

Program Host Energy Tie-in Mini Lessons

Overview:	These lessons seek to offer program hosts supporting activities to the community activities Energy Explorations and What's a Watt Worth.
Keywords:	Law of Conservation of Energy, Energy Transfer, Kinetic Energy, Potential Energy
Age / Grade Range:	5th-6th Grade students
Background:	<p>These supporting lessons are based on the Law of Conservation of Energy which states that energy cannot be created nor destroyed, only transformed¹.</p> <p>Energy can exist as potential, kinetic, electrical, chemical, thermal, mechanical and other states. As energy is transformed from one state to another a small portion is lost as heat.</p>
Next Generation Science Standards	<p>MS-PS1-2: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.</p> <p>MS-PS1-4: Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.</p> <p>MS-PS3-2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.</p> <p>MS-PS3-5: Construct, use, and present argument to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.</p>
Common Core:	<p>MP.2: Reason abstractly and quantitatively.</p> <p>WHST.6-8.7: Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</p>
Goals:	Students will be engaged in demonstrations exploring the concepts of law of conservation of energy.

¹ <http://www.grc.nasa.gov/WWW/k-12/airplane/thermo1f.html>

Guiding Questions:

Can energy can be created or destroyed?

What happens as energy is transformed form one state into another?

Objectives:

Students will understand that energy cannot be created nor destroyed, only transformed form one state into another.

Students will understand that energy is "lost" as heat as it is transferred from one state into another.

Materials:

Bucket Air Cannon, Tea candle and matches

Alka seltzer Tablets and Film Canisters

Softball on fishing line

Vinegar and baking soda, tall beaker, Tea Candle and matches

Two Styrofoam cups and rubber band chain

Balloon and Styrofoam peanuts/wall

Comb and small ripped up pieces of paper

Stomp Rocket

Set up:

Make sure that demonstrations that require close up views are projected onto the smartboard via the program host computer's photobooth application.

Overview:

Each of these mini lessons has a specific topic in mind. This lesson plan functions more of a guide with activities relating to the topic. Concepts for across the topics listed can be combined to create new activities. For instance, you could combine types of energy with energy transfer into one morning time period.

Classroom Time:

Each supporting lesson will take 3-7 minutes

Topics**Types of Energy**

Morning activity, after energy audit and weather.

Introduction

"How many types of energy do you know? Can you name them?"

Materials

Alka seltzer or vinegar and baking soda

Object to drop, heavy is ok

Activity

"Two forms of energy you encounter everyday: Potential Energy and Kinetic energy. Some others you will encounter daily could be electrical, chemical, and thermal energy."

"An example of each energy type:

Electrical, turn off and on the lights

Chemical, mix vinegar and baking soda or alka seltzer and water

Thermal, have students rub hands together

Potential, hold an object above ground

Kinetic, drop the object being held above ground"

Explanation

"How many of those types of energy do you think you have? Where would they be?" (Humans use/have all of the examples. Electrical signals from the brain to limbs; Chemical in your stomach, thermal through body heat, potential in the height above ground and falling hurts, kinetic through your body's movement. You could also guide students through these by asking questions or having them point to different parts of their body)

Elaboration

"Electricity is energy we have been talking about this morning. A common type found in houses. What common type of energy do you think you'll find in nature? I'd like to know what you see at the end of the day."

Evaluation

Ask students at the 4 pm meeting what common types of energy they saw in the field after reviewing their day.

Energy Transfer

Morning activity, after energy audit and weather.

Introduction

"We know there are different types of energy, what were some of the ones we talked about yesterday? Using your observation skills, and previous knowledge, can we get one energy type to change into another?"

Materials

Ethanol, glass bottle and lighter/matches

Object to drop, heavy is ok

Space heater (optional)

Bucket Air Cannon

Balloon/comb and paper

Activity/Explanation

(Using the bucket air cannon, extinguish a lit candle from a short distance of approximately 2-4 feet)

"What types of energy did you notice and where were they?" (Bucket is the potential energy, the candle being extinguished is kinetic energy)

(Inflate the balloon and rub it on wool or your hair, stick it to the wall. It should stay. Alternatively you could take a comb rub it on felt and hold it over small ripped up pieces of binder paper. The balloon could be used in place of the comb)

"What types of energy did you notice and where were they?" (Kinetic energy on the balloon and wool/hair and electrical energy when the balloon/comb interacted with the paper/wall)

(Take a glass bottle and add about 10 ml of 95% ethanol. Cap the bottle and shake the ethanol around until you feel satisfied that it has been distributed throughout the bottle. Uncap the bottle and using a lighter or a long match, ignite the ethanol. Do this example away from students and away from flammable objects overhead. When ignited this will produce a loud noise and blue flame. Once all the oxygen is used the flame will go completely out. There might be small back drafts that will occur in the bottle that can be extinguished by capping the bottle)

"What types of energy did you notice and where were they?" (Potential in the ethanol/air combination. Chemical in the ethanol. Thermal and kinetic in the flame and sound.)

(Take an object and suspend it above the ground and then drop it)

"What types of energy did you notice and where were they? Does this object have two types of energy? Where?" (Above ground the object had potential energy. As it was falling it had gained kinetic energy and lost potential energy. Midway through the fall the object will have 50% kinetic and potential energy)

Additionally you could also use a space heater to demonstrate electricity to heat.

"What type of energy did electricity come from?" (Field answers, generations that spin, kinetic energy, mechanical energy if you want to go in depth)

Elaboration

"Energy changes in all forms around us. As you go out into the field today where will you find energy transforming? How many types of energy will you see in one object? I'd like to know what you see at the end of the day."

Evaluation

Ask students at the 4 pm meeting what common types of energy they saw in the field after reviewing their day.

Energy Loss

Morning activity, after energy audit and weather.

Introduction

"I need a volunteer who is brave enough to stand in front of this softball and hold their ground."

Materials

Softball on fishing line.

Activity

(Hang the softball from the ceiling and from rest pull it back until it touches the chin of the volunteer. On the count of 3 release the ball. Make sure to instruct the volunteer to not move forward or back)

"Who thought the softball would have hit our volunteer? What did you think happened?" (Field answers)

Explanation

"Energy on the softball was lost through friction! As the ball is moving through the air, it collides with air molecules transferring a small bit of energy to the molecule in the form of heat. The common way that items lost energy is by heat. Your body is giving off heat and using electricity gives off heat. (use the stomp rocket) What type of energy did the rocket have? Where did it come from? What slowed it down? If energy can be transferred, can it be created or destroyed? What is this called?"

Elaboration

"The law of conservation of energy is something that all energy obeys. It can be transferred, never created or destroyed. When you are out in the field today. Think to where the energy came from, where it is gone. How far back can you trace the energy that you, plants and animals get today? It I'd like to know what you see at the end of the day."

Evaluation

Ask students at the 4 pm meeting what common types of energy they saw in the field after reviewing their day. Answers should be either from the sun or even further back to the big bang.

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