermodynamics, energy cannot be created or destroyed. That means that the amount of energy in the universe will never change. The energy that prehistoric plants used to grow is the same energy that we use today to power our cars. Since the amount of energy on the planet is constant, many people might wonder why it is important to conserve energy. Although the amount of energy doesn't decrease when we leave extra lights on, the amount of *useful* energy does.

The law of conservation of energy states that energy cannot be created or destroyed, it just changes forms. So when a light is turned on, electrical energy from the outlet is transformed into heat and light energy inside the light bulb. In a regular incandescent bulb, 95% of the electrical energy is converted to heat. Unless the purpose of the lamp is to keep food, plants, or pet lizards warm that means all but 5% of the energy is wasted. All



This is an example of an energy chain. The orange arrows show the transfer of energy. The sun makes energy that the plant turns into sugar. The cow eats the plant and stores the energy in it's meat, which becomes a hamburger. The children eat the hamburger and use its energy to play, then releasing heat.

processes waste some energy but conditions can be changed to make them much more efficient. Fluorescent and other "energy saving" lamps use closer to 20% of the electrical energy for light.

The transformations that energy undergoes can be tracked using a tool called an energy chain. Energy chains are a visual representation of energy flow in a specific system until it can no longer be used easily. Hard to use energy types include light, heat, and sound.

Typically we think of energy as the electricity that powers our lights and computers. However much of the nation's electricity comes from chemical energy stored in coal and natural gas. Burning these fossil fuels releases energy stored in the molecules creating large amount of heat. This heat is use to heat water that powers steam turbines and becomes mechanical energy. The mechanical energy in the turbines becomes electricity and is carried to our homes. Solar, nuclear, hydroelectric, and geothermal plants all use a similar process to transform light, heat, chemical or mechanical energy into electricity.

Preparation

Gather all needed materials (see attachments)

Doing the Activity

Introduction-What is energy?
Give the students about 20 seconds to consider the question: What is energy?

The students may list examples of energy like heat or electricity or suggest that energy is what we need to move around or play sports. Explain to the class that energy is the ability to do work so "what we need to do stuff is a fairly accurate answer.

Have the class discuss where energy comes from and what forms it takes.

Ask students if they have ever heard of a food chain. What is a food chain? Similarly we can trace energy's path.

Activity 1- Energy in One Act
Hand out a piece of paper to each student. Have students fold the paper in half; the top half will be used for the first activity. Start by having students stand up and jog in place, do jumping jacks, etc. Ask students to predict where they got the energy to exercise and draw the path of the energy making sure to include as many steps as they can. Give students about 5 minutes to do so.

Tell students that they are going to trace the path of energy starting with the sun. Show students the packing peanuts and tell students the peanuts represent energy. Ask students what organisms on Earth use that energy. (Plants use it to make food with photosynthesis). Ask who is feeling extra bright. Have the "bright" student come to the front of the classroom and pretend to be the sun, the sun will hold the bowl of packing peanuts. Choose a student wearing green to act as a plant.

The sun will say: "I am the sun, I give energy to the earth."

The plant will respond: “I am a plant. I use the sun’s energy to make food.” Have the plant take as many packing peanuts as possible in both arms. Some peanuts may fall on the ground, leave them there.

Ask whether the energy stops in the plant or if it can still be used. (yes it can)

Select one volunteer to dress as a cow. The cow will take as many packing peanuts from the plant only using two hands and say “I am a cow. I take energy from plants and use it to make muscles and heat.” Cow will let some peanuts fall to the ground to represent heat loss.

Ask how to get energy out of the cow’s muscles (eat it). A student will come to the front of the room and take the packing peanuts from the cow.

The student will say “I am a human, I use the energy in my food to run, jump, swim, and climb”. Student will scatter some peanuts on the ground to represent heat loss.

Activity 2– Energy Flows

Ask where energy goes once it is used by referring back to the previous activity, pointing out the peanuts on the ground.

If students have trouble coming up with ideas have the class stand up and run in place.

Remind the class that they’re using energy that they got from food to move and ask if they feel different when that energy is being used.

The heat produced by running in place is the energy in food being changed into motion energy and finally heat.

Ask where the “energy” in the bowl (of peanuts) came from and what happened when it was distributed to others. (Once the peanuts are scattered they are still in the room, but we can’t use them to do work anymore.)

Have students use the bottom half of their paper to create their own energy chains. Students will choose their favorite food and create an energy chain including their food and how they get energy from it. Before starting the activity, do a quick brainstorm of favorite foods for some ideas.

Explain that energy can’t be created or destroyed; it just changes forms and can be more or less useful. Using a simple energy chain as a model, repeat how energy is not destroyed, just changed (potential to kinetic to heat).

Activity 3– Our Energy Chain

After students finish drawing, put them in groups of 4-5. Each group will choose ONE energy chain per group to perform as a skit in front of the class. Since packing peanuts may be harder to clean up, introduce students to the idea of using a balloon filled with air, to represent energy and heat loss. Demo a simple energy chain skit with the balloon first. (To explain heat transfer mention that once the air is let out it is still in the room, but we can’t use it to do work anymore)

Conclusion

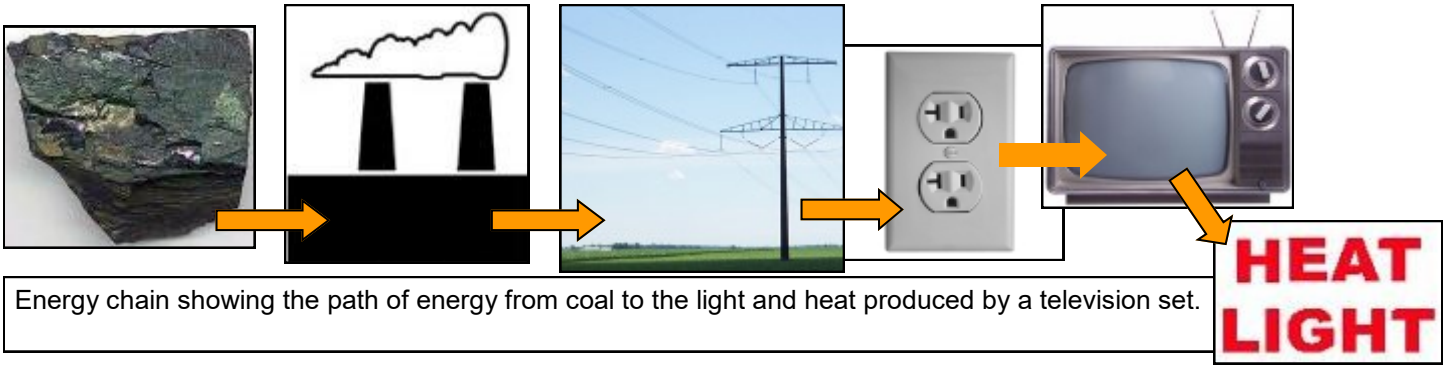
Conclusion

Verbally review with students-

- Types of energy: chemical, thermal, light, sound, kinetic, potential
- How organisms use energy
- Where energy goes once it does work

Informally evaluate students by their ability to arrange the energy chain cards in the correct order for both energy chains.

Assess students’ learning by asking students to write a page from the perspective of the energy by starting in the sun and imagining what it would be like to travel/change all the way into an energy of their choice and then ultimately ending up as heat, light or sound.



Energy chain showing the path of energy from coal to the light and heat produced by a television set.

Assessment

Ask students if their energy chains look like another kind of chain they are familiar with (a food chain). Relate the transfer of energy to objects to the transfer of energy from animals and the things they eat. Have students draw an energy food chain and write an explanation of how the energy moves from one food source to the next and where it goes at the "end" of the chain.

Extensions

Have students create a play similar to the third activity for another energy chain. Have them create props, and write lines to act out the transfer of energy from each object to the next. Additionally, make sure the students develop a prop to represent the release of energy from human control.

In groups, have students use the energy cards and energy worksheet to show the path energy takes from the sun to humans and from coal to the TV.

You may also ask students to identify the type of energy on each card or trace the path of energy used for other processes.

Vocabulary

Coal: A black sedimentary rock that is combustible due to a composition high in carbon and hydrocarbons.

Energy: The ability to do work.

Energy Chain: an ordered arrangement of objects that use energy in which each gets energy from the one before it.

Heat: a form of energy shown by the increase of temperature.

Photosynthesis: The process by which plants make sugar from air and water using energy from the sun.

Sources

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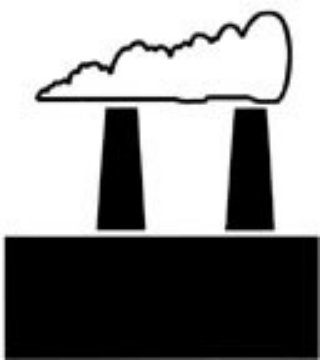
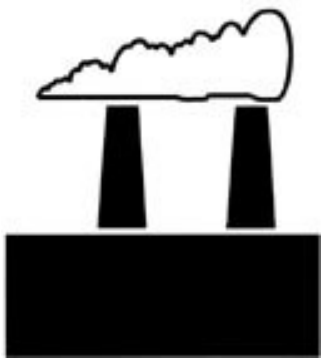
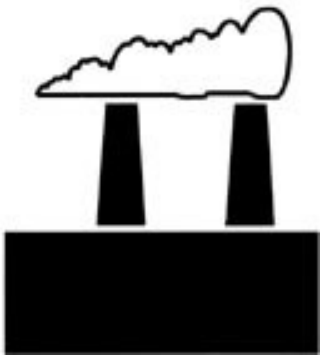
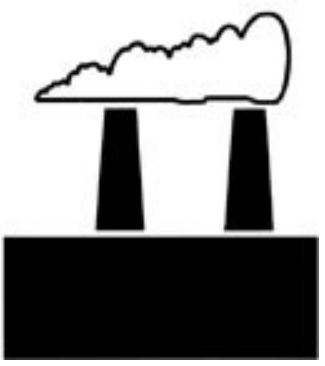
ENERGY CHAIN CARD TEMPLATE









HEAT LIGHT

HEAT LIGHT

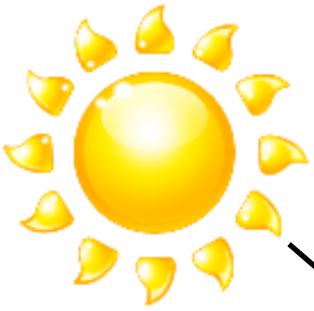
HEAT LIGHT

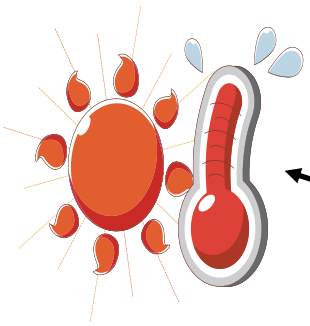
HEAT LIGHT

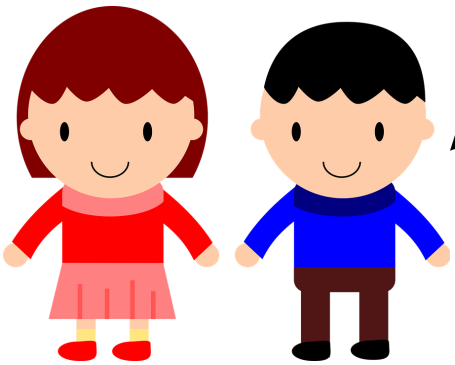
OUR ENERGY CHAIN

Name_____

Student's Page





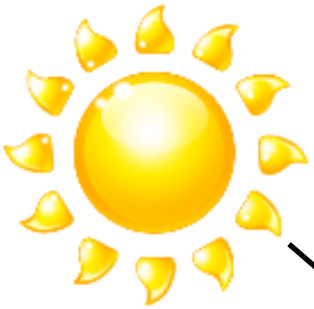


OUR ENERGY CHAIN

Name_____

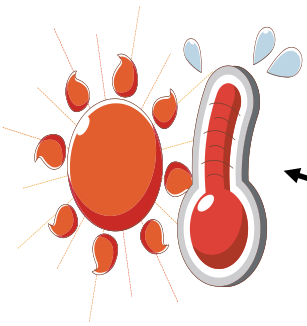
Teacher's Page

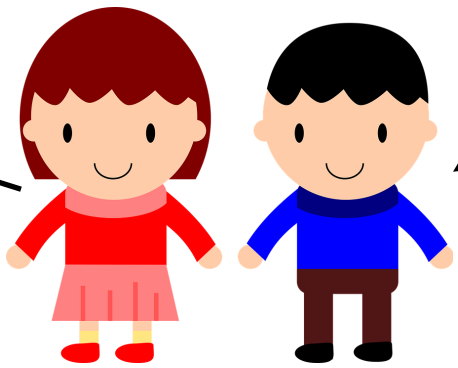
The Sun gives energy to the earth.



The bugs, spiders, vertebrates, and birds eat the plants from the earth and get energy.

The bugs, spiders, vertebrates, and birds then become food for other animals to eat.





We get energy from the food, and then are able to jump around. After jumping around we release the energy from our body through thermal energy. (Think about when you were running in place and your bodies got hot from the energy you were releasing)


THE SUN

GRASS

FOOD (MEAT)

FOOD (PLANT)


PLAYING


HEAT
HEAT
HEAT
HEAT
HEAT
HEAT